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ABSTRACT BOOK

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FATAL BRONCHOVASCULAR FISTULA VISUALIZED THROUGH POST MORTEM COMPUTED TOMOGRAPHY ANGIOGRAPHY

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False aneurysm of the pulmonary artery complicated by bronchovascular fistula formation represents a rare life threatening condition. We report a case of fatal hemoptysis after formation of a bronchial fistula in the late postoperative period after sleeve lobectomy. Cause of death was determined by external post-mortem examination, post mortem computed tomography (PMCT) and angiography (PMCTA) without conventional autopsy.

Disclosure: All authors have declared no conflicts of interest.

DETERMINATION OF LSD AND 25H-NBOME BY SQUARE WAVE VOLTAMMETRY

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A new class of psychoactive designer drugs, N-Benzyl- substituted phenethylamines known as NBOMes ("N-bomb" or "Smiles") has been highlighted among seized drugs, and it englobes a great variety of substances, as the 25H-NBOMe. Apart from its detection, it is essential to differentiate these new drugs from others as the most common form of consumption of NBOMe is in blotter, similarly to those found for LSD (lysergic acid diethylamide). Besides, the detection of these drugs must be sensitivity, fast and specific. In order to comply with these characteristics, voltammetric analysis holds an important role in forensic scenario. The present work focuses on the detection of both of the drugs by a unique Square Wave Voltammetric methodology. The measurements were performed on a glassy carbon electrode as the working electrode in a methanolic solution containing $LiClO_4 0$, 1 mol.L^{-1} as supporting electrolyte. The experimental parameters used were: step potential of 0.005V, frequency of 25Hz and amplitude of 0.02 V. In this experimental condition, it was possible to detect LSD in 2.57 10^{-7} mol L^{-1} and the quantification of 25H-NBOMe allows to reach concentration level of 4.25 10^{-6} mol L^{-1}. In the first drug, the present methodology only identifies LSD, which implies in a qualitative analysis; when 25H-NBOMe is analyzed, qualitative and quantitative results are achieved. After considering the extraction process applied for blotter samples, concentrations values around 10µg of LSD or 25H-NBOMe are enough to result the oxidative peaks observed in 1.12V (LSD) and 1.35 V (25H-NBOMe). From the same Square Wave Voltammetric methodology, it is possible to differentiate LSD and the new psychoactive drug 25H-NBOMe in less than 1 minute of analysis. These reliable results observed after a simulation in blotter extraction allow the application of this electroanalysis in the routine of forensic laboratories.

Disclosure: All authors have declared no conflicts of interest.

CERVICAL INJURIES IN DROWNING CASES

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Introduction: Discovery of bruises in the muscles of the neck and a fracture of the hyoid bone in a body recovered from water make the diagnosis as well as the determination of the manner of death difficult. **Aim:** The aim of this work is to report a case of a drowned body with cervical injuries and to highlight the importance of not misinterpreting these findings. **Case report:** A 39-year-old female was found dead, the face down in a well filled with water up to 3 meters whose height is 6 meters. She was mentally disturbed and had a history of suicide attempts in the same place and in the same way. The autopsy revealed bruises in the muscles of the neck and a bruise associated with a fracture of the left horn of the hyoid bone. **Conclusion:** In the case reported here, these lesions were explained by the impact of the fall from a high place and the cervical hyperextension or hyper-flexion due to mechanical asphyxia.

Disclosure: All authors have declared no conflicts of interest.

DENTAL AGE ASSESSMENT AMONG TUNISIAN CHILDREN USING THE DEMIRJIAN METHOD

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Introduction: Since Demirjian system of estimating dental maturity was first described; many researchers from different countries have tested its accuracy among diverse populations. Some of these studies have pointed out a need to determine population-specific standards. **Aim:** The aim of this study is to evaluate the suitability of the Demirjian's method for dental age assessment in Tunisian children. **Materials and Methods:** This is a prospective study previously approved by the Research Ethics Local Committee of the University Hospital Fattouma Bourguiba of Monastir (Tunisia). Panoramic radiographs of 280 healthy Tunisian children of age 2.8–16.5 years were examined with Demirjian method and scored by three trained observers. **Statistical Analysis Used:** Dental age was compared to chronological age by using the analysis of variance (ANOVA) test. Cohen's Kappa test was performed to calculate the intra- and inter-examiner agreements. **Results:** Underestimation was seen in children aged between 9 and 16 years and the range of accuracy varied from −0.02 to 3 years. The advancement in dental age as determined by Demirjian system when compared to chronological age ranged from 0.3 to 1.32 year for young males and from 0.26 to 1.37 year for young females (age ranged from 3 to 8 years). **Conclusions:** The standards provided by Demirjian for French-Canadian children may not be suitable for Tunisian children. Each population of children may need their own specific standard for an accurate estimation of chronological age.

Disclosure: All authors have declared no conflicts of interest.

SUPPORTING FINGERPRINT IDENTIFICATION ASSESSMENTS USING A SKIN STRETCH MODEL

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In this study, a skin stretch probability model is proposed to support identification assessments undertaken by the fingerprint expert. This approach relies on the hypothesis that there are limits to the distortion caused by skin stretch and that perceived 'distortion' outside of an expected range suggests a between-source rather than within-source comparison. Such limits can be modelled by applying a multivariate normal probability density function to the distances and angle formed by a marked ridge characteristic and the two closest neighbouring minutiae. In this study, the ranges of expected values of distortion in a within-source comparison were determined for 5 to 15 minutiae and compared to between-source comparisons. The densities for within-source comparisons were determined to be in a log-probability density range that the vast majority (greater than 99%) of between-source data fell outside of. The model has implemented a ratio of the two distances (D1/D2) which allows for comparison of images of different resolutions. This in turn has allowed for testing with an increased population of between source images. The results suggest that the proposed model could be a powerful tool for the quality assessment of fingerprint expert opinion in operational casework. Outcomes of this study will contribute to strengthening the scientific underpinning of fingerprint science.

Disclosure: All authors have declared no conflicts of interest.

MEDICOLEGAL IMPLICATIONS OF BREAST TEXTILOMA MIMICKING A RECURRENT TUMOR

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Introduction: Textiloma is a mass composed of retained surgical textile foreign body. It is a rare iatrogenic complication. The most common cases occur after abdominal or thoracic surgery but rarely after breast surgery. It is a frequently injurious situation that can lead to medico-legal implications. It is considered to be a sample of medical negligence that involves the surgeon responsibility. It is a preventable condition and it can be avoidable by maintaining standard recommendations. **Aim:** To report an unusual case of breast Textiloma mimicking a recurrent tumor and to highlight its medico-legal implications. **Case report:** A 47-year-old lady, without past medical history, was diagnosed with a breast infiltring intraductal carcinoma. She was treated with mastectomy and adjuvantchemo radiotherapies. Four years later, the patient consulted her surgeon for a subcutaneous mass in the operative site. The physical examination found a palpable hard painless mass near the surgical scar. Ultrasonography showed a heterogenous mass. Both medical and radiological investigations concluded to recurrent tumor. The patient underwent surgery. Macroscopic exploration revealed an adherent whitish mass, measuring 5x5 cm with sclerotic consistency. The section showed a spong. The histological examination confirmed the diagnosis of Textiloma and noted granulomatous inflammation with multinucleated foreign body type of giant cell infiltration around textile fibres. **Discussion:** The medico-legal implications of Textiloma are high and significant. In fact, the doctor can be made liable in civil law for paying compensation and in criminal law if the degree of negligence is so gross. **Conclusion:** In spite of continual improvement in surgical procedures and the technical evolution aimed at protecting patients in the operating room, textiloma is unlikely to be completely eliminated.

Disclosure: All authors have declared no conflicts of interest.

THE USE OF DEEP LEARNING IN FORENSIC MEDICINE – A FEASIBILITY STUDY

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Introduction: The Virtopsy project aims at utilizing modern imaging techniques in forensic medicine. A variety of image modalities are used, most notably post mortem computed tomography (PMCT) and post mortem magnetic resonance imaging (PMMR). The amount of data generated by modern medical scanners can be huge, especially in a forensic setting, were the entire body is documented in high resolution. For PMCT, 10000 single image slices can be generated for one case, which has to be fully analyzed by forensic radiologists. For a routine forensic case, reading of images can therefore easily take 2 hours; complex cases can take even longer. A solution these issues could the use of deep learning techniques. Deep learning utilizes artificial neural networks that mimic the function of neurons in the human brain. Rather than building an algorithm, the computer is offered a set of training datasets and learns to detect patterns automatically. As a first test of the feasibility of deep learning in forensic medicine, we hypothesize that deep learning techniques might help in automatically detecting and segmenting cases of hemopericardium in PMCT. Matrials and Methods We used the ViDi Suite 2.0 as a deep learning image analysis software. 28 cases (20 male, 8 female) of hemopericardium were selected retrospectively. In a first step, for each dataset, one slice (the first slice cranial to the liver) was extracted, windowed and converted to the PNG format. In a second step, the training parameters were optimized. We tested the performance of the software to classify and segment a hemopericardium by using 50% of the input data for training and the other 50% for validation. Training was repeated 20 times, randomly selecting different images for training and validation. Results For classification, the software achieved an average f-score of 0.79 ±0.1 (max 0.96, min 0.54). The f-score for the correct segmentation of the hemopericardium was 0.8 ±0.02 (max 0.84, min 0.78) compared to the manual segmentation serving as reference. Discussion The trained networks were able to detect and segment a hemopericardium with reasonable success considering the limitations. While this technique is not yet feasible for routine use, we could demonstrate that deep learning might be a suitable tool to solve the problem of large datasets in forensic medicine in the future.

Disclosure: All authors have declared no conflicts of interest.

TESTING THE REPRODUCIBILITY OF 3D MODELS OF LONG BONES: MDCT VERSUS 3D SURFACE SCANNING

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Multi-detector computed tomography (MDCT) and 3D Surface scanning (3DSS) are two modalities used in forensic medicine and science for digitisation of the body and/or discrete body parts. The 3DSS technology may also be employed in the digitisation of bones. Both methods are used regularly, but there is currently no indication given about their reproducibility in the literature. In our study, we have generated 3D models from data derived by MDCT and 3DSS, in order to test the repeatability of both technologies. For this first study, we investigated 6 femurs and 7 humeri with both imaging modalities. A primary MDCT data acquisition has been carried out using a 64-row MDCT-device. Slice thickness was chosen at 0.6 mm with an increment of 0.3 mm to obtain high resolution images. The same bones were scanned with the GOM ATOS Compact Scan 5M Surface Scanner. The scans of all 13 bones were repeated again using both imaging modalities with the same equipment and scanning parameters a few months later (secondary acquisition). From all resulting scans, 3D models of the MDCT data were generated first by volume rendering followed by surface rendering using Osirix Software. The 3D models created by surface rendering have been exported in STL format. In order to compare the obtained

3D-models (n=52), GOM ATOS Software was used for superimposition and comparison. We first compared the primary and secondary 3DSS of each bone under test, with the secondary acquisition in order to investigate the reproducibility of 3DSS. Second, we compared the primary MDCT scan of each bone with the secondary acquisition for investigating the reproducibility of MDCT. Finally, we made a comparison for each bone using the data obtained in the second 3D surface scan against the data obtained from the second MDCT in order to compare the two modalities against each other. Our results revealed that the repeatability of 3DSS and MDCT are almost the same. In fact, both methods revealed a deviation of <1 mm. Also the comparison of the 3D-models obtained by the different methods did not show any significant deviations. This led us to the conclusion that both modalities are equally suitable to document dry bones.

Disclosure: All authors have declared no conflicts of interest.

FINGERMARK VISUALISATION FROM POST-BLAST IED FRAGMENTS AND BOMB DEBRIS

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It has previously been assumed that fingermarks are too fragile to withstand the extreme conditions associated with an explosion. There is also little research in this area to date. The identification of fingermarks from post-blast Improvised Explosive Device (IED) fragments allows not only knowledge of who detonated the device, but also the potential maker of the device or anyone else associated with the making, distributing and detonation of an IED. In the present study car bombs, pipe bombs, letterbox bombs and backpack bomber scenarios have been carried out. Three car bomb scenarios (known as Vehicle-Borne IEDs, or VB-IED) have been conducted in total, using C4, Cast Booster and TNT as the explosives. Twenty pipe bomb scenarios have been conducted: two brass pipe bombs using gunpowder, nine copper pipe bombs using gunpowder, seven steel pipe bombs using gunpowder, and two steel pipe bombs using C4. For the mailbox bomb a mixture of C4 and gunpowder was used. and for the backpack bomber scenario an ammonium nitrate Ammanol explosive was used, placed in a backpack which was then placed in a trash can to mimic a possible airport or train station style public detonation. Fingerprints were deposited directly onto the IEDs, onto "evidence" placed in the VB-IEDs and backpack bomb, as well as on the outer surfaces of the vehicles, mailbox and trash can. After each scenario, fragments of the IED, planted "evidence" and debris from the blast scenes were recovered and taken back to the laboratory for non-contact, non-destructive analysis using an in-house built Multi-Spectral Imaging system at the University of Leicester. In every IED scenario, positive results were achieved, with fingermark ridge detail being visualised. Multiple fingermarks of suitable quality to lead to a conviction were achieved on multiple fragments and debris. Those not of sufficient quality for conviction identify a region of potential biological material that can be targeted for DNA analysis. Being a non-contact and non-destructive fingermark visualisation technique, other post-blast analyses can still be conducted on the fragments and debris, such as explosive residue analysis and DNA analysis.

Disclosure: All authors have declared no conflicts of interest.

EXTERNAL-CAUSE MORTALITY IN YOUNG PEOPLE AGED 10-24 YEARS DURING 1998-2016 IN EPIRUS, GREECE

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Background: Remarkable shifts in health occur around puberty and patterns of injury alter substantially during physical maturity from early adolescence to young adulthood. Various psycho-social and behavioral public health issues affect young people's mortality. The present study aims to record and analyze rates, patterns and trends of external-cause mortality (non-natural deaths) in young people aged 10-24 years in the Region of Epirus, northwestern Greece, during the period 1998-2016. **Methods**: The archives of the autopsy records kept at the Department of Forensic Medicine and Toxicology, University of Ioannina, Greece (which is authorized to perform all the medico-legal autopsies and investigate all the non-natural and violent deaths occurring at the region of Epirus), were retrospectively investigated and the number of deaths due to external causes, during the 19-year period, was extracted. Extracted cases were divided in three age groups for each gender: young adolescents (10-14 years), older adolescents (15-19 years) and young adults (20-24 years) and all relevant data were analyzed. The causes of death were coded as V01–Y98 according to the ICD-10. **Results**: During the study period there were 293 deaths out of 317 (92%) total autopsies performed among the young. The male-to-female ratio was 4:1. Road traffic accident (RTA) was the most common cause of death (70.3%) in the study population, followed by suicide (8.5%) and deaths attributed to illicit drug abuse (6.8%). The most common methods of suicide were gunshot (40%), with young adults preferring this method (no/no, 80% of cases), and hanging (32%), with adolescents being the majority of choosing this method (63%). Mortality rates from external causes for the studied age group in the region (deaths per 100,000 inhabitants) increased from 15.2/100,000 in 1998 to 18.9/100,000 in 2016, though presenting substantial fluctuation throughout the study period (mean annual mortality rate: 29.2/100,000). Similarly, the mortality rates from RTAs, increased from 11.4/100,000 in 1998 to 15.2/100,000 in 2016 (mean annual rate: 20.5/100,000). Mortality rates were higher in young adults than in adolescents and in males than in females. **Conclusions**: Our findings suggest that these deaths could be preventable and therefore a strategy is needed to overcome the financial barriers to adequately detect the risk factors responsible for young people's mortality. Policy-makers should adopt an efficient health information system to prevent mortality during that important period of life.

Disclosure: All authors have declared no conflicts of interest.

HOMICIDAL CROSSWISE CUT OF THE HEART: EVALUATION USING POST-MORTEM IMAGING AND VIDEO SURVEILLANCE

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Introduction: In forensic evaluation of homicide cases in which fatal injuries have been inflicted by sharp force trauma, it is essential to analyse the case referring to the possibilities of reconstruction of the course of the critical event. Material and Methods: The authors present a case of a 22-year-old male whose chest has been stabbed once from the back. Post-mortem examination comprised of both post-mortem computed tomography (PMCT) with PMCT – Angiography (PMCTA) and conventional autopsy examination. PMCT and PMCTA performed using Somatom Emotion (Siemens AG, Germany), kVp 130, mAs 50 and 240, reconstructed slice thickness 0.75 and 1.5, collimation 16×0.6, and pitch 0.85 and 0.55. Contrast medium administered to right femoral vessels in two phases (arterial and venous) was 6 % paraffin oil solution of Angiofil® (Fumedica AG, Muri, Switzerland). The CT data acquisition was completed within 15 hours after death. The results were evaluated using the open source Digital Imaging and Communication (DICOM) viewer, OsiriX (Pixmeo SARL, Switzerland, version 5.0.2), including the analysis of two-dimensional (2D) slices, multiplanar reformatted (MPR) images and formation of three-dimensional (3D) images by volume-rendered reconstructions. The critical event happened in the street at the city center which enabled the access to Closed-Circuit Television (CCTV) / video surveillance recordings of the event from three different cameras (angles). Results: It has been revealed that among the injuries, the victim's heart was almost completely cut crosswise, at the distance of about 5 cm from the apex, with the partial opening of the right ventricle and the total opening of the left ventricle. The

authors present autopsy specimens as well as PMCT and PMCTA 2D and 3D reconstructions, showing the pattern of injuries and the actual injury track. The CCTV films showing the critical incident prove quite unexpected behavior of the victim, who having received the fatal stab, managed to run from the place of the critical event within the time of about 7 seconds before he finally collapsed. Conclusion: Forensic post-mortem examination strengthened by both post-mortem imaging techniques and analysis of video surveillance recordings made possible a very precise description of the critical event and the pattern of injuries.

Disclosure: All authors have declared no conflicts of interest.

ESTIMATION OF CHRONOLOGICAL AGE BASED ON THE DENTAL DEVELOPMENT OF THE THIRD MANDIBULAR MOLARS

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Introduction: Very few techniques can be used to determine someone's age between 16 and 20 years old. For teenagers and young adults, the third mola is the only dental element which is still evolving at this time. The technique outlined by Demirjian et al and revised by Mincer is commonly used. In order to validate a method, it must be tested on various populations. The main objective was to show the reliability of this method. The second objective was to test its reproducibility. Materials and Method: To achieve this, we analyzed 1,062 panoramic dental radiographs in a population from western France. Our sample was made up 564 men and 498 women, all aged between 15 and 25 at the time of examination. Each of the panoramic radiographs was thus analyzed and interpreted anonymously and independently by three observers with diverse experience, namely one dental surgeon with experience in the method, and two young forensic specialists. The statistics were analyzed using Microsoft® Excel 2010 for Windows, GraphPad Prism and Stata 11.1 (College Station, TX). Means and standard deviations were calculated for each stage of development, by gender. Student's t test was used by way of comparing the means between the genders with a degree of significance of $p < 0.05$. Linear regression was used to determine the correlation between chronological age and stage of development. Inter-observer and intra-observer concordance is expressed using Cohen's Kappa coefficients. Results this study showed that Mincer's method is reliable on the population studied, with a good correlation between the development of tooth 38 and chronological age (men: $r^2 = 0.23$; women: $r^2 = 0.35$). Dental development was seen to be statistically more premature between men and women at stage H ($p<0.05$). This method can be reproduced (kappa > 0.800), and inter-observer concordance is notable (Kappa > 0.650) Conclusion The method outlined by Demirjian et al. and revised by Mincer et al. remains the most reliable technique in determining the chronological age of an individual between the ages of 16 and 20, in the absence of any more accurate method for this age group. Finally, analysis of inter-observer and intra-observer concordance highlighted the ease of application and useful nature of the method for practitioners recently trained in this technique.

Disclosure: All authors have declared no conflicts of interest.

LETHAL ACETAMINOPHEN POISONING: MEDICO-LEGAL IMPLICATIONS

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Introduction: Acetaminophen poisoning, leading to death, is a serious and dramatic accident for even the family and pediatricians. Prescribing error can engage the physician's responsibility. **Aim:** To report a case of lethal acetaminophen poisoning occurred in an infant with underlying liver disease and to discuss its medico-legal implications. **Case report:** An 11 month-old boy, without medical history, was presented to his pediatrician for a nasopharyngitis with gastroenteritis of three days duration. The prescription involved two drug forms of Acetaminophen. The total prescribed dose was 270mg / kg / day. The death occurred after two days. A blood test taken before his death showed a major hepatic cytolysis with toxic level of acetaminophen. Forensic autopsy has been ordered. At dissection, the liver was palish and hemorrhagic. Toxicological screening showed a high level of acetaminophen (79mg/l). Histological examination concluded to diffuse microvacuolar steatosis. **Conclusion:** This case report highlights the risk of hepatotoxicity of acetaminophen. This complication is even more serious if the child already has a congenital, unknown liver disease. The physician and the pharmacist's liability, in this case, would be incurred even withpartial causal link.

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NEW FORENSIC TECHNOLOGY: A VALIDATION STUDY

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A new crime scene investigation tool has been built and tested at the University of Leicester. The technology, provisionally named FINDER (Forensic Identification via Non-Destructive Evidence Retrieval) can be deployed rapidly as a technique for the non-contact and non-destructive analysis of evidence at the scene or in the lab. This includes fingermark visualisation, blood and semen identification as well as an array of other applications. Regarding fingermarks, an initial validation study has been performed in two stages: the first being a blind test with fingerprint examiners around the world, the second being an eye-tracking experiment. Three surfaces, each with ten fingermarks deposited on them from the same donor, were used: polypropylene plastic, glass and stainless steel. The fingermarks were then non-destructively visualised using FINDER, before being enhanced using traditional methods – either black powder or aluminium powder – and then imaged using a Nikon D3300 Digital SLR camera. This gave one FINDER image and one traditional image per fingermark deposited. For the first part of the validation study, the fingermark images were collated and a blind test conducted with fingerprint examiners around the world. The examiners scored the images in terms of quality (based on the 0-4 CAST scale) as well as the number of minutiae and whether the detail was sufficient to further compare to a known fingermark. In the second part of the validation study, fingerprint examiners underwent eye-tracking experiments to determine how the eyes and brain respond to the different stimuli – whether the images from FINDER or the traditional techniques are a better stimulus for the fingerprint examiners to make a comparison or determine the quality of the fingermarks. The order in which the examiners in both parts of the validation study saw the images was random, with each examiner having the same number of FINDER images compared to traditional images, although unaware of which was which, to prevent any bias in the study. To further remove any bias, the participants were also unaware of the enhancement techniques used; they simply saw an image of a fingermark.

Disclosure: All authors have declared no conflicts of interest.

ESTIMATION OF STATURE FROM THE LEG AND FOOT DIMENSIONS: APPLICATION ON TUNISIAN POPULATION

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Introduction: Forensic anthropology is a multidisciplinary field that deals with the identification of human remains in a legal context. In fact, stature estimation is considered to be one of the most significant anthropological parameter in establishing personal identity. For that alternative methods have been developed to deal with these identification difficulties. Aim: To analyze the correlation between stature and the leg and foot dimensions in a Tunisian population. Material and methods: It's a transversal analytical study that was conducted at the department of forensic medicine of Fattouma Bourguiba hospital of Monastir (Tunisia), during the period from March 2014 to August 2014. The study sample consisted of 165 Tunisian living subjects aged over than 18 years. Stature, eight measurements for each foot (Five distances between the most posterior and prominent point of the heel and the most distal point of each toe, the width of the heel, the width of the foot and the height of the foot) and a length measurement of the right leg were measured for each subject, using a standard anthropometric technique (graduated anthropometric rod) and a contact scanner. Results: Our results showed a positive and significant correlation for all dimensions of the foot except the foot width for both sexes and the heel width for men. The five foot length measurements are highly correlated with the stature with no significant differences between the measures of the two sides. The length measurement of the big toe has the highest correlation with the stature ($r = 0.89$).Considering the total population, the leg length seems to have a low correlation with height ($r = 0.40$). This correlation becomes much more meaningful when we consider men and women separately with $r = 0.70$ for women and $r = 0.65$ for men. We also concluded that the combination of the length of the leg with the length of the foot taking into account the sex improves highly the correlation (with an error of). The study of the other variables showed that the shoe size is correlated with the stature but with an error exceeding 5 cm, while the weight does not present any correlation. As to the age, we found that it has a significant, but negative and very low correlation coefficient ().

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ENVIRONMENTAL CRIMES IN BRAZILIAN FEDERAL DISTRICT: AN ANALYSIS FROM 2009 TO 2015

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The Brazilian Federal District (BFD) lies within the Cerrado (savanna) biome, considered one of the most threatened and over-exploited biomes in Brazil. BFD territory houses more than 113 conservation areas and to protect them, the Brazilian Law of Environmental Crimes comes as an effort to limit the damages caused by human activities on natural heritage. This work aims to: i) characterize the records of environmental crimes in BDF, identifying their peculiarities and ii) identify possible associations among the study variables. Environmental crime data recorded by the BFD Police (PCDF) from 2009 to 2015 were evaluated by means of descriptive statistics and Principal Component Analysis (PCA). From 4,085 records, 39.2% referred to harm to conservation areas, 33.7% to crimes against urban planning and cultural heritage, 25.2% to crimes against fauna, 1.8 % to crimes against flora and 0.1% referred to environmental pollution. Ceilândia county had the highest absolute number of records (417), being characterized by crimes against fauna, urban planning and harm to protected areas, while the Special Police Station for Environmental Protection and Urban Order (Dema) was responsible by the majority of records (752) among police stations. Associations between crime records, counties and police stations are explained by some local singularities such as the intense urbanization where crimes against urban planning were mostly recorded, elevated number of urban trees where many crimes against flora were recorded, and the proximity to conservation areas where crimes against fauna and harm to these same areas were recorded at most. Data suggest that local attributes attracts specific sort of crimes.

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ROLE OF MPMCTA IN THE CONGRUENCE OF CARDIOVASCULAR MEASUREMENTS: AUTOPSY AND POST-MORTEM IMAGING

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Over the last decade, the application of post-mortem imaging has been introduced as a common tool in forensic investigations. Post-mortem CT angiography is considered the method of choice for post-mortem imaging investigations of the cardiovascular system, though autopsy still remains the gold standard for cardiovascular measurements. Currently, there are no studies concerning cardiovascular measurements on multi-phase post-mortem angiography (MPMCTA) which includes comparisons with autopsy. The aim of this study is to compare cardiovascular measurements between the unenhanced CT-scan and the three contrast enhanced phases (arterial, venous and dynamic/circulating) of the MPMCTA to ascertain which of these protocols correlate best with autopsy measurements. In order to perform this study, we retrospectively selected 50 post-mortem cases that underwent both MPMCTA and autopsy. A comparison has been carried out between cardiovascular measurements regularly measured in imaging (aortic diameter; diameter of heart cavities and cardiac wall thicknesses; maximum cardiac diameter and cardiothoracic ratio) and those regularly measured at autopsy (aortic diameter; heart valve circumference, ventricular thicknesses and cardiac weight). Our results show that the circulating (or dynamic) phase displays an advantage for the measurement of the aortic diameter. However, MPMCTA is not accurate in measuring the cardiac wall thicknesses. The measurement of the heart cavity diameter shows no correlation with the heart valves, although both are used to indicate chronic congestive heart failure. The cardiothoracic ratio measured by the MPMCTA show no correlation with the heart weight. However, the maximum cardiac diameter does exhibit a correlation with the latter on the venous and dynamic phase. Finally these results highlight that few cardiovascular parameters measured with imaging correlate with measurement obtained at the autopsy. These results indicate that in order to better estimate values obtained at the autopsy, we need to define new reference values for the cardiovascular measurement on MPMCTA.

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FORENSIC CASEWORK ON NPS AT THE DRUGS ANALYSIS LABORATORY DE MEDICINA LEGAL. BOGOTÁ, COLOMBIA

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The NPS in Colombia are a challenge to criminal investigation due to the continuous introduction of new synthetic psychoactive substances to the market, the simple synthesis processes, the few precursors required, the low cost and the low concentration of these products needed to obtain strong psychoactive effects. Since they appear and disappear quite fast from the market in order to avoid legal controls in different countries the acquisition of analytical standards is quite difficult. All these factors make it a challenge to establish an analytical protocol. In a period of only two

years the laboratory identified nine different new molecules: 4-chloro-2,5-dimethoxyanphetamine (DOC), 4-Bromo-2,5-dimetoxyanphetamine (DOB), 4-Metoxymetanphetamine (PMMA), 25B-NBOMe, 25C-NBOMe, 25I-NBOMe, 3,4-methylendioxymetcationone (Metilona), 4-Bromo-2,5-dimetoxypheniletylamine (2C-B), 4-iodine-2,5-dimetoxyphenilethylamine (2C – I). This finding calls attention in a country considered to be producer and consumer of cocaine, heroin and marijuana.

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CONSIDERATIONS FOR THE MOUTH ALCOHOL EFFECT DUE TO LOW-CONCENTRATION ALCOHOL DURING BAC TESTING

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The mouth alcohol effect, which transiently increases breath alcohol results, is widely known amongst forensic toxicologists, e.g., Gullberg, 1992. Situations where an individual experiences the movement of stomach contents into the mouth (regurgitation, vomiting) could also produce a mouth alcohol effect. Gastric alcohol content after the last drink can range between 0.1 – 2.9% alcohol v/v (Pollack et al. 1992). Therefore, it is forensically relevant to consider the effect of mouth alcohol resulting from low alcohol concentrations on individuals providing breath samples. This study attempted to determine the effect of low-concentration alcohol on breath results obtained with the Intoxilyzer 8000C. Low concentrations of alcohol (1, 2, and 3% alcohol v/v) were held in the mouth for 1, 3, and 5 seconds prior to being expectorated or swallowed. Baby food (puréed chicken and vegetables) was also introduced as an alternative diluent to water. Finally, subjects with a pre-existing BAC (i.e., drinking subjects) were compared to alcohol-free subjects. Differences were considered significant at $p<0.05$. In alcohol-free subjects (n=8) the average (±SD) maximum BAC achieved was 153 ± 33 mg/100 mL; range 94 – 190. The average time required to reach 0 mg/100 mL was 5.5 min ± 1.6 (range 2.8 – 7.7). Food as a matrix had no effect on the maximum BAC or the rate of dissipation. The initial BACs of the drinking subjects (n=5) were 91 ± 41 mg/ 100 mL. Average BACs in drinking subjects after ingesting the low-alcohol/food matrix were 255 ± 66 mg/100 mL; range 141 – 378 indicating the mouth alcohol effect increased the BAC by as much as 150 mg/100 mL. Drinking subjects with a food matrix eliminated mouth alcohol more rapidly when compared to all other conditions (2.8 ± 0.72 min). In contrast to previous mouth alcohol studies where a masking effect in the BAC of drinking subjects was reported we observed an additive effect. In Canada, two breath samples, taken at least 15 minutes apart, and within 20 mg/100 mL when truncated, are considered to be in good agreement. This requirement likely would negate the possibility of overestimation of the BAC attributable to mouth alcohol effect produced by low-concentrations of alcohol.

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THE ENDOSCOPY OF FIREARM BARRELS: A NEW APPROACH IN SHOT RANGE ESTIMATION

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After a lethal gunshot injury the differentiation between suicide and homicide is a complex interdisciplinary task. Gunshot residue analysis can help to identify the firing hand. Backspatter on the hand of the deceased can be an indication of a self-inflicted injury. Another important evidence is provided by the shot range estimation. Previous studies documented biological traces inside the firearm barrel after contact shots, especially to the head. In a research project funded by the Swiss National Science Foundation staining inside barrels after experimental contact shots was investigated and compared with real cases. 12 x 12 x 12 cm gelatin cubes doped with pads containing acrylic paint, radiocontrast agent and human blood (triple contrast method) were used as target models. Shots from varied distances were compared to contact shots using current handguns in forensically relevant calibers. The barrels were examined using a rigid borescope with video camera. Swabs were gathered from both ends of the barrel and quantitative PCR was performed. Contact shots showed a characteristic staining inside the barrels. The amount and extension of the traces depended on the firearm system. Visible traces were always decreasing from the muzzle to the rear end of the barrel. This could be confirmed by significantly different DNA yield in the anterior and the posterior part of the barrel. With increasing shooting distances (1 to 3 cm) systematic staining was reduced and finally restricted to the anterior part of the barrel. Singular traces were observed in some shots from up to 10 cm distance. Real cases of contact gunshots to the head show more heterogeneous findings, from clean seeming barrels to morphologically identifiable traces. However, swabs of endoscopically inconspicuous barrels provided DNA yield, which allowed the identification of the victim. Examination of staining inside firearm barrels could help to estimate shooting distance of near or close contact shots, especially in cases where the classical shot range determination fails e.g. because of putrefaction.

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IMMUNOHISTOCHEMICAL LOCALIZATION OF LANGERHANS CELLS AS A TOOL OF VITALITY IN HANGING MARK WOUNDS

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The determination of vitality and wound age is one of the most challenging issues in forensic pathology, about which a large amount of scientific work has been submitted for many decades up until now. In the first minutes or hours, standard histological examination may not distinguish ante mortem wounds from post mortem damages. The immunohistochemical analyses of factors that mediate initial events of the inflammatory reaction are useful to distinguish vital from post-mortem injuries and to reduce the range of vitality estimation. Previous studies have substantially established that cytokines, tryptase and P-selectine are extremely early immunohistochemical markers of vitality in skin injuries. In addition, mast cells and dendritic cells were recently proposed as a tool to discriminate between vital and post mortem lesions. However, the uncertainty in the timing of wounds remains, especially when survival time was short and the standard histological or immunohistochemical examination may not determine whether the wound was inflicted in the pre- or post-mortem period, as well as in hanging death. Hanging death is common and characterized by a very short survival time of the victim and usually macroscopic and histological exams are not able to distinguish vital from post-mortal lesions. The study comprised skin specimens from the edge of vital wounds (with a survival time by 0 to 5 minutes), from ligature marks and from post mortem lesions, compared with control skin specimens taken at 5 or 20 cm from a wound. Cryosections were fixed in cold acetone, stained for hematoxylin eosin, fluorescent avidin, CD1a and MHC class II+ antigens and examined by light microscopy or fluorescence microscopy; digitized photomicrographs were used for image analysis. No differences were found for histological scores, fluorescent avidin, and MHC among controls, vital lesions and ligature marks, suggesting that such markers are stained with a 5 minutes minimum time interval for positivity. Differences were found about Langerhans cells density among vital lesions and ligature marks with the other specimens. The results may be useful in forensic practice when macroscopic and microscopic objective evidence of vitality is absent, and may support the hypothesis that the time of death in hanging is very close (< 5 min) and that, consequently, some of the immunohistochemical markers are not helpful in such cases.

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STUDY ON STRONTIUM ALUMINATE PHOSPHOR MATERIAL FOR FINGERMARK DETECTION

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Recent research on long afterglow phosphor powder in forensic science shows that it could be a suitable candidate of latent fingerprint developing agent on luminescent and highly patterned surfaces. In this paper, europium doped strontium aluminate phosphor material is synthesized by combustion method. The photoluminescence emission spectra of the material are studied. The fine powder for fingerprint dusting is made and its application on the detection of latent fingermarks on various surfaces is reported. The developed fingermarks are obtained under various wavelength light resources using different exposure time. The influence factors to the afterglow lasting time are evaluated as well. The result shows that the prepared SrAl2O4:Eu2+ material can emit long afterglow luminescence when excited by UV light or sunlight. It is able to detect latent fingermark on nonporous surfaces and most porous surfaces. The visible afterglow of the developed fingermarks can last more than 10 minutes long. It's easy to capture the developed luminescence fingerprints by digital camera. and the minutiae details of the developed fingermarks are clear enough for the fingerprint examination and analysis. The prepared europium doped strontium aluminate phosphor can be a good substitute for ordinary fingerprint powders according its good physical and chemical properties.

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INBREEDING EFFECT ON FORENSIC INVESTIGATIONS INVOLVING DNA MIXTURES: THE LEBANESE POPULATION CASE

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Forensic DNA has become an indispensable tool to help ensure justice by identifying perpetrators and more importantly by exonerating falsely convicted individuals. Yet, when DNA mixtures which represent an increasing fraction of forensic caseworks are involved, the match probability with the suspect(s) profile becomes more difficult to assess due to several challenges such as multiple genotype possibilities, homozygosity, allele sharing between contributors, allele drop-outs, allele stacking, and stutter production. These challenges are further increased when the true DNA contributor and an innocent person, who was nowhere near the crime, belong to the same subpopulation and to a higher extent share a common grand ancestor. Consequently, it's highly possible to produce false links between crime scene traces and innocent persons if the inbreeding effect is not evaluated and taken into consideration in the population under study. This study presents an assessment of inbreeding effect on DNA mixture interpretations in the Lebanese population which is structured over eighteen religious communities with high endogamous (88%) and consanguineous (36%) marriage practices. Samples from six villages with high inbreeding rates were collected. 28 STR systems were amplified via PowerPlex_16HS®, PowerPlex_ESI17® and PowerPlex_CS7®. DNA mixture simulations were performed electronically, using an in-house Software, by combining each individual profile with each of all other inhabitants of the same village, followed by matching between each simulated mixture and all the profiles observed in the village. The possibility of false links between crime scene traces and an innocent person was assessed. These simulations revealed the possibility of false inclusions using DNA profiles established with 15 & 23 systems. *All false inclusion cases were solved only when 28 systems were used*. In other words, if only 15 or even 23 genetic systems are used in an investigation involving a mixture DNA profile, innocent people from the same community are likely to be falsely included. The 28 system profile-size has the potential to resolve these cases. Based on these observations, in the Lebanese population, to calculate the probability of the profiles *that could not be excluded* from a DNA mixture at 15 or 23 genetic systems, 28 STR systems need to be tested *mandatorily*. Further standardized mixture interpretation guidelines should to be established in order to reduce false inclusions and uncertainties in mixture analysis in populations with increased genetic relatedness like the Lebanese population.

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POST-MORTEM MR ANGIOGRAPHY AFTER MPMCTA – PRELIMINARY RESULTS

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There are an increasing development and interest in the field of forensic imaging. In many forensic institutes, post-mortem imaging is already incorporated into routine work; in particular post-mortem computed tomography (PMCT), which primarily permits analyzation of the skeleton and detection of foreign bodies as well as multi-phase post-mortem computed tomography angiography (MPMCTA), which allows for a detailed evaluation of the vascular system and organs. Magnetic resonance imaging (MRI) is advantageous as it allows for excellent visualization of the soft tissue, organ parenchyma and muscle tissue. Therefore, MRI could be a useful complement to PMCT and MPMCTA in cases of natural death. Until now, there are few studies concerning post-mortem magnetic resonance imaging angiography (PMMRA). To our knowledge, no protocol for whole body PMMRA has been established thus far. For this reason, at our institute, we have started to perform, for some selected cases (e.g. natural deaths due to a cardiovascular disease or trauma) post-mortem magnetic resonance imaging (PMMR) after having carried out a MPMCTA using the standardized protocol with the Virtangio® perfusion device and Angiofil® contrast agent. Once the MPMCTA was completed, bodies were disconnected from the perfusion device before MRI acquisition. For the MRI examination we use a 1.5 Tesla Scan (Ingenia, Philips Healthcare, Best, The Netherlands) with a dStream Torso coil combined with a FlexCoverage Posterior coil (with up to 32-channels). 3D T1-weighted and 3D T2-weighted sequences, as Dixon sequences in different weighting are performed for each case. Preliminary results show that the contrast medium used in MPMCTA was also suitable for PMMRA. The majority of findings which were visible in the MPMCTA were detected in the PMMR. Additionally, organ parenchymal visualization was superior compared to MPMCTA. However, we recognized the difficulty of detecting the exact site of hemorrhage in PMMRA. This was due to vessel collapse as a result of an absence of circulatory pressure after the perfusion device was disconnected. This led us to the conclusion that there is a requirement of a protocol that allows an ongoing perfusion during MRI acquisition, similar to MPMCTA.

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FORENSIC ANCESTRY ANALYSIS WITH COMBINED TWO ANCESTRY INFORMATIVE MARKER (AIM) PANELS

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Ancestry Informative Markers (AIMs) provide biogeographic ancestry information of an unidentified individual. These information may assist forensic investigations of unknown contributors or identification of missing persons and disaster victims. The routine forensic markers, which are STRs, cannot provide an acceptable ancestry information and mitochondrial DNA/ Y chromosome markers can only provide maternal/ paternal lineage information. On the other hand, the autosomal SNPs and insertion/deletion (InDels) can be used for predicting ancestry information of an individual as they can show high allele frequency differentiation amongst population groups. In this study we aimed to perform an ancestry prediction test for Turkish population samples (N=60) using combined AIM

panels 46 ancestry-informative InDels and 34-plex. We performed Single Base Extensions (SBE) method performed using the SNaPshot Multiplex kit (Thermo Fisher Scientific) for the 34-plex SNP panel. We separately applied PCR to capillary electrophoresis method for the 46 InDel panel. Then we used the Snipper online Bayes analysis portal () for the statistical inference of ancestry for each individual. The results show that almost all the Turkish individuals have high European ancestry components when we test three population (Europe, East Asia, and Africa) differentiation option in the SNIPPER portal. The results unsurprisingly remain similar when the number of reference population increased with additional Americans and Oceanians. As a result of this study, the accurate inference of the unknown individual can be easily achieved for only the continental groups of Europe, Africa, and East Asia. However sub-continental differentiations, in this case differentiation of Europe versus Middle East or Central South Asia, can be more optimally differentiated by a second tier panel which includes ancestry-informative markers chosen for the target region.

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THE NEED FOR LEADERSHIP TRAINING IN FORENSICS AND THE SUCCESS OF THE FORENSIC MANAGEMENT ACADEMY

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Abstract: A crime laboratory sits at the intersection between science and business, yet while the majority of forensic managers have had adequate technical training, they often have not had the opportunity to undergo formal management and business training. In addition, managers of crime laboratories are often promoted from within the organization for their proficiency in their technical skills, without undergoing a transition process, or a succession plan to prepare them for their new position, leaving it up to them to learn several aspects of their job on the fly. Management and leadership education that is targeted specifically to forensic professionals is crucial to better equip forensic managers to succeed in the complex environment of a crime laboratory. This session will discuss the management and leadership competencies necessary to manage a crime laboratory and share the success of the Forensic Management AcademyTM (FMA), a program designed at West Virginia University specifically to address the forensic industry-specific management competencies and skills which has been offered to hundreds of forensic managers throughout the United States.

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HIERARCHICAL TOP-DOWN EXAMINATION OF CRANIAL GUNSHOT INJURIES

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Bone tissue is a hard, composite material with the capacity to persist external forces. The bone persistence originates in the structural and mechanical characteristics on both the macroscopic and microscopic level, and can be expressed in terms of bone mineral density (BMD) and microarchitecture of the cortical porosity. It is well known that to a certain extent these parameters determine the overall strength and eventually the response of the skeleton to different mechanical stress. Literature survey shows that the majority of published studies have been dealing solely with the skeletal fractures, while the other types of damage have not been fully considered. The present study aims to describe cranial bone tissue damage due to gunshot trauma on various hierarchical levels while employing a micro-CT examination. The compact bone and its porosity network, together with the characteristics resulting from gunshot injuries (microcracks) were visualized by the combination of automatic and manual segmentation tools available in Amira 4.0 software and further quantified in terms of linear dimensions, surface area and volume. In doing so, different resolution parameters (the voxel size particularly) were considered. The relations between bone structural characteristics and those due to gunshots were assessed with regards to bone composition (fresh vs. archaeological bone) and mechanism of induced damage (ante- vs post-mortem gunshot wound). The amount and size of microcracks was expressed relative to the volume of the compact bone and the cortical porosity. In addition, characteristics of the microcracks passing through basic elements of the coritcal bone microstructure (e.g., osteon, Haversian canals) were considered. The acquired results shed light on interactions between external force and affected bone microarchitecture. This provides theoretical foundation to the comprehension of the microdamage inflicted by the gunshot injuries.

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THIRD MOLAR MATURITY INDEX: HAS IT ACCURACY TO ASSESS THE LEGAL AGE OF 18 YEARS?

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Introduction: The age estimation in Forensic Sciences is a complex procedure required in the daily practice of legal medicine. Since many stages of human development are already completed when the population gets 18th, the maturity of third molars stands out, because these teeth are still in development and can be useful for estimating adulthood. **Objective:** This systematic review aimed to assess the accuracy of third molar maturity index (I3M), proposed by Cameriere et al. (2008), in discriminating whether an individual is under or over 18 years. **Methods:** This systematic review was developed in accordance with PRISMA´ protocol and registered in the PROSPERO database (CRD42016038507). The literature search was performed independently by two researchers in the following databases: PubMed, Scopus, ISI Web of Science, Cochrane Library, LILACS, SIGLE and CAPES Database. MeSH terms, keywords, and other free terms related to age estimation, forensic dentistry, third molar, adolescents and young adults were used with Boolean operators (OR, AND) to combine searches. The reference lists of the retrieved articles were also examined to identify additional studies (hand searching). An initial selection was performed from the analysis of titles and abstracts. Subsequently, full-text versions of papers were retrieved for confirmation of eligibility. The quality assessment and risk of bias were performed by using QUADAS 2. Three meta-analyses (MA) were accomplished using MetaDiSc 1.4 software: an overall, one for males and another for females. **Results:** From 1885 articles identified, 14 met the eligibility criteria. Of these, only one showed high risk of bias in the Reference Standard domain. The percentage of individuals correctly classified ranged from 73.9% to 91.4%, not differing among studies. From the thirteen studies included in MA, a tendency to higher specificity than sensitivity values was observed, independently of the gender (pooled sensitivity = 0.86 (0.84 to 0.87) and pooled specificity = 0.93 (0.92 to 0.94)). The AUC (area under the Summary Receiver Operator Characteristics curve) and DOR (Diagnostic Odds Ratio) values were, respectively, 0.967 and 109.76, indicating an overall high discrimination and determination effect. Separately, I3M accuracy for males and females measured by AUC was similar and the DOR was higher for males. High heterogeneity was achieved both for sensibility (95.4%) and specificity (90.1%). **Conclusions:** The third molar maturity index is a suitable and useful method for estimating adulthood regarding legal purposes, since it has high accuracy in discriminating if an individual has reached 18 years of old, independently of gender.

Disclosure: All authors have declared no conflicts of interest.

OPTIMIZATION OF A NEW 20PLEX STR PANEL FOR FORENSIC USE

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Short Tandem Repeats (STRs) analysis is the widely used for forensic science applications. Almost all the commercial kits contain at least core 13 CODIS STR loci. In this study we aimed to develop a single reaction, fluorescently labelled in-house STR panel containing 20 different loci for forensic use. We chose 18 loci from two commercial kits (AmpFlSTR® Identifiler®, Thermo Fisher Scientific, and The PowerPlex® 16 System, Promega) and combined it with two miniSTRs (D6S1043 and D12S391) which does not exist in either of the kits to constitute a 20plex panel. Both of the kits contained core 13 CODIS STR markers plus Amelogenin in common, while AmpFISTR® Identifiler® (Thermo Fisher Scientific) has the STRs D2S1338, D19S433 different than the other and PowerPlex® 16 System (Promega) has PentaD, Penta E differently. Primers for each loci were designed and labelled with 4 different dyes (6-FAM, HEX, TAMRA, ROX) considering that they should not overlap in the mix. Primarily, each loci was amplified alone to check the amplification efficiency and observe its size. After the optimization of the each loci we successfully combined 20 STRs in a single multiplex. DNA concentration and primer volumes were adjusted to get an efficient and balanced amplification. The 20plex fluorescent STR system worked successfully combining the two commercially used kits and two mini STRs. A non-overlapping, highly sensitive single tube STR multiplex was constituted. The high performance of this 20plex fluorescent PCR system makes it a valuable alternative to the current commercial kits and can be used widely for forensic purposes.

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SUICIDE AMONG TUNISAN CHILDREN: EPIDEMIOLOGY, RISK FACTORS, AND APPROACHES TO PREVENTION

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Introduction: Suicide among children is a public health problem. National and international statistics are not exhaustive and precise. It is a tragedy that always upsets the balance of family and communities. In Tunisia, and since the Tunisian revolution, suicide in children is more and more lived. Several risk factors are involved. **Aim:** To study the epidemiological and thanatological characteristics of suicide in children in the region of Monastir and Mahdia (Tunisia) and to identify preventive approaches to suicide in children. **Material and methods:** This retrospective study was conducted at the Department of Forensic Medicine of the Medical College Hospital of Monastir, during a time period of 23 years. Thirty one cases of suicidal deaths of children aged under than 18 years, subjected to medico-legal autopsy, were the subjects of the study. The data were collected from the police reports, testimonies and the results of the forensic investigations (autopsy and complementary examinations). **Results:** The death of children, accounted for 6.3% of the thanatological activity of the Department of Forensic Medicine of the Fattouma Bourguiba University Hospital in Monastir, of which 11.2% were suicide cases (31 cases). We noted a female predominance with a sex ratio (M / F) of 0, 4. The average age of our study population was 14.9 years with extremes ranging from 11 to 17 years. The most affected age group was 11-14. In our series, no case was authenticated having psychiatric histories or auto-aggression. However, histories of suicide attempt were noted in only 3 cases (9.6 %). We also found that 80.6% of suicidal children were enrolled in school. No cases of drug addiction were revealed in our series other than tobacco addiction (6.6%) and occasional alcohol consumption (9.6%). Most of the cases were of low socioeconomic status and from a large family. In our series, suicide occurred mostly as a result of a family conflict (32.2%). Hanging was the most commonly used method. More violent means such as immolation were observed in a single case. **Conclusion:** Our study showed that suicide among children occurred mostly as a result of a family conflict most. The prevention of this phenomenon is a priority today and strategies of prevention should be better developed on a national and regional scale.

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FIRST APPLICATION OF A MUSCLE PROTEIN BASED APPROACH FOR TIME SINCE DEATH ESTIMATION

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Estimation of the time since death represents a central aspect and a complex practical task in daily forensic casework. Particularly in cases of unnatural death the post-mortem interval (PMI) has to be estimated as precisely as possible since inaccuracies and misinterpretations can have tremendous impact on the course of criminal investigations. Despite considerable research efforts, a golden standard in PMI delimitation is lacking at the moment, especially when the body core temperature has adjusted to ambient temperature. We have recently proposed a novel approach for PMI estimation, based on muscle protein degradation that has already justified its qualification by its first successful application in an actual forensic case: In January 2016, two dead bodies were discovered in a lake near Salzburg/Austria. At the scene and during autopsy, none of the available methods for PMI estimation could be applied for the female individual, and the time of death was as well unclear for the male. We present the results of our analysis of post-mortem protein degradation in these two corpses, and by that highlight the potential and current limitations of this approach. Results, in this case, highly supported a non-simultaneous death, which clearly confirmed the available non-biomedical evidence implying that the female individual died several days earlier than the male. Although, further research in the field of muscle protein based PMI estimation is inevitable to withstand as a valid method, in cases that are not in conflict with the current limitations, this approach herewith proved to already be a valuable tool in time since death-related case investigation. We will also compare these results with current findings and applications in other forensic cases from in and around Salzburg/Austria and further discuss the challenges and prospects of this new approach.

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VISUALIZATION OF LATENT FINGERPRINTS ON FRUITS AND VEGETABLES

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Development of latent prints on fruits and vegetables has become a great area of interest in forensic science. These everyday food items which are often overlooked for forensic evidence can be a great source of prints. This experiment was conducted to determine the effectiveness of three different fingerprint powders to visualize the sebaceous fingerprints on selected fruits and vegetables after different time intervals. Black powder, Supra Nano Fluorescent Green powder, a new experimental powder were used to recover the latent fingerprints. Apple, onion, potato, and tomato were used to lay the sebaceous fingerprints which were developed after different time intervals. The results show that the quality of fingerprints was different with each powder. The new powder made by mixing three different powders was successful on all the surfaces and was easier to use. The fingerprints recovery and visualization is not affected by the time passed after fingerprints deposition. We were able to recover fingerprints up to two weeks after deposition.

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IN VITRO INHIBITORY EFFECT OF EAM-2201 ON CYTOCHROME P450 AND UDP-GLUCURONOSYLTRANSFERASE ENZYMES

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EAM-2201, a synthetic cannabinoid, is a potent agonist for the cannabinoid receptors and has been increasingly used in recreational and illicit drug markets. Despite its popular and concomitant abuse of other drugs, the inhibitory effect of EAM-2201 on major drug metabolizing enzymes such as cytochrome P450 (CYP) and uridine 5'-diphospho-glucuronosyltransferase (UGT) activities was not reported. We evaluated the inhibitory effect of EAM-2201 on human major eight CYP (CYPs 1A2, 2A6, 2B6, 2C8, 2C9, 2C19, 2D6, and 3A4) and six UGT (UGTs 1A1, 1A3, 1A4, 1A6, 1A9, and 2B7) activities in pooled human liver microsomes using LC-tandem mass spectrometry in order to investigate EAM-2201-induced drug interaction potentials. EAM-2201 negligibly inhibited CYP1A2, CYP2A6, CYP2B6, CYP2D6, UGT1A1, UGT1A4, UGT1A6, UGT1A9, and UGT2B7 activities at 50 μM in human liver microsomes.EAM-2201 showed potent mechanism-based inhibition of CYP2C8-catalyzed amodiaquine *N*-de-ethylation, CYP2C9-catalyzed 4'-hydroxylation, CYP2C19-catalyzed [*S*]-mephenytoin 4'-hydroxylation, and CYP3A4-catalyzed midazolam 1'-hydroxylation with K_i values of 0.54 μM, 3.0 μM, 3.8 μM, and 4.1 μM, respectively, and k_{inact} values of 0.063, 0.0462, 0.0264, and 0.0250 min^{-1}, respectively. EAM-2201 competitively inhibited UGT1A3-catalyzed chenodeoxycholic acid 24-acyl-glucuronidation with K_i value of 2.4 μM. Based on these *in vitro* results, EAM-2201 has the potential to cause *in vivo* pharmacokinetic drug interactions with other co-administered CYP2C8, CYP2C9, CYP2C19, CYP3A4, and UGT1A3 substrates.

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THE PERSISTENCE OF FIBRES ON WINDOW FRAMES: SHOULD WE BE SAMPLING?

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Prolific offenders of burglaries are frequently forensically aware, therefore leaving no DNA or fingerprint evidence. Without these forms of evidence, the investigation may focus upon other types of particulates to provide evidence of the perpetrator being present at the scene and link between multiple crime scenes. Fibres evidence in the UK is rarely taped for in these volume crime scenes due to, in part, the assumption that fibres transferred at point of entries, i.e. window frames, do not persist long enough to be sampled by crime scene investigators. This study has investigated the persistence of a variety of fibre types upon uPVC windows (both in indoor controlled and exposed outdoor environments) for up to 4 hours. Persistence of fibres was demonstrated for all fibre types and indicated that fibres may be found past 4 hours after transfer. This paper will also refer to an initial study investigating the most probable locations of fibre and fingerprint evidence when climbing through a window. This paper will discuss how the results from these studies may inform sampling strategies for fibres evidence at scenes of crime.

Disclosure: All authors have declared no conflicts of interest.

EXAMPLES OF VEHICLE SPEED MEASUREMENT USING VIDEO INFORMATION OF DASHBOARD CAMERA

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Abstract: The dashboard camera could record not only driving image but also various information, such as the speed of the vehicle, GPS Information, the sound information and so on. The characteristics of the recording showed different states for each apparatus. In this report, we have summarized the measurement of the vehicle speed using the dashboard camera video information. 1. Confirmation of time-lapse rule of image 1.1. When the video is recorded, the time information is recorded in the video. If the rules of the time lapse coincide with the file format, the video sequence is extracted and confirmed over time. 1.2. In the case where the time information is not recorded in the video but the audio information is present, the reference of the time lapse can be confirmed by comparing with the lapse of the reproduction time. When there is no acoustic information, the characteristic of the passage of time is confirmed by comparison with the verification file by the recording apparatus. 1.3. Even when the rule of the time lapse does not match the file format, the characteristic of the time lapse is confirmed by comparison with the verification file by the recording apparatus. 2. Confirmation of the position in the image There is a limitation in confirming the absolute position in the dashboard camera video, but it is possible to confirm the relative position with the movement of the vehicle. They had been chosen the structure located at the center of the angle of view as the criterion for the position. The distance between the reference positions is not considered to be less than 10 cm for the actual measurement at that location and the error of 1 m for the 30 m is compared with the average actual measurement data when the satellite photograph is used, respectively. 3. Confirmation of additional information In the case where information by GPS is recorded, since the speed at the time when the GPS information is transmitted is recorded, it is possible to compare the measured value with the video information. In addition, it is possible to check the position of the image to be measured in a complementary manner when there is information by the GPS when the position is inevitably confirmed. Also, in the case where EDR exists in the vehicle, it could be compared the speed value.

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THE OSCAR PISTORIUS TRIAL: ETHICO-LEGAL PERSPECTIVES FOR FORENSIC PATHOLOGISTS

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Every forensic pathologist over the course of his/her professional career will encounter cases which will prove to be of a high profile or newsworthy nature. The profile of these cases cannot always be anticipated at the outset and will sometimes only become apparent long after the autopsy and initial investigations were conducted. Yet there is often an opportunity for us to learn from these high profile cases - and opportunity to use such cases to teach or to highlight certain issues, whether it be to educate and inform the public or to sensitize politicians and administrators to resource limitations or legislative deficiencies, etc. Most importantly though, such cases offer opportunity for us as pathologists to learn and to improve on our standards and service delivery to society. This presentation aims to highlight basic ethico-legal issues, by juxtaposing some of the issues which arose during the Oscar Pistorius trial, with the "Four Principles" of biomedical ethics (non-maleficence, beneficence, respect for autonomy and justice). This trial, dubbed by some in the media in South Africa to be the "trial of the century", generated huge media interest and public debate - but some issues remain unexplored and require critical review within the forensic fraternity. Discreet use may be made of case material to illustrate and substantiate some of these concerns and other dilemmas which arose in this case - and indeed, in other similar matters. South Africa has one of

the highest non-natural death rates in the world, with exceptionally high numbers of fatal outcomes due to interpersonal violence. In theory at least, many (perhaps all) of the issues which arose in the OP trial and which were subjected to intense debate and social comment are applicable to most other such cases. It is perhaps our duty to (responsibly) use the OP trial to sensitise society to some important issues which arise in the context of death investigation and presentation of evidence in subsequent legal proceedings. Hopefully, something good can thus come of this extremely sad incident, by our responsible debate regarding some issues which go to the heart of morality, ethics and jurisprudence – but which certainly require thorough debate amongst forensic pathologists and scientists in particular, from across the globe.

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FORENSIC SCIENCE EVIDENCE AND WRONGFUL CONVICTIONS IN NON-ADVERSARIAL EUROPEAN COUNTRIES

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What do we know about forensic science evidence as a contributor to wrongful convictions in continental Europe? The short answer is: not much. In the last two decades, a number of wrongful convictions caused at least in part by erroneous or misleading forensic science evidence have come to light. Moreover, several reports have denounced in forceful terms the lack of empirical validation in many forensic science disciplines, the insufficient education of some forensic practitioners, and the lack of standardization in the field. However, most of the debates that have ensued around the reliability of forensic science evidence and the contribution of such evidence to the phenomenon of erroneous prosecutions and wrongful convictions have taken place in the Anglo-Saxon realm and have been informed by data gathered in Anglo-Saxon jurisdictions. and yet, some highly publicized cases suggest that, just like in adversarial jurisdictions, forensic science evidence of unknown or dubious quality is sometimes offered in support of the prosecution's case in European courts. It also appears that, much like Anglo-Saxon juries, European professional judges sometimes misinterpret forensic science findings in the context of a given case. But is the situation in continental Europe similar to the problems that have been recently denounced in the United States, the United Kingdom, Canada or Australia, or are there significant differences? Basing on qualitative data collected in non-adversarial jurisdictions in Western Europe, this presentation will aim to explain how scientific evidence is used in such jurisdictions and what specific challenges fact-finders and parties face when such evidence is adduced.

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THREE GUNSHOTS AND ONE TRAJECTORY - CASE REPORT OF A MULTIPLE GUNSHOT SUICIDE

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Introduction: Multiple gunshot suicide occur when an individual commits suicide by inflicting multiple gunshots upon themselves before becoming incapacitated. Although uncommon, they are by no means rare. Multiple self-inflicted gunshot wounds usually present a challenge to the forensic pathologist in determining the manner of death, depending on the person's ability to act following a given gunshot wound. The authors present an unusual case of suicide involving three gunshots to the abdomen. This presentation will impact the forensic community by serving as an acknowledgement of the vital contribution of Forensic Pathology in a systematized format via interdisciplinary communication and collaboration, with other entities, such as police forces in the investigation of specific cases such as the one presented. **Case:** A 57-year-old male, found dead in the driver's seat of his vehicle, with what seemed as 2wounds, possibly caused by firearm, to the abdomen. Crime scene investigation revealed a small calibre handgun on the front passenger's seat, a projectile on the driver's seat and 2casings, one in the car and another on the ground next to the driver's semi-open window. While carefully examining the victims' clothes during autopsy, another casing was found. The outer garment presented a single gunshot hole, surrounded with burning and blackening (near firing), and a circular burning and blackening, with no hole. Post mortem exam revealed 2wounds to the abdomen, one in correspondence with the circular blackening of the clothes, which was merely an abrasion, and one other which corresponded to a single entrance wound. No exit wounds were found. Despite only having one entrance wound, radiographs of the body showed shadows of two bullets in the lower left part of the abdomen. During dissection, only one trajectory was identified, and 2 bullets were recovered, adjacent to one another. Toxicological results came back positive for alcohol(1,76±0,23g/L). **Discussion/Conclusions:** The determination of suicide is supported not only by the presence of a close-range wound but also by the scene and historical information, namely the presence of the gun near the body. Many factors, such as a lack of knowledge of anatomy, flinching at the time the trigger is pulled, defective ammunition, ammunition of the wrong caliber, or just missing a vital organ,- can account for multiple wounds in a suicidal setting. With this presentation the authors intended to emphasize the importance of a proficient forensic investigation, integrating competent forensic autopsy, as well as meticulous crime scene investigation and complementary examinations.

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APPLICATION OF DYE ANALYSIS IN FORENSIC FIBRE AND TEXTILE EXAMINATION: CASE EXAMPLES

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A few years ago, we developed and published a method to analyse fibre dyes [1]. This method will be introduced. The main part of the contribution will be on the application of the developed methodology in case work. We will present seven cases and a quality assurance test. In these cases, fibres or textiles submitted for investigation were analysed by HPLC-DAD-MS to identify the dyes present. The cases presented illustrate that it is possible to identify textile dyes in fibre traces recovered for forensic analysis. The results show that a mixture of dyes is present in all textiles investigated, except one sample that was taken from a manufacturer dye shade card. It is concluded that dye analyses improves the evidential value of forensic fibre examinations, as it becomes possible to distinguish textiles that are chemically different, but have a similar colour. In addition, dye analysis makes the examination more robust, as it becomes possible to attribute colour differences between samples to identical dyes (mixed in different ratios) or to chemically different dyes. (The information in this contribution has been submitted for publication.) [1] A. Carey, N. Rodewijk, X. Xu, J. van der Weerd, Identification of Dyes on Single Textile Fibers by HPLC-DAD-MS, Analytical Chemistry. 85 (2013) 11335–11343. doi:10.1021/ac402173e.

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APPLYING 3D HUMAN BODY SHAPE IN FORENSIC IDENTIFICATION TASKS

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Body shape and body proportions are among key characteristics employed in forensic identification of living persons, specifically, when other individualizing characteristics are not observable or retrievable from the collected evidence. Somatic features, such as development of thoracic

kyphosis, lumbar lordosis or shape of shoulders are group-specific traits permitting classification and assessment of biological profile. If established as unique they are also applicable in the process of individual identification. In the present paper we tested an algorithm for matching 3D body images using a dataset sampled randomly from patients treated at the Cardiovision Brno 2030 program (FNUSA-ICRC). The tested dataset composed of 3D body scans collected from 50 participants (30 males, 20 females) aged from 27 to 62 years (average at 44 years). For each participant, a pair of 3D body images in the standardized position was recorded with a full-body scanner TC2-19 ([TC]²Labs) in an interval of approximately five months. One image per individual was taken for a probe while the other was set as a target. Subsequently, each probe was tested against of an array of the possible targets. Differences in body shape were quantified by Fidentis Analyst program (v. 1.32,), where the magnitude of dis/similarity between aligned meshes (Iterative Closest Point alignment) is expressed by absolute closest vertex-to-vertex distances. For the purpose of the study, values of root mean square (RMS) were extracted from the sets of closest distances and taken for the global univariate measure of dissimilarity. For each probe, the acquired results were sorted in descending order according to the RMS values and match/mismatch decision-making was conducted in concordance with the provided ranking. Performance was expressed in terms of rank-1 identification rates. The acquired results were further tested for differences between sexes and for age-related variations by a series of nonparametric tests. The results yielded up to 97% of correctly matched scans depending on the resolution of 3D models and probe's sex (96.63% for males, 80% for females). Although in agreement with the unbalanced identification rates reported for different sex, an in-depth analysis showed that the mismatches were mostly due technical inconsistencies in the original 3D data. Altogether, the tested algorithm proved to be useful for further development of forensic identification standards. There are, however, other issues of the computational and technical nature that need to be addressed in order to acquire high-match scores in same-person comparisons

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ANALYSIS OF FIBRES AND OTHER TRACES BY AUTOMATED MICROSCOPY

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Microscopy is a very important tool in forensic science, as it allows the visualisation of minute traces. Trained microscopists can perform detailed and accurate identifications and comparisons of several types of traces. An important current limitation of microscopy is its subjective nature. The microscope offers means to visualise traces, but the *observation* and the especially the *interpretation* is carried out by the microscopist. A more objective method to perform microscopy would be very advantageous for several reasons: a) the results are more repeatable and less dependent of the microscopist; b) results can be stored in a database for future reference; c) results stored in a database can be used to facilitate international exchange, background studies and provenance studies. Development of methodology for objective microscopy that can implement in case work requires several issues to be solved. A camera connected to the camera port of a normal microscope may acquire objective images, but these images do not necessarily contain the relevant information. Moreover, cameras only facilitate the *acquisition* of images, they do not *interpret* images. In the current contribution we will present our current system for automated microscopy. We will highlight - The *instrumentation*. Current instrumentation has a spatial resolution of about 1.5 µm. It allows a spectrometric imaging approach and provides analysis of transmitted, reflected, polarised and fluorescence light. The instrumentation is prepared for the scanning of larger samples, especially tape lifts. - The *interpretation* of images by image processing algorithms. We have developed algorithms to classify several types of traces that are common on tape lifts, such as blood, skin cells, fibres, glass, and sand. For most of these traces (glass, blood, skin cells), this classification allows isolation of the trace for further analysis. Fibre traces are special in this respect, as the acquired images can also be used for further analysis of colour, morphology, and identity (based on polarisation microscopy). We will present algorithms that track and classify available fibres.

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DEATH DUE TO MIXED DRUG INTOXICATION INCLUDING MULTIPLE NEW PSYCHOACTIVE SUBSTANCES: A CASE REPORT

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In recent years, the number and type of acute intoxications linked to the use of new psychoactive substances (NPS) have increased. Also known as "legal highs", these chemicals are supposed to have similar effects to illicit substances; however most of them are not banned. When death occurs, it can be difficult for the forensic pathologist to determine the contribution of these products to the cause of death. Case report: A 55-year-old male was found dead in his house. Drug paraphernalia was collected near the body: a parcel that was sent from abroad was found on a table, containing 5 labelled single-dose packets with white powder indicating either synthetic cannabinoids (MMB-CHMINACA) or other designer drugs (methoxphenidine - MXP, methiopropamine - MPA, 3-fluorophenmetrazine – 3-FMP), as well as several lighters, a broken pipe with brown residue, and a glass with white powder. The autopsy was unremarkable, except for an intense and diffuse congestion and pulmonary edema. There were neither external injuries nor endogenous diseases judged by macroscopic and microscopic observations. The packets, the pipe and the glass contents were analyzed by gas chromatography-mass spectrometry and found to contain multiple psychoactive substances : ADB-CHMINACA (one packet), MXP (one packet), MPA (one packet), 5F-APINACA, AB-FUBINACA, FUBIMINA, MMB-CHMINICA, MPA and 3-FPM (one packet), MMB-CHMINACA and FUBIMINA (the pipe), ethylphenidate, 5F-APINACA, AB-FUBINACA, AB-CHMINACA, FUBIMINA, THJ-018, MMB-CHMINACA, 3-FPM, MPA and MXP (the glass). Liquid chromatography-tandem mass spectrometry (LC-MS/MS) analysis allowed to detect two synthetic cannabinoids: MMB-CHMINACA and ADB-CHMINACA in the peripheral blood, as well as opioid (oxycodone: 0.104 µg/mL), benzodiazepine (oxazepam: 0.11 µg/mL), three psychoactive substances (MPA: 2 ng/mL, MXP: 0.081 µg/mL, 3-FPM: 11.4 µg/mL), and antipsychotic (alimemazine: 0.09 µg/mL). The same drugs, together with zopiclone, were also detected in the urine (MXP: 0.285 µg/mL, 3-FMP: 32 µg/mL). Death was attributed to combined drug intoxication. Discussion: In the literature, each of the NPS that have been found in the post mortem sample of the decedent is not usually associated with lethal outcomes when ingested alone, and it can be difficult to correlate the concentration of one particular substance to effect, especially in the presence of other drugs. However the combination of several psychoactive substances, even in small amounts, may increase the risk of central nervous system depression and lead to death. The permanent emergence of NPS create challenges to police officers and forensic scientists to identify the substances, and determine the cause and mode of death.

Disclosure: All authors have declared no conflicts of interest.

SHARP FORCE INJURY FATALITIES IN ONTARIO, CANADA: A FIVE-YEAR RETROSPECTIVE STUDY

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Sharp force injuries (SFIs) are caused by contact with pointed or sharp-edged objects and include stab wounds and incised wounds. The purpose of this study was to identify the relevant characteristics to distinguish between homicidal and suicidal SFI deaths. A five-year retrospective

study was conducted of all deaths where SFI was listed as the cause of death from January 2011 to December 2015. The following variables were considered: age, sex, type of SFI, number of wounds, presence of non-fatal injuries (hesitation marks) or defensive injuries, manner of death, location of wounds, orientation of wounds, competing cause of death and location of the deceased. Studies have looked at subsets of these variables but none have considered them all. Deaths due to other traumatic causes such as motor vehicle collisions and accidental or undetermined manners of sharp force injury were excluded. The sample for this study included a total of 520 autopsy cases that met the inclusion criteria; 299 homicides and 221 suicides. This sample represents approximately two percent of the 29380 autopsies done by the Ontario Forensic Pathology Service during the same time period. The average age of homicide decedents was 39 years, whereas that of suicide decedents was 51 years. The male: female ratio for SFI deaths is 3.2 units. The percentage of female homicidal decedents is 31% and 14% for suicidal decedents. When compared to suicide victims, homicide victims incurred a greater number of wounds. The average number of wounds for suicide victims was 8.7 wounds and 15.3 wounds for homicide victims. SFIs in homicide decedents were more common to the extremities (54%), the chest (48%) and the neck (47%). Injuries to the extremities (63%), neck (47%) and chest (26%) were more common in homicides. Non-fatal injuries occurred in 32% of suicides, whereas defensive injuries occurred in 47% of homicides. The findings of this study can help coroners and training and experience forensic pathologists determine manner of death more efficiently. The findings of this study cannot be used to replace a thorough death investigation and a complete autopsy must still be performed.

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MONITORING CHANGES IN THE VOLATILE PROFILE OF AGING HUMAN BLOOD

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The detection of blood at a crime scene can provide critical information about the nature of events that occurred, the order of events, and possibly the identity of the individuals involved. Therefore, the detection of blood has always been an important aspect of forensic investigations. Establishing an accurate volatile organic compound (VOC) profile of blood can assist with developing and improving existing forensic methods to locate blood. This can be relevant at a crime scene or may also apply to the search for living and deceased individuals using scent-detection canines or portable detection devices. In recent years, the possibility to train scent-detection canines on blood has become more popular by forensic agencies. In order to provide more information about such applications, comprehensive two-dimensional gas chromatography (GC×GC) coupled to time-of-flight mass spectrometry (TOFMS) has been proposed as a novel analytical tool that can increase the ability to separate and identify blood VOCs. The introduction of new analytical approaches and technological developments requires the critical assessment of instrumental parameters and their combination. In this study, we apply a method using thermal desorption (TD) and GC×GC-TOFMS for monitoring subtle changes in headspace VOC profiles of aging human blood. Further, the use of variable-energy electron ionization (EI) allowed mass spectra to be produced with less fragmentation and an increased presence of structurally significant ions and the molecular ion. This provided additional confidence in peak assignments, especially for closely eluting isomers often observed in the profiling of the headspace of blood. The combination of low and high ionization energies and the use of retention time indices improved the identification of challenging compounds for blood VOC profiling. Statistical analysis using principal component analysis demonstrated that differences in blood VOC profiles due to sample aging are greater than inter-individual variations. The results further confirmed that distinctive patterns existed between fresh and aged blood; furthermore, we were able to highlight subtle differences in VOC profiles within the first week of aging. This demonstrates that by taking advantage of a broad array of instrument technical capabilities, blood VOC analysis will be able to reach its full potential in the future and contribute to practical advancements in the forensic sciences.

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DEATH OF AN INFANT DURING A CIRCUMCISION SURGERY: IS IT CRIMINAL MEDICAL NEGLIGENCE?

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Disclosure: All authors have declared no conflicts of interest.

FORENSIC ANALYSIS OF HARD COPIES OF DIGITALLY MANIPULATED DOCUMENTS

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Abstract: Forgers have become tech-savvy, using the tools of modern technologies to fabricate documents. It is very simple to adjust or modify digital image files with the help of image processing software. Images are cropped, rotated and compacted to make them fit for a document. Scanners, printers and computers are good enough to generate fraud documents, therefore, to prove the genuineness of a document is becoming more and more difficult. Research in the analysis of computer generated documents is very challenging and there is greater need to develop various forensic examination techniques to state the genuineness of such documents. Thus, the current study focuses on the possibilities to detect the traces of alterations made on hard copies of questioned documents. These alterations made were done with the help of various image editing tools offered by various image processing software's.

The alterations made to the hard copies of digitally manipulated documents included addition or deletion of numerical numbers, words, letters, stamp impressions etc. Hard copies of the altered documents along with their original copies were examined and compared using Digital Stereomicroscope Microscope. The digital microscope offers high resolution images which are recorded directly to a computer. The results demonstrated numerous features that are useful in detecting the alterations and confirming the authenticity of the documents.

Disclosure: All authors have declared no conflicts of interest.

A MOBILE APPLICATION TO AID IN EVALUATING AND INVESTIGATING DEATH SCENES

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Introduction: Thorough death/crime scene investigation - and the recording of relevant findings - plays a critical role in the overall medico-legal understanding and investigation of non-natural deaths. Information gathered at the scene of death not only assists in planning the subsequent death investigation, but ultimately may play an important role in determining the cause and manner of death. **Methods:** By applying commonly available smart phone / tablet programs or applications ("apps") to the death scene, a simple yet effective aid to death investigation has been developed at the University of Pretoria, for use by death investigators and pathologists. This application allows for structured, rapid and real time capture and storage of relevant information in electronic format, which can in turn be immediately made available by means of wireless transmission technology to off-site parties, including consultant pathologists, police officers, etc. Security of information is ensured by appropriate data encryption technology. A multiplicity of relevant facts or information fields may be easily and accurately incorporated into the on-site data capture, including elements such as crime scene GPS co-ordinates, ambient temperature, scene photographs, etc. The information / data could then be transmitted and stored in electronic format and/or linked to existing data archives. This application is specifically geared towards supplementing or enhancing the information fields /sets which forensic pathologists may require or find to be of value in order to prioritise scene attendance, plan and conduct their post mortem examinations or viewing procedures, or to interpret subsequent autopsy findings. **Conclusion:** In countries or communities where the lack of adequately skilled or trained personnel in the form of expert death / scene investigators may compromise the quality of the initial investigation (and even lead to grave miscarriages of justice), this new tool may greatly assist in ensuring that relevant information is systematically contemporaneously captured, stored and made available for assessment by trained professionals, thereby assisting in eventual criminal and civil justice administration. This tool indeed has potential for greatly improving the quality of medico-legal death investigation, not only in South Africa, but internationally.

Disclosure: All authors have declared no conflicts of interest.

ENHANCED CHEMICAL PROFILING OF HUMAN DECOMPOSITION IN A CASE STUDY

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Odor analysis is still highly controversial in the legal system regardless of its foundation in well-established gas chromatography – mass spectrometry (GC-MS) techniques. A prominent homicide case in the US recently brought forth the question of the admissibility of odor evidence in forensic casework; a chemical analysis of cadaveric odor was presented with conflicting opinions from two expert witnesses. Extensive research for the characterizing of decomposition odor has been conducted in recent years and classical GC-MS analysis of decomposition odor is now further supported by comprehensive two-dimensional gas chromatography – mass spectrometry (GC×GC-MS). GC×GC coupled with high-resolution time-of-flight mass spectrometry (HRTOFMS) was applied to the analysis of volatile organic compounds (VOCs) from case samples recovered at the site of a decomposing body in a forensic case in Belgium. The goals were to accurately profile decomposition odors from case samples using GC×GC, establish the start of a long-term case study, and understand future challenges. Adipocere and soil samples from the cadaver decomposition island were collected at the discovery site to reflect the heterogeneity of the decomposition environment. VOCs identified in the soil samples reflected previous studies, while the profile of adipocere was demonstrated for the first time by GC×GC-MS and was dominated by volatile acids and esters. Difficulties were identified with interpreting complex decomposition VOC mixtures due the low specificity of VOCs; therefore, VOC quantification and ratios were recognized as being important for future advancement. The power of GC×GC images in court testimony was considered to be of high potential. This study represents the first application of GC×GC in a realistic case scenario, which demonstrates the progression of this technique in the field in past years.

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ARE ANIMAL MODELS PREDICTIVE FOR HUMAN POST-MORTEM MUSCLE PROTEIN DEGRADATION?

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Abstract: Determination of the post-mortem interval (PMI) is a crucial part in forensic casework when gathering evidence in a crime. It is an essential tool to validate witness's statements, assess alibis and thus possibly narrowing the field of suspects. Diverse approaches are available to date the time of death, but the high heterogeneity of cases and respective postmortal changes often limit the validity and sufficiency of methods. Thus, forensic research focuses on further improvement of existing methods as well as on novel approaches to expand the methodic spectrum. We have recently described such a new approach for time since death estimation, by the use of postmortal changes of muscle proteins that occur in predictable fashion, in dependence of PMI and ambient temperature (summarized as accumulated degree days, ADD). Aiming to further improve the reliability, and thus applicability of this new approach, it is necessary to describe a standardized degradation model and further investigate the effects of possible individual and environmental influencing factors. For this purpose, we compared representative protein profiles from our human dataset to those of two different animal models (mouse and pig) from our standardization research projects. This comparison is inevitable for the legitimacy of research on influencing factors (on post-mortem degradation events) in the animal model. Only if protein degradation events occur in comparable fashion in different species, respective results can sufficiently be transferred from the animal model to application in humans. The presented comparative study indeed revealed similar degradation events in humans and animals in most of the investigated proteins, while some others could not be compared between different species as easily. These results clearly demonstrate the huge importance of comparative studies, like the one presented. Although we were able to verify the validity of animal models to reflect the basic principles of protein degradation processes in humans and the sufficiency to investigate the significance of influencing factors (on degradation progresses) in this manner, we also gained insight in the difficulties and limitations of the applicability of the developed methodology in different mammalian species regarding protein specificity and antibody functionality.

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FORENSIC AUTOPSY OF DECEDENTS IN SLEEPING ACCOMMODATIONS IN MUNICH, GERMANY BETWEEN 2011 AND 2015

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Background: The discovery of bodies in commercial accommodation facilities requires special attention in official investigations. Not only indications for serious crime can be difficult to recognize for the police forces who initially enter the scene, but also the discovery of clues where a cover-up of other forms of criminality such as drug dealing, gambling, or sexual assault has taken place. **Aims:** In this study we analyzed the files of the Institute of Forensic Medicine in Munich from the years 2011 to 2015 for autopsy cases of bodies discovered in sleeping accommodations. Information from police investigations and further analyses, such as toxicology reports, were assessed additionally. **Results:** In total, 52 cases of dead persons, discovered in sleeping accommodations, were subjected to medico-legal autopsies. Among them were 40 men and 12 women, of whom the age range was between 23 and 79 years. The majority (35 decedents) was found in hotel rooms. Nine persons were found dead in sleeping quarters used for placement, e.g. following the release from jail or from therapeutic institutions. Eight bodies were found in holiday lodges. In 34 cases, the decedents died while on a private trip. Nine persons were on a business journey and additional nine had their residence in the accommodation where they were discovered. Thirty-eight of the deceased were from German origin. Fourteen were from abroad. Some bodies were found up to six days following their last live appearance. As a result, decomposition impaired the assessment of the bodies in 19 of these cases. Severe burning of the bodies took place in six cases. Natural causes of death were observed in 14 cases. Heart failure was the predominant finding. Unnatural deaths involved intoxications with alcohol and/or drugs and suicides, but also accidents, including one case of body-packer syndrome, as well as one person dying during autoerotic practice. **Discussion:** The present study analyzed the circumstances of and the medical findings in bodies retrieved from sleeping accommodations in the Munich area. Unexpected reasons for natural as well as unnatural deaths were discovered, which had significant effects on the subsequent police investigations. The knowledge of autopsy findings from such cases might facilitate the work of police and coroners on the scene in further cases.

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STATURE ESTIMATION FROM HAND LENGTH: ATTEMPT TO POPULATION-NONSPECIFIC METHOD

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Estimation of the stature from separated body parts represents an important step in the process of group identification of victims in mass disasters. However, the methods utilizing hand measurements might be biased as the relationship between the hand size and body height varies with sex, population and other factors decreasing external validity of the estimates. The aim of this study was to propose new population-nonspecific stature estimation method based on the measurements of the hand length and to compare these estimates with the results from conventional least squares regression methods. The data were based on literature review of studies where statistical parameters of body height and hand measurements were simultaneously available (right hand: 106 samples of both males and females). On these average values of all populations we computed regression equation by means of the method of reduced major axis (RMA). The newly developed cross-population equation was tested on samples of young adults from the Czech (sexes combined, 218 females, 214 males), Slovak (35 females, 30 males) and Bosnian (91 females, 100 males) whose hands were measured on 2D scans. As an alternative approach we computed simple linear regression equation (least squares, LS) based on the individual data of the Czech sample. When applied the simple LS equation derived from the Czech sample back to the Czech data, the differences (DIFFs) between the estimates and their true stature reached zero mean values and 95% of DIFFs ranged between -91.3 and 92.8 mm (50% between -29.6 and 29.8 mm). Similar results were obtained when tested the Czech LS equations on the Slovak sample. Estimates of the Bosnian sample were systematically higher on average of 10.69 mm. When used new cross-population RMA equations, the results seriously underestimated stature of about 60 mm (95% of DIFFs ranged between -179.4 and 36.8 mm). However, the performance of the cross-population equations substantially improved when the data were limited to populations of European origins only, i.e. more affine to the testing samples. According to our results, the differences in hand and stature proportions among human populations are too large to allow development of a population-nonspecific method possessing an acceptable error of estimates.

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DEATH DURING A PLASTIC SURGERY: IS IT CIVIL MEDICAL NEGLIGENCE?

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DEVELOPMENT OF NOVEL FINGERPRINT ENHANCEMENT METHOD AND ITS EFFECT ON STR PROFILING

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The ability to detect, enhance and retain latent fingerprints and subsequent recovery of DNA from developed fingerprints would benefit crime scene investigators in achieving two targets with one stone i.e. utilizing both finger prints and DNA as evidence. Previous studies had highlighted the use of various techniques like Iodine fuming, 1,2-indanedione in ethyl acetate enhancement, DFO, Ninhydrin and its variants to develop and enhance latent fingerprints only on porous substrates and their subsequent effect on the recovery of DNA. In the present study, an attempt has been made to visualize latent fingerprints with non destructive iodine fuming method and to study its subsequent effect on generation of STR profiles on both porous and non porous surfaces. For the first time, attempt has been made to study the application of Synthetic adhesive to retain and enhance iodine developed fingerprints. Further, the proficiency of this combination method (Iodine fuming and Synthetic adhesives) to generate Autosomal and Y-chromosomal short tandem repeats (STRs) were evaluated. To study15 STR loci and Amelogenin, AmpF/STR Identifier® plus PCR Amplification Kit has been used to amplify DNA extracts from porous and non porous substrates. The results indicated that iodine fuming and synthetic adhesive had not much observable effect on the quality of DNA isolated and STRs generated. It was also observed that quantity of DNA and allele numbers were found to be comparatively lower for non-porous substrates as compared to porous substrates. Certain paper types, such as personal diaries, note books, newspaper, magazine and lower GSM paper allowed recovery of DNA in 79% of cases, while in case of higher GSM paper, the recovery of DNA was comparatively low i.e. 19% only. Higher proportions of alleles were detected from metallic substrates as compared to other non-porous substrates that showed allelic dropouts in 83.3% of cases. Based on above observations iodine fuming and Synthetic adhesive can be used to enhance the fingerprints on both porous and non-porous surfaces and subsequently, DNA can be recovered from enhanced fingerprints.

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CASE STUDY OF IDENTIFICATION OF VIDEO AUTHENTICATION RELATED TO DIGITAL DISCOVERY

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The police arrested a suspect who claimed to have used his iPhone to shoot the video of the scene and export to his computer, to prove his innocence. We examined the device and found that the phone has been reset to the factory settings. Using the various methods for data recovery of the phone, we found that the video which had been photographed could not be restored. Then we tested the suspect's computer. In the computer, there are several videos which marking time are close to the incident. However, after further analysis we found that the parameters of the video in the computer and iPhone phone shooting parameters are inconsistent. We test the applications installed on the computer and experiment the transport process, confirm that the difference in the parameters is derived from the compression of a connection-transport software. The test also found that the software logged the paragraph file name, file size, video duration and other information of the connected mobile phone. Through the analysis of the log file, the original record of the video was found. Finally, the authenticity of the video was confirmed by comprehensive analysis including of computer, shot device and video itself.

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ETHICAL AND LEGAL ISSUES ABOUT SEXUAL AND REPRODUCTIVE HEALTH SERVICES IN TURKEY

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To make sexual and reproductive health rights equally accessible for all individuals in Turkey, identifying ethical and legal issues about sexual and reproductive health services is important. In that presentation, sexual and reproductive health services in Turkey will be investigated in five main titles. 1. Protection of private life: Recent years, by the great pace of transformation of health policies, the Ministry of Health in Turkey make some legal arrangements about collecting, recording, saving and sharing of personal health data's. Thus, government would collect many personal data about sexual and reproductive lives whenever people take health facilities. This is criticized for causing the problems about protection private life and for hindering the utilization of sexual and reproductive services by patients. 2. Induced Abortion: Some legal arrangements are criticized by the problems about right to access of sexual and reproductive health services by women who want induced abortion in the legal time without their husbands' permission and women who have not completed the age of 18. 3. Living with HIV: There are many ethical and legal discussions about facing discriminations and stigmatizations for people living with HIV especially in receiving medical care and services and protection of their private life. Some legal problems can be seen about refusing to treat, saving data or explanations of data for people living with HIV. 4. Under 18: There are important problems and barriers seen in taking sexual and reproductive health services in people under 18 because of legal controversies about taking their informed consent by themselves or with their legal representations. 5. Sex Reassignment: Individuals are granted the right to want to change their sex by civil laws. According to this laws, people over 18 years old, not married and infertile have right to change their sexes if they want. These conditions are criticized for both not considering individual decision-making capacity and compelling unnecessary medical interventions. In this oral presentation, these five titles will be discussed in ethical perspective and legal arrangements in Turkey will be compared with International Conference on Population and Development, Fourth World Conference on Woman, Convention on Right to Child, The Committee on Economic, Social and Cultural Rights (CESCR), General Comment No. 14: The Right to the highest attainable standard of health assessments.

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A NEW MODEL WHERE CORONERS AND FORENSIC PATHOLOGISTS WORK LITERALLY SIDE BY SIDE

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In Victoria, Australia the investigation of sudden and unexpected deaths is the responsibility of the State Coroner and regulated by the Victorian Coroners Act 2008. The Victorian Institute of Medicine Act 1985 regulates the medical/pathological arm of the death investigation process and in this respect the two pieces of legislation are complementary. In practice, according to the Coronial legislation, the State Coroner directs the Victorian Institute of Forensic Medicine to perform medical examinations (which may or may not include an autopsy) on all reportable deaths and to provide a report of those examinations to the Coroner. In 2013, following an independent review, the Coronial Admissions and Enquiries (CAE) office was established within the Forensic Pathology Service of the VIFM replacing the previous initial investigations office which sat within the Coroners Court of Victoria. The CAE is a 24-hour service that is the first point of contact for both the coronial and forensic pathology processes relating to all reportable deaths. The office is staffed by nurses and medico-legal executive assistants. This new model is designed to improve

the death investigation process by early engagement of medical personnel in the Coronial investigation of a death. It allows for a more focused, informed and timely approach to information gathering which underpins the medical investigator's advice to Coroners regarding the medical cause and circumstances of death, and the most appropriate form of examination of a body. An integral part of the office's functions is the daily presence of a Coroner and Forensic Pathologist who are located in adjacent offices. All reported deaths are thus reviewed collaboratively, providing preliminary assessments and allowing for rapid Coronial determinations. The workload is considerable and every day the 'duty' Forensic Pathologist reviews up to 25 cases including CT scans, medical and police reports and direct examination of the body, and then makes recommendations to the Coroner about whether or not in their opinion an autopsy is necessary for the Coroner to fulfill their statutory duty in respect of the death . Over the past four years this new model has significantly streamlined processes, improved communication with families and fostered the development of strong professional working relationships between Coroners and Forensic Pathologists.

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FIBRE TRANSFER AND PERSISTENCE STUDIES: ARE WE CONTAMINATING OUR SCENES OF CRIME SUITS?

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Scene of Crime Officer (SOCO) suits are now standard protection for major scenes to prevent contamination from both DNA and trace particulates but what if we are contaminating our suits prior to entering the crime scene? This paper will outline a series of studies that have identified that transfer of fibres from SOCO's clothing to the outside of the suits occurs during donning and that these subsequently persist long enough to enter the scene of crime. Low, medium and high shed garments were analysed in terms of their ability to transfer fibres to the outer surface of the crime scene suit and therefore potentially contaminate any environment they subsequently come in contact with. The subsequent persistence of different fibre types on SOCO suit surfaces were identified to ascertain the potential for these fibres to be carried into crime scenes and then redistributed within the scene. Contamination 'hot-spots' on the crime scene suits were also identified. Results indicate that considerable fibre contamination can occur whilst crime scene suits are being donned and this is dependent on the sheddability of the garments being worn underneath (mean number of fibres transferred were 225 (low shed), 340 (medium shed) and 437 (high shed)). Persistence of different fibres on SOCO suits indicated that fibres were retained for long enough to be taken into a crime scene and shed when undertaking common movements/ activities of Scenes of Crime Officers thus highlighting the potential for scene contamination. This paper will also outline a series of solutions to this potential contamination that could be utilized in serious crime investigations where fibres evidence are readily utilized, including the development of a SOCO undersuit that reduces fibre contamination and appears to have additional benefits including an increase in wearer comfort and a perceived improvement in wearer temperature regulation.

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CREDIBILITY OF MEDICOLEGAL REPORTS: IMPACT OF QUALITY MANAGEMENT SYSTEMS

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Background: A quality management system (QMS) is a formalized system that documents processes, procedures, and responsibilities for achieving quality policies and objectives. Implementing a quality management system affects every aspect of an organization's performance. Two principal benefits to the design and implementation of documented quality management systems include: *First*: meeting the customer's requirements (victims, detectives and judges), which help to instill confidence in the organization, in turn leading to more referral and repeated consultations; *second*: meeting the organization's requirements, which ensure compliance with regulations and provision of products and services in the most cost- and resource-efficient manner, creating room for expansion, growth, and profit. In a quality context, the most important product in Forensic Medicine Center is the medicolegal report and consequent consultations. **Purpose:** The aim of the current study is to call attention to the need of quality management system application and authentication through all the Forensic Medicine Centers and mortuaries all over the country to improve medicolegal reports proficiency. **Methodology**: To fulfill the requirements needed for ISO 9001:2015, a timetabled plan was designed to outline and build Forensic Medicine Center's quality policy, quality objectives, and producing a quality manual including detailed procedures, instructions, and records. Working on defining the risks facing the workers in the field of forensic medicine was crucial as well as limitations, monitoring plan, data management and maintenance requirements as well. Assembly and classification of all administrative procedures was done and it included admission requirement, autopsy requests, burial requests, transportation between hospitals and forensic morgues, as well as technical processes and different post-mortem forensic procedures until disposal. Coordination plans with all customers (other Forensic Medicine Centers, interrelated organizations and ministries, hospitals, and other related civilian institutes) were established and prepared as well for any disastrous event. **Results and Application**: The results of monitoring, response teams, and feedback mechanisms have been encouraging, demonstrating the effectiveness of the new policy and clear Internal processes in improving the daily work and outcome. Deployment of quality management systems must be a shared effort from all staff members of Forensic Medicine Center. Our teams assume to achieve advantages of producing consistent medico-legal reports, preventing repeated administrative mistakes down to zero level, reducing costs, ensuring that processes are defined and controlled, and continually improving future plans.

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IT'S THE PEOPLE--

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It's The People Forensic Science is truly at a crossroads. Was there ever so much interest in ensuring that the findings used in court cases is valid? Data is the war-cry and accreditation and validation seen as the cornerstone on which to build a robust discipline. There have been far too many examples where poor or inadequate science is responsible for miscarriages of justice. In my opinion root cause analysis, so lived in accreditation systems, has not been used well in these calamities. The result is that regulation is based on bad practice and there is insufficient guarantee that the same will not happen again. The source material is the focus of attention while the questions or issues are at activity level. We need useful information on frequency of occurrence data and assurance on the validity of testing regimes, but this will never be the full story. Forensic Science is not dealing with reproducible systems. The test results are not diagnostics as in clinical practice. The questions focus on the probability of finding the trace in instances where the quality of the trace may be the highest variable and the most useful question may be how, not what. The only way to deal with this, in my opinion, is to trust good quality, well trained scientists and accept that a process approach will not deliver the desired outcomes.

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CASE REPORT: SUDDEN DEATH BY AORTIC ANEURYSM RUPTURE INTO THE ESOPHAGUS

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Aortic aneurisms are a relatively common pathology, however their insidious onset often turns the outcome of an aortic aneurysm deadly, even though nowadays cardiovascular surgery is able to approach the aneurysm before the rupture point and treat it. Aortic aneurysms are less common in the thoracic aorta, and when it reaches the peak point of pressure, it normally ruptures into the pericardium or mediastinum. Less commonly, the aneurysm can create an aortoesophageal fistula (AEF). There are multiple causes for the development of AEF, and most of them (2/3) arise as a result of thoracic aortic aneurysms. There is a well described symptom triad by Chiari in 1914, which involves acute retrosternal pain, sentinel arterial hemorrhage and a symptomless period followed by exsanguination. In this context, the authors report the case of a 78-year-old female, autopsied at the South Branch of the National Institute of Legal Medicine and Forensic Sciences in Lisbon. She was found unconscious by her son in the bathroom floor, with a bloody runoff coming from her nose and a pool of blood around her head. What initially appeared to be a violent crime scene was then discovered, upon dissection, to be an aortic aneurysm that broke into the esophagus and fulfilled the digestive tract with blood. During autopsy external findings were limited to the head: traces of blood in the mouth and nostrils, with no evidence of any traumatic lesions. Upon internal examination it became evident the esophagus wall was adherent to the ascending aorta aneurysm that measured 8 centimeters of diameter, showing a hole that communicates between both their lumina, measuring 3 centimeters of diameter. Besides the AEF, the corpse displayed severe atherosclerosis, with the presence of multiple atheroma plaques, all of them calcified and ulcerated, spread along the vases. Cases like this one, epidemiologically less common, make the forensic pathologist job a challenge, considering that sometimes what may appear to be a traumatic death can indeed be something less common and therefore needs careful and precise post-mortem examination. It is also of core importance, as a forensic pathologist, to identify the risk factors for some less known diseases, thus playing a major role in public health by establishing new prevention strategies, decreasing the mortality rate associated to those.

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CASUISCRIME: AN INNOVATIVE PROJECT TO MAKE THE BEST OF CASE STUDIES FOR FORENSIC SCIENCE EDUCATION

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Real case study is a pedagogical strategy commonly used to arouse students' curiosity and encourage their reflexion by guiding them through concrete situations. One of its main strengths is to connect higher education with professional practice. However, handling forensic case studies is not straightforward. On the one hand, professors enrich their courses with their own personal experiences, making it hard to build and develop a pool of cases shared across teachers. Renewing each personal collection of case examples is also an issue. Therefore, teachers must often resort to mock case studies that suffer from several limitations. On the other hand, practitioners do not have time nor methods to formalize for teaching purposes the very interesting casework they deal with routinely. For these reasons, sharing experiences and knowledge between practitioners and the university should be optimized to improve learning in forensic science. The presentation showcases an innovative pedagogical project conducted at the School of Criminal Justice of the University of Lausanne (Switzerland) that aims to provide solutions to this concern. The project promotes and facilitates the use of case studies and real case data within forensic science education to strengthen students' learning experience. The project develops a methodology to collect cases among practitioners, professionals and professors, and to structure them into an innovative and effective teaching material. The case scenarios and data are sustainably memorized and shared through a dedicated database called *CasuisCrime* in order to be available to all teachers and to support various teaching schemes (jigsaw classroom, roleplay, interactive classroom discussions, serious games, etc.). The methodology is organized around a progression through successive teaching sequences which reconstitute reasoning patterns, decision points and fundamental steps in the processing of complex and serial cases. The presentation illustrates the use of the methodology in the framework of an undergraduate forensic intelligence course at the University of Lausanne. *CasuisCrime* methodology facilitates students' access to a rich universe of knowledge and field experiences. They are engaged in a dynamic process that immerse them into concrete situations, thus mobilizing their theoretical knowledge and problem-solving capacity. It also stimulates their decision-making ability and encourages them to compare their results with peers and practitioners who originally dealt with the case.

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APPLICATION OF QUALITY TOOLS IN FORENSIC MORTUARIES FOR BETTER MEDICOLEGAL PRACTICE

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Forensic morgues or mortuaries are made for the storage of human corpses awaiting medico-legal autopsy or post-mortem identification, and then submitted for embalming and transport to distant countries or body washing as a religious process before disposal by burial. Corpses have customarily been refrigerated to delay decomposition, which is significantly rapid in the Arabian Peninsula due to its distinctive climate with extremely high day-time temperatures (around 45°C and can be as high as 54°C in summer). The uncontrolled repeated freezing – thawing cycles during multiple forensic medicine procedures could lead to tragic advanced decomposition, thus leading to loss of wounding characteristics and affecting medicolegal interpretation due to these avoidable post-mortem artifacts which will have major consequences on the medico-legal reports. Moreover, buildings and interior design of medicolegal autopsy facility have unique demands and functional criteria not seen elsewhere and should be designed according to case load, operational space requirements, and future growth. Associated spaces include laboratories and zones for histology, specimen examination, toxicological testing, specimen and consumable storage, and DNA analysis. To perform these vital projects, a quality–controlled strategy must be implemented, including monitoring plan, hazards, limitations and maintenance schedule. Policies and procedures must be unified with all mortuaries of other hospitals under different ministries, and other specialized hospitals. A unified computer–based program must be used in all mortuaries, all administrative procedures including admission, autopsy requests, burial requests, transportation between hospitals and forensic morgues, as well as technical and different post-mortem forensic procedures from admission till disposal. This study calls attention to the need of a clear and effective quality improvement strategy, project management capability and international validation for all the mortuaries and autopsy facilities to improve medico-legal work. The exceptional mission of this strategy is to facilitate forensic medical services, support the pathologists and medical examiner policies and procedures, and successfully accommodate varying investigation workloads and methods into the causes and manners of deaths of public interest.

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FAMILY PHYSICIANS' KNOWLEDGE ABOUT CHILD ABUSE RISK FACTORS AND ATTITUDES FOR LEGAL REPORTING

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Introduction: Family physicians' awareness of child abuse is important to have accurate reporting of the cases and on time intervention. Therefore, it is required that family physicians are aware of both child abuse symptoms and related risk factors to diagnose appropriately. They should have both enough medical and psychological knowledge about abuse, pay attention to the risk factors and should have appropriate attitude for the phenomenon. The aim of this study was to determine levels of knowledge of risk factors for child abuse by family doctor and their attitudes in identifying and reporting the cases. Method: Researchers prepared a questionnaire by considering relevant literature. The questionnaire includes questions about demographics, experiences with child abuse and neglect cases, feelings about managing abuse cases, level of knowledge about familial risk factors, and obstacles related to legal reporting. Participants filled self-administrated questionnaires voluntarily. Marmara University Ethical Committee approved this study. Statistical analysis were done by SPSS 14.0. Findings: One-hundred-sixty-four primary care practitioners with the mean age of 40.34 (SD=8.83) participated into the study voluntarily. Only 34.4% (n=56) had education about child abuse and neglect in graduate level and 66.8% (n=109) indicated that they felt responsible for preventing childhood abuse. Thirty-five participants (21.5%) came across abuse cases personally and managed these cases by themselves. The most common difficulty in managing these cases was handling the psychological processes and half of the physicians did not learn the last legal decision of the cases that they managed. 21.9% (n=7) said that they did pay almost no attention to the familial risk factors while managing abuse cases. 83.3% (n=20) of the participants who were aware of the familial risk factors indicated that combining clinical findings with these risk factors eased their diagnosis process. Physicians indicated that the most important three risk factors are parental mental health problems, parental alcohol or drug abuse, and child's mental retardation. Discussion and Conclusion: Graduate level of education about child abuse and neglect could be enriched by daily examples and legal process that physicians should follow must be introduced detailed. Related proficiencies that the doctors will collaborate could be introduced in early years of medical education.

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PROBLEM WILDLIFE: USING DNA TO IDENTIFY PERPETRATORS IN ANIMAL ATTACKS

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Human-wildlife interactions occur regularly in Canada. Sometimes these interactions result in serious injuries or can be fatal for the human victim. When the interaction is a serious attack, the Government of Alberta uses the Fish and Wildlife Forensic Unit (FWFU) to identify the animal responsible for the attack. Biological evidence collected from the victim and attack area can be linked to an individual animal via DNA analysis using a suite of microsatellite markers. The FWFU has more than a decade of experience in analyzing problem wildlife cases. Here we present best practices for evidence collection and analysis in order to quickly resolve problem wildlife cases. As public safety is the primary concern, the rapid identification of the perpetrator allows enforcement personnel to relocate or euthanize only the specific individual responsible for the attack while leaving other animals undisturbed. These actions result in safer communities, reduced incidents of defensive kills, and provide peace of mind for the victim's family.

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A HAND-HELD MULTISPECTRAL CAMERA FOR CRIME SCENE INVESTIGATION

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We are developing a Hand-Held Multispectral Camera for Crime Scene Investigation. The purpose of this camera is to improve the efficiency of crime scene investigation by improving the detection rate for targets of forensic interest -- such as bloodstains on dark fabric -- using multispectral imaging to enhance the contrast between target and background. A prototype camera, using 16 five-megapixel monochrome CMOS sensors viewing the same scene simultaneously through a cascade of beam splitters, dichroic mirrors, and 10 nm wide spectral filters has demonstrated the viability of our approach. The camera is built entirely of commercial-off-the-shelf components housed in a custom 3d printed body. Because all the sensors view the target on the optical axis of the system there is no parallax between the 16 channels, and so alignment of the data is simple and robust. We will present a description of the camera design, construction, and implementation, and will show results that demonstrate the utility and future potential of the multispectral approach in the discovery of crime scene evidence.

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ADVANCES IN THE USE OF INFRARED FLUORESCENT REAGENTS FOR LATENT FINGERMARK VISUALIZATION

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The development of near infrared (NIR) fluorescent fingerprint powders has shown promise in allowing fingermarks to be easily visualised on notoriously difficult substrate backgrounds (patterned, coloured, fluorescent and reflective). The preparation of NIR fluorescent wet powder suspensions has also been explored and results illustrate its high sensitivity and ability to develop marks where traditional powder suspensions struggle. For the first time, the use of NIR phosphorescence has also been explored using a tailored inorganic ceramic that possesses exceptional optical properties that allow all conceivable background interference to be removed.

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NOVEL INNOVATION FOR THE CONTACTLESS DETECTION AND IDENTIFICATION OF BODILY FLUIDS

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The use of forensic light sources for the detection of body fluids has been well documented over recent years. This approach is non-invasive and non-destructive to the evidence that is being examined and allows the forensic practitioner the ability to discern inherently fluorescent stains that may otherwise have gone unnoticed under standard visible examination. The detection of fluorescent stains is typically followed by invasive chemical presumptive and confirmatory tests that may provide indication into the nature of the residue being investigated. As well as being invasive to the evidence in question, chemical tests can be time consuming and ultimately costly in their use, given the fact that many non-biological residues fluoresce under typical examination conditions (UV to green excitation, for example). This often means that tests are

conducted on stains that have no biological content, but fluoresce in a manner typical of body fluids. Recent advances within our group have concentrated on a novel identification method that relies on spectroscopic analysis of the fluorescing area of interest. This process is non-invasive and non-destructive and allows the user to quickly "triage" evidence *in situ* to identify whether a stain is of biological origin.

Disclosure: All authors have declared no conflicts of interest.

FATAL ACCIDENTS WITH PEDESTRIAN VICTIMS: PMCT AND AUTOPSY CORRELATION

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This study compares post mortem computed tomography (PMCT) and medicolegal autopsy whereas autopsies were done in the light of previously reported PMCT (and not without knowledge of the findings). From a retrospective analysis of the last three years, a series of 20 pedestrian fatalities with full PMCT documentation were identified and 10 of these were randomly selected for this paper. Findings were rated according to reconstructive relevance and again to relevance to cause of death in both PMCT and autopsy protocols. Results summarized in tables. Deliberately chosen single points were awarded for scoring identified features in both methods. The 10 cases comprise 6 collisions with cars and 4 collisions with trucks. PMCT in the domain of reconstructive relevance performed "better" than autopsies, with an overall of 93 points over 73 for autopsies. Conversely, autopsies dominated the score for cause of death, identifying 31 relevant features compared to PMCT with 20. Reconstructively, soft tissue emphysema, pneumothorax, and skeletal fractures caused PMCT to offer more relevance and lead to useful conclusions as to from what direction and in what size shape, distance from the ground up trauma was delivered from. Some fractures were not identified at autopsy because forensic pathologists relied on PMCT. Relevant cause of death morphology that was identified by autopsy (but not PMCT) contain the presence or absence of pulmonary fat embolism, some cervical spine injuries, coronary artery thrombosis and myocardial infarction, cardiac contusion, and indirect signs of lethal blood loss. The score point difference between PMCT and autopsy was only 1 or 0, with one case where PMCT scored 1 point better and one case with a par, indicating that PMCT performed reasonably well. While both methods offer overlap, the interesting approach consists in combining the two. PMCT and autopsy have a slightly different profile. The coverage of fractures in pedestrian vehicle collision cases was better in PMCT. External inspection and autopsy deliver a detailed documentation of skin abrasions and external wounds, where any future reconstructive 3D match against vehicle structures is greatly aided by a first step of 3D surface scanning. Cause of death identification requires both methods. Gas embolism and pneumothorax causes of death are a key domain for PMCT. Pulmonary fat embolism, lethal blood loss, myocardial infarction or other organ pathology is best identified at autopsy. It is best to combine PMCT and autopsy for both purposes. Both methods have difficulties to cover all aspects.

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AGEING CHANGES IN THE FACE AND THE CARDIOVASCULAR SYSTEM

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Introduction Cardiovascular disease is still one of the biggest single cause of death worldwide. To this date, many studies have explored new potential risk factors which could support the early detection and the management of this disease. Arcus cornea, xanthelasma and earlobe crease are visible facial traits which were previously suggested to be associated with several cardiovascular diseases including atherosclerosis, ischaemic heart disease, myocardial infarction. The purpose of this study was to investigate these three traits in the post-mortem setting and determine their possible correlation with cardiovascular disease. **Methods** In January 2016, an audit study was designed to investigate post-mortem cases covering a coroner's area in London. Previous medical history and background data was collected from both hospital records and coroners' reports, when available. Results of post-mortem reports were divided into two groups; cardiovascular disease related primary causes of death (including acute and congestive cardiac failure, hypertensive heart disease, ischaemic heart disease, coronary artery disease, aortic aneurysms) and non-cardiovascular disease related primary causes of death, to observe any potential correlation between cardiovascular risks and arcus cornea, xanthelasma and earlobe crease. Diabetes mellitus (both types), smoking, alcohol and drug use were also noted individually. Arcus cornea, xanthelasma and earlobe creases were determined by visual inspection during post-mortem external examination. Following data collection, a binary logistic regression model was used to analyse possible correlation between arcus cornea, xanthelasma, earlobe creases and cardiovascular disease. Using the same regression analysis, each potential risk factor was then evaluated against BMI, age, smoking and gender, in cardiovascular disease related cause of death cases. **Results** Preliminary analysis of data of 157 post-mortem cases showed an age range of 29 to 97 years (mean: 68.5yrs). Among these, 60 were females and 97 males. The highest mortality was seen in the age group of 71-97yrs (79 deaths) of which, 41 were female and 38 were male. Cardiovascular disease was found to be the most common single cause of death accounting for 42% of overall deaths and followed by respiratory disease related deaths with 28%. Individual assessment of arcus cornea and xanthelasma showed potential correlation with cardiovascular disease (p-value:0.006 and p- value:0.028 respectively). Earlobe creases, as seen in previous clinical and autopsy studies, were found to be significantly associated with cardiovascular disease (p-value: 0.003), suggesting this trait has a potential to become a predictive risk factor for cardiovascular disease.

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IMPROVED LAB EFFICIENCY WITH A NEW LC/MS METHOD BY COLLABORATION OF TWO GEOGRAPHICALLY SEPARATE LABS

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The Centre of Forensic Sciences (CFS) provides post-mortem forensic toxicology services in non-criminal death investigations and analysis of ante-mortem and post-mortem samples in criminal investigations for the province of Ontario through two full service laboratories located in Sault Sainte Marie and Toronto. The Toxicology section of the CFS continually evaluates its laboratory procedures to find efficiencies. A recent evaluation determined that our resources would allow for optimization of laboratory operations and turnaround times. Traditionally, method development and validation is performed at one site only, with the other location adopting the method once validated. A new approach introduced to enhance inter-laboratory partnership and to share the method development and validation workload enabled us to minimize setup complications, maximize method robustness and generate a concise method to improve laboratory efficiency overall. The goal of this work was to develop a simple liquid chromatography/mass spectrometry (LC/MS) method across two laboratories that would reduce operation costs, improve turnaround times and yield high quality results that would be seamlessly reproducible at both sites. In this work a single quantitative assay for blood, serum and urine at relevant concentrations ranging from 2.5ng/mL to 1600ng/mL was developed. This quantitative assay combined six pre-existing assays including antidepressants, opioids and benzodiazepines for a total of 48 drugs. This resulted in 140 multiple reaction monitoring transitions acquired on a hybrid triple quadrupole linear ion trap mass spectrometer capable of scheduling the acquisition of transitions in order to achieve high quality, reproducible data. To further maximize efficiency we opted for protein precipitation followed by phospholipid removal rather than

implementing a more time-intensive solid phase extraction method. Extraction efficiencies ranged from 41% to 84% in blood and 42% to 91% in serum. During validation all analytes for all positive controls fell within the acceptance range of 80-120% for precision; all but two analytes fell within an acceptance range of 85-115% for accuracy. This collaboration resulted in the sharing of the considerable workload associated with method development and validation, enhanced the partnership between the two laboratories and produced a valuable new analytical method whose quality and performance is reproducible at both sites. Through this collaboration, key observations and findings relating to method setup, procedure interpretation, data quality and data processing were also confirmed and resolved through consistent communication leading to seamless adoption at time of launch. Efficiencies in operational cost and turnaround time will also be presented.

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TRENDS IN DEATHS IN CARE HOMES IN CASES REPORTED TO THE CORONER

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The need for long – term care has increased exponentially over the last few years due to the rise in the elderly population. In the UK, most long term care for elderly people is provided by the staff working in care homes. The main tenet in care homes is to provide a safe place for where people of all ages with complex health issues live: It is their home before death and where quality of life matters. Recent studies showed that approximately 416,000 people live in care. This is 4% of the population aged 65 years and over, rising to 16% of those aged 85 or more. Two thirds of people die aged 75 or over, with almost three quarters of women (74.4%) dying in this group, compared with (58.4%) of men. With a changing demographic, the average length of life has been increasing, and deaths from respiratory, cardiovascular disease including stroke are more common, in contrast to cancer which decreased because terminal cancer patients were relocated to a hospice. In addition to deaths which are sudden and unexpected, many of the deceased from care homes that are autopsied within the Coroner's system, are as a result of next of kin expressing concern, particularly in relation to the presence of pressure sores, the appropriateness of medication provided and the general standard of care. A study was conducted to investigate care home deaths from multiple coroner's areas in London from data collected from both hospital records and coroners' reports. The main objective of the study was to examine the deaths within a care home setting and possible medico-legal issues which may arise. Preliminary analysis of post-mortem cases from 2015 and 2016 (n=30), showed an average age of 78.5 years (Range of 44-95 years). Mental health issues including depression and/or dementia were found to be the most common feature in this study. Reduced mobility (bedbound and wheelchair) was also significantly prevalent in most of the cases. Pulmonary embolism and pneumonia were found to be the most common cause of death which was then followed by cardiovascular disease related deaths. Results showed a good correlation between medical history and cause of death. Inquests were held in only a very small number of cases.

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AN APPROACH TO THE CONTROL OF THE NEW PSYCHOACTIVE SUBSTANCES

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New Psychoactive Substances (NPS) has been on the rise since it first surfaced about ten years ago. Initially these drugs are termed as "legal highs" as these are substances specifically manufactured to produce similar effects as illicit drugs but yet are not under the international drug conventions or under the control of the local legislation. These drugs are often marketed as "legal highs", "research chemicals", "spices", "herbal highs" or "bath salts", and are likely to pose significant health risks as demonstrated by numerous fatal cases after consuming these NPS. Over the past five years, there is an increasing number of exhibits submitted by law enforcement agency in Singapore that are found to contain one or more NPS. The fast emerging nature of NPS poses significant challenges for the legislators as well as the chemists analysing the drugs. This paper traces the history and evolution of the legislation for NPS in Singapore, and shows the importance of the chemists and legislators working together to implement the framework.

Disclosure: All authors have declared no conflicts of interest.

VERY AFFORDABLE IMMERSION PUMP FOR POST MORTEM CT ANGIOGRAPHY IN FORENSIC PATHOLOGY: FIRST 10 CASES.

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About ten years after roller pumps were introduced for forensic post mortem CT angiography, it remains an open question why that relatively expensive pump mechanism (costing around 1000 USD for a used old heart lung machine to 80 000 USD for dedicated top of the line post mortem equipment) is actually necessary for post mortem CT angiography (PMCTA). Roller pumps make sense for non-Newtonian fluids like blood, where also mechanical hemolysis is a factor. In PMCTA, however watery or oily liquid is pumped into the vascular system of a body. After we established in a feasibility study that a simple immersion pump (priced around 15-20 USD) can be calibrated to obtain a linear voltage - flowrate relationship for the contrast agent solution used, and that vascular filling compared to a roller pump is basically the same, we present the results of the first eight cases in this presentation. Methods: Immersion pump (IP): a Barwig model 0444 pump (max. 10L/min) was used (required PMCTA flow rate 0,2 - 0,8L/min) (cost around 16-20 EUR, power supply from 20 EUR upwards). Roller pump / heart lung machine (HLM): Stoeckert Shiley heart lung machine (max. 10L/min) was employed. Cases: eight cases from forensic pathology caseload were selected where PMCTA was seen as relevant and examined with the IP. Eight controls examined with the HLM. were used as comparison. Both arterial and venous sides were filled from a femoral access. PMCT / PMCTA: Dual source / energy CT scanner (Somatom Flash Definition, Siemens, Germany) was used (100 kVp tube voltage, automatic dose modulation). Reconstructions were obtained on Siemens syngo.via software. Results: Vascular filling was compared related to large vessels, coronary arteries, neck and head arteries, extremity arteries and on the same level, veins. Figure (IP: immersion pump: HLM: heart lung machine). Results were the same when access lines were reliably placed and vessels did not contain gas. Reduced filling was observed in case 3 (IP) based on gas due to post mortem decomposition and a leaking arterial access possibly due to the same reason. Tube handling was problematic at first but greatly supported by adding custom 3D printed support structures. Discussion: To be able to perform a post mortem CT angiography with very affordable equipment with the same quality as high priced equipment means that a parameterized method can be validated and employed in far more institutes than when very expensive equipment is used.

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VISUALIZATION STRATEGIES FORENSIC IMAGING AND VIRTOPSY-RECOMMENDATIONS BASED ON SEMIOTIC ANALYSIS

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Semiotic analysis is the search for hidden, unconscious or obscure patterns, symbols and meanings in what appear to be openly accessible images. With the question of what semiotic analysis could add to Virtopsy imagery, we approached the Zurich University of the Arts (ZHdK) and sought cooperation with the result that Eloisa Aldomar now finished a first part of her Bachelor degree on that subject. With that, we present the first results of this research cooperation. Two cases - an accidental blunt trauma injury to the head with fracture and lethal subdural hemorrhage and a suicidal pistol head shot - were selected. The wide choice of visualization options when visualizing 3D data forces the expert to reflect on both preattentive and attentive processing mediated by qualities of the imagery created and presented. Preattentive processing is conveyed by implicit visual control codes that contain positioning, amount of detail, contrast, color, transparency or saturation. Attentive processing is directed by explicit use of metagraphic symbols, labels and captions. Relevance of image parts is given to focus objects, focus near objects and contextual visuals to convey anatomical orientation whereas decontextual objects may even approach irrelevance in a strictly medicolegal context. Based on a semiotic analysis of a range of 15 single image variations derived from the two selected cases, a number of statements can be made. Image labels should not cover visual image content. Using single letters or digits makes it easier to place them without covering visual relevance. Arrows and labels should not impede a natural image reading direction usually from left to right. Parallel or orthogonal projections allow to easily convey scale whereas perspective distortion conveys “true” 3D. Relational information to identify cut planes or slices relative to overall anatomy may be important. Color may add coded similarity; it may visualize radiological or anatomical conventions and add structure to a visual object. As post mortem computed tomography is not a light based method, using colors wisely such may be a relevant issue. Furthermore, 3D visualization allows the combination of color and opacity to visualize depth and virtual lighting. Our conference paper will give general recommendations for software settings and visual image presentation design and illustrate these issues, which is relevant in order to understand the points being made.

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MORAL PANICS AND HIDDEN AGENDAS - WHAT’S IT GOT TO DO WITH FORENSIC SCIENCE?

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The aim of this presentation is to review high-profile miscarriages of justice in England and Wales and other common law jurisdictions in order to consider the influence of public indignation or moral panic, and of political agendas. In the Canada, the United Kingdom and the United States, for example, wrongful convictions identified in innocence projects, case reviews and appeal judgements have frequently involved sex crimes and crimes against children. Prejudice against the class of people to which the defendant belonged is a recurrent issue, with black men commonly represented among victims of miscarriages of justice in the United States - although not so in crimes against children. Indigenous men are commonly represented in high profile miscarriages of justice in Canada. People from vulnerable groups are also prevalent in high-profile cases. In England, the IRA mainland bombing campaign of the 1970’s offered the background to the infamous wrongful convictions of the Birmingham Six and the Maguire Seven. While these cases and underlying patterns are commonly known, less consideration is been given to contemporary pressures to ‘get convictions’ in cases of sexual assault, historic abuse cases, and ‘violence against women’. The presentation will use concrete examples to argue that forensic science may be the artbiter of truth regarding a fact in issue, but only if the process within which it operates is itself free from prejudice. Even today and in a free society, forensic scientists may have to insist a little harder that their evidence is not compromised by hidden or not-so-hidden agendas.

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GENETIC AND MICRO-CHEMICAL ANALYSIS OF HOUSEHOLD DUST AS AN IDENTIFIER OF A ROOM AND ITS OCCUPANTS

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The ultimate goal of trace forensic evidence in a criminal investigation is to identify the people, places and things involved in the commission of the crime. A commonly found trace material that does not appear to be widely analyzed in operational crime labs at this time is household dust. This is unfortunate since the potential for identification rather than merely association with this type of evidence is a realistic possibility. Dust bunnies appear to be a unique entangled conglomeration of fibers containing a variety of inorganic and organic particulates from the immediate environment that are formed over a period of time due to air flow and that accumulate inside rooms (inside homes or the workplace), vehicles (e.g. trunk) or even in some outdoor locations. They can be transferred onto, for example, the clothing of a body that has been dragged across the floor prior to the body being taken away and deposited elsewhere. Thus, in principle, if one or more dust bunnies are found associated with a crime it should be possible to positively identify the room from which it originated. Previously, we have developed microscopical techniques and DNA methodologies for the collection and identification of human traces in household dust with a view to improving its potential probative value. The use of enhanced micro-manipulation collection techniques and direct micro-volume DNA profiling from individually isolated bio-particles recovered from within the dust bunnies resulted in mainly single source DNA profiles, with multiple donors identified in some specimens. We were also able to distinguish dust bunnies from different locations using combined genetic and micro-chemical analysis. In the current work, we have expanded our analysis and performed a comprehensive evaluation of dust samples from over 40 single- or multiple- occupant dwellings from different locations with the U.S., each consisting of samples from living rooms (expected high activity/numerous transient and/or habitual occupants) and bedrooms (expected moderate activity/primarily habitual occupant(s)). The goal of the current work was to evaluate differences not only between dwellings but also between rooms within the same dwelling. We have performed genetic and micro-chemical analysis of the dust specimens and have developed a preliminary direct acyclic graphical model (DAG, i.e. Bayesian network) to formally combine the different classes of evidence. We will describe the results of the DNA analysis and a statistical model combining the trace DNA and conventional trace evidence data.

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A NEW DIMENSION IN FIRE DEBRIS ANALYSIS: VACUUM ULTRAVIOLET (VUV) ABSORPTION SPECTROSCOPY

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Fire debris analysis is routinely conducted by many forensic laboratories with the primary goal of determining the presence or absence of an ignitable liquid. Gasoline, or petrol as it is often referred is the most

commonly utilized ignitable liquid in intentionally set fires. However, while gasoline is routinely analyzed and well-established methods exist, efforts to compare or differentiate samples are rarely successful. This research interfaced a VUV Analytics VGA-100 VUV spectroscopy detector to an Agilent 6890N gas chromatograph. This detector allows for the generation of high quality absorption data between 125-240 nm by using coated reflective optics and a charge coupled device light path to assess absorption across the VUV spectrum. Spectral filters allow for class discrimination of hydrocarbon-containing compounds by providing enhanced visualization of unresolved chromatographic species. This is a distinct advantage, especially for characterizing complex hydrocarbons in petroleum-derived products such as gasoline. VUV Analytics VUV Analyze™ analysis software engine allows for easy peak identification, as well as analysis of mass and volume percent of compound classes and carbon number class within the analyzed fuel samples. The unique software and detection capabilities were utilized to assess VUV absorption spectroscopy as a viable method for distinguishing gasoline brands. GC-VUV data for 0%, 25%, 50, and 75% evaporated samples was produced for numerous gasoline sources obtained from local stations to assess both neat and weathered samples. Mass percentages of carbon number classes were generated by VUV Analytics VUV Analyze™ software. The VUV PIONA+™ application software plug-in is optimized for gasoline analysis and utilizes proprietary retention index files to identify the mass percent of parafins, isoparafins, olefins, naphthenes, and aromatics (PIONA), as well as the mass percent of each carbon number class, i.e. the percentage of C6s, C7s, etc. The generated data was evaluated to determine if the VUV PIONA+™ software could be used for brand differentiation based on carbon number class and associated spectral features. During this presentation, data will be shown highlighting differences of 2-15% in PIONA mass percentages for the same hydrocarbon classes of different brands. A detailed characterization based on mass percentages of hydrocarbon classes represents a new and exciting dimension in fire debris and ignitable liquid analysis for the field of forensic science.

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AN INTERNATIONAL PERSPECTIVE ON BEST PRACTICE IN SEXUAL OFFENCE INVESTIGATIONS AND EXAMINATIONS

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The number of complainants reporting sexual offences, or accessing services designed to support victims of these type of offences, is known to represent only a very small proportion of the true number of victims. Equality of access, equity of service availability and methods of service delivery vary internationally. This research, supported by the Winston Churchill Memorial Trust, aims to examine practices in the UK, the USA and Canada to gain a better understanding of best practice, and to establish mechanisms for continual sharing of this practice in the future. The themes this paper will consider include mechanisms for improving access across different demographics, the diversity in structure and offering of support services, the involvement of law enforcement organisations, the evidence collection and examination processes, as well as processing of evidential samples post-collection. This research involves considering the input of many different individuals and organisations including, but not limited to, Sexual Assault Referral Centres (SARCs) and Rape Crisis Centres (RCCs), Sexual Assault Nurse Examiners (SANEs), Specially Trained Officers (STOs), Forensic Medical Examiners (FMEs), Sexual Assault Response Teams (SARTs) and voluntary sector organisations. The findings of this research could positively impact on the number of victims reporting sexual offence crimes, improve forensic practices internationally, enhance the patient experience and enable identification of potential collaborative research opportunities in this area.

Disclosure: All authors have declared no conflicts of interest.

A NOVEL DNA/RNA CO-EXTRACTION METHOD USING EZ1 DNA INVESTIGATOR EXTRACTION 'WASTE'

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Current body fluid identification methods use a variety of labor intensive and technologically diverse techniques that do not permit the identification of all frequently encountered body fluids such as saliva, vaginal secretions, menstrual blood or skin. Proper identification of the biological material present might be crucial to the investigation and prosecution of a criminal offense and a misrepresentation of the nature of the evidence can have undue influence on the perception of the circumstance of the crime. Therefore, it is critical that novel strategies for the conclusive identification of forensically relevant biological fluids be developed. One such approach is the use of mRNA profiling which uses patterns of gene expression unique to each cell type to determine the body fluid or tissue source of origin. Advantages of mRNA profiling include: (i) the ability to perform parallel tests for numerous markers of a single body fluid in a single assay format, (ii) the ability to perform parallel tests for different body fluids in a single assay format, (iii) a definitive identification of body fluids for which presently no specific tests exist. In addition to the ability to conclusively identify all forensically relevant biological fluids, it would be desirable, if not critical, for the developed mRNA body fluid identification system to be compatible with current DNA typing technology. Without the development of compatible DNA and RNA isolation methods, separate samplings of biological stains would need to be taken. Separate sampling of these mixed stains from different "geographical" locations of the stains to isolate DNA and RNA could result in a misleading estimate of the ratio of the body fluids present and, in extreme cases, even fail to detect one of the contributors. In this work, we have developed a novel DNA/RNA co-extraction method using flow-through or 'waste' from a standard semi-automated DNA extraction protocol which does not require modification to the existing DNA protocols, therefore requiring less validation for forensic laboratories. Purification of these waste fractions permits the recovery of RNA of suitable quantity and quality for analysis as shown through the use of high resolution (HRM) RNA profiling assays. The new co-extraction method is compatible with standard DNA extractions as well as differential extractions which permit the separation of sperm and non-sperm cells which is critical in sexual assault cases. We have validated this new co-extraction method with an examination of sensitivity (stain/swab size), reproducibility, environmentally compromised samples and mixtures.

Disclosure: All authors have declared no conflicts of interest.

PROCESSING DIGITAL IMAGES FOR INVESTIGATION, INTELLIGENCE AND EVALUATION PURPOSES: A NEW APPROACH

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Digital images, both photographs and videos, available in the framework of criminal investigations come from an ever broader range of sources, such as witnesses, offenders themselves, CCTV, smartphones, Internet, police body-worn cameras, drones, mug shots, covert police operations, traffic enforcement cameras, etc. All these images can be viewed as forensic remnants of crime events and represent obviously an opportunity for forensic science, policing and justice. However, they raise an acute methodological and management challenge as they represent a novel, rich, evolving and complex source and flow of data. Currently, most policing organizations process these images as they come and on the job without a defined strategy that incorporates forensic science principles and forensic best practices. Even if successful in some cases, this current practice would certainly benefit from a scientific and more structured approach. The collection, storage, processing, comparison and evaluation of digital images falls more often than not outside the supervision of forensic scientists, a situation that has to come into question. The presentation

advocates that digital images should be duly considered as forensic data and that forensic science should take leadership if not ownership of the process and management of digital images. The presentation exposes a methodology developed and implemented in a police service to handle digital images effectively, efficiently and in respect to forensic science principles (such as ACE-V for instance). That methodology is aimed to serve investigation, intelligence as well as evaluation purposes. The bottom-up development of the methodology and its operation implies a collaborative approach bringing together forensic scientists (both researchers and practitioners), uniformed police, the criminal investigation division, and crime intelligence analysts. The presentation details forensic and managerial solutions that were designed to structure the collection and storage of images coming from a wide range of sources, and to handle a growing qualitative and quantitative flow of images. It presents the database and the original analysis, search and comparison toolbox that supports the process. That toolbox has been developed in-house and does not require costly technological solutions. Evaluation of the strength of evidence in regard to digital images is raised as a key issue where empiric solutions currently prevail and where further research is obviously needed. The methodology contribution is illustrated through use case scenarios related to a large scope of crime types, from serious crimes to burglaries or card frauds.

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ETHICAL CONSIDERATIONS FOR THE FORENSIC PATHOLOGIST: A CANADIAN PERSPECTIVE

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Forensic pathology represents an intersection of medicine and law and as such, the ethical standards by which it is practiced should unite the basic principles of both professions in such a way that reflects the unique nature of the sensitive and complex issues forensic pathologists encounter. As physicians, forensic pathologists may have training in medical ethics. The four pillars of medical ethics include: autonomy, justice, maleficence and beneficence. While these pillars provide a sound foundation, they are often coarse tools to assist forensic pathologists because they do not encompass the distinctive complexity of their scope of practice. Forensic pathologists, unlike other physicians, have a more expansive role in their duties, which extends to not only to families, but also society within the context of public safety, the courts, other pathologists and medical colleagues as well as other forensic professionals. The concepts of virtue ethics may be a more applicable within the field of forensic pathology and includes a value-based approach that allows for consideration of trust and harm reduction. There is a paucity of reference material specifically applicable to forensic pathologists in Canada despite its critical importance to maintaining and continually improving professional standards. In Ontario, following the Goudge Inquiry in 2009, which examined the field of pediatric forensic pathology following wrongful convictions, the need for a more rigorous ethical decision making framework was highlighted. Following this recommendation, a code of ethics for all Ontario pathologists performing medicolegal autopsies was adapted from the Forensic Pathology Section of the Canadian Association of Pathologists. An ethical foundation in practice is ideally facilitated when forensic pathologists are independent and impartial of other stakeholders within the death investigation system. A code of ethics is an integral element of best practice guidelines and falls under the general rubric of good professional practice. It must however be understood that adherence to ethical principles differs from cognitive bias, mistakes and incompetence. Our goal is to inspire and contribute to a thought-provoking discussion amongst forensic pathology professionals concerning the scope of ethical issues unique to forensic pathology as well as encourage establishment of a code of ethics in other forensic communities.

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EFFECT OF DIFFERENT PACKAGING TYPES ON PRESERVATION OF LATENT FINGERMARKS ON CRIME SCENE EXHIBITS

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Packaging an exhibit appropriately at the crime scene is crucial to maintain the integrity of any evidence on that exhibit. This is not only to prevent contamination, but also to preserve the evidence. However, the types of packaging used for particular exhibits, such as bottles and knives, vary among police forces, and there is a paucity of published empirical data to underpin the use of different types. This is particularly true regarding the effectiveness of different packaging protocols to preserve latent fingermarks. The experiments presented here therefore examine the effect of different packaging types on the quality of latent fingermarks on common exhibits. Fingermarks were placed on glass and plastic bottles and the handles of steak knives and screwdrivers, through a single individual holding each pre-cleaned item for 5 seconds with medium pressure. The items were then packaged according to different protocols used by two UK police forces, or not packaged and retained as positive controls. Two different types of bottle boxes were used, and knives and screwdrivers were packaged in weapon tubes or appropriately-sized crime scene boxes secured with wire or cable ties. After packaging, items were placed in the boot of a car and driven for 45-60 minutes to simulate transport from the crime scene. Fingermarks were then recovered from all exhibits 24 hours after deposition using black magnetic powder. For all exhibit types, packaging significantly reduced the quality of the fingermarks recovered when compared to those of the positive controls, with mark quality also significantly varying among different packaging types. For the bottles, one box type preserved the fingermarks better than the other, except when the bottles were large and made of glass. For both the knives and screwdrivers, securing the items in boxes with wire preserved the fingermarks better than using weapon tubes. These results show that, when possible, fingermarks should be recovered at the crime scene to prevent loss of detail as a result of packaging and transportation of exhibits. However, when it is required for exhibits to be collected from the scene, consideration must be given to the type of packaging employed to ensure maximum preservation of fingermark quality. For example, the data here suggest that boxes should be used over weapon tubes to best preserve fingermarks on knives and screwdrivers, and therefore have the potential to impact police practice. Furthermore, design improvements are proposed that might increase the effectiveness of these packaging types.

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VERIFYING THE AUTHENTICITY OF DIGITAL IMAGE USING AUTOMATIC EXPOSURE AND WHITE BALANCE APPROXIMATION

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The rapid development of image-editing software has made it increasingly easier to tamper digital images. Therefore, before a specific image is trusted or adopted, its authenticity must be verified, especially in the industries of news, science and law. This study was aimed to suggest a method to determine whether a digital Image is original or has been edited, through analyzing its characteristics resulting from the automatic exposure (AE) and automatic white balance (AWB) functions which are widely used when taking a picture with a digital camera or a cell phone. AE and AWB are processes designed to ensure, based on the illuminant intensity and color measurements, best tone and color representations of the scene according to the pre-defined criteria. To satisfy the criteria, the brightness and color of an object will vary synchronously with the change of the size, color and brightness of other contents in the same frame. If a picture was adjusted or doctored, the whole statistics of it, and meanwhile the relationship of brightness and color among objects in it would become abnormal. In this study a re-mapping method emulating AE and AWB processing was proposed to check image authenticity. A doubtful

image was re-mapped and then the difference between the before- and after-processed images was inspected to verify its originality. The results of experiments demonstrate the effectiveness of the proposed method. Because different camera manufacturer may adopt different AE and AWB strategies, this method may also be used to identify the source device for a digital image.

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GENETIC ARCHITECTURE OF FIVE ETHNIC GROUPS OF PUNJAB (NORTHWEST INDIA)

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India represents a pool of culturally and genetically diverse populations. The region of Punjab (India) has an extreme importance in understanding the population diversity of India as it acted as a passage to the foreign invaders from Eurasia and Central Asia. The present study was designed to explore the genetic diversities and affinities among the five major endogamous groups using autosomal markers. A total of 1012 unrelated samples belonging to Banias, Brahmins, Jat Sikhs, Khatris and Scheduled Castes were genotyped for four Ins/Del (*ACE, APO, PLAT, D1*) and six restriction fragment length polymorphisms [*ESR (Pvu*II*), LPL (Pvu*II*) HTR2A (Msp*I) and three *DRD2* (Taq1A, Taq1B, Taq1D)]. All the loci were found to be polymorphic among the studied populations. The average heterozygosity among the studied populations is fairly substantial ranging from 0.3872 in Banias to 0.4311 in Scheduled Castes. The genetic differentiation among studied populations ranged from 0.0418-0.0022 for the *PLAT* and Taq1A loci, respectively, with an average value being 0.0136. Phylogenetic analysis revealed that Banias and Khatris are genetically closest to each other. The Jat Sikhs are genetically close to Brahmins and are distant from the Banias. The Jat Sikhs, Banias, Brahmins and Khatris are genetically very distant from the Scheduled Castes. Overall, a uniform allele frequency distribution pattern and low level of genetic differentiation was observed in the studied population groups indicating that genetic drift might have been small or negligible in shaping the genetic structure of North-West Indian Populations.

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DNA ANALYSIS OF MIXED SEXUAL ASSAULT AND TOUCH SAMPLES WITH THE DEPARRAY DIGITAL CELL-SORTING SYSTEM

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It is now routine for the forensic scientist to obtain the genetic profile of an individual from DNA recovered from a biological stain deposited at the crime scene. However, the analysis of DNA profiles can be complex and challenging for samples in which donors are present in low template levels. This can include sexual assault evidence in which only a few sperm are present as well as touch DNA samples in which a majority of biological material present may dead skin cells. Standard analysis of these types of samples may not permit recovery of the donors of the biological material or could result in an admixed DNA profile, which can be more difficult to resolve when the contributors are present in low template levels. The need for the use of complex statistical interpretations in these cases necessitates further research aimed at developing new methodologies to aid operational forensic laboratories in the analysis of challenging low template and mixture samples. This work evaluates an alternative approach that involves the physical separation and collection of cells using the DEParray digital cell-sorting system. This system enables the identification by fluorescent antibody staining of electronically captured individual sperm and epithelial cells in situ, and the routing and recovery of selected individual cell types into PCR tubes for direct DNA genotyping. Here we report on our initial investigations of the system for the collection and recovery of sperm and epithelial cells from sexual assault mixtures and touch DNA evidence. In this presentation we will describe the testing and evaluation of sensitive and robust lysis and DNA profiling methods for the analysis of isolated cells, including single, few or pooled (>10) cells. We will also present our results in determining (i) the optimal and minimum number of captured cells from the three different cell types capable of providing probative STR profiles, (ii) the conditions under which PCR standard and increased cycle number are appropriate and (iii) the quality of the STR profiles obtained from sexual assault and touch DNA samples.

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TRAFFIC ACCIDENT REPORT EVALUATED BY JUDGES, PROSECUTORS, PUBLIC DEFENDERS AND CHIEFS OF POLICE

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This is a specific study on the forensic reports issued by the Accident Reconstruction Unit, with the purpose of optimizing the expert's work, which can result in a faster elaboration of the forensic report. By the forensic report main user`s point of view, i.e., survey completed by judges, prosecutors, public defenders and chiefs of police, this study focus on finding the most important report items in order to synthesizing, or even suppressing, certain parts of the forensic reports issued in the Civil Police of the Brazilian Federal District (*PCDF*). Through interviews and online forms, a survey was conducted with those professionals, whom work specifically on the area of traffic accidents. The forms covered 122 questions about the three main documents issued by the Accident Reconstruction Unit: a "short report", a "complete report" and a "vehicle inspections report". The estimated time to respond to the online form was 20 minutes. Fifty-six forms were answered by professionals who have been worked on this field for 11 years, on average (except the chiefs of police that have been worked for seven years, on average). Overall, among other results, for approximately 90% of the interviewed, the forensic reports were considered evidence key pieces due to solve the traffic accidents. The items with greater acceptance (90%-95%), which really help those professionals in the development of their work, are related to the technical aspects, mainly: directions of travel, velocities, impact vehicles relative position and the discussion of the vehicles dynamics (pre- and post-impact). Basically, there was concern about a greater detailing of sketches and photographs registration of the accident site, as well as a more technical and theoretical fundamentals in that discussion. Most do not believe that it is necessary to change the item "Conclusion", although the main reason for disregarding a forensic report has been to be "inconclusive" to determine the traffic accident causes.

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DEFINING EXPOSURE TIME USING BURN SEVERITY OF SKIN TISSUE UNDER THE SCANNING ELECTRON MICROSCOPE

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This research examines whether a scientist can determine the time interval associated with skin when exposed to a burning substance using observation through an Environmental Scanning Electron Microscope (ESEM). The ESEM was used in this experiment due to its high magnification at a low vacuum, preserving the sample without drying it

out and causing artifacts. The microscope barrages the surface of the skin with electrons, giving the viewer an image of the topography of the sample. This allowed for the pores to be seen both individually as well as in clusters, giving the viewer a close-up example of artifacts on the skin caused by burning. Pig epithelial tissue was the medium experimented upon due to its similarity to human skin, and was stored in formaldehyde to keep the tissue fresh until examination could occur. The tissues were burned chemically (with concentrated and half-diluted hydrochloric acid) as well as thermally (using a household non-industrial refrigerator/freezer unit and a toaster oven) with controlled variables allowing only exposure time and percentage of fat to be variable within the experiment. Determining the exposure time interval will better the scientific understanding of pin-pointing evidence leading to a near-definitive estimation of timed exposure. This idea is forensically relevant because it encompasses burn damage on individuals both living and deceased. When burning the substance thermally, large bubbles and tearing were seen in the frozen tissue whereas many small bubbles were seen dotting the heated tissue. In terms of the acid, heavy pocketing occurred in the skin, eating the epithelial layer away from the sample. Thus, the results show that as the time interval of exposure increases, the observed artifacts of burning (bubbling and pocketing) also increase in number. In summary, due to the results collected in this experiment, the time interval in which the skin was exposed to a burning substance can be determined based on the amount of artifacts seen on the skin under the ESEM.

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WHY SERS MIGHT (OR MIGHT NOT) GREATLY IMPROVE THE WAY WE ANALYZE PHYSICAL EVIDENCE

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Physical evidence analysis has always been a particular area in forensic science. There exist no standard and unique sequence of examination, nor reference method, and each case is a matter of selecting the most appropriate techniques based on destructiveness and expected outcomes. The choice of a proper sequence of examination is always based on criteria such as sensitivity, specificity, repeatability, reproducibility, quantity/quality of the materials, and complementarily of the methods. Among all of the available techniques, Surface-Enhanced Raman Spectroscopy (SERS) is a relatively new-comer that possesses most (if not all) of the advantages listed above. In order to be more extensively used, the technique still needs to find an adapted position in the sequence of examination, demonstrate its use with casework examples, and improve a few of its drawbacks. The following points will be discussed during the presentation: 1) SERS provide very intense spectra (up to 10^{10} Raman enhancement) when resonant conditions are attained through molecular, surface plasmon, or charge transfer resonances. 2) It has an exceptional sensitivity (theoretical single molecule limit) and allows detection of minute amount of forensic materials. 3) The technique is extremely adaptable: it allows all kind of molecules (i.e. hydrophobic-hydrophilic, soluble-insoluble) in all forms (i.e. liquids, solids, and gazes) to be measured. 4) SERS is repeatable and reproducible enough to satisfy forensic validation. 5) Laboratory examiners are regularly required to work without comparison samples, a situation that is regrettably not authorized in some laboratories. SERS has the potential for characterizing trace amount of materials and provide intelligence through databases. 6) SERS has already been used for the analysis of fibers, paints, inks, explosives, drugs, DNA, body fluids, fingerprints, toxicology and environmental forensics. 7) The main drawbacks are its instrumental cost, the occasional need for specific substrate, and the requirements of having a Raman active molecule

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IN SITU DETECTION OF DRUGS OF ABUSE IMPREGNATED INTO PLASTIC MATRICES FOR DRUG TRAFFICKING PURPOSE

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Drug smuggling is an ongoing operation by drug traffickers to move controlled drug substances around. There are many ways to smuggle a drug. One technique that has become more apparent over time is the impregnation of drugs of abuse in various matrices. This method involves mixing the drug in the actual material it is being trafficked in. This can include dissolving the drug substance in a solvent and soaking it up with fabric items or adding the drug at the manufacture stage to some commercial products such as food and plastic-based items. This proof-of-concept study aimed to investigate the impregnation of atropine, a cocaine analogue, into various plastic materials and then develop in situ screening methods to detect the presence of the impregnated drug. Paraplast and plastimake were purchased commercially. Polyvinyl alcohol (PVA) was made using 4% PVA powder and 4% borate solution (10:1). Polymethyl methacrylate (PMMA) was made using Technovit® and curing. Atropine was moulded into these materials at 0, 2.5, 5, 10 and 15% (w/w). Signs of plastic abnormality due to atropine impregnation were observed by visual examination (human eye and microscope) and using video spectral comparator (VSC). Presence of atropine in the impregnated plastic matrices was screened in situ by using spectroscopic techniques such as Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy. Visual examination did not reveal any significant difference between the impregnated and the non-impregnated plastic materials for majority of the impregnation conditions investigated. Differences, however, did show up when these plastic samples were examined by the use of light microscopy and VSC. FTIR was found to have limited capacity to detect atropine in the mixtures. Raman spectroscopy on the other hand was effective in detecting atropine even at lower concentrations. The study shows that impregnation of drugs into plastic materials represents a feasible means to hide drugs for trafficking purpose. VSC and Raman spectroscopy are promising screening techniques to detect abnormality and presence of drugs in plastic matrices and to prompt further investigation of potential drug impregnation. Future studies are planned to examine the efficiency of solvent extraction in recovering the impregnated drugs and to quantify their concentrations in plastic matrices. Ultimately the study will provide law enforcement agencies with more analytical tools to fight against drug trafficking.

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ALLELE FREQUENCIES OF THE NON-CODIS 10 STRS LOCI IN TURKISH POPULATION

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Autosomal Short Tandem Repeats (STRs) loci are applied successfully in forensic science areas such as; identification, missing people, mass disasters, and paternity/maternity cases. STR loci in the genome are various and there are lots of suitable loci for DNA analysis. Evaluations and design of new STR markers are useful tools to obtain additional information and to complete conventional STR analysis. To increase the number of STR loci will be resulted in reducing the risk of random match probability and will be raised power of discrimination and paternity index. In this study, we investigated 10 new, non-CODIS STR loci (D7S1517, D3S1744, D12S391, D2S1360, D6S474, D4S2366, D8S1132, D5S2500, D21S2055, D10S2325) and Amelogenin as a complementary panel to current kits. Amplifications of the new 10 STRs were performed by using the Investigator® Human Identification HDplex PCR Kits (Qiagen) according to the user's manual recommendations. We also calculated the allele frequencies and forensic parameters for new 10 STR loci in a sample of

100 unrelated individuals from Turkey. In conclusion, the 10 new non-CODIS loci in Turkey are suitable for the forensic testing and population data is also available.

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A NOVEL D-π-A TYPE FLUORESCENCE DYE FOR SELECTIVE SENSING OF PICRIC ACID IN AQUEOUS MEDIA

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Nitroaromatics were widely used in the fields of explosives, fireworks, pharmaceutical industries, dyes, and their residues often cause much damages. Among the nitroaromatics explosives, 2,4,6-Trinitrophenol (TNP) is the typical one. It has been widely used in World War I as an explosive. However, it should be noted that TNP can be a risk to human health and cause serious problems for environment. Therefore, it is necessary to develop some reliable and realtime methods for the detection of trace TNP with satisfactory sensitivity and selectivity to prevent terrorist threats and environmental pollution. Many fluorescent probes have been reported to meet the demand for the specific detection of TNP. To the best of our knowledge, only a limited number of intramolecular charge transfer (ICT)-based probes for TNP have been reported. The ICT-based probes is desirable for ratiometric probes, whose self-calibration effect of two excitation/emission bands can eliminate the interference of photobleaching and deviated microenvironments. In our research, we design a ICT-based probe for the detection of TNP in water solution. The probe exhibited a selective, sensitive, and ratiometric fluorescent response to TNP in aqueous solution.

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READING PATHOLOGY IN BONES FOR CREATING THE BIOLOGICAL PROFILE: THE CASE OF DIABETES

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When creating a biological profile, the correct interpretation of bone lesions is fundamental since it may lead to the identification of diseases such as diabetes, cancer, gout or arthritis, which in turn can serve as crucial traits for identification. The present pilot study aims to verify the characteristic features of skeletal lesions on diabetics. Diabetes mellitus is one of the most widespread diseases, currently affecting more than 415 million people worldwide. Much is therefore known about the manifestation of this disease from a physiopathological, clinical and radiological point of view; however, from the forensic anthropological perspective, the macroscopic aspects of the consequences of diabetes on the skeleton are poorly described. This study aims to investigate the manifestation of diabetes mellitus on 19 skeletons of diabetic patients (and one negative control case), selected from the documented Milano Identified Skeletal Collection, according to their known pathological history. Aim of this investigation is to identify and describe the macroscopic signs left on dry bones by the diabetic condition, through an osteological analysis. Such skeletons were initially cleaned and studied from an anthropological point of view. After a clear revision of the main lesions described in the clinical practice, the same or corresponding manifestations (periostitis, lytic lesions, erosion, remodeled fractures, osteomyelitis and osteoarthritis) were sought, identified and described, as well as their localization on the skeleton and frequency of appearance. The results show that the lower limbs are the first areas involved in the diabetic condition, appearing as lytic lesions (50% of cases), erosion (40%) and, to a lesser extent, remodeling (30%), periostitis (25%) and deformation (5%). Such lesions can virtually affect any bone of the distal foot, but the most frequently affected areas are the head of the 1° and 5° metatarsal and the distal phalanx of the great toe; however, the severity of the extension of the pathology varies among the individuals considered, from cases without signs to cases of amputation at the femur. Only in 20% of cases the hand is also affected, in particular the 1° metacarpal, displaying alterations of the carpo-metacarpal joint. However, the most difficult aspect of the forensic anthropological practice is to differentiate similar manifestation caused by different pathologies. The present investigation therefore also attempted to provide initial and macroscopic guidelines for better performing a differential diagnosis between diabetes and other diseases, such as gout, leprosy, septic arthritis, osteomyelitis and periostitis, consequent to non-specific infections, and trauma.

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A COMPARATIVE STUDY ON UNNATURAL FEMALE DEATHS FROM TWO PROVINCES IN SRI LANKA

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Introduction: Unnatural deaths are defined as deaths not caused by disease or aging but by external causes such as injury/trauma or poisoning etc., where the manner/ circumstance could be homicidal, suicidal or accidental or at times even undetermined. Death due to violence not only affects the family, but also the community and society. Provided many deep rooted gender perceptions and assumptions regarding females, a death of a female due to violence is highlighted as well as morally condemned due to her care-giver role in the society. **Objectives:** To describe the demographic associations of different types, circumstances of unnatural deaths of females and their etiologies as well as the association of presence of sexual and gender based violence to different circumstances in Western (WP) and North Central (NCP) Provinces. **Methodology:** A retrospective descriptive study on unnatural female deaths in WP and NCP was carried out employing convenient sampling method. Records of Inquirers into Sudden Deaths, post-mortem reports and police information for a duration of three years (2013-2015) were perused following obtaining approval from relevant stake holders. Data was obtained using a pro-forma and analysis was done using Statistical Package for Social Sciences 16. **Results:** The analysis of 131 deaths from WP and 128 from NCP revealed that there were more deaths in the NCP in the age category of 40-60 years (32%) where as in the WP more deaths were recorded in 20-40 age (46%). In the WP 36% of deaths were from urban areas while 3% were rural. However, in the NCP more deaths were from rural (81%) areas while only 5% were from urban. The analysis of the types of deaths in two provinces revealed that deaths due to poisoning was statistically significant in NCP ($p=0.000$) with the commonest poison being plant in origin. The underlying circumstance was suicide due to love affair or family disputes. However asphyxial deaths were statistically significant ($p=0.016$) in WP. The commonest underlying reasons for deaths in NCP were family disputes followed by land disputes whereas in WP it was family disputes followed by financial problems. **Conclusions** The pattern of unnatural deaths of females in two provinces differ demographically as well as by the etiology. Poisoning was significant in NCP while it was asphyxia in WP. Although family disputes were the common reason for deaths in both groups land disputes were more in NCP while financial problems were more in the WP.

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THE DEGREE OF INJURY AND INJURY MANNER REAPPRAISAL BY FORENSIC CLINICAL VERIFICATION

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The human body injury identification and injury manner inference usually affects the conviction of a criminal suspect. In mainland China, the classification of injury degrees include slight injury, minor injury and serious or severe injury. Both of minor injury and serious injury include level 1 and level 2, while level 1 is more serious than level 2. In some cases, the judgment of the injury manner is helpful in determining the degree of injury. We report the case of knife stab wound, a wounded man have been stabbed in left anterior chest and left back. The first identification was that the wounded man had and he was rated in a category of minor injury. However, following the victim's serious symptoms, the police thought minor injury verdict might be wrong and unfair to the wounded man. They entrusted us to do reappraisal of his injury manner and the previously stated injury degree. Based on victim's original medical history, we took CT scan, ultrasound and echocardiography to identify the specific injury as well as injury manner as his second identification. We assumed that his injury manner was in accordance with the sharps stabbed from left chest pierced between the second and third rib through his chest wall tissue and pierced chest wall, left lung and pericardium. According to the injury manner, we certified his pericardium ruptured and prorated him as severe injury level 2.

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MULTIPLE GUNSHOT WOUND INJURIES: COMPARISON OF FINDINGS BETWEEN CT SCANS AND FORENSIC EXAMINATION

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The goal of this presentation is to discuss the existing challenges in the radiological and clinical examination of victims sustaining extensive injuries from shooting events leading to a multidisciplinary approach to injury interpretation. The presentation aims to highlight the benefits of classic bone reconstruction in severe ballistic injuries and the importance of pathological/anthropological documentation of post mortem computed tomography findings. In the last decade, radiographic imaging in forensic medicine has become standard practice for the documentation and interpretation of injuries. The use of radiology in the investigation of firearm fatalities has been a standard practice since the discovery of X-rays. The contribution of forensic imaging in ballistic cases is widely acknowledged however some radiological aspects of gunshot injuries may be difficult in terms of interpretation, especially when victims exhibited severe soft tissue defect and bone comminution. This presentation will discuss the comparison of findings between computed tomography, autopsy and anthropological examination on 10 victims sustaining multiple gunshot injuries after shooting events. The documentation by multi-slice computed tomography provides an important contribution to the autopsy, however some injuries interpretation were overturned during forensic examination. Like any post mortem radiological examination, the reconstructed image is only a mathematical representation of the existing injury. The severity of injuries constituted a great limitation, especially for imaging documentation, therefore bone and soft tissue reconstruction was performed during the autopsy, allowing direct analysis of wound characteristics (entrance/exit) based on skeletal defects, fracture and apposition of soft tissue wound margins. Even if this approach is time consuming, the reconstruction procedure is the only possibility to perform an accurate evaluation of injuries. The results of this study indicate that radiological aspects of ballistic injuries could sometimes be misinterpreted, especially with 3D reconstruction where fractures margins and defects morphology are not precisely recreated. The comparison of documented injuries from 10 cases with computed tomography and photographs during autopsy highlights the need to confirm radiological features by direct examination. In fact, 3D reconstruction could be inaccurate despite high-quality image in case of severe injuries. A multidisciplinary approach with radiographic imaging, bone and soft tissue reconstruction and pathological interpretation is therefore recommended. The development of innovative radiological technologies will certainly allow, in a nearest future, to be close to direct examination.

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PLC FORENSIC ANALYSIS: FORENSIC TRACES OF INDUSTRIAL CONTROL SYSTEM ATTACKS

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Industrial Control Systems (ICS) are used in many critical infrastructure systems, which involve large amounts of data collection, communication and operation. There are different types of control systems, including supervisory control and data acquisition (SCADA) systems, distributed control systems (DCS), and smaller control systems which are implemented using programmable logic controllers (PLCs). In the past few years, many cyberattacks were targeted towards these ICS. Before the Stuxnet incident, few researchers were concerned about the security and forensic analysis of ICS because ICS are closed systems. Many engineers did not aware that the internal network environment can be utilized to access and control the ICS for an attack. Stuxnet shows that it is possible to launch a cyberattack towards the PLC. As many existing legacy ICS has been operating for a long period of time and have the following problems: 1. The PLC has been optimized for reliability, limited logging mechanism is implemented. 2. The internal infrastructure is unknown. The engineer can easily access and control the PLC. 3. No digital forensic methodologies can be applied to the ICS. In summary, it enables lots of new research to focus on this area because there is no security and incident response procedure if the ICS is being targeted by an adversary. In the past few years, many researches try to apply forensic investigation methodologies for the ICS. Our research analyses the Siemens S7-1200, one of the popular PLC models that is widely used in many ICS. It is also the same brand that was targeted in the Stuxnet. In this research, we describe possible attacks that adversary can be performed. We then discuss the logging information inside the Siemens TIA Portal, Siemens' PLC diagnostic buffer and Human Machine Interface (HMI). All these logging information can be considered as forensic traces in the ICS that can be used to assist investigation after an attack. This logging information also allows the investigators to identify changes that have been made to the PLC program, starting from when the program has been modified, compiled and uploaded to the PLC. We then propose a forensic analysis framework on how to conduct forensic analysis on Siemen's PLC and a case study to demonstrate the effectiveness of the framework. The result of this research shows that these forensic traces inside the PLC can be used by security experts to better protect against attacks to the PLC and the critical infrastructure.

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THE DEVELOPMENT OF THE NEW GONOSOMAL INDEL PANELS

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Insertions/deletions (InDels) are a variety of polymorphisms that are observed with deletion or insertion or both. These loci have short amplicon lengths (60-200 bp) and have a high discrimination power. They are now being used as an alternative marker system to STR loci in forensic identification. The patrilineality and the relationship between father

and son can be determined by using Y chromosome polymorphism, the relationship between father and daughter can be determined by using X chromosome polymorphism. In this study, we developed two gonosomal InDel multiplex panels, in total 21 InDels loci, those from twenty X-chromosome InDel loci and one Y-chromosome. We chose InDel markers that are located on the X-chromosome and Y-chromosome with reference data available at Marshfield Clinic (). We tested 21 gonosomal InDel panels in Turkish population (N=100) in order to provide preliminary information about the gene frequency. Allele frequency data and basic forensic statistics are obtained with Powerstats software (Promega) in Turkish population data. No significant deviations from Hardy–Weinberg are found and calculated using Arlequin ver. 3.5. The mean heterozygosity ratio of 21 loci is determined as 0.400 and the discrimination power is defined as 99%. As a result of this study, the gonosomal InDel multiplexes are polymorphic for the Turkish population with a high discrimination power. Therefore these multiplexes can be used for forensic purpose.

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ITALY'S STRUGGLE FOR THE IDENTIFICATION OF DEAD MIGRANTS

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In the present European migration crisis Italy is dealing with an enormous number of dead victims; recent statistics show that one in eight who attempt the crossing die. Over half remain unidentified and do not receive the same attention as for any other mass disaster. Since 2014 the Commissioner for Missing Persons' office of Government (UCPS) has set up a project to facilitate the identification of migrant victims together with the University of Milano's LABANOF (Laboratorio di Antropologia e Odontologia Forense). A Memorandum of Understanding signed in October 2014 conferred to the University of Milan the task to facilitate identification of the victims who died in three events: the October 3rd and 11th, 2013 Lampedusa disasters and subsequently the April 18th 2015 shipwreck. These two groups of disasters were selected as pilot studies in order to devise a system of post-mortem (PM) and ante-mortem (AM) data collection in the difficult scenario of migration. Work on the Lampedusa 2013 disasters has so far led to the acquisition of 70 AM profiles from as many families looking for their dead, half of which have already been identified. This experience revealed the difficulties in identification and the need for combined strategies. The project was then extended to the April 18th, 2015 disaster, where over 700 died. A maxi operation involving UCPS, the Italian Navy, the Prefecture of Siracusa, the Police Department, the Italian Military Red Cross and several Universities was created for managing the recovery and identification of victims. Forensic procedures adopted in this disaster included the detailed PM examination on each recovered body by a team of forensic experts. Because 10% of the bodies carried some sort of ID, it will be possible to begin AM data collection by initially targeting the countries and villages represented. At the moment the Italian Government is finalising activities aimed at creating a secure network for collecting AM data from the countries of origin and Europe. This will hopefully create a model which can be repeated in different scenarios and lead to identification. This Italian effort has proven the potential of Academia teaming up with Governmental offices and humanitarian organisations, in a European scenario in which the entire issue of unidentified bodies of migrants is being ignored.

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ESTIMATING ERROR RATES FOR FIREARM EVIDENCE IDENTIFICATIONS IN FORENSIC SCIENCE

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A 2009 National Academies Report on forensic science challenged the reliability of firearms examination, citing its subjectivity and lack of error rate estimation. To address this fundamental issue, we describe a procedure to distinguish matching cartridge cases (fired by the same firearm) from non-matching cartridge cases (fired from different firearms) using surface topography measurements and an objective classification algorithm--the Congruent Matching Cells (CMC) method recently developed by researchers of the National Institute of Standards and Technology (NIST). This procedure was tested on two sets of firearms' slides and produced wide separation between matching and nonmatching populations. An error rate procedure was developed, which can provide a statistical foundation for error rate estimation. This talk describes the CMC method for image correlation, its application to firearm evidence identification, and its usage and initial results for error rate estimation. The CMC method is based on a discretization procedure whereby compared topography images are divided into square arrays of correlation cells and high correlations are sought for pairs of individual cells. Four identification parameters are defined for quantifying both the topography similarity of the correlated cell pairs and the pattern congruency of the registered cell locations. An identification (declared match) requires a significant number of CMCs, i.e., cell pairs that meet all similarity and congruency requirements. Initial testing on breech face impressions of a set of 40 cartridge cases fired with consecutively manufactured pistol slides showed wide separation between the distributions of CMC numbers observed for known matching (KM) and known non-matching (KNM) image pairs. Another test on 95 cartridge cases from a different set of slides manufactured by the same process also yielded widely separated distributions consistent with the first set. The test results were used to develop two statistical models for the probability mass function of CMC correlation scores--a binomial model for KNM distributions and a β-binomial model for KM distributions. The models were applied to develop a framework for estimating cumulative false positive and false negative error rates and individual error rates of identifications and exclusions for this population of breech face impressions. The CMC method can provide a statistical foundation for estimating error rates in firearm evidence identifications. We hope to scale up the tests to realistic population sizes consistent with case work, thus emulating methods used for forensic identification of DNA evidence. (386 words)

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FORENSIC ANALYSIS FOR CRIMINAL INVESTIGATIONS OF A BRAZILIAN DAM BREAK

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In 2015, Brazil came across its largest environmental disaster: the failure of the "Fundão" barrage, in the city of Mariana, state of Minas Gerais. The event happened in the vicinity of a small village where lies the "Germano" mine, an open-cast ore mine controlled by Samarco Company, a joint venture from Brazilian company VALE S. A. and anglo-australian company BHP Billiton Limited Plc. Besides registering human casualties, the dam failure caused harmful environmental effects related to the slurry wave that flowed several km along streams and river basins, surpassing the state limits and reaching the Atlantic Ocean. Brazilian Federal Police (BFP) took over the investigations in order to enlighten alleged crimes. Several BFP Criminal Experts, from environmental to engineering specialists, acted in a multidisciplinary task force through local evidence search, information gathering in companies' database servers and documental analyses. Since most vestiges were lost, examinations were focused on revision of

projects, spreadsheets and reports; identification of flaws along the dam working life and identification of interferences between such flaws. One identified the following contributions to the accident: faulty bottom drains; foundations settlements and malfunctioning at the galleries components joints; underestimation of side structures interference onto the main dam structure; inappropriate operations of tailing disposal; disregarded contribution of tailings mud; project premise infringement for minimum safe beach; mud contamination at the sandy portion; disregard of the real conditions of liquefaction in laid tailings; untimely analysis of possible seismic occurrence; outdating of the gauges safety parameters along the working life; insufficient monitoring of geometrical conditions and pore pressures at the embankment; adoption of corrective solutions inconsistent with original projects, worsening global safety conditions of the structure; inadequate structural amends to cope with increasing production due reduction of commodity prices, resulting in raising rates far beyond those technically recommended; reduction of financial contribution to technical teams in charge of tailings maintenance systems. One concluded that, in the event of any failures in drainage devices, the tailings system did not have enough safe alternatives to ensure uninterrupted operation in accordance with the project premises. Thus, the forensic analysis detected a series of concurrent faults acting in a row, which revealed a blind working system, totally detached from its original project and without any compliance with the actual geotechnical properties of the laid material.

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DETERMINATION OF VEGETAL OIL USED IN AESTHETIC SURGERY

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In the Trace Evidence group of the National Institute of Legal Medicine and Forensic Sciences of Bogota – Colombia one of the services is to analyze and to determine silicon. One of the most common cases is to analyze the silicone that is used in aesthetic surgery. This analysis is made using Fourier Transform Infrared Spectroscopy (FTIR). In a specific case, a woman passes away by a surgical procedure when supposed silicone was implanted in her gluteus. The analyzed sample was not consistent with the infrared spectra of silicone, but it matched with some spectra of soil and linseed vegetal oil. A determination of refractive index was made, the obtained values from silicone oil and from vegetal oil were compared, the obtained values of the sample were outside the range width for silicone and near the values of the vegetal oil. Extraction of the sample was acquired using a nonpolar solvent like hexane, cyclohexane, ethyl ether, among others. Following this, the sample was derivatized with 2 milliliter of solution 2N of KOH in MeOH, then it was centrifuged and the organic phase was retired to be analyzed by GS-MS. The obtained chromatograms registered the presence of the following fatty acids, Lauric acid, Myristic acid, Palmitoleic acid, Palmitic acid, Margaric acid, Linoleic acid, Oleic acid, Stearic acid. These fatty acids are present in vegetal oils, it was not possible to determine with exactitude the type of oil but it is confirmed that the substance implanted in the body of the victim was not silicone. The method to determine vegetable oil is used to analyze fire debris. Key Word (Trace evidence, Silicone, plastic surgery, FTIR, GC-MS, Refractive index, vegetable oil)

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EFFECT OF CANNABIS EXTRACT ON LARVAE DEVELOPMENT AND DETECTION OF CANNABINOIDS IN LARVAE BY GC-MS

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Introduction: Forensic entomology concerns the use of insects such as *Chrysomya rufifacies* (Diptera: Calliphoridae) and flesh fly (Diptera: Sarcophagidae) to assist in the determination of the post mortem interval (PMI). Δ9-tetrahydrocannabinol (THC) may have an effect on larval growth and PMI conclusions and may also be incorporated into the body of larvae. This specimen may be an important tool in establishing cause of death when other sample types are unavailable. **Method:** Eggs and larvae were collected from a pigs' head and introduced to homogenised pig tenderloin. The tenderloin was pre-prepared containing dilutions of cannabis plant extracts (0.77 g/g) in 2 mL 1%, 5%, 10% or 15% methanol in water to solubilise the extract. Controls included the methanol/water mixtures without THC extract to study the effect of methanol on larval growth. Larvae were collected at first instar and subsequently at 6-hour intervals until the third instar. Larvae were killed with boiling water, dried with a paper towel and stored at -20°C. Larval lengths were measured using a ruler, their masses recorded and larval instar determined by viewing larval spiracles under an AmScope microscope at 10x magnification. Extracts of the larvae were subsequently analysed by gas chromatography-mass spectrometry for the presence of cannabinoids. **Results:** A mixture of Calliphoridae and Sarcophagidae larvae were identified with more Sarcophagidae larvae observed within the environments. The presence of THC caused larvae development to occur at a slower rate compared with the controls. *C. rufifacies* larvae also reached the third instar stage forty-eight hours after being introduced to the meat environments as opposed to an expected 22 hours. Results also indicated that larvae may be suitable for establishing cannabis use antemortem by gas chromatography-mass spectrometry. **Conclusion:** Care should be taken when determining post mortem intervals using instar stage and larval lengths as it may be underestimated if collected from bodies of individuals who had consumed cannabis prior to death, particularly if samples are collected up to 54 hours after death. **Relevance and Potential Application:** The findings suggest corrections of PMI are necessary when using larval stage and length in estimates.

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CIRCRNAS MAY SERVE AS OPTIMUM BIOMARKERS IN FORENSIC RESEARCH

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With the development of RNA deep sequencing technology and bioinformatics development, RNA, especially noncoding RNA (ncRNA), has received increasing attention in the field of forensic science. CircRNA is a class of ncRNA, and recent work has revealed that numbers of circRNA are endogenous, abundant, conserved and stable, which enable them to serve as optimum reference markers. To explore the stability of circRNA in post-mortem specimens, we selected 8 target circRNAs from literatures, and designed specific divergent primers for each gene. Human brain tissues were subjected to qPCR and following the results of a geNrom assessment of transcript stability, the stability from high to low was SHPRH = UBXN > MBOAT2 >TME56> DNAJC2 > TULP4 > XPO1 > HIPK3. Then we regrouped the human specimens according to cause of death (mechanical asphyxia and craniocerebral injury subgroup), and found SHPRH or UBXN always showed the most stable expression level in each group. Therefore, these two markers can be chosen as reference biomarkers. Moreover, HIPK3 was increased in cases of mechanical asphyxia compared with craniocerebral injury, this marker may serve as hypoxia biomarkers.

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DIRECT PCR AMPLIFICATION OF BLOODSTAINS RECOVERED FROM HARD POROUS MATERIALS USING FTA ELUTE CARDS

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Hard porous materials such as concrete are commonly used in construction. As a result of their frequent use, biological samples including blood are often left behind after criminal activity. Concrete is made from composite matrix containing many different ions, the combination of which can make DNA profiling challenging. Biological samples can become embedded in the porous matrix and inhibitory ions extracted from the concrete can have a detrimental effect on the ability to amplify a useable profile. In forensic science 'direct' PCR is referred to a genotyping method that amplifies a DNA profile directly from a sample without DNA extraction, saving time and money. Hard porous materials such as concrete can be problematic to process directly. In addition to inhibitory ions, it can also be difficult to physically remove the tiny amount of sample required. This project investigated a novel application of FTA® Elute cards in their ability to directly profile trace-amounts of blood that have been deposited on different concrete structures. The project investigated the efficiency of FTA Elute cards to recover samples and their components through capillary action and determine whether subsequent direct DNA profiles could be successfully amplified. The ability to directly profile DNA from three volumes of blood (2, 1 and 0.5 µL) that were deposited on two concrete structures (that differed in composition and porosity; a concrete stone pavement slab and a concrete brick) were evaluated using Promega's PlowerPlex® Fusion and Y23 STR kits. Two collection methods were tested; the FTA Elute card and the flocked nylon swab (Copan®). The study demonstrates the potential of using FTA Elute cards (with no post treatments) as a collection tool, showing a significant improvement when compared to its traditional collection method counterpart, the swab (even when using a PunchSolution™ post-treatment). When using PowerPlex® Fusion, 100 % of loci were amplified when using a FTA Elute card punch (1.2 mm diameter in size), significantly higher percentage ($P<0.05$) than the swab; 72 % and 20 % of loci were successfully amplified when used with and without PunchSolution™ treatment respectively. Similar significant results were observed when using PlowerPlex® Y23 kit. The project was designed to establish a new direct sampling method from blood stained hard porous materials that will ultimately increase the overall success rate of DNA profiling. FTA Elute cards can provide a reliable, inexpensive and superior alternative to traditional methods, which will benefit the organization assigned to profiling.

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AGE ESTIMATION BY ASSESSMENT OF DENTAL PULP VOLUME: A BAYESIAN METHOD APPLIED TO DENTAL EVIDENCE

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Background: The pulp-dentin complex is a dental structure that exhibits age-dependent modifications, which result primarily in reduction of pulp chamber volume due to the continual deposition of secondary dentin. The aim of this study was to investigate the performance of a Bayesian method in the evaluation of dental age-related evidence collected by means of a geometrical approximation procedure of the pulp chamber volume. Measurement of dental volumes were based on Cone Beam Computed Tomography images. **Methods:** Two operators randomly analyzed 286 CBCT (114 males and 172 females) and considered the upper left central incisor. This research was designed to simplify the volume measurement through a geometric approximation of different parts of the tooth. The ratio between the pulp volume and the hard tissue volume (PHr) was assumed as a variable according to the following formula: PHr=V(P)/V(H). The Bayesian method was applied by means of a probabilistic graphical model, namely a Bayesian network. Performance of that method was investigated in terms of accuracy and bias of the decisional outcomes. Influence of an informed elicitation of the prior belief on the chronological age was also studied by means of a sensitivity analysis. **Results:** The physical measurements revealed that the CBCT analysis consistently underestimated the real dental pulp volumes by 53%-70%; however, the error occurred for estimation of both pulp and hard tissue volumes, and it tended to be eliminated by the ratio. The Bayesian method for adult age estimation appears to be a logical and robust approach for age estimation. The Bayesian network optimizes the evaluative procedure, which is relevant for daily forensic practice. Conclusions support the integration of expert initial belief in order to improve estimation results. Sensitivity analysis of the initial belief on the chronological age shows that an informed elicitation seems to considerably increase the quality of the estimates. Even when the initial belief on the most probable age is elicited with a 10-years distance from the real age of a given individual, results tend to be more accurate than those obtained with uniform prior. These findings encourage to use background information in the inferential process.

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HUMAN ORGAN TISSUE ID BY TARGETED RNA DEEP SEQUENCING TO AID THE INVESTIGATION OF TRAUMATIC INJURY

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Molecular analysis of the RNA transcriptome from a putative tissue fragment should permit assignment of its source to a specific organ since each will exhibit a unique pattern of gene expression. Determination of the organ source of tissues from crime scenes may aid in shooting and other investigations. In shootings involving multiple bullets, guns and victims/participants, bullets and bullet fragments are recovered. If a recovered bullet possesses human tissue it might be possible to determine its precise trajectory through the human body. One bullet may contain brain tissue, another may contain a lung/skeletal muscle mixture and a third may contain adipose, thus indicating different trajectories and potentially different health outcomes. In some instances a crime is suspected of taking place at a particular location (e.g. in the home of an ex-wife who has disappeared) without a body being recovered. Traces of tissue at the scene (e.g. on the ceiling or wall) or on a suspect's clothing may be found. If the tissue is identified as brain, as opposed to blood, and DNA testing indicated it was from the missing person, this would be an important piece of evidence indicating the likelihood of a fatal traumatic event. We have developed a prototype next generation sequencing (NGS) mRNA profiling assay for organ tissue identification designed to definitively identify ten organ/tissue types using a targeted panel of 46 mRNA biomarkers. The identifiable organs and tissues include brain, lung, liver, heart, kidney, intestine, stomach, skeletal muscle, adipose and trachea. The biomarkers were chosen after iterative specificity testing of numerous candidate genes in various tissue types. The assay is very specific with little cross reactivity with non-targeted tissue and can detect RNA mixtures from different tissues. Preliminary work has been conducted using pre-isolated tissue total RNA from multiple commercial sources. In this presentation we will describe the testing and evaluation of the novel 46plex NGS human organ tissue identification assay, including (i) sensitivity, (ii) specificity, (iii) performance with two and three admixed tissue samples. We also demonstrate the ability of the assay to successful identify the tissue source of origin through the use of a blind study.

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FINDINGS IN POST-MORTEM COMPUTER TOMOGRAPHY AND AUTOPSY IN A FATAL CASE OF STOMACH ACHE

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Stomach ache is a very unspecific clinical symptom, from which everyone suffers more or less often during lifetime, mostly due to a harmless cause. Especially a longer period of pain and self-medication without medical monitoring can lead to a life-threatening condition. We present a case of a 45 year old man who suffered from severe stomach ache and was found dead outside his flat. During autopsy augmented with post-mortem computer tomography and pharmaco-toxicological testing of blood and urine samples, it was shown that neither the perforation of the duodenum with a consecutive peritonitis nor the acute toxic hepatitis due an intoxication with paracetamol led to death. The extensive vomiting and associated increased intrathoracic pressure led to a fatal tension pneumothorax due to a rupture of the right lung as a complication of a pre-existing bullous emphysema.

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WALKING DEAD: INDIVIDUALIZED 3D MODELS FOR FORENSIC RECONSTRUCTIONS

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Accurate and precise forensic reconstructions are fundamental for clarifying the course of events that occurred during a crime or an accident. The use of victim-specific 3D models, i.e. 3D models with actual victim proportions and exact location of the injuries, has been demonstrated very valuable. The procedure for creating individualized 3D models combining computed tomography (CT) scanning and photogrammetry data will be presented in details. 3D models of bones, skin, internal organs, bullet paths and other lesions can be rapidly generated from CT scanning using Mimics software (Materialise). Detailed 3D model of external appearance of the lesions can be instead created from 2D photographs using Photomodeler (Eos Systems Inc), photogrammetry software. Then, the combined whole-body 3D model can be virtually animated based on a complete human anatomy 3D model using 3Ds max software (Autodesk). This procedure will be demonstrated in different cases: 2 cases of gunshot injuries, 2 cases of sharp force injuries and 2 cases of blunt force injuries. It will be shown how specialized 3D modelling and animation techniques allow to better understand the sequence of events and how medical evidences can be more accurately documented and reported in a more intuitive manner using this procedure.

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LUMINESCENT MARKERS FOR GSR: DETERMINATION OF THE SHOOTING POSITION AND ENCODING OF AMMUNITION.

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In forensics, estimative of shooting distance can provide important information about the crime dynamics. The available methodologies allow estimating a range of shooting distance (as contact, near contact, intermediate or distant shots). However, when it comes to distant shots, it is almost impossible to determine the shooting position with accuracy. In addition, this task becomes more difficult when a non-toxic ammunition (NTA) is used. Our group had developed luminescent markers that allow the *in loco* detection of the luminescent GSR (LGSR), which can be deposited on the surfaces of a crime scene. In this work, eight different markers, isostructural to the MOF MIL-78, with different proportions of dopants were added to the gunpowder of 9 mm NTA in a weight ratio of 4% wt. Then, three shots were performed in the indoor shooting range of National Institute of Criminalistics of the Brazilian Federal Police. The position of the shooter and the marker used were unknown by the expert. After the shots, the expert analyzed the simulated crime scene using only a portable UV lamp (254 nm), and through the LGSR dispersion, the shooting position was correctly determined in 100% of the cases. At the trigger point, a larger number of luminescent particles was observed, while the number decreased as they approached the target. Furthermore, LGSR samples were collected from the shooters' hands, guns and floor with stubs covered with double-sided adhesive conductive carbon tape and analyzed by SEM/EDS. This analysis allowed to identify all the markers based on their chemical composition, and to correlate the residues collected on each shooter, with the residues found on the firearm and on the floor. In conclusion, the use of the luminescent markers showed to be very effective, for both estimating shooting position, and identification of the used marker in an encoding process. Accurate information was obtained even for distant shots. It was also possible to correlate the shooter, the firearm and the residues collected on the firing range.

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THE MILANO IDENTIFIED SKELETAL COLLECTION: A TOOL FOR FORENSIC IDENTIFICATION AND TRAUMA ANALYSIS.

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Known forensic skeletal collections are a priceless instrument for research and teaching in forensic anthropology and pathology. Over the past six years, LABANOF (Laboratorio di Antropologia e Odontologia Forense) of the University of Milano, in close collaboration with the municipality of Milano, succeeded in concluding an agreement for the creation and the assemblage of a new and contemporary known skeletal collection, composed of unclaimed known skeletons collected from three of the main Cemeteries of Milan according to Police Mortuary Regulations. The collection presently counts more than 2100 individuals, with age at death ranging from 0 to 104, most of which died in the last decades of the past century (1990), representing a rare and invaluable example of a "documented" modern skeletal collection, since sex, age at death, disease, trauma and cause of death are available (in some cases full autopsy and laboratory reports of the previously autopsied cadavers). The collection represents many cases of trauma of various types (blunt force, gunshot, sharp force, mechanical asphyxia), as well as intoxications and poisonings. There are also documented cases of disease such as cancer, diabetes, HIV infection, tuberculosis, rheumatoid arthritis, syphilis, Down's syndrome, to name a few. The collection counts a large number of skeletons belonging to individuals for which facial photographs are available. Several investigations have already been conducted, aimed at testing newly developed anthropological methods or at improving the current knowledge of the skeletal manifestation of different pathologies and trauma. The remarkable dimension, which makes it one of the largest skeletal collections currently existing, together with the related available information and the countless studies that can arise from such kind of material, make the Milano Skeletal Collection a useful tool for research and training in the areas of demography, identification, pathology, trauma, taphonomy and many other aspects of the anthropological and odontological practice. Furthermore, it encompasses also a microscopic collection of 2000 human bone slides (mainly for the purpose of aging), CT and X ray documentation.

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COMPARING FIST SIZE TO HEART SIZE IS NOT A VIABLE TECHNIQUE TO ASSESS CARDIOMEGALY

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Introduction Several medical textbooks state that the human physiological heart is approximately of the size of the persons fist. Cardiomegaly is therefore assumed, if the heart is larger than the persons fist. Because there is no study actually investigating this claim, we formulate two hypotheses that are being tested. First, we hypothesize that in cases without cardiomegaly, the volumes of the hand and the heart are not significantly different. Second, we hypothesize, that in cases of cardiomegaly, the heart volume statistically significantly exceeds the hand volume. Materials and Methods We retrospectively selected 64 PMCT datasets (32 with cardiomegaly, 32 without cardiomegaly according to the autopsy report) from the Institute of Forensic Medicine, Zurich since 01.01.2013, over an approximately 3-months period. Based on the PMCT data gathered, volumes of hands and hearts were estimated by using segmentation techniques. Results For all groups (male, female, with and without cardiomegaly), the mean heart volume was larger than the mean hand volume. Except for females with cardiomegaly (n=8), no correlation between mean hand volume and heart volume could be found. Discussion In this study, we demonstrated that the commonly used idea that a heart lager than the fist of a patient suggests cardiomegaly, might be wrong. Because this is commonly used in autopsy reports, it might lead to avoidable errors. Until further studies confirm this hypothesis, it should not be taught or used anymore.

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TO EXECUTE FEMALE IN THE NAME OF FAMILY DECENCY IN NORTHERN PART OF INDIA

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In the recent era of modernization and high educated society, women and girls are being killed for a variety of behaviors which may include consensual relations, outside marriage seeking divorce or refusing to marry the person chosen by family. Often the relatives seeking to punish young couples who are even the suspicion of a transgression or who defy communal customs by marrying outside of their religion, clan, or caste on the honour of family among all the communities at every place where most of the marriages are arranged by families. In northern part of India, woman is beaten to death for not performing her domestic duties or physically assaulted. Khap panchayats violate a person's fundamental right to life as they kill or instigate murder, in the name of honour. The Act is relevant in cases where the khap panchayats have forcefully separated married couples who are of eligible age to get married. The Constitution of India has ample provisions allowing an individual to exercise her choice independent of caste, religion or gender and protection from honour related crimes including honour killings. Indian Penal Code Section 299 and 301 of the IPC, deals with culpable homicide not amounting to murder while Section 300, deals with murder. As per the Indian Democratic Women's association, Haryana, Punjab and Uttar Pradesh account for about 900 honour killings and up to 300 in rest of the country. Not in India but throughout the world, it has been observed by Honour based violence awareness network 5000 honour killings/year took place.

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LUMINESCENT MARKERS FOR GSR: THE INFLUENCE OF WEAPON TYPE

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Gunshot residues (GSR) consist of particles produced after the firing and are of great interest in forensic science. Studies using high-speed cinematographic showed that the GSR distribution can be influenced by the type of the gun due to the dynamics of the plume after shot. Our group developed luminescent markers to be added in the ammunition which provides an optical and chemical signature to GSR. The luminescent GSR (LGSR) showed to be very helpful to experts in identifying GSR produced by non-toxic ammunition (NTA) and in analyzing the crime scene. In this work, it was studied the distribution of LGSR produced by different pistols to assess the difference in the firearm in the LGSR formation and distribution. Six types of pistols were used in this experiment: Glock G17, Glock G26, Smith & Wesson 6906, Browning Hi-Power, Jericho 941F and Taurus PT 908. Different shooters performed two shots each one, using a NTA with 10% wt. of the luminescent marker. After the shots, the shooter`s hands and guns were analyzed by video spectral comparator (VSC) (λ = 254nm). LGSR particles from the gun's and the shooters' hands were collected using SEM stubs and analyzed by scanning electron microscopy with energy dispersive X-ray analysis (SEM/EDS). In all types of pistols tested was possible to identify the presence of the luminescent markers, thereby, they can be used in many types of pistols, with no loss of efficiency. Barrel length and trigger mechanism showed to play a role in LGSR dispersion. Guns with a smaller barrel, such as Glock G26 and Smith & Wesson 6906, presented a greater amount of LGSR deposited on the gun and on the shooter hands, as expected. Few particles were found on the face and on the chest of the shooter when Taurus PT 908, Browning Hi-Power and Jericho 941F were used, due to exposed harmer. In conclusion, it is not possible to infer the type of weapon used based on the LGSR distribution but is possible (and easy) to identify LGSR independently of the weapon used, even when they are deposited on less usual places such as face and chest.

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INTERACTIVE CRIME SCENE VISUALISATION – THE FORENSIC HOLODECK

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3D scanning of vehicle collisions, victims or objects is a common tool in forensic reconstructions. However, visualisation of the resulting 3D reconstruction is often limited to 2D screens or print from defined points of view. Virtual Reality is an approach to enable visualisations of reconstructions in real 3D. For the presented system, after acquisition of the 3D data and subsequent reconstruction of the scene, the data is visualised with the *HTC Vive* and the software *Destinations* provided by *Steam. Destinations* is a software that focuses on visualizing photogrammetric data using computer gaming methods. These computer gaming methods allow not only the visualisation of 3D data but also interaction with objects as for example switching between scenes, changing the position, scale, colour of 3D objects or even animation of objects and scenes. A clear advantage of visualisation of 3D data in 3D is that the point of view can be defined by the viewer themselves enabling a better understanding of a scene. Additionally, by interactively highlighting objects it becomes even easier to understand links and relationships between these. The requirement of additional hardware such as the VR kit and powerful computer for the graphics calculations are a comparably small disadvantage. This makes 3D visualisation an important tool for future crime scene investigations, their understanding and legal judgement.

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IDENTIFICATION PROCEDURES AND MORTUARY OPERATIONS: THE 2015 TERRORIST ATTACKS IN PARIS

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Between January and November 2015, Paris and the city's suburb were hit by a series of terrorist assaults resulting in 147 deaths and hundreds of injured victims. The first responders and forensic teams were confronted with a variety of challenges which occurred as a result of the variability of the modus operandi (shootings, hostage-taking, suicide-bombings), the condition of victim's bodies (which ranged from complete to highly disrupted), the location of single and multiple scenes, both indoor and outdoor, and the fact that both national and international persons were affected. In cases of terrorist attacks in France, the Central Directorate of Judicial Police is responsible for overseeing the operations and engaging Crime Scene Investigation units and Disaster Victim Identification (DVI) teams. The particular circumstances of the Paris November 2015 attacks with multi-site assaults resulting in a death tool of 130 victims and 401 injured raised a number of significant issues: - the need to adapt operational plans to the specificity of the context in a unique site where all the forensic work can be carried out in order to accelerate the identification process with the collection of primary identifiers combined with external examination of victims, - the importance of performing a complete identification procedure on all victims even when identities document are recovered, before establishing the causes of death (two steps examination) in order to speed up the elaboration of a consolidated list of victims - the need to perform complete autopsies for casualties with complex injuries, for those whose cause of death is unclear, in case of in corpore bullets, when survival time has to be assess and for victims who die in hospitals, - the importance of having one team dedicated to the examination of fragmented remains to ensure the determination of total number of victims and the re-association of body fragments to corpses, - the need to proceed to the identification of unidentified victims in hospitals to avoid any visual recognition by relatives, - the importance to have one consolidated list of missing persons and a unique list of victims dead and injured. The concerns expressed by the families regarding the identification process, and lessons learned from all actors involved in the 2015 terrorist attacks in France, have led to the elaboration of new Standard Operating Procedures that was successfully implemented for the Nice terrorist attack in 2016 where 84 victims were examined in 36 hours.

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DIAGNOSIS OF BURNS FROM HEAT HAEMATOMA USING CARBON MONOXIDE DETECTOR TUBE

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To determine vital reaction of the death by fire, most useful evidence is the presence of carbon monoxide in the circulating blood. They prove that the victim was still alive when the fire was in progress. However, when it is set fire after some kind of head injury, the results become same as death by fire. The extradural haematoma may be investigated in another way to determine its time of origin. If it is a true traumatic injury arised before a fire began, it should contain no carboxyhaemoglobin. A spurious heat haematoma is formed from blood that will contain carboxyhaemoglobin. However not all persons alive during a fire accumulated sufficient carboxyhaemoglobin. The measurement of the carboxyhaemoglobin in the heat hematoma was another choice to determine death by fire during the life, but there was a limit by the classic analytical method. Therefore, we developed a simple and easy method to measure carbon monoxide concentrations from haematoma. Heat haematoma and aqueous solution of potassium hexacyanoferrate were placed in a glass vial and the vial was immediately sealed up with a rubber stopper. The contents in the vial were mixed well by shaking it and were left as it was. After 5 minutes, a needle connected to a carbon monoxide detector tube was pricked through the rubber stopper of the vial, and the head space was drew into the detector tube, then carbon monoxide concentration in the head space was determined with the detector tube. By the method mentioned above, we can successfully measured carbon monoxide concentrations from heat haematoma.

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FATAL INTOXICATIONS: DO SUBJECTS WITH CARDIAC PATHOLOGIES DIE AT LOWER CONCENTRATIONS OF DRUGS?

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Introduction: Suspected fatal intoxications, are in most jurisdictions subjected to a forensic autopsy including toxicology. Whenever one or more drugs are detected in high concentrations and the circumstances suggest intoxication, this will typically be considered as the cause of death. However, in proportion of the suspected intoxications, drugs are detected in only 'normal' or somewhat elevated concentrations. In such cases the pathologist may still consider the cause of death to be an intoxication, and blame pre-existing medical conditions as an explanation for a low concentration. We tested the hypothesis that drugs that may cause arrhythmia, such as the tricyclic antidepressants amitriptyline and clomipramine, and the beta blockers propranolol and metoprolol, produce a fatal intoxication at lower concentrations if the subject shows heart enlargement, coronary sclerosis or myocardial fibrosis. **Material and Methods:** The Swedish Forensic Medicine and Toxicology Database was searched for all cases where any of these four substances had been detected and quantified in post-mortem femoral blood from Jan 2012 through June 2015. The forensic autopsy files, including the police reports and autopsy protocols were studied to classify cases, i.e. confirm intoxication from circumstances, and to grade coronary sclerosis and myocardial fibrosis. **Results:** A total of 705 cases were found; 283 women and 421 men, aged 20-95 years. In total, 193 had sclerosis, 19 fibrosis and 112 both sclerosis and fibrosis. In 380 cases there were no sclerosis or fibrosis. Heart weight was used as a continuous variable to analyze its impact on blood drug concentrations. p-values between 0.004-0.046 was obtained in 6 of the 72 comparisons (8%). Only one statistically significant p-value was found in the lethal single-intoxication group ($p=0.043$), whereas the other five was found in the group where one or more of the substances was found post mortem and regardless of cause of death. No statistical significance was found in the group with all lethal intoxications. **Conclusions:** The results of this study do not support the notion that subjects with a pre-existing heart condition are more vulnerable to a particular concentration of any of these pro-arrhythmic drugs. Hence, even if some subjects may die at low levels of cardio-toxic drugs, the reasons for this remain incompletely understood. Referring to a morphological heart pathology as an excuse for making the diagnosis of fatal intoxication with cardio-toxic drugs when the blood levels are low is not supported by the results of this study.

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MEDICAL CARE ASSISTANCE OF PEOPLE WOUNDED BY POLICE OFFICERS AND CLASSIFIED AS TORTURED

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Introduction An increase in human rights transgressions in Colombia has been reported; torture is one of them according to Amnesty International (2015, 2016). Those victims require complete care evaluation which begins at primary health care centers; it must include physical and psychological assessments in order to decrease catastrophic sequels on health and life quality; furthermore many of these events remain unpunished. In light of these needs, this study describes the medical care assistance of people wounded by police officers and who have been classified as tortured and have received medical care at the Instituto Nacional de Medicina Legal y Ciencias Forenses (INMLyCF) in Manizales (Colombia) between 2009 and 2012. Methodology This study was designed as case series comprehending 24 clinical histories recorded at a primary health care center in Manizales of people who claimed to be hit by police officers; these cases have been classified as torture in a prior study by INMLyCF. The multidimensional test designed in this research was applied to the sample in order to assess the diagnostic approach of the clinical histories. The test emphasizes in how the anamnesis and physical examination were used to make a prompt diagnosis and complete treatment. Results The test items were evaluated all together, finding scores with a wide range between 3.7 and 22.7, with an average of 12.2. In the test, there were chosen two main items in order to make the diagnostic approach to torture: a) whether the anamnesis registered information supports the diagnosis of torture and cruel, inhuman and degrading treatment and b) if the anamnesis had enough information to guide a complete management of torture victims; the results of both items obtained very low values. Also, the results show that physicians who assist these tortured patients were unaware of the torture diagnostic approach. Conclusions According to the outcomes of this research, it is clear that first care physicians involved in the investigation had a poor holistic approach of the torture victim. The main reason that explains the inadequate diagnostic of torture is multifactorial; the results suggest an unsatisfactory training of the physicians evaluated in this study, and even a lack of interest of government institutions, revealing an absence of guidelines and protocols to help the first care physician to manage victims of torture.

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VALIDATING AND IMPLEMENTING STRMIX™, A PROBABILISTIC GENOTYPING SYSTEM, FOR FORENSIC DNA CASEWORK

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The Centre of Forensic Sciences (CFS) processes over 6,000 cases, and 14,000 DNA samples per year for the Province of Ontario. A significant proportion of these samples result in mixtures of DNA from multiple contributors. The CFS has historically employed a manual interpretation method using a modified, restricted, random match probability to address the weight of any non-exclusionary findings. However, this method is not always suitable in the interpretation of complex mixtures. To this end, the CFS has recently acquired and validated the STRmix™ probabilistic genotyping system for use in DNA casework. The CFS validated two different autosomal STR DNA typing kits (PowerPlex® 16HS and Identifiler® Plus) according to the SWGDAM Guidelines for Validation of Probabilistic Genotyping Systems. These validations included assessments of mixtures of up to five contributors with varying amounts of template DNA. One goal of the validation was to assess how STRmix™ behaved, with simple mixtures, as compared to the manual interpretation methods employed at the CFS. The results demonstrated that, for these types of mixtures, STRmix™ and manual interpretation were similarly capable of resolving contributing genotypes. The extensive validation studies also allowed for an assessment of the limits of the software with regards to input amounts, numbers of contributors, and relative amounts of DNA from each donor. Results were used to inform internal policies, procedures and information documents. The CFS opted for a staged implementation of STRmix™ into casework. Initially, usage was limited to a subset of samples in sexual assault cases. Often, these are intimate body samples in which the complainant's own DNA is expected but incidental. Conditioning the analysis of these mixed samples on the assumption that the complainant represents one contributor simplifies interpretation such that it can often be performed manually. In including these for STRmix™, the CFS has amassed a body of casework results for which scientists are able to assess the STRmix™ output against what would otherwise have been determined manually. While validation demonstrated that STRmix™ was suitable for its intended use, this staged approach to casework provided the opportunity to optimize the platform, through incremental improvements to policies and procedures, in advance of being applied to other case types. Stage two, implemented in early 2017, involved an expansion of STRmix™ usage to complex mixtures encountered in homicides and attempt murder cases. This presentation will summarize the validation performed as well as the benefits of, and lessons learned throughout implementation.

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THE INCIDENCE OF TETRAHYDROCANNABINOL IN FATAL MOTOR VEHICLE COLLISIONS IN ONTARIO, CANADA IN 2015

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Tetrahydrocannabinol (THC) is the primary psychoactive component of cannabis products that are available in many forms e.g. marijuana, concentrates and hashish. The role of THC in impaired driving cases and fatal motor vehicle collisions (FMVC) is of particular interest to individuals, organisations and governments concerned with public safety. The Federal Government of Canada is preparing legislation that will effectively decriminalize marijuana use and possession and it has been predicted that this will increase the incidence of use by motor vehicle operators. As such the Centre of Forensic Sciences (CFS) conducted a review and analysis of THC in fatal motor vehicle collisions (FMVC) that occurred in 2015. This information will provide an effective base reference to monitor any changes that occur following cannabis decriminalisation. All FMVC cases from 2015 were reviewed and THC positive cases in drivers were identified. Additionally it has been recommended that similar to existing drink driving legislation, the Government should explore the possibility of establishing a per se limit for blood THC concentrations; therefore, the concentrations of THC detected in FMVC cases were also evaluated. Analysis for THC was performed by immunoassay screening with confirmation and quantitation of results using liquid chromatography-tandem mass spectrometry (LC-MS/MS). Out of 244 FMVCs, THC was detected in 57 (23%) cases. Blood concentrations of THC ranged from traces (< 0.6 ng/mL) up to to 200 ng/mL. The ages of THC positive drivers ranged from 15 to 64 years and the incidence of THC detected decreased with increasing age. Comparing the detected concentrations of THC with per se limits used in other countries (2 to 5 ng/mL) 54% of positive cases were greater than a 5 ng/mL limit and 80% of positive cases were greater than a 2 ng/mL limit. The findings in this study indicate that THC is frequently detected in FMVC cases and in the majority of these cases at a concentration higher than per se limits used in many regions around the world.

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METHAMPHETAMINE INDUCED ILEUS IN RAT

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Methamphetamine (MET) is a psycho-neuro stimulant drug that is abused frequently on the entire world. MET overdose presents with altered mental state, agitation, acute psychosis, dilated pupils, tachycardia, tachypnea, dyspnoea, hypertension, shivering, chest pain and hyperpyrexia; results to end organ damage, seizures or Coma . We reported two cases of animal MET-induced ileus that were found during our researches on MET intoxication. In dose finding parts of our researches on MET intoxication on rat, we administrated different doses of MET into animals. They were Sprague Dawley male rats treated by 50mg/kg (rat A) or by 45mg/kg (rat B) of MET intrapreitonaly and 18ml/kg of normal saline intravenously. Through 0.5 hours after MET administration, they became hyperthermic and showed high degree of stereotypic motions. They could not move on open filed box bottom and found tremor. They became hypothermic before death and they died at 4.5 – 5 hours after MET intoxication. Both rats were scarified immediately after death. They general appearance of died rats were normal except a mild abdominal distention. On laparotomy, the all hallow parts of gastrointestinal tracts were distended and pushed out from abdominal cavity immediately after cutting the abdominal muscles. We could not find any sign of bowel ischemia or obstruction. These are rare cases report of MET intoxication as two previous cases (one humane and one dog).

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THE UTILITY OF GIS IN THE SPATIAL ANALYSIS OF SAW CUT MARKS ON BONE

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Geographic information systems (GIS) have been used extensively for storing and analyzing raster and vector data covering large spatial extents. Because of its ability to analyze spatial data and patterns, GIS has recently been applied to micro-scale features of bones. Kerf wall striations, while highly visible, have proven for the most part to be ineffective in defining saw class. GIS appears well-suited to recognize saw cut striations as spatial patterns. To test this a series of test cuts were made using long bones of *Odocoileus virginianus*. Two saws were chosen with reasonably different class characteristics; 11 tpi cross-cut pruning saw and 32 tpi wavy set hacksaw. Using a digital microscope the kerf wall striations were digitally recorded in a jpeg format. Using ArcMap 10.1 each jpeg image was separated into three color bands. To analyze the variation within each image an Isocluster Unsupervised Classification in ArcGIS 10.1 was applied to determine the maximum number of statistically similar cluster classes. The more homogeneous the image the fewer classes required to represent the spectral variation in the image. FRAGSTATS spatial pattern analysis software analyzed the striation patterns using two values; Patch Richness and the Interspersion-Juxtaposition Index. Eight trials using the 11 tpi cross-cut produced an average of 25 classes whereas five trials for the 32 tpi wavy cut produced an average of 8 classes. This indicates a greater degree of variation in reflectance among the red, blue, and green bands for images from the 11 tpi blade and thus more surface variation texture. Interspersion-Juxtaposition Index refers to the spatial intermixing of different patch types and increases in value from 0-100% as patches tend to be more evenly interspersed. This is an indicator of the total edge increasing as patch shapes become more irregular (as the image contains more edge relative to interior of cluster classes. The 11 tpi saw blade had an average IJI of 68% while the 32tpi blade produced an average of 77% indicating that produced fewer and more homogenous classes each occupying a larger proportion of the image area and thus likely to be adjacent to different class types. This study has demonstrated that GIS can be used in the pattern analysis of saw cut striations. Further analysis is needed to establish the Patch Richness and Interspersion-Juxtaposition Index for additional saw classes and formulate a methodology for testing an unknown striation pattern against known patterns.

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THE USE OF FORMALDEHYDE IMBEDDED HUMAN REMAINS IN EXPERIMENTAL PROCEDURES

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When looking at trauma patterning and various fractures in mass disaster scenarios, it is critical to have a firm understanding of bone biomechanics. Experimental recreations of the fracture types seen in mass disasters can aid in the humanitarian effort to identify and repatriate remains. In such instances where charring or cremation are involved, identifying human remains becomes more difficult. In most burn experiments, animal surrogates are used because they are easily obtained and can be good models for human bone tissue, however; the biomechanical structure between human and animal irregular bones is significant and precludes the use of animal bone for this tissue. To aid in the identification of charred or cremated remains, human specimens need to be used instead of animal substitutes. To proceed with research using formalin-saturated bones typical of medical cadavers, it is essential to test how the formalin will affect the analysis. There is no relevant forensic data stating how formaldehyde saturated bone changes when introduced to heat. In this project, sections of bone from medical cadavers are tested to examine the flash point, length of cremation time, and heat fracture patterning. The results obtained from this study will lead to a better understanding of the implications of using medical cadavers to recreate heat traumas instead of defaulting to animal remains. This will greatly aid in allowing for more quantitative and direct studies of heat trauma.

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AGGREGATION AND COMPETITION IN LUCILIA SERICATA AND PHORMIA REGINA MEIGEN (DIPTERA: CALLIPHORIDAE)

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Blow flies (Diptera: Calliphoridae) are commonly used to estimate the post-mortem interval of unattended death when this interval is greater than 48 hours. This estimate utilizes the developmental biology and behaviour of these first arriving insects. Female blow flies typically engage in aggregated egg laying, resulting in larval feeding masses once the eggs hatch. The density of individuals from the same species and from other species of blow flies has the potential to impact developmental rates and survival between different developmental stages through competitive interactions. During larval feeding aggregations, the larvae are capable of generating internal heat temperatures that can exceed ambient temperatures by 20-30ºC. In order to withstand the thermal stress induced by this high internal temperature, maggots synthesize heat shock proteins. The aim of this research is to study the implications of spatial aggregation for larval competition on two forensically important blow flies *Lucilia sericata* Meigen (Diptera: Calliphoridae) and *Phormia regina* Meigen (Diptera: Calliphoridae). First instars approximately 2-3 hours old are transferred onto 50g of liver at several densities for pure and mixed laboratory cultures and reared at three different temperatures, 15°C, 25°C and 35°C. In pure cultures of *Lucilia sericata* and *Phormia regina* development rate and mortality increases with increasing temperature while adult size for both species decreased with increasing larval density. We will be measuring heat shock induced proteins synthesized during

development at different densities of larvae. The results of this study will be used to refine estimates of post-mortem interval utilizing blow fly development and to potentially explain oviposition behaviour and larval behaviour during development. This research is particularly significant because of blow fly importance in the field of ecology, forensics, medical and veterinary science.

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SETTING ACCEPTANCE CRITERIA FOR LUBRICANT ANALYSIS OF SWABS AT THE CENTRE OF FORENSIC SCIENCES (CFS)

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Of the few studies that evaluate lubricant persistence on body swabs used to collect samples in sexual assault investigations most have a limited amount of data on which to determine suitable case acceptance criteria. This study expands this knowledge base by examining swabs used to collect post-intercourse samples after a range of time periods and cleansing activities in order to establish acceptance criteria when lubricant analysis has been requested. CFS staff who volunteered for the study were supplied with lubricated condoms and/or personal lubricants for use in sexual activities, and swabs for collecting post-intercourse samples. Areas sampled included the vagina, external genitalia (male and female) and rectum. Swabs were examined via solvent extraction and GC-MS and/or FTIR analysis. In the first phase, water insoluble (dry) lubricant products containing polydimethylsiloxane (PDMS) were used. PDMS was identified on 38 of 43 swabs. A total of 31 swabs were collected within 24 hours of intercourse and PDMS was identified on all. Of the 12 swabs collected between 24 and 72 hours post-intercourse, PDMS was identified on 7 with the longest collection interval being 56 hours after intercourse. PDMS was also identified after post-intercourse activities such as washing (4 out of 7 swabs) and voiding (9 out of 12 swabs) up to 56 hours. In the second phase, water soluble (wet) lubricant products were used: polyethylene glycol (PEG) condoms and glycerol personal lubricant. Glycerol and/or PEG were identified in 20 of 41 swabs. The longest post-intercourse interval for identification was 13 hours. For samples collected within 6 hours post-intercourse, wet lubricants were identified less frequently on vaginal swabs (4 out of 8 swabs) than on female external genitalia (4 out of 5) or male external genitalia (10 out of 10 swabs). Previous studies indicated wet lubricant persistence of 8 hours[1] and 24 for dry lubricant[2], however this study has demonstrated that wet lubricants can be identified up to 13 hours and dry lubricant up to 56 hours post-intercourse. Due to the small amount of data regarding wet lubricant persistence beyond 13 hours, the CFS has determined it reasonable to set the acceptance criterion for wet lubricant analysis of swabs to within 24 hours of an alleged incident. Swabs collected beyond 24 hours will be considered for dry lubricant analysis only. 1. P. Maynard et al., Forensic Science International 124(2001) 140-156 2. R.D. Blackledge and M. Vincenti, Journal of the Forensic Science Society 34(1994) 245-256

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POST-MORTEM CT FOR FORENSIC APPLICATIONS: A SYSTEMATIC REVIEW OF GUNSHOT DEATHS

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Over the past fifteen years, the computed tomography (CT) scanning techniques have attracted increasing interest for their great usefulness in the forensic field. This review describes the studies published to date on virtopsy in gunshot injuries cases and shows a lack of standardized practices in performing CT post-mortem and autopsy examinations, as well as in comparing their results. We thus point out the main differences among studies with the aim of supporting forensic research towards shared and validated practices, whose results are used as evidence in the courtroom.

Disclosure: All authors have declared no conflicts of interest.

EFFECT OF INTRAVENOUS LIPID EMULSION ON ACUTE METHAMPHETAMINE TOXICITY

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Background: Methamphetamine (METH) is the second most abused drug and there are several cases reported of severe adverse effects of MET intoxication . Intravenous lipid emulsion (ILE) showed a potential application in the treatment of poisoning. We try to evaluated the potential role of ILE as an antidote for acute METH poisoning. **Materials and Methods:** Two groups of six male rats were treated by METH (45 mg/kg), intraperitoneally. Five to seven min later, they received an infusion of 18.6 ml/kg ILE 20% through the tail vein or normal saline (NS). Locomotor, behavioral activity,body temperature and survival rates were assessed at different time after METH administration. The brain and internal organs were then removed for histological examination and TUNEL assay. **Results:** ILE therapy for METH poisoning in rats could prevent rats mortalities all ILE treated rat were alive at the time of the last evaluation .Nevertheless, only 50% of rats treated by METH+NS were survived (Mean survival time of METH+NS = 13±3.7 hrs and METH+ILE = 24± 0 hr, $P<0.05$). LE also returned the METH-induced hyperthermia to normal rates ($P<0.05$). ILE reduced freezing and stereotyped behaviors and increased rearing responses ($P<0.05$). Locomotor activity also returned to control levels especially during the last hours of the experiment. ILE administration decreased the prevalence of pulmonary emphysema in the lungs ($P<0.05$ and $P<0.01$) and percentages of TUNEL positive cells in the brain ($P<0.05$), in comparison with the control group. **Conclusion:** ILE could reduce the severity of METH- induced toxicity as well as mortality rate in the animals. Intravenous infusion of lipid emulsion may save the life of patients with acute METH intoxication who do not respond to standard initial therapy.

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GUNSHOT TRAUMA IN 3D: THE SUITABILITY OF 3D-PHOTOGRAMMETRY

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3D digitisations are becoming an essential tool for the forensic anthropologist. Imaging methods are required to visualise the specific morphological features that identify peri-mortem gunshot trauma, and distinguish it from other types of trauma. Traditional radiographic imaging fails to capture 3D, colour, and texture data essential for a forensic anthropological trauma assessment. The multi-directional force of gunshot trauma on bone results in features with multiple geometric faces. Heaving fractures and bevelling, for example, need to be viewed from multiple angles and planes to visualise the complete feature. Additionally, fracturing can lead to fragmentation. Reconstruction is essential to properly visualise the trauma morphology, and a 3D reconstruction can replace traditional gluing methods. A 3D reconstruction preserves evidence better than traditional methods by limiting physical contact with the bone, and allowing for a more accurate reconstruction to be achieved. A further challenge in trauma analysis is the common occurrence of concealing human remains, as observed in forensic cases; different burial environments

affect the colour and texture of the bone surface and obscure the surface morphology. Radiographic methods do no capture these original colours and textures of the specimen. Magnetic Resonance Imaging (MRI), for example, engineers false colours to improve image contrast. The value of 3D data over 2D data in gunshot trauma analysis has been demonstrated in the field of forensic medicine. However, methods like MRI and Multi-Slice Computed Tomography (MSCT), which have been favoured, have the same limitations as traditional radiographic methods in capturing original surface data In addition to this, these methods are both high-cost and non-portable. With tighter budgetary requirements in place for UK forensic science services, such methods are not fit-for-purpose. 3D-photogrammetry methods, conversely, are low-cost, portable, and customisable methods that produce 3D, interactive, and photorealistic models. A series of bone specimens with gunshot trauma from archaeological human and mammalian collections were imaged with Structure from Motion (SfM; a 3D-photogrammetry method). Gunshot trauma morphology analysis, colour and texture data visualisation, and 3D reconstruction were all achieved using this method. This study demonstrated that SfM is a precise and flexible method for the forensic analysis of gunshot trauma on bone in forensic cases.

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COMPARATIVE ANALYSIS OF 763 AUTOPSY CASES OF POISONING DEATH

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Objective: To provide references for forensic expertise by investigating the kinds of toxicant, routes of exposure and manners of poisoning deaths, etc. **Methods:** Seven hundred and sixty-three autopsy cases of poisoning deaths from 1957 to 2016 in Department of Forensic Medicine, Tongji Medical College (Tongji Forensic Medicine Center of Hubei), were comparatively reviewed. For each case, thorough autopsy and pathological examination was performed. The final conclusion was reached by comprehensive analysis of the investigation report, clinical history, autopsy and pathological findings and the toxicological report of the case. **Results:** In 374 cases from 1999 to 2016, more than 50% of decedents were male in the ages of 30-49, which had no statistical significance compared to the data of 1983-1998 and 1957-1982. The toxicants were usually taken orally and the most common manner of death was accidental. The common substances involved in poisoning death were pesticide, alcohols and poisoning gas, the proportion of which was 20.6%, 16.3% and 15.8% respectively. Compared to the data of 1983-1998 and 1957-1982, the common species of toxicants had changed significantly. The number of cases involving pesticide, hypnotic and cyanide decreased in recent years as well as the number of cases involving rodenticide, poisoning gas and alcohols displayed an increase tendency, especially for drug abuse. In addition, multiple poisoning, including the kinds of toxicant and routes of exposure, also increased. **Conclusion** Threat of alcohols and poisoning gas increases gradually, which could not be ignore. Poisoning deaths of pesticides remain a major public health problem for a long time and the awareness of prevention need to be raised, especially for the prevention of deaths from multiple poisons.

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LA VIOLENCE À L'ÉGARD DES FEMME ETUDE MÉDICO-SOCIALE (2015-2016).CHU DE SÉTIF - ALGÉRIE

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Objectifs -Dresser un tableau descriptif sur les violences à l'encontre des femmes ayant consulté au niveau de notre service de Médecine Légale. -Déterminer la violence à l'égard des femmes par rapport à l'ensemble de la consultationde notre service. -Evaluer la fréquence de la violence intrafamiliale à l'égard de la femme par rapport aux autres lieux de survenue. - Evaluer la fréquence de la violence conjugale par rapport aux violences intrafamiliales -Identifier l'auteur et établir son profil socio –économique. -Etablir le profil socio économique et éducatif de la femme victime de violences conjugales et du conjoint auteur de ces violences. -Identifier les causes de la violence dans le couple. **Méthodologie** Etude prospective sur les femmes victimes de violence ayant consulté au niveau de notre service de Médecine Légale du 01/01/15 au 31/12/16. Le recueil de l'information est effectué à partir des registres et des certificats pour coups et blessures et à partir d'un questionnaire préétabli par les psychologues du service. La saisie, le contrôle et le traitement de l'information sont effectués sur un logiciel informatique **Résultats** Du 01/01/ 15 au 31/12/16 : 17725 consultations dont 66 % pour CBV dont 29% sont des femmes et dont 2% sont des agressions sexuelles. Les femmes de 18ans et plus sont victimes seulement d'agressions physiques. 80,41% des femmes ont accepté de répondre au questionnaire. 60% sont mariées, 30% célibataires et 10% veuves ou divorcées. Une femme sur quatre à un travail. L'auteur des violences est de sexe masculin dans 82% des cas. L'époux dans les 2/3 des cas, le fiancé dans 20% des cas, père, frère, le fils dans 11% des cas, « les hommes » de la belle famille 3%, les hommes (collègue, voisin, inconnus) 6%. Dans 18% l'agresseur est une femme dont 50% de la belle. les violences conjugales, 1/3 des femmes sont battues dès les deux 1eres années de mariage, 50% d'entres elles vivent chez la belle famille ne consultent pas avant la 3eme agression. 90% ont des enfants et ne projettent pas porter plainte. L'époux travaille dans les 2/3 des cas mais a revenu modeste, son niveau scolaire ne dépasse pas le collège dans 60% des cas. Les causes prédominées par les problèmes financiers et la cohabitation avec la belle famille. La différence du niveau d'instruction et du revenu entre les conjoints, les habitudes toxiques sont retrouvées dans 10 % des cas

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SKELETAL REDUCTION AND DEATH DATE IN A COASTAL ENVIRONMENT FOR THE PURPOSE OF A CASE

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From a geographical point of view Ecuador is a small country. Nevertheless it is characterized by its unique topography. In the coastal region the cool stream of Humboltd moves from south to north, and the warm current of the child, running from north to south, converging on the coast of Manabi. We present a case of a male cadaver in a stage of skeletonization found on the beach, who was preliminarily assigned the identity of a well-known lawyer, who would have disappeared 10 days ago. The unusual rapid decomposition of the body caused questions about the identity of the bones, but later identified climatic factors that accelerate the decomposition process, with the confluence of ocean currents being a major factor in this process.

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SUICIDES IN OLD AGE: THE CROATIAN STUDY

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Aim. To investigate characteristics of suicides in Croatia in a five year period: distribution according to gender, age and method of committing suicide with special focus on the elderly population (65 years and older). Methods. For the purposes of this investigation we have used autopsy records of the persons who committed suicide in the period from 1 January 2011 to 31 December 2015. Results. During the study period there were 817 suicides, from which 267 were committed by people 65 years of

age and older (32.7%). In both groups, the ratio of men and women was in favor of males (3.04:1 in the younger age group, 2.8:1 in the older age group). When we compared the way of committing suicide it can be seen that in both age groups hanging was the most commonly used method of committing suicide among males. In second and third place in both age groups were suicides committed by firearms and suicides committed by jumping from height. Women also used hanging as the most common way of committing suicide in both age groups, while in second and third place were suicides committed by jumping from height and self-poisoning in both age groups. **Conclusion.** Population censuses in the period from 1991 to 2011 revealed a significant increase in the number of older people in the Croatian population. The most recent census revealed that 17.7% of citizens were over 65 years old. The increase in the population of older persons will consequently lead to an increase in the number of suicides. With this paper we wanted to contribute to a better understanding of this issue and change the general population's attitudes that suicide in this age is a rare and inevitable event.

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THE ESTABLISHMENT OF FORENSIC SCIENCE LABORATORY SERVICES IN THE WEST BANK

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The Palestinian Civil Police Forensic Science Laboratory was officially inaugurated in November 2016. The laboratory, established by the Government of Palestine in conjunction with the United Nations Office on Drugs and Crime, provides services to the Palestinian judiciary system and other stakeholders in drug analysis, firearm and toolmark examination and document examination and is the first of its kind in the West Bank. Prior to its establishment there was no forensic laboratory capable of performing the range of routine examinations required to support the justice system. It was therefore necessary to develop wider institutional and administrative capacity in parallel to the development of technical services and new facilities. Governance was a key consideration throughout the laboratory's development to help ensure reliability and independence of laboratory findings. This paper discusses the establishment of forensic science laboratory services and governance mechanisms in the West Bank with a focus on non-technical components. This paper provides insights into the capacity development process from different perspectives and highlights the key role played by the international forensic science community in ensuring its success.

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DIAGNOSTIC LABELS AND MULTIPLE-PATHOLOGY

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Introduction A middle-aged patient with asthma since childhood had undiagnosed pulmonary tuberculosis leading to his premature death. Case report A 40 year old male lorry driver, a heavy alcoholic and a chain smoker was a known patient of bronchial asthma since childhood. He was not followed up regularly either in state or private sector. His frequent exacerbations and baseline wheeze was conveniently attributed to smoking, asthma and COPD while frequent hospital admissions without baseline investigations. He was on steroid inhalers. Last illness was fever with severe shortness of breath which was treated as for status asthmaticus. Autopsy revealed extensive pulmonary TB with cavitations and secondary infective foci. Gross appearance was confirmed by histology. Discussion His "label" of childhood asthma has been continued to adulthood. Alcoholism, heavy smoking, poor compliance, frequent defaults made the doctors continue with the same diagnosis. Appropriate minimal baseline investigations of FBC, ESR and Chest X-ray preceded by cautious clinical examination of the respiratory system with due clinical interest on every patient despite the patient's socio-situational background would have led to correct diagnosis with immense clinical benefit to the patient and opportunity for contact tracing and treatment of the close-associates for TB. Upon everything the premature death would have been prevented. This emphasizes the importance of paying attention to clinical examination, the danger of sticking onto previous "diagnostic labels" and the value of re-thinking the possibility of presence of multiple-pathology even among correctly diagnosed chronic patients.

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USE OF MANIKINS TO DEMONSTRATE GENITAL TRAUMA IN SEXUAL ASSAULT EXAMINATIONS - A STEP FORWARD

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Examination of victims and perpetrators of sexual violence is a major role in clinical forensic medicine throughout the globe. Accurate examination, recording of findings, interpretation of injuries and proper sampling of genitalia and anus play a pivotal role in a successful prosecution as well as in further management of the victim. A thorough understanding of the normal anatomy of the female external and internal genital organs with possible anatomical deviations, common and uncommon genital injuries and other pathological conditions is essential for an accurate medico-legal genital examination. In addition to an understanding of the anatomy, a hands-on practice on various examination techniques, procedures, positions and instrumentation and sampling methods too is vital for a smooth and successful genital examination with minimal hazel to the examinee and maximal success in locating injuries and obtaining samples. This is true for males and females as well as the adult and the young. Undoubtedly the best way to gain mastery in this art is to examine as many patients as possible representing diverse clinical scenarios. Yet, this is definitely a slow and steady process which may take many years of one's career. Additionally, practicing instrumentation and other procedures on "non-essential" cases for the sake of mastering one's art will be ethically questionable. Dummies or "manikins" are being used in medical education in a variety of disciplines such as emergency medicine, anaesthesiology and gastroenterology, for a considerable period of time. An accurately designed manikin would be a better alternative to a live patient in teaching undergraduates as well as post-graduates, the art of sexual assault examination with all its above mentioned components and needs. It will be an excellent teaching aid in demonstrating the widest array of genital, anal and para-sexual injuries, normal and abnormal anatomy, instrumentation techniques and sample collection methods. The re-usability, adjustability and the ability to use repeatedly for the same procedure until the trainee is confident are the added advantages over live patients. Technology could be incorporated to add voice prompts simulating the patient experiencing pain, if wrong procedure is adopted or undue pressure is applied. The simulation of a real life scenario with manikins for different ages would enhance the skills in examination of a female or a male victim following sexual violence. The authors propose to make manikins available in the field of clinical forensic medicine for teaching and practical purposes.

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CAN YOU SEE IT? THE ABILITY TO IDENTIFY TRACE AMOUNTS OF BODY FLUIDS

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Blood, semen and saliva are the most common body fluids found on crime scenes or on items of evidence retrieved from scenes, victims or perpetrators. Efforts to destroy or clean up evidence or crime scenes

may result in trace amount of these body fluids being present. At crime scenes the recovery of more than one type evidence from a surface may be necessary. In processing scenes or physical evidence, it is critical to be able to determine which evidence should be collected first and if its recovery will affect the recovery of the other evidence. It is therefore important to be able to determine the lowest concentration of blood, semen or saliva that can be detected with some of the most available and popular presumptive and confirmatory tests and to determine if trace amount of blood can be detected and identified after a surface has been dusted for fingerprint. Diluted human blood and diluted blood dusted with fingerprint powders were detected and identified using presumptive tests Kastle-Meyer (KM) and Leucomalachite Green (LMG) and confirmed using RSID-Blood and Seratec Hemdirect kits. Dilutions of semen were identified using RSID-Semen and Seratec PSA Semiquant kits and dilutions of saliva were identified using RSID-Saliva and Phadebas paper. The KM and LMG tests are sensitive to be able to detect dilutions of blood, 1x 104 and 1x 103 respectively, the sensitivity of KM tests was slightly reduced by fingerprint powders especially magnetic powders LMG tests were less sensitive than the KM test and its sensitivity was not reduced by the finger print powders. Seratec PSA Semiquant was more sensitive than RSID- semen with limit of detection 1in 1000 compared to 1in 500. RSID- Saliva is very sensitive and is able to detect as little as 1 µl of saliva and it is specific to identify human saliva. Phadebas paper can be used to localize the saliva stain and the RSID- saliva can then be used to confirm its presence. The ability to detect trace amount of body fluids is greatly enhanced by highly sensitive presumptive and confirmatory tests. The tandem of old and trusted with new and rapid has made the detecting and identifying of minute amount of body fluids possible both on crime scenes and on forensic case work samples.

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LEARNING THE ART OF FORENSIC PATHOLOGY THROUGH DIGITAL CASE MODULES

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Abstract: Learning forensic pathology involves a combination of both theory and practical experience. The approach to thinking through a case in its entirety is often missed by first-time learners, who may get exposure to only a few steps of the autopsy, most notably the dissection of the body. A complete view of the case is necessary to encourage learners to develop their critical thinking around each case, and help them formulate an opinion about the cause of death. These digital modules were developed around 10 cases commonly encountered by forensic pathologists. The cases increase in complexity, from routine toxicological and natural cardiac deaths, to a simple, single stab wound homicide. Each module contains the data necessary to formulate an opinion (relevant scene photos, description of circumstances, pertinent autopsy findings/photos, digital microscopic slides etc). The learner will have to ability to "order" tests and see the results. These modules are interactive, with links to definitions and literature for more self-guided learning. At the end of each module, the learner will be required to submit their own cause of death statement, after which the original cause of death statement will be made available for comparison. Once completed, the learner will progress to the next module. It is expected that each learner will become better at integrating all the information collected at each step of the autopsy, and develop their own style with respect to a summary/opinion. These modules are meant to be portable, with the potential for international use. The first module will be made available for demonstration purposes.

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INTERNATIONAL FORENSIC SERVICES CAPACITY DEVELOPMENT

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Forensic evidence carries an inherent legitimacy that transcends borders. However, operational forensic practice is not an ideological pursuit and the establishment of new forensic services within emerging state structures and institutions is complex. The experiences of the United Nations Office on Drugs and Crime (UNODC) have highlighted that forensic capacity-building is an integral element of criminal justice reform and the rule of law. Forensic services are critical to the provision of objective and reliable information within the criminal justice process. UNODC implements a variety of technical assistance programmes to assist States in developing forensic services. These technical assistance programmes include development of institutions, legislative support for governing authorities, awareness raising for stakeholders and the provision of training, equipment, tools and materials. This paper outlines the development of forensic services in a national capacity development context and provides examples of tools and materials that have been developed by UNODC for the State of Palestine. Capacity development is more likely to be successfully achieved if is nationally driven and adapted to the country context. However, regardless of context, the examination of forensic evidence must be conducted at a standard that preserves the integrity and probative value of the evidence. Without proper checks and balances within each component of the forensic process there is a risk that forensic evidence will be improperly represented.

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EXTREME VIOLENCE AGAINST CHILDREN AND ELDERLY WOMEN: INTERPROFESSIONAL COLLABORATION FOR JUSTICE

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Starting from the presentation of two cases of extreme violence against two categories of vulnerable people (children and elderly women), the authors show in this paper the Romanian model of interprofessional collaboration in forensic sciences. In the first case (which we called "The Sleep of Reason Produces Monsters"), two children, 2 and 6 years old, sister and brother, were extremely abused for 2 years, with very serious physical and psychological consequences, by the foster mother, with her husband's complicity. The deficiencies in the work of the institutions involved showed problems such as: negligence within the Department of Social Work and Child Protection Services, deficiencies in the care provided by the children's primary family physician, deficiencies at the level of the educational institutions / school, day care that led to unimaginable consequences. The model of interdisciplinary approach was presented by different types of forensic expertise: trauma and psychiatric expertise of the two children and of the two perpetrators who have committed acts with discernment. The second case (named by us "Snow White and the Seven Dwarfs") is a matricide of extreme violence (manual strangulation-throttling and suffocation followed by evisceration of the intestines through the anus), committed by a schizophrenic man, without discernment, under the influence of auditory sexual and religious themed hallucinations, on his elderly mother, with whom he lived. Women's autopsy, forensic psychiatric expertise and regular forensic psychiatric evaluations of the man, admitted after the crime in a hospital for safety measures, have been carried out by different departments but all of them under the umbrella of the forensic network. The cases were analyzed from the perspective of interdisciplinary collaboration in order to provide to justice accurate data and scientifically substantiated arguments for correct judicial settlement and for respect of human rights (both for victims and perpetrators). Considerations were made regarding the micro and macro social context of the committed acts,

in the sense of signaling the deficiencies and the positive aspects within the system and the current norms. There were shown the benefits of the Romanian model of psychiatric evaluation of perpetrators and victims in the medico-legal network, emphasizing the major role of the interdisciplinary collaboration in social control by making integrated recommendations.

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RELATIONSHIP BETWEEN FRACTURE TYPE AND FORCE ON MAMMALIAN JUVENILE RIBS (SUS SCROFA, LINNEAUS)

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The interpretation of bone trauma is an important aspect of understanding the circumstances within a death investigation. Proper interpretation of fractures can aid in identifying the number of blows, impact sites, the order in which they occur and the amount of force required to inflict such wounds. Yet there is a paucity of research regarding the force applied through the utilization of blunt and sharp implements used to inflict trauma. Such a study has the potential of more accurately characterizing the trauma, with regard to the amount of force used to create observed fracture patterns. In this preliminary study, a computer controlled impacting machine was used to inflict direct trauma onto several full, fresh racks of juvenile pig ribs (*Sus scrofa,* Linneaus) with a hammerhead attachment. Although there has been a recent interest in impacting machines, this one differs in that it mimics the arching motion of a human overhand swing, and is able to inflict trauma onto fully fleshed and intact specimens. After each strike the force at the moment of impact was recorded and was later paired with its corresponding fracture. From there the range of force associated with transverse, oblique, spiral, greenstick, and comminuted fractures, as well as having no fractures at all were examined in light of the recorded forces. When all data is collected for this experiment, a one-way ANOVA will be utilized to determine if there are significant differences between the groups of fractures, Chi-Square tests will be used to determine if there are significant differences between fractured and non-fractured ribs, and T-tests will be utilized to determine if there are significant differences between each of the fracture groups two-by-two. At this moment, the results are pending statistics.

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A MULTI-PURPOSE SMART MORTUARY TABLE FOR THE TWENTY-FIRST CENTURY

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The mortuary table is a fundamental requirement for an autopsy. The most basic form comes with running water with or without an overhead light source. Technology and creativity have been readily incorporated in to designing surgical tables for different sub-specialties of surgery, gynaecology, orthopaedics, ENT, ophthalmology and etc. Accordingly, it has become imperative to design a more modernized smart mortuary table with extra facilities such as assistance in dissection, photography, tissue sampling, teaching, imaging, scanning, disinfection, employing special dissections, performing high-risk autopsies, rotation and cleansing of the table. This will facilitate easy handling of the dead body by the mortuary assistant as well as by the pathologist himself during the different stages of the autopsy procedure. Ergonomic and bio-safety issues would be better addressed in this approach. The concept of a smart mortuary table would make the autopsy more scientific, reviewable (recordable), safe, less cumbersome and less time-consuming. Perhaps it will eliminate the need of a pathology assistant during various steps of the autopsy. Designing and manufacturing of the first smart table would be a tedious procedure with multi-disciplinary assistance. Modifications would have to be introduced over the first few years. Once properly designed, the maintenance will be easy and minimal skills and training would be sufficient to handle/ maneuver the table. Many would argue that the vast majority of the autopsies being uncomplicated and rather straightforward procedures, there is therefore no dire need for modern technology. However, in units where there is high turnover of autopsies and the standards, precision and accuracy need to be kept at a higher level, the concept of a smart mortuary table would be appreciated. The authors wish to present a proto-type of a smart mortuary table for the consideration of the forensic community.
Key words: smart mortuary table, modern technology, prototype, autopsy

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NEW APPROACHES TO GATHER INFORMATION ABOUT THE CLANDESTINE PRODUCTION OF AMPHETAMINE

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Two new approaches to gather forensic and police intelligence data about the clandestine production of amphetamine from either seized amphetamine samples or the disposed synthesis waste are presented. Both are part of the ongoing EU project 'microMole' which investigates the possibility to identify clandestine labs by means of their disposed waste. Basic research was conducted to identify new unambiguous markers in amphetamine samples indicating that it was produced from the important pre-precursor alpha-phenylacetoacetonitrile (APAAN). Controlled amphetamine syntheses via the Leuckart route were performed and the organic phases were collected after each reaction step. GC/MS measurements showed that three possible markers were formed if APAAN was present during the synthesis. The most promising of those, showing high signal intensity and stability, was identified as phenylpyrimidine derivate using HR-APCIMS and NMR. The markers were searched in over 500 samples from German and Dutch amphetamine profiling databases going back as far as 2009. The markers appeared in samples from 2010 for the first time, one year after APAAN was first reported in Europe, and reached a maximum in 2013 showing a good correlation with reports on APAAN use. The main goal of the microMole project is to utilise different sensors that are placed in the sewage system close to a suspected location to detect discharges of clandestine synthesis waste. Due to extreme pH and conductivity values of such waste, corresponding electrodes are used in a first detection step. The second step involves chemical sensors based on molecular imprinted polymers for higher selectivity. The final step is to collect a liquid sample for later analysis. First tests in an artificial sewage system showed promising results for the use of pH and conductivity sensors in wastewater. This was demonstrated by placing them into flowing wastewater and recording the signal changes after solutions with different pH and conductivity values were discharged. The next step is to detect characteristic amphetamine marker substances in the wastewater using the chemical sensor. Both approaches can be used to obtain new information about the clandestine production of amphetamine. The new markers allow to elucidate trends in the use of the pre-precursor APAAN and could provide useful data about the amphetamine production process. This can be relevant for expert testimonies at court to draw conclusions regarding the amphetamine production. The use of sewage monitoring could be an additional specific tool for police intelligence to detect and monitor clandestine laboratories if implemented properly.

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ENGINEERING EXPERTISE AGAINST CORRUPTION IN BRAZIL

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The Brazil currently lives a serious political crisis, mainly due to widespread corruption. One of the mechanisms most used by corrupt involves the diversion of part of the public financial resources, for the construction of infrastructure works and social purposes, such as: Road and rail road's, urbanization and drainage, water treatment, water supply, sanitation, electric power plants, transmission lines and distribution, oil refinery, health posts, schools, etc. The current supervisory structure, so necessary to monitor and control the correct use of these public resources, is kept intentionally weak to allow this kind of corruption remains and develops. It results, in some cases, in a corruption system too complex and sophisticated, even with branches in other countries, beyond the sphere of activity of the institutions of control, not giving the opportunity for checking responsibilities and coming to prescribe the criminal process, as the loose Brazilian law. In this way, the demand for engineering forensic tests to determine diversions of resources in public works has grown exponentially in recent years. In general, the engineering forensics experts should review the thousands of documents so confusingly joined in a long and time-consuming criminal process, in addition to visiting the constructions site, in order to ascertain the following: If the contracted price is compatible with the market at that time, if the amount of hired services is compatible with the object examined, if the quality of the work performed is compatible with what was designed and contracted and if the economic and financial balance was maintained.

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THE INFLUENCE OF IMPACT DIRECTION AND AXIAL LOADING ON THE BONE FRACTURE PATTERN

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Bone trauma is an important source of information regarding the circumstances that "led" to the death of the victim. Proper fracture interpretation may assist in identifying the location and number of impact sites, establishing the sequence of blows, and determining the characteristics of the object that inflicted the injuries. Studies on fracture pattern in the forensic setting are of importance in cases such as homicidal assault, suicide, falls, child abuse, and road traffic accidents. Knowledge on fracture associated with specific modes of trauma can be used to predict the nature of the injury. The need for traffic accident reconstruction is of major importance, since road traffic injuries are the leading cause of death worldwide among young people aged 10-24 years. Analyses of the lower-extremity fracture patterns are particularly relevant in car-to-pedestrian impacts, since they reflect the actual location of the pedestrian relative to the vehicle. The effect of the direction of the impact and the presence of axial loading on fracture patterns have not yet been established in experimental 3-point bending studies. *Purpose*: To reveal the association between the direction of the force and the fracture pattern, with and without axial loading. *Material and methods*: A Dynatup Model POE 2000 (Instron Co.) low energy pendulum impact machine was utilized to apply impact loading on fresh pig femoral bones (n=50). The bone clamp shaft was adjusted to position the bone for three-point bending with and without additional bone compression. Four different directions of the force were applied: anterior, posterior, lateral, and medial. *Results:* the impacted aspect can be distinguished from the non-impacted aspects based on the fracture pattern alone; the impact point can be identified on bare bones (the area from which all oblique lines radiate and/or the presence of a chip fragment). None of our experiments (with and without compression) yielded a "true" butterfly fracture, but instead, oblique radiating lines emerged from the point of impact (also known as "false" butterfly). Impacts on the lateral and anterior aspects of the bones produce more and longer fracture lines than impacts on the contralateral side; bones subjected to an impact with axial loading are significantly more comminuted and fragmented. Under axial loading, the number of fracture lines is independent of the impact direction. Our study presents an experimental model for fracture analysis and shows that the impact direction and the presence of axial loading during impact significantly affect the fracture pattern obtained.

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RCMP FINGERPRINT EXPERT TESTIMONY CHALLENGED IN BRITISH COULMBIA SUPREME COURT.

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RCMP expert testimony on fingerprint impression evidence was challenged by defence counsel who called US fingerprint critic, Dr. Simon Cole, as an expert witness in the re-trial of Mr. Timothy Bornyk, charged with a residential break and enter based on a single fingerprint (R1) recovered from the crime scene. At the original trial of Mr. Bornyk, the judge acquitted the accused citing several reports that were critical of fingerprint practices in his reasons for judgement as well as perceived troubling aspects of the Crown's expert testimony. The Crown's appeal was allowed as the appeal court found two errors in law: firstly, the trial judge had relied upon independently researched literature that was not properly tested in evidence; and, secondly, he embarked upon an independent, unguided comparison of the fingerprint. Defence witness Dr. Cole has raised some legitimate concerns about how the process of fingerprint comparisons have been carried out in the past and how they are carried out today. He has testified in several US criminal trials often quoting from the US National Academy of Sciences (NAS) report, *Strengthening Forensic Science in the United States: A Path Forward* (2009). In preparing for the re-trial, the RCMP's Integrated Forensic Identification Services adopted a strategy that addressed Dr. Cole's criticisms upfront and transparently. The RCMP recommended that the scientific studies and the ongoing standards development work in the fingerprint community, since the NAS report, should be presented to the court. Consequently, the Crown's strategy changed in three significant ways compared to the original trial. Firstly, the testimony of the fingerprint examiner expanded to include: RCMP policy on proficiency tests, use of SWGFAST's Quality Table and Sufficiency Graph to assess the quality and quantity of R1; awareness of controversial erroneous identifications and error rate studies. Secondly, several key scientific publications and SWGFAST standards that support Canadian fingerprint practices were introduced by this author, who the court accepted as a fingerprint expert. Finally, the verifier was called to testify. On February 10th, 2017 Justice Crawford found Mr Bornyk guilty as charged. This presentation will discuss the impact of the President's Council of Advisors on Science and Technology (PCAST) report *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* (2016) and the changes in expert testimony that maintained the court's confidence in fingerprint evidence. As the RCMP learn from this court challenge potential changes to IFIS policy and training will also be discussed.

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AORTO-OESOPHAGEAL FISTULA: A RARE CAUSE FOR UPPER GASTRO-INTESTINAL BLEEDING

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Introduction Acute upper gastrointestinal (UGI) bleeding could be a potentially life threatening condition warranting prompt surgical

intervention. Aorto-oesophageal fistula is a rare condition for UGI bleeding which was first recognized in 1818. The great majority are primary fistulae caused by atheromatous aneurysms or less frequently by penetrating ulcers. The etiology of primary aortoesophageal fistulae is uncertain though theories include direct wear and inflammatory destruction triggered by infection, foreign bodies and erosion. The clinical presentation is characterized by Chiari's triad-thoracic pain followed by herald bleeding and a short symptom-free interval followed by fatal exsanguinations. Case report A 61 year-old male had undergone upper GI endoscopy for dysphagia in the early morning and was discharged the same afternoon. He developed chest pain and haematemesis the same evening and was found to be dead on admission. Post mortem examination revealed pallor, flame shaped haemorrhages in the left ventricular sub-endocardium and approximately 650 ml of unclotted blood in the stomach. Esophageal mucosa was free of acute injury and no evidence of ruptured esophageal varices was present. An extensive ulcerative lesion of the esophagus measuring 3.8 cm x 3.5 cm with a fistula track between the esophageal lesion and the superior part of descending aorta were noted. Both kidneys were granular and contracted. The cause of death was termed as haemorrhagic shock following aortic aneurysmal rupture into oesophagus. Discussion The blood clots may obscure the site of fistula-formation, making the diagnosis challenging. Surgical intervention is the definitive treatment for fistula, but mortality rate is very high. The diagnosis is mostly based on high clinical suspicion, supplemented by attentive use of UGI-endoscopy. Necrotic areas are fragile and more susceptible to rupture. Vital reaction is not prominent. Histological samples frequently may fail to show tissue reaction related to the injury. Non-invasive investigation methods are recommended prior to the invasive procedures in a patient with features highly suggestive of aoroto-oesophageal fistula.

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GPU FORENSICS: GRAPHICS RECOVERY PROCESS CHALLENGES AND FINDINGS

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Graphics Processing Unit (GPU) has been used for many purposes such as malware hideout, assist in Denial of Service (DoS) attacks, and password cracking. Very few attempts have been made on GPU forensics even though GPUs may hold crucial evidence that may help solve crimes. The purpose of this research is to design and implement a graphic recovery process based on the memory dump of the GPUs. The tool developed in this research was implemented using OpenCL and supports recovering JPEG, TIFF, and BMP images. Factors such as the Operating System (OS), GPU vendors, models, and software drivers were tested to measure the validity of the approach. The research indicates that images can be recovered from a 'clean' state of the GPU by using a set of pre-discovered and pre-recorded mapping patterns. The research also shows that there is a relationship between the number of unique patterns and the size of the image. The larger the image size in pixel, the more combinations of pixel mapping can be found on the GPU. This implies the bigger the image, the harder the recovery process. In a series of experiments conducted, the authors were able to successfully recover thirty different images using 2 unique mapping patterns when the graphic size is 64 pixels x 64 pixels, 4 unique mapping patterns for 100x100 images, and 9 unique mapping patterns for 200x200 images. It can be inferred from this study that any graphic images can be recovered using the approach if the dimension of the image is known and there are no other data in GPU memory. The study also discovered that to be able to read GPU memory data, it requires the read operation is supported and enabled in GPU driver. To conclude, this research also highlights three challenges when implementing forensics on GPU: 1) elusive GPU global memory allocation scheme; 2) permissions and API support from different versions of GPU drivers; and 3) the correct versions of the OS and the applications.

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EFFICACY OF NOVEL NANO KIT FOR DETECTION OF PHOSPHINE IN BIOLOGICAL SAMPLES IN FORENSICS MEDICINE

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Phosphide is highly toxic gas, this gas is deadly even in low concentrations is fitted and therefore, aluminum phosphide to control and eliminate insects and pests of grain products like rice and storage in silo loaders, loaders are used mostly in Middle East and Asia. Diagnostic reagents in this kit is based on Nano-particles with a diameter of ≈ 5 nm and special chemical groups have made a specific chemical and changing structure and features a unique book that would not be sediment and keep its properties for a long time (8 months) for detection of evaporated phosphine in seconds. Phosphine Nano sensor has been made in a green synthesis manner using plant extract. One other component of the kit is 10% hydrochloric acid with the capability of reacting with remnant aluminum phosphide in sample and evaporating phosphine gas. A special color change will be seen introducing the Nano reaction in the viewer will appear and in the absence of any change in the structure of phosphide gas monitor fitted don't see color. More than 95% sensitivity and specify and testing error of 5%. In some cases, poisoning with aluminum phosphide have been confirmed with headspace GC-NPD system. Immediately after that of the upper display input kits, reagents Nano onto filter paper to consider as well. If any suspicious samples aluminum phosphide Poisoning or suicide by gas of phosphide Tablet rice, evaporate and enter the display compartment is transparent.

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THE TEMPORARY CAVITY IN CLOSE CONTACT SHOTS

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Gelatin has been established as a substitute for biological tissue in wound ballistics. The energy transfer of a penetrating bullet causes a centrifugal temporary displacement of the medium generating the so called temporary cavity. After the collapse of this cavity the gelatin shows radial cracks whose lengths correlate with the energy deposited. In the context of a research project funded by the Swiss National Science Foundation concerning contact shots the influence of muzzle gas pressure on the temporary cavity was investigated. 12 x 12 x 12 cm gelatin cubes doped with paint pads were used as target models. Shots from distance were compared to contact shots using current handguns in the calibers .32 auto, .38 special and 9 mm Luger. The shots were recorded using a Photron SA-X2 high-speed camera with up to 40.000 fps. The gelatin cubes were cut to 1 cm thick slices perpendicularly to the bullet track and were scanned using a flatbed scanner. Image analysis and measurement of the crack lengths were performed using the software AxioVision 4.9. Non-deforming bullets fired from more than 10 cm distance left moderate tubular temporary cavities. However, contact shots using the same ammunition produced huge ellipsoid temporary cavities which were comparable with the energy transfer by expansive bullets. The gelatin slices showed, in accordance with the high-speed video, shorter cracks for distant shots and longer ones after contact shots. Furthermore, distinct morphological differences could be observed. Contact shots showed much more radial cracks per slice in the first half of the bullet track than shots from distance using both non-deforming or expansive bullets. Major tissue destruction by muzzle gases has to be discussed. The importance of this finding for the comprehension of real cases especially regarding the ability to act should be investigated in the future.

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PMI ESTIMATION CONSIDERATIONS BASED ON BLOWFLIES' (DIPTERA:CALLIPHORIDAE) RESPONSE TO COMPETITION

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The most common use of Forensic entomology is the estimation of the minimum post-mortem interval (PMI_{min}), usually measured by the rate at which an insect species grow at a given temperature. Blowflies have been used as good indicators of PMI_{min} because they arrive and oviposit in a carcass shortly after the death. However, a significant amount of uncertainty associated with PMI_{min} estimation might be passing unnoticed. By ignoring the multitude of intricate processes regarding the local adaptation of a species to diverse habitats, we assume as true old presumptions that evolutionary biologists and ecologists have already dismantled. Phenotypic plasticity is the property of a genotype to yield different phenotypes (e.g. developmental rate) in various environments. As phenotypic malleability is crucial for species to spread and establish in new habitats, this process is gaining raising the attention of ecology and evolutionary biologists. The influence of abiotic factors (e.g. temperature) on the developmental rate in calliphorids is well known, but we are not aware of studies focusing on biotic factors (e.g. competition, predation) in blowflies. Although it is common to find more than one species in a carcass, we do not know how the presence of one species affects its competitors' phenotypes. To investigate whether competition and the competitor identity matters for phenotypic plasticity we selected three species of blowflies to test for survival rate, adult size, wing morphology and time of development in pairwise scenarios and cloistered conditions. Both sets were tested in three larval densities for dietary availability. The results revealed differences among species reactions to interspecific competition. Responses from the three species showed conflicting patterns ranging from no effects of interspecific competition to directional shift dependent on the identity of the competitor. Developmental time for *Lucilia sericata* was influenced by intraspecific, but not interspecific, aggregation, as *Calliphora vicina* and *C. vomitoria* were influenced by aggregation regardless of competitor species. Differences in patterns of response were also noted for wing shape, body size and survival rate between the three species, urging the debate for standardized methods to execute experiments and interpret data. These results suggest that the estimation of uncertainties go further than the instrumental error, and the presence of a competitor and its identity must be considered in a predictive report. More studies are needed to elucidate the mechanisms underpinning this variability and the correlation of plasticity between traits.

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RARE AUTOPSY FINDINGS IN BODIES BURIED BENEATH A MOUNTAIN OF DUMP

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Seven municipal personnel were buried in the burning garbage during a landslide occurred in garbage recycling site, near Shiraz, Fars province, south Iran on 11th April 2014, 8:30 a.m. All of the personnel died and they were discovered one and two days after the event. The cases were referred to forensic administration for post mortem examination (PME) and determination of the cause of death. Gross examination of the victims showed grade 1 to 3 burning in different parts of the bodies as well as stench odor, swelling body, progressive putrefaction of the body, bruise and post-mortem peeling and rupture of the skin. Although the victims were trapped under the garbage, no foreign body was found in their pharynx, trachea and lung. Autopsy findings of the bodies showed sever degeneration of the brain, petechial hemorrhage between lung lobes, edema and congestion of the lung as well as color change of the liver and spleen in favor of cooked tissues. Accumulation of semiliquid fat in pleural and peritoneal spaces was unique and rare finding resulted from high temperature of the situation that the bodies were trapped in. The amount of the accumulated fat was variable in regard to the body mass index (BMI) of the victims; more fat was accumulated in pleural and peritoneal area of the victims with more values of the BMI. Accumulation of melted body fats in body cavities were rare findings in cases of asphyxial death occurred in high temperature area.

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APPLICABILITY OF A SET OF FACIAL PROPORTIONS FROM FRONTAL IMAGES IN AGE ESTIMATION OF BRAZILIANS

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Introdution: Child pornography on the internet is one of the crimes with highest increasing incidence and the victim's age plays an important role for legal implications. To overcome the lack of scientifically established protocol, an European research group has explored and proposed a set of facial proportions obtained from images to estimate age (Cattaneo et al., 2011). **Objective:** Verify the applicability of a set of facial metric relations taken from frontal images to estimate age in Brazilian population. METHODS: Standardized frontal view images from 800 Brazilians (400 females and 400 males) divided in 4 age groups (6, 10, 14 and 18 years ± 30 days) were randomly selected from a Civilian Database of Brazilian Federal Police. The selected images were analyzed by one examiner using cephalometric points which could be objectively visualized. After landmarking the reference points, 18 metric relations proposed to frontal images by Cattaneo et al. (2011) were assessed and analyzed through parametric tests (Komolgorov-Smirnov, Pearson´s correlation, Student´s T-test, ANOVA and Turkey test) and discriminant analysis. This study was approved by Ethical Research Committee from University of São Paulo (Process n: 17017213.0.0000.5440). **Results:** Pearson´s Coefficient showed that ten indices had a weak correlation with age (0 to ±0.3); two had a moderate correlation (-0.7 to 0.3 or 0.3 to 0.7) and six were not correlated with age (al-al/n-sn, al-al/n-sto, al-al/ch-ch, ch-ch/ft-ft, n-sn/ft-ft and n-sto/ft-ft). Eleven indices were statistically different between sexes. Regarding ANOVA analysis, only two indices (al-al/n-sn and al-al/ch-ch) did not show difference among age groups, but the results from Turkey test demonstrated that the differences were observed more frequently in the comparisons involving the 6 years old individuals. Few indices were different between 14 and 18 years old individuals and the same have occurred when the data were analyzed separated for each sex. The discriminant analysis showed that 49.6% of the pooled sample was correctly classified into the respective age group. This percentage increased when each sex was analyzed separately: 50.2% for females and 53.5% for males. **Conclusions:** It can be concluded that the set of facial proportions from frontal images proposed by Cattaneo et al. (2011) is related to face development, but it should not be used to ageing victims of pornography among Brazilians due to its poor power of discriminating important age groups for legal purposes. Nonetheless, new approaches using metric and non-metric parameters needs to be developed to estimate age exclusively from images.

Disclosure: All authors have declared no conflicts of interest.

EPIDEMIOLOGICAL AND FORENSIC STUDY OF CRIMINAL DEATHS IN THE SOUTH OF TUNISIA

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Background: Homicide is the ultimate form of aggression. It represents a reliable scale of violence in society. Homicides are a significant public health problem all over the world. In Tunisia, there is no accurate official statistics on homicides. The aim of our study is to analyze the homicide victims' profile in our local context in order to ensure appropriate prevention programs. **Methods:** We conducted a descriptive retrospective study including all cases of homicides autopsied at the Forensic Department of Habib Bourguiba Hospital in Sfax, over a period of 5 years (2011-2015). **Results:** We collected a total of 61 cases of homicides over the study period. Victims were males in 68.85%. The average age was 40.2 years with extremes between 8 and 73 years old. Most of the victims were from an urban area (70.5%), single (42.2%) and semi-skilled (57%). The homicide took place mostly in summer and spring (31.15%), during the weekend (44%), between 6 p.m. and 6 a.m. (69%), in a public place (40.7%). It was frequently quarrelling related (44.3%) and most often committed by one single perpetrator (55.7%). Females were most often killed at home (69.9%) by a current or a former intimate partner (55.1%) whereas males tended to fall victim to strangers (51.3%) in public places (58.3%). The most common methods of homicide were sharp force (31.15%) and blunt trauma (26.3%). Males predominated for all methods except for mechanic asphyxia. We recorded 5cases of sexual homicide (8.2%) and 2cases of homicide-suicide (2.29%). **Conclusion:** This study helped us to establish the typical profile of homicides' victims in Tunisia in order to allow a better understanding of homicides. It also highlighted the necessity of creating a national "Violence Register" providing real and updated statistics in order to adapt preventive measures.

Disclosure: All authors have declared no conflicts of interest.

CLOTHING AND BEDDING FROM SEXUAL ASSAULTS CASES: IS DNA ANALYSIS STILL RELEVANT AFTER LAUNDERING?

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We looked at semen and saliva persistence by investigating the serological and genetic properties of washed and unwashed stains on fabrics. For semen, detection with the naked eye or under a forensic light source, acid phosphatase (AP) testing, PSA testing and microscopy analysis were done on stains washed up to six times. We then sampled the stains with two different methods (swabbing and cutting) to compare the DNA quantities and the resulting genetics profiles. For saliva, detection under a forensic light source and α-amylase testing were done on stains washed up to three times. Saliva stains were sampled by cutting for DNA analysis. Throughout all experiments, five donors, three different washing machines and two detergents were assessed. Results show that some semen stains washed six times can still be detected using a combination of forensic light source and PSA testing, and that most will generate a complete genetic profile when sampled by cutting. Swabbing collected DNA in quantities sufficient for amplification only from unwashed semen stains. Saliva stains could hardly be detected through forensic light source and α-amylase testing after a single wash, but it was still possible to generate complete genetic profiles, even after three washes. Our study shows that it is possible to obtain interpretable DNA results on washed semen and saliva stains. We also provide some insights to optimize stain detection and sampling strategies according to the circumstances of the case and whether the forensic biologist is looking for an unwashed stain (ex: sexual assault in a hotel room) or a stain that may have been washed multiple times (ex: underwear from a child who reported a sexual assault several days after the event).

Disclosure: All authors have declared no conflicts of interest.

THE CAUSALITY NEXUS BETWEEN THE TAKO-TSUBO SYNDROME AND AN ASSAULT: A FORENSIC CASE REPORT

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Introduction: ''Tako-tsubo'' cardiomyopathy, also known ''broken heart syndrome" is one of the rarest types of stress induced cardiomyopathy. It is frequently mimics acute coronary syndrome, characterized by transient left ventricular dysfunction, electrocardiographic changes, and release of myocardial enzymes. After treatment, the patient cured without sequelae in the majority of cases. Tako-tsubo syndrome is a very rare reason for consultation in the forensic department. Moreover it is typically precipitated by acute emotional stress. **Case report:** Herein, the authors report a case of a 68-year-old post-menopausal woman who has been assaulted by her policeman neighbor. The victim was urgently hospitalized in the cardiology department for chest pain and dyspnea accompanied by ST-segment elevation and high troponin level. Tako-tsubo cardiomyopathy was diagnosed based on clinical findings, electrocardiography, echocardiography, coronary angiography and MRI findings. During medical care and the hospitalization of the victim, we were asked, under requisition, to describe physical injuries caused by assault and to evaluate the total transitory disability rate. **Conclusion:** This case shows that Tako-tsubo cardiomyopathy may be triggered by emotional stress induced during an assault. The forensic pathologist must consider this syndrome in assessing of the total transitory disability rate even if it is not serious visible physical injuries.

Disclosure: All authors have declared no conflicts of interest.

AUTOPSY FINDINGS AND ANALYTICAL METHODS OF FATAL CASES OF STRYCHNINE INGESTION

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This study describes eleven fatal cases of strychnine ingestion including 8 men and 3 women with minimum and maximum ages of 17 and 56 years old. Most of them had education level of high school and had neither criminal history nor psychological disorders except 3 cases that were consuming psychiatric drugs. The strychnine was isolated from biological samples using a solid phase extraction (SPE) procedure and detected by analytical methods such as thin layer chromatography (TLC), gas chromatography/mass spectrometry (GC-MS) as well as high performance liquid chromatography (HPLC). Facial and ocular congestion, facial cyanosis, lung edema and hemorrhage were found in all of the cases. Hyperemic kidney, brain, liver and meninges and lung collapse were other pathologic findings. Reactive gliosis, subarachnoid focal hemorrhage and 6 cm laceration on the left side of the face were separately found in three cases. Considering highly fatal effects of strychnine and its potential suicide use it should be strictly and severely vigilant. On the other hand, used analytical methods indicated their reliable, simple, specific and sensible application in forensic and clinical investigations.

Disclosure: All authors have declared no conflicts of interest.

HOMICIDE WITH ALUMINUM PHOSPHIDE: UTILITY OF NOVEL NANO-SENSOR KIT FOR DETECTION OF PHOSPHINE

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Aluminum phosphide (ALP) is extremely lethal and ingestion of ALP is usually suicidal in intent, uncommonly accidental and homicidal. Here, we aim to present two cases of homicide with ALP which were detected based on clinical, para clinical and forensic findings as well as a using novel Nano sensor kit. Two cases of 70 and 32 years old women with clinical signs of acute poisoning such as vomiting, diarrhea, low consciousness, low blood pressure, metabolic acidosis, low Hb levels and, severe coagulation disorders were admitted to hospital and in spite of performed treatments, they died after 24 and48 hours. Cyanosis, brain and lung congestion and edema, congestion of the gastric mucosa, slight sub arachnoids hemorrhage, mild necrosis of the kidney tissue were autopsy and pathologic finding in two cases. Biological samples including visceral organs such as heart, lung, kidney, liver, brain, blood, bile, and gastric contents from victims were referred to forensic pathology and toxicology laboratories. In 70 years old woman's samples, phosphine was detected in gastric content and food sample using silver nitrate and head space Gas chromatography mass spectroscopy with NPD detector. In organ tissue samples phosphine was not detected by silver nitrate and GC-NPD. About 32 years old woman, also phosphine was detected in gastric contents and food sample with silver nitrate and HS-GC-NPD detector; however, in blood sample, organ tissue samples, phosphine was not detected. Besides routine toxicology methods, Nano sensor kit for detection of phosphine was applied and could detect the phosphine in tissue and food samples of the victims. Novel Nano detector of phosphine detected phosphine in visceral organs, blood and food sample of 32 years old woman and also in food sample of 70 years old woman. The strength point of this novel Nano kit was very fast detection as well as high sensitivity for phosphine. Same as previous trials of this Nano kit, it cloud detect the availability of phosphine in mentioned samples in early seconds of exposure. In this trial study we found the strength and fast response of Nano sensor for detection of phosphine compatible with the results of gold standard method of HS-GC-NPD and silver nitrate method. Finally, based on clinical and Para clinical findings of the victims as well as autopsy, pathologic and forensic toxicology results, the cause of death for these two victims were reported fatal poisoning with ALP.

Disclosure: All authors have declared no conflicts of interest.

INCAPACITATING TERRORISTS: CAUSES OF DEATH AND INTERPRETIVE CHALLENGES

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Terror acts have become frequent all over the world in recent years. Many of the terrorist attacks come to an end when the terrorists are neutralized and in many cases - killed. Detailed description and thorough examination of the bodies can assist in assessment and investigation of the security forces response, and can shed light on its effectiveness. We have reviewed all the post mortem examination reports of terrorists' bodies that were brought to the Israel National Institute of Forensic Medicine in Tel Aviv during the years 2001-2016.
During this period 343 bodies of terrorists were examined in our institute. Of these 136 were suicide bombers who died of explosion injuries. The rest died of gunshot wounds apart of one case of stabbing injuries.
In this presentation we will describe the pattern of injuries, the location of bullet entrance wounds, and will remark on the range of fire, type of ammunition used, and number of shots used to incapacitate the terrorists. These can reflect on the time needed to incapacitate the terrorists, the effectiveness and appropriateness of the neutralizing response. We will also refer to the identity of the person who effectively carried out the incapacitation, whether it was a military person, a policeman or a citizen that was bearing a weapon. This can reflect on the availability of firearms and presence of armed persons in the population.

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OPTIMUM HOMOGENIZATION SYSTEM FOR USE IN FORENSIC TOXICOLOGY LABORATORY

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After conducting research studies and reviews the features and drawbacks of different tissue homogenizers and also in order to upgrade the efficiency and, quality of homogenization system, the experts and specialists of mechanical engineering laboratory of toxicology collected comments and suggestions and finally to the design of the system and optimize performance action of homogenizer shaft. After doing the design of the equipment for the shaft manually, its design was prepared using AutoCAD software. After final approval of technical and engineering drawings, by skilled and industrious workman hands turning required components using high quality stainless steel alloy was used. In order to assess the efficiency and performance of the shaft made in forensic laboratories, the various organs including the tissues of the lung, liver, and muscle tissue were homogenized. Concurrent with the building and homogeneous machine Maker was compared with existing devices and important parameters were provided in homogenization of toxicology samples to be considered in the next stages of the forensic toxicology tests.

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DEEP LEARNING FOR FORENSIC IDENTIFICATION OF HUMAN IMAGES

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Deep learning for face identification-verification application has been proven to be fruitful. We study the deep learning face representation for forensic identification of human images. Human faces constitute the main information for human identification besides gait, body silhouette, etc. Deep learning for forensic face identification can provide quantitative indexes for face similarity measurement between the questioned and the known human faces in cases, which has the advantage of result objectivity without expert experience influences. In the case of the forensic identification of human images in videos, we propose a "winner-take-all" strategy. That is, firstly a target face region in a specific frame of videos is assigned, and we track the selected face region in the following video frames, and detect the potential faces in tracked image regions, which finally form a questioned face pool consisted of the detectable target face images in videos. Then deep learning-based face verification is carried out in pairs of the known face and each questioned face in the questioned face pool, and the highest score in face verification is used as the result. On the other hand, despite the great achievement in deep learning for face recognition, we should face the current status that deep learning for forensic face identification cannot completely substitute experts because of its latent technical defects including: (1)It is hard to explain the "where like" problem in deep learning-based methods that is important in forensic human identification; (2)Deep learning for face representation doesn't pay enough attention to human special markup features, such

as black spots, scars, etc., which could play important roles in human identification especially for the faces of identical twins; (3)As mentioned above, faces are important but not all features for human identification, forensic identification of human images should comprehensively consider all possible features revealed in human images.

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THE INVESTIGATOR® QUALTIPLEXHYRES LIMITS IN SEXUAL ASSAULT CASEWORKS

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Sexual assault became a concern in legal genetic investigation due to mixture of DNA collected from the victim. Targeting male DNA component using Y-chromosome STRs was usually the alternative tool to overcome the contaminating DNA profile masked by the female victim's profile. However, quantification prior amplification of sexual assault casework samples become an important step in the DNA typing process to help detection of perpetrator component. Dual quantification using IvestigatorQuantiplexHYres technology become an alternative in the genetic investigation field. It was able to detect the male component within the whole human DNA background within a mixture. We report here a retrospective study of a dual quantification of 73 DNA extracted from vaginal swabs. All differentially extracted DNAs were typed by autosomal and Y-STRs using PowerPlex HS® System (Promega) and Investigator Argus Y-12 QS kits(Qiagen) respectively. This study is to compare the sensitivity of the Y-STRs genotyping and the dual identification of the male component. Autosomal geno typing failed in 58of 73 DNAs. Y-STRs genotyping positively identified Y-DNA in 25/58 and totally scored 53.3% (including 15 DNAs identified by autosomal markers as well). A dual quantification was applied twice on samples and performed on the ABI 7500 Fast (Applied Biosystems). Among the called 58 DNAs, Y-DNA was detected in 11 DNAs using HYresQuantiplex (Qiagen). Among the mentionned 15 DNAs, two samples failed to be quantified. This was attributed to the limitation of the input DNA in quantification (2µl) compared to PCR/genotyping (up to 7µl).Moreover, comparing to the Y-STRs, no positive detection of Y-DNA already failed by Y-STRs. However, 16 samples already identified by Y-STRs failed to be quantified. The sensitivity and specificity testes over the Y-STR genotyping calculation gave 60% and 100%, respectively. We notice that dual quantification prior to the amplification and genotyping was irrelevant due to the detection limits in the mentioned samples. Detection level in sexual assault specimens still unable to allow quantification replacing genotyping. Even we proceed to quantify DNA, it was necessary to go through dual panels even quantification results were negative and no component was quantified. Unless the Investigator QuantiplexHYres was largely adopted, it is still not recommended as a determinant as the genotyping is. Y-STR identification from vaginal swabs was more sensitive and specific than male quantifilers, which let us consider the ability of the male genotyping as the cornerstone of sexual assault casework analysis.

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CHANGING THE PATTERN OF ACUTE PEDIATRIC POISONINGS IN MASHHAD, IRAN (2011-2013)

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Background: Children poisonings are common in all world. We evaluate the recent changes in epidemiological pattern of acute pediatric poisonings in Mashhad, the second largest city of Iran. **Materials and methods**: we analyzed the recorded data of the hospital information system (HIS) of children who admitted in pediatric toxicology unit of Imam Reza hospital; the biggest referral hospital in Mashhad during 2011-2013 .**Results**: Over the three years, 1701 children (53% male) aged 60.57±1.95 months were hospitalized. The annual children poisoning admission and the percentage of poisoning cases in compare to the total number of pediatric admission from 2011 to 2013 were in the order of 519 (14.1%), 472 (13.5%) and 710(18.1%), respectively ($p<0.0001$). The rate of pediatric to adult poisonings (9.7%, 8.9% and 8.5%) did not change significantly ($p=0.0561$) over the years. However there was any change in the pattern during the years, the age pattern changed significantly from 55.6±2.3 months in 2011 to 70.0±2.7months in 2013 ($p<0.0001$). The most frequent pediatric poisoning cases was opium (179) in 2011 that decreased to 117 in 2013 ($p<0.0001$), whereas methadone induced poisoning cases increased from 144 to 252 ($p=0.0303$). C**onclusion**: Number of pediatric poisonings increased in this area over the period of study. The pattern of pediatric poisoning changed from a traditional opium poisoning to methadone overdose from 2011 to 2013 that may be due to changing pattern of addictions and increased availability of methadone in the homes of addicted parents.

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TO STUDY SOIL COLOR BENEATH THE BURIED CARCASS OF PIG AS EVIDENCE FOR FORENSIC SCIENCE

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Soil has its many attributes. These attributes offers the investigation for the police and environmental investigator on the crime scene and exhumation. Soil as a forensic evidence was pioneer work of Edmond Locar since 1910. Mostly examiners begin with color comparison for sample matching. To solve a case soil plays important role because soil can travel with footwares, car tyres, clothes, etc. from one place to other. Due to this we can found the exact place from where the suspect can arrive to do crime. The color of soil is different from the different areas. Soil color is extremely useful in forensic science to detect the crime site. This more objective notion of soil color uses three coordinates: hue (shade), value (lightness), and chroma (intensity). For the forensic investigation we conducted an experiment with buried pig carcass to determine the soil color. In this experiment the soil samples were taken beneath the buried pig according to decomposed stages i.e. blotted stage, decay stage, active stage and skeleton stage. A sample of control soil also taken for comparison with decomposed stages. The color was observed after dried the soil samples at 100°C in oven for 6-8 hours. The soil color was identified with the help of Munsell Color Chart. In the results the color of control soil was grey olive. The color of soil in blotted, decay, active decay and skeleton stages were observed as greyish olive, yellowish gray, yellowish grey and dark grey respectively. The soil color was changed due to the seepage of fluid from the carcass during decomposition stages.

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AN ASSESSMENT OF DIFFERENT METHODS OF GSR DEPOSITION ON CLOTHING AND HANDS IN A FIRING RANGE

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It is well established that gunshot residue (GSR) particles can be deposited on the hands and clothing of a person who discharges a firearm, or is in proximity to a firearm during discharge, or who contacts a GSR bearing surface. There is little published information however on the relative effectiveness of airborne versus direct contact deposition of GSR onto a subject or on how GSR deposition is affected by the shooting environment. A study published by Andrasko and Pettersson in 1991[1] did touch on the possibility of airborne GSR deposition on clothing, however that study did not include replicate testing and lacked control samples. To augment the knowledge currently available on GSR deposition, studies were conducted in the indoor 50m firing range at the Centre of Forensic Sciences (CFS). The first study contrasted the airborne deposition of particles, stirred up by a walkthrough of the firing range, with those particles transferred by physical contact with work surfaces in the range. Subjects wearing disposable lab coats walked through the firing range and placed the palms of both hands on a work bench and then wiped their palms onto the chest area of their lab coats. Samples were collected from the hands and lab coat of each subject. No GSR particles were detected on the backs of the subjects' hands. More than 60 characteristic GSR particles were found on the contacted area of each lab coat. A second study explored the effect of airflow on the deposition of GSR particles on a shooter. Samples from a shooter's clothing were collected immediately following the discharge of a firearm in the CFS range. Testing was done both with the ventilation turned off and on (rated airflow of 0.3 m/s). On average, more than 800 characteristic GSR particles were detected. These studies demonstrated that walking through an area with a high GSR background did not result in airborne deposition of GSR. By contrast, direct contact with a surface known to contain a high number of GSR particles was an effective means of GSR deposition. Moderate airflow did not have an observable effect on the number of GSR particles deposited on a shooter. [1] Andrasko, J., Pettersson, S., "A simple method for collection of gunshot residues from clothing", Journal of the Forensic Science Society 1991; 31: 321-330.

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A PARTNERSHIP APPROACH TO SEXUAL OFFENCE RESEARCH AND PRACTICE

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Violence, rape and serious sexual offences against women and the vulnerable remains a critical issue for criminal justice. Related offences are increasing in many jurisdictions and there is a lack of consistency in standards across the investigation process. This lack of consistency relates in part to the variance in 'quality' of the investigative service delivery and, consequently, results in an 'inconsistent journey' for the victim. In the United Kingdom many sexual offences remain under reported and there exists attrition, where only a relatively small percentage of the offences get to court and fewer still are detected. In the Hampshire region of the U.K., like many other regions worldwide, these issues remain a key strategic priority for law enforcement. In response, the local police service, academia and the forensic service providers are utilising a collaborative and partnership approach to tackling the prevailing issues through applied and salient research linking investigators, forensic practitioners, scientists, academics and students. The aim is to undertake cross-discipline research and educate stakeholders to improve the quality in the investigative process, linked to improving the victims' experience, the reporting levels, and subsequent detection of offenders. This presentation outlines the collaborative and partnership framework and it will provide an overview of the way forensic based research is being used commensurately and in association with investigative, victim centred and human factors research. The outcomes of each research theme are used interchangeably to inform and improve the effectiveness of the investigation process across the investigative continuum. This has resulted in a multi-disciplinary regional sexual offences research hub. The presentation will provide delegates with an overview of the key research projects, including the integration of Rapid DNA technologies, reviewing the transfer and persistence data relating to biological evidence, the solvability of forensic evidence in sexual offence investigations, a review of contamination in the Sexual Assault Referral Centres (SARC) and more qualitative research reviewing the implementation and use of the Rape Investigation Toolkit for senior investigating officers. We will give delegates a detailed overview of the way in which disparate disciplines are working together to produce holistic research outcomes conjoined, and producing a systems-level review of the investigative process. This is helping investigators to implement process change and novel approaches with understanding of its impact on other areas of the investigation, and, it provides an inter-professional collaboration to improve the quality of sexual assault investigations.

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FORENSIC SCIENCE & HUMAN MIGRATION: THE ROLE OF SOCIAL MEDIA

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The world is in a state of mass movement. While migration may not be a new phenomenon, we are currently experiencing movement on an unprecedented scale. For example, over one million migrants arrived in Europe in 2015 but nobody knows about those who did not arrive; those who attempted the journey but perished en route. The international forensic science community is responding to this humanitarian crisis and attempting to identify decedent migrants. However, due to the complex nature of the migrant situation there are practical limitations to some conventional identification methods such as dental records and DNA profiling. Antemortem data can be difficult to gather. The limitations of conventional forensic identification methods may mean that innovative, new scientific techniques are required. Several novel approaches are utilising social media to reach out to migrants and their families. For example when faced with a lack of ante mortem data to match with primary identifiers personal descriptors may be compared with photographs on social media accounts. This poster will discuss current efforts to aid the forensic identification of migrants using social media and potential future uses. An analysis of the intersection of forensic science and migration on Twitter will also be presented.

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RESPONDING TO AND PREVENTING RAGGING IN A SRI LANKAN STATE UNIVERSITY

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Sexual and Gender-based Violence (SGBV) refer to acts of inflicting physical, mental or sexual harm or suffering that deprives a person's liberty whether based on one's gender or sexuality and can take various forms. Ragging in educational institutions can often be considered a form of SGBV. Ragging related SGBV continues to be a problem despite various legal, policy and programme initiatives introduced over many decades. While the punishment of perpetrators through the criminal justice system is expected to deter perpetrators, there is a perceived need for other

strategies (such as awareness-raising, attitudinal changes, institutional redress mechanisms and the empowerment of students to say no to ragging) to eradicate ragging from universities. The paper is based on a case study of an incident of ragging at a state university. The objectives of the paper are: 1. to examine the institutional conditions and culture related to an incident of ragging which led to the arrest of 10 students under the Anti-ragging Act, 2. to explore the socio-political and cultural significance and aftermath of the incident which led to dividend institutional opinions and a backlash from the student union and society, and 3. to discuss the action taken by the University authorities to respond to the immediate situation as well as to prevent future incidents of ragging (including a task force to prevent ragging) The paper is based on literature reviewing and qualitative interviews with those who were involved in the incident (including the experiences of students and the task force members). It is expected to provide an in-depth understanding of the subtleties, specificities, and complications associated with a contentious problem such as ragging. Given the political and ethical issues involved with insider research as well as the sensationalism of the topic, maximum care is been taken to safeguard the interests of those concerned.

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THE AARDVARK™: A PRELIMINARY STUDY IN FORENSIC TRACE EVIDENCE COLLECTION

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The Aardvark™ is a set of new forensic tools, aimed to better collect and preserve trace evidence material. In this research, a single-use, sterile, trace evidence material collection cassette was tested. This device uses adhesive tape lifting techniques to collect different trace evidence materials such as fibres, glass, narcotics, gunshot residue, explosives, etc. The device is connected to a handle with different appliances such as cameras and a touch screen. The cameras record the collection process and display the recording on both the touch screen and remote devices in real-time. To this day, crime scene technicians mostly use a manual tape lifting technique for trace evidence material, either with a zonal or a 1:1 technique. The latter is time consuming, and often does not even guarantee having relevant microtraces collected (at least not before laboratory examination). As a result, physical evidence (microtraces) are being neglected and minimally collected on crime scenes. It would nonetheless benefit both crime scene technicians and laboratory examiners to improve the collection and recovery process, by rendering a systematic, time efficient recovery. These issues regarding manual tape lifting may be resolved with The Aardvark™ device. In sum, the Aardvark™ design ensures the systematic preservation of evidence through a sequence of video recording, collection by adhesive tape, automatic optical recognition, sealing, and preservation in individual cassette. The subsequent choice of whether to analyze the traces is left to the laboratory. This presentation will display the design of the device, the ideas behind its conception, and the proof-testing on concrete cases. The research consists in demonstrating that the Aardvark™ is indeed quicker and easier to use than manual tape lifting techniques. In order to compare both procedures, trace evidence are first collected with the taping 1:1 technique. Known amounts of evidence material (fibres, paint, and glass) are deposited on a surface (sofa or shirt) by an independent participant. The collection is timed, and quantified by the amount of trace evidence collected. Finally, the procedure is then replicated using the Aardvark™ tool. The results are compared and the performance of the Aardvark™ as opposed to manual lifting is established. Furthermore, the users are also asked to answer a quick survey, to establish if they find the tool easier to use than a regular taping 1:1 technique, and what added value they believe the Aardvark™ may bring to an everyday use.

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UNDERWATER DECOMPOSITION AND FORENSIC ENTOMOLOGY IN PORTSMOUTH, ENGLAND

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Investigation of insect succession on human remains can help to provide an estimate of minimum post-mortem interval (mPMI) during death scene investigations. The use of entomological evidence in these situations can be crucial for helping to provide a timeline for events and providing vital links to other corroborating evidence. Insect succession on land is well studied, however although decomposition of human remains in water is known to differ from that on land, little research has been conducted into how these differences extend to forensic entomology. To date no research covering insect succession on remains decomposing in aquatic habitats, which is vital knowledge for accurately estimating mPMI, has been undertaken in the United Kingdom. In addition, personal observation by forensic entomologists and police personnel suggests that forensic entomology is being underused in an investigative context. Through a mixed methods approach and multi-agency collaboration, this study aims to provide data on insect succession in aquatic habitats in Portsmouth and make recommendations for the collection and storage of entomological evidence from aquatic death scenes. Alongside this, questionnaires and interviews will be used to gather data from a range of professionals who may be present at aquatic death scenes on current practices and levels of awareness of forensic entomology. The results of these questionnaires and interviews will be used to provide targeted information and training where gaps in awareness may exist. To provide the data on insect succession in aquatic environments, field studies are being conducted in which piglet carcasses are being allowed to decompose naturally on land (in a small local wooded area), in fresh water (in a pond located in the same wooded area) and in sea water (suspended from a raft in Langstone Harbour (Portsmouth, UK)). Species colonisation patterns for each habitat will be discussed. As part of death scene investigations the data from this type of study can provide vital supporting information to narrow down searches, corroborate and support other evidence sources and it can provide additional intelligence to inform investigators.

Disclosure: All authors have declared no conflicts of interest.

AGE ESTIMATION BASED ON DENTAL PULP VOLUME OF HUMAN REMAINS FOUND IN TWO NECROPOLIS IN ITALY

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Background: During archaeological excavations skeletonized bodies are often found and very often, in mass graves . The age and sex identification of the bodies can be useful in understanding the nature of the population as well as determining whether they are family units or soldiers . For this purpose two different types of findings have been examined, the first in Florence and the other in Sardinia, Italy,carried out by the Archaeological Superintendence of Tuscany. The necropolis found in Florence, close to the Uffizi museum and the Vasarian Gallery, was composed by numerous mass graves, each containing three to eleven individuals, crammed together and often positioned in an alternating manner. The disorderly position of the skulls and upper limbs has been interpreted by the researchers as an indication of hasty burial due to a special emergency condition which can be ascribed to the presence of a deadly epidemic plague in the city. The second necropolis was found in Sardinia, in Monte Prama, this was made up of individual graves where the skeletons were found crouched down. Male bodies clearly prevail over females bodies and there is a significant lack of infants and the elderly. **Aim:** The aim is the estimation of the age at death of the human skeletonized remains to reconstruct a complete picture of the samples and in general a picture of the life of the population at the time, through multidisciplinary research. **Material and Method:** The archeological excavations under the Uffizi Museum found 32 skeletons

and in Monte Prama 41 skeletons. CBCT radiographies were taken from skulls and the method proposed by Pinchi et Al (2015) was applied to calculate the volumes of the dental pulp and hard tissues. This method was previously validated on a reference sample of adults of known age. It was chosen because it is non-destructive, has a fast application, and proved to be more or similarly reliable and accurate compared with most other methods for estimating the age of skeletal remains or teeth in adults applied so far in anthropological literature. **Conclusion:** The age at death of the skulls was estimated by calculating the ratio between the pulp and hard tissues of CBCT taken for the skulls. The results were compared with different estimates obtained from the analysis of different biological evidence (bone age, e.g.) . The statistical analysis is near to completion.

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FINDING THE BEST WAY TO PRESENT EXPERT EVIDENCE FOR JUROR COMPREHENSION IN CANADIAN CRIMINAL CASES

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Prominent members of the justice system have suggested that the present adversarial model for presenting evidence may not be the best way to put expert evidence before juries. Do jurors, when presented with science in the courtroom via the adversarial model, focus more on the persona/demeanour of the expert witness rather than the substance of the evidence? Would movement away from the adversarial model for presenting expert scientific evidence improve the focus and comprehension of the jury of the science presented? Firstly, an alternative model for presenting expert evidence, the court-appointed expert model, is proposed as a way to increase jurors' comprehension of science in the courtroom. With the use of student mock juries in a criminal case with toxicology expert evidence, studies were conducted to test if the use of the court-appointed expert model would decrease jurors' focus on the persona/demeanour of the expert while increasing their scientific comprehension of the evidence. Findings supported that although the court-appointed expert model did not decrease the jury's focus on the persona/demeanour of the expert witnesses the model contributed to an increased focus and comprehension on the scientific evidence by jury members. Secondly, if comprehension of science is improved using the Court-appointed model, why is it not being used in criminal courts in Ontario? A survey of key players in the criminal justice system is ongoing to gain insight into the barriers to using such a model. Increasing juries' comprehension scientific evidence by considering other models for presenting evidence may be significant in preventing miscarriages of justice.

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CHEMICAL ENHANCEMENT OF 2D BLOODIED FOOTWEAR IMPRESSIONS ON A TILE SUBSTRATE.

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This study investigates the enhancement of two-dimensional bloodied footwear impressions, amido black and leucocrystal violet, lifted by dental stone on ceramic tile. Five series, with six depletions each were carried out for each chemical enhancement, yielding a total of sixty impressions. The impressions were graded using the Bandey Scale (0-4), adapted for footwear impression grading. Through linear regression it was determined the amido black impressions were of better quality than the leucocrystal violet, generally graded at having minimal oversaturation with good lug definition, with moderate leaching of chemicals into the impression.

Disclosure: All authors have declared no conflicts of interest.

RECOGNISING AND REPORTING LIMITATIONS IN THE SCIENCE OF FINGERPRINTS

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Continuous improvement is integral to the progression of fingerprint science. Practitioners must understand their accountabilities and the risks associated with failing to keep abreast with current literature. Attempts must be made to critically analyse recommendations that have been published in recent authoritative reports, and bridge the existing gaps. One recurring theme in these critical reports is the need to move towards transparency in reporting fingerprint conclusions. Part of this shift involves the requirement to state any limitations that exist within the fingerprint science, and what may affect the evidence being presented. In the Australian adversarial system, fingerprint expert reports are bound by legal requirements. In Victoria, if an expert report is requested as per the County and Supreme Court Practice Direction, it must specify any limitations or uncertainties affecting the reliability of the methods or techniques used, the data relied on to arrive at the opinion(s), as well as any uncertainties affecting the reliability of the opinion stated as a result of insufficient research or data. It is important for fingerprint practitioners to have an understanding of the limitations within their field, and to accurately report and articulate them in a manner that is understood by a lay person. and so these questions are posed - what limitations exist within the science of fingerprints? Do practitioners agree on what constitutes a limitation in their field of expertise? How can limitations be reported and articulated? This presentation will consider and discuss limitations at foundational and practitioner levels, inclusive of error rates, cognitive factors, lack of probabilistic analysis, absence of fingerprints, ageing of fingerprints and the subjective nature of sufficiency determination.

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THREE-DIMENSIONAL FACIAL RECONSTRUCTION BASED ON SOFT TISSUE THICKNESS FROM HEAD CT SCAN IMAGES

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In forensic anthropology field, facial reconstruction of the skull is occasionally required in an identification of skeletal remains. A variety of methods such as clay modeling method, drawing method as well as computer-assisted three dimensional (3D) method has been applied for the facial reconstruction. In this study, we developed 3D facial reconstruction method based on soft tissue thickness examined from head CT images. X–ray CT images of head were obtained from living Japanese individuals (13 males, 6 females). 3D shapes of skull and head surface were each segmented from these images. On the skull shape, 38 landmarks were defined and orientation of the skull was standardized by Procrustes analysis. Then the skull shape was simplified by simulating virtual elastic film covering the skull shape based on steepest descent method (SDM). Homologous shape models consisted of 10,242 data points were created for these simplified skull shapes also by the method with SDM. On each data point, length to the head surface was measured for every individual. Average value of each was calculated. The facial reconstruction of specific skull was performed by creating homologous model of its simplified skull shape, followed by applying the average length to each data point. Reconstructed 3D face shapes from 15 skull specimens represented morphological features of their original skulls, such as protrusions of zygomatic and gonial regions as well as of an eyebrow arch. These features can be recognized well while rotating reconstructed face to particular angles. This is one of the merits to reconstruct faces three dimensionally. Comparisons of the shapes between reconstructed and original (correct) faces of donors of the head CT imaging were also made. It was suggested that each individual has characteristic facial

soft tissue thickness distribution which seems to be affected by an aging and a body weight change. Creating several models modified from originally reconstructed shape by applying these effects would be helpful to find missing person of unknown skull. Detailed studies on anatomical concordances between original skull and reconstructed face are now ongoing.

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COMPARISON OF LIP AND FINGERPRINTS AMONG TWINS IN A SUB-SAHARAN AFRICA POPULATION

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Introduction: Closest genetics-based relationship is in identical twins therefore, maximum similarity is expected among identical twins. **Objective:** To compare the level of similarity of finger and lip print among identical and unidentical twins **Methods**: Study was conducted at a tertiary health facility and a rural community outpost with heavy twin population. 40 twins comprised of 18 identical and 22 non-identical twins. The identical twins comprised of 7 males and 11 female twins while the non-identical comprised of 9 male and 9 female twins and another 34 twins that are of both gender. **Results:** The most common type of finger print pattern was the core (75%) followed by the left loop (41%) while the least common was the tented arch (1.8%). The most predominant lip pattern was the incomplete vertical (65.2%) followed by the reticular type (59.1%) while the least was the undetermined type. 28.6% of the finger prints poised difficulty with separation of identity between twin siblings but difficulty was not significantly associated with gender. 5% of the lip print poised difficulty with separation of identity between sibling without gender association. **Conclusion:** Authors suggest the complementary use of lip print with finger prints to facilitate identification of especially similar twins.

Disclosure: All authors have declared no conflicts of interest.

FINGERMARK-SELEX: A NOVEL APPROACH TO DEVELOP DNA APTAMERS FOR FINGERMARK DETECTION

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Although there are a number of fingermark detection methods currently in use by law enforcement agencies, there is a constant pursuit to improve their sensitivity or selectivity to maximise fingermark recovery. It is widely known that fingermarks consist of a complex mixture of eccrine and sebaceous constituents, but many of the fingermark reagents only target specific ones (e.g. amino acid-sensitive reagents). Over recent years, there has been great interest in incorporating immunology into single- and multi-target fingermark reagents, primarily with the use of antibodies. Unfortunately, antibodies have a short shelf life and are limited for use in physiological conditions. Aptamers, alternatives to antibodies, are short single-stranded DNA or RNA sequences that bind to targets with high affinity and specificity. They are selected *in vitro* through a process called Systematic Evolution of Ligands by EXponential enrichment (SELEX) for various clinical and industrial applications. Previous research investigating the use of readily available lysozyme-binding DNA aptamers to develop an aptamer-based fingermark reagent showed promise. It was, however, limited to the fast degradation of the target. The goal of this research was to develop aptamers for targets that are relevant to fingermark residues via a novel SELEX variation: fingermark-SELEX. To mimic real-world scenarios, natural fingermarks from multiple male and female donors were deposited onto strips of black garbage bag and white copy paper, commonly encountered substrates, and aged for different time intervals under ambient laboratory conditions. They were then put through the SELEX process with an Atto 550-modified DNA pool. Percent binding of DNA to fingermarks was monitored for all rounds except the initial. Sequencing of select SELEX rounds was used to identify potential aptamer candidates suitable for fingermark detection. These sequences were then trialled in aqueous working solutions on aged fingermarks deposited on multiple substrates. Comparisons were performed to each other, to routine fingermark detection methods, as well as to previous single- and multi-target immunogenic fingermark reagents. Results will be presented and the prospect of a universal biomolecular recognition fingermark enhancement reagent will be discussed.

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LUMINESCENT PROBE FOR GSR IDENTIFICATION

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The identification of gunshot residues (GSR) provide essential information to reconstruct crime scenes involving firearm offenses. However, due to its microscopic nature, most of the time forensic experts perform the collection without visualize the residues. This feature can make hard to find GSR particles. Recently, it was proposed the introduction of luminescent markers into ammunition as way to visualize luminescent residues after shots and overcome the drawback associated with the characterization of GSR from non-toxic ammunition (NTA). This is because the proposed markers, besides allow the visualization of luminescent particles *in loco* using an UV lamp, have unique compositions that provide chemical signatures for ammunition. Thus, luminescent markers can bring several benefits to sample collection, residues characterization and crime scene investigation. Despite the numerous advantages provided by using luminescent markers, which makes it a reliable future option in the ammunition market, little or nothing is known about the interaction of the markers and the ammunition compounds after the shot. In this sense, it is of extreme interest for forensic laboratories to anticipate the commercialization of luminescent ammunition by knowing the type of particles that are produced after firing. That is, it is important to investigate if the ammunition compounds and the marker merge to form single particles or they form individual particles that travel separately. In this work, conventional ammunitions tagged with two types of luminescent markers were shot and then luminescent residues were visualized under UV radiation on the shooters, firearms, floor and cloth targets. On the floor, luminescent residues spread out to form a trail of luminescent particles of 9 meters, which helped to determine shooter's position and bullet trajectory. On the targets shot at different distances, patterns of luminescent residues were easily visualized using a portable UV light, avoiding colorimetric tests. The GSR particles were collected and subjected to SEM-EDX and Raman spectroscopy analysis to get information about their inorganic and organic composition. As result, the unequivocal identification of the GSR and the marker was achieved by SEM-EDX, while the Raman spectroscopy identified the markers and the propellant organic compounds. It was also observed that part of the marker and the GSR tends to join and travel together. Meanwhile, other part of the marker and the GSR that remains separated realize similar trajectories. In both cases, the markers acted as luminescent probe that help to find GSR particles and improve the evidence collection.

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THUNDERSTORM ASTHMA: A CLUSTER OF DEATHS IN MELBOURNE

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Bedford P[1] Although severe asthma is considered a major health concern, death following unexpected exacerbation of acute asthma is rare. On occasion, weather conditions dictate a rise in allergy mediated acute asthma presentations to emergency departments, and GP clinics. In Melbourne, Australia late 2016, following a period of some days of elevated temperature, an inner city thunderstorm occurred, resulting in thousands of calls for assistance to ambulance service, and also individual presentations to emergency departments. This completely overwhelmed emergency services, and culminated in 9 deaths. In post-mortem casework, the investigation of unexpected death resulting from asthma in the immediate proximity to an extreme weather event in Australia has not been undertaken. All deaths where asthma is included in the cause of death occurring in a three month period were examined over five years. Whilst it is possible that the circumstances of the thunderstorm (e.g., documented weather change) dictate a definitive rise in patients experiencing asthma symptoms, the lack of concrete evidence available at post mortem examination dictates a diagnosis based on circumstance. The cluster of deaths specifically attributable to the thunderstorm are examined.

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'MICROANTHROPOLOGY': A MULTIDISCIPLINARY APPROACH FOR ESTIMATING PMI IN AN AUSTRALIAN CLIMATE

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Accurate determination of the post-mortem interval (PMI) is critical in forensic casework. Research investigating decomposition processes and determining PMI from remains has been on the rise in recent times. Most studies conclude that PMI determinations are dependent on local climatic and geographical factors. Despite this, there is little data in an Australian environment outside of entomological studies. In the absence of insect data on or around the remains, alternative methods are required. Anthropological methods of observing and scoring the extent of decomposition at the time of discovery provide only broad estimates of PMI. Recent studies have determined that microbial succession is responsible for these observable soft tissue changes, particularly in early and late decomposition. The aim of this study was to combine anthropological and microbiological methods to provide baseline data for determining PMI in a temperate Australian climate. Skin and cavity swabs were collected from pig carcasses (as a human proxy) at regular intervals for 12 weeks during winter (June-September). Microbial DNA was isolated and used to perform 16S rRNA metagenomic analysis to quantify the population structure at each major stage of decomposition (as determined by degree of observable soft tissue loss). This analysis showed clear changes in microbial community structure over the course of decomposition that aligns with the visual changes observed in the soft tissues. During early decomposition (Day 0-9) there was the greatest microbial diversity comprising genera from the Fermicutes (30%), Proteobacteria (35%), Bacteriodes (25%), and Actinobacteria (5%). There was a clear and observable decrease in population diversity, with Proteobacteria the dominant community (80%) by the late decomposition stage (Day 70). Interestingly, the Psychrobacter species most abundant at this stage, potentially because of the prevailing winter temperatures. The rapid decline of community diversity is best visualised when analysing cavity swabs using qPCR analysis, suggesting these body regions may be the most useful in designing a tool to develop an accurate quantitative method of determining PMI.

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SURVEY OF BACTERIAL DIVERSITY ASSOCIATED WITH VARIOUS LIFE STAGES OF LUCILIA SERICATA IN VIRGINIA

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Lucilia sericata are small metallic flies of forensic, medical, and veterinary importance. They are one of the most common primary colonizers of carrions in Virginia, and contribute significantly to carcass microbiome composition. Although extensive data exists on the biology of green bottle flies, a well replicated study on bacteria associated with different life stages of *Lucilia sericata* is missing. In this study we characterized bacteria associated with different life stages of *Lucilia sericata* by using 16S rDNA MiSeq sequencing. Five *Lucilia sericata* colonies were established from five female *Lucilia sericata* flies collected from Richmond, VA and nearby areas on beef liver bait. DNA was extracted from each sample using organic CTAB extraction method. Variable region 4 (V4) of 16S rDNA was amplified and sequenced on the MiSeq platform using dual-index strategy and following the manufacturer's protocol. Sequences were then analyzed using Mothur version 1.39.4 and statistical analysis was performed using R version 3.3.2. Preliminary results suggest that the bacterial structure is maintained within and between generations. The majority of bacteria associated with different life stages of *Lucilia sericata* belong to classes Gammaproteobacteria and Bacilli. Flavobacteria was present at relatively high abundance (9.8%) in pupal samples, whereas its relative abundance was very low (<1%) in all other samples. Egg samples had high abundance of the genus Yersinia, whereas its relative abundance was very low (<1%) in all other samples. In summary, this ongoing study provides information of the bacterial communities associated with the various life stages of *Lucilia sericata* and its importance in forensics. This information will help to gain better understanding on carrion resource utilization, blowfly colonization pattern determination, and in improving precision in post-mortem interval (PMI) estimation using bacterial evidence.

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AN INDEL POLYMORPHISM WITHIN RYR2 MODULATES SUDDEN UNEXPLAINED DEATH RISK IN CHINESE POPULATIONS

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Sudden unexplained death (SUD) constitutes a part of the overall sudden death that cannot be underestimated. Over the last years, genetic testing on SUD has revealed that inherited channelopathies might play important roles in the pathophysiology of this disease. Ryanodine receptor type-2 (RYR2) is a kind of ion channel extensively distributed in the sarcoplasmic reticulum (SR) of myocardium. Studies on RYR2 have suggested that either dysfunction or abnormal expression of it could lead to arrhythmia, which may cause cardiac arrest. In this study, we conducted a case-control study to evaluate the association of a 4-base pair (4-bp) Indel polymorphism (rs10692285) in the 3'UTR of *RYR2* with the risk of SUD and sudden cardiac death induced by coronary heart disease (SCD-AS) in a Chinese population. Logistic regression analysis showed that the insertion allele of rs10692285 had significantly increased the risk of SUD [OR=2.03; 95% confidence interval (CI) =1.08-3.77; *P*=0.0161; statistical power=0.743]. No relevance was observed between rs10692285 and SCD-AS. Further genotype-phenotype association analysis suggested that the expression level of RYR2 in human myocardium tissues with the insertion allele was higher than that with the deletion allele at both mRNA and protein levels. Dual-Luciferase activity assay system was used to detect the effect of rs10692285 on the transcription activity of *RYR2*. As expected, the result

indicated that the transcription activity of *RYR2* with the ins/ins genotype was higher than that with the del/del genotype. Finally, *in-silico* prediction revealed that different alleles of rs10692285 could alter the local structure of RYR2 mRNA and microRNA (miRNA) binding. In summary, our findings provided evidence that rs10692285 might contribute to SUD susceptibility through affecting the expression of RYR2, which suggest that abnormal ion channel activity is very likely to be the underlying mechanism of SUD, but not for SCD-AS. Thus, rs10692285 may become a potential marker for molecular diagnosis and genetic counseling of SUD.

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ENSURING THE MENTAL HEALTH OF YOUR MORTUARY STAFF: WELLBEING STRATEGIES FOR GOOD PRACTICE

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The Victorian Institute of Forensic Medicine (VIFM) is responsible for the provision of medico-legal autopsy services in the State of Victoria and reports under Statute to the State Coroner. The role of the forensic technical officer in the medico-legal death investigation process is physically and mentally demanding and encompasses many aspects of forensic science, with various levels of complexity and responsibility. The service is operational 24 hours a day, 7 days a week. The staff of the mortuary at the VIFM, play a hands-on role in autopsy, radiology, and photography examinations and a sterile tissue retrieval service for the Donor Tissue Bank of Victoria. Importantly, the mortuary staff are primarily responsible for the care of the deceased from the time of admission until the time of release to the funeral director. On occasion, some staff will also interact with the family of the deceased. This is a professional boundary that is not often crossed within the mortuary context. In 2007 the Victorian Institute of Forensic Medicine introduced quarterly group debriefs for forensic technical officers. Initially these were implemented to minimise the impact of the role on staff mental health, and to meet the needs of OHS regulations. Over time, with the changing expectation on the workplace, and particularly in management of staff, these sessions have altered to go beyond traditionally offered confidential psychological support based on self-referral. More recently the wellbeing sphere has again evolved to include various action strategies in general health and wellbeing, vicarious trauma and post-traumatic stress management. It is well documented that mortuary workers encounter significant stressors in their day to day work. This paper will discuss activities undertaken at VIFM to build confidence and resilience amongst this group, and to enable senior staff with strategies to mitigate the risk of mental health injury.

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THE STUDY OF INFLUENCES ON DNA RECOVERY FROM DIFFERENT MOISTENING SOLUTIONS

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Swabbing with moistening solutions is commonly used in crime scenes to collect biological evidence. To obtain successful DNA profiles, the method of collecting evidentiary samples in crimes scene is crucial. To maximize DNA yields of LCN (low copy number) samples, the optimal choice of moistening agents is needed. There are only few studies on influence of swabbing solution in forensics. In this study, we investigated the influences of three different moistening solutions (saline, distilled water and tap water) on cotton swabs with blood/saliva stains. The samples of swabs were impregnated with known amounts of blood and saliva separately and then dried in the air for 24 hours. The cotton swab samples with blood/saliva stain were used for DNA extraction after 0, 1, 4 and 7 days. The DNA yields were evaluated by DNA quantification and STR typing. The results suggested that the most efficient moistening agent for greater DNA yields is saline in both blood/saliva stains with all 0, 1, 4 and days compare to DW and tap water. Also, the results showed that the DNA recovery was rapidly decreased with DW and tap water on both stains after 4 days.

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ANALYSIS OF STR PROFILES FROM THE ULTRAVIOLET IRRADIATED BLOODSTAIN BY WHOLE GENOME AMPLIFICATION

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Assay of DNA polymorphism is a main technique in forensic personal identification. However, as an evidence sample collected from the forensic casework, DNA molecules always have been already degraded under the influence of environment and physics, chemical factor. As is generally known, if the DNA has been damaged, the progression of the DNA polymerase during the PCR may be prevented. The whole genome amplification (WGA) is a useful method to amplify all genomic DNA from limited small fragments based upon random fragmentation by universal priming sites. This study describes the use of two STR systems for the purpose assessing DNA profiles by WGA method from the bloodstains which were irradiated by ultraviolet light artificially. Blood was collected from 20 applicants, spots onto sterilization cotton gauze and allowed to dry at room temperature as the sample of bloodstain. The ultraviolet irradiation reached by 870kJ/m^2 energy using a UV cross linker (UVP) each in UVA (365n), UVB (302nm) and UVC (254nm), respectively. The DNA was extracted from the bloodstain by DNA Extractor FM Kit (Wako), and the concentration of DNA was measured using Qubit®3.0 Fluorimeter (Life technologies). Analysis of STR polymorphisms were carried out with 1 ng of genomic DNA and WGA products by GenePrint® Silver®III System (Promega) and AmpFlSTR®Identifiler®Plus PCR Amplification kit (Applied Biosystems). For amplification of STR genotyping from ultraviolet irradiated the bloodstains, GenomePlex® Complete WGA Kit (Sigma) was used. The full STR profile of bloodstain was not able to detect after UV irradiated at 30 days for UVA, 20 days for UVB and 35 minutes for UVC, by the normal laboratory procedure. However, after these UV irradiated bloodstains were amplified by WGA, then running the PCR again with the WGA products, the STR genotyping was detected successfully. Furthermore, by this WGA method, the STR genotyping was able to detect even longer UV irradiation bloodstain, for 40 days in UVA, 50 days in UVB and 3 hours in UVC. The WGA method is regarded as one useful method in detection of STR polymorphisms from UV irradiated bloodstain sample. The WGA products of good DNA quality will result in DNA profiles with efficiencies of forensic individual identification.

Disclosure: All authors have declared no conflicts of interest.

TESTING FEASIBILITY OF VIRTUAL REALITY HEADSET FOR PC-ASSISTED RESTORATION OF SKELETAL REMAINS

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Prior to assessing fractured or fragmented skeletal remains, forensic anthropologists are frequently in need to restore the original bone integrity. Traditional techniques of assembling the fragments by an adhesive material are increasingly combined with more advanced virtual approaches, where digitized skeletal elements are reassembled within the computer environment. While the PC-assisted approach permits preserving the physical evidence, it is known to be highly time-consuming if conducted with standard computer accessories, i.e., mouse, keyboard and flat-panel screen. In recent years, a number of scientific fields have

witnessed renewed interest in virtual reality (VR) and introduction of head-mounted displays combined with handheld controllers. By providing an operator with three-dimensional visual perception, tactile response and natural navigation within the 3D environment these peripherals have potentials to enhance efficiency of manual reassembling techniques. To test feasibility of VR accessories for restoring fragmented skeletal remains, three sets of digitized skeletal elements were reassembled by multiple operators using a HTC Vive headset. The testing remains composed of three datasets featuring 3-17 digital cranial fragments. Two of them were designed as mock cases, aimed to simulate the process of fragmentation due to external forces, whilst one represented a real-life forensic case of a devastating gunshot wound to the head. The restoration was conducted in an in-house application developed with Unity3D. Simultaneously, the same task was performed using tools incorporated in CloudCompare v2 software while the employment of available traditional peripherals was controlled. The inter- and intra-method differences were quantified using the mesh-based comparison and further assessed in terms of time-efficiency and ergonomics. The results demonstrate that the VR periphery enhances effectiveness of the restoration process. While the handheld controllers allowed the operator to translate and rotate the fragments within the 3D space in a habitual way, the headset enabled an instant assessment of their spatial relations in all three dimensions. As a result, the VR device allowed for each of the procedures to be carried out in a faster and more straightforward manner comparing to that conducted by the standard PC accessories. As far as the accuracy is concerned, the two techniques yielded comparable bias and could be regarded as complementary. The most beneficial aspect of VR technology is the ability to bring the expert's activities within the virtual environment closer to the real-word experience. This may enhance a wide spectrum of PC-assisted examination techniques without the needs for a larger learning curve and advanced computer literacy.

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DETERMINATION OF INORGANIC CYANIDE IN HUMAN BLOOD BY HS-GC/MS

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Objective: To establish a convenient method to determine the cyanide in human blood by headspace-gas chromatography/mass spectrometry (HS-GC/MS). **Methods:** In the pre-treatment, 1.0mL blood was used as the sample, which was put into a 12mL headspace vial with 1mL deionized water to dilute. After adding in 0.5mL phosphoric acid (98%), the cap was sealed immediately. Then the vial was heated at 60°C for 15min, and ready to be analyzed by HS-GC/MS. An Agilent® GC-GASPRO chromatographic column (30m×0.32mm) was used and the scan mode of the mass spectrum was selected ion monitoring (SIM). **Results:** The linearity of the determination of cyanide at 0.1-100mg/mL was good (R^2>0.995), RSD (n=6) < 10%, recovery>80%, and the limits of detection (LOD) was 0.05μg/mL. **Conclusion:** This method could simply, efficiently, and accurately determine the cyanide in human blood.

Disclosure: All authors have declared no conflicts of interest.

DEATHS DUE TO SUICIDE IN PUTTALAM, SRI LANKA: AN AUTOPSY STUDY

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Introduction: All cases of deaths due to suicides are subjected to an inquest in Sri Lanka and some of them are referred for autopsy investigations. Moreover, the management of deaths due to suicide should not be confined to medico-legal aspects. Therefore, this study was conducted to identify and describe the patterns of suicides and to identify the strategies of management of patients with deliberate self-harm. **Methods:** Retrospective descriptive study was conducted on all the deaths due to suicides that were reported for autopsy investigations to Base Hospital, Puttalam, Sri Lanka from 2014 to 2016. **Results:** There were 105 deaths and 73% (n=77) were males. Ages ranged from 13-89 years and 40% were 30-49 years. Among victims,91% were Sinhalese and 79% were non-skilled labourers. Regarding the incident, 76% occurred at home, 37% during January-March, 40% due to family problems, 53% using chemical methods and 52% died at home. Previous attempts were found in 18%. Thecauses of deathsincluded hanging (46%) and organophosphate poisoning (27%). In 84% of deaths due to chemical methods and 67% of deaths due to physical methods had been committed at home (p=0.047). In 98% of deaths occurred at hospital and 23% of deaths occurred at home/outside were due to chemical methods (p=0.000). However, 75% of chemical methods and 71% of physical methods of suicides were not significantly associated with male gender(p=0.680). **Conclusions:** Majority were non-skilled, middle aged, Sinhalese, males. Majority occurred at home due to family problems by hanging. Suicides committed at home are usually done by chemical methods. The chemical methods do not immediately cause death and usually die at hospital, whereas the physical methods usually kill before reaching the hospital. However, there is no significant sex preponderance for the method of suicide. Family problems should be managed holistically to prevent suicide deaths.

Disclosure: All authors have declared no conflicts of interest.

IDENTIFICATION OF MOTORCYCLE DRIVER AND INJURY FEATURE EXPLORATION THROUGH ACCIDENT RECONSTRUCTION

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Objective: The objective of the present study was to study the kinematics of a motorcycle–microvan accident involving three riders and differences in injury severities and characteristics between the motorcycle driver and passengers. **Methods:** A real accident was reconstructed using MADYMO multi-body simulation software. Moreover, a series of simulation experiments was designed to analyze the relationships between the velocity and impact angle of the microvan and the injuries to the three riders. **Results & Conclusions:** When the speed of the microvan was set at 18 km/h and that of the motorcycle was set as 28.8 km/h, the kinematics of the simulation correlate well with relevant accident data and the impact positions and injury parameters correlate well with the actual injuries. When the impact angle is smaller than 30 degrees and the microvan impact velocity is lower than 40 km/h, the head injury of the driver is the more life-threatening than the rear passenger. When the impact angle is 15 degrees and the microvan impact velocity is in the range of 0 to 20 km/h, the risk of femur fracture is higher for the driver than for the passengers. Simulations results showed that MADYMO multi-body simulation software well reproduces the traffic accident, and the results of the study will be helpful in identifying the driver of a motorcycle involving more than one rider.

Disclosure: All authors have declared no conflicts of interest.

THE METAGENOMIC ANALYSIS OF THE SAMPLES IN CADAVERS WHO FOUND IN WATER USING NGS

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Introduction Generally, the cadavers who found in the water are not always dead by drowning, and the places where cadavers were found are not often the same as drowned place. Therefore the detection of diatoms from some organs and water is useful methods for the examination of the cadavers in the water. We could obtain additional information by using next generation sequencer (NGS) from the samples of cadavers who found in the water. Materials and methods The blood and lung tissue of the cadavers who found in the water were used for samples. The cause of death of these cases was containing both drowning and other causes. The waters at the place where the cadavers were found were also examined. The DNA was extracted from each sample and PCR amplification was performed for the 16S ribosomal RNA gene of microbes and prepared the library for NGS. After the NGS running, the data was analyzed using software. Result and discussion The metagenomic data of the blood and the lung of the cadavers by drowning was very different from that of the non-drowning case. Aeromonas is the main microbe of freshwater drowning cases. Vibrio and/or Photobacterium were detected from seawater drowning cases. Both kinds of microbes were detected from brackish water drowning cases. These were also detected from lung of the decomposed case. The analysis of the cadaver who suffered heart attack during driving and fell into the creek detected Aerononas in lung. No microbe was detected in blood of this case. This result showed that the driver died by heart attack after short time aspiration of a few freshwater. The metagenomic analysis of blood and/or lung had coincided with the circumstance during death in the water. It is certain that the Aeromonas in the fresh water and Vibrio and/or Photobacterium in the sea water were detected for considerable percent of the total microbes in the blood and/or lung in typical each drowning in each waters. However, the detected microbes in blood and lung tissues were different from those in waters in many cases. It may consider that the cadavers are floated from the drowned place to the founded place. More detailed investigations of the waters in each place and each depth are needed.

Disclosure: All authors have declared no conflicts of interest.

AN ASSESSMENT OF RAMAN SPECTROSCOPY FOR POST-MORTEM INTERVAL ESTIMATION FROM SKELETONISED REMAINS

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The calculation of the time since death (post-mortem interval, PMI) is an integral element of the forensic examination of human remains and may provide significant information pertaining to the circumstances surrounding death. Typically, PMI studies have focussed on soft tissue changes and insect activity during decomposition. Due to the resilient nature of bones, they are more likely to persist during decomposition than other biological tissue, making their examination and the information obtained invaluable in forensic investigations. As a result, research in PMI calculation using bone has recently gained in popularity. A precise method which allows for PMI estimation from skeletonised remains would aid in the identification of victims, and may lead to evidence which is admissible in court. Few precise techniques exist presently to calculate PMI from skeletonised human remains. Due to the variable nature of human decomposition, the accuracy of these methods must be explored in various environmental conditions before application to forensic casework. Considering the unavailability of accurate techniques for PMI calculations from skeletonised remains and the environmentally specific nature of decomposition, extensive research on the decomposition process in Australia is essential. There is evidence that Raman spectral patterns of skeletonised remains correlate to PMI. Research shows a decrease in organic Raman spectral bands, specifically bands associated with collagen, with increasing PMI. This is due to the loss of collagen from bone through chemical breakdown and collagenase activity of bacteria upon introduction to soil. Consequently, the current study aims to investigate the application of Raman spectroscopy in the examination of collagen loss and other diagenesis patterns in decomposing bones for the purpose of PMI calculation. Raman analysis using 785nm and 1064nm benchtop lasers was performed on bones from skeletonised pig remains with known PMI of approximately one year to two and a half years. The method was replicated in a second study using a portable 785nm Raman instrument to determine its applicability in on-site forensic case work. Here, we present preliminary spectral data obtained from bones using benchtop and portable Raman instrumentation, and discuss whether Raman spectroscopy is an effective tool in the accurate calculation of PMI from skeletonised remains.

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FORENSIC SCIENCE EDUCATION – FLAVOUR TO FOUNDATION

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A review of forensic science degree programs around the world and industry feedback have shown that in education, forensic science traditionally seconds core scientific disciplines (such as chemistry or biology); it is not considered as a core discipline on its own. Education providers have designed tertiary courses to produce discipline specific graduates (chemists, biologists, etc) who are able to give an application of this discipline to forensic science. This has led to the current silos and prevents the development of a unified culture of 'Forensic Science'. There is growing indication that this model presents serious issues and may not be appropriate for forensic science education. These programs tend to focus on tools rather than problems and rarely consider the complex interpretation, problem solving, critical thinking and evaluative skills required to be an effective forensic scientist. While the development of laboratory-based skills is important, it is often at the expense of the bigger forensic picture – the value of the trace in court proceedings, in investigative and intelligence processes. This is becoming more of an issue as technological advances are changing how forensic scientists work. If we focus on the tools, education cannot keep up in this dynamic dimension; the focus needs to be on building better Forensic Scientists. To reflect these changes, significant work has been conducted on the design and delivery of introductory units for undergraduate and postgraduate students at the Centre for Forensic Science of The University of Technology Sydney. This presentation will outline some of the changes made to the first year subject 'Principles of Forensic Science', which have positively impacted on the students' growth as forensic scientists. By shifting the focus from discipline knowledge to skills such as interpretation, critical reasoning, collaboration, communication, hypothesis formation and problem solving, the students were able to develop and apply these skills to specially designed forensic science activities. This was performed through the implementation of collaborative workshops and engaged learning activities that supplemented traditional lectures. Since this change, there has been a significant improvement in student performance and engagement in later year subjects. This presentation will also highlight important factors that should be considered when evaluating forensic science degrees and how to improve them to meet industry needs.

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A MULTI-AGENCY AND COLLABORATIVE APPROACH TO TACKLING CYBERCRIME

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The proliferation and ubiquity of digital media supported crimes and incidents of cybercrime have been comprehensively reported in the media and throughout the academic literature. These 'incidents' along with the associated pervasion of digital devices in police investigations are placing heavier burdens on police and propagating innovative ways to respond and tackle the threat posed. The rise in digital enabled crime is forcing law enforcement agencies in the United Kingdom and across the world to strategise approaches and means to manage and process the increased volume of devices, implement novel technological approaches and broaden operational capacity. This increased demand and burden placed on police agencies in the United Kingdom has, in some instances, resulted in increased waiting times for processing digital media, often delaying investigations. Rapidly evolving technology translates to evolving methods of criminality changes quickly and, commensurately, the operational response is trying to catch up with the new methods and processes. It produces a broader requirement for new and emerging technologies and enhanced skill bases to tackle the threat. Furthermore, and confounding the ability to meet this demand, local law enforcement in the United Kingdom are undergoing an extended period of austerity and therefore, the continued investment to future proof the working environment, staff skills and associated technologies required is often compromised or slow to form and respond. The Hampshire region of the United Kingdom has taken a partnership approach to tackle these issues and meet the demand. Delegates will be given a detailed overview of this approach which includes relocating an operational digital forensic unit, including its entire staff, to the University of Portsmouth campus. All digital media and forensic imaging materials and evidence from the region's crimes and investigations are being processed at the facility. Academics, researchers and students are working alongside practitioners to enhance and optimise the education of future cyber and digital crime investigators and to facilitate applied and mutually beneficial research incorporating a unique model to coordinate and allocate relevant research. This is designed to meet operational requirements, improve capacity and provide purpose built facilities and resources. Delegates will also receive an overview of the research and projects ongoing along with the outcomes. This includes the development of a multi-stakeholder research, educational and collaborative response hub in the community under the name Cybercrime Awareness Clinic, and the deployment of 'cybercrime specials' or volunteers with specific skills to meet the increased demand.

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DISCRIMINATION OF LASER PRINTER TONERS USING ATTENUATED TOTAL REFLECTANCE-FTIR WITH CHEMOMETRICS

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The examination of laser printer toners in past decades has been done using various spectroscopic and chromatographic techniques. These techniques have helped in the differentiation of the toners to certain extent, but the disadvantages linked with them pose a great threat to the examination of document received in forensic laboratories for discrimination and identification. Therefore, in the present study we propose the use of Attenuated Total Reflectance-FTIR (ATR-FTIR) in the discrimination of laser printer toners commercially available in North western part of India (Chandigarh). This technique is considered to be non-destructive as it allows the analysis of the toners on the surface of the questioned documents itself, without being affected from presence of the substrate. This technique does not involve any kinds of removal of toner from the surface either by scratching or by heating method, which may leave the document damaged and not suitable for reading purposes or further analysis. A total of 60 samples from different printers were obtained and studied. Both qualitative and quantitative analysis was performed and multivariate analysis was found to produce more legible results with high repeatability and precision. Spectra's obtained were organised in groups based on their chemical composition and peak intensity. Such methods may attain high significance in fields of forensic science and may prove out to be of high evidential value in court of law.

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DEVELOPING LATENT SWEAT FINGERPRINTS ON PAPER BY THERMALLY-INDUCED FLUORESCENCE IMAGING

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Firstly, the reaction mechanism of developing latent sweat fingerprints on paper by thermal induced fluorescence imaging is explored, searching the effect of the principal sweat components on the thermally-induced fluorescence. In the process of research, the paper, aluminum foil, glass slides and metal surfaces are chosen as fingerprint carriers. The main components of sweat are separately examined along with the fingerprint carriers so that the principal reason of emitting fluorescence can be determined. The experimental results show that it is just the amino acids, when being heated, to produce strong and stable fluorescence other than the else ingredients of sweat or the carriers. The fluorescent substance is mainly evolved from sweat-contained amino acids such as glycine, alanine and serine. Secondly, latent sweat fingerprints on all kinds of permeable paper object is developed. A good effect is obtained for printing paper, the newspaper, card paper, tissues and the notebook. So the experimental results show that developing latent sweat fingerprints on paper by thermal induced fluorescence imaging has a wide applicable scope. Through the experiment it is discovered that if the paper carrying sweat fingerprints is folded it cannot affect the developing results. In addition, the thermal induced fluorescence imaging technology has no effect on the traditional method, mainly because it is a kind of non-destructive examination, without destroying the legacy material in fingerprint sample (sodium chloride, amino acids, etc.).

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CHANGE DETECTION IN BONE HISTOLOGY USING RASTER-BASED GEOGRAPHICAL INFORMATION SYSTEMS

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This presentation will demonstrate a new forensic method for utilizing geographic information systems (GIS) for mapping microstructural features in human bone to assist in histological aging methods. Traditionally, GIS are tools and techniques for storing and analyzing spatial data to points on the surface of the Earth; however, the software can be used to map anything that is inherently spatial. The use of GIS software for bone histological analysis is relatively novel, although researchers have utilized ArcGIS software to manually delineate intracortical remodeling events as polygon feature classes across the femoral midshaft. The current project uses a raster (or pixel based) GIS program, IDRISI. The advantage of using IDRISI is that it analyzes the micrographs using their native pixels rather than necessitating an error-prone conversion to points, lines and areas used in vector GIS. Raster-based methods eliminate a conversion step, allow for spatial mapping of both continuous and discrete histological elements, and easily perform quantitative analyses using map algebra. This project demonstrates the value of using map algebra – or change detection algorithms to quantify differences in area and shape between histological transverse sections. This method is applied to the cross-sections of an

unstained Medieval Age human femur and an unstained modern-day pig (Sus sp.) with the goal of identifying the histological remodeling events over the entire cross-section. Osteon population density quantifies the total number of these remodeling events per square millimeter, and is used in forensic and archaeological contexts to calculate the age at death of adult humans. This study reinforces the concept of GIS software for identifying, comparing, and describing patterns of histological mapping for the purposes of developing new aging tools for forensic anthropology.

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WHEN ARE FIBRES RELEVANT: DAILY ACTIVITY AND BACKGROUND EXTRANEOUS FIBRES ON T-SHIRTS

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Extraneous fibres transferred to a garment can provide important reconstructive or linkage evidence. The significance of the recovered fibres is dependent on a number of factors with varying complexity and level of characterisation in the forensic science literature. The interpretation of this evidence can become difficult in cases where small collectives of fibres are recovered from an item, which may be indicative of differential shedding, secondary transfer, background fibres transferred by unrelated activities or significant fibres loss after the transfer. In order to help understand the prevalence of fibres accumulated during day-to-day activities and interpersonal contact, a pilot study was performed using random volunteers from the university student population. During a mild Sydney Spring, 19 volunteers were provided with a white cotton T-shirt to be worn as the top layer of clothing during a standard 8 hour working or study day. Each T-shirt was pre-screened for background fibres originating from manufacture and warehouse storage. Worn T-shirts were returned in sealed evidence bags along with a participant survey. Fibre populations were then classified by type and colour and compared to factors including public transport usage, physical activity, and level of intimate and non-intimate social contact using a weighted scoring system. In total, 3567 were recovered from the 19 garments with the vast majority being natural fibres (75%); black/grey being the most frequent colour. As expected, fewer fibres were recovered from the T-shirts of participants with higher physical activity levels. Public transport users recorded lower fibre populations than those commuting in private cars, while participants who reported high levels of social contact typically had a greater proportion of coloured fibres present on their T-shirts. Although this was only a small pilot study, it provided some interesting preliminary data and trends for further investigation.

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ASSESSING THE USE OF DNA EXPERT EVIDENCE, BY JUSTICE SYSTEM PARTICIPANTS, IN ONTARIO CRIMINAL COURTS

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What happens to forensic DNA opinion evidence when the expert witness is not present in the court room? Research addressing this issue has been largely focused on polling lawyers regarding their perceptions of DNA evidence, and studies of juror understanding of DNA expert evidence in real and mock court situations. We have attempted to address the question by analyzing transcripts of expert DNA evidence, opening & closing addresses, and judges' instructions for cases that have passed through the Ontario criminal courts within the past fifteen years. This project is the first assessment of Canadian criminal court case transcripts with a view to comparing expert DNA evidence with the (largely) non-scientist attorneys' and judges' inferred understanding and use of that evidence. Relevant trial transcripts from cases involving DNA expert evidence were located by keyword searching Ontario Court of Appeal decisions via the Canadian Legal Information Institute online database. This research question was approached from a social science methodology, using qualitative and quantitative analyses. Quantitative analysis was conceptualized first as a survey developed to track topics of interest in Interval Ratio and Nominal variable form. Qualitative Data Analysis (QDA) Miner Lite™ was used to code sections of transcripts and complete the survey. We coded sections involving random match probabilities (RMPs), likelihood ratios, confidence intervals, as well as body fluid attribution statements by attorneys and judges. Transcript excerpts were compared to each case's respective DNA expert testimony. This allowed us to apply qualitative analyses of question and response exposition within the expert testimonies. Survey data were inputted into IBM Statistical Package for the Social Sciences (SPSS) Statistics 23 for pattern analysis and descriptive statistics. One case set contained forty random match probability statements provided by DNA experts. Many times these RMPs did not enter into the crown summations (only 37.5%), defence summations (32.5%) or judges' instructions (52.5%). When attorneys and judges did discuss and review the DNA statistical evidence, mistakes and misstatements occurred in the majority of instances – these mistakes included statistical fallacies and numerical misstatements. Our research suggests a lacunae of knowledge regarding the meaning of DNA evidence, and in particular, the correct understanding and communication of the RMP estimate of statistical weight of DNA profile comparison evidence. Further research is planned to address the use of transfer and persistence expert testimony, as well as testimony regarding complex mixture profile interpretations and comparisons.

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THE INTERSECTION OF FORENSIC SCIENCE AND THE LAW: WRONGFUL CONVICTIONS AND THE PATH FORWARD

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This presentation will examine the unique role that forensic science has played in the criminal justice system: it has both contributed to and uncovered, even assisted in correcting, wrongful convictions. The intersection of forensic science and the law will be explored, with the view to prevent wrongful convictions by advancing strategies to enhance the expert-lawyer relationship and improve scientific literacy in the courtroom. The presenters will discuss their work in the 2016 text "The Lawyer's Guide to the Forensic Sciences" and will highlight content that aims to advance the use of forensic science as a positive force in the criminal justice system. Specifically, there remains a need for the legal community to be scientifically literate to think critically about the strengths and limitations of each forensic discipline. There is also a need to better understand and improve the expert-lawyer relationship, particularly as it relates to facilitating inter-community collaboration and dialogue. Wrongful convictions are the result of a number of contributing systemic factors in the criminal justice system - a human system that strives to evaluate the reliability of the evidence before it to arrive at fair and just decisions. By addressing the needs of the individuals working within the criminal justice system, whether from the scientific or legal community, the system as a whole will be improved to the benefit of those who rely on it to impact their future.

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APPLICATIONS OF SURFACE-ENHANCED RAMAN SPECTROSCOPY ON HEADLIGHTS DYES AND DRUGS IDENTIFICATIONS

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In the past century, analytical tools such as GC, HPLC, and MS have

dominated the forensic field for sample analysis. While these techniques provide accurate measurements of forensic evidence, major drawbacks remain. First, due to low sensitivity, a bulk amount of sample is usually required when using HPLC which at times becomes a challenge when the evidence is in trace amounts. Second, while methods such as GC and MS are known for their sensitivity, they are time consuming and usually require an expert analyst. Third, the extraction or preparation of the sample for usage by these techniques can be destructive and can alter the integrity of the original sample, such as textiles, documents, and other forensic evidence, whose value or function precludes sampling. Over the past years, normal Raman (NR) spectroscopy and Surface-Enhanced Raman Spectroscopy (SERS) have been gaining attention in samples comparison, characterization, and identification. Owing to its nondestructive nature, the possibility to measure both large- and micro-sized samples in a repetitive and rapid fashion, and the high spectral resolution, NR is an effective analytical method. However, interference from fluorescence naturally found in the organic sample can sometimes obscure the much weaker Raman signal. This leads to the growing popularity of SERS, a method for enhanced sensitivity compared with NR. The SERS effect is characterized by its dramatic increase in Raman scattering intensity by six to eight orders of magnitude for species adsorbed on a plasmonic surface such as silver. SERS is being increasingly used by forensic scientists as a tool for analysis of paints, inks, fibers, mineral residues, pharmaceuticals and controlled substances. Various applications of SERS in the forensic field are presented here, including headlight dyes, stimulant drugs and some synthetic cannabinoids. For NR, simple use of a Raman instrument provides the samples' spectra; while for SERS, some simple steps of preparation are required involving the use of silver nanoparticles being placed in with the analyte and the addition of an aggregating agent. With certain NR spectra being affected by fluorescence, surface enhancement by silver nanoparticles both improves the Raman signal and suppresses the fluorescence. We present the comparisons of the NR and SERS spectra for the analytes.

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SPECTROMETRIC AND CHEMICAL ANALYSIS OF BRUISES AND DISCOLOURATIONS IN VULNERABLE PEOPLE

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The changes in chemical composition after a blunt force trauma cause a bruise to form and change colour over time. Discolourations of vulnerable people, including the young and the elderly who may not be able to speak for themselves, have been investigated using chemical and spectrometric methods to try to determine the age of a bruise. The chemicals responsible for these colour changes include oxyhemoglobin (red), deoxyhemoglobin (darker red), carboxyhemoglobin (bright red), methemoglobin (orange-brown), sulfhemoglobin (green), hemosiderin (yellow-brown), biliverdin (green) and bilirubin (yellow). Analysis of these compounds and mixtures have been undertaken using a UV-vis-NIR spectrophotometer with an Integrating Sphere at Flinders University, Adelaide, Australia and at the Far-IR beamlines at the Australian Synchrotron, Melbourne, Australia. Of particular interest is the rapid conversion of bilverdin (green) to bilirubin (yellow), as the detection of the relative amounts of these compounds may be a 'clock' that can be used to 'time' the age of a bruise. This is important in cases where there is a need to determine if an attack leading to a bruise occurred when a young child was in the custody of one parent/care-giver or another or who was on duty when an elderly or handicapped person was hit whilst in care. Analysis has been carried out on pure compounds, compounds in polyethylene pellets, compounds in polytetrafluoroethylene, compounds under skin and, using novel liquid cells at the Australian Synchrotron, compounds in the liquid state which is a truer representation of the conditions found in a real bruise. Results to be presented indicate potential spectral differences that could be used to determine the relative amounts of the chemical components that could be used as an indicator of the age range of a bruise.

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CHIRAL DETERMINATION AND ASSAY OF ENANTIOMERS IN CLANDESTINE DRUG LABORATORY SAMPLES USING LC-MSMS

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Many illicit drugs produced in clandestine laboratories exist as optical isomers, and due to their differing pharmacological properties, it is necessary to determine their respective amounts in a sample. Furthermore, the chemical signature of a clandestine laboratory sample could yield information about possible synthetic routes and product origin. The aim of this study was to optimise a method for the chiral resolution of amphetamine-type stimulants (ATS) and subsequently validate a liquid chromatography-tandem mass spectrometry (LC-MSMS) method for their simultaneous identification and quantification. This study used a CHIROBIOTIC V2 column, which contains interactive chiral additives, to successfully resolve the ATS enantiomers. The correlation coefficients (r^2) acquired through the optimised method were determined to range from 0.9956 to 0.9989. Recovery was evaluated at two different concentrations and found to be between 78% and 102%. The method was proved to be fit for purpose as the repeatability and intermediate precision values were found to be below 2.40% and 5.18%, respectively. Five clandestine laboratory samples were analysed using the validated method and found to predominantly contain dextromethylamphetamine in concentrations ranging from 39.7 ppm to 5880 ppm. Dextroamphetamine was also identified in much smaller concentrations.

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INSIDE KNOWLEDGE OF THE FACTORS INFLUENCING FINGERMARK DETECTION

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Fingermark detection research mostly focuses on improving sensitivity and selectivity of detection. This is usually performed through the development of new techniques to provide alternatives to or improve current methods. While this endeavour is important to explore and pursue, it fails to address the underlying fundamental question: what are the main factors that affect the detection of a latent fingermark? There has been significant research that has examined the differences between techniques, the effects of donors and the age of the fingermark, as well as the composition of the fingermark residue. However, these studies tend not to focus on determining the effect these factors have on the quality of the developed mark and the overall efficiency of the technique.

Through the development and evaluation of over 14,000 fingermarks, this study examined the effect of substrate type, age of the mark, donor variability (both inter- and intra-), depletions and finger on fingermark development. Fingermarks were deposited on four substrates (two porous and two non-porous) and developed with either indanedione-zinc or cyanoacrylate fuming and rhodamine 6G staining. Using the evaluation scale suggested by the UK Home Office Centre for Applied Science and Technology (CAST), three independent assessors graded each mark on the quality of development; the data was then analysed for trends or any other useful information. The results from this work reaffirm that the substrate (and therefore the choice of development technique) plays a major role in the number and quality of marks developed. It was found that fingermarks

were more likely to be detected on porous substrates and to also be of a higher quality than on non-porous surfaces. The effect of fingermark donor variability was also explored, with clear differences observed between donors. More interestingly, there was a strong degree of variability within donors. This research reinforces the need for further research into the fundamentals of fingermark detection in order to gain a better understanding of the techniques currently used and how to account for the variability when designing fingermark research experiments.

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RAPID DNA IDENTIFICATION OF HUMAN REMAINS: A NEW PATH FORWARD FOR THE MEDICO-LEGAL COMMUNITY

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At present there are an estimated 40,000 unresolved human remain cases within the border of the United States. These unresolved cases encompass fatalities related to accidents, murder, and natural causes. Often the bodies are in a state of decomposition that does not allow for facial recognition or fingerprint identifications. Some of the cases have potential family members who are eager to provide DNA reference samples in an effort to scientifically and conclusively identify the human remains. The majority of U.S. medical examiners and coroners do not possess the capability to accurately identify these human remains as they do not have any in-house DNA testing capabilities or budgets to initiate such capabilities. As a result, most of these medical legal offices outsource their DNA testing. The current DNA testing process can be expensive and time consuming. Rapid DNA, a portable printer sized instrument that generates a DNA profile in 90 minutes, may potentially offer an affordable solution to the DNA testing needs of medical examiners and coroners. The Massachusetts Office of the Chief Medical Examiner (MA OCME) was the first OCME in the world to purchase the Rapid DNA instrument for use in daily operations. The instrument is operational and is used to significantly expedite DNA testing when reference samples are available. With the help of the Department of Homeland Security Science and Technology Directorate (DHS S&T), the MA OCME is actively engaged with AABB to revise standards and guidelines for relationship (kinship) testing accreditation in order to accommodate the new Rapid DNA technology. A 234-page request for revisions for kinship testing accreditation was submitted in January 2017 and approved for incorporation into the revised standards. The MA OCME applied for AABB accreditation for kinship testing. During the preparation process the MA OCME conducted validation studies: novel extraction procedures for bone, kinship analysis; casework samples, concordance and reproducibility with the NetBio ANDE system. As a result of the accreditation process the MA OCME with the help of DHS S&T has developed protocols, best practices and lessons learned for the successful AABB accreditation of the Rapid DNA instrument. The methodology, policies, procedures, documents, forms and lessons learned will be presented. This presentation will offer helpful information and guidelines for other agencies seeking to successfully integrate this innovative technology for relationship testing DNA accreditation.

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RECONSTRUCTION OF OBLITERATED SERIAL NUMBERS IN POLYMERS

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The main objective of this research project is to develop a new method to recover obliterated information in polymer materials. Our goal was to provide an effective method that would allow the reconstruction of serial numbers in polymer objects of forensic interest such as firearms or automobile parts. The recovery of obliterated serial number remains an active area of research in fields such as forensic science, counterfeiting and manufacturing. Indeed, as conventional techniques for metals are not transferable to plastics, there is currently no reliable method available for polymers. Since plastics tend to replace steel and alloys as the main component of objects, there is a real need of such a technique. During the marking process of a serial number, plastic deformations are induced in the material. These deformations consist in residual mechanical strain and may still remain detectable after the obliteration even if the original marking is no longer visible. Our approach consists in using vibrational spectroscopy imaging, a non-destructive technique, to monitor the strain in polymers resulting from the marking process. This analytical technique is sensitive to chemical bonds and strain will be indicated by a shift in some spectral peaks corresponding to the affected chemical bonds. Therefore, we can use this method to study the deformations in a material and recover the obliterated information. Our experimental results first show that vibrational spectroscopy techniques allow the detection of mechanical strain in polymers. We are then able to perform the recovery of an obliterated letter with Raman spectroscopy imaging in different polymer samples such as polycarbonate, polyethylene and nylon, commonly used in the fabrication of firearms. Through cross-section experiments, we determine the detection threshold of the method. This study reveals that the color of the polymer under study (black or white) does not have a significant impact on the results. This non-destructive method demonstrates a very strong potential for direct application in forensic science and many other fields to efficiently recover obliterated serial numbers in polymer materials.

Disclosure: All authors have declared no conflicts of interest.

THE EFFECTIVENESS OF USING VOLUME RENDER FROM THE SOFTWARE INVIVO5 TO DETECT ANOMALIES IN CT SCANS OF THE HUMAN BODY

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Evaluate the accuracy to detect anomalies in the human body using 3- dimensional volume render provided by the software Invivo5.4. Invivo5.4 has the ability to recreate a 3D model of the human body from 2-Dimensional software such as, Computed Tomography (CT) scans and Magnetic Resonance Imaging (MRI), DICOM data can be loaded to provide a volume reconstruction. The software can examine soft tissue, cavities and bones, the damage to the soft tissue, and dental work. Invivo5 is relevant for medical, odonatological and, forensic purposes. Volume rendition has the ability to measure fractures or anomalies in the bones, soft tissues can be divided into coronal, sagittal and axial slices to examine certain areas of the body. The CT scans of healthy people were compared to the CT scans of two forensic cases. The two CT scans included an abdominal CT scan and a cranial CT scan. First, the two types of CT scans were compared and then, volume render was used to recreate 3-Dimensional images of the forensic cases to detect the anomalies at better precision. The software could become a new alternative in forensic medicine and for forensic pathology to understand and detect the changes caused by injury, trauma and to determine the cause of death.

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THE DETECTION OF LATENT FINGERMARKS USING LUMINESCENT METAL-ORGANIC FRAMEWORKS

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Metal-organic frameworks (MOFs) are porous three-dimensional materials formed by the coordination of metal ions to organic ligands. The physical, chemical and optical properties of these materials can be tuned by altering the metal ion and/or ligand, and MOFs synthesised by traditional methods have been used in a variety of applications, including gas storage, catalysis and semiconductor fabrication. Recently, researchers at Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO) reported that MOFs could be formed directly on the surface of printed protein patterns. Initial proof-of-concept experiments showed that luminescent MOFs could also form along latent fingermark ridges in approximately 30 seconds. Common proteins within fingermark secretions were hypothesised to promote MOF formation. The aim of the research to be presented was to evaluate and optimise the use of MOFs for latent fingermark detection. The evaluation was performed in accordance with the International Fingerprint Research Group guidelines for phase 1 (pilot study) and phase 2 (optimisation and comparison) research. Several methods of applying the MOFs to a substrate were trialled to minimise background development. Experiments were performed using fresh and aged latent, blood- and semen-contaminated fingermarks from several donors. The MOF-based method was limited in its effectiveness on latent fingermarks, but gave good ridge development on protein-rich impressions, particularly blood marks. The results of initial comparisons between routine fingermark detection techniques and MOFs will also be presented.

Disclosure: All authors have declared no conflicts of interest.

INVESTIGATION INTO THE EFFECT OF HAND SANITIZERS ON LATENT FINGERMARKS

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Hand sanitizers are commonly used by a wide cross-section of the population. There is speculation in the community that, when applied to the hands, hand sanitizers have a negative effect on fingermark secretions and deposited fingermark residues. It is believed that this may result in poor development of fingermarks. This hypothesis is not unfounded, as some hand sanitizers contain compounds (e.g. ethanol) that have been previously reported to affect concentrations of eccrine and sebaceous secretions. However, there has been no reported experimental study to test this hypothesis. Five hand sanitizers – alcoholic and non-alcoholic – were evaluated in this study. Single fingermarks were deposited (six repetitions, three donors) after using hand sanitizer and, respectively, not using hand sanitizer. One type of porous substrate and one type of non-porous substrate were used as supports for deposited marks. The following fingermark detection techniques were applied: 1,2-indanedione-zinc, ninhydrin, physical developer (porous substrate); and cyanoacrylate, rhodamine 6G, magnetic power (non-porous substrate). Comparison between hand sanitized fingermarks and non-hand sanitized fingermarks showed that the alcoholic based hand sanitizers did not result in any significant differences. The non-alcoholic hand sanitizers, however, noticiably improved the quality of fingermarks developed with 1,2-indanedione-zinc, ninhydrin, and magnetic powder. Different parameters including age of mark and time since hand sanitizer application were tested to determine the longevity of increased development quality. The non-alcoholic hand sanitized marks showed no decrease in quality when aged (up to two weeks). The time since application was determined to be the only factor which affected the quality of non-alcoholic hand sanitized fingermarks. It was hypothesised that the active ingredient benzalkonium chloride was responsible for the increase in fingermark development observed with the use of non-alcoholic hand sanitizers.

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INJURY-RELATED DEATHS IN ENUGU, NIGERIA FROM 2010 TO 2016: A DESCRIPTIVE REVIEW

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Background: Death from injuries is a major global public health problem contributing about 9% of death worldwide with 90% occurring in low- and middle-income countries like Nigeria. The objective of this study was to determine the burden and demographic characteristics of injury-related death in Enugu, Nigeria.
Methods: In this retrospective study of injury-related deaths in Enugu over a 7-year period, standardized forms were used to collect data from autopsy reports archived in the Forensic unit of Enugu State University Teaching Hospital, Enugu and a descriptive analysis of collected data performed. Limitations of this study include unavailability of ancillary studies e.g. toxicology and lack of death registration in the state. **Results:** Of the medicolegal deaths examined in the period reviewed, 1,067 (86.9%) were injury-related. The male-to-female ratio was 5.2:1. Mean age of victims was 34.2±14.3years and range was 8 months to 86 years. Most victims (56.7%) were aged 21 – 40 years while the fewest were aged ≥10 years (4.2%) and <60 years (6.7%). Accidents accounted for 568(53.2%) deaths followed by homicide 473(44.3%), suicide 5(0.5%) and unspecified 21(2%). Road traffic death (51.4%), cult/gang violence (20.8%) and robbery (14.7%) were the commonest. Suicide (0.5%) and domestic violence (0.7%) were the least. More females died in domestic incidents while more males died in all other circumstances. Persons aged 21-40 years made up 65.8% and 46.7% of homicide and accident victims respectively. Firearm (56.7%) was the most common weapon followed by knife (19%). Most cult/gang killings (68.8%) and robbery (74%) were by firearms. Knife and wood (28.7% each) were the commonest weapons in domestic violence. Two domestic accidents involved firearms use by children. All suicides were by hanging. Generally, more fatal incidents occurred in the day time (65.5%) including road traffic deaths (81.2%) and cult/gang related deaths (63.4%). Most robbery incidents (80.4%) and suicides (60%) occurred at night. Most cult/gang killings (75.2%) and robbery (81.7%) occurred in public places and at homes respectively. Full autopsy was conducted in only 11.5% of cases. For various reasons, no death from accident and only 8.2% of homicide cases is being tried in court. **Conclusion:** Injury is a significant cause of death in our environment both in number and manner. Effort to curb it appear insufficient. There is need for definitive policy on the management of injury-related deaths.

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LATENT FINGERPRINT RECOVERY FROM CANADIAN POLYMER BANKNOTE SUBMERGED IN WATER

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This study was undertaken to visualize latent fingerprints on the Canadian polymer bank notes submerged in clear and muddy water for different time periods. The fingerprints were developed using fluorescent powder IR Natural 1, Supra Nano powder and a new modified mixture of powders. The results indicate that the sebaceous latent fingerprints on the bank notes left underwater up to eight weeks can be easily recovered from

all the areas of the bank notes, with these powders but the quality of fingerprints recovered by using IR natural 1 powder was much better as compared to other powders. We were able to recover the fingerprints even from the bank notes left under muddy water up to four weeks by this method. This work provides a quick and easy method to recover and visualize the sebaceous fingerprints from the polymer bank notes.

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VEHICLE-PEDESTRIAN ACCIDENTS IN THE BRAZILIAN FEDERAL DISTRICT: A COMPREHENSIVE STUDY

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The high incidence of vehicle-pedestrian collisions makes these events one of the most important public health problems. It results in high social security expenses, elevated economic costs and creates problems related to property damage, besides to causing physical injury and suffering to the victims, their relatives and the society as a whole. Only in the Brazilian Federal District (BFD), where is located Brasília (the Capital of Brazil), there were, between 2012 and 2014, 365 fatal vehicle-pedestrian accidents, being that in 127 the victim was positive tested for BAC and/or illicit drugs. Concerned with this alarming percentage of death pedestrians involved in drugs (licit or illicit), the objective of this work is to analyze these data and to propose solutions that reduce the number of deaths and damage to Brasilia society. Data were collected from the Civil Police Department of the BFD documents: police reports, accident reconstruction and medical legal reports. Statistical tests revealed the determinant factors that caused these sorrowful events, being the main: the first days of the month; the weekend days; between 18h - 23h59; in dry surface condition with double lane roads; with 60 km/h and 80 km/h of road speed limit; the drivers' age between 18 - 24 years old, male and married; the victim's age between 25 - 49 years old, male, brown skin, single, weight 51 - 60 kg, height 1.61 - 1.70 m, with a Body Mass Index smaller than 18.5 kg/m², dressed with dark clothing and a BAC between 1.3 and 4.0 g/l. In addition, this study mapped areas, from GPS data, with the highest incidence of pedestrian accidents in order to elucidate the determining factors and, thus, many improvements can be suggested in these hot spots and delivered to the public security organs, so, could reduce the number of crashes in these areas. Finally yet importantly, multivariate statistical analysis was done to identify relatively homogenous groups of cases based on selected characteristics in order to find the most important factors in vehicle-pedestrian collisions. The results from this research can provide a basis to guide the creation of prevention strategies and/or potential interventions and contribute to the planning of public policies and actions to be taken in the BFD.

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CONCENTRATION OF HYPOXANTHINE IN KOREAN VITREOUS HUMOR FOR THE ESTIMATION OF POST-MORTEM INTERVAL

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In the field of forensic pathology, many studies have been conducted to estimate the post mortem interval (PMI) for very long time. In order to choose the biomarkers for PMI, concentrations of Hx, uric acid and lactic acid in Vitreous Humor were measured in this study by using Tandem Mass Spectrometry (LC-MS/MS). The hypoxanthine (Hx) is the terminal stages of purine catabolism in man and known to be highly correlated to PMI. A vitreous humor was collected from cadaver with a known time of death at the National Forensic Service (NFS) in Korea. Ten corpses (6 male and 4 female) with a mean age of 50.7 years (range, 27-72 years) were studied. Vitreous Humors were extracted by a solid-phase extraction with OASIS MAX cartridges. Agilent 1260 infinity HPLC system and Sciex 3200 Q-trap mass spectrometer were used for the quantification of Hx, uric acid and lactic acid in vitreous humor. Chromatographic separation was performed by using 0.1% formic acid in water and methanol as mobile phase. The multiple reaction monitoring (MRM) of ion transitions monitored was m/z 137.0 > 110.0, 119.0 for Hx, 166.9>124.1 for uric acid, 89.0>44.0 for lactic acid and 5-(p-methylphenyl)-5-phenylhidantoin 267.2>163.3 as internal standard (IS). Hx, uric acid and lactic acid were selected as biomarkers for estimation of PMI in this study. Lactic acid and uric acid were detected in all samples. Analysis of 10 vitreous humor samples revealed that the concentration of Hx ranged from 100 μM to 400 μM. Comparing Time after death with Hx concentrations, it was noted that the longer the Time after death the higher the concentration of Hx in Vitreous Humor. The difference in HX concentration between gender and age was not observed. The correlation between the concentration of Hx and time after death will be very useful information for the estimation of PMI.

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EXCESSIVE FUMING WITH CYANOACRYLATE FOR THE DETECTION OF LATENT FINGERMARKS ON POLYMER BANKNOTES

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Polymer banknotes constitute a problematic, semi-porous substrate for latent fingermark detection. Early research in Australia indicated that conventional cyanoacrylate (CA) fuming plus the application of a luminescent stain was only successful for developing relatively fresh fingermarks, up to around two weeks of age. A more detailed study found that a sequence consisting of CA fuming, vacuum metal deposition (VMD), and application of a luminescent stain produced the best results, particularly for older fingermarks, and this process was implemented operationally by the Australian Federal Police (AFP). Recent research in Canada, on Canadian polymer banknotes, confirmed that this sequence was the one recommended for fingermark detection on this substrate. However, operationally, arranging for the VMD treatment of a significant number of banknotes can be problematic and time-consuming. For this reason, AFP examiners undertook a preliminary study to determine if excessive CA fuming followed by application of a luminescent stain could give acceptable results in the absence of VMD treatment. Surprisingly, good results were achieved; however, in some instances, reverse development was observed (i.e., dark ridges against a light background). A more detailed investigation of excessive CA fuming on polymer banknotes was subsequently undertaken and the results will be presented. While the excessive fuming method was found to develop good ridge detail in some instances, it was highly dependent on the condition of the banknote (e.g., uncirculated versus heavily soiled due to normal circulation). The use of one-step luminescent CA fuming techniques was also assessed as a possible alternate approach for this substrate.

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MISCARRIAGE OF JUSTICE & WRONGFUL CONVICTION - A CASE PRESENTATION

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Instances of miscarriage of justice and wrongful convictions for erroneous and insufficient reporting on medico-legal cases by Forensic Pathologists

are not unheard of. Needless to overemphasize the slogan ' let hundreds of true criminals go to prison for their wrong doings but not a single innocent person'! The present case is about a young eccentric individual who was charged initially for allegedly beating and inflicting injuries to his grandfather, an elderly man in his eighties and causing death of the latter. Subsequently after a few years, based on a review of the autopsy findings, the injuries in particular in addition to the pre-existing morbid heart condition of the elderly victim, there was a 'not guilty 'verdict pronounced by the Apex court leading to the young innocent man's acquittal ! Of a special note, the victim had to be hospitalized for a massive heart attack a few days before his sad demise. He was discharged from the hospital just the day before his death when he suffered another such cardiac arrest at his home, rolled down the stair-case and thus sustained a few injuries including lacerations to his back of head. He was unresponsive at this time and was rushed again to the casualty wing of the hospital and was subjected to 'Cardio-Pulmonary Resuscitation' during which a few of his ribs were fractured and the 'liver' was lacerated. The above injuries during the autopsy were misinterpreted as 'homicidal' and attributed to the erroneous causation of death in the victim. The victim's cardiac pathology was overlooked during the autopsy! But a later review of the autopsy findings especially the morbid heart condition and the victim's recent hospitalization for a cardiac catastrophe with concomitant 'CPR' assisted the Apex court in the right direction leading to an eye opening exemplary judgement and could avoid a wrongful conviction!

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STRENGTHENING FORENSIC SERVICES IN FORENSIC IDENTIFICATION IN CONTEXTS OF WIDESPREAD VIOLENCE

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The International Committee of the Red Cross (ICRC) is an impartial, neutral and independent organization which is working in accordance with and promoting International Humanitarian Law in favour of victims of armed conflicts, other situations of violence and catastrophes, among them the Missing and the Dead. The ICRC forensic experts participate in activities worldwide related to the promotion and implementation of scientific best practices on the management of human remains and identification of the dead This presentation aims to create a better understanding in the forensic community of the challenges that forensic services face in countries with extremely high rates of violence, particularly in forensic identification, and of ICRC's holistic approach to strengthening their abilities to respond to the large numbers of unidentified bodies and families searching for their loved ones. In Central America and Mexico the rates of violence, including homicide and disappearance, have increased exponentially in the last two decades, as is clearly visible in the annual statistics. Also, there is an increase in the complexity of cases, such as dismemberments, massgraves, use of fire, acid etc. This increase, combined with a lack of resources, has put enormous stress on the medico legal services of the affected countries which were prepared neither for the caseload, nor for the challenges of identification which come with such situations. Due to the lack of required resources and capacity, many bodies remained unidentified and their families without information on the fate of their loved ones. In 2012 the ICRC started supporting forensic services in Honduras, El Salvador, Guatemala and Mexico. Initial limited activities of support and assistance, have since then developed into comprehensive programs. These programs encompass a wide range of support, from refurbishing family reception areas, training for personnel in antemortem interview techniques, forensic capacity building, development of data collection forms and protocols, data management systems, self-care and stress management for morgue personnel, morgue infrastructure and burial niches for unidentified remains. While the challenges are many and a long term sustainable strengthening takes time, some significant improvements are being made. With examples from the above mentioned countries, this presentation will illustrate advantages of applying a comprehensive and inclusive approach to support and capacity building.

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THE SCREENING ERRORS OF COCAINE PRESENCE IN HEROIN SAMPLES & PHARMACEUTICALS.

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Suspected illicit samples are routinely submitted as forensic evidence and preliminary screening usually involves the recital of recommended color tests as initial screening tool to identify their presence so that further analysis may be continued till their confirmation. Cobalt thiocyanate reagent is most primarily recommended spot test for the cocaine presence. Like Cocaine, Chlorpheniramine also produced blue color with cobalt thiocyanate reagent present as a cutting agent in powdered Heroin samples, suspected narcotic injections and other pharmaceutical dosage forms that could be mistakenly interpreted as the presence of cocaine. The color developed with chlorpheniramine was shifted to chloroform layer (bright blue) in order to separate it from aqueous phase that also happened in case of cocaine developed coloration (greenish blue) with cobalt thiocyanate. Both colors were highly distinguishable. Further using this coloration, the method for quantification of chlorpheniramine using spectrophotometry was developed. Chloroform extract of chlorpheniramine showed λ_{max} at 628nm which was also different in case of cocaine coloration. The linearity range for chlorpheniramine was 25µg/ml-125µg/ml, limits of detection (LOD) and quantification (LOQ) for chlorpheniramine were 8.0µg/ml and 15µg/ml respectively. The commercially available chlopheniramine pharmaceutical dosage forms were randomly purchased from different pharmacies and evaluated for their active ingredient according to their label claim for quantitative estimation. Drug recovery was attained by basic extraction mechanism. So Chlorpheniramine's presence in sample can divert the forensic analyst attention by giving a false positive color test but this error can be copped up by performing further step of color transfer to an organic layer to separate drugs belonging to two different classes of drugs which are using same colorimetric reagent.

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CHILD SUICIDE IN THE OUTSKIRTS OF MAPUTO

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Albert* was a 09 year old boy whom recently moved to Mozambique's capital, Maputo, together with his mother, stepfather and a soon to be born, brother. The family lived in a compartment in the backyard of a large house, next to two other compartments in which another family lived and an elderly man lived by himself, in the third compartment. Albert's parents separated in 2012 and since then, he lived with his mother, whom embraced a couple of informal businesses for their living. The move to the capital city envisaged a better life for the whole family. However, the stepfather struggled to find a long-term job, the mother did some errands for neighbours to help with the bills and Albert was still not attending school due to the financial struggle. In a sunny morning of August 2016, Albert was in the company of his mother in the backyard when both heard the baby cry inside the compartment. The mother rushed inside to attend the crying baby and left Albert playing next to the trees. On her return she was shocked to find Albert hanging in one of the trees. As to his behaviour, both stepfather and uncle spoke nicely of Albert, whom had been a well behaved boy, not known for having any deviant nor awkward behaviour. His body had no signs of physical nor sexual abuse. International literature refers that youth suicide is significantly more frequent than child suicide;

in Mozambique only recently studies were made towards capturing suicide rates. Youth suicide is much lesser than adult suicide and child suicide barely has any statistical meaning. Depression, anxiety, anger, self-aggressiveness, tension, isolation, fear of not being able to succeed in the future, family and or peer pressure, guilt, shame, are usually the underlying factors for suicide attempts especially during youth. Would any or some of these be the causes for Albert's despair? Changes in behaviour patterns during childhood are usually easily noticeable by the surrounding family and peers but mostly seen only as tantrums it probably goes a long way without getting proper attention. Even in the form of attempt, suicide is a matter of public health that should be dealt with in a meticulous way by any society especially taking measures towards its prevention. *Fictitious name

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SHOULD MICROSCOPIC SLIDE INTERPRETATIONS OF INTRACRANIAL INJURIES BE ADMISSIBLE?

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Microscopic interpretation of human tissues in health and disease is a skill that is limited to a small fraction of professionals in forensic medical science, mainly pathologists. Among pathologists, expertise varies widely, both individually and as a function of specialization. Since the fine details of microscopy are foreign even to the majority of physicians outside of pathology, it is reasonable to conclude that judges, lawyers, and jurors cannot independently evaluate the reliability of conclusions that may be asserted as regards microscopic pathology. As an additional challenge to systems of justice, microscopic interpretations, already inherently subjective, are used to assert timelines, the implications of which are obvious. Timing of intracranial injuries is particularly problematic, given its specialized nature and superficial understanding. Seven cases of homicidal abusive head trauma are presented as cases in point. In each case, the forensic pathologist who performed the autopsy concluded that the timing of the injuries was consistent with the timing of the collapse reported in the investigation. Also in each case, a retained defense expert or experts in forensic pathology opined an extended timeline based on their microscopic assessment. One noteworthy case was reviewed by multiple experts both primarily and retained by the defense, who collectively indicated timelines ranging from less than 12 hours to 4 weeks. This range was opined based not only on the same case, but upon review of the same microscopic slides. While differences of opinion are expected, the extreme degree of malleability of microscopic interpretation, its vulnerability to cognitive and other biases, and the ease with which it may be exploited to "prove" hypotheses, may not be appreciated non-pathologists. It is also not generally appreciated that timing of intracranial injuries based on microscopic pathology has never been subjected to rigorous controlled, blinded analysis. Thus, as regards factors considered in *Daubert*, timing of intracranial injuries by microscopic examination has not been rigorously tested in actual field conditions, has not subjected to peer review, has no known potential error rate, and there are no rigorous standards for its application. It therefore remains an open question as to whether microscopic interpretation of intracranial injuries, and assertions about of timing of those injuries based on microscopic assessment, should be admissible in court.

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A FATAL CASE OF PODOSTROMA CORNU-DAMAE POISONING

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There are a lot of unknown natural toxins which were suspected to cause serious damages to the dead in autopsy cases. Without reference materials, it was almost impossible to identify the suspicious natural toxins by GC-MS or LC-MS. A man had drunk mushroom-liquor with meal in his house. After 7 hours, he was transferred to emergency room and died 12 hours later. In the ingested infused mushroom-liquor, some pieces of mushroom were found and they were estimated to be *Podostroma cornu-damae (Hypocreacea)* from their morphological characteristics. To confirm the species, chemical component analysis was conducted using LC-QTOF/MS system owing to the absence of reference materials. LC-QTOF/MS could measure the exact mass and the chemical structure of target compound can be also confirmed by MS/MS fragmentation. From the analysis of the mushroom, toxic trichothecenes type compounds were identified; satratoxin H, satratoxin H 12´,13´-diacetate, satratoxin H 12´-acetate, satratoxin H 13´-acetate and verrucarol. From autopsy, heart blood, peripheral blood and stomach contents were collected and only satratoxin H was found, which the first reported finding of satratoxin H was in human biological sample. LC-QTOF/MS system is proven to be an effective method for mushroom intoxication cases in the absence of reference materials. Also, the experiences, knowledge and analytical methods we obtained in this study would be a great asset to solve other possible natural toxin intoxication cases.

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THE PARAMETERS OF EYE-TRACK IN PATIENTS WITH MENTAL DISORDER DUE TO BRAIN DAMAGE

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A lot of research had studied the features of eye movements in normal subjects, however, it was unclear in people with mental disorder due to brain damage. Our research mostly explored the character of eye behavior in the special objects that suffered organic mental disorder, and compared their difference in cooperative and exaggerative or fake situation. Our results shown that:1. the eye parameters were different between normal control and patients with mental disorder due to brain damage, the difference could be presented in the eye behavior of blink, saccade and pupil size. 2. The paramaters of eye behavior could be affected by the patients' cooperation, especially in some peocess of forensic evaluation. for patients with good cooperation, their pupil size were different from that with poor cooperation, and the difference was significantly positive in statistics. some other eye behavior, such as blink, fixation and saccade, they also had some significance difference between good and poor cooperative patients, but their specificity were lower than the pupil size.

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REPORTING OF UNNATURAL DEATHS OF FEMALES IN THREE NEWSPAPERS - A QUALITATIVE STUDY FROM SRI LANKA

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According to the code of ethics for journalists in Sri Lanka, every journalist is expected to respect the reputation and privacy of individuals. They are expected to refrain from reporting or printing or publishing any information as well as commenting on an individual's private life and identity. Unnatural deaths of women and girl children are often a subject of speculation especially when due to external causes such as injury/trauma or where

the manner/circumstances of death are homicidal/suicidal/accidental or undetermined. A qualitative study was carried out by examining selected newspapers with the objectives of 1) describing the coverage of unnatural deaths among Sri Lankan women and girl children, and 2) considering whether newspaper coverage adhered to the code of ethics for journalists. It was based on the content analysis of newspaper articles reporting deaths of women and girl children over a period of six months (September 2016 to February 2017) in three national newspapers published in Sinhala, Tamil and English. A majority of news reports on the subject deal with road traffic accidents followed by suicides and homicides. The title of "woman runs over at pedestrian crossing", "woman dies in accident", implies road traffic accident however other types of accidents such as "woman drowns while taking selfie on eve of university admission", "Woman dies during exorcism ritual to get rid of demon" were also seen during the study period. Titles such as "teen girl commits suicide", "Ukrainian woman hangs herself", "woman hacked to death" clearly indicate suicidal or homicidal circumstances, but titles such as "illicit love affair ends in tragedy" "Gunshot fired at house; a woman dead, three injured" leaves the reader to speculate the circumstances. During the study period, 115 newspaper articles were perused and findings deal with the reporting content and styles of the three newspapers. These include the length, degree of factuality, opinion and embellishments vis-à-vis reportage; and the level of emotiveness and sensationalism of articles. Moreover, the study discusses the ways in which the code of ethics for journalists are being breached by these three newspapers.

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THE GROWTH AND DEVELOPMENT OF LUCILLIA AND CALLIPHORA SP. IN THE PRESENCE OF A RANGE OF DRUGS

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Entomological evidence can be a powerful tool in forensic investigations with uses ranging from drug detection through to the location of a crime. One of its most important and frequent uses however, is in the determination of post mortem interval (PMI). Pathologists will use techniques such as rigor mortis, algor mortis, livor mortis and core body temperature for PMI determination but this is only effective up to around 72 hours at most. As long as they are accessible however, bodies will be infested with anthropod species, and blowflies in particular, soon after death. An understanding of the life cycle of the blowflies allows for reasonably accurate PMI determination as long as known variables such as temperature are taken into account. There may however be unknown variables that can affect the life cycle and that may lead to incorrect calculation of PMI. These factors could include drugs within the body which could affect the number of insects, the time of oviposition and how long it takes to go from one developmental stage to another. In previous studies the range of drugs was small and some of the results were contradictory. Given the numbers of known drug related deaths (see table 1 for figure in the UK between 2008-2012), it would be useful to have more detailed knowledge of the potential consequences of drugs on anthropod behaviour relating to PMI determination. In this presentation, we will discuss results from both Lucillia sp and Calliphora sp, common blowflies know to infest remains during the first two waves of colonisation. All of the drugs tested (paracetamol, aspirin, barbituates, amphetamine and caffeine) showed some effect although this was not always significant at the same level and was dependent on species and substrate. The results indicate the presence of drugs could impact accuracy of PMI determination.

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SERIOUS VIOLATIONS OF HUMAN RIGHTS AND INTERNATIONAL LAW IN GAZA 2014

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The armed conflict in Gaza of 2014 led to accusations of serious violations of human rights and international law. Two teams of independent medical experts were sent into the Gaza Strip on fact-finding missions (FFM) to gather and document information during real-time war and shortly after a cease fire in this first published report of events from the 2014 war. The professional account of public health, medical care and civilian safety raises issues requiring further in-depth, objective investigations. Forensic pathologists and physicians from the fact-finding teams examined surviving patients in West Bank hospitals and analyzed their injuries to determine the types of trauma. In addition, 370 descendent photographs (from a minimum of 75 cases) were analyzed from the Gaza Forensics Department photo archive. General impressions from the examination of these photographs and the survivors were that the majority of deaths were due to injuries sustained by explosions. The majority of the decedents suffered multiple injuries from various types of trauma including burns, blunt trauma and perforation injuries (one decedent). The injuries were not indicative of a specific type of explosive ammunition. Large numbers of civilian casualties (up to 70%) resulted from lack of or ineffective warnings of targets, lack of safe passage or location to shelter. These issues led to the feeling of no safe place for the general population. Protection granted to medical teams, hospital staff and physicians was seriously compromised by specifically targeted attacks on these medical teams and facilities. Human rights violations were documented in Khuza'a including the use of civilians as human shields, humiliation and torture, denial of medical care to obviously injured persons and use of lethal force in civilian homes. The long-term medical, public health and psychological impacts of the 2014 war represent a monumental challenge for the people of the Gaza Strip for many years to come. With the fact-finding members, the Physicians for Human Rights-Israel have called for an independent investigation in an attempt to prevent further hostilities leading to life-altering devastation.

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ANALYSIS OF NOVEL HUMAN SEX DETERMINATION GENES

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Human sex determination is a very important investigative tool in forensic science. Historically and up to the present date, amelogenin and sex determining region Y have been the genes targeted using the polymerase chain reaction (PCR) to determine the presence of a Y chromosome in an unknown sample of DNA. Amelogenin sequences are part of the microsatellite-based Human identification systems CODIS, SGM+ and DNA 17, currently commonly used around the world. In these kits the detection is based on AMELX and AMELY sequences which are similar in DNA sequence but located on different chromosomes (X and Y). However in some rare cases and with certain populations these methods are not always fully reliable. Using the data available in the literature we designed a new set of amelogenin primers to be used with quantitative PCR (qPCR), avoiding if possible the common sites for deletions on AMELY. As the system is quantitative, it gives an estimation of the X:Y ratio, which could be useful for mixed profiles. Furthermore, using the Human X and

Y chromosome sequencing data and bioinformatics, we selected over 50 novel candidate gene pairs similar to AMLEX and AMELY, of which fifteen were chosen for further investigation. The aim was to produce sets which would provide size differences detectable with gel-based systems and qPCR, in addition to the conventional fluorescence-based detection on automatic sequencers. These candidate pairs were further narrowed down in silico to seven PCR-primer sets. The preliminary results obtained suggest that some of the new primer sets, such as Thymosin Beta 4, are at least equally reliable as amelogenin-based sex detection, and some appear to be more sensitive than the currently used alternatives. In addition to the obvious forensic uses, these new candidates could therefore be useful for sex determination applications in clinical genetics, i.e. hospitals, also providing fortification of results based on amelogenin only. These potentially could also provide quick and inexpensive results when used with portable forensic equipment.

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THE SCIENCE BEHIND HIGH-PROFILE HISTORIC COLD CASE JACK THE RIPPER

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The Jack the Ripper murders have fascinated the world for more than 125 years. The case still has a massive following around the world; there are dedicated Ripper-societies and a considerable commercial interest. Every year new books and documentaries appear on the market, with old and new suspects. The wildest suspect candidates in popular literature include extra-terrestrial invaders. However, these were serious and real murders in 1888 and to our knowledge very little scientific work has been conducted, and not a single peer-reviewed paper have been published regarding any biological or physical evidence. With our research we have tried to see how far we could stretch the science in a historic case like this: by analysing arguable the only existing piece of evidence linked to the murders. This work is based on a shawl which was allegedly found from the murder scene of Catherine Eddowes. Some of these findings were used in a recent book which caught massive media attention in September 2014; however the book in question was aimed at the general public. In this presentation we will provide "behind the scenes" information regarding the scientific work and showcase the novel approaches we used which have relevance to forensic investigations in general. These include a novel sampling method to avoid surface contamination, application of Laser Capture Microdissection (LCM) to isolate single Human cells from evidence and Whole Genome Amplification (WGA) of LCM captured Human cells. In addition to mtDNA haplotype sequences of both alleged victim and suspect, we determined the hair and eye colour from genomic DNA which was WGA-amplified from the captured single cells using a custom SNP-based "Irisplex" system. Ethical issues regarding the descendant of the victim and suspect will also be discussed, as well as recent developments of the project.

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FORENSIC ANALYSIS OF GLASS FRAGMENTS BY LA-ICP-MS METHOD. SAMPLING AND GLASS CORROSION ISSUES

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Glass is commonly used for production of different items, such as windows, windshields, bulbs, bottles and jars. Glass fragments can be revealed at the crime scene and on the clothes of perpetrator and victim. Therefore, information about elemental composition of glass is important for identification purposes. The trace elements content appears to become essential for solving the comparison or classification problems of glass fragments. The method which is capable for delivering information about trace elements content, without sample preparation is Laser Ablation - Inductively Coupled Plasma - Mass Spectrometry (LA-ICP-MS). The method provides a specific information from very small area of glass fragments (from areas with diameter about 25 μm) and allows also for analysis of composition of different layers of the glass. Thus, it is important to apply proper sampling strategies. External layers of the glass is sensitive to humid or non-chemically neutral environment. Therefore, forensic experts should take into account possible changes in composition of glass when comparative material from suspect was not recovered and collected at the same time as glass fragments from the crime scene. The aim of the research was to verify the importance of heterogeneity and corrosion changes of glass samples on results obtained from LA-ICP-MS analysis. Elemental composition of green, brown and transparent container glasses and transparent float glass was determined by LA-ICP-MS. External calibration with matrix-matched standards, together with internal calibration was applied. Research shows that LA-ICP-MS is capable for deliver information about local composition of external and internal layers of the glass. Big differences in some elements (titanium, tin, strontium, copper) content were detected between both sides of glass samples. This confirms that heterogeneity of glass should be taken into account within interpretation of the results. Such additional data on recovered glass fragments can increase the evidential value of results from chemical analysis. The study also shows that analysis in the point mode with repetition rate equal to 20 Hz is suitable for bulk analysis and results are not affected by external thin layers of glass. The results indicates also that composition of glass samples stored in acid and humid conditions (in water or 100% rh) for one year is only slightly affected by corrosion processes. Thus, LA-ICP-MS analysis provides proper data for forensic comparisons.
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DEVELOPMENT OF COMPUTER-GENERATED IMAGES AS A STANDARD FOR COURTROOM INJURY PRESENTATION IN ONTARIO

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Viscera Technologies (VT) is setting the standard for the development of Computer-Generated Images (CGIs) for the courtroom presentation of injuries in Ontario. Through a flexible and unique methodology, we have developed a system that can efficiently and cheaply produce 2D and 3D images and animations from Autopsy Photographs and Body Diagrams. The existing literature has shown that the graphic nature of post-mortem photographs can introduce bias against defendants by jurors. In homicide trials, members of a victim's family are often present in court and the public display of the crime scene and post mortem photographs of the decedent's body with images will be a traumatic experience for them. Body diagrams serve their purpose in recording findings during a forensic investigation, however they are limited to static, pre-defined views of the body and often lack the visual clarity sought in a courtroom presentation, and fail to convey critical information about internal wound tracks and subsequent damage to internal organs. VT was approached by a forensic pathologist in Ottawa who had experience with this modality in the U.K. to partner with, develop and introduce CGI into Ontario Courts as a routine modality of injury presentation, in preference to autopsy images for the stated reasons. Use of CGIs as a standard modality had not previously been considered in Ontario and its introduction is revolutionary. Through this collaboration, VT has developed the automated capability to process post-mortem photographs, body diagrams and case notes to deliver accurate and authentic digital 2D and 3D images that inform without bias. Viscera offers forensic pathologists, prosecutors and defense counsel, coroners, medical examiners and other death investigators a valuable tool for creating and delivering high-quality, effective and unbiased forensic visuals for courtroom use. To date CGIs produced by Viscera have been used successfully in one criminal trial in Ontario (Belleville) in December

2016, and interest in it is growing. This presentation will cover the history of Viscera's development as an automated tool for producing graphics by exploring some major challenges, including: determining accurate models to capture and reuse information to rapidly recreate images, creating accurate wound mapping and tracking systems, extracting pertinent information directly from wound descriptions and autopsy diagrams, and creating a scalable library of 3D models including body parts and different wound types. In addition, we will discuss some of the broader applications for this tool, including non-courtroom settings.

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IMPROVISED EXPLOSIVE DEVICES - A TREND

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In the present day of worldwide Terrorism, improvise explosive devices are the weapon of choice for mass destruction of life and property and for creating terror amongst common man. The use of Improvised explosive devices has become common to achieve their ulterior motive. In the recent past Terrorists/ militants are continuously making efforts to improve explosive devices in order to strengthen their crime operation without being noticed. Improvised explosive devices range from simple to highly sophisticated one--but either way they demand skilled experts and up-to-date knowledge of the IED's. Almost all the criminal cases involving IEDs/ explosives are related to terrorist acts. Increased threat of terrorist's acts is now an issue of national and international importance. Therefore, it has to be tackled at all fronts and in this context the role of forensic scientist has become vital. Terrorists of all nationalities adopt similar tactics. In today's terrorism, the outside powers and their agencies are playing a significant role by providing highly skilled leadership and ideological motivation to the terrorists. I n addition, they provide finance, training, equipment, and intelligence etc. The author studied the Trend of IEDs based on finance, availability and other factors which is of great help to law enforcement agencies and will discuss in detail during the presentation.

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THE CHEMICAL COMPOSITION OF SOILS AS A NOVEL METHOD FOR LOCATING BURIALS

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One of the problems of a growing population is the potential for high pollutant loads on soil, especially when the land has to be re-used for another purpose, for example changing from a cemetery to recreational or housing purposes. This initial use may alter soil components, both chemical and biological, following interment of bodies. Soft tissue is quickly lost during decomposition but the bone may remain for many years. There is some understanding of the pathways involved in bone decomposition, but the information is still lacking regarding the chemical interactions of bone with the soil environment. Understanding these interactions could assist in further understanding of the bone decomposition pathways as well as locating the presence of older skeletal remains which would be otherwise difficult to locate due to heavy decomposition of the bone material. Little work has been done on the detection of older buried remains, apart from attempts using ground penetrating radar, magnetometry, electrical resistivity, and geophysical technology, with limited results. Techniques such as electrical resistivity has shown some improved results, but needs experience to use. The objective of this study was to characterise how the use of land as a cemetery affects the chemical composition of the soil surrounding the burial sites. In the Liverpool cemeteries studied, human remains were reported to be completely dissolved within 20-30 years post interment although this cannot be verified by our work. Using standard chemical analysis techniques it was hoped to gain some understanding of the interaction of soil and body. The sample sites were selected from municipal cemeteries and allowed the analysis to extend from 10-150 years post interment. Soil samples (N=132) collected from two Liverpool municipal cemeteries were subjected to X-ray Fluorescence analysis in order to analyse the levels of elements in various depths at and around the burial sites. The results demonstrated clear, systematic alterations in soil element composition caused by the dissolving bodies. The data acquired from this project can give a valuable insight into environmental pollution and for the re-use of the land. Furthermore, the information acquired could also be used to assist the location of modern and historic burial sites.

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THE USE OF MICRO-ORGANISM PROFILING FOR DETERMINATION THE CAUSE AND LOCATION OF DEATH BY DROWNING

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When determining drowning as a cause of death, the basis of the diagnosis would normally depend on pathological findings from the post mortem, which may include laboratory tests along with external physical signs and environmental characteristics. It is notoriously difficult to diagnose with certainty as many of the symptoms, such as Emphysema Aquosum, overweight lungs and fluid extruding from the nose and mouth, can be infrequent and can be dependent on many variables. They are also not specific to drowning and can be found in other situations. Therefore the diagnosis relies heavily on laboratory testing including histological tests and diatom analysis. Alongside this, the type and source of water that the victim fatally ingested is also hard to determine, due to the fact that water from different sources have not been sufficiently analysed and studied to give a full bacterial and phytoplankton profile at the level required. Currently one of the most used and recognised laboratory techniques for determining death via drowning is the use of diatom testing, however it has been previously reported that diatom based methods should be used with great caution as it is possible for false negative results to be obtained. To overcome this problem we quantitatively determined 16S rRNA bacterial "signatures" or "fingerprints" of water profiles from various aquatic sources, including several fresh and marine water samplings. Multiple biological and technical replicates were sampled and the method applied used species-specific oligonucleotide primers designed in-house for Quantitative Polymerase Chain Reaction (qPCR). This approach allows not only detection of the quantity of the bacteria but also QC control of the specificity of the reaction using High Resolution Melt (HRM). The data demonstrated clear and reproducible differences in micro-organisms content between the water sources. For more extensive coverage of species, Next Generation Sequencing (NGS) of the aquatic microbiome has been planned to identify more signature species. The ability to determine the type of water ingested could help to aid in identifying the location of death. The results suggest that these data could provide a valuable insight of bacterial spectrum in common aquatic environments, applicable for forensic use.

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THE RE-DEVELOPMENT OF THE MISSISSIPPI STATE MEDICAL EXAMINER'S OFFICE

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The goal of this presentation is to show how the development of a structured State Medical Examiner system has improved medico-legal death investigations throughout the state of Mississippi. This presentation will impact the forensic community by showing how an unstructured medical examiner system has improved the quality of the forensic

pathology services throughout the State of Mississippi. For over thirty years, the state of Mississippi contracted with non-board certified pathologists to provide autopsy services to the coroners, law enforcement and District Attorneys in order to assist them with medico-legal death investigations. This arrangement resulted in numerous false convictions leading to appeals. Many cases were reopened and overturned due to the efforts of the Mississippi Innocence Project. The core of the problem was untrained and unsupervised pathologists tailoring their reports and testimony to support the expectations of law enforcement and district attorneys in order to obtain convictions. The majority of the examinations were performed in local funeral homes with substandard facilities. This deficiency compromised documentation of findings, collection of evidence and chain of custody. Further, two different pathologists reportedly performed a total of approximately 1800 autopsies per year under these conditions. This total is unfeasible given the complexity involved in cause and manner of death determinations. The state of Mississippi finally recognized the need for a structured State Medical Examiner's System. Since 2011 the state has hired only board-certified forensic pathologists who perform medico-legal autopsies in a new, state-of-the-art facility. While the quality and continuity of autopsy services has dramatically improved, we continue to battle funding and staffing issues.

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DETERMINATION OF PEN INK RESINS BY THERMAL DESORPTION AND GAS CHROMATOGRAPHY-MASS SPECTROMETRY

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Objective: The documents like writing, photography, painting, film which are witness to truth, defined as document; this subject is used in forensic science as a written or printed source, to show of a reality or the accuracy of an assertion. Inks, which are on document, have their own profile and own characterized by chemicals, are described commonly by rooted methods. General and in a simple way, manuel authoring tool of the inks occur from one, or more solvents, one, or more resins, a colorant or a coloring substance with a mixture of a carrier or by any means. **Materials and Methods:** In the most recent publications the authors use GC-MS with thermal parsing technique to examine the properties of the solvent of ink, binding resins, and adhesive substance. In this study, to get more accurate result and to prove the applicability, the research is done with 20 different brands of ballpoint pen. 10 black and 10 blue ballpoint pen are examined by Thermal Desorption and Gas Chromatography-Mass Spectrometry. This study's purpose is to uncover of the characterization of questioned document inks which are available on document. The three main components to be examined, these are solvents, colorants, resins. Initially, the method have been developed by TD-GC/MS to analyze liquid, gentle, and natural or synthetic high molecular weight substance, the resin of asetofenon-formaldehyde polymer, siklohegzanon-formaldehyde polymer, alkyd polymer-modified polyester, natural resins, phenol-formaldehyde. A sample of ballpoint pen ink on paper was cut out with 0.5 cm punch and placed in a thermal desorption tube. The tube was kept at 200°C for 5 min and then resin fragments were kept in trap at -10 °C for 5 minutes and given quickly at 300 °C. Subsequently, the compounds were transferred onto the column and analyzed in the GC-MS. **Conclusion**: With this method, pens used on the questioned document can be easily detected by differences of their structure resin.

Disclosure: All authors have declared no conflicts of interest.

THE BEAVER DAM, FLIES AND THE AXE: YOU CAN'T HIDE FROM MOTHER NATURE

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After attending this presentation, attendees will understand the importance of a multidisciplinary team approach to investigating and solving a complex homicide. This presentation will impact the forensic community by demonstrating the value of incorporating various disciplines (e.g., forensic pathology, forensic anthropology, and forensic odontology) to correctly interpret complex post-mortem taphonomic changes. The decedent was taken by two acquaintances to a remote wooded area to inspect a clandestine below-ground methamphetamine cooking laboratory. The decedent, who was suspected to be a police informant, was killed and subsequently buried in the same hole. Approximately two weeks later the killers became nervous about the body being discovered, and they returned to the grave. The decedent was exhumed, dismembered, packaged in plastic bags, wrapped in a tarp and submerged in a near-by lake. Twenty-two months later the beaver dam supporting the lake partially failed, revealing the tarp containing the remains. Within the rolled-up tarp were five plastic garbage bags. Initial examination showed numerous pupal cases associated with the bags. Radiographs revealed fragmented remains of a single decedent and multiple bullets. To insure accuracy of trauma interpretation, the contents of each bag were scrutinized and documented. The antemortem, perimortem, and post-mortem examination of a violent death involved cooperation of pathology, anthropology, odontology, and forensic autopsy personnel which resulted in a positive identification and in the determination of the cause and manner of death.

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DRIVING UNDER THE INFLUENCE OF ALCOHOL IN MOTORCYCLE FATALITIES

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Introduction: Lack of barrier between the driver and forces emerging in an accident makes motorcycle riding particularly risky. Between 2009 and 2013, motorcyclists have taken part in 4.28% of all traffic accidents in Croatia, but they have accounted for 22.48% of all fatally injured vehicle users. Since the most important factor in generating traffic accidents are the vehicle users we have decided to focus on their characteristics. **Methods:** We have reviewed the records on fatally injured motorcyclists from 2009 through 2013. The information relating to age, sex, time of the year, injuries and causes of death and circumstances of the accident were obtained. Blood alcohol concentration (BAC) and toxicology analysis results were collected and analysed. **Results:** 83 fatalities were identified (95% men, 5% women). 63% of the victims were 20 to 39 years old. Running-off-road (23%) and collision with another vehicle (20%) were the most common types of accidents. The most common injuries were to the chest (89%) and to the head and neck (84%). BAC was above legal limit for driving (0.5 g/kg) in 58% of cases. BAC of drivers who were responsible for the accident was significantly higher than in those who were not responsible (p=0.009). **Conclusions:** Alcohol intoxication has a major role in motorcycle related fatalities. Education on the role of alcohol intoxication in traffic accidents and especially education of motorcycle drivers on specific effects of alcohol intoxication on motorcycle riding abilities is crucial in lowering the number of motorcycle related deaths.

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EFFECT OF WASHING ON DNA ANALYSIS FROM BLOOD STAINED CLOTHING

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One of the most common types of evidence at a violent crime scene is blood, which can be used for both DNA and blood pattern analysis. This potentially gives information as to the identity of the victim and perpetrator as well as helping give an understanding of the events that took place. However, over time any DNA present will degrade at a rate dependent on the environment. Furthermore, the actions of the perpetrator to destroy the evidence by washing or other cleaning activities can lead to difficulties with DNA analysis. This may be due to removal of cellular material, degradation of the DNA, inhibitory substances affecting the Polymerase Chain Reaction (PCR) or a combination of these factors. In this study we have treated a range of blood stained fabrics to a number of different commercial and domestic washing and cleaning regimes before undertaking DNA analysis using PCR and quantitative real-time PCR (qPCR). Horse blood was used throughout and to achieve highest sensitivity, horse-specific mitochondrial DNA (mtDNA) primers designed in house to give a range of different sized products from 82 bp to 496 bp, were used. Overall, natural fibres were seen to be better in retaining and recovering DNA following all treatments. Synthetic fibres proved to be more problematic although trace amounts of DNA could still be recovered and amplified dependant on the primer set chosen. Carpet, as might be expected due to its structure, retained the most biological material following treatment. Primers producing a product size of 275 bp proved to be most efficient in nearly all cases, possibly due to the sequence stability and melting temperature of the primer binding and PCR product as that has previously been shown to be an important determinant. Bleach, as in other studies, proved efficient at reducing PCR product formation along with washing powders containing fabric softeners followed by biological powders. In general, the temperature of the wash had a marked effect on the success of DNA recovery. In some cases, inhibitory effects of the residual chemicals in the clothing could also be detected using quantitative-PCR The results for enzyme based cleaners were dependent on fabric and primer set. Implications for forensic analysis will be discussed along with possible further work in this area.

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SEXUAL DIMORPHISM IN HUMAN HIP BONE FROM THE PERSPECTIVE OF 3D SURFACE BASED TECHNIQUES

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Sexually dimorphic features of the hip bone are essential for reconstructing biological profile from unidentified human remains. Traditional visual assessment of the skeletal traits is known to be burden by subjectivity and provide limited information about studied morphology. In contrast, morphometric approaches, which process linear distances or spatial coordinates of discrete osteometric points respect requirements on reliability and repeatability, but reduce complex morphology to a restricted sets of linear and spatial data. Available 3D mesh-to-mesh comparison tools have potential to quantify biological information encoded in the skeletal morphology in a complex way and make use of larger amount of biological information encoded in the bone morphology. The present study test mesh-based techniques for sex determination on a sample of left and right human hip bones from 75 individuals (44 males, 31 females) originated in a documented skeletal collection housed at Charles University, Prague, Czech Republic. Each bone was 3D digitized via photogrammetry and within-sample morphological variation was examined in FIDENTIS Analyst v 1.28 (). The program allows quantifying dissimilarity within the sample pairwise on a basis of closest vertex-to-vertex distances, which are further displayed in terms of color scalar maps. Matrices of selected statistical parameters were tested for dependency on the recorded sex by Permutation Analysis of Variance (PERMANOVA) and processed by Principal Coordinate Analysis (PCoA). The results revealed statistically significant sexual dimorphism in hip bones morphology on both body sides. Scores of selected coordinates were further processed by a Discriminant Function Analysis in order to test performance of models for sex determination. We demonstrated that by processing the very spatial information of the digital models, the 3D surface or mesh-based techniques are capable of quantifying and visualizing manifestation of sexual dimorphism. Predictive models created for hip bones from both sides ascribed the correct sex in more than 90% cases, after cross-validation. In addition, the visualization tools provided elementary insight into studied sexual dimorphism. Ability of the approach to examine digital copies of the bone elements could provide a basis for universally applicable semi-automated software tools for sex diagnoses.

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ESTIMATING AGE AT DEATH FROM ACETABULUM, AURICULAR SURFACE AND PUBIC SYMPHYSIS USING RANDOM FORESTS

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Estimation of age at death relies on patterns of growth, development and degeneration of morphoscopic skeletal traits and represents one of the crucial parameters used in reconstruction of biological profile. Standard visual assessment of skeletal features is known to be burden by subjectivity and even though modern morphometric approaches analyzing three-dimensional data provide promising results, they mostly focus on a single skeletal trait and require advanced computer literacy. It has been proposed that a complex analysis combining several skeletal traits may significantly reduce bias in estimated age. The present study tested this hypothesis on a documented skeletal collection housed at Charles University, Prague, Czech Republic. For this purpose were selected the acetabulum, auricular surface and pubic symphysis of the hip bone, all considered as established skeletal ageing sites. Each hip bone was 3D digitized via photogrammetry based techniques in order to permit morphoscopic assessment of skeletal traits and to profit from morphometric analysis of continuous variables. A morphoscopic analysis was performed by a single observer and to test repeatability the intraobserver error was assessed. Further, quantification of regions of interest was processed by using the relief index, orientation patch count and Dirichlet's normal energy. Key aim was to investigate the impact of morphoscopic features and quantitative data obtained by different morphometric approaches as input variables on the process of estimation by using the advanced machine learning algorithm. Random forests operate by constructing a multitude of decision trees, designed to analyze high-dimensional data. The initial random forests model has been constructed and further its performance has been tuned by modifying parameters of the algorithm such as the number of trees, number of variables processed at every split point of the tree and by processing preferred input variables with significant impact on the performance of the model. A blind test was performed at every point of tuning and the results proved ongoing tendency for improving the performance of the model. The acquired results show that the proposed multifactorial approach has potential to effectively fuse traditional and computer-aided techniques allowing estimating age at death in a very complex manner.

Disclosure: All authors have declared no conflicts of interest.

VALIDATION OF THE SUREID® COMPASS HUMAN DNA IDENTIFICATION KIT

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Current commercially available STR kits look predominantly at autosomal loci, potentially missing information that could be gained through typing with Y-chromosomal markers. Using 6-dye technology, the SureID® Compass kit (Health Gene Technologies, Ningbo, China) simultaneously amplifies 33 loci, including 15 Autosomal STRs, in conjunction with 16 Y-STRs, 1 Y-indel, and the sex-determining marker Amelogenin. Validation studies were performed in order to test the robustness and reliability of the SureID® Compass kit. Results showed the SureID® Compass kit could produce 100% profiles with the recommended input and was able to detect a 60% profile with an input template of 125 pg. The kit was shown to be fully concordant with GlobalFiler® (Thermo Fisher Scientific, MA, USA), and showed almost complete concordance with PowerPlex 21® (Promega, WI, USA). The ability of the SureID® Compass kit to produce analysable results from various compromised samples was assessed, and the results will be presented. In particular, a minor male contributor was able to be detected in the Y-STR, down to a ratio of 19:1 in two-contributor and three-contributor mixed samples, and multiple male contributors could be detected using the Y-STR. The inclusion of Y-chromosomal markers within the one multiplex allows for the streamlined analysis of mixed samples, and the detection of minor male contributors when present in small quantities or in the presence of excess female DNA. The stochastic effects have shown to be minimal with few instances of allele drop-out and drop-in and a consistent heterozygote balance. Through this study, the SureID® Compass kit has shown to be comparable to current commercially available STR kits.

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ANONYMOUS PERSONAE IN CYBERCRIME: STYLOMETRY AND COMPUTATIONAL FORENSIC LINGUISTICS

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While the primary focus of digital evidence has traditionally been (1) the recovery and preservation of digital data and (2) the analysis of digital data for evidence of tampering. In several types of crime, the issue that arises from digital evidence is "who wrote it?" or authorship identification. Anonymous and pseudonymous personae are rampant in electronic communications, with the screen name the most innocuous of aliases. There are two main approaches to authorship identification within the digital context: stylometry and computational forensic linguistics. Stylometry uses surface features of the text that are easily countable by very basic computer programs or mathematical algorithms. In the earliest uses of stylometry, sentence length was a mainstay, but this was proven unreliable very quickly. Current subvarieties of stylometry focus on words or characters. A stylometric approach focusing on words measures the word frequencies in a text, with various statistical analyses comparing word frequencies in known texts to the questioned text; this stylometric approach is also known as "keyword identification." A stylometric approach focusing on characters measures the character frequencies or the n-gram (characters-in-a-row) frequencies, with various statistical analyses comparing character frequencies in known texts to the questioned text. Since words consist of characters, the two stylometric subvarieties can overlap, with function words (e.g. 'the', etc.) captured by both word and character approaches or with long n-grams capturing content words (e.g. 'poison', etc.). The length of the n-grams is variable so that the analyst can select different lengths; this is a methodological flaw that could be easily fixed. But a more serious and unavoidable issue with the current stylometric approaches is the fact that topic of a text automatically generates keyword vocabulary (with words as character strings), so that the current stylometric approaches conflate topic and author. A single author writing on different topics will appear to be multiple authors, while multiple authors writing on a single topic will appear to be a single author. Computational forensic linguistics uses abstract features of text, specifically syntax, that require specialized tools e.g. parsers and machine learning algorithms. Although computational forensic linguistics is more difficult to implement than stylometry, its accuracy for authorship identification is higher than stylometry affords because the author is not conflated with topic. This talk reviews three cases – homicide, kidnapping/rape, and defamation – in which the computational forensic linguistics method of authorship identification assisted digital evidence investigation in ways that stylometry could not.

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VIOLENCE AGAINST WOMEN AND VULNERABLE PERSONS IN JAMAICA

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Violence against women is an age-old global and multifaceted scourge on mankind. Each culture across the global divide exhibits varied forms of violence including genital mutilations, stoning, beatings, rape, sexual assault in all forms, forced prostitution with its requisite disciplinary penance, trafficking and murder. The WHO has intimated that up to 35 per cent of women worldwide are victims of intimate partner violence or non-partner sexual violence in their lifetime. Domestic or interpersonal violence has been implicated as one of the top causative factors. Truthfully, violence against anyone is about seizing power and abusing persons who find themselves in a position of vulnerability. In Jamaica, figures for violent crimes against women and children are generally much lower than for men, except for sexual offences. Victims 0 -17 years category show that for murder, shootings and aggravated assaults, over 2011 to 2016, men show two to three times the prevalence than women for being victims of these crimes. Sex crimes for men are reported much less than for women. As perpetrators, the under seventeen years also have that gender relationship where the prevalence of males committing violent acts far exceeded females. This then begs the question of which gender in society is the more vulnerable. Gender based violence (GBV) across the years 2014 to 2015 show that females aged 0 – 39 years reported more assaults than males. Ages 10 to 14 years appeared to be the most susceptible, with women reporting two times as many cases as men. Ages 15 to 19 years, women reported violence almost 1.5 times more than men. It would appear then that GBV affects females more than males. The differences in reporting between genders must be taken into consideration when analyzing the data. Sex crimes in Jamaica show a stronger prevalence toward female victims. For sex with a person under the age of sixteen years and other sexual offences, 10-14 years and 15-19 years display the largest prevalence figures. In summarizing, no specific time trends of increase or decrease are evident for the period under analysis. Men are more susceptible than women to being victims of violent crimes with the exception of sex crimes. Minors perpetrating violence see more male than female perps. Psychologists can appreciate the complexity of the crime problem and perhaps should add to the research of where the vulnerabilities lie and propose who deserves the label of 'vulnerable'

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ISTANBUL PROTOCOL – A REVIEW FROM A FORENSIC ODONTOLOGY PERSPECTIVE

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United Nations Convention against Torture, 1984, defines torture as "[…] any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person for such purposes as obtaining […]

information or a confession [...]." Article 2.2 specifically states that "No exceptional circumstances whatsoever, whether a state of war or a threat of war, internal political instability or any other public emergency, may be invoked as a justification of torture." Any cruel, inhuman or degrading treatment is a serious human rights violation and is perceived extremely atrocious if committed by healthcare professionals. Istanbul Protocol is a Manual on the Effective Investigation and Documentation of Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment which was drafted and signed in Istanbul and submitted to the United Nations High Commissioner for Human Rights on August 9th, 1999. It provides guidelines on how to examine, document, and report inhuman treatment allegations. Proper diagnosis and documentation of torture claims have always been crucial components in the prevention of inhuman or degrading treatment. Forensic odontologists' role in the fight against ill treatment is often ignored or underrated. Physical examination of the oral cavity and the teeth is an integral part of the medical evaluation of torture and ill-treatment. However; detecting and distinguishing the signs of cruel treatment requires training and diligence; recovery and preservation of relevant evidence depend on expertise. Documentation and reporting of torture allegations are essential to break the cycle and prevent recurrence. This presentation provides an extensive review of the Istanbul Protocol from a forensic odontology perspective. It also proposes an expansion of the investigative duties of forensic odontologists to include a leading role in the training of healthcare professionals to recognize the signs of violence, document findings thereof, and report ill-treatment appropriately.

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IDENTIFICATION OF SOME FORENSIC PARAMETERS FOR THE COLLECTION OF HUMAN MICROBIOME SAMPLES

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Use of the human microbiome as a tool for identification in forensic scenarios was considered in this research. Although they are not visible to the naked eye, different microorganisms such bacteria, viruses, and fungi surround us. These organisms—known collectively as the human microbiome—are essential to us, and we live symbiotically with them. The human microbiome is highly personalized and for this reason may be useful for forensic identification. In this study, the value of the human microbiome as trace evidence collected from the crime scene or a piece of evidence was considered. While the duration of interaction between the subject and a piece of evidence was also considered, the main focus was to determine if the surface has an effect on the number of bacteria collected. Five surfaces were analyzed: marble, silicone, wood, stone, and metal. The results indicate that non-porous surfaces are more effective at retaining bacteria than non-porous surfaces. The quantity of bacteria recovered directly from the touched surfaces was found to be inadequate to provide a profile sufficient to link a suspect with a piece of evidence or a crime scene. Since gloves represent a typical piece of evidence left at a crime scene an attempt was then made to obtain a suitable sample from inside a pair of nitrile gloves. The samples collected from the gloves were spread on a trypticase soy agar plate in order to make the bacteria grow and obtain a higher yield than with direct swab extraction. Samples recovered from the gloves responded positively to the amplification of the 16 s RNA gene that can be used for future sequencing and species identification. It was determined that it is possible to use this technique to link the person that used the glove with the actual glove used. This was seen from similarities in bands observed on the resulting agarose gel. Although these results were not sufficient to make a conclusive forensic identification, they did suggest that sequencing and using bioinformatics analysis can create bacterial maps which may generate a useful profile from the suspect and the piece of evidence.

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ANALYSIS OF BREATH FOR CANNABIS MARKERS USING CAPILLARY MICROEXTRACTION OF VOLATILES (CMV)

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The noninvasive collection of exhaled breath makes for an attractive sample for field detection of drugs from suspected impaired drivers. Previous studies characterizing the breath of individuals who have smoked marijuana used filter pads as sample collection devices resulting in low collection efficiencies but have identified the necessity to sample as low as single ng of the target compounds. This study proposes the evaluation of a new technology, capillary microextraction of volatiles (CMV), for its utility in the collection of breath aerosols and volatiles from exhaled breath. The CMV preconcentrates breath components using a patented mini capillary tube filled with polydimethylsiloxane (PDMS) coated glass filter strips. The CMV offers dynamic sampling of volatile organic compounds (VOCs) with a simple coupling to the inlet of a gas chromatograph (GC) for analysis, avoiding expensive thermal desorption instrumentation needed for bulk sorbent type collection devices. CMV offers a 5,000-fold increase in surface area and an improved collection capacity over the static single solid-phase microextraction (SPME) fiber. In addition, the CMV sampling is dynamic, allowing for a relalively large volume (> 2L) of lung/mouth air to be sampled in approximately 1 minute. The collection efficiency and analysis of VOCs associated with normal breath and from VOCs associated with tobacco smoking were collected from human subjects and the results for discriminating non-smokers from smokers will be presented. The simulation of synthetic breath composed of vapors generated by permeation tubes into a flow of humidified nitrogen have also been sampled. After collection of the synthetic breath onto the CMV, two extraction methods were tested for efficacy in releasing analytes for analysis. The comparison of the direct thermal desorption and online supercritical CO_2 extraction of a CMV into a GC/mass spectrometer (GC/MS) inlet was used to determine the recovery profiles of the two approaches that target VOCs and semi-volatile organic compounds (SVOCs). The chemical characterization of these breath components provides a better understanding of breath collection with CMV and further allows for the differentiation between normal breath constituents and the exogenous compounds resulting from the smoking of marijuana. Reliable demonstration of the CMV for breath collection would serve as a proof of concept for future applications of the CMV for detection of marijuana smokers' breath for drug impaired driver management. The portability and sensitivity of the CMV could aid law enforcement agencies during traffic patrols of drug impaired drivers in the future.

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AN OVERVIEW OF SINGAPORE HSA FORENSIC LABORATORIES' QUALITY MANAGEMENT FRAMEWORK

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Quality assurance and control are important aspects in forensic laboratories. The quality of the results of examinations performed in forensic laboratories has always been a concern as many times, the results and interpretation are often required for the investigation of criminal justice. In order to safeguard the reliability of the results in forensic examination, it is essential to ensure and maintain the highest standards of accuracy in forensic science. The Health Sciences Authority (HSA) Applied Science Group (ASG) Forensic Laboratory in Singapore has a good reputation of being a well-recognised ASCLD/LAB-*International* accredited forensic laboratory in the region. With wealth of accreditation experience and the constant expansion of forensic services, HSA ASG recognised the benefits of having a delegated and independent group of Quality staff who would focus on managing and maintaining the quality management system for the laboratories. In 2012, the Quality Assurance Unit (QAU)

of ASG, led by a Quality Director and several Quality Managers, was set up. Their main responsibility was to manage the quality activities and to maintain a structured, robust and effective quality management system within the ASG laboratories. The holistic quality management framework adopted by QAU and ASG Forensic Laboratory consisted of the following aspects: assessing conformity; ensuring conformity; preventing non-conformity; reducing non-conformity and improving quality system. In the aspect of "assessing conformity", QAU would organise, conduct and coordinate internal audits or external assessments for the laboratories to systematically identify problems, risks and non-conformities. To "ensure conformity", QAU would conduct monthly surveillance to "spot check" on the laboratories in specific areas. Each of the laboratories were also required to fulfil the proficiency testing requirement as specified by the ISO standard (ISO/IEC 17025) and accreditation body (ASCLD/LAB) which would be closely monitored by QAU. In order to "prevent non-conformity", ASG and QAU recognized the importance of being pro-active than reactive. Alert systems which prompted and reminded individual to calibrate/ maintain the instrument, dispose and recertify chemicals and reference materials were also set up to prevent misses and non-conformities. To create a quality awareness culture, staff from the laboratory were encouraged to self-report any potential or possible non-conformity through appropriate feedback loops where relevant staff and Quality Managers would investigate on the issues, suggest and implement certain measures / corrective actions. This would help to "reduce non-conformity" and constantly "improve the quality system". More examples of best practices will be discussed and shared in the presentation / poster.

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ADDRESSING CHALLENGES IN REGULATED AND VALIDATED WORKFLOW USING CONVERGE™ SOFTWARE

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Software data management and analysis is critical to the advancement of forensic science and to solve crimes. Managing such data and analysis is a complex, resource intensive endeavor when the laboratory is comprised of a multitude of actors, workflows and information resources. There is a strong need for the lab administrators to regulate access of data and functions, track changes in the system and allow technical leads to approve analysis reports generated by analyst. Converge ™ Software addresses these challenges using its Role based Access Control (RBAC), Audit Trail (Electronic Record keeping) and E-Signature functionality. · Role based Access Control (RBAC) addresses the need for laboratory administrators to regulate access of data and functions. Administrators can define roles with a set of permissions which can be assigned to analyst or subjects within the laboratory. The roles and permissions are highly configurable such that it can be defined as per the laboratory protocol. · Audit trail (Electronic Record keeping) enables laboratory administrator to perform auditing at different levels based on the laboratory needs. This helps the laboratory to demonstrate compliance with regulatory requirement. The system can be configured to audit all actions or just select actions within the software and the stored audit records can be searched using the audit reporting module. · E-Signature functionality lets technical leads to perform secondary review of the analysis results and approve them by performing E-signature. The E-signatures are included in the reports generated by the software. The RBAC module, E-Signature and Audit trails enables the laboratory to enforce and regulate the processes in the lab and as well eliminate traditional paper records.

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FORENSIC IN SILICO: SIMULATED IR SPECTRA OF NPS AMPHETAMINES AND CATHINONES

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New Psychoactive Substances (NPS), also known as designer drugs or "bath salts", have increasing in number and use.[1,2] Their effects are still unknown as well as their identification. This work presents a series of simulated IR spectra for 42 NPS, 21 amphetamines and 21 cathinones. For this purpose, theoretical calculation with quantum chemistry methods was performed. Firstly, the X-Ray structure of the basic amphetamine was used for all molecules, and the different groups were replaced to build each NPS. Density Functional Theory (DFT-B3LYP) method with a 6-31G** basis set implemented in Orca® package[3] was used to perform the molecular conformational analysis and optimization. The minimum energy structure for each molecule was submitted to a frequency calculation and the respective IR spectra were generated. For the simpler amphetamine and its respective cathinone the simulated spectra are in accordance with experimental ones. However, there are few experimental studies for the others NPS. In this sense, the simulated spectra using *in silico* methods is an alternative get information about unknown NPS, which have not being identified. A meaningful comparison between any pair of spectra can be the Kullback–Leibler (KL) divergence, which a way of measuring a distance between two distributions, in this case, the IR spectra. The KL divergence matrix with all 42 NPS allows the molecules to be correctly classified in each group. Moreover, the KL divergence can distinguish details within each group, which can be regarded as a potential to be used for drug characterization of new designer drugs and their toxicity. 1. UNODC, World Drug Report 2013, 1st ed., United Nations publication, Sales No. E.13.XI.6, New York, (2013). 2. M.H. Baumann, J.S. Partilla, K.R. Lehner, Psychoactive "bath salts": not so soothing., Eur. J. Pharmacol. 698 (2013). 3. NEESE, F.; ORCA - An ab initio, Density Functional and Semi-empirical Program Package, version 2.8; University of Bonn: Bonn, Germany, 2010

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CHALLENGES TO POSITIVE IDENTIFICATION OF HISTORICALLY UNIDENTIFIED REMAINS

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The positive identification of unidentified human remains is a global issue. Customary International Humanitarian Law enshrines the right to respect for family life which includes the right of families to know the fate of their loved ones. In our experience in Ontario, families who are missing a relative never stop searching for them. This presentation will outline the efforts made in Ontario, Canada to positively identify unidentified decedents. While there have been a number of successes in this regard, there remain challenges to identification. In 2005, the Office of the Chief Coroner and the Ontario Forensic Pathology Service entered into a unique partnership with the Ontario Provincial Police. It was recognized at the time that there were many unidentified bodies in the province of Ontario, and there was no easy way to match them up with missing persons. A relational database was developed which could search and match variables, and a website visible to the public was launched. The website was the first in Canada to publish actual photographs of the deceased. Some cases were identified by public tips, and others were identified as police added missing persons to the database. In the first 6 years approximately 10 decedents were identified. In 2012 we undertook a comprehensive review of the database. Initially, only those UI remains that had something with which they could be positively identified (dental, DNA, fingerprints) were added to the database. In addition, a decision was taken to only add UI remains back to 1972. The review added all UI remains going back 50 years (to 1964) whether or not they had something with which to positively identify them. All material for each case was reviewed by a content expert (forensic anthropologist) and

in many cases biological information was changed, updated or added to. We did not exhume any of the remains. From 2012 to 2015, 14 additional bodies were identified. These numbers do not include newly discovered remains which were quickly matched to missing persons in the database. There are currently approximately 225 individuals awaiting identification. In general, the impediments to positive identification can be listed under the headings of lack of funding, lack of legislation or mandate and lack of expertise. The specific issues under each of these headings will be presented. This presentation will expand upon an earlier one given at IALM in 2016

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MULTIPLE FATALITY RESPONSE TO NINE INDIGENOUS DEATHS IN A BURNED HOUSE IN PIKANGIKUM, ONTARIO

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Abstract: A multiple fatality is defined as a single event in which two or more people die. A multiple fatality can occur with little or no warning and vary in its scope and nature. In Ontario all death investigations fall under the jurisdiction of the coroner, regardless of the cause of the death, although there are often parallel investigations, most commonly criminal. The guiding principle for the implementation of our plan is: "Business as Usual, just More Business than Usual". The OFPS provides qualified expertise in the areas of anthropology, pathology, odontology, medical imaging and photography. For many years now, anthropologists and sometimes pathologists have been integral members of scene examination and recovery teams when needed. This is our business as usual. In addition to daily casework, we maintain a partnership with the Ontario Provincial Police called the Resolve Initiative. This is our vehicle for comparing missing persons with unidentified remains. In the event of a multiple fatality, the OFPS has access to a clean copy of this functional relational database, in order to compare cases for Disaster Victim Identification (DVI). In the early morning of March 30, 2016 the OFPS forensic anthropologist was notified of a house fire on the Pikangikum Reserve. As the person responsible for the OFPS multiple fatality implementation plan, the anthropologist opened communications with our partners in the Office of the Chief Coroner (OCC), the Ontario Provincial Police (OPP) and the Office of the Fire Marshall (OFM) and also began planning our response with the staff of the OFPS as well as, our expert consultants in anthropology and odontology. This presentation will illustrate that a death investigation system must draw upon its daily practices in order to successfully address a multiple fatality in its jurisdiction. If those regular practices, do not include appropriate experts (or at least an established network of expert consultants) and good communication, then there is a real probability that an agency's response will be problematic. The use of inexperienced experts, the lack of a teamwork attitude and the use of unfamiliar DVI tools would all have created problems with this multiple fatality response and would have delayed returning the decedents to the community.

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SERS, RAMAN AND DFT OF FENTANYL CARFENTANYL: TOWARD DETECTION OF TRACE SAMPLES

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Recreational use of fentanyl and carfentanyl has garnered attention to the so-called opioid epidemic that has been responsible for thousands of overdoses and deaths the past decade. In this work, we examine the normal Raman (NR) and the surface-enhanced Raman (SERS) spectra of fentanyl and carfentanyl. Although Raman spectroscopy is a valuable analytic tool for the detection and identification of molecular species, it is a rather weak effect, and requires specialized equipment for detection of trace samples. We therefore turn to surface-enhanced Raman spectroscopy, which utilizes the large enhancement of the Raman signal endowed by proximity to silver or gold nanoparticles. The enhancement factor (E_F) obtained in this experiment is $\geq 1.6 \times 10^5$. As an aid in the assignment of the spectral lines, we also present a Density Functional Theory (DFT) calculation and a description of pertinent molecular vibrations, where we point to differences between carfentantyl and fentanyl, and their respective SERS spectra. This points the way towards a non-destructive, sensitive and rapid methodology, which combines experimental and theoretical data for detecting molecules of forensic importance at low concentrations.

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MULTIPLE FATALITY RESPONSE TO NINE INDIGENOUS DEATHS IN A BURNED HOUSE IN PIKANGIKUM, ONTARIO: DVI

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Nine family members died in a house fire on the Pikangikum Reserve, a remote Ojibwe community in Northern Ontario. While commingling of the remains at the scene was minimal, the remains were extensively thermally damaged and fragmented. Antemortem medical and dental records were only available at the nursing station on the reserve and had to be collected while the scene was being processed in order to be transported with the remains to Toronto for the purposes of identification.
The OFPS maintains a Multiple Fatality Plan with a section devoted to undertaking DVI. In large multiple fatalities, a clean copy of the Resolve Initiative database will be used. This database is used on a daily basis to compare unidentified remains and missing persons in Ontario, and is a shared relational database used by members of the Resolve Initiative team at the OFPS and the Ontario Provincial Police (OPP). In smaller multiple fatalities it has been our practice to utilize excel spreadsheets, one each for antemortem and post-mortem information. The sheets are filled with available information and the identifications are confirmed by a meeting of an Identification Committee prior to release of bodies to families.
In the case of this multiple fatality, the anthropologists, and pathologists provided information on age, sex and antemortem medical findings to populate the post-mortem spreadsheet. Another team carefully went through all of the medical records for each presumed decedent and populated another spreadsheet with pertinent information for identification. Police investigation in the community prior to removal of the bodies from the scene had confirmed that the decedent group was a closed population. Although there was an attempt to blind the collectors of the post-mortem information to the antemortem information, some of it was shared which resulted in an interesting case of confirmation bias. This was easily resolved, but it illustrated that it is a good practice to separate the antemortem information team findings from the post-mortem team findings until they are formally reconciled by the Identification Committee. This presentation will illustrate that a team or committee approach to identification in multiple fatalities utilizing evidence-based methods can be accomplished in a short time-frame. Early communication with all members of the team will ensure that the appropriate antemortem information is collected as soon as possible after the event. Finally, blinding of the post-mortem team to existing antemortem information ensures that unbiased information is collected.

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BIOMECHANICS AND COMPOSITION OF BURIED JUVENILE PIG RIBS IN RELATION TO THE POST-MORTEM INTERVAL

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The assessment of fracture timing based on bone characteristics by forensic anthropologists is key to the determination of the circumstances of death from human skeletonized remains. Bone characteristics used to differentiate between perimortem and post-mortem fractures are discussed in terms of occurring in "fresh" bone *versus* "dry" bone and there is very little knowledge about how fresh fracture characteristics persist into the post-mortem period, particularly in juveniles. This study uses a juvenile porcine model to examine the relationship between the length of the post-mortem interval in buried environments and 1) changes in the biomechanical properties of juvenile bone in response to localized load, and 2) changes in the chemical composition of juvenile bone. An additional goal is to understand the relationship between the biomechanical properties and chemical composition of juvenile bone. Twenty-seven suckling piglets (*Sus scrofa*) aged approximately between two and eight weeks were purchased from a local supplier. The ribcages were manually defleshed and each set of three half ribcages was buried in one soil filled container at 15 cm deep, in a controlled environment. The sets were excavated sequentially, the first four 1-week apart, the following two 2-weeks apart and the remaining sets 4-weeks apart in a total post-mortem interval of 12 months. In each excavated half ribcages set, ribs were individually disarticulated and fractured experimentally using a three point bending flexural test to quantify the tensile material properties and structural response to loading. A bone section from each rib was sacrificed for ash weight analysis to quantify water, collagen and mineral content of bone. Results show an unclear relationship between the length of the post-mortem period, tensile properties and chemical composition of bone over the first four sets (one month). Forthcoming analysis of the remaining sets may provide a better understanding of the changes in biomechanical properties and chemical composition of juvenile buried bone over time that may clarify how long fresh bone characteristics persist into the post-mortem interval.

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TESTING AND OPTIMIZATION OF METHOD VALIDITY FOR FORENSIC GENETIC ANALYZES

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Objective: Validation is to confirm with objective evidence that the methods used in DNA analyzes provide the targeted requirements. Prior to this validation procedure, it is very important that the calibrating pipettes to be used in the study are verified by the personnel working in the laboratory. Our goal in this study; In-service methods, and to establish awareness of the working conditions of the laboratories and the supply of consumables and kits used. **Materials and Methods:** The subject has been evaluated and interpreted according to the experiences in the Forensic Genetics Laboratory, comparison test results with other national / international laboratories which has been accredited since 2012 and by searching the relevant guides and standards. **Results:** The values specified for each pipette were measured ten times before the validation. This work was performed for every staff member who will work in the lab. Even with calibrated pipettes, the accuracy was maximized by virtue of the verification, and the maximum benefit was achieved. Later on, in the validation phase, evaluation was made in terms of analysis threshold, dynamic field sensitivity, stochastic threshold, reproducibility and reproducibility according to the working conditions of the equipment and the environment of our own laboratory. Analysis on the verge of capillary electrophoresis available detection limit, the highest and the lowest amount of DNA that can determine was calculated in the dynamic range. With the sensitivity stage, the highest and lowest amounts of DNA that the PCR device can operate were determined. In the stochastic threshold phase the DNA concentration at which the imbalance between the siblings of the same locus observed was determined. It was revealed that the same result was obtained when the reproducibility phase was studied at different times and/or by different persons. **Conclusion:** In this respect, determining the operating conditions within the optimum conditions given in the kit allows us to save the materials to be used as well as to determine the optimum conditions for the procedure in our laboratory. The result we have obtained for the quantities of DNA, PCR cycles and other values we have determined for our laboratory is important in terms of proving the validity of the validation performed by obtaining the same result as studying in another laboratory that has been accredited to the same extent and has achieved ISO / IEC 17025 requirements.

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CRIMINAL-SCIENCE: STUDY OF TECHNICAL AND JURISPRUDENTIAL ASPECTS ABOUT DRUGS LAW IN BRAZIL

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In Brazil, forensic procedures lack standardization, and in its analysis different documents may be formulated. It is not difficult to find a disparity in the information offered by expert reports depending on how and where they were produced. Besides, this non-standardized information may be misunderstood in Court. The drug law is responsible for most of the imprisonment, and it has overcrowded the prison system. One of the reasons is the criminalization of drug use. In this context, the study of technical aspects in the applicability of the law is important in connection with human rights. This work studied some aspects of the problem, from three perspectives: (A) Technical procedure of analysis. We randomly collected at least nine reports for each region of Brazil (45 samples). A qualitative and quantitative analysis was performed according to law-based questions. Preliminarily, results showed that most of the reports have important and useful technical information, but different procedures are sometimes observed. (B) Evaluation of the perception regarding the law and technical requirements. In this item, various groups in society were investigated: professionals with criminal knowledge (judges, prosecutors, attorneys, etc.), professionals with legal but non-criminal familiarity, professionals with technical understanding (experts, researchers, professors, etc.) and lay population (people without specialized legal, criminal or technical deep information). In this case, data showed that there is a lack of technical and juridical knowledge, indicating the need for interdisciplinary discussions. (C) A quantitative and qualitative survey based on decision containing the terms related to the technical reports (presumptive and final). This survey took place in two jurisprudence levels: (1) Decisions given by Superior Tribunal de Justiça (STJ) and by the Supremo Tribunal Federal (STF), which are the two most important courts in Brazil; (2) Decisions rendered by the Court of Justice of São Paulo in a temporal cut of 24 months. In this case, the main observations indicated that although some legal and technical problems have been found, results suggest that most judicial processes had an adequate technical support. We concluded that, from the forensic point of view, there is no problem with the applied law. However, a social discussion must be done about the law requirements. Authors would like to thank the Santander Bank for the financial support. Aline T. Bruni and Jesus A. Velho also thank CNPq as part of the Project developed by Instituto Nacional de Ciência e Tecnologia Forense, Porto Alegre, RS, Brazil.

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A STUDY ON CARCASS DECOMPOSITION AND INSECTS OF FORENSIC IMPORTANCE IN JAMAICA

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Forensic entomology is a new and unexplored discipline in Jamaica with only a few documented studies to date. This study identified insects associated with carrion as well as the stages of carrion decomposition and thus contributes information relevant to the estimation of post mortem interval (PMI). Carcasses of pigs (*Sus scrofa*) were used to determine the species composition and the stages of carrion decomposition. Five stages of decomposition were observed and a total twenty-three species potentially of forensic importance were collected. There were five families of Diptera, (Calliphoridae, Sarcophagidae, Muscidae, Piophilidae, Stratiomyidae) and five families of Coleoptera (Staphylinidae, Histeridae, Cleridae, Dermestidae, Tenebrionidae). Among the insects collected were two endemic species belonging to the Calliphoridae and Sarcophagidae.

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PHOTOANTHROPOMETRY: USE OF IRIDIAN PROPORTIONS TAKEN FROM FACIAL FRONTAL IMAGES TO ESTIMATE AGE

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Introduction: Child pornography on the internet is increasing and due to the lack of a well-established and reliable scientific methodology for age estimation of youngsters exposed on images, the fight against this crime has become a real challenge. **Objective:** Investigate if Iridian Relations (diameter of the iris related to a set of facial measurements) are capable of detecting morphological changes in face due to age in Brazilian individuals, comparing their results with the methodology of a reference study, conducted in Europe. **Mathods:** Standardized frontal view images from 1000 Brazilian (500 females and 500 males) divided in 5 age groups (6, 10, 14, 18 and 22ys) were randomly selected from a Brazilian Civilian Data Bank. The images were analyzed using cephalometric points which could be objectively visualized. Fifteen metric relations depending on the diameter of the iris (test group) were used and compared with 15 variables proposed by the reference study (reference group). Data were analyzed by parametric tests (Student´s T-test, ANOVA, Tukey test and Pearson´s correlation) and logistic regression models. This study was approved by the Ethical Research Committee from University of São Paulo (Process n: 17017213.0.0000.5440). **Results:** Statistical differences between sexes were detected for all age groups, being less frequent to 6 year-old group (4 indices) and more frequent among 14 year-old individuals (9 indices) in the reference group of variables. Regarding iridian proportions, this difference was less frequent to 10 year-old group (5 indices) and more frequent among 18 year-old individuals (12 indices). The majority of variables from reference group showed a weak correlation with age (0 to 0.39) while all variables from test group demonstrated a strong correlation (0.60 to 0.79). Both methods were able to detect difference among age groups (ANOVA), but the reference group detected difference between specific ages in 44.9% of cases and the test group in 87.3% (Tukey test). The area under the ROC curves showed that the test method was superior to the reference to diagnose both the age of 14 years (97.4 and 86.4) and of 18 years (91.4 and 81.3). **Conclusions:** The method based on iris diameter was useful to detect morphological changes of the face at all ages studied both for males and females and was considered superior to the reference method. These results encourage the use of the method to estimate age by images for forensic purposes, but more studies should be done in different populations.

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GC-MS GC-MS/MS AND GC-IR STUDIES ON SUBSTITUTED CATHINONE DESIGNER DRUGS

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GC-MS, GC-MS/MS and GC-IR Studies on Substituted Cathinone Designer Drugs C. Randall Clark, Jack DeRuiter and Younis Abiedalla, Department of Drug Discovery and Development, Harrison School of Pharmacy, Auburn University, Auburn, AL, USA This presentation will describe our research efforts to evaluate the structure-retention, structure-fragmentation and other structure-property analytical relationships for a series of substituted aminoketone-type drugs (cathinone derivatives). Our research has focused on regioisomer specific methods for the identification of ring substituted aminoketone compounds. Based on the structure of the unsubstituted cathinone molecule, designer modifications are possible in three distinct regions: the aromatic ring, the alkyl side chain and the amino group. Gas chromatographic techniques combined with electron ionization mass spectrometry (EI-MS), vapor phase IR and product ion MS/MS are used for the differentiation of regioisomeric and homologous cathinone derivatives. This work includes the chemical synthesis of regioisomeric forms for selected aromatic ring substituted aminoketones as well as homologous alkyl side chains and tertiary amines of varying ring size. The cyclic amines azetidine, pyrrolidine, piperidine and azepane were incorporated into a series of aminoketones. Deuterium labeling in both the cyclic amine and alkyl side chain allowed for confirmation of the structure for the major fragment ions formed from the EI-MS and MS-MS experiments. Vapor phase IR provides differentiation of aromatic ring substitution patterns. The side chain and amino group regioisomers yield equivalent iminium cation base peaks. However, these iminium cations show characteristic product ion spectra which allow differentiation of the ring and side chain portions of the structure. The small alkyl side chains favor ring fragmentation in the formation of the major product ions. The higher side chain homologues promote product ion formation by side chain fragmentation. Product ion spectra also allow differentiation of the side chain propyl and isopropyl groups in the cathinone structure. In the MDPV series the n-propyl side chain containing iminium cation base peak (m/z 126) yields a major product ion at m/z 84; the regioisomeric m/z 126 for the isopropyl group yields a characteristic product ion at m/z 70. Product ion fragmentation provides useful data for differentiation of cyclic tertiary amine iminium cations from cathinone derivatives. Regioisomeric iminium cations of equal mass yield characteristic product ions for the alkyl side chain homologues of azetidine, pyrrolidine, piperidine and azepane cyclic amines. Regioisomeric n-propyl and isopropyl iminium cations of equal mass yield characteristic product ions identifying the alkyl side chain regioisomers in the pyrrolidine cathinone derivatives.

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LEAD TOXICITY FROM FRAUD OPIUM: REPORT OF TWO AUTOPSY CASES OF LEAD TOXICITY

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Lead is a toxic metal that affects many organ systems and functions in

humans, and acute poisoning with lead can present with nonspecific signs and symptoms of intoxication such as abdominal pain, constipation, irritability, and anemia. Although the incidence of occupational and adult lead poisoning has declined, the problem still exists and present in new features. Lead poisoning due to drug, cosmetics or heroin addiction has been mentioned in some studies. Here, we aim to present two autopsy cases of 38 years old and 49 years old addicted men with lead poisoning in Iran, both associated with history of diffuse abdominal pain, which was at times colicky in nature, sideroblastic anemia, diarrhea, nausea, vomiting, and abnormal liver function tests. A history of opium ingestion was present in these patients. None of them reported known occupational exposure to any toxin. There was so much amber color liquids in pleural and peritoneal cavity of 49 and 38 years old men respectively. Visceral organs were pale. The lung were also edematous and congested. No other specific nor pathognomonic finding was observed in autopsy of two cases. Samples taken from the bodies were referred foe toxicological investigations. Diagnoses of lead poisoning were confirmed through the detection of elevated blood lead levels with polarography method which in 38 years old man's blood 8163 µg/L lead was detected. In the blood sample of 49 years old man, 3644.6 µg/L lead was detected. The cause of such acute lead poisoning was attributed to the ingestion of fraud contaminated opium. Opium adulterated with lead had not been previously recognized as a source of lead poisoning in Iran but it seems that lead has been recently used in order to increase the weight of sold opium. Also, it has been found that lead poisoning should be considered as a differential diagnosis for acute abdominal colic of unclear cause in patients with opium addiction. Finally, as lead poisoning can be fatal, other sources of lead intoxication such as contaminated opium should also be considered as one of probable causes of death especially in addicted individuals.

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VALIDATION OF THE Y-SCREEN ASSAY USING THE QUANTIFILER™ TRIO DNA QUANTIFICATION KIT

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Sexual assault kit (SAK) samples are among the most difficult sample types encountered by many forensic laboratories. Conventional serology screening and differential extraction procedures used as part of a sexual assault workflow are time-consuming and labor intensive. As an alternative to onerous and laborious conventional serology screening and differential extraction, Thermo Fisher Scientific has developed the DNA Y-screen assay, which is designed to assess swab evidence from SAKs to rapidly detect the presence of a male contributor, facilitating a "direct to DNA" workflow. Using the Applied Biosystems™ Quantifiler™ Trio DNA Quantification Kit, the Y-screen assay provides a fast, sensitive, and reliable method for screening SAKs for the presence of male DNA. The Y-screen assay is the first step in an efficient and robust sexual assault kit processing workflow that helps maximize the results from forensic evidence. Because each laboratory may incorporate the Y-screen assay into their workflow differently, a comprehensive validation plan is essential. Thermo Fisher's HID Professional Services (HPS) team has developed a flexible and comprehensive validation plan to implement the Y-screen assay into a laboratory's workflow. During the validation, standardized semen:buccal swab mixtures are utilized to assess the sensitivity of the assay for the detection of male DNA, which are complimented with an assessment of known and non-probative casework samples. Replicate analysis evaluates the precision and reproducibility of the assay. Quantifiler Trio results generated will provide a mixture ratio of the quantity of male DNA vs. female DNA, as well as an indication of degradation and/or inhibition of the sample. Finally, the Y-screen workflow is evaluated to help ensure that the process can be performed without introducing contamination. This presentation will provide an overview of validation data generated as part of Phoenix Police Department's Y-screen validation conducted by HPS. Data correlating Y-screen results with probative downstream GlobalFiler and Yfiler Plus will be presented as well as a comparison between conventional serology methods and the Y-screen assay.

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SOCIO-DEMOGRAPHIC ANALYSIS OF SOUTHERN SRI LANKA THROUGH AUTOPSY DATA OF THREE DECADES

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Introduction Death investigation is an essential tool in a society to study socio-demographic evolution of a population. Here we present a retrospective analysis of deaths referred for autopsies by the forensic pathologist of Deptartment of Forensic Medicine Galle at the Teaching Hospital Karapitiya Galle Sri Lanka from 1981 to 2004. Methodology The details of 5184 deaths reported to Inquirers and Magistrates in southern province and adjoining provinces which were referred to autopsies were included in this study. Although 5833 cases were registered during the study period, only 5184 had complete data on files and 26 case files were not located. Results The death investigations (inquests) of 5075 cases were held within the southern province. In 3865 cases the inquest was conducted by an inquirer and in 1319 cases the inquest was conducted by the local magistrate. There were 961 homicides, 1099 suicides, 1037 accidents, 1975 natural deaths during the study period. It is also revealed that 13 explosion deaths and 16 exhumations have been conducted during the same period. The cause of death was undetermined in 112 cases and in 42 cases decomposed bodies were subjected to autopsies. Conclusions Most of the deaths subjected to investigation had been due to natural circumstances (38%). Surprisingly the suicidal deaths were about 21%. Accidental deaths were at third place and the last was homicidal cases (18.5%). Most of the homicides (281) were caused by stab and cut injuries; Blunt force trauma to head was observed in 186 cases and firearm injuries were recorded in 156 cases. Shotguns have been used in 22 cases due to firearm injuries. Cranio-cerebral injuries were reported in 326 accidental deaths. Most natural deaths were due to cardiovascular causes (752). This study reiterates the importance of maintaining accurate statistics on autopsy performance. Autopsy data of a country is a significant denominator of the morbidity- mortality pattern of its inhabitants. Regional autopsy data maintenance in Sri Lanka was not properly scrutinized in eighties and considerable amount of incomplete files found in this study could be accounted to this fact. Our data on suicidal deaths coincides with the prevalence of high suicidal rates in the country during mid-nineties. Recent studies of autopsy data on the same region shows reduction of suicidal deaths. The composition of homicides is also changed and more firearm deaths are recorded than sharp force trauma. These findings reflect some aspects of the socio-political transformation in public life.

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ASSESSMENT OF DIFFERENT PREDICTION MODELS UTILIZING TWO PREDICTORS FOR DENTAL AGE ESTIMATION

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Background: The third molar development (TMD) has been widely utilized as one of the radiographic method for dental age estimation. By using the same radiograph of the same individual, third molar eruption (TME) information can be incorporated to theTMD regression model. This study aims to evaluate the performance of dental age estimation in individual method models and the combined model (TMD andTME) based on the classic regressions of multiple linear and principal component analysis. The latter was used to address multicollinearity between variables (third molar staging scores). **Method:** A sample of 705 digital panoramic radiographs

of Malay sub-adults aged between 14.1 and 23.8 years was collected. The techniques described by Gleiser and Hunt modified by Kohler and Olze were employed to stage theTMD andTME, respectively. The data was divided to develop three respective models based on the two regressions of multiple linear and principal component analysis. The trained models were then validated on the test sample and the accuracy of age prediction was compared between each model. The coefficient of determination (R^2) and root mean square error (RMSE) were calculated. **Result:** In both genders, adjusted R^2 yielded an increment in the linear regressions of combined model as compared to the individual models. The overall decrease in RMSE was detected in combined model as compared toTMD (0.03-0.06) andTME (0.2-0.8). In principal component regression, low value of adjusted R^2 and high RMSE except in male were exhibited in combined model. **Conclusion:** MLR has proven to perform better than regression PCA despite the arising multicollinearity issue. Adding age-relatedTME information to theTMD regression provides better dental age prediction than on onlyTME model. TheTMD model offers better accuracy thanTME and the use of combined model is highly recommended should the subject fits the criteria set by the present study in assessing dental age estimation.

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PHOTOANTROPOMETRIC FACIAL ANALYSIS: VARIABILITY OF LANDMARKING POINTS AND FORENSIC IMPLICATION

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Introduction: Non-automated comparison of facial images for human identification purposes is an important forensic tool. Despite the theme importance, which grows in parallel to the massification of digital images devices acquisition, there is a great lack of scientific studies that evaluate the reliability of methodologies by linking two facial images, mainly regarding on variability determination of anatomical points of reference. Because they are initially defined for direct or indirect determination in lateral radiographs (cephalometric points), they generate great settling difficulties when analyzing photographs indirectly, application commonly used in Forensic Facial Identification processes. Objective: Evaluate a standardization methodology in determination and definition of cephalometric points, for use in facial examinations exclusively based on frontal normalized images. The methodology aims to adapt the classic cephalometric descriptions present in the literature for its indirect application, when only facial images are available for analysis, renaming them as photoanthropometric. The aim of this study was to compare the reproducibility of settling 16 reference facial points in frontal images, considering three parameters: the examiner knowledge (specialist or lay person), the descriptive methodology adopted (cephalometric or photoanthropometric) and the anatomical points of reference. It is proposed, therefore, to determine the factors that influence the variability of marking these points when they are performed on facial images. Methods: The study was previously approved by ethics committee of the Dentistry College of Sao Paulo University, Ribeirao Preto, Brazil, and was divided into two phases. Both were analyzed by two groups of analysis: examiners with knowledge in craniofacial anatomy and lay examiners in this area. Each group settled 16 facial points in ten photographs in frontal norm, randomly selected from an image bank, using two methodologies for marking these reference points: traditional (cephalometric) and adapted (photoanthropometric). Results: It can be observed that the adapted methodology adoption for using in frontal facial images (photoanthropometric methodology) was determinant to reach a greater accuracy of settling points in general, both by people with knowledge in craniofacial anatomy, and by lay people, being more reliable than classical cephalometric analysis. **Conclusion:** The proposed photoanthropometric description can be applied in facial imagens comparison, providing a more categorical and scientific analysis, which are fundamental requirements for the forensic expert. However, it is necessary to test the adapted method in uncontrolled situations, such as low image resolution, incidences and diverse illumination.

Disclosure: All authors have declared no conflicts of interest.

FORENSIC IN SILICO STUDY OF NPS: AMPHETAMINES AND CATHINONES

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A current problem with drugs is the emergence of new substances that have a similar effect to that of illicit drugs. According to UNODC (*United Nations Office on Drugs and Crime*), new substances have been created to address gaps in drug control legislation, which has become an international problem.[1] The toxic effects of these drugs are unknown and can be a health problem. Besides, there has been a significant increase in cases in which fatal poisonings are associated with the use of designer drugs, also reported as "bath salts."[2,3] In this work we studied 21 amphetamines and 21 cathinones structures. Many variables were calculated by Derek™ Nexus[4] and ACD/I-Lab 2.0[5]: molecular mass and volume, molar refractivity, index of refraction, surface tension, polarizability, logP and LD50 for many human (blood, duodenum etc.) and animal (rat and mouse) situations. Despite experimental studies can be found about these drugs, they are done for few molecules; the references are spread, with different methodologies. In this sense, *in silico* studies can provide some insight into the toxicological behavior of this entire group of drugs. All toxicological values were used as dependent variables, and Partial Least Squares regression was performed on Pirouette® Package.[6] Eleven regression models were obtained from the structural properties. Two values of LD50 (blood and jejunum) showed good values of Q^2 and R^2. Table 1 summarizes results. In both cases, variables associated with structure were the most important to describe the toxicity. The authors would like to thank to the Santander Bank for the financial support. Table 1. PLS results for each model

Model	Dependent variable	Number of Latent Variables	Cumulative information	Q^2	R^2	Most important variable in regression Vector
1	$LD50_{blood}$	5	99	0.80	0.84	Molecular Mass
2	$LD50_{Jejunum}$	5	99	0,85	0,88	Molecular Volume

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ANALYSIS OF POST-MORTEM CHANGES IN INTERNAL ORGANS AND GASES USING COMPUTED TOMOGRAPHY DATA

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Purpose: Post-mortem computed tomography (PMCT) is a useful method

to identify various causes of death and measure the volume of internal organs and gases. The purpose of this study was to investigate post-mortem changes as measured by PMCT, and the relationship between the volume of organs and gases and post-mortem interval (PMI). *Materials and methods*: Forty-six cadavers (22 men, 24 women) were examined by CT before autopsy. The volumes of the lungs, intrahepatic gas, and intrarectal gas were measured by CT using a workstation. A stepwise regression analysis was used to establish a predictive equation to ascertain the measured volume using factors including sex, age, height, body mass index (BMI), body surface area (BSA), and PMI. For estimation of PMI, stepwise regression analysis was used. *Results*: In the equations for each measured volume, height, diaphragmatic height, and BSA were adopted for the left lung; height and diaphragmatic height were adopted for the right lung; PMI was adopted for intrahepatic gas; and sex and PMI were adopted for intrarectal gas. In the PMI equations, left lung volume, intrahepatic gas, and intrarectal gas were adopted together with sex, weight, and BMI. *Conclusion*: Values of intrahepatic and intrarectal gas volumes obtained by PMCT may be useful in investigation of post-mortem change. It will be necessary to include other parts of the intestine and to analyze volume changes in gases from these parts after death.

Disclosure: All authors have declared no conflicts of interest.

OUR PREPARATION FOR NEXT DISASTER IN CHIBA, JAPAN

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We had a big tragedy Great East Japan Earthquake in March 2011. Over ten thousand and five hundred people died in tsunami. Japanese police, clinical doctors, forensic pathologists and odontologists worked hard for Disaster Victim Identification (DVI), respectively. However, ninety percent of causes of death were determined drowning from their external examinations and thoracentesis without autopsy. Furthermore, more than eighty percent of victims were identified from their facial and physical appearance and/or personal belongings so that misidentifications of victims have come into clear after disaster. There are many problems in death investigation system in Japan not only in disaster but also in ordinary cases. In Japan, police agency manages death investigation mainly about its criminality, so that natural causes of death have been considered less serious including disaster cases. Interpol DVI protocol has been widely used for the purpose of scientific DVI in many countries. We have to learn more about systematic DVI procedure and build an effective team consists of forensic pathologists, odontlogists, technicians and police. Now therefore we held a new DVI training course using small paper-victim-doll and having discussion about every victim within all experts to know more each other practically. Furthermore, we participate clinical disaster trainings on rescues and aids to let them know about importance of DVI and build cooperation system between the antemortem and post-mortem activities in disaster to prepare for next disaster, an earthquake, a volcanic eruption, or terrorisms.

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FORENSIC IN SILICO: MULTIVARIATE METHODS APPLIED TO IMAGE ANALYSIS ON BALLISTIC COMPARISON

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Ballistic examinations are indispensable elements in obtaining evidence within a criminal investigation. The main goal of this work was to study ballistic comparison using image analysis. For this, eight projectiles from two different guns (Taurus, caliber 40, model 24/7 pro-tactic from Civil Police of Ribeirão Preto) were evaluated. Each projectile was photographed in twelve different angles (from 0º to 330º, with 30º increments). A Nikon D1300 camera, with macro lenses and a unique standard of photographic definition captured images. The Softwares GIMP 2.8[1] and FV Fits Viewer[2] were used to generate the pixels identity of each photo. The extraction resulted in a 400x440 matrix for each image, which was vectorized by MATLAB® package.[3] The whole process generates a matrix with 96 lines and 176000 columns, corresponding to 12 samples for each projectile, being four projectiles for each gun. Partial Least Square-Discriminant Analysis (PLS-DA) and Soft Independent Modeling of class analogies (SIMCA) methods, implemented on Pirouette® package, 4 were used in the analysis. Both Techniques were able to recognize projectiles from each gun using supervised learning. PLS-DA results needed six principal components for modeling, which described around 97% of the whole information and provided an R^2= 0.95. SIMCA results showed that ten principal component were enough to distinguish the classes and around less than 2% of samples was misclassified, ensuring more than 95% of confidence limit. We concluded that image analysis has potential to be used in a ballistic comparison, providing a less subjective procedure, and a quantitative method. Additionally, this procedure has economic viability and seems feasible, if the physical characteristics of the projectile are preserved. 1. The GIMP Team, GIMP 2.8.18, www.gimp.org, 1997-2016, released on 2016-07-14. *2. Fv*: The Interactive FITS File Editor, version 5.4, https://heasarc.gsfc.nasa.gov/ftools/fv/, released September 2015. 3. MATLAB 2015a, MathWorks, released in 2015. 4. Pirouette Multivariate Data Analysis Software, version 4.5, Infometrix, Inc, Bothell, WA, 2014.

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A NOVEL APPROACH TO REFORM THE CLASSIFICATION OF LIP PRINTS

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From the earliest times, primary tools for the investigation of forensic cases have been manual observations and 3rd degree methods or to some extent the interpretation of physical evidences. The use of fingerprints in the past century has been the only substantial means of identifying persons. However, increased awareness regarding advanced techniques of crime detection and human rights has alarmed the criminals for taking sufficient precautions like attempts to destroy the ridge pattern (Cummins and Midlo, 1961). Under such circumstances, fingerprint often fails to establish a positive identity. Thus, the investigator can rely upon adjuvant techniques like Cheiloscopy as corroborative evidence. Cheiloscopy deals with identifying a person from the wrinkles and grooves present on the labial mucosa (called *sulci labiorum*) which form a characteristic pattern called lip prints. Various researchers have classified lip prints based upon the pattern of wrinkles and furrows present on the Klein's zone of lips (Suzuki and Tsuchihashi, Martin Santos, Renaud, Afchar Bayar and Jose Maria Dominguez) whereas Kasprzak classified lip prints on the basis of individual characteristics. After going through the literature, it was felt desirable to have a more comprehensive system to classify the lip prints so that if any quadrant is affected may be because of smoking or tobacco usage, etc. even then the lip print can be used to identify the individual successfully. In the present study the whole lip (Klein's zone) has been divided into ten quadrants (five on the upper lip and remaining five on the lower lip) so that every part of the lips can be examined objectively. It was observed that the pattern present in all the quadrants are not the same; rather it is a combination of two different forms of patterns i.e. *Basic Patterns and Combination Patterns*. Further attempt has been made to collect and analyse the lip print samples from smokers where the central quadrant is mostly affected due to prolonged smoking and satisfactory results have been obtained thereof to identify the individual from remaining part of the lip/lip print.

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IMPROVEMENT OF THE SUCCESS RATE OF IDENTIFICATION IN FORENSIC CASES

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Objective: In determining the relationship between crime and perpetrator and forensic cases such as murder, sexual assault or theft, it is tried to determine whether there is a connection between the suspect and the judicial case by using the genetic information obtained from the biological materials at the crime scene. The rapid development of DNA technology, the ability to work with less material, the increasing accurate and reliable results, the development of automation and the cost-effective technology have made this technology to have a great use and success in forensic genetics. In order to provide all these vital expert services, reliable and current methods and systems conforming to quality standards are required. **Materials and Method:** Firstly, the isolation and the quantification of DNA from biological specimens should be carried out and then the loci to be isolated from the isolates need to be amplified with the GlobalFiler ™ PCR Kit containing 24 STR DNA, Y STR and miniSTR loci. After the amplified STR locus alleles were typed with capillary electrophoresis having *6-dye* detection capability, the results may be visualized and evaluated. **Results:** With the use of this system in forensic laboratories, faster and more reliable results can be obtained during paternity and maternity test in the absence of a parent (mother-father) or in the case of high heterozygosity and inadequacy of classical STR loci, as well as in challenging forensic cases such as natural disasters and terrorism having trace amounts of DNA and many loss of life. **Conclusion:** This new technology allows for increased efficiency and success rate in determining the paternity and kinship relationships, identifying the biological materials found at the crime scene and the person in mass disasters, as well as in the detection of missing persons. In this way, in cases where identification is not possible, results are obtained and identification is performed by using a newer technology. We believe that the GlobalFiler ™ system consisting of 24 STR regions, which is increasingly used in forensic genetic analyzes and that will replace all systems in the future identification, should have the necessary infrastructure studies for use in forensic genetic laboratories and should be routinized.

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ANALYSIS OF SOCIO-DEMOGRAPHIC AND FORENSIC EVIDENCE IN SEXUAL ABUSE SURVIVORS OF SOUTHERN SRI LANKA

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Introduction Rape and sexual abuse has become a significant socio-cultural issue in the modern Sri Lankan community at an alarming rate. Hence research on evidence based forensic medical practices is an urgent requirement to the country's legal system in formulating strategies for crime prevention and conviction. Objectives The objectives of the study were set as follows. 1. Evaluation of socio-demographic aspects in female sexual abuse survivors 2. Statistical analysis of positive forensic evidence 3. Statistical analysis of statutory rape, child sexual abuse, childhood pregnancies, incest and gang rape. Materials and methods A descriptive cross sectional study was carried out in sexual abuse survivors presented to the Office of the Judicial Medical Officer, Teaching Hospital, Karapitiya, Galle from 1st of January 2009 to 31st December 2014 using a pre-coded data collection format. A selected 140 cases were statistically evaluated. Results Majority of the victims (114) were from rural areas. Their geographical distribution in the study population (81.4%) was statistically significant. It was evident that most of the victims belonged to low socio-economic group (85%). It was also revealed that 2.1% had never been to school and 7.1% had studied up to grade 8; 8.7% had studied up to grade 11. The maximum percentage of victimization was observed in the teenage group 11-19 years (82%). The total number of cases (115) in this respect was statistically significant. Prevalence of statutory rape was 68.5%. Prevalence of child sexual abuse was 89.5%. In relation to hymenal shape, 52.8% had annular hymen and 30% had fimbriated hymen. In relation to injury prevalence, 62.5% of them had hymenal injuries but only 5% had fresh hymenal injuries. All complete hymenal tears were confined to the posterior half of the hymen. In relation to location of hymenal tears, 32.1% had tears at 3 o'clock and 6 o'clock position and 21% had tears at 6 o'clock position. Prevalence of restraint and resistant injuries was 1.4 %. Sperm positivity and STD positivity of the study population was zero. The high incidence of childhood pregnancies observed in this study (94.5%) was statistically significant. Conclusion Overall forensic evidence of this study suggest that urgent strategies should be made to reduce the incidence of child sexual abuse and childhood pregnancies specially among vulnerable communities living in regional Sri Lanka. Presence of fresh hymenal injuries was minimal probably due to delayed presentation to medico-legal authorities and consensual sex in cases of statutory rape.

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RECOVERY AND ANALYSIS OF DNA FROM CARTRIDGE CASES

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Recovering DNA of sufficient quality and quantity to generate complete STR profiles from cartridge cases is rarely successful. While DNA transfer via touch is expected to result in low levels of DNA transfer, degradation may further hinder STR amplification. One mechanism that may degrade DNA on such items is the formation of reactive oxygen species (ROS), facilitated through metal-ion electron transfers. Swabbing with water may increase the formation of ROS on particular cartridge casings, such as brass. To examine this effect and optimize the quantity and quality of DNA recovered from cartridge cases, various alternate solutions and approaches were tested. Due to inconsistent transfer of biological material through touch, known quantities of diluted saliva were applied to brass (n=65) and nickel (n=50) 9mm-luger cartridges and to clean sterile swabs used as controls. Unfired and fired cartridges were processed using different swabbing or soaking mediums, including water, methanol, vitamin-E, melatonin, sodium dodecyl sulfate and sarkosyl. While soaking cartridges failed to recover DNA yields above the stochastic threshold of quantification, swabbing with water, melatonin, SDS and sarkosyl mediums recovered DNA yields greater than all other methods for both brass and nickel cartridge casings, unfired or fired. However, no medium significantly improved DNA yields over water. The average percent DNA yields from swabbing with water on unfired and fired brass cartridges were 10.0% and 9.6%, and on nickel cartridges, 56.2% and 39.4%, respectively, compared to the positive control swab. Furthermore, while complete autosomal STR profiles were obtained from nickel cartridges, those collected from brass cartridges using each method described above demonstrated substantial inhibition or degradation. To assess whether the above results were applicable to "touched" samples brass (n=25) and nickel (n=25) cartridges were rolled between the fingers of a volunteer for 30 seconds then loaded into a magazine and fired. Samples were then taken using the most effective techniques from the earlier studies. Of these DNA above the stochastic threshold was detected on only a single nickel casing, from which the full DNA profile of the volunteer was obtained. The results observed with brass cartridges do not support the theory that formation of ROS during sample collection degrades DNA, affecting success in DNA typing. With respect to the increased recovery of DNA from nickel cartridges, further work will be necessary to understand this

phenomenon.

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DNA IDENTIFICATION OF THE MOLOTOV COCKTAILS USED IN EXPLOSIVE ACTIVITIES

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Objective: The acts of Molotov explosion leave important effects on social memory both economically, psychologically and sociologically, and it is not easy to make up for these. The duty of the state at this point is; To ensure that the perpetrators is caught as soon as possible and to make public conscience relax and to be brought to justice and punishment within the framework of the law. The goal of this research is; to investigate the quality of the traces on the findings obtained at the scene of the crime and to determine the effect of heat on the deterioration of the existing DNA and to establish standards that can be used as a routine examination method in the police and gendarme criminal laboratories. **Materials and Methods:** Fingerprints were taken from six volunteers (3 males, 3 females) who signed the informed consent forms. The fingerprints were placed on various surfaces such as microscope slides for glass, metal china galvanized sheet metal piece. The voluntary individuals who signed the informed consent forms were kept waiting for 10 seconds after each surface was contacted. Fingerprints from volunteers were left on three different periods on different types of surfaces, providing an environment where antagonism could occur at the scene. Subsequently, the DNA samples were taken by using cotton swabs on these traces and the samples withdrawn were amplified by PCR and visualized in the capillary electrophoresis system. The GlobalFiler ™ Kit we use is composed of 24 STR regions and contains shorter amplicon regions than the other identification kits used in the field. **Results:** From the viewpoint of DNA profiling of the fingerprints generated by the modeling method, it has been determined that the results obtained from the epithelial cells from the paper surfaces are more suitable for identification than glass and metal surfaces. According to the results obtained in the direction of these determinations, it was determined that the full profiles obtained from the sampled paper surface at 50 ° C and 90 ° C were comparable to each other. On glass and metal surfaces, DNA profile suitable for comparison at 50 ° C was obtained. **Conclusion**:. It is believed that this work, which has been made for the first time in our country, may be further developed and that it may have significant contributions in the identification of the attacker and in the elucidation of the events, especially in terror events.

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DISCRIMINATION OF MEXICAN AND SOUTH AMERICAN HEROIN HCL WITH 87SR/86SR ISOTOPIC ANALYSIS

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Terrorist and criminal organizations around the world use heroin as an important source of revenue. Federal law enforcement and intelligence agencies are relying upon sophisticated means of chemical analysis to profile illegal drugs for information relevant to their investigations. Having analytical tools that can help correctly predict the source of drugs seized within or bound for communities in the US and Canada would be crucial for intelligence gathering to use in the fight against the international heroin crisis. With the hopes of providing a means to analyze the trace elements in heroin and predict the most likely region of production, over 200 authentic samples of heroin HCl were analyzed. Heroin samples known to originate from one of the major four heroin producing regions in the world, Southwest Asia, Southeast Asia, South America and Mexico were dissolved by microwave-assisted, acid digestion and analyzed for a large mass range of trace element concentrations by inductively-coupled plasma mass spectrometry (most elements from ^{7}Li to ^{238}U suitable for ICP-MS). Samples found having sufficient [^{88}Sr] had elemental strontium extracted from other matrix interferences by ion exchange resin. The ratio of ^{87}Sr/^{86}Sr was measured using a multi-collector ICP-MS (MC-ICP-MS). Initially, the focus of the research is on the differentiation of Mexican and South American heroin, as those are the primary sources of the heroin plaguing the USA and Canada. A preliminary batch of 51 samples of Mexico and South America were correctly assigned 74.5% of the time when (^{87}Sr/^{86}Sr) strontium isotope ratio measurements were used to construct the logistical discrimination model. The mean and 95% confidence interval of ^{87}Sr/^{86}Sr values for heroin HCl originating from Mexico was 0.70829±0.00076 (n=29) and for South America, 0.70624±0.00055 (n=22). This is the first exploration into radiogenic strontium isotopic analysis for profiling heroin.

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FORENSIC MOLECULAR GENETIC LABORATORIES: A MODEL STUDY IN THE FRAMEWORK OF INTERNATIONAL STANDARDS

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Objective: The purpose of forensic science studies is not to include chance, to minimize the impact of the human factor as much as possible and to carry the validity and reliability of the laboratory activities to the highest point. It is a prerequisite to ensure that this laboratory achieves accurate and reliable results when receiving service from an experimental / measurement / calibration laboratory. Technical competence of laboratories is regulated according to the national and international measurement results traceability, to the effective recording and reporting system and to the test / measurement system, to the quality of the working personnel, to the educational status and experience, to the technological status and calibration of the test / measurement equipment, to the suitability of sampling methods depending on the nature of the facilities. The purpose of our work in the direction of these qualities is to determine how a forensic molecular genetics laboratory should be in the framework of international standards. **Materials and Methods:** The subject was evaluated by scanning the source and the laboratory was designed in three dimensions in AutoCAD® software and considering all the conditions of the forensic molecular genetics laboratory. All drawings will be presented during the presentation. **Results:** In the first stage, the plan of the laboratory where it is located should be obtained and the basis of energy resources, water resources, communication facilities should be evaluated for the necessary infrastructure. Following this, the laboratory should make its own layout plan to evaluate the electricity, water, ventilation and communication facilities, study spaces, office areas, personnel resting places and management areas. To prevent contamination, the units in which the different test procedures are performed should be kept separate from each other. Appropriate storage areas and responsible personnel should be identified for chemical and biological materials. Health of the staff should be guaranteed. Facilities for urgent intervention such as emergency shower, eyebath, fire system, first aid materials should be provided.. **Conclusion:** Today, the struggle against crime has gained a transnational dimension from national regulation. All work done in forensic molecular genetics laboratories is now assessed and tested at the international level, with staff competence, prepared documents / minutes or expert reports, and the validity and reliability of forensic science laboratories. Forensic molecular genetics laboratories must strive and endeavor to raise the standard of current standards so that the services offered can be better and better.

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ACCREDITATION OF FORENSIC LABORATORIES IN COUNTRIES OF THE VISEGRAD GROUP

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With the accession of the Visegrad Group to the Schengen zone board inspection was terminated which also had negative effects, as criminals' crossing of boarders became easier, as well. In order to make the prevention and discovery of crimes crossing boarders more effective, the closest possible criminal cooperation is necessary. For achieving this goal, unified processes, procedures and standards need to be introduced. The object of the research is to present the possible tools of the above mentioned goal, as well as to evaluate steps' efficiency that have been taken so far. The UN ISO/IEC 17025 standard covers the whole forensic expert activity, prescribes very detailed documentation requirements and demands regular self-control and inner control as well. Hence, a successful accreditation is a huge step from the point of view of cooperation among members of the Visegrad Group. If we investigate the wider significance we can determine that accreditation is also important with respect to the European Forensic Area to be formed until 2020.

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COMPARATIVE ANALYSIS OF THE LEGAL REGULATION OF FORENSIC EXPERTS IN EUROPE

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Introduction Simultaneously with the development of technics and science, the need of jurisdiction towards special competency also grew. Thus, the cooperation of forensic experts in jurisdiction is more and more indispensable. In accordance with this, expert testimonies as evidences' evidentiary role is also high that is, where it is applied, the judge strongly takes the testimony of a given expert into consideration when ruling. The increase of relevance of experts work and testimonies caught the attention of states to that the overview, possibly supervision or even modification of the areas' legislation is necessary. We are in the middle of this process in Hungary in 2015. Aims Current study's subject is the comparison of the Czech Republic, Slovakia, Austria and Germany's legal system with the currently operating national regulation according to the following criterion: conditions to become an expert test of experts' competency organization having authority to appoint experts existence of compulsory further education period of appointment supervision of activity experts' fee (per hour) Methodology We overviewed the national, the Czech, the Slovakian, the Austrian and the German legislation, chamber documents, government information. Results are summarized in written form and in tables as well. Results As the result of the comparison it is obvious that great differences exists among certain states' legislature referring to experts. This is significant as according to the concept of the European Forensic Area 2020, a unified areas shall by formed in the European Union by 2020, in which forensic processes for processing, use and delivery of forensic data are based on equivalent minimum forensic science standards, and in which forensic service providers will work on the basis of a common approach to implementation of these standards that fosters closer cooperation between them and the criminal justice systems. It is clear that in order to achieve this, nations' legislation shall come closer to one another, at least in those areas which are supposed to assure the activity of experts.

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MEASURING DEGRADATION OF NARCOTICS AND NOVEL PSYCHOACTIVE SUBSTANCES USING MASS SPECTROMETRY

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Detection and confirmation of traditional narcotics and novel psychoactive substances (NPS) continues to be a crucial factor in forensic science research. While new methods are constantly being developed and new technologies are being evaluated, less focus has been placed on the behavior of these narcotics in real-world conditions. Understanding how these compounds behave in the environment can provide valuable insight into proper collection and storage conditions for evidence believed to contain these materials while also providing evidentiary information on either the potential time a residue was deposited or provide an explanation for the presence or absence of suspected materials. This talk will highlight work investigating the stability of trace (tens of nanograms) deposits of both traditional narcotics (*i.e.* cocaine, heroin, and THC) and NPS's (*i.e.* fentanyls, synthetic cathinones, and synthetic cannabinoids) to evaluate the environmental stability and lifetime of these materials. For this work, samples were created using piezo-electric inkjet printing and exposed to one of seven environmental conditions (Laboratory, -4 °C, 30 °C, 47 °C, 90 % relative humidity, UV exposure, and ozone) for up to six weeks. Samples were analyzed throughout the study by electrospray ionization mass spectrometry (ESI-MS) and thermal desorption direct analysis in real time mass spectrometry (TD-DART-MS) to obtain spectral and quantification data. ESI-MS was completed to quantify the mass of narcotic lost (stability) as a function of time and exposure by extracting samples into a solvent containing an internal standard. The quantification data was subsequently used to establish fitted degradation curves for all narcotics and all conditions, and for a pairwise comparison analysis between different environments to evaluate the magnitude of effect different environmental conditions had. TD-DART-MS was used to obtain full scan mass spectra, in positive and negative ionization mode, to identify spectral abnormalities which could be attributed to degradation or decomposition products formed as a result of the environmental exposure. Using this full scan spectral data, a statistical analysis was completed to evaluate the ability to identify the environmental condition based on spectral abnormalities. Stability was found to be exposure and compound dependent with UV-exposure and elevated humidity greatly impacting losses across nearly all narcotics studied. Degradation products for all compounds examined have been established, and mechanisms of degradation are currently being deciphered. The results of this work will provide insight to forensic examiners on the fate of narcotic traces that have been exposed to various environments.

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EUROPEAN FORENSIC SCIENCE AREA (EFSA 2020) – NEW CHALLENGES IN FORENSIC SCIENCE

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Introduction: Analyzing forensic evidence is highly subjective due to human interpretation and incomplete methodologies. This fact has led the EU to improve methods of fighting crime on international level as well as to increase the mutual recognition of collecting and analysing evidence by one another. These recent efforts focus mainly on policy matters and scientific innovative methods. The harmonization of forensic experts' knowledge and training requirements is of significant importance. **Results:** In 2011 the EU Council made a decision of The Vision for European Forensic Science2020 including the creation of a European Forensic Science Area, in which routine forensic processes for the collection, processing, usage and delivery of forensic data will be based on equivalent minimum standards, and in which forensic service providers will work

on the basis of a common approach to implement these standards that foster closer cooperation between them and criminal justice systems. Member States and the Commission works together to make progress in the following areas: accreditation of forensic laboratories, establishment of common best practice manuals respect for minimum competence criteria for forensic science personnel, application of minimal quality standards for crime-scene investigation, recognition of equivalence of law enforcement forensic activities with a view to avoid duplication of effort through cancellation of evidence owing to technical and qualitative differences, and achieving significant reductions in the time taken to process crimes with a cross-border component. **Conclusion:** The Council declared the concept of EFSA2020 to ensure the equivalence of professional forensic examinations. It aims at working out and accepting European forensic science standards. These will be instrumental for scientists and criminal investigators in guiding them with the standard procedures for carrying out such examinations. One of the consequences of implementing this approach in the international area will be the realization that in many countries the standards are such that their practitioners will not be able to operate them at the required level in an international environment. This imposes a further responsibility on the international forensic community, namely to provide supported, formal, training opportunities for practitioners from the developing world in the full range of forensic disciplines necessary to meet the required standards.

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ACTIVITY OF FORENSIC EXPERTS AND QUALITY ASSURANCE IN HUNGARY

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Introduction: The view of quality as criteria always dependents on a given age, culture. Nowadays growing need for the usage of modern natural sciences' results to be used in case-in-chief in frame of criminal procedures is typical. Experts' "special competency", testimonies formed by them may have a significant influence on the outcome of cases. Therefore, expert testimony' reliability, verifiability and accuracy are of crucial importance. In this respect we can talk about not only national but international expectations as well, as inter-state, more and more intense juridical, criminal cooperation's basic condition is mutual trust, which main criteria regarding quality is unquestionable evidence and proof. This study aims at presenting the Hungarian situation with reference to this topic. **Results:** The expertise system's quality assurance has two keystones: individual quality assurance affecting experts themselves general quality assurance referring to the expertise system itself During the course of the investigation we came to the conclusion that more problems can be identified regarding the area of legal expertise (with reference to both above mentioned keystones), moreover, the government, jurisdiction and experts themselves see problems and possible solutions differently. However, it is indisputable that the greatest problems in the Hungarian expertise system are the followings: legal regulation is unsatisfied a unified quality assurance system (except criminal laboratories) is missing Hungarian Chamber of Judicial Experts, experts' representative organization does not operate adequately certain special areas' competency is not clear no such training and further education system exists which could assure experts' continuous, up-to-date and quality education the great number of cases is not equally split among the great number of experts (tensions arise among experts due to the splitting of work and money) **Conclusion:** It is obvious that while domestic problems still arise, it is not possible to fulfill the conditions of the European Union. The European Union's requirement is legal harmonization, which is only possible if a reliable system operates in member states that is able to adjust to the growing challenges.

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STEPS TOWARDS THE CREATION OF EUROPEAN FORENSIC SCIENCE AREA IN HUNGARY

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Introduction The Council of the European Union had adopted the conclusions on the vision for European Forensic Science 2020 including the creation of a European Forensic Science Area and the development of forensic science infrastructure in Europe" in Brussels, on 13-14 December 2011. The Council declared several aims in order to foster cooperation between police and judicial authorities across the European Union with a view to creating a European Forensic Science Area by 2020. **Aim of the research:** The aim of the research is to collect the Hungarian measures and regulation which have been introduced in connection with the European Forensic Science Area. **Methods:** We have used the typical methods of jurisprudential researches. The primary methods were making an analytical description of laws and other sources, their evaluation, the presentation of international and domestic practice of law enforcement, and drawing conclusions from that. Of course, we processed the domestic and foreign literature beyond the evaluation of legal standards. **Results:** The Hungarian legislator has adopted laws to implement frameworks, regulation and other decision. **Conclusion:** Not only the Hungarian measures have shortcomings but also the European ones. There is no further improvement or specific decision, regulation in the field of creation of European Forensic Science Area. The Stockholm Programme (2010-2014) ended in 2014: what is after that?

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3D GEOMETRIC MORPHOMETRIC FACIAL RECONSTRUCTION: A PRELIMINARY REPORT

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Skeletal remains usually retain very little information about a specific individual's identity. Thus, reliable reconstruction of a face from a skull is a powerful tool to help match an unidentified skull to a particular person. Originally, average soft tissue depth was acquired from cadavers. This proved to be problematic as embalming techniques tend to alter soft tissue in many aspects. Later, tissue depth had been assessed from x-ray images, ultrasonography, MRI and CT. Usually, faces were then reconstructed with the help of artists. While this process was used in many forensic and historical cases, it still poses methodological problems, such as the dataset used for reconstruction and even the artists' subjective interpretation. Most importantly, as the human face is highly variable, relaying on average tissue depth at few selected points, holds inherent problems. Over the last few years, computer based techniques have been developed in order to solve this problem. These techniques use mathematical approach to quantify the difference between the shape of a skull and the corresponding face. However, these mathematical models and techniques are difficult to use and repeat on a day-to-day basis, without proper mathematical knowledge and expertise. Here we suggest a new, simple and more accurate method to evaluate the shape of a face from a skull. 20 CT scans of healthy individuals from routine medical scan were acquired. DICOM images were then 3D reconstructed for each skull and face. 125 equivalent landmarks and semi-landmarks were placed on all skulls and faces. 3D morphometric techniques were used to describe and compare the shape of the skulls and faces. First we used Procrustes analysis to discard size and spatial location differences. In order to find out if there is a connection between skull and face shape, partial least squares (PLS) method was applied. Next, using principal component analysis (PCA), the space-shape relation of skulls and faces was explored. PLS shows strong co-variation between skulls and faces. From the PCA, a clear connection is visible between individual skull and its corresponding face. As a test case, another skull was imported into the principal component space-shape. The proposed face, was compared to the real face and was

found to be similar. Future research will increase the number of individuals, from both sexes, different ethnical background, ages and body shape & size, to make the analysis more population specific, accurate, and reliable.

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THE STORY OF CREATING A NATIONAL "HANNIBAL" – WHEN SCIENCE GETS LOST IN AMBITION

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In December 2002, a 76-year-old woman was the victim of an assault in Istanbul, Turkey, which left several bite marks on her body. In February 2003, another elderly woman was found dead in her home in the same neighbourhood, with bite marks on her cheek and arm. In June 2003, another woman was assaulted in a close-by neighbourhood, bitten on her face, severely injuring her left eye. Fascinated by the bite marks, the Turkish mass media eagerly linked these three crimes together. Despite the fact there was only one homicide, some utterly ambitious 'investigative journalists' were very keen to produce a national serial killer story. The police had one suspect who was already imprisoned for the sexual assaults. The young, homeless drug addict admitted the assaults but strongly denied the murder. Focused on the bite marks, the police did not further investigate any other possible lead in the homicide case. Requested by the court, a bite mark analysis was conducted by a forensic odontologist in the Council of Forensic Medicine (CFM) in Istanbul. The bite marks found on the body of the homicide victim were compared to the dentition of the only suspect. Considering that his upper central incisors were missing, a positive identification seemed inevitable. The defence lawyer objected to the expert opinion report and the case was referred to the Council for a second opinion. As the analysis on the same material conducted by another forensic odontologist resulted in a second report contradicting the first one, the court ordered the case to be decided upon by the General Assembly (GA) of the CFM. The case was presented to the GA by a third dentist with no forensic training and experience who had enthusiastically concluded that the bite mark was produced by the suspect's dentition, supporting the first report. The GA voted in favour of the first report amid strong objections by some voting members of the assembly. Since bite mark analyses are vastly discredited as physical evidence, this case led to divided reactions within the Turkish forensic medicine and forensic science community. This presentation aims to discuss how media's interest in high profile cases can create unsubstantiated stories when fueled with weak, yet exotic scientific information. Forensic scientists must protect science from getting lost in ambition.

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DEVELOPMENT OF IMPROVED ISOLATION METHOD FOR DETECTION OF INSECTICIDES FROM BIOLOGICAL FLUIDS

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Insecticides are widely used, and as a result they are involved in numerous acute and even fatal poisonings. The aim of this study was the development of improved isolation method for the detection of three insecticides (malathion, chlorpyrifos and carbofuran) in urine and viscera. The selectivity of the method was adequate with minimal matrix effect in all blank samples. Percent recovery was assessed by running three replicates at different concentration. The percent recovery for each insecticide was found to be higher than 70.0%. The limit of detection (LOD) and limit of quantification (LOQ) for each insecticide were determined as the lowest concentration yielding signal to noise ratios of at least 3:1 and 10:1 respectively. LODs and LOQs for the three insecticides were found to be between 0.1–1.00 and 0.5–2.0 µg/L, respectively. In the present study methodology has been improved. Requirement of amount of substance has become less due to increased sensitivity. Overall analytical protocol has become reliable, accurate, reproducible and user friendly application oriented in forensic and analytical toxicology cases.

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COMPREHENSIVE SEPARATION AND DETECTION PROTOCOLS FOR COMPOUNDS OF FORENSIC IMPORTANCE

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Illicitly used amphetamines are an ongoing problem worldwide, particularly in Australia, where a National Ice Task Force was introduced in 2015. This task force is indicative of the level in which these particular amphetamines are abused and the need for ongoing research. There is also the need for optimisation of current detection methods, to include a broader range of analytes, or to develop a more selective method. Deakin University focuses on illicit drug profiling in collaboration with the Victoria Police. Part of the amphetamine research at Deakin University involves drug profiling methamphetamine samples, with a number of unknowns, received by the Victoria Police Forensic Services Department. These complex samples have been separated by a 2D-HPLC method and the unknowns have been identified through a number of analytical techniques. The 2D-HPLC method is useful as it has the ability to separate isomers that are likely to be present in methamphetamine samples, such as ephedrine and pseudoephedrine. Another area of work at Deakin University involves chemiluminescence detection using a tris (2,2'-bipyridine)ruthenium(III) reagent. Chemiluminescence detection is known to increase sensitivity and selectivity, and is a useful tool when dealing with complex samples, such as a seized street drug sample. The tris(2,2'-bipyridine)ruthenium(III) reagent is used primarily with analytes that contain an amine moiety, which has proven successful with a number of amphetamines, namely the methylenedioxy ring substituted amphetamines (MDA, MDEA and MDMA). Optimisation of the chemiluminescence detection was established through flow injection analysis, and applied to a post-column HPLC separation. Initial testing on seizure samples obtained by the Victoria Police Forensic Services Department showed great promise for this mode of detection to be employed for amphetamines. This method that has been developed at Deakin University has potential to extend into a broader range of amphetamines or other illicit compounds. It also has the potential to be applied in a microfluidic hand-held device, which is a useful tool for on the spot testing.

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ON SCENE BLOOD STAIN AGE ESTIMATION; POSSIBILITIES LIMITATIONS AND PRACTICAL IMPLEMENTATION

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Despite the high forensic value, currently no method exists for determining the time of deposition of bloodstains. We previously showed the feasibility to use optical reflectance spectroscopy for this purpose. To bring the age estimation of blood stains in forensic practice, the method was adapted to be applicable for blood stains found on many different backgrounds. We adapted a multi layer light transport model to correct for influences of the optical properties (scattering and absorption) of the background. With the model, we are able to calculate the relative amounts of HbO_2, MetHb and HC in blood stains on coloured backgrounds, based on their reflectance spectra. Additionally, we describe a statistical method to calculate the 95% confidence interval. For crime reconstruction purposes, the absolute and relative age of different groups of blood stains were measured in

several real cases, using our novel method and a newly developed portable hyperspectral camera. Combined with other evidence, the age of blood stains may lead to a better reconstruction of the timeline of events.

Disclosure: All authors have declared no conflicts of interest.

FORENSIC PATHOLOGY IN TRINIDAD AND TOBAGO

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Trinidad and Tobago, a twin island developing state in the West Indies has been in need of qualified forensic pathologist for more than a decade. This was evident when the Former Minister of Health Dr. Fuad Khan stated "As far as I am aware, the only doctor who is a forensic pathologist in this country, being registered with the Medical Board, is Dr (Valery) Alexandrov," (Poser, 2013). When contacted, Dr Alexandrov stated the urgency of hiring new forensic pathologists in the country. It was revealed that according to international standards, one forensic pathologist is supposed to carry out between 250-300 autopsies per year. He said, "Today (yesterday) June 2 I already did 200 autopsies" (Kowlessar, 2016) and added that on average over 1000 autopsies are conducted annually at the forensic centre. Dr Alexandrov suggested that more house officers and forensic pathologists should be hired to even out the workload. Why Trinidad and Tobago do not have sufficient forensic pathologist? Why Doctors are not doing the relevant training to be qualified for the job in Trinidad and Tobago? It was said that Doctors are being trained abroad and are not coming back. Dr. Alexandrov in the same article said, "as soon as they become a forensic pathologist they immediately get a green card because such medical examiners are supposed to testify in court and you cannot testify being an illegal immigrant," he also went on to speak about the benefits forensic pathologists receive in the US unlike in Trinidad, for example medical insurance. I, Dennecia George am a medical student and I would like to specialise in forensic pathology upon graduation. What I intend to get out of this conference are new ideas on how to motivate medical physicians to become forensic pathologists and also learn about initiatives that first world countries implement to encourage their staff to stay in their country and give service. Kowlessar, G. (2016, 06 03). *Guardian*. Retrieved from http://www.guardian.co.tt/news/2016-06-03/four-pathologists-needed-tt Poser. (2013, 06 01). *Trinidad and Tobago Online Community*. Retrieved from http://www.ttonline.org/forum/threads/21177-Pathologists-are-not-qualified-in-Trinidad-and-Tobago

Disclosure: All authors have declared no conflicts of interest.

**MULTIPLE FATALITY RESPONSE TO HOUSE FIRE IN PIKANGIKUM ONTARIO:
THE SCENE**

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An extended family of 9 persons, from the Ojibwe First Nation, perished in an unsuppressed house fire on the Pikangikum 14 Reserve in north western Ontario over the evening of March 29, 2016. This presentation will describe the subsequent inter-agency forensic response at the scene. The purpose is to demonstrate how an organized response with suitable experts working systematically via a standard, inter-disciplinary scene approach, helps to attain a successful and expedient multiple fatality investigation of a group of significantly burned human remains. The scene was located within the Canadian Shield, in a rural neighbourhood on the Pikangikum 14 Reserve (area ~ 1,808 hectares; elevation ~ 335 meters). The property was privately owned and consisted of a single story, six-room structure made mostly of wood with side panelling. According to OPP investigators, at roughly 23:44 on March 29, 2016, neighbours witnessed the fire. It burned unsuppressed until at least 09:00. The investigators collected multiple witness accounts, including police patrols of that day, which reported that the property owners were a married couple who were hosting a house party with extended family. The missing included 6 adults and 3 children, under 5 years of age. The house displayed significant thermal alteration as damage to, and structural collapse of, approximately 95% of the structure. The forensic field team included 3 Forensic Identification Officers from the Ontario Provincial Police (OPP - Kenora), 2 Fire Investigators and 1 Forensic Engineer from the Office of the Fire Marshall (OFM), and 1 Forensic Anthropologist from the Ontario Forensic Pathology Services (OFPS). The ruins were processed systematically and took 3 working days. The first 11 hours were dedicated to the exposure, documentation and recovery of 9 sets of human remains and associated artefacts. Challenges included the remoteness of the location (over 1,400 km from Toronto) and the variable, cold weather (snow, temperatures between -15.5 ºC and +3.8ºC, wind gusts to 35 km/h). These factors affected logistics, the initial response time by the forensic team, technical aspects of scene processing (e.g. functionality of unmanned aerial vehicle (UAV) and 3D site scanner), health and safety (e.g. physical work time reduced), in addition to the transportation of cases, records and information to OFPS in Toronto for examination.

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THE RELATIVE LOCATION OF THE MENTAL FORAMEN AS A DETERMINANT OF SEX IN MANDIBLES FROM JAMAICANS

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Introduction: The sex of an individual is often best determined using the pelvic bone. However, this may not be present in all instances, therefore characteristics of the skull have to be analyzed in the identification of sex. The skull is considered as the second most relied on guide for sex determination.
The bone of the mandible, found in the skull, is one of the most durable of the human skeleton and persists for a long time. This is forensically significant because it may be used to aid in the determination of sex despite conditions of decomposition, or incineration. The mental foramen is located in the mandible. **Objective**: The aim of this research was to ascertain the usefulness of the relative position of the mental foramen using twenty-six mandibles of Jamaicans as a determinant of sex.
Method and materials: Twenty-six mandibles were obtained from Jamaican cadavers from the Anatomy Department at the University of the West Indies, Jamaica. Measurements were taken from the anterior aspect of the mental foramen (MF) to the mental symphysis (MS), from the anterior aspect of the mental foramen to the posterior border (PB) of the mandible, from the superior border (SB) of the mental foramen to the lower border (LB) of the mandible, from the inferior border (IB) of the mental foramen to the lower border of the mandible, and from the superior border of the mental foramen to the cementoenamel junction (CEJ) of the teeth. The measurements were tabulated and calculations were done.
Results*:* The mean value for the ratio (A/A+P) is 0.26 for males, and 0.25 for females. The mean distances on the right from the SB of the MF to the LB was 18.35mm and 15.26mm in males and females respectively. On the left side, it was 18.22mm and 15.49mm for males and females respectively. The mean distances from the IB of the mental foramen to the lower border of the mandible were as follows: On the right side, males exhibited a distance of 15.24mm, while it was 12.54mm for females. The mean distance on the left side was 15.13mm for males, and 12.57mm for females. **Conclusion:** It may be deduced that the ratio of the distances of the mental foramen to the mental symphysis over the distances to the posterior border exhibits sexual dimorphism, as well as the measurements from the mental foramen to the lower border of the mandible.

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MULTIPLE FATALITY RESPONSE TO HOUSE FIRE IN PIKANGIKUM ONTARIO: FORENSIC ANTHROPOLOGY

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An extended family of six adults and three children, from the Ojibwe First Nation, perished in an unsuppressed house fire on the Pikangikum 14 Reserve in north western Ontario over the evening of March 29, 2016. The inter-agency multiple fatality response involved two forensic anthropologists from the Ontario Forensic Pathology Services (OFPS), including one full-time employee (Gruspier) and one consultant (Kosalka). This presentation will discuss the roles and contributions of the OFPS forensic anthropologists in the multiple fatality response to the fire that had occurred in the remote Indigenous community. It will show how integrating these experts into multiple fatality responses – as well as daily practice – benefits death investigations of significantly burned human remains. Forensic anthropologists played key roles in the official response between March 30 and April 4. At first, the full-time forensic anthropologist coordinated the OFPS effort and deployed the consultant to the scene to be responsible for the search, exposure, documentation, and recovery of human remains and associated artefacts as well as antemortem records collection and transport. The consultant also interpreted preliminary scene findings, photos and created maps in order to lead a briefing to almost 40 staff prior to the post-mortem examinations (the forensic anthropologist was the only field team member in Toronto). Over the days of April 3rd and 4th, both forensic anthropologists engaged in the post-mortem examinations and identifications. The post-mortem examinations occurred three at a time by three forensic teams and the forensic anthropologists contributed by the interpretation of post-mortem CT scans, removal of debris, anatomical positioning and skeletal inventory, dental reconstructions, burn pattern interpretation, traumatic injury interpretation, estimation of biological profile (age-at-death and, sex), analysis of unique skeletal features for identification purposes via antemortem radiographs, 3D virtual reconstruction (for skeletal inventory and juvenile age-at-death estimation), and the resolution of commingling. While the full-time anthropologist directed the identification reconciliation meeting, both sat sitting on the Identification Committee and organized the summary findings from the antemortem and post-mortem records. The consultant authored the final anthropological report, which was inclusive of findings from the scene recoveries through to the identifications.

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INTEGRATED PROTEO-GENOMICS AND MALDI-IMAGING ANALYSIS IN FORENSIC BODY FLUIDS AND FINGERMARKS TRACES

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Body fluids such as blood, seminal fluid, vaginal fluid, urine or saliva and traces of them in fingermark ridges are very important in the investigation of crimes against the person such as murder and rape. Whereas current DNA profiling methods are extremely reliable in establishing from whom the body fluid originated, often during homicide and violent crimes the circumstances surrounding the events are important to determine. The identification of trapped fluid traces from fingermarks is crucial information for forensic investigation. Our recently submitted article describes a streamlined and mass spectrometry (MS) based single methodology for the direct identification of body fluids using matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-ToF-MS) that avoids pre-fractionation or isolation of proteins. Microliter quantities (or less) of neat fluids or their extracts or deposits of them *in situ* on tufts of fibers plucked from evidence (such as garments) can be analysed directly and quickly. Here, we describe extensions of our mass spectrometry-based "proteomics" and "genomics" approach in regards to the identification protein markers of other fluid traces present in fingermark and fingernails scrapings, both human and non-human, and explore its combination with DNA and mRNA profiling analysis.

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SUICIDE IN PRETORIA: A RETROSPECTIVE REVIEW FOR THE PERIOD 2007 – 2010

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Objective: In one study from South Africa (reported in 2004), Scribante *et al* reviewed 1018 suicides in Pretoria over a four year span for the years 1997-2000. This study was undertaken in an attempt to establish whether there have been substantial changes in the profile of suicide victims who died in Pretoria a decade later. **Methods:** Case records at the Pretoria Medico-Legal Laboratory were reviewed retrospectively, for the period 2007-2010. **Results:** A total of 957 suicide cases were identified. Hanging was the most common method of suicide, followed by self-inflicted firearm injury. The true incidence of suicidal intake of prescription drugs/medication has been difficult to determine, because of a backlog of testing at the state toxicology laboratories. White males and females appear to be overrepresented amongst suicide victims, but there has been an increase in suicide amongst Black persons. There appears to have been a substantial drop in the use of firearms to commit suicide - possibly reflecting a positive outcome of gun control legislation which has been introduced in the interim. **Conclusion:** Suicides continue to constitute almost ten percent of all fatalities admitted to the Pretoria Medico-Legal Laboratory, as mentioned in the previous study by Scribante *et al*, confirming suicide as a major cause of mortality in our society. Further research is needed to clarify the profile of suicidal deaths, with a view to informing resource allocation and to improve preventative strategies.

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DIAPHRAGMATIC HERNIAS PRESENTING AS SUDDEN DEATH: 2 CASE REPORTS.

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Background and aim: Diaphragmatic hernias, whether congenital or acquired, that present as cases of sudden death is a rare occurrence. Diaphragmatic hernias may also be missed clinically, especially in the presence of polytrauma. **Methodology:** Two cases of fatal late-presenting diaphragmatic hernias are described that presented at the Ga-rankuwa Forensic Pathology Mortuary in 2016. **Results:** The first case is that of a black male adult of approximately 33 years of age, he demised after a short history of vomiting. At autopsy, a diaphragmatic hernia with strangulated necrotic bowel was found in the left pleural space. The second case is that of a black female adult of approximately 39 years of age. She allegedly visited a General Practitioner the day before she died and complained of constipation and abdominal pain for which she received medication. The following day she was taken to the hospital with difficulty in breathing and a decreased level of consciousness. She died shortly after admission before any diagnostic tests could be performed. At autopsy, a diaphragmatic hernia with strangulated necrotic small bowel was seen in the right pleural space. **Conclusion:** Diagnosing a diaphragmatic hernia can be challenging in clinical practice, and a high index of suspicion is needed. To determine the exact aetiology of these hernias (traumatic or congenital, is very challenging at autopsy and a thorough history is needed. Unfortunately, in our setting, no or very poor histories are obtained.

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FIRST APPLICATION OF CT SCAN IN FORENSIC CENTERS IN SAUDI ARABIA

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Introduction: The forensic radiology application in forensic medicine is rapidly expanding. As CT is an important tool of forensic radiology, it helps in identification, evaluation of injury, Abuse and virtual Autopsy **Aim of the topic:** To introduce and establish the important role and benefits of CT scan in the forensic medicine. **Methods:** Deceased individuals who were CT-scanned and evaluated prior to autopsy or inspection of the body (external examination) at the Riyadh Forensic Medicine Center. Cadavers were selected according to the role of CT benefits in forensic medicine, and the clinical history of the case. **Discussion(2 cases)**: 1- A 50 years old male with firearm injury: - Inlet wound located on the midline of the forehead 3 cm below the hairline with bone beveling to the inside of the skull. - Fissure fracture starting from the inlet opening of the skull and extending to the left and upward until it reaches the end of the left parietal bone. - Exit wound located in the occipital area on the midline directly with bone beveling to the outside and some bone fragments protruding from the skull. 2- A one year old male was scanned for educational purposes to detect the age through Ossification centers and deciduous teeth. - The Anterior fontanel didn't close yet, which Indicates that the child is less than 18 months. - Dentation shows that the child is about 12 months old,(upper first molar has appeared). - The head of femur ossification centers has appeared which indicates that the child is about 12 months old. **Conclusion:** Computed tomography (CT) are now commonly used in forensic medicine. It is very useful to guide the medical examiner through the autopsy and identification. In contrast to autopsy, it is a non-destructive method, establishing the principle of CT Imaging is very valuable in our daily practice base. As forensic radiology and clinical radiology has totally two different approaches, we have faced some challenges through our beginning. For example, interpreting an image in a cadaver is totally different than a living patient. As we proceed, we open a different aspect of promising potential from using CT imaging. 3D constructions were among different possibilities that we have encountered and gained. In near future, promising virtual Autopsies and CT with contrasts would be significantly applicable.

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ELECTRICAL ABUSE AND TORTURE: FORENSIC PERSPECTIVES

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A forensic investigative approach is considered in respect of the situation where presented with evidence of possible abuse through electrical means, or where such abuse may be suspected from evidence or information, or may need to be considered and investigated. Aspects covered in this paper include: - What is the nature of potential abuse using electrical and electronic devices? - What are the typical methods and equipment used? - What are their characteristics and potential effects? - What are their associated medical mechanisms of injury? - How does this evidence typically manifest? - and what are the constraints and challenges from a medical, and other evidence, and investigation perspective? This paper will consider the forensic investigative approach to such a claim or situation.

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THE STUDY OF ELECTROENCEPHALOGRAM IN ASSESSMENT OF MILD PSYCHIATRY IMPAIRMENT

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Objective To explore applied value of electroencephalogram (EEG) in the assessment of mild psychiatric impairment among patients with mental disorders due to traumatic brain injury. **Methods** During the psychiatric impairment assessment, 271 patients with mental disorders due to traumatic brain injury were enrolled according to ICD-10 criterion. Activity of daily living scale (ADL), functional activities questionnaire (FAQ) and social disability screening schedule (SDSS) were used to evaluated the severity of patients. All the participants should examined by EEG and tested by Wechsler adult intelligence scale (WAIS). **Results** At last, 215 patients accomplished the study. Glasgow coma scale (GCS) and severity of craniocerebral injury showed significant difference between normal, slightly abnormal and moderately abnormal EEG groups (P=0.010 and P=0.010, respectively). There was significant difference between grades of psychiatric impairment among normal, slightly abnormal and moderately abnormal EEG groups (P=0.007). The scores of FAQ, SDSS and ADL showed significant difference between normal, slightly abnormal and moderately abnormal EEG groups (P<0.001). **Conclusion** EEG could reflect the severity of craniocerebral injury, preliminarily evaluate social function and daily activity of patients with mental disorders due to traumatic brain injury, and distinguish the mild psychiatric impairment grades, which suggested that EEG could have the potential indicative value in the assessment of psychiatric impairment.

Disclosure: All authors have declared no conflicts of interest.

THE MAKING OF A HUMAN TAPHONOMY FACILITY IN AMSTERDAM, THE NETHERLANDS

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The Academic Medical Center (AMC) of the University of Amsterdam, The Netherlands, manages a body donation program (BPD) for anatomical dissection courses that presently comprises 5000+ living donors. In 2010 a team of anatomists, archaeologists and forensic scientists started exploring the possibilities of creating an outdoor decomposition facility, using human bodies, obtained through this BDP. In 2013 we obtained governmental authorization to use donated bodies for forensic scientific purposes, provided that donors are offered the possibility to opt out for this type of research. Subsequently, the Board of the AMC granted our request to assign a lot of around 500 sq meters on its private territory for this specific purpose. Considering the densely populated Amsterdam area, taphonomic studies would be restricted to buried bodies in shallow graves, which in fact simulates the most common way in which bodies of crime victims are disposed of in the Netherlands. Using telemetric devices (e-noses, temp loggers, etc.) and *in situ* sampling equipment in and around the buried body, decomposition can be monitored with minimal or no disturbance of the natural taphonomic processes. Simultaneously, geotaphonomic parameters can be investigated with e.g. ground penetrating radar and infra-red cameras. In December 2016 we finally

received permission from all involved legal authorities to proceed and realize a human taphonomic facility, which was publicly announced in January 2017 and quite positively received by the scientific and general audience. Presently, we are in the stage of building the facility, taking baseline measurements, and planning the first inhumations. In addition to the successful initiatives in the USA and in Australia, this is a European novelty offering the forensic science community a multitude of possibilities to investigate all aspects of human decomposition.

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BOTTOM UP PROTEOMICS FOR DETECTION AND PROVENANCE DETERMINATION OF BLOOD IN STAINS AND FINGERMARKS

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Currently employed enhancement and detection techniques for blood and blood in fingermarks are not confirmatory due to targeting generic compound classes like proteins, and as such are not sufficiently specific and prone to false positives. In order to confidently determine whether a crime scene sample is in fact blood and more specifically human blood, an in solution bottom up proteomic approach targeting blood-specific proteins employing MALDI-MS has been presented previously with great success even on samples as old as 34 years. This work has been developed further to devise a protocol for proteomic *in situ* analysis of bloodied fingermarks with MALDI-MS imaging, enabling the mapping of blood peptides to fingermark ridges and thus establishing a strong link between the suspect and the event of bloodshed.
In order to achieve this, the concentration of the proteolytic enzyme was optimized on a model sample. Putative peptide identifications were made for signals originating from a number of different blood-specific proteins, including not only the most abundant blood proteins like haemoglobin, but also several other proteins (e.g. Complement C3, Hemopexin and Erythrocyte Membrane Protein Band 4.2). To further prove the concept, a blind study has been conducted analysing unknown samples provided by Elite Forensic Services LLC, ranging from different species' blood to other substances known to produce false positives with conventional techniques. Employing MALDI-MS it was possible to not only determine which samples contained blood, but also determine if they were of human origin, therefore signifying a huge step forward in the forensic analysis of suspected blood samples and demonstrating potential for re-analysis of cold case samples or samples of disputed origin.

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THE SERIAL KILLER JEFFREY DAHMER: 25 YEARS LATER

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On July 23, 1991 personnel from the Milwaukee County Medical Examiner Office and Milwaukee Police Department responded to an apartment where partially skeletonized remains of eleven individuals had been detected. The assailant, Jeffrey Dahmer, was quickly taken into custody. In this unique situation, Dahmer freely discussed his role in the murders with law enforcement and provided a valuable resource for collaboration of scene, anthropological and autopsy findings to pathologists and law enforcement personal during the investigation. Scene investigation and autopsy analysis of the bodies provided prosecutors with detailed evidence of motives, and psychological state of Dahmer during the course of a death spree that lasted nine months. The evaluation of the scene allowed investigators to establish methods of death, begin the preliminary identification process, and demonstrate the deteriorating mental capacity of the assailant. Forensic pathologists assisted with the identification, established the cause of death, and documented injuries that allowed investigators to question Dahmer on various injuries he inflicted upon victims. Anthropological examination assisted with the identification and also resulted in the establishment of victim profiles. A forensic psychiatrist constructed Dahmer's psychological profile characterized by a destructive behavior in which his collection of fetishistic memorabilia provided an expression of his deep ambivalence and mixed hostility towards his victims. Frustrated with his sexual immaturity and continual rejection, Dahmer channeled his hostility into a sadistic sexual behavior characteristic of the psychopathology of a serial killer. The multidisciplinary investigation that followed provided a number of conclusions which permitted the successful prosecution and conviction of Jeffrey Dahmer. Dahmer strangled his victims following his use of "chemical" restraints. He experimented with a method of injecting caustic material in the brains of his victims to sedate and pacify them into helpless "zombies." Forensic autopsies demonstrated the methods of death, post-mortem dissection and disposition. Anthropological analysis suggested Dahmer was attracted to a certain anthropometric body type. Materials recovered from the science confirmed the methods of an "organized" serial killer with souvenir taking to enhance sexual pleasure. The Jeffrey Dahmer Case has captured and captivated the American consciousness for the past twenty-five years. This presentation will discuss pitfalls in the investigative process using the lessons learned in the Dahmer case. Participants will confront the complexity of the crime and relive the experience by confronting the difficulties encountered real time by investigators at the scene which played an important role in the judicial proceedings that followed.

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CHARACTERIZATION OF DIFFERENT NATIONAL COSTUMES TEXTILE FIBERS USING FT-IR AND RAMAN MICROSCOPY

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The UAE national dress has been designed with the dual intent of providing comfort and adhering to tradition. Men wear an ankle-length, loose-fitting garment mostly made of white textile material known as **Kandora.** On the other hand, women wear a long black flowing light coat over their clothing, named **Abaya**. In this study, samples from different textile fibers of Kandora and Abaya were collected and analyzed using Micro-Fourier transform infrared spectroscopy (μ-FTIR), and μ-Raman spectroscopy, in addition samples were physically examined using 3D microscope to identify, characterize and compare fibers with respect to composition, diameter, and their cross-section shape. Based on the results, comparisons were made between different textile fiber samples to demonstrate the potentiality of these fibers to solve a real case.

Disclosure: All authors have declared no conflicts of interest.

"CUTTING-EDGE" RESEARCH: IDENTIFICATION AND CLASSIFICATION OF KNIFE TRAUMA ON BONE

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Knife mark analysis to date has been intermittently researched across a range of disciplines, despite its potential to significantly contribute to criminal investigation. The current study aims to elucidate cut mark analysis by proposing a novel classification system for the identification of knife cuts (kerfs) in bone. The system was devised, to record accurate and reliable information about cut marks and the criteria were tested for

association with the knives that created them. Optical Microscopy was used to examine knife cuts on fleshed porcine bone. Incised cuts were made by a range of serrated, scalloped and fine-edged blades (n=9), by the author, and participants (n=23) were recruited to make marks on bone under the same force-measured conditions, using the Kistler force plate and a bespoke frame to control the level of height to which the knife can be raised above the bone prior to impact. Resultant kerfs were created by a single operator (n=86) and created by a range of individuals (n=186). The data suggests that consistent force was not achieved and the resultant marks on the bones made by the same knife had wide variation in their appearance and depth. The classification criteria tested did not provide discrete identification of knife blades from the assessment of kerf features; however, trends were identified from criteria including margin regularity, margin definition, floor width and wall gradient, which may form the basis for further investigation. Marks made by a single operator showed more significant associations ($p<0.05$) than group operators, and although kerfs from each share some trends, several significant relationships observed in marks made by a single operator are not shared by the participant group. Limitations of using optical microscopy included the inability to view all aspects of each mark, particularly when combined with variation in depth and angle produced by human operators. From the present results, it is suggested that the use of digital microscopy with a superior ability to build three dimensional images of indented marks would provide the necessary step forward to improve discrimination between knife classifications, based on the areas highlighted by the current research. This reinforces the need for further understanding of the mechanics of cut mark application and their potential effects on kerf features.

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TWO DEATHS ASSOCIATED WITH FURANYL FENTANYL TOXICITY

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Patterns of recreational drug use are constantly evolving. North America is seeing an explosion in opioid deaths that has been labelled *The Opioid Crisis*. While older stimulant drugs such as amphetamines and cocaine are still seen along with heroin and prescription opioids, novel opioids are also appearing on the illicit market. These drugs include new synthetic fentanyls. While fentanyl has been abused, particularly diverted patches, novel non-prescribed fentanyl derivatives have now entered the market and are the cause of significant morbidity and mortality. We present two deaths associated with furanyl fentanyl toxicity. Case 1 An 18 year old female was found dead at home. She was said to have no history of drug misuse. She was found with a collection of pills marked as *Percocet.* The tablets were subsequently shown to contain furanyl fentanyl and alprazolam. At autopsy there was green material in the nostrils. The combined lung weights were 1160 g grams. There was no natural disease found. Toxicology revealed furanyl fentanyl at a concentration of 1.1 ng/mL, alprazolam in trace amounts and ethanol at a concentration of 100 mg/100 mL. Death was recorded as due to furnayl fentanyl and ethanol toxicity. Case 2 14 year old girl was found collapsed at home with drug paraphernalia present. She was resuscitated but subsequently declared brain dead and her organs were donated. A collection of pills present and marked as *Percocet* were subsequently shown to contain furanyl fentanyl and alprazolam. Subsequent analysis of clinical blood revealed a furanyl fentanyl concentration of 0.68 ng/mL. 4-ANPP was detected at a concentration of 1.7 ng/mL and alprazolam at 25 ng/mL. Death was due to furnayl fentanyl toxicity. Discussion Furanyl fentanyl is a novel fentanyl that has been recorded in a limited number of deaths. It has been associated with an overdose epidemic in British Columbia where crack cocaine was contaminated with furanyl fentanyl. Reported concentrations in fatal cases have been in the range 2.6-76 ng/mL with mean and median concentrations of furanyl fentanyl of 26 ng/mL and 12.9 ng/mL respectively. The source of furanyl fentanyl was identified as illicit tablets marked as *Percocet.* Our reported cases had lower recorded concentrations of furanyl fentanyl, were of a younger age than previous cases and were snorting the drugs. These cases once more illustrate the changing nature of the opioid crisis in North America.

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THE PITFALLS OF FORENSIC AUTOPSY PRACTICE AND ITS IMPACT ON JUSTICE DELIVERY IN UGANDA

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Forensic autopsies are an important medical investigation in establishing the cause and circumstances of death and particularly in unlawful deaths. Courts of law rely on medical evidence particularly the results of forensic autopsies to dispense justice as these are considered important and independent corroborative evidence. In Uganda, located in the Eastern part of Africa, forensic autopsies are carried out by various cadres of health workers including the forensic pathologies, anatomical pathologies and medical offices. Most of these autopsies are carried out in poorly equipped mortuaries. and these have not been without serious impacts on justice delivery in the country. Two anatomical pathologists carried out a forensic autopsy on a woman who died at her home. The pathologists found injuries on her body which they both described as “multiple ecchymotic bruises and punched out abrasions on both upper and lower limbs surrounding multiple black deep burns” and they stated that the cause of death was “shock due to electrical burns with blunt force trauma”. The husband of the deceased woman was sentenced to death and this sentence was upheld by the highest court in Uganda. These injuries were not photographed and an independent opinion could not be obtained. However what is certain is that these were not descriptions of electrical burns. Furthermore the toxicology results indicated that the deceased had substantial amounts of an organophosphate in her body. Another case of interest in Uganda was of a young woman who was found dead in her bed. An anatomical pathologist who carried out the autopsy concluded that the young woman died as a result of blunt force trauma following sexual assault. His main finding was a dilated anus. Two forensic pathologists who carried out a repeat post-mortem established that the cause of death was aspiration pneumonia. The deceased was an epileptic. In yet another case an inmate was found hanging in a police cell. The first autopsy carried out by an anatomical pathologist concluded that the death was consistent with suicidal hanging. However a forensic pathologist who reviewed the case concluded that the deceased had died and the body hanged up after rigour mortis had set in and other post-mortem features were inconsistent with suicidal hanging. The main challenges therefore in the performance of forensic autopsies in Uganda therefore include incompetence and inadequate training, lack of mechanisms to regulate these autopsies, lack of guidelines, lack of peer reviews and poor facilities.

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EFFECT OF PHOTOCOPIER ON THE FORENSIC EXAMINATION OF PHOTOCOPIED THUMB IMPRESSIONS

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In certain cases, where the original document bearing thumb impression is missing or may be deliberately damaged, only photocopied document is available and these types of documents are usually received in the Forensic Science Laboratories for making an opinion on their authenticity. The general perception among the scientists is that a photocopied fingerprint might not possess sufficient ridge details required for an efficient examination, which renders fingerprint experts to refrain from taking such cases. The problems pertaining to form an opinion in such cases motivated us to evaluate this particular aspect of fingerprint examination and to answer the questions such as whether it is possible to render an opinion on a thumb impression present on the photocopied

document. And, if yes, then to study the extent of variation caused by the photocopier and further to assess the generations of the photocopy up to which an opinion could be given. In India, despite the literacy rate hovers around 74% of the population, the thumb impressions are still used as a tool for authentication of important documents, pretty much the same way signatures are used to approve the authenticity of a document. The present study has been undertaken with a purpose to observe and interpret the minute but significant contribution a photocopier makes to a photocopied thumb impression present on the document. For this study, the original thumb impressions have been taken by using an official blue stamp pad and were photocopied for the subsequent five generations from the various brands and models of photocopy machines. For a thorough analysis, 20 points have been marked in original and photocopies of subsequent generations. After the analysis, results indicated that in the photocopies produced from some of the photocopier brands, extra deposition of toner deteriorated the ridge characteristics while the other photocopiers did not affect the ridge characteristics much. The apparent loss of ridge details became conspicuous in the 3rd to 5th generation copies. The results demonstrated changes in the 2nd level ridge details, which will help us in approaching an objective and logical opinion regarding the disputed thumb or finger impression on the photocopied documents.

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Y-STR GENETIC STRUCTURE OF MOST COMMON SURNAMES IN JAMAICA: FORENSIC IMPLICATIONS

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Analysis of short tandem repeat (STR) loci has shown that there is greater genetic diversity within the populations of African descent in comparison to other groups. Over 90% of our fore-parents were African descendants; most of us acquired European or Asian surnames since some of our enslaved ancestors took the name of the last slave owner and some used a surname from a previous slave owner. Studying sites of Y-chromosomal DNA variation can reveal how likely it is that men sharing the same surname have common ancestry. This genetic information can be useful in uncovering familial relationships connected to the source of the forensic profile from the crime scene and providing investigators focus and direction in their search for an offender's identity. The Y-STR genetic structure of 41 unrelated males bearing five most common surnames from various parishes in Jamaica was analyzed for surname and haplotype correlation. Forty-one haplotypes have been observed, all of which are unique. There were no shared haplotypes observed. This may be due to multiple independent founders for these names, acquiring names, adoptions, name changes, non-paternities, and mutation of Y haplotypes. This low correlation demonstrated that surname prediction may not be adequate for forensic purposes in Jamaica and a larger sample size is needed.

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MURDER BY FALLING: AN EXPLORATORY ANALYSIS OF STAGED FATAL FALLS

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Homicides committed by causing someone to fall from a height are rarely documented in the literature. In fact, very little is known about accidental, suicidal or homicidal deaths from falling. This is due to the difficulty in classifying manner of death after a fall - because physical evidence used to make this determination is often equivocal. In these cases, cause of death is commonly determined to be "multiple injuries consistent with a fall from a height", and manner of death is at risk of being left undetermined, especially when there is suspicion of a homicide. The difficulty in establishing manner of death in fall cases complicates death and homicide investigations. When exploited by offenders, it may provide an opportunity to avoid detection by staging a homicide to appear as an accidental or suicidal fall from a height. To begin to explore homicidal deaths by falling, 12 solved murder by falling cases were examined in detail. Results showed that homicidal falls often occur at outdoor locations (cliffs or bluffs); are commonly planned in advance by offenders who are engaged in otherwise violent and/or controlling relationships with the victim (usually their female spouse); and are often motivated by a desire to secure insurance money or avoid costly separations. Offenders often do not manipulate evidence, instead planning the murder and lying to police afterwards about the circumstances of the fall. These offenders were detected, and later convicted, based on evidence of this planning, their post-offence behaviour, and inconsistencies between their versions of events and the known victimology. The difficulties these offenders create for investigations and prosecutions are discussed.

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A NOVEL ANALYTICAL METHOD OF TFMPP AND MCPP IN FLUIDS OF DRUG ADDICTS USING LLE-GC/MS AND LLE-GC/NPD

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Aim: In recent years, drug-abuse is getting more serious day by day, which has become a hard nut to crack for the today's international society. Since nations around the world have tightened controls on traditional drugs, new-type drugs have become popular. 1-(3- trifluoromethylphenyl) piperazine (TFMPP), 1-(3-chlorophenyl) piperazine (mCPP) and other new piperazine-drugs, acting as hallucinogens like 'ecstasy', spread to the whole of the world. However, the research of relevant detection methods for TFMPP, mCPP in biological fluids are nearly blank in our country, that makes detecting and preventing the criminal cases related to piperazine-drugs difficult. Therefore, the establishment of some simple, fast, reliable detection methods for them is an important issue in forensic science. **Method:** In this paper, A new method for liquid-liquid extraction and GC/MS, GC/NPD detection with two sets of Chromatography and mass spectrometry conditions for TFMPP and mCPP was established by comparing the extraction purification effect of different solid-phase extraction columns for TFMPP, mCPP in biological fluids (urine and blood). In the analysis, the feasibility and accuracy of this method has been verified. **Result:** The results showed that the best conditions for extraction and purification of TFMPP and mCPP in the urine are as following: 3mL of ethyl acetate as extractant and at PH =10. The recycling rate for TFMPP and mCPP are 102.77% and 99.86%, respectively. Meanwhile, they are 3mL of Chloroform/isopropanol (4/1, V/V) as extractant and at PH =10 in the blood with the recycling rate 81.38% (TFMPP) and 91.96% (mCPP), respectively. Additionally, this method has good linear relationship and a low detection line for TFMPP,mCPP in the biological fluids (urine and blood) by GC/MS and GC/NPD. **Conclusion:** The above experimental results show that the new method in Liquid-Liquid Phase Extraction for TFMPP and mCPP in biological fluids has high recycle ratio and a good repeatability.

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IMPLICATIONS OF THE THIN EGGSHELL SKULL RULE ON DOCUMENTING THE MANNER OF DEATH

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The eggshell skull rule or thin skull rule is a legal doctrine that asserts that frailty of the injured person is not a defense in a tort case. This assertion may cause a dilemma in prescribing the manner of death by medical practitioners. A medical doctor is often required to state the manner of death in addition to the cause and mechanism of death. Amongst the various manners of death is death due to natural causes. However in most jurisdictions, deaths that may apparently arise from natural causes, are not classified as unlawful deaths. However the circumstances of some of the deaths due to natural causes make them unlawful deaths. In a recent case in Uganda a man died while being pursued by the police who kept shooting in the air. At autopsy the man was found to have ruptured a thoracic aneurysm. The cause of the aneurysm was syphilis and this death was technically classified to result from natural causes but legal experts thought otherwise; it was deemed to fall under the thin eggshell skull or thin skull rule, an unlawful death. Many other deaths deemed to have been from natural causes have been recorded in which the thin eggshell skull rule has been successfully applied. The question of causation cannot be answered simply by applying the medical principles. Key words; manner of death, unlawful death, thin skull rule

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ONTARIO PROVINCIAL POLICE WORK IN PARTNERSHIP TO PROTECT OUR VULNERABLE CHILDREN

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Of the approximately 45,000 children reported missing in 2015 in Canada, more than 12,000 were from Ontario, Canada's largest province. Every time a child goes missing, there is the potential for exploitation through sexual abuse, human trafficking or domestic servitude, all of which expose them to serious trauma that will forever affect their lives. In response to the alarming number of children who go missing every day in Ontario and driven by a philosophy of community mobilization and engagement, the Ontario Provincial Police (OPP) has taken significant strides to keep our children safe. The OPP has partnered with police agencies, victim service providers, community partners and the Ontario Government to develop strategies to identify potential victims, remove opportunities for predators to exploit children, and develop prevention strategies. One of these innovative partnerships is with the Office of the Chief Coroner of Ontario and the Ontario Forensic Pathology Service that resulted in the creation of the Provincial Centre for Missing & Unidentified Persons in 2016. The OPP also leads and coordinates a Provincial Missing Persons Working Group, formed the Anti-Human Trafficking Working Group and continues to implement proactive initiatives coordinated by the Missing Person Unit, Child Sexual Exploitation Unit and through the Provincial Strategy to Protect Children from Sexual Abuse and Exploitation on the Internet. The OPP is one of North America's largest deployed police services with more than 6,200 uniformed officers, 3,100 civilian employees and 800 auxiliary officers who provide frontline and specialized policing services. It provides policing services to more than 320 Ontario municipalities and patrols over 126,000 kilometres of provincial roadways. This presentation will expand on some of the specific initiatives the OPP has undertaken to address the numerous challenges in identifying those who prey on children both online and in person. Some of these challenges are the anonymity provided by the Internet that hampers the ability to identify potential victims and predators, limited community and police resources, cross-jurisdictional nature and lack of awareness.

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ROAD SAFETY CONSIDERATIONS WITH THE LEGALIZATION OF MARIJUANA - AN OVERVIEW

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Prospective legalization of Marijuana in Canada by July 2018 will bring an urgent requirement for preventive measures to counter drug impaired driving since THC is known to impair cognitive and motor functions for the safe operation of a vehicle, thereby increasing the crash risk. Present technology for roadside drug screening involves collection of saliva from drivers followed by analysis using lateral flow immunoassay technique. The methodology provides several advantages such as: 1) Sensitivity and Accuracy of detection of the parent compound 2) Low detection limits for screening applications 3) Legally accepted matrix for drug detection 4) Indication of recent use 5) Convenience of roadside testing for non-invasive detection The correlation between THC and the metabolite content in physiological fluids and the specific degree of driving impairment is a very challenging task due to THC lipid solubility (as opposed to alcohol water solubility) and the individual metabolic profile of the drug depending on administration frequency, drug tolerance, driving experience, age and health of the driver.

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THE NATIONAL INSTITUTE OF FORENSIC SCIENCE AND FORENSIC GOVERNANCE IN AUSTRALIA & NEW ZEALAND

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The National Institute of Forensic Science Australia (NIFS) was established in 1992 by the then Australasian Police Ministers' Council and governed by a Board of Control. In 2013 an independent review of NIFS resulted in significant changes for the forensic landscape in Australia and New Zealand. These changes include a new governance framework, which allowed for participation in the funding and governance of NIFS by all forensic service providers of Australia and New Zealand (not just police). A new planning and work program framework was introduced in 2015. The framework is underpinned by a three year Strategic Plan comprising funding allocated to programs of work and approved by the Police Commissioners. The Strategic Plan is given effect through the implementation of an annual Business Plan developed in conjunction with a new governance group called the Australia New Zealand Forensic Executive Committee (ANZFEC). ANZFEC comprises representatives from the forensic service providers who now fund NIFS and include police and non-police agencies. NIFS is now the peak body for forensic science in Australia and New Zealand and coordinates all international representation on behalf of forensic government service providers. The implications of these changes on our international stakeholders and the impact on the future direction of NIFS and forensic science in Australia and New Zealand will be discussed.

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GARISSA UNIVERSITY TERROR ATTACK: HOW FORENSIC DNA RESOLVED THE CASE

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Aim: This paper is about what went wrong during the Disaster victim Identification process, how forensic DNA aided in resolving the problem and recommendations. **Background** Garissa University College is located in Garissa town, in Northern Eastern part of Kenya. The institution had 749 students at the time. On the 2nd day of April, 2015, at around 5.30am, the university was attacked by an armed gang. The attack was followed by an explosion at the university's entrance, before the attackers moved

into the nearby hostels, and shot the students. Al shabaab, a terror gang based in Somali claimed responsibility. The attack left 147 fatalities, 113 casualties. The day's temperatures were 32-36degrees Celsius. The bodies were air lifted to Nairobi, for identification purposes. By this time decomposition rate was high and physical identification was a problem: **Methodology** The fingerprints were taken from the bodies and compared to those in the National fingerprints registration bureau. **DNA Extraction: NAILS:** DNA extracted by the Prepfiler BTA kit(refer to ApliedBiosystem Method) **Buccal swabs**; DNA extracted from the buccal swabs using the Chelex method (Walsh et al 1991). **Quantification:** Real Time PCR **Results** 146 bodies were identified by fingerprints method (records from National registration Bureau) and bodies released to their relatives. One body was left at the mortuary,(tagged no 658) one family could not account for their daughter and the university could not account for one of their students. **Conclusion** Forensic DNA was used in resolving the issue. Two bodies had been given to the wrong families, resulting to exhumation and the correct bodies released to the correct families. **Recommendations**: In Disaster human identification, DNA sampling should be carried out to complement the other methods I hope, the observations made during this presentation and hints may be of some benefit to others facing the management of a mass disaster human identification.*Keywords: mass disaster, human identification. Fingerprints, Terrorists, Forensic DNA, nails.*

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THE "MANHOLE MURDERS" - A SERIES OF HOMELESS PERSON HOMICIDES

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Homelessness represents a worldwide problem. Even amongst so-called "developed" nations, where the standard of living far exceeds that within so-called "developing" nations, homelessness can result in significant socioeconomic issues. This is particularly true within large urban areas within the United States (U.S.); however, over the last several decades, homelessness has increasingly become a troublesome reality within medium- and small-sized cities. A variety of factors are associated with homelessness, including unemployment, poverty, mental illness, and substance abuse, including alcoholism. The homeless are considered a vulnerable population because they lack a variety of basic necessities, including personal shelter, food, warmth, and safety. As such, homeless persons are at greater risk for illness, injury and death. Although numerous programs are available to assist homeless persons in the U.S., many homeless people remain within their dangerous living situations, sometimes by choice. Medical examiners and coroners (ME/C) offices are familiar with the increased mortality inherent within the homeless population. Offices within every large- and medium-sized city within the U.S. routinely investigate deaths involving homeless persons. Common causes of death include alcoholism, other forms of substance abuse, and environmentally-related conditions, such as hypothermia. As the homeless population is also at-risk for violence, ME/C offices also investigate a substantial number of homicides occurring within this population; however, the usual case is typically not considered high-profile. Indeed, the homicide of a homeless person may go virtually unnoticed by much of the local community, especially in large urban areas. In this report, a series of related homicides involving 4 homeless men is reported. The circumstances of the discovery of the bodies, and the fact that the cases occurred in a medium-sized city, resulted in widespread media attention, as well as fear and apprehension within the local community. In mid-January, the decomposing bodies of two homeless men were discovered in a manhole adjacent to a railroad track, near the downtown area of a medium-sized, Midwestern U.S. city. Autopsies revealed that both men had died from severe craniocerebral trauma. Two days later, the decomposing bodies of two more homeless men were discovered in a different manhole. These victims had also died from severe craniocerebral trauma. The initial concern was that there was a serial killer targeting the homeless. Subsequent investigation revealed that all 4 men were killed by 2 other homeless men. The details of the investigation will be presented, with discussion of important forensic points and societal implications.

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THE ROLE OF DISPUTED PATERNITY IN GENDER BASED VIOLENCE (2011-2015) -KENYA

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Key words: disputed paternity, gender based violence, spouse, criminal justice system Abstract: Many cases of disputed paternity have been reported in both the criminal justice system and the media in Kenya. This study focuses on these cases documented in the last five years (2012-2016). It is suspected that such disputes could have led to male aggression on their spouses. Introduction: The application of physical force in marital unions against a vulnerable spouse has been cited as a problem in many communities. In the third world setting, the problem is possibly aggravated by poverty and lack of gainful employment in either or both spouses. Many families live on less than one US dollar a day with dependants to feed, clothe and offer shelter. In Kenya prominence has been given to a case of extreme physical maiming of a wife by her husband by decapitation of her arms and permanent facial disfigurement. Gaps exist on possible causes of this kind of violence. Alleged unfaithfulness and resultant paternity disputes from extramarital unions could be a possible cause of spousal aggression. The courts in Kenya have ordered for more than 200 DNA paternity tests annually as a possible legal remedy to disputed paternity. The men in the Kenyan community appear to use aggression on their partners and the child/children concerned in cases of disputed paternity Methodology Sexual violence cases investigated and submitted to the government chemist laboratories in three Kenyan cities for DNA paternity testing. The period of study is five years (2012-2016). The concerned individuals were escorted to the laboratory for DNA sample collection through buccal swabbing or blood submission by the investigating officer. The DNA was extracted using Chelex method (Walsh et al, 1991) and quantification, amplification and detection carried out. The report was finally prepared for use by the criminal justice system and individuals. Conclusion Results revealed that more than 75% of the cases analysed produced inclusions of the alleged father as the biological father to the disputed child/children. It is therefore possible that most men use the paternity disputes/ suspected unfaithfulness as an excuse for aggression on their spouses and children. Gaps exist on the other possible underlying factors that precipitate aggression by the men in a marital union.

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GENERIC SYSTEM AS A METHOD OF CHALLENGING WITH NEW PSYCHOACTIVE SUBSTANCES: TURKISH EXPERIENCE

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New Psychoactive substances have gained higher demand in Turkey compared to the traditional drugs in the past two decades. Turkey carries an important role when it comes to the transition of traditional drugs such as opioids, however, this does not apply for new psychoactive substances. Turkey is one of the main marketing areas of New Psychoactive substances, Due to universal "Principle of Legality", individual listing

system was in use alone till 2014 .However this plodding system remained insufficient when it came to fighting this type of crime. Thus, generic classification of the psychoactive substances has been implemented to the Turkish criminal act. After one year of observation, it was determined that the generic system has covered approximately 45% of new seizures (a total of 24 NPSs are within the generic classification out of 56 new seized substances during this period). It was also experienced that there were some preventable leakages from the generic system. Therefore some amendments were done at the generic classification such as discarding the restriction of carbon numbers added to the alkyl substitution. These small modifications have widened the coverage of NPSs. Although the effectiveness of the generic system, the NPSs which are out of coverage have still been included to the act by individual listing. The most prevalent seizures among NPSs in 2015 are synthetic cannabinoids, similar to previous years. Approximately 16% of them are related with selling, marketing, and manufacturing, while the rest are usage and possession of the substances. One fourth of the cases have been arrested in Istanbul as similar to previous years, but it has been observed that the count of the cities where the substances were seized in have progressively increased (from 43 cities in 2012 to 71 cities in 2015). Another important point from previous years are amendments to the Turkish Criminal Act in which the punishment of the crimes related with synthetic cannabinoids elevated to the aggravated drug crime levels. There are still some problems concerning the evaluation of the cases admitted to the emergency services because of the physicians lack of awareness and knowledge. The establishment process of some of the regional drug confirmation laboratories across the country are still ongoing. As for the post-mortem analysis of drugs, many improvements were achieved by the forensic toxicology departments. Most of them have LC MS MS, updated libraries, experienced staff and also have purchased reference materials as soon as possible.

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THE NIGERIA CORONERS' LAWS: EVOLUTION AND CHALLENGES

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Nigeria was a former British Colony that won its independence in 1960 and naturally adopted the British Coroner System. The Revised Coroners Law of Nigeria was conducted by Sir Donald Kingdom QC and handed over in June 1958. It was differentially applied across the northern and southern parts of the country. The laws at that time had many inadequacies but unfortunately the various succeeding governments never improved on it. The country is currently divided into 36 separate States plus the Federal Capital Territory, each supposedly with its own version of the Coroners law; it is largely non operative in the northern part of the country for religious reasons. The law witnessed amendments in Lagos State in 1972 but the most dramatic was the Lagos State Coroners Systems Law of August 2007. This is a fusion of the Coroner and Medical Examiner System, it created the Offices of the Chief Coroner and Chief Medical Examiner, working synergistically to investigate statutorily defined reportable deaths. The Coroners have powers to order autopsies (including exhumations), hold inquests and provide for specific sanctions. The law also provided for the establishment of a forensic science laboratory, regulates organ retention and cremation procedure. Certain regulations are currently being considered by a group at the instance of the Chief Coroner, who is a High Court Judge. Unfortunately the rest of the country is yet to adopt the example of Lagos State. This law allowed for the first proper medico-legal investigation of a plane crash in 2012 during which 98% of the victims were identified and that marked the 'end' of mass burials in Lagos State. A number of other mass disasters have been similarly investigated within that jurisdiction. Sadly many similar incidents in other parts of a country, resulting from terrorism, religious conflicts and extrajudicial killings, are never investigated. Despite the advances in Lagos State there are still challenges ranging from poor police training with corruption and extrajudicial killings to religious sentiments, poor public education, dearth of forensic pathologists and other experts, limited forensic knowledge by lawyers and judges, resistance of many doctors to medical audit, and wrong socio-cultural values among others. There is a need to deal with this plethora of problems and for the national government to adopt the Lagos model.

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VARYING LEVELS OF METHAMPHETAMINE IN HAIR OF FIVE FAMILY MEMBERS LIVING IN AN EX-METH LAB

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The increase in clandestine drug laboratories has a knock-on effect in the increase of people who are unwittingly exposed to the chemicals and drugs left behind. Whether the drugs were synthesised in a hotel/motel room or a home there are consequences for the next people who live in that place. This presentation reports on an investigation where a family with three young children unwittingly bought a house that had been used as a clan lab. They experienced behavioural problems, breathing problems, attention deficiency and sleeping disorders. With their permission samples of their hair were taken one week after they moved out of the house. These samples were analysed at Forensic Science SA (FSSA). Methamphetamine was detected in the hair of all family members at concentrations ranging from 5 to 460 pg/mg. Amphetamine was also detected in the hair of the two youngest children, ranging from 16 to 20 pg/mg. The highest methamphetamine levels in the hair samples collected (330 and 460 pg/mg) were found in the two youngest children (boys aged 7 and 8 years), with a lower level (50 pg/mg) found in the hair of the older child, a girl aged 11 years. Lower levels of methamphetamine were reported in the hair of the children's mother (17 pg/mg) and father (5 pg/mg). The varied levels of methamphetamine in the five people living in the same house can be explained by their behaviour. The father worked two jobs outside of the home - so spent little time at the residence. The mother (who dyed her hair) had spent time cleaning the house before and after they left and methamphetamine was also found (8 pg/mg) in the methanol wash from her hair . The 11 year-old girl was mostly static with computer-based activities. The highest levels were found in the 7 and 8 year-old boys - who were running around, rolling on the floor, touching the walls and, perhaps, not washing their hands before eating. These levels are consistent with those expected from methamphetamine smoking of approx. 0.5 to 1 g /day. Hair was retested 3 months after the family moved out and only the elder boy still had a positive signal for methamphetamine down from 330 1 week after leaving the home to 60 pg/mg. If there is an 'epidemic' of illicit drug synthesis and use then incidences where innocent people are exposed to drugs in homes and hotels will also increase creating a new issue.

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THE PRECISION OF VIRTUAL PELVISES DERIVED FROM CLINICAL CT-IMAGES FOR FORENSIC ANTHROPOLOGY

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Almost all European countries lack contemporary skeletal collections for the development and testing of forensic anthropological methods. Legal, ethical, and practical considerations hinder the development of these skeletal collections. Clinical CT scans provide a possible solution, albeit being associated with varying imaging conditions. This study investigates the effects of image segmentation and varying imaging conditions on the

variability of virtual modelled pelvises. One adult cadaver was scanned using varying imaging conditions (scanner type and their associated standard patient scanning protocol, slice thickness, and exposure level). Segmentation was used to generate virtually modelled pelvises. The precision of the virtual models was calculated by the fraction of polygon mesh points resulting in point-to-point distance errors of 2mm or less. Additionally, areas that have high variability and low precision were visualized by colour mapping. Almost all polygon mesh points (97%) resulted in point-to-point distances errors of 2mm or less. Furthermore, 90% of these points resulted in point-to-point distance errors of less than 1mm, well below the accepted error level of 2mm in traditional forensic anthropology. Colour mapping shows that areas of the pelvis with large variability are predominantly joint surfaces, which are practically irrelevant for standard osteometrics. Segmented bone elements from clinical CT scans are a precise source for creating a virtual skeletal database. Virtual models provide the possibility to automate measurements and perform shape fitting analyses. This may not only reduce user/measurement error, but also provide information on the spectrum of variation for complex populations with high rates of immigration/migration.

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ESTIMATION OF TIME SINCE DEATH USING A BODY COOLING MODELS OF PIGS

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Ondol is a traditional floor-heating system in Korea, where the floor is heated from below and the heat radiates to warm the room. Bodies are commonly found indoors in Korea and the application of the Henssge nomogram is problematic due to the effects of the *ondol* heating system on the rate of post-mortem heat loss in the body. The aim of this study is to test the effects of the Korean floor-heating system on heat loss using adult pig models, and to create a novel formula for estimating time since death during the early stages of decomposition Four 40Kg pig carcasses (Sus scrofa) were killed by administering euthanasia drug for animal per Soonchunhyang University Institutional Animal Care and Use Committee protocol. Three electric mattress pads were placed on the ground to maintain a constant temperature of the substrate like the *ondol* heating system. Each pig was placed on four different surfaces; low-heat, medium-heat and high-heat electric mattress pads (experimental group), and the ground (control). Four temperature measuring probes were placed in each pig: inside of the rectum, on the body surface, between the body and the surface of mattress pad/ground, and on the mattress pad/ground. The probes were connected to a temperature data logger system, and Watchdog 2000 mini station was located at the research site to measure the ambient temperature. Temperature was recorded every minute and pigs were monitored hourly for 48 hours by CCTV. Statistical analysis was performed using the SAS (version 9.3) program. Spearman's Rank Correlation results demonstrate the magnitude of the relationship between four body temperatures and ambient temperature. The rectal temperature and the temperature between the body and the surface of pad/ground are strongly correlated with post-mortem cooling of the body rather than ambient temperature. The rate of cooling of the body is represented by a cube function of time rather than an exponential or bi-exponential function. The results of this pilot study demonstrate that post-mortem cooling is correlated with the rectal temperature and the temperature between the body and the surface where the body was laid. It indicates that post-mortem cooling of the body is more influenced by ground surface temperature than by ambient temperature.

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FORENSIC INVESTIGATION OF THE DANA FLIGHT 992 CRASH: OVERVIEW OF THE NIGERIAN EXPERIENCE

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Plane crashes occur around the world for many reason Nigeria has recorded several accidents in the past four decades with resultant deaths of over a thousand lives. On 3rd June, 2012 at about 1600 hours another plane crash occurred in Nigeria. This time it involved a commercial airplane, DANA flight 992 which crashed in a densely populated residential suburb close to the airport, destroying buildings and followed by an intense fire killing all the supposed 147 passengers and 6 crew members on board. The victims killed on the ground were estimated to be 10. Accessibility of the crash site posed a problem to the responders apart from those caused by on-lookers, some of whom came to loot the scattered belongings of the passengers. Considering that the crash occurred within the jurisdiction of Lagos State and empowered by the new Coroners Systems Law, the Office of the Chief Medical Examiner was saddled with the responsibility of identifying the victims as well as determining the cause and manner of death. 152 body bags including body parts and bone fragments were appropriately labeled and stored in two of the State Government owned mortuaries. Most of these bodies were largely decomposed while some others were moderately to severely charred. Out of the 152 body bags, four bags were shown by DNA analysis as actually representing two bodies only. In other words, only 150 bodies were recovered. Medicolegal autopsies (including radiological, odontological and toxicological studies) were conducted on the victims of this mass disaster, a procedure that was carried out for the first time in Nigeria. Out of these, 147 representing 98.0% were positively identified through the DNA analysis in combination with other ancillary methods. Another victim was identified from the recovered bone fragments. On the whole, 148 victims of the crash were positively identified and these were subsequently released with the death certificates to the next-of-kin. Three bodies remain unidentified despite exhaustive tests. Toxicology revealed that some of the victims died as a result of multiple injuries coupled with significant fume inhalation. This investigation was successfully conducted because of the new medicolegal system introduced in Lagos State in 2007 and the fact that the State government made necessary resources available. The relations cooperated fairly well despite cultural and religious limitations.

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URINE DRUG SCREENING POSITIVITY RATES IN PATIENTS FROM CHEMICAL-DEPENDENCE PROGRAMS IN WESTERN NY

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Introduction: There has been a substantial increase in drug use, misuse, and abuse, and an increase in drug-related overdose deaths in the US. Urine drug screening has become standard monitoring tool to assess drug abuse, and/or to provide basis for medical or legal action. **Objective:** To investigate the drug use positivity rates by gender and year in western New York, New York. **Method:** This is a retrospective study designed to assess the positivity rates of drug use in persons who were from chemical-dependence program between January 2014 and December 2016 in Western New York, New York. Laboratory screening tests for drugs were studied using the cloned enzyme donor immunoassay technique in urine. **Results:** The over one million urine specimens were collected from 2014 to 2016. The overall positive rates were 7.18%. The positivity rate for individual drug panel is 2.08% for amphetamines, 14.42% for THC, 2.76% for fentanyl, 4.03% for 6AM, 5.48% for benzodiazapines, 6.92% for opiates, 2.77% for oxycodone, and 6.40% for Ethyl glucuronide (ETG). Increases in Fentanyl use were most notable among drug testing panels. The positive rates in fentanyl use has increased steadily from 2014 to 2016(0.96% in 2014, 1.87% in 2015, 3.84% in 2016). There is a slight increase in THC use

(12.50% in 2014, 14.13% in 2015, 14.77% in 2016). The positive rates of 6AM, Benzodiazapines and Oxycodone use showed a decrease from 2014 to 2016. There was no difference in opiates and ETG use among the years. No gender difference was found. **Conclusion:** Urine drug screening provided an objective and reliable indication of recent drug use in patients.

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TRENDS IN DRUG DEPENDENCE IN SRI LANKA

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Drug dependence is a state characterized by an overpowering desire or need (compulsion) to continue taking a drug and to obtain it by any means. It is sometimes accompanied by physical dependence. There are many addictive or dependence producing drugs in Sri Lanka. They include alcohol, amphetamines, cannabis, heroin, pharmaceuticals and tobacco products. However, major illicit drugs abused today are cannabis and heroin. Cannabis is illegally cultivated in Sri Lanka, with main hubs of activity generally occurring in the three Provinces. It is estimated that the total area of land under cannabis cultivation is about 500 hectares, and it is believed that cultivation is on the increase. Heroin is the second largest and the most commonly consumed opiate in Sri Lanka. Heroin has become a major health and social problem in the country. Based on heroin seizures, the estimated street level supply of heroin in Sri Lanka is estimated to be nearly 800 Kg per annum. Pharmaceutical drug abuse has recently gained popularity in Sri Lanka and is becoming a major health concern. Pharmaceutical drug is taking of prescription drugs, whether obtained by prescription or otherwise, other than in the manner or for the reasons or time period prescribed, or by a person for whom the drug was not prescribed. Controlled pharmaceutical drugs abused in Sri Lanka includes narcotics such as opiates and opioids, morphine, codeine containing cough syrups, methadone and benzodiazepines. In 2015, the total number of drug related arrests were 82,647. Of this, 26,458 (32%) offenders were arrested for heroin and 52,319 (63%) for cannabis. 3,870 persons were arrested for other products including tobacco products. The total quantity of heroin seized island-wide was 47 kg in 2015. 6570 kg of Cannabis were seized. In addition, 3867 kg other drugs such as cocaine, tobacco powder and opium were seized The government and non-government organizations were involved in drug treatment services in Sri Lanka. The reported number of persons received treatment for drug use island-wide was 1,395 in 2015. Sri Lanka is a signatory to three United Nations Conventions, the Single Convention on Narcotic Drugs (1961), the Convention on Psychotropic Substances (1971) and the United Nations Convention against Illicit Traffic in Narcotic Drugs and Psychotropic Substances (1988). Legislation pertaining to drug abuse in Sri Lanka controls over 118 narcotic drugs, 113 psychotropic substances and 23 precursor chemicals.

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THE ANALYSIS OF BALLPOINT INKS WITH APCI-MS AFTER FADING WITH LIGHT, PEROXIDE AND BLEACH

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The ability to discriminate between different inks and to determine the length of time an ink has been on a substrate can provide important scientific evidence, especially in cases involving document fraud. Many techniques have been used to analyse inks for ink dating including chromatography and spectroscopy, but the results are unreliable as a result of factors affecting the aging process such as light. This study utilises established techniques in document examination, including filtered light examination but also novel techniques for ink analysis; Atmospheric Pressure Chemical Ionisation (APCI) to analyse inks and dyes with the aim of discriminating between samples based on their degradation products. APCI-MS was used for the first time to study nineteen ballpoint pens from a range of manufacturers by investigating the chemical processes that occur and the products that are formed following deposition of ink onto a substrate and in solution. Monitoring the degradation process as an ink ages and fades enables the identification of components present in the inks. Using molecular mass data, accurate ink component identifications could be made over a period of two years on samples subjected to a range of external influences. Light, hydrogen peroxide and sodium hypochlorite bleach were used to simulate natural and deliberate fading of inks and dye solutions. Benzophenone and phenol molecules were identified as degradation products but their presence differed for each of the different conditions tested such as no phenol products when bleach was used. This study shows that the degradation of ink was not consistent for all external factors and care must be taken when attempting to date an ink based on degradation products.

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REFORMING THE CENTURY OLD LAWS RELATING TO INVESTIGATION OF DEATH (CORONER SYSTEM) IN SRI LANKA

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Introduction: Sri Lanka (Ceylon) inherited the 'coroner system' of investigating death in the early nineteenth century from the British. Unlike in England and Wales, the coroner system in Sri Lanka did not change much in the last century. Honourable Ministry of Justice appointed a Committee to Reform the Laws and Procedures Relating to Inquests of Death two years ago. The Committee was requested to consider the existing legal framework and prevailing procedures and practices pertaining to the conduct of Inquests into Deaths as contemplated in the Code of Criminal Procedure Act, and recommend amendments if any to be introduced to such legislation, procedures and practices. If the said amendments are substantial in nature, the Committee may even recommend the adoption of a new Chapter XXX to replace the existing Chapter. **Method:** The Committee held several meetings to discuss the current law and its deficiencies. With the sponsorship of the International Committee of Red Cross, three workshops were held with all important stakeholders including the Coroners Association, Bar Association of Sri Lanka, Departments of Police, Prisons and the Government Analysts, Medico-Legal Society, College of Forensic Pathologists, Disaster Management Centre, Human Rights Commission of Sri Lanka, the Law and Society Trust, Ministry of Home Affairs and Academics. **Results:** The Committee has identified categories (types) of deaths in respect of which Inquests should be held. The Committee has **also** proposed four types of inquests. They are Inquests by Inquirers, Magisterial Inquests, Magisterial Investigative Inquests and Inquests by High Court Judges where deaths as a result of mass natural disasters and where on a consideration of the attendant circumstances pertaining to the death of a person, the Attorney General is of the opinion that interest of justice warrant the conduct of a detailed and in-depth Inquest by a senior judicial officer. **Conclusion:** The Committee will present its report the Minister to be forwarded to the Cabinet of Ministers and then to the Legal Draftsman's Department to draft the new law. It has to be approved by the Parliament of Sri Lanka.

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POLICE CUSTODIAL DEATHS: INDEPENDENT POLICE COMPLAINTS COMMISSION VS CORONIAL INQUEST CONCLUSIONS

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Introduction: A recent study explored complaints against healthcare professionals (HCPs) in police settings in England, Wales and Northern

Ireland via Freedom of Information Act enquiry. Inconsistencies were noted where deaths in police custody in which healthcare professionals were apparently involved, did not appear in the recorded complaints. Further exploration identified apparent incongruity between the conclusions of Independent Police Complaints Commission (IPCC) investigations and coronial inquest conclusions. We further explore the role of HCPs in deaths in police custody and professional regulatory complaints that ensue. **Aims:** This study compares coronial inquest conclusions with recorded findings from IPCC investigations into deaths in custody so as to a) determine whether the findings are similar, b) determine whether any HCP involvement was identified and c) determine whether apparently inappropriate or inadequate patient safety issues were properly highlighted. **Methods:** Each published IPCC investigation into death in police custody between 2004/5 – 2015/16 was reviewed which relate to the following categories: deaths in or following police custody; apparent suicides following police custody; other deaths following police contact that were subject to an IPCC independent investigation. Coronial inquest conclusions were sought for each of the deaths identified. The IPCC and inquest conclusions were compared. **Results:** IPCC records identified the following numbers of deaths in each category: deaths in or following police custody – n=104; apparent suicides following police custody – n=18; other deaths following police contact that were subject to an IPCC independent investigation – n=83. The IPCC identified HCP involvement in 28/104 deaths in or following police custody; 4/18 apparent suicides following police custody; and 0/83 of other deaths following police contact that were subject to an IPCC independent investigation. The IPCC identified a possible deficiency of HCP care in 4/104 deaths in or following police custody; 1/18 apparent suicides following police custody; and 0/83 of other deaths following police contact that were subject to an IPCC independent investigation. Coronial inquest findings will be reviewed. **Conclusions** Death in custody investigation is open and transparent in England, Wales and Northern Ireland. However there appear to be inconsistencies between IPCC investigations and coronial inquest conclusions. This may impact on the relevance of any lessons to be learned from such cases.

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AN EXPANDED ROLE FOR FORENSIC SCIENCE AND A PATHWAY TO ACHIEVING IT.

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The current operational environment for national law enforcement is characterised by broader and more sophisticated organised crime syndicates, emerging technology-enabled transnational crimes, and new and complex national security and terrorist-related threats. In the community policing context there is the challenge of counteracting the far-reaching impacts of drug and alcohol related offending, cybercrime, identity fraud and antisocial behaviour. How is forensic science best deployed in this context? What traditional approaches and technologies remain relevant and powerful enablers of successful investigations and prosecutions? What new approaches and technologies are likely to emerge as a panacea to these threats? In 2016 the Australian Federal Police (AFP) opened a new purpose-built forensic facility in Canberra. The design concepts underpinning the facility attempt to support world's best-practice forensic science and technical intelligence that, in turn, will assist the ACT, Australian and international communities to respond to the criminal justice challenges of today, and into the next twenty years and beyond. Our approach is based on a "best-of-both-worlds" philosophy that chases highly specialised capabilities that are flexible, responsive and have high operational relevance. Laboratory precincts allow full integration and co-location of experts and their technologies. Intelligence leads are favoured together with expert evidence and forensic outcomes proactively inform disruption strategies as much as they attempt to indicate "whodunit?" In this presentation I will share my reflections on the field of forensic science, its current place in the criminal justice landscape and my vision of an expanded future operating model. As we experience an increasingly complex and rapidly changing operational environment, I will discuss how innovative and agile capabilities are being developed and the paradigm shift we are undertaking into the emerging world of forensic intelligence.

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REPLICATORS AN ALTERNATIVE FOR LOCAL CAPACITY BUILDING IN FORENSIC IDENTIFICATION IN MEXICO

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As part of the efforts to support local authorities in their actions for the resolution of the missing persons problem and unidentified bodies, the Regional Delegation of the International Committee of the Red Cross (ICRC) in Mexico, Central America and Cuba has supported the Medico Legal Services in Mexico in the creation and setting up of The Post-mortem Replicator Group (PRG). Mexico has a complex federal system which poses big challenges in terms of communication and coordination amongst the multiple institutions involved in the identification. Forensic experts need efficient strategies, guidelines and support to conduct their job in due manner. Continuous training and guidance is of utmost importance to ensure sustainably improved identification procedures and attention to the bereaved. For forensics to better address the problem of missing persons and unidentified human remains, the PRG was created in 2014 in the framework of an agreement of cooperation on missing persons between the Secretaria de Gobernación (Interior Ministry and the ICRC. The project was developed as part of a strategy to build sustainable forensic local capacity in the country, in line with international best practices. A core group of participants are provided knowledge, skills, and the practical experience necessary for forensic experts to then train peers in various forensic aspects, with focus on identification processes. Thirteen forensic experts from different Mexican States initiated the group; through exchange with international experts, review of case studies, over 500 hours of autopsies and drafting of institutional guidelines, the PRG is now in the advanced level and had already initiated a replication phase to a new team of 150 junior forensic experts in the beginner and intermediate stages. After three years the PRG has led to the creation of identification units, guidelines and standard operating procedures, better communication and coordination, as well as the development of policies and laws. The purpose of this presentation is to share the lessons learned of the project and to propose it as a sustainable forensic capacity building model to replicate in all of Mexico in order to promote and support relevant authorities in making the necessary changes and adjustments to the existing identification system and its legal framework. This will not only strengthen the medico-legal system, but will also help state obligations in fulfilling the right of families to know about the whereabouts of their loved ones and provide them with answers.

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IS AN INQUEST THE ONLY TOOL IN THE TOOLBOX?

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What is a Regional Coroner's Review? (A Case Study)
Demonstration of a regional coroner's review, producing effective recommendations to prevent deaths in similar circumstances.
This presentation/poster addresses innovative collaborative processes between experts in death investigation, with a focus on public safety.
History During an early morning commute in a Canadian city, a man, driving along an access ramp, lost control, slid over a high snowbank abutting the concrete barrier and plunged onto the highway below, dying immediately. The same day, the provincial government announced a review of winter road maintenance in another city, related to a series of motor vehicle collisions during icy road conditions. Media, family; concerned citizens expressed a view his death was related to this issue. Investigation/ Regional Review Process Autopsy confirmed death due to trauma. There were no criminal charges; the death investigation could move forward without delay.
A death investigation, according to Ontario's Coroners Act, must answer five questions: 1) Who died?
2) How did they die? (the Cause of Death)
3) When did they die?
4) Where did they die?
5) By What Means did the person die? It must determine whether an inquest is necessary; collect and analyze information about the death in order to prevent further deaths in similar circumstances. No blame can be assigned.
An inquest is public, with witnesses and evidence presented. A coroner's investigation is not public; information is shared with co-investigators, direct relations of the deceased and others as required/allowed by law. Due to the formality and complexity of the inquest process, it can occur years after a person's death. A more efficient process, within the coroner's investigation, could lead to timely recommendations, ultimately with more effectiveness. With this in mind, a regional coroner's review was instituted, involving the police investigator and collision reconstructionist, maintenance engineer/supervisors from the ministry involved and the investigating coroner. On a step-by-step basis, working meetings examined the circumstances, standards; real-life evidence of road maintenance; reviewed recent evaluations of winter highway maintenance in an open and nonjudgmental environment. After the investigation's completion, the family was presented with its findings and proposed recommendations, and asked for feedback before they were submitted to the recommendation recipients. The feedback on this process was uniformly positive, and completed within a year of the person's death.
Conclusion Regional coroner's review is an effective, inclusive alternative to the inquest process.

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INQUEST AND PUBLIC SAFETY – RECOMMENDATIONS FOR CULTURE CHANGE

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Case Study: The Rowan Stringer Inquest - Head Injury in Youth Sports
An inquest is a public process, held in the public interest. This case study illustrates an inquest when public awareness and culture change are the underlying goals.
History Rowan Stringer was a 17 year old rugby player, who suffered several concussions over days, unbeknownst to anyone. She then was tackled and suffered a head injury, which led to malignant cerebral edema, and the diagnosis of second impact syndrome, in which a catastrophic brain injury arises when an initial concussive brain injury does not heal before a subsequent brain injury occurs. Her death did not meet criteria for a mandatory inquest.
The Inquest Process A death investigation is not public in Ontario. An inquest, though, is a public hearing, whose goal is to ascertain facts relating to deaths, and formally focus attention and initiate community response to preventable deaths. This death underwent a discretionary inquest. From recounting the story of Rowan's death; describing youth sport culture; exploring efforts made to change that culture, and proposing recommendations to recognize and prevent head injury, the focus was on recommendations for individual and culture change.
Witnesses and evidence were selected with this focus. Rowan's friends, mother, coaches, driving examiner; school and community sports representatives, the school board and Ministry of Education, shared the circumstances of her death, and changes to procedures and prevention initiatives. Her neurosurgeon and neuropathologist explained her illness, and research into head injury. A football hall of famer explained the athlete culture; his own struggle with repetitive head injuries, as well as his experience as the father of an athlete who suffered concussions in competitive team sports. A researcher into pediatric concussion and knowledge translation, and a world renowned expert in concussion described proposed recommendations. But it was Rowan, testifying for herself through texts to friends and family just before her death, who was the most powerful in making a case for change. Participants at the inquest presented a joint slate of recommendations to the inquest jury, to enable and motivate culture change at a personal, social and structural level. The jury took this slate, modified it and added recommendations. The verdict contained 49 recommendations to prevent deaths in similar circumstances. Rowan's Law was passed by the provincial government in June 2016, to consider how to implement the recommendations.

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NEUROSCIENCE APPLICATION IN AUTOPSY EXAMINATION

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Background and Aim: Recent neuroimaging studies of prefrontal cerebral cortex in aggressive/violent behavior and in major depressive disorder have shown decreased volume and altered glucose metabolism. The aim of our work is to link those neuroimaging findings with a possible anatomic/ microscopic correlation. The current study is a morphometric histological analysis of particular areas of the prefrontal cortex, the orbitofrontal and the dorsolateral, corresponding to Broadmann areas 10-47 and 9, respectively, in 2 subjects who committed suicide and 2 controls, with no psychiatric disorders. **Materials and Methods:** Prefrontal cortex areas 9, 10, and 47 of 2 suicide subjects and 2 controls were totally sampled from both hemispheres. Immunohistochemistry for NeuN and Calretinin (CR) were performed. Morphometric count of positive neurons was realized by J-Image software. **Results:** In suicide subjects, compared to controls, the number and density of NeuN neurons were reduced in right area 10. Moreover, CR expression was markedly reduced in left areas 9,10, and 47 and in right area 9. Either decrease of NeuN or CR was statistically significant. **Conclusion:** These results confirm and support neuroimaging data of abnormal functioning of prefrontal cortex in aggressive subjects and, with this report, even in subject who are auto-aggressive. That is probably due to an abnormal underlying neuronal structure and connection. Our findings add further information to the current knowledge as the prefrontal cortex was analyzed in both cerebral hemispheres. The study is still ongoing and more cases will be subsequently analyzed.

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POST MORTEM GENETIC TESTING OF LQTS IN SUDDEN INFANT DEATH CASES: PRETORIA MEDICO-LEGAL LABORATORY

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Introduction: In many countries, Sudden Infant Death Syndrome (SIDS) continues to be the most common cause of death in infants in the post neonatal period. Cape Town, a capital city in South Africa, portrays one of the highest SIDS rates in the world. Approximately 80% of all sudden deaths in infants remain unexplained after a thorough autopsy investigation. The underlying mechanism of SIDS remains elusive however; research has shown that inherited cardiac arrhythmic disorders that are morphologically unidentifiable at autopsy account for up to 15% of SIDS cases, with LQTS associated with *SCN5A* genetic variants, predominating. The aim of this study was to determine the prevalence of variations in the *SCN5A* gene linked to LQTS in sudden and unexpected infant death cases examined at the Pretoria Medico-Legal Laboratory. **Methods:** A retrospective study was conducted on SIDS cases and controls, analysing DNA extracted from formalin-fixed, paraffin-embedded (FFPE) tissue samples as well as blood samples. A total of 48 archived FFPE myocardial tissue blocks (cases), ten control FFPE tissue samples and nine control blood samples were included. DNA extracted from all samples was used to test for variations in the *SCN5A* gene by using high resolution melt (HRM) real-time PCR and sequencing. **Results:** Genetic analysis revealed 33 different single nucleotide variants among the entire study population (n=67). Seven previously reported variants of known pathogenic significance, and 14 variants of benign clinical significance, were identified. The study revealed 12 different variants that were not found in any database or published literature, which were considered to be novel. Of these novel variants, two were predicted as "probably damaging" with a high level of certainty (found in one case and one control sample, respectively), and nine variants were predicted to be of benign significance. In addition, one novel variation was identified in one case sample that was predicted to be "possibly damaging" with a 50% chance of being disease-causing. **Discussion:** This study shows the significant added value in determining the cause of death in South African sudden infant death cases using genetic testing. Considering the high level of genetic predisposition linked to these arrhythmic disorders and the fact that it is treatable, post mortem genetic testing will aid in the diagnosis and treatment of family members at risk, ultimately preventing similar future cases.

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COMPARISON OF XRF, SEM-EDS AND LA-ICP-MS IN FORENSIC GLASS FRAGMENT ANALYSIS

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Glass is one of the most tangible pieces of evidence found in forensic cases, as it appears everywhere in our daily lives, and because of its physical, chemical, mechanical and optical properties it presents the kind of evidence that can be analyzed using many different methods. For this reason, much research has been conducted on these methods. This research has generally consisted of the determination of the glass refractive index and elemental analysis. Improvements in analytical technology have made possible the development of new methods in elemental analysis leading to an increase in the ability to distinguish between glass fragments. Because of its nature, glass consists of different oxides. When elemental analysis methods are applied the oxide components in the glass vary proportionately. While some oxides make up a large bulk of the composition, others are found in very low quantities. The oxide composition of the glass is a very important factor in comparing different samples in terms of their relative oxide quantitative distribution. The aim of this study is to establish the definition and differentiation of glass samples by looking at their elemental composition, particularly when the evidential glass is of unknown origin. In this study, glass samples encountered in many criminal cases are examining using X-ray fluorescence spectrometer (XRF), scanning electron microscope with energy dispersive X-ray spectroscopy (SEM-EDS) and laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). These three techniques provide high resolution of the elemental analysis of glass materials, while based on different principles. A total of 50 uncolored glass samples are divided into two groups, window and headlight. As a result of some analysis that has been done during the research, it became clear that the quantification of only one oxide is insufficient to differentiate between the various types of glass. When several of the oxides are analyzed together, the results obtained can help in the recognition of and differentiation between glass fragments. Also more precise results can enable determination of which oxide is useful in defining and differentiating the glass. This can achieve by normalizing the elemental analysis of the oxide composition, selecting an appropriate oxide, and then carrying out a critical evaluation of the results. In conclusion, this study will be performed in order to ascertain whether spectroscopic analytical methods are beneficial in distinguishing between glass samples, and thus in defining the origin of unclassified glass.

Disclosure: All authors have declared no conflicts of interest.

THE IMPORTANCE OF CURATION IN A FORENSIC SETTING

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The National Institute of Justice (NIJ) lists the large number of missing persons and unidentified human remains in our nation as "a silent mass disaster." Over the last 20 years hundreds of thousands of people have been reported as missing, many under suspicious circumstances. More than 40,000 sets of human remains are stored throughout medical examiners and coroners officers in the United States but many of these cases have not been entered into federal databases such as NCIC, CODIS, IAFIS, and/or ViCAP. Ritter, Nancy Missing Persons and Unidentified Human Remains: The Nations Silent Mass Disaster. NIJ Journal Issue No. 256, January 2007. In 2009, NIJ funded an online database called NamUs, which compares missing persons' antemortem data with unidentified remains data from law enforcement, medical examiners, and/or coroners officers and is publically searchable. The database addresses the major gap in missing persons and unidentified human remains investigation but does not provide any specific protocols for curating the unidentified remains. In order to inititiate this processes, there needs to be formal organization on the local medical examiner and coroner office level, nationwide. With over 40,000 unidentified human remains stored in various locations and conditions, the primary goal of each office should be to properly categorize, inventory, analyze, and prepare for long term storage. I suggest following standard operating procedures that draw from proper curatorial protocols based on museum quality collection. This would include organization of all case materials, including physical documents, digital records, skeletal material, and evidence. Skeletal remains must be processed to remove all biological tissue. They must be photographed, x-rayed, documented, and analyzed using modern forensic anthropological techniques. Finally, the remains must be stored in acid-free boxes to prevent deterioration and placed in a secure location. Reviews should occur annually, and include the medical examiners or coroners, law enforcement, and other investigating specialists. Each case that is ready to be stored should have the following: storage location, case number, NamUs number, law enforcement report, medical examiner or coroner report, DNA report, anthropology report; and may also include: dental report, evidence inventory. There must be a log of all of the unidentified cases housed at the facility, saved digitally and in physical form. While this process may not solve the "silent mass disaster" itself, it will help organize investigators attempting to properly address each and every set of unidentified human remains.

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ANSWERING THE FAMILIES: ANTEMORTEM DATA COLLECTION FOR MISSING MIGRANTS IN WEST AFRICA

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There exists a long tradition of migration from West African countries; usually towards other African countries. Increasingly restrictive migration policies, however; have forced migrants to choose more dangerous routes to reach their destinations. This may include crossing the desert and taking additional risks to cross the Mediterranean. Results of those risks can include confiscated documents, physical attack, lack of health services, traveling to regions with armed groups, detention, the loss of contact with family, and in some cases, death. In the last two years, the world has witnessed numerous shipwrecks in the Mediterranean involving migrants attempting to reach Europe. One of the deadlier shipwrecks occurred on 18 April 2015 off the coast of Italy with an estimated death toll just under 700 persons. The International Committee of the Red Cross (ICRC), through its efforts to provide answers to the families of missing persons (those who go missing as a result of conflict, natural disasters and migration), has engaged with the Italian authorities in an aim to support them in the identification process of deceased migrants – including from this vessel. One area of support includes gathering more precise information on the missing through antemortem data collection. The data collection is conducted by visiting the communities in countries of origin for those who are presumed to have died during the crossing of the Mediterranean. Antemortem data collection is conducted as one part of an overall support programme for those who have a missing family member. The author will outline the unique challenges and solutions faced by the ICRC in gathering antemortem data of the missing as a result of migration in some equally challenging contexts.

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GRATEFUL FOR YOUR SERVICE: A PROPOSAL TO BETTER COORDINATE MILITARY DEATH INVESTIGATIONS

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A glance through the major media of several western countries can quickly demonstrate the unique position that the deaths of service personnel holds for that country's public. What is not clear, however, is whether such public interest translates into an effective mechanism to manage investigations into the military dead from past wars, current conflict and deaths as a result of service. The United States of America, Canada and the United Kingdom each have programmes that use archaeological, anthropological and genetic science to determine the identity of human remains of personnel who go missing in wars from the 20th Century. For those who die in service, the recent conflicts in Iraq and Afghanistan have forced each military to seek the best means to investigate, repatriate and hopefully reduce the number of deaths of their service personnel. At the same time, families of soldiers who die while during training or while on the base – are demanding a more professional approach to death investigation of their loved one. Finally, investigations into those who die after (but likely because of) their military service, have much to provide the military, veterans affairs and public health in how to prevent increased morbidity and mental illness as a result of service. The lack of a clear feedback loop between coroner, veterans care organisations and the military, however; may be hindering the ability to prevent unnecessary deaths of veterans. The presenter will propose a mechanism for Canada which aims to facilitate death investigation for those who died during or because of their service.

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A BURNT BODY AND VENA CAVAL LIQUID FAT

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Introduction: The burnt body may present with unusual artefacts such as heat fractures and epidural hematomas. In the case presented the body contained liquid fat within a major blood vessel that was being aspirated for toxicologic studies. **Case Presentation**: Decedent was an 82 year old female whose body was found in her home after a house fire. Her medical history did not indicate that she was obese or that she had problems related to her liver or abdomen. On external examination the entire surface was black with soot and showed 4th degree burns over 100% of the body surface area with heat amputations of the hands. The victim was subsequently identified by dental records. Radiologic examination disclosed no missiles or weapon fragments. There were no long bone fractures indicative of antemortem injury. Internal examination revealed intact thoracic and abdominal organs with mild to moderate heat artefact. Soot was observed in the mouth and the airway all the way down to both main bronchi. The inferior vena cava was sampled for toxicologic analysis and approximately 15 cc of clear yellow oily liquid fat was aspirated. Blood was subsequently aspirated. No mass was observed in or around the inferior vena cava, in particular at its junction with the portal vein. The liver was red brown and weighed a kilogram. Cut sections were significant for a 7 cm simple cyst locatedon the anterior surface of the right lobe. Although the lungs were bilaterally edematous, the rest of the examination was unremarkable. **Conclusion:** Aspiration of liquid fat from the inferior vena cava of intact or burned bodies has not been reported in the medical literature. Unlikely but possible explanations include heat liquefaction of the rarely reported intravascular lipoma or of a ruptured hepatic lipoma, a fat embolus from fractured bone or hyperlipidemia. Clinical history, antemortem imaging and results of laboratory analyses were helpful in providing possible explanations. However the cause remains unknown in this case.

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FORENSIC IN SILICO OF NPS: PRINCIPAL COMPONENT ANALYSIS STUDY OF CANNABINOIDS

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The recreational use of *Cannabis sativa* has been allowed in many countries. The discussion about its effects on the human health is diverse. There are studies regarding its medicinal properties and about its toxicological properties. However, the increase of New Psychoactive Substances (NPS) brings new elements for the discussion. According to UNODC (United Nations Office on Drugs and Crime), the toxic effects of these drugs are still unknown.[1] The main purpose of this work was to study a series of cannabinoids properties. Experimental studies are important to ensure theoretical ones. However, sometimes they are difficult to implement because of the costs and the time associated. In this sense, *in silico* training is an alternative to understanding the behavior of the new substances. Besides, these studies may guide experimental ones, giving important information about structure and activity. In this work, we have studied 30 cannabinoids divided into three different classes of compounds, according to their molecular structure. Many variables were calculated by DerekTM Nexus[2] and ACD/I-Lab 2.0[3]: Molecular Mass and Volume, Molar Refractivity, Index of Refraction, Surface Tension, Polarizability, LogP and LD50 for many human (blood, duodenum, etc.) and animal (rat and mouse) parameters. Non-supervised learning was performed by Principal Component Analysis (PCA) on Pirouette® Package[4] to identify the natural clustering and the main differences among the samples. Scores and Loadings results allow the samples to be separated into three groups. LD50 values related to animal tests are related to class 3, whereas

classes 1 and 2 have a greater influence of the human values. These findings are likely to be related to the different OH positions in each group. New descriptors are under calculation to try to describe these relations with other molecular properties. The authors would like to thank to the Santander Bank for the financial support. 1. UNODC, World Drug Report 2013, 1st ed., United Nations publication, Sales No. E.13.XI.6, New York, (2013). . 2. Icgm, E. Derek Nexus and Sarah Nexus : working together for ICH M7. (2014). 3. Masunov, A. ACD/I-Lab 4.5: An Internet Service Review. *J. Chem. Inf. Comput. Sci.* **41**, 1093–1095 (2001). 4. Pirouette Multivariate Data Analysis Software, version 4.5, Infometrix, Inc, Bothell, WA, (2014).

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PERINATAL DIAPHYSEAL GROWTH IN AN ITALIAN HISTORICAL SAMPLE FROM NAPLES

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It is patent that genetic, geographic, nutritional and socio-cultural factors have the capacity to affect both intrauterine and post-natal development. While there is compelling evidence that dental calcification and eruption are developmentally conservative, growth in size and weight is less so. This implies that age estimation from skeletal remains in either the bioarchaeological or forensic/medico-legal fields are best served by standards derived from loosely defined local or regional populations to minimize intrinsic or extrinsic effects. From the 1880's to 1890's, a large collection of human perinatal remains were accessioned to the Institute of Legal Medicine at the University of Naples. The data, published by Gaetano Corrado and Edoardo de Archangelis in a series of lengthy monographs, record diaphyseal length for six long bones, body length (stature/crown-heel) and weight for 162 female and 212 male ($n_T = 374$) cadavers. The ages, or estimates thereof, were not registered by the original authors of the data. Despite the evident quality and size of this historical collection, it is not apparent in the literature, appearing to have become 'lost'. Here, the data are evaluated for strength of linear relationship and predictive utility in view of significant theoretical and analytical consolidation (Hoppa and Vaupel 2002 among others) in the past 15+ years. Results, as expected, show significant correlation coefficients between variables, r_P^2 values in excess of 0.98 and reduced standard errors. Comparison of the ellucidated trends with methods commonly employed for age estimation (e.g. Sheuer et al. 1980) show that the current dataset is compatible. Fundamentally, the absence of predicted ages of individuals permits interpretation of C-H lengths using pertinent populational standards.

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THE ROLE OF COURT-APPOINTED EXPERTS IN THE U.S.

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Experts play an increasingly important role in the trial process in the U.S., and the average civil trial in the U.S. includes approximately 3.7 to 4.1 experts. In general, the testimony that experts provide at trial is influential. U.S. juries find experts to be credible and report being influenced by the expert testimony they hear. At the same time, there is a growing trend that when parties in a lawsuit hire experts, juries perceive the experts' cloaks of objectivity as weakened or non-existent. Put another way, experts lose credibility in the eyes of the jurors "when experts are too much of an advocate for a party." Rather than viewing experts as objective suppliers of truthful information—information that is beyond the ken of the average juror—many U.S. jurors view experts as "hired guns" willing to say whatever the party paying them wants them to say if the compensation is enough. Fair or not, such a perception damages the U.S. justice system because it feeds into the view that verdicts can be bought by those with the largest purse strings. Federal Rule of Evidence (F.R.E.) 706 provides for court-appointed experts to assist judges in their gate keeping role of admitting only reliable expert testimony for the jury to weigh in deliberation. This presentation encourages judges to exercise their inherent authority to appoint experts and attorneys to request said appointments. In a trilogy of U.S. Supreme Court cases beginning in 1993 with *Daubert*, the Court has specifically entrusted trial judges with the role of gatekeepers of expert testimony to ensure that unreliable evidence is kept away from jurors. Gate keeping judges who must ultimately decide the admissibility of disputed scientific and technical evidence under F.R.E. 702 need expert assistance. F.R.E. 706 provides that assistance in the form of authority to appoint neutral experts. Europeans have long valued the important role that court-appointed experts play in their judicial process to the point that they disfavor a court process considered adversarial in nature with hired gun experts. By appointing experts to assist in understanding scientific evidence like European nations, U.S. judges—both federal and state—can improve the public's confidence in the independence of our judiciary. The increased use of court-appointed experts will move the U.S. adversarial legal system closer to its goal of providing an objective, impartial forum to litigants while promoting the integrity and independence of the judiciary, which is priceless.

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SUICIDE IN THE ABORIGINAL POPULATION IN ONTARIO, CANADA

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Suicide is only one measure of the health and well-being of a population. Suicide has many different contributing factors including cultural, historical and political considerations that contribute to the high prevalence. This analysis was to identify what is distinctive about suicides among Canadian Aboriginal people within the larger context of the general population in Ontario from 2010 to 2015. We analysed deaths of Aboriginal people and the general population in Ontario over a 6-year period. Information was obtained from the database of the Coroners Information System (CIS). A total of 1589 deaths under the Aboriginal/First Nation category were investigated. A greater percentage of all manners of deaths that were certified as suicide were doubled among the aboriginal population when compared to the general population(14% vs 7%). Although hanging was the most common cause of death amongst both groups, there were more diversity in causes of death, and hence methods chosen, amongst the general population. Amongst the aboriginal people there were more suicides among males compared to females. The opposite sex ratio was identified among the general population (F:M = 1:1.2 vs 1:3.3). The greatest incidence of suicides in the aboriginal population was younger women and girls (11-29 years old) whereas the peak among women of the general population was usually two to three decades older (40 to 59 years old). This analysis shows that there are stark contrasts in the suicides between aboriginal people and the general population. This study will allow factual determination of trends in deaths and help ascertain variables, including determinants of health, which result in suicide. These results could influence public policy and factually clarify why and how Aboriginal people commit suicide in Ontario.

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INDENTATION RECOVERY THRESHOLD USING THE ELECTROSTATIC DETECTION APPARATUS®

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The Electrostatic Detection Apparatus® (ESDA) is an instrument employing techniques used by Questioned Document Examiners (QDE) for the development of indented impressions. It has been reported that impressions can be recovered from between three and five sheets beneath

the original writing, however there have been limited studies on the impact of paper type in this process. In this experiment paper densities ranging from 54 – 170 g/m^2 were examined and evaluated using a standard ESDA® protocol. Paper density affects both the quality and the depth at which an underlying impression can be visualized by electrostatic methods (between one and five sheets). Knowing the paper density could aid QDE in the effective examination of documents for impressions.

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AORTIC STENOSIS IN A MAN WITH MULTIPLE SCLEROSIS INVOLVING THE BRAIN STEM

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Introduction Multiple sclerosis is an immune-mediated demyelinating disease of the central nervous system. Natural death in these patients is most often related to infection or other systemic co-morbidities rather than primarily to multiple sclerosis. Theoretically, demyelinating lesions in the vital centres of the brain should be associated with increased incidence of sudden death. However, this is not uniformly true in patients with this disease distribution. Case Report A 69 year old man known to have diabetes mellitus, chronic kidney disease and multiple sclerosis, presented to hospital with seizures, was treated and discharged home. Approximately 3 hours later he had onset of shortness of breath, became unresponsive and died despite resuscitative efforts. Post-mortem examination revealed evidence of multiple sclerosis with demyelinating plaques scattered in the periventricular and cerebral cortical white matter, the midbrain involving the substantia nigra and medial leminiscus, the medulla at the level of the inferior olivary nucleus and the spinal cord. In addition, there was atherosclerotic and hypertensive heart disease with moderate aortic stenosis. Multiple sclerosis involving the brainstem may be considered a competing cause of death in some cases. However, epidemiological data shows that death is more likely due to other disease or illness rather than primarily to multiple sclerosis. In this case the cardiovascular disease was thought to be more significant. Death was attributed to atherosclerotic and hypertensive heart disease with aortic stenosis, as it was sufficiently fatal disease that could account for all of his symptoms.

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REVIEW OF SHELLFISH ILLNESSES AND DEATHS IN MISSISSIPPI

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After attending this presentation, attendees will gain an understanding of the epidemiology and spectrum of illnesses and deaths caused by the consumption of, or direct contact with, shellfish from the Gulf Coast region of Mississippi. This presentation will benefit the forensic science community by providing the results of clinical reviews and autopsy findings of shellfish disease and death over a period of five years. Risk factors, history of exposure, source and types of organisms and autopsy findings will be discussed. The family *Vibrionaceae* consists of eight genera of bacteria, not all of which are pathogenic to humans. Infection caused by pathogenic species of *Vibrionaceae* result in two separate types of illness (i.e., cholera and vibriosis) in humans. Cholera was first reported in the United States in 1832. Of the more than 200 serotypes, only types 01 and 139 are referred to as the cause of cholera. On average, seven cases are reported annually in the U.S. Vibriosis is caused by infection with any of the remaining serotypes representing pathogenic species of *Vibrionaceae*. There are approximately 80,000 cases reported annually in the U.S. with 300 deaths. Vibrios were recognized as an important pathogen in the 1970's. The Cholera and other Vibrio Illness Surveillance System (COVIS) was initiated in 1988 by the CDC, FDA, and the states of Florida, Alabama, Mississippi, Louisiana and Texas. Over the past five years, 46 cases of Vibrio infection have been reported in the state of Mississippi by the State Health Department and State Medical Examiner's Office. Fifteen of these cases were caused by *Vibrio vulnificus;* four were fatal. *Vibrio vulnificus* is a halophilic (salt-requiring), gram-negative and naturally occurring bacterium commonly found in warm marine environments. It causes disease in humans via consumption of contaminated shellfish or by contamination of an open skin wound by seawater. Ingestion results in vomiting, diarrhea and abdominal pain. Skin infection results in ulceration, hemorrhagic bullae and necrosis. In both types of contamination, the infection can progress to bacteremia and result in sepsis and death. Persons with pre-existing medical conditions are 80 times more likely to develop bacteremia. Patients who develop bacteremia have a mortality rate of approximately 50%.

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ATTACHMENT, DEPRESSION, ANXIETY, STRESS, COPING AND ALEXITHYMIA IN SEXUALLY ABUSED ADOLESCENTS

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Child sexual abuse is the most hidden phenomenon among child abuse types with psychological, medical, judicial and educational and sociological aspects. Its' adverse effects will be done in order to explain the relationship between attachment styles, depression, anxiety, stress levels and coping styles and alexithymic characteristics of sexual abuse adolescents. Risk and protective factors need to be identified and supported with methods that will contribute to overcome psychological problems for the sake of children and adolescents exposed to severe traumatic effects of sexual abuse. It is necessary to apply the effective practices and models to the adolescents experienced sexual abuse for healthy and safe lifestyles while taking that today's victims may be the agents of tomorrow into consideration Sexual abuse should be integrated with its direct/indirect effects in short and long term and protective measures should be improved as well as preventive measures. For this reason, it is necessary to explain the multiple relational factors to develop psychosocial support programs to support coping skills of adolescents sexually abused and especially the adolescents who are under the protection. However, it has been observed the scientific research that combine multiple factors and conducted with adolescents who are victims of sexual abuse is insufficient to make evaluations. For this purpose, in this study, will be done in order to explain the relationship between attachment styles, depression, anxiety, stress levels and coping styles and alexithymic characteristics of sexual abuse adolescents. 80 adolescents between the ages of 11-18 who were under institutional protection affiliated to the Ministry of Family and Social Policy participated to the research. Sociodemographic Questionnaire, Stress - Coping Style Scale, Depression Anxiety Stress Scale and Toronto Alexithymia Scale were applied to the adolescents. The IBM SPSS AMOS program will be used for analysis of acquired research data. Assessing these variables together will allow to understand how the adolescents are affected by the sexual abuse and how those variables affect each other. It is aimed that result of this research will contribute to the development of effective preventive, protective and treatment models.

Disclosure: All authors have declared no conflicts of interest.

BACKGROUND ON JUDICIAL GATE KEEPING OF SCIENTIFIC EVIDENCE UNDER FRYE VS DAUBERT IN THE U.S. COURTS

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Justice and science co-exist in our court rooms in the U.S. for the good of society. When deciding the admissibility of scientific evidence, state trial

judges in a *Frye j*urisdiction such as Pennsylvania consider whether the evidence is generally accepted within the relevant scientific communities; however, in *Daubert*-type federal jurisdictions, judges also consider empirical testing of hypotheses regarding falsifiability; known or potential error rates; existence and maintenance of standards and controls; peer review and publications, and other factors. Federal U.S. judges, when considering qualifying scientific and technical experts to testify in court, apply Federal Rule of Evidence 702 which provides the following conditions: A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert has reliably applied the principles and methods to the facts of the case. Moreover, the U.S. Supreme Court case of *Kumho* clarified this gatekeeper role to include evaluating all expert testimony, scientific as well as technical. The U.S. Supreme Court's ruling in *General Electric vs. Joiner* affirmed the role of trial judges as gatekeepers to ensure expert testimony is both relevant and reliable to be admissible. *Daubert, Kumho* and *Joiner* are also known as the *Daubert* Trilogy. Your presenter will discuss how cases are reviewed in both *Frye* and *Daubert* jurisdictions in the U.S. and how expert testimony should be evaluated through the lenses of both *Frye* and *Daubert* to admit relevant and reliable scientific evidence in courtrooms.

Disclosure: All authors have declared no conflicts of interest.

BENZODIAZEPINE EFFECT IN A HANDWRITING ANALYSIS CASE

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In April 2015, in an investigation of social security crimes, a labor booklet dated 1967 was received at INC, accompanied by comparison samples of two suspects of making alterations in employment contracts, which would benefit the document holder. One of the suspects was the holder himself who at the time of the exams was 71 years old. The questioned entries was supposedly handwritten between 1968 and 1976, therefore showing a difference of approximately 40 years amongst the exams and the alleged original date. The requested standard of the document holder featured both dynamic entries and others with tremors and breaks, raising suspicions of graphic disguise. However, in the anamnesis fact sheet accompanying the standard material, the supplier reported a continuous use of Rivotril®. It is a benzodiazepine which active ingredient, clonazepam, causes light CNS inhibition, which may slow reactions and cause movement incoordination, lentification and muscle hypotonia, probably caused by GABA-mediated post-synaptic inhibition. This substance may cause addiction, and abstinence can lead to tremors and cramps. The tremors and breaks observed in the standard material, when the writer was asked to write the dictated words, could be related to this movement retardation. On the other hand, the words referring to his own name and the city of residence were highly dynamic. The literature says that, when already automated, the movements that generate handwriting depart from another brain area. What is inferred is that the entries most common to the writer (his name and place of residence) could not be affected by the use of the drug, since they demanded the activation of an area of the brain distinct from the area of action of the active ingredient. The case has shown us that knowledge of the medical history of the writer of standard material is essential because there are several factors that can influence the writing behavior and, consequently, the analysis and the result of a handwriting examination.

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25I-NBOH: IDENTIFICATION WITHOUT DERIVATIZATION OR OTHER ANALYTICAL TECHNIQUES

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25I-NBOH is a labile molecule that was identified in blotter papers samples seized on the streets and are possibly being used as a replacement for the NBOMe series, now scheduled in many countries. Compounds from the NBOH series fragment into their correspondent 2C counterpart (e.g. 2C-I for 25I-NBOH) when analysed by standard screening gas chromatography (GC) methods. To avoid misidentification, samples reported as containing 2C-I by GC–MS should be submitted to derivatization prior to re-injection or subjected to alternative analytical techniques, which are often unavailable to most forensic laboratories. Here we report a procedure to correctly identify NBOH samples using standard GC–MS methods without the need to resort to derivatisation. Considering the degradation of 25I-NBOH into 2C-I during standard GC injection as a fact, it was hypothesized that residual mass by-products from this degradation would enter the GC column, possibly generating other peaks. By adjusting GC conditions and reducing solvent delay time, detection of residual fragment ions from the 25I-NBOH degradation on a secondary early chromatographic peak was observed. This secondary peak was not observed for the 2C-I standard and presented major fragment ions m/z 138, 106, 78 when methanol was the solvent used. Also the mass spectrum for thid peak had no reasonable match on any MS library available. Analysis of the fragment ions present suggested that, in the presence of an alcohol and under heating (as occurring during GC injection), 25I-NBOH degrades and generates 2C-I and 2-(methoxy methyl) phenol by means of nucleophilic substitution, where the alcohol acts as a nucleophile group and the 2C-I as a leaving group. The correlation between the fragment ions detected on the secondary peak to the 2C component present on the primary peak, allowed distinction between 25INBOH and 2C-I from standard GC without recurring to derivatization or other analytical techniques, thus preventing misidentification between the two species.

Disclosure: All authors have declared no conflicts of interest.

INTERPERSONAL VIOLENCE WITHIN FAMILIES: TWO CASE REPORTS FROM MISSISSIPPI

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After attending this presentation, attendees will understand the variation observed in homicidal cases as it pertains to interpersonal violence in the state of Mississippi. This presentation will impact the forensic science community by discussing two homicide cases in which the act of violence was committed by a sibling or parent. Case 1: The 9 year-old decedent was reportedly shot by his 11 year-old brother while the two were alone at their residence. A neighbor called in the shooting after discovering the scene in the house. Pertinent findings at the post-mortem exam were distant entrance wounds to the back of the head, left arm, and upper chest. Further, there were significant injuries to the liver, right lung thoracic vertebra, and brain. Two bullets were recovered. Given the circumstances surrounding the death and the examination findings, the manner of death was determined as homicide. At the time of this submission, the 11 year-old has been removed from the home and is undergoing psychological evaluation. He is not expected to be charged as an adult in the case. Case 2: Police were called about a domestic disturbance in eastern Mississippi. When officers arrived at the residence, the house was on fire. While a woman and her 7 year-old stepson escaped the fire, the female was treated at a local hospital for her injuries. However, the bodies of an

adult male and 9 year-old male child were found in the driveway. Autopsy findings on the child indicated sharp force injuries of the intestines, the mesentery, and the spleen. In addition to blunt force injury, the adult exhibited a sharp force injury of the right external jugular vein. Based on the case histories and autopsy results, the cases were ruled homicide and suicide, respectively.

Disclosure: All authors have declared no conflicts of interest.

REVIEW OF IN-CUSTODY DEATHS IN MISSISSIPPI

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The goal of this presentation is to review the history and structure of the prison system in the State of Mississippi and to present various cases in which inmates have died while in custody. This presentation will impact the forensic community by demonstrating the challenges in determining the cause and manner of deaths occurring in custody. The first reported prison to be developed in Mississippi was in 1789 in the city of Natchez. The first centralized prison was not established until April 1840, and was designed to house 200 inmates. Overcrowding soon became an issue. Subsequently, the Governor released 40 inmates in order to increase the manpower of the Confederate Army. The prison was eventually overrun by Sherman's army on his march to Atlanta. The current State Penitentiary in Parchman, Mississippi was built in 1901. A federal mandate in 1972 ordered the state to develop a plan to address issues that included racial segregation, possession of weapons, drugs and alcohol, and the punishment of inmates. The Mississippi Department of Corrections (MDOC) was established in July 1976. Under their jurisdiction there are three state-run prisons, eleven regional prisons, six private prisons and four restitution centers. In addition, each of the 82 counties has at least one county jail. The MDOC houses approximately 21,000 inmates, 47 of whom are currently on death row. The MDOC inmate population figure is the second highest in the nation. The investigation of in-custody deaths is a multidisciplinary team effort and presents challenges at all levels. Although recent data was unavailable at the time of this submission, a total of 71 in-custody deaths were reported in 2014. This presentation will provide photographic and video documentation of scene and autopsy evidence which illustrates the variability exhibited by in-custody deaths falling under the jurisdiction of the Mississippi State Medical Examiner's Office.

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PERFORMANCE CHARACTERISTICS OF THE INTOXILYZER 9000 - AN INDEPENDENT ASSESSMENT AND REVIEW

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Evidential breath alcohol testing (EBT) instruments are typically evaluated to determine their accuracy, precision, specificity towards ethanol detection and overall reliability by government agencies and state run or sponsored forensic crime labs. Independent testing and analysis by individuals in private practice is rare, due in part to controlled access to EBT instrumentation. The author had an opportunity to conduct an independent inspection of an Intoxilyzer Model 9000, recently introduced by CMI Inc. as the most advanced EBT in their product line and now in use in a few jurisdictions in the United States. A review of the report prepared by the Georgia Bureau of Investigation will be presented, and compared to the independent inspection conducted. The instrument was assessed in its performance in the following areas: Specificity towards the detection of ethanol in combination with interfering volatile organic compounds (VOCs) including acetone, isopropanol, methanol and d-limonene; Susceptibility towards radio frequency interference (RFI); The ability of the instrument to identify the presence of oral pathway contamination by the residual alcohol detection algorithm, and; The ability of the instrument to report accurate of precise breath-alcohol concentrations (BrAC) in testing the vapors of simulation solutions having a known ethyl alcohol concentration. The findings support the notion that the Intoxilyzer 9000 can reliably detect the presence of VOCs and report that the breath sample is contaminated by a substance other than ethanol, although the preliminary electronic display on the instrument often indicated a substantially higher reported BAC that was subsequently not reported on the printed results. There is a concern that a breath test operator may misinterpret the preliminary display results and attempt to report them to the courts as an accurate representation of the BAC of the test subject. The RFI detect process was observed to generate both false-negative and false-positive results without indicating the presence of the RFI. The findings also support the notion that the residual alcohol detection system does not reliably detect the presence of mouth-alcohol contamination, thereby reinforcing the necessity of correctly performing a deprivation and observation period of at least 15-20 minutes prior to receiving breath samples suitable for analysis. The author will present the results of this independent testing along with photographs and videos of the instrument. Recommendations will be made for breath-testing procedures that will minimize the impact of identified concerns on an evidential breath-alcohol test.

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RELIABILITY OF HEMASTIX® VS. KASTLE-MEYER/PHENOLPHTHALEIN TEST AND ASSOCIATED FALSE-POSITIVE RATES

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The purpose of this study was to test the reliability, in terms of specificity, of the Hemastix® vs. Kastle-Meyer/Phenolphthalein test (3-step) detection abilities for the presence of blood by studying their associated false-positive rates in order to determine the most suitable test for use at crime scenes. This study was conducted by testing 7 different categories of materials, each comprising between 3 and 12 items. The categories tested included plants/fruits/vegetables, manufactured items, animal, metal compound solutions, chemical solutions, household chemicals and household products. A total of 55 items were tested, each sampled 4 times with each of the two presumptive tests. The Wilcoxon Signed-Rank Test results demonstrate that there is a significant difference between the Hemastix® and Kastle-Meyer tests overall, taking all categories into account. Specifically, testing with Hemastix® produced more false-positives for the plants/fruits/vegetables and metal compound solutions categories, whereas there were no significant differences between the two tests for: manufactured items, household chemicals and household products. It should be noted that the animal and chemical solutions categories also displayed no significant differences between the two tests (statistically significant but not practically). Based on the results of this study and taking into account other factors such as accessibility, efficiency, cost and sensitivity, the recommended presumptive blood test for use at crime scenes for reliability in terms of specificity is the Kastle-Meyer (3-step) test. This research will provide valuable information for investigators and forensic identification officers in their assessment and consideration of which method to use at crime scenes. It will also assist the Bloodstain Pattern Analysis Scientific Area Subcommittee (OSAC) and International Association of Bloodstain Pattern Analysts (IABPA) in potentially revising their protocols and guidelines for the detection of bloodstains as well as aid expert witnesses in explaining why one method was chosen over the other.

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EVALUATION OF TRANSFER OF GUNSHOT RESIDUE DURING THE TYPICAL ARREST PROCESS

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Gunshot residue (GSR) collection from suspects involved in firearms related crimes is a common task for forensic investigators. The current standard of practice with Peel Regional Police is the collection of GSR from the back and webs of a suspect's hands after their arrest using an adhesive dauber. These samples are then sent to the CFS for further processing using the SEM-EDX. Recently in court, defense attorneys have been presenting the concern that the GSR collected from their client was transferred to them from the police officer during the arrest process. The purpose of this research is to determine whether or not GSR can be transferred onto a suspect's hands through the typical arrest processes by a uniform patrol officer. A total of 20 mock arrest scenarios were performed, with Peel Regional Police officers arresting civilian members of the force. 10 of the scenarios occurred shortly before the arresting officer's annual use of force training, and the other 10 were performed during the officers' first shift back to duty after their training. These two conditions present as a best and worst case scenario for GSR exposure and transfer. Each scenario involved physical contact between the arrested subject and arresting officer, as well as contact with locations such as the back of a police vehicle, the cells and booking area of a police station, and an interview room. This is a foundational study, as it is the first Canadian study to use mock arrest scenarios, and similar American studies focus on specific tactical units of the police force, and not uniform officers. It is also the first to use a realistic timeline and arrest process that places the arrested subject in all the typical areas they would encounter in a real arrest. The results of this research can be used to determine the direction of future studies to further understand GSR contamination risks between the police and a suspect.

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GENETIC FACTORS UNDERLYING 3D VARIATION IN CRANIOFACIAL LANDMARKS IN A MIXED-ANCESTRY SAMPLE

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This presentation will consider the preliminary findings of a collaborative international research project in facial anthropometry and genetics. The sample consists of 396 subjects who consented to participate in the investigation at the University of Toronto Mississauga, Canada, and the University of São Paulo Ribeirão Preto Medical School, Brazil. The Canadian sample consisted of persons of diverse, but not substantially mixed ancestry, including a significant proportion of first and second generation immigrants to Mississauga. The Brazilian sample, in contrast, was highly admixed, reflecting the extensive historic intermarriage in that country. The volunteers gave samples of saliva, from which a genotype of circa. 660,000 SNPs and CNVs was obtained using the Illumina 660W-BeadChip (genotyping undertaken at the SickKids Hospital, Toronto, Canada). Facial images of the volunteers were also captured in 3D, using sterephotographic and laser capture devices in Mississauga and Ribeirão Preto. Subsequently, 3D traditional craniofacial landmark points were located at 30 sites on the image surfaces, using point and click operations, in Mississauga, Ribeirão Preto and Newcastle Upon Tyne, England. These measurements were repeated by two (laser scanned subjects) and three (stereophotography scanned subjects) observers. Intra- and inter-observer error exceeding the third standard deviation of variation was investigated and landmarks locations reassigned. Given the small size of the genotyped sample and its anticipated genetic heterogeneity, a larger non-genotyped sample of >3000 subjects was also used to inform the analysis of variation in facial dimensions. This sample was collected in South Yorkshire, UK, and Ribeirão Preto, Brazil, using 3D stereophotography and subjected to the same process of intra- and inter-observer error analysis and investigation of outliers. This paper will review sex, age and ancestry-related influences on variation, and present a preliminary analysis of the ongoing study of potential gene-shape relationships.

Disclosure: All authors have declared no conflicts of interest.

SUDDEN UNEXPECTED DEATH IN EPILEPSY - A CASE REPORT AT LITERATURE REVIEW

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From a case of sudden death of a patient known for epilepsy, we reviewed the literature to understand the incidence and the way of diagnosis. We were led to do the autopsy of a woman that was found dead at home. She was epileptic, but without treatment. The autopsy performed did not reveal any pathological element that could explain the death. The toxicological analysis carried out on the samples recovered an alcoholic impregnation, but at a non-toxic level. Pathologic examination did not reveal any specific lesion. We have concluded that it was a case of sudden unexplained death in epilepsy. According to various publications, sudden unexplained death in epilepsy accounts for 17% of deaths among people with epilepsy. The autopsy does not reveal a cause of death. The mechanisms of death remain unknown, with both cardiac and pulmonary derangements having been hypothesized, but no element is noticed at pathologic examination. Sometimes we can find transient ictal conduction abnormalities and myocardial injury, but in the most of the cases there is no pathological aspect. Some criteria have been suggested for the diagnosis of sudden death in epilepsy, and these criteria are based on clinical and contextual aspects. When no other cause of death is found in victims that had epilepsy, sudden unexplained death in epilepsy seems a reasonable diagnosis.

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A CASE OF AORTIC DISSECTION WITH NOVEL GENETIC MUTATION

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Learning objectives: Attendees will learn about the molecular autopsy in investigating aortic dissection in the young, connective tissue gene disorders and associated aortopathy/arteriopathy and a novel mutation and potential familial effects. Abstract: Aortic dissection, separation of the layers constituting the aortic wall, is a relatively uncommon occurrence associated with high morbidity and mortality rates, typically in men in the fifth to sixth decades of life. Whilst most dissections are acquired due to atherosclerotic disease or blunt trauma, a subset is congenital. The latter can be associated with genetic mutations in connective tissue genes, resulting in aortopathy. We present the case of a man with an aortic dissection, having an aortopathy with an unreported genetic mutation. A 35-year-old man with no known chronic medical illness presented to hospital complaining of shortness of breath and chest tightness. He was diagnosed with pneumonia and discharged on antibiotics. His symptoms worsened, he was witnessed to have a seizure and became unresponsive. The emergency services were called, resuscitation was unsuccessful and he was pronounced dead. Post-mortem examination revealed a well-developed male with a Basal Metabolic Index of 37.3 kg/m2. Internally there was 1040 cc of hemopericardium. The heart showed cardiomegaly with concentric left ventricular hypertrophy. A DeBakey type-II ruptured aortic dissection with inflow 12 cm from the aortic root and outflow 6 cm from the aortic root were identified. The aorta (dissected and intact) was sampled, along with a number of other medium to large arteries. Histological examination showed widespread changes including varying degrees of medial degenerative changes, disorganization

and disarray of smooth muscle indicating a systemic arteriopathy with aortopathy. Post-mortem molecular testing demonstrated this man to be heterozygous for an autosomal dominant Myosin Heavy Chain 11 (MYH 11) mutation (c.685G>A). This change is a highly conserved area of the protein and has not been previously reported as either a mutation or a polymorphism. The cause of death was given as hemopericardium due to ruptured aortic dissection consequent on aortopathy/arteriopathy. A recommendation was given to first degree relatives to consider genetic screening to ascertain the relevance of this potentially heritable mutation to family members. Keywords: aortic dissection; myosin heavy chain 11(MHY 11); aortopathy/arteriopathy.

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VOICE BIOMETRIC DISTINCTION BETWEEN ENGLISH AND ARABIC USING SPEECH PRO SIS II

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Voice identification and speaker recognition has become a lead role in forensic investigation as technology advances and individuals are more capable of fulfilling government legislations and daily obligations, such as banking and billing, over the phone. The disadvantages of such advantageous facilitation are the increasing potentials of fraud, impersonation, and identity thief. Forensic voice biometrics have helped resolve those audio related disclaimers and assisted courts with prosecution of offenders. Audio forensic expert decode voice samples concerned with derogatory audio threat, fraudulent calls, and similar criminal activities to identify or eliminate potential suspect. Experts are trained with the necessary skill sets and provided with the advancements of voice biometric software to analyze and report on a questioned audio recording. However, analysts may face some difficulties in multicultural countries, like Canada, in which citizens may speak multiple languages that the expert is not knowledgeable of. Thus, a database that summaries the different aspects and correlations of each language with respect to speech must be constructed to facilitate voice identifications in multilingual countries. This research examines the difference in articulation of consonant and vowel sounds between English and Arabic using Speech Pro SIS II. Sound Cleaner is used to edit and filter the audio samples, and SIS II graphically analyzes and compares the speech signals and formants patterns. The audio biometrics software showed formants overlap for A, I, and U vowels, and it is able to identify both English and Arabic audio recordings to the same research candidate.

Disclosure: All authors have declared no conflicts of interest.

ELDER ABUSE AND NEGLECT IN PORTUGAL - FORENSIC MULTIDISCIPLINARY APPROACH

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Elder abuse and neglect is recognized internationally as a growing problem. The World Health Organization (WHO) defines elder abuse as "a single, or repeated act, or lack of appropriate action, occurring within any relationship where there is an expectation of trust which causes harm or distress to an older person", and it includes physical abuse, psychological and emotional abuse, sexual abuse, financial exploitation, and neglect. A study developed by the Portuguese National Health Institute, between 2011 and 2014 estimated that 12.3% of Portuguese citizens over 60 years old have been victims of at least one episode of violence in the year prior to the interview. In Portugal, a forensic medical evaluation is mandatory in Portugal, and must be performed by forensic medical examiners from the National Institute of Legal Medicine and Forensic Sciences (INMLCF). When a forensic medical exam is required, especially those performed at the elder's house or nursing homes, a series of steps must be accomplished which must follow a proper guideline. The early identification of any kind of abuse is essential in order to ensure the safety of the older person, which will ultimately depend on an effective multidisciplinary intervention. The aim of this work is to propose a practical framework model to approach such interventions in order to produce a more robust forensic medical exam and report, being the latter essential to assist public prosecutors' proper decision.

Disclosure: All authors have declared no conflicts of interest.

STAB WOUND SUICIDE, DIFFICULTIES ESTABLISHING THE MANNER OF DEATH - A CASE REPORT

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Introduction: Traumatic lesions caused by a sharp blade instrument is not the most common method of suicide, however, there have been some reported cases in Portugal. Sharp force injuries are typical in these cases, incision lesions being more commonly found in the neck and upper limbs and stab lesions in the thorax, abdomen and neck. There is great variance in the number of injuries, as there is on its characteristics, with various levels of depth and hesitation traits, which are relevant when asserting the manner of death. The description and evaluation of these injuries during the crime scene examination may be incomplete due to circumstantial limitations, so the external examination during the autopsy is extremely relevant. **Case:** 78-year-old male, found dead by his wife on the bedroom floor. It was established during the crime scene examination that the victim was in the prone position as well as an abundance of blood around the body. Later a wooden cable knife was found inserted on the jugular notch, without any apparent defense wounds. According to the wife, the victim had previously stated his intentions to commit suicide. During the autopsy, after the removal of the blood on the body surface, a number of parallel incisions became apparent, the majority of which of only a few millimeters, on the head, face, neck and abdomen. When the thorax was opened, it became possible to describe the trajectory of the sharp instrument (knife), which sectioned the aorta. **Discussion/Conclusion:** The characteristics of multiple traumatic injuries to the head, face, neck and abdomen are consistent with hesitation injuries. These, as well as the laceration of the aorta, are placed in areas of easy access to the victim, which indicates the possibility of self-infliction. Besides the limitations of the crime scene examination and the high number of injuries later identified during the autopsy, it was possible to determine that the type of injuries reinforced the diagnosis of suicide.

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AGE ESTIMATION OF THE PUBIC SYMPHYSIS USING COMPUTED TOMOGRAPHY SCANS OF CADAVERS

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The importance of accurately identifying human remains has sparked recent research in age estimation methods. The evolving capabilities of three-dimensional (3D) technology, including CT and laser scanning, has allowed forensic autopsy techniques to move towards a less invasive approach. During death investigations involving unknown individuals, a biological profile is developed by a forensic anthropologist using features of the skeletal remains. This process is hindered when the skeleton is not readily accessible due to the presence of soft tissue which is more often than not the case. Current methods of bone preparation for skeletal analysis involve laborious and time consuming techniques for retrieval of bones from remains. Utilizing CT scans, visualizing the skeleton and then creating a 3D rendition of selected skeletal features offers a new opportunity for modernizing and creating efficiency in the field of forensic anthropology. CT scans could speed up case analysis to improve the

potential of identifying unknown remains. The Suchey-Brooks method is well-known as a reliable standard for aging the pubic symphysis using dry bone. This research endeavored to determine whether the Suchey-Brooks method could be used to accurately estimate the age of the pubic symphysis from CT scans of cadavers. CT scans of 205 cadavers of known age at death were assessed from the Ontario Forensic Pathology Service. The sample consisted of 127 males and 78 females. This paper will present the results of age determination from the 3D rendered scans as compared to the known ages at death. In addition, the research compared the results of scans targeted at the pelvic area with those of full body scans, as well as renderings created as both DICOM and QuickTime images. The differences in the results utilizing these methods and software's will also be presented.

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HANDWRITING EXAMINATION IN A CASE OF TWIN BROTHERS

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In an apparently ordinary case, an ID document was sent to INC for both authenticity and handwriting examinations. The standard material submitted for handwriting examination presented several convergences with the questioned signature, indicating authenticity of the writing. Nevertheless, among the accessory documentation sent there was an electoral enrollment form where the applicant reported to have a twin brother. It was further noted that the siblings were born and raised in a small town in a midwestern state of the country. Analyzing the situation, it was considered that it was very likely that the twin brothers were literate in the same school and with the same teacher. Other elements of context allowed us to know that the brothers have very similar names, changing only the last letter of the name, and that one of them was involved in several cases of fraud in the region. He was accused by his twin of using his brother's ID document as if it was his, assuming his identity to conceal his own. Corroborate this the fact that the questioned ID presented some perforations made with a sharp instrument, making it difficult to read parts of some words, especially the holder's name. Due to this situation, the conclusion was that the handwriting examination would only be proceeded if the other twin's standard samples were also analyzed, so that the characteristics and writing habits of each one, whether or not they converged, could be studied. The possibility of a high degree of writing convergence between twins who were literate together was considered highly relevant, which led the experts to opt for a non-conclusive report regarding handwriting authenticity, despite the observed convergences. In addition, the importance of knowing familiar aspects of the investigated was demonstrated, since they may have a determining influence in the exams and especially in the conclusions in handwriting analysis.

Disclosure: All authors have declared no conflicts of interest.

PORTUGUESE REALITY IN THE ORIENTATION OF INTIMATE PARTNER VIOLENCE CASES

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The goal of the present work is to present the Portuguese framework regarding the crime of "domestic violence", specifically intimate partner violence cases, approaching the legislation on this subject as well as the social network support both to the victim and to the alleged offender. Intimate partner violence includes physical, sexual, psychological and emotional abuse by an intimate partner and is considered to be a public health problem as well as a violation of human rights. It can lead to serious consequences including physical and mental health permanent damage or even leading to suicide or homicide situations as well as the exposure of children to the couple violence with long-term effects on their development and physical and mental health. Portugal is a southwestern European country with a population of 10 million inhabitants. According to the Portuguese National Institute of Statistics' most recent data (2015), 27.585 citizens alleged to have been victims of intimate partner violence, being this the most reported crime to the authorities regarding the same year. Over the past three decades many countries, including Portugal, have adopted or improved legislation regarding intimate partner violence. The crime of domestic violence, which includes intimate partner violence, was first introduced in the 1982 revision of the Portuguese Penal Code. It has been revised many times throughout the years, and in the current version, article 152º of the Penal Code, includes the person of another or the same sex with whom the victim maintains or has maintained a spouse or analogous relation, even if without cohabitation. Since 2000 it is classified as a "public crime", meaning that it does not require a complaint made by the victim, as it can be reported by any person, though the victim's testimony will still be needed in the prosecutor's office. In 2009, a specific law addressed to the prevention, protection and assistance of victims of domestic violence was instated, and a "victim status" was established. This status, given by the authorities in the moment of the complaint, offers legal and civil protection (such as shelters, free legal advice, free medical care and the possibility of a monthly financial support) and a support network of professionals and organizations (governmental or non-for-profit) promoting victims' assistance and protection as well as their offspring. This law also includes measures addressed to the aggressors, like prohibition of contact with the victim supervised by electronic devices and promotion of their treatment/rehabilitation.

Disclosure: All authors have declared no conflicts of interest.

EASYLIFT TAPE SYSTEM: SIMULTANEOUS PRESUMPTIVE TESTING FOR BLOOD AND RETRIEVAL OF FIBRES EVIDENCE

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The ability to recover multiple evidence types simultaneously at crime scenes increases the speed of analysis and creates more effective crime scene processing. In addition to this, the capability of gaining fast results at the scene, such as presumptive testing for the presence of body fluids, creates potential intelligence information which can be used in the forensic strategy of the investigation. The idea of a universal tape that is effective for the recovery of multiple evidence types is not new but the collection of particulates whilst testing for the presence of body fluids is an advancement upon current methods. This poster will describe the initial creation of a tape lifting system which simultaneously tests for the presence of blood. This study investigated the adaption of Easylift® tape lifting system, which currently has benefits for the analysis of fibres and other particulates as it allows in situ analysis of samples without the need for dissection, for the presumptive testing of blood from surfaces whilst retrieving particulates. This poster will outline the methods used to integrate leucomalachite green (LMG) reagent into Easylift® taping system and the subsequent success rates of detection for different blood dilutions. This poster will also report on a blind trial for the presumptive testing for blood on two different objects and discuss the next steps for the development of this universal tape.

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HOW WELL DO PEOPLE KNOW THEIR SIGNATURES?

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The act of writing a name is an automatic action and can become extremely individualized. Therefore one can assume that a signature itself can, or even should be, unique for every individual. This could imply that

each person should be familiar with his or her own signature and thus be able to discriminate between the genuine signature and a simulation. In this study, 100 participants were asked to provide 10 signatures on paper. These were then scanned to obtain an 'electronic' version. The original genuine signatures on paper served as a model to produce simulated versions on a computer (using a digitizing tablet). After a couple of weeks, every participant was shown 10 signatures one by one on a computer screen and asked to judge whether they were genuine or simulated. Only one person was 100% correct in recognizing their signatures (10/10 correct answers). The average of all results was 57.6%.

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EFFICACY OF REFLECTANCE TRANSFORMATION IMAGING (RTI) IN DOCUMENTING 3D FOOTWEAR IMPRESSION EVIDENCE

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In this paper, the efficacy of Reflectance Transformation Imaging (RTI) in documenting footwear impression evidence was examined. Currently, both direct and oblique lighting are the traditional forensic photography techniques employed when documenting three-dimensional (3D) footwear impression evidence. However, these techniques result in shadows being casted onto the impression — and therefore hide potential details or artifacts that could be critical in comparisons and individualizations. RTI has the ability to capture the reflectance information of each pixel in an image and consequently decreases the likelihood of details or artifacts to be hidden in the shadows of an image. The efficacy of RTI was determined by comparing photos of footwear impressions made in BIO-FOAM®, dirt, and mud — each photographed using direct lighting, oblique lighting and RTI. Forensic Identification officers at Durham Regional Police Services compared four photos for each of the footwear impressions. Two of the four photos were taken using RTI, such that one photo was the default RTI image while the other photo had a preset filter applied to it. The reason for having two RTI images was to compare filter preferences between the two. The officers ranked the four photos from best to worst based on the following criteria: clarity of detail, lighting condition, visibility of texture and depth, and suitability for comparison work. Based on the criteria, the photo taken with direct lighting was ranked "best" most frequently (50%) for the footwear impression in BIO-FOAM®. RTI was ranked "best" most frequently (58.5%) for the impression in dirt. For the impression in mud, oblique lighting was ranked "best" most frequently (75%). With all things considered, RTI was chosen as the preferred photo for comparison work 50% of the time for both BIO-FOAM® and dirt while oblique lighting was most preferred 83% of the time for the impression in mud. Therefore, all results suggest that RTI is best for impressions in dirt and BIO-FOAM®, but oblique lighting should still be used for impressions in mud.

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SEVERE, UNILATERAL RETINAL HEMORRHAGE IMPLICATES TRAUMA PER SE AS THE LIMITING PATHOGENIC FACTOR

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Background: The pathogenesis of ocular hemorrhages in young children in the setting of craniocerebral trauma is complex. Hypotheses for the retinal hemorrhage component have included vitreoretinal traction, increased intracranial pressure, blunt impact, hypoxia, and increased intrathoracic pressure. Whereas severe, bilateral retinal hemorrhage has a robust association with acceleration-deceleration injury, mild posterior retinopathy and unilateral hemorrhage may occur in more diverse settings. Optic nerve sheath hemorrhage is often encountered with craniocerebral trauma, but may also be seen with non-traumatic, acute intracranial pathology. **Case report:** We report the ocular findings in an 8 month-old girl who presented with cardiovascular collapse in the setting of acceleration-deceleration trauma to the head. She was pronounced dead the following day. She had a history of cerebral palsy, hypertonia, and non-compaction cardiomyopathy. **Results:** Autopsy examination revealed small (less than 1 cm), faint contusions involving the right forehead, right temple, and right mid chest, and small abrasions on the feet. There were no skull or other fractures. There was no evidence of impact to the orbit. There was no evidence of blunt trauma to the chest or abdominal viscera. Neuropathological examination showed bilateral, acute subdural hemorrhage over the cerebral convexities, a left convexity neomembrane, focal acute subarachnoid hemorrhage in the left frontal parasagittal region, global ischemic brain injury, and diffuse, bilateral polymicrogyria. Focal hemorrhage in the corpus callosum, with amyloid precursor protein-positive axonal varicosities were also present. Noteworthy was ocular examination, which showed extensive but unilateral retinal hemorrhage limited to the left eye. This included sub-internal limiting membrane hemorrhage, intraretinal hemorrhage, and subretinal hemorrhage. Acute hemorrhage was diffuse within the retina and extended broadly to the ora serrata. Also present on the left was a prominent perimacular retinal fold. The retina of the right globe was entirely normal, with no hemorrhages or folds. Optic nerve sheath hemorrhage was present in equal amounts on both sides. **Conclusions:** Unilateral, severe retinal hemorrhage with perimacular folds in this decedent with minimal external impact injury and global ischemic brain injury strongly implicates asymmetrical acceleration-deceleration in the pathogenesis of severe hemorrhagic retinopathy. Globally increased intracranial pressure, systemic factors such as coagulopathy, sepsis, and increased intrathoracic pressure, are essentially excluded. The pathogenesis of optic nerve sheath hemorrhage is less clear.

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IS IT POSSIBLE TO POSTPONE POST-MORTEM DIAGNOSTIC OF KETOACIDOTIC STATES AND OBTAIN RELIABLE RESULTS?

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Beta-hydroxybutyrate (BOHB) is considered to be most reliable post-mortem indicator of ketoacidosis. Therefore, it is frequently measured at the Institute of Forensic Medicine in Ljubljana, especially in cases of otherwise unexplainable deaths of alcoholics and diabetics. These measurements are performed in the clinical laboratory, by means of Autoanalyser Olympus AU 400 using Rambut detection kit for BOHB, along with measurements of lactate, glucose, urea, potassium, sodium and chloride. To limit the costs, analyses are preferably performed stepwise, starting with vitreous fluid (when available) and urine. Results can be obtained even during the very autopsy enabling forensic pathologists decision regarding the necessity of analysis of other bodily fluids. Determination of alcohol, which also reveals acetone, contributes to diagnostic of ketoacidosis, while HbA1c percentage measurement helps determine its cause. Since 2010 such analyses have been performed in 1052 cases, which represent approximately 14% of all autopsies. In 37 cases BOHB levels in vitreous fluid and in additional 16 cases BOHB levels in blood, serum or pericardial fluid exceeded the value of 4000 µmol/L, which we adopted (upon Brinkmann's proposal) as critical for establishing the diagnosis of ketoacidosis. All together BOHB values sufficient for establishing the diagnosis were found at 0.69% of all autopsies, but we believe that the real figure is higher. Hoping that postponed post-mortem biochemistry might clarify at least some of quite a few cases in which all macroscopic, microscopic and toxicological findings failed to reveal the cause of death, we decided to test the feasibility and reliability of delayed BOHB analysis. For this purpose, we retested available samples of bodily fluids of 57 deceased, which had already been tested and subsequently stored refrigerated (4°C) for different periods, up to 62 months. Before retesting, all samples were centrifuged and characteristics of the supernatant recorded. The comparison of primary and secondary testing

results revealed a general decrease in BOHB values, on average by 15% in urine and by 20% in vitreous fluid. The samples showing very low BOHB retesting values were mostly characterized by light green staining, opacity or fetid smell. Such deterioration occurred already in the first months of storage and its extent was not time dependent. The fact that deteriorated samples can be easily recognized offers a possibility to conduct postponed post-mortem diagnostic of ketoacidosis. Plausible conclusions could be expected if obviously deteriorated samples are excluded and beside urine at least one fluid (vitreous, serum or pericardial fluid) analyzed.

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ANALYSIS OF COCAINE AND ADULTERATING AGENTS IN DIFFERENT MATRICES IN THE NARCOTIC LABORATORY

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Cocaine (also known as coke, blow, snow, etc) is a substance widely known because of its use as a narcotic. Although cocaine analysis in drugs labs is not currently very difficult, It becomes increasingly more complicated as we now have to identify other substances that are being used as adulterating or cutting agents. Adulterating agents are being used to reduce the Cocaine purity. On the other hand, the use of different matrices to camouflage It has made the separation, identification and quantification an increasingly difficult challenge for Narcotic Forensic Science Laboratories. Narcotics Laboratories work hand in hand with other International Agencies helping to identify the different adulterating and cutting substances being used today. This allows to detect the region of the country where they have been produced in order to detect the origin and criminal organizations responsible for the production. By extracting the Cocaina from the diverse matrices that contain it allows the quantification of the amount of cocaine present so that judicial authorities are able to apply the corresponding penalty. During the last few years adulterating substances being used to reduce the purity of Cocaine have changed. Currently high content samples of substances such as Aminopyrin, Caffeine, Dimethylterephthalate, Levamisole and Lidocaine are being found. Similarly the matrices in which the Cocaine is camouflaged have varied. Ten years ago the majority of the samples received were solid substances and as such they were hidden in various metal, wood, cardboard, ceramics, and clothing fabrics. Today samples containing such elements are still being recieved but an increasing number of samples are being found impregnated in different materials, such as plastics, food, detergents, shampoos, etc. These methods make It necessary and important that we develop a methodology for the Cocaine extraction from these materials, using different types of Solvents.

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THE DEVELOPMENT OF A EUROPEAN FORENSIC EDUCATION NETWORK (EFEN): COLLABORATION ACROSS BORDERS

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Forensic education, training and research is constantly evolving with huge steps being made over the last ten years to create robust forensic science education provision across Europe and beyond. The number of higher education courses in forensic science related studies has increased significantly across Europe and, with this, a need to ensure that education providers are creating graduates that possess the appropriate skills and knowledge for the forensic workplace. In order to achieve this, mechanisms such as accreditation schemes for forensic science courses and collaboration with industry have been introduced. The latter has been a slow but steady process, which has been invaluable for forensic education providers to create fit-for-purpose courses. Forensic education providers often share best practice and work in partnership with industry well within their own countries. However, it becomes increasingly difficult to collaborate across borders and therefore there is a tendency to focus upon own national practices rather than taking a more international approach. With the European Union stressing the need for a singular 'European Forensic Science Area' and a taskforce being set up under the same name in order to facilitate shared forensic methods and swift international cooperation, there is a necessity to identify where forensic education can aid this endeavour. This paper will describe a 3-year project funded by ERASMUS+ Strategic Partnerships that will undertake the task to create a European network for forensic education providers (linking with industry partners) in order to share best practice and develop a series of international study programs that meet the sector needs for professionals with knowledge of cross-border forensic investigation. The results from a baseline study of current forensic science education across Europe will be discussed along with the next phase of this project which aims to extend beyond Europe to allow further facilitation of collaborative research and sharing of best practice.

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INTERPERSONAL VIOLENCE INVOLVING AN ASSAULT RIFLE: A MISSISSIPPI CASE REPORT

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After attending this presentation, attendees will understand the variation observed in homicidal cases as it pertains to interpersonal violence in the state of Mississippi. This presentation will impact the forensic science community by discussing a homicide case in which the decedent was killed by the father of her child. The 38 year-old decedent was shot and killed while on her way home from work. Her vehicle was found stopped in the roadway, still running and with the door open. Authorities called to the scene noted what appeared to be gunshots in the driver's side of the car. The decedent's body was found in a nearby field. During the post-mortem examination multiple gunshot wounds were identified and associated with extensive internal injuries. Injuries of the mesentery, intestines, pelvis, vertebral column, long bones of the upper and lower extremities, the internal genitalia, the liver, the left kidney, and right lung were observed. Multiple projectiles and projectile fragments were recovered. Varying trajectories with multiple, intersecting wound tracks were identified. Fragmentation of projectiles and the extent of intersecting wound pathways precluded the definitive determination of the exact number of gunshot wounds. The injuries observed at autopsy were consistent with incident details later obtained from investigators. As the decedent was driving home the driver of another vehicle stopped in front of her car and began shooting at her with an AK47 assault rifle. The decedent got out of her car and ran into a wooded area while the other driver continued to shoot at her. Despite her massive wounds, the decedent was able to climb over a fence bordering the nearby field and cover a short distance before succumbing to her injuries. The decedent's ex-boyfriend, against whom she had obtained a protection order, was arrested in connection with the crime. He is currently in custody and awaiting trial.

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HOMICIDE DEATH REVIEW OF CHILDREN UNDER THE AGE OF TEN IN WAYNE COUNTY, MICHIGAN

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Deaths due to child abuse are rare compared to other causes of death in this age group, most common of which include congenital anomalies and unintentional injuries. Even in medical examiner offices with large caseloads, deaths due to child abuse are uncommon. A five-year retrospective review from 2012 to 2016 in Wayne County, Michigan of children under the age of ten revealed 53 homicides. The most common causes of death were blunt force trauma (36%) and gunshot wounds (25%), followed by: asphyxia (7%); stab wounds and scalding (5%, each); drug toxicity, neglect, carbon monoxide toxicity, early birth due to maternal homicide, and unknown etiology (4%, each); and combined blunt force trauma and thermal injuries (2%). Of the deaths due to blunt force trauma, significant injury to the head alone was the most common finding (53%) and 80% of all blunt force trauma deaths had external impact injuries. Of the deaths due to gunshot wounds, the head alone and multiple parts of the body were most commonly involved (31%, each). African American children were the most common victims of both blunt force trauma (84%) and gunshot wound (92%) deaths. The average age of deaths due to blunt force trauma and scalding was 20 months, each, while all other deaths besides those secondary to maternal homicides were greater than 38 months. Approximately 1,600 children (under the age of eighteen) die each year in the United States from abuse or neglect, the majority of which are younger than the age of three. This is equivalent to the number of children diagnosed with a bone or soft tissue sarcoma each year. The Wayne County Medical Examiner Office has a higher caseload of these deaths due in part to a local children's hospital with a large regional referral area. These deaths are especially tragic and prominent due to the victim's age. In addition, children's developmental differences may render interpreting injuries difficult. This suggests that regional referrals of fatal child abuse cases to centers that see a larger number of these cases is a policy that merits consideration and can help dissipate the aura of controversy that often clouds these deaths. Furthermore, referrals may help medical examiners team with social workers to better identify and understand local sociocultural risk factors that may lead to child abuse deaths. This may lead to actionable solutions that may prevent future child abuse deaths.

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DETERMINING THE SUITABILITY OF 3D LASER SCANNING FOR FORENSIC FOOTWEAR IMPRESSION ANALYSIS IN SAND

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Footwear impression is the mark made by the outsole of a shoe on any surface. Such impressions can be three-dimensional depressions, and they are evidence often present in crime scenes. The analysis of 3D footwear impressions may be used to eliminate or identify suspects in a forensic case, and it involves the comparisons between the characteristics of the impressions and known samples. While impression evidence is usually collected with physical casting methods such as sulphur and dental stone, this research aims to examine the potential and limitation of 3D laser scanning technology as a non-destructive alternative to the collection and analysis of footwear impression evidence. The digital data generated by 3D laser scanning may be used for different quantitative and statistical tests. For this purpose, six worn out shoes were used in the study, which are labelled A, B, C, D, E, and F. All shoes possess the same general outsole pattern, but differ in their wear patterns. Both shoes A and D are US men's size 4, while B, C, E, F are sizes 3, 3.5, 4.5, and 5 respectively. Shoe A was used to create ten footwear impressions in sand. All impressions and shoes were scanned using FARO Design ScanArm. Each shoe was compared to each impression using the CloudCompare software, resulting a total of 60 comparisons. Percent similarity between each shoe and impression can be calculated by CloudCompare. One-way ANOVA is used to analyze the group data, followed by Tukey's multiple comparison procedure. Significance is represented by $p\text{-value} < 0.05$, while family confidence level of 95% is used. The analysis will give insight to how well 3D laser scanning technology can distinguish between the shoe that made the impressions and the shoes that did not.

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RETROSPECTIVE ANALYSIS OF POST-MORTEM MICROBIOLOGY CULTURES IN CHILDREN UNDER FIVE YEARS OF AGE

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A retrospective analysis of sudden unexpected child deaths under five years of age was performed at the Provincial Forensic Pathology Unit in Toronto, Ontario in an attempt to correlate post-mortem microbiological yield to cause of death. The study focused on a five year period between 2011 and 2015 for a total of 284 cases, of which 180 were of undetermined cause. All sudden unexpected and non-violent deaths that occurred within the designated time interval were included. All post-mortem examinations were performed by qualified specialists at a regional forensic pathology unit or hospital. All post-mortem examinations were performed in Ontario, with the exception of 13 cases, which were performed in Manitoba for cost associated reasons. All facilities included in this study abided by the same Standard Operating Procedure. Routine microbiological samples were taken from blood, cerebrospinal fluid, and lung and spleen tissue. Additional samples were analyzed when deemed necessary. A spreadsheet was compiled including date and location of autopsy, post-mortem interval (days), sex, age at death (months), details of medical history and circumstances of death, microbiological findings, autopsy findings and final diagnosis. All data was extracted from a central computerized pathology database and manually entered into a separate spreadsheet. All cases were identified in the database by an assigned study number only. Only specimens obtained during post-mortem investigation were included and microbiological results were restricted to bacterial and viral cell culture results. Microbiological data was assigned a presence or absence score in the form of a 1 or 0 for each individual bacterial or viral type. Cause of death data was scored in the same fashion. Spearman correlation coefficients were calculated for each potential combination using a correlation matrix. Correlation coefficients above 7.5 and below -7.5 were considered significant and 95% confidence intervals were calculated for each significant correlation coefficient. The majority of the significant correlations between causes of death attributed to bacteria and/or viruses and their respective cultured specimens were expected and logical. The significance of microbiological specimens in undetermined causes of death is currently under investigation.

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UNDETERMINED MANNER OF DEATH: WHAT'S MISSING? A 10-YEAR STUDY OF FORENSIC AUTOPSIES IN LISBON

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Injury deaths are the ones caused by an external cause and a major source of mortality around the world. The manner of death can be divided into three big groups according to intention: suicide, homicide and accident. If the forensic pathologist can't determine the manner of death after a complete autopsy exam, it can be established as undetermined. It is crucial to think about strategies to avoid classifying manner of death as undetermined. To achieve this, it becomes essential to provide the forensic pathologist with all the information and instruments available, from all

the investigation teams involved, so he can accurately access the most probable intention, and therefore conclude the manner of death. The aim of this study was to define the set of characteristics most frequently associated with undetermined manner of death, specifically, the victim's profile, the circumstances and the cause of death. It was also a goal of this study to determine which factors prevented the forensic pathologists from otherwise determining the manner of death, and how these situations could be avoided. We performed a retrospective, observational and descriptive study, analyzing the reports of forensic autopsies performed in the South Branch of the National Institute of Legal Medicine and Forensic Sciences, in Lisbon, Portugal, from 2001 until 2010. Among the 12023 forensic autopsies performed in the location and period of time described above, 229 were classified as undetermined manner of death. The following variables were collected: sex, age, ethnicity, nationality, cause of death, external agent involved, place of death, length of hospital stay and ancillary tests performed, such as toxicological, histological or radiological exams. This study raises the need for awareness of the most common limitations that forensic pathologists face, which lead them to classify manner of death as undetermined. It supports the need for a thorough and broad investigation, the importance of a complete report of the circumstances surrounding death and of the detailed information about the crime scene and clinical records, usually from police investigation or healthcare providers. It is also of great importance to define strategies for forensic pathologists to overcome the difficulties when it comes to establish the manner of death. It also emphasizes the need for a multidisciplinary approach to every single injury death.

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TRANSFER AND PERSISTENCE OF DNA AS A RESULT OF SKIN-TO-SKIN FONDLING/GRABBING

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The transfer and persistence of touch DNA on skin after fondling or grabbing has only briefly been studied, yet it is a common allegation in sexual assault investigations. One hour after washing their hands (to ensure consistency), five male individuals held onto and rubbed the exposed skin on the arms of five separate female volunteers for either 10 or 60 seconds. When samples were collected using wetted swabs immediately following skin to skin contact, 35 of 50 samples generated autosomal STR DNA profiles corresponding to the male volunteer, with no statistical difference observed dependent on the duration of contact. To more closely replicate the timing of collection following a true assault, a subsequent identical skin to skin contact event (with 5 males and 5 females) was performed following which samples (n = 25) were collected 6 hours after contact. Fewer than half of the samples yielded detectable male DNA at the quantitation stage. None of the samples containing male DNA produced interpretable autosomal STR DNA profiles due to the presence of additional low-level foreign DNA and/or the overall complexity of the mixtures. Six of these samples were further tested using male-specific Y-STR analysis: profiles corresponding to the male volunteer were determined in just 2 samples; the remaining 4 samples produced Y-STR profiles that were uninterpretable mixtures of at least two males. This research suggests that the passage of time is a significant factor in the successful outcome of this type of DNA analysis.

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THE SURVIVE STUDY: EXPERIENCES FROM A DANISH NATIONAL AUTOPSY-BASED STUDY OF DECEASED MENTALLY ILL

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Background: The Danish national **SURVIVE study** commenced in 2013 and is a cross-disciplinary, prospective study of deceased mentally ill (MI) patients. The mortality in the MI by far exceeds the background population. Life style-associated factors, medication/illicit drug use and abuse, and genetic disposition play important roles. Most research on premature death in the MI has been registry based, identifying risk factors. Little is known about the underlying causes and mechanisms. Autopsies have never been performed prospectively taking advantage of accessible bio-samples for molecular methods with reference to known risk factors and clinical observations in the living. **Aim:** The overall aim is to uncover causal mechanisms leading to premature death in MI individuals with focus on: 1) heart diseases, 2) adipose tissue changes 3) toxicology, 4) stress and brain changes 5) genetic and epigenetic mechanisms. **Materials and Methods:** An optimized autopsy model has been employed comprising registration of somatic diseases, use and abuse of alcohol and drugs, together with whole body CT and MR scanning of heart and brain and bio-sampling for toxicology, genetics, histology and biochemistry. In a 2-year period 500 cases were included. Advanced methods for imaging, quantification of various metabolic and inflammatory parameters as well as studies for genetic and epigenetic measurements have been initiated. **Results:** Preliminary results show that we can: 1) Perform coronary artery calcium score by CT, coupled with exact quantification of Calcium and the degree of occlusion; 2) Quantify and correlate the distribution of adipose tissue with the degree of cardio-vascular-disease 3) Quantify the amount of fat cells in various organs by stereology, and correlate with cellular metabolic and inflammatory activities; 4) Measure specific brain structures volumetrically by CT and also quantify the related hormone production; 5) Perform genetic variations and 6) toxicological levels of medication and illicit drugs in blood and heart tissue . We will present the experience, obstacles and preliminary results of SURVIVE **Perspectives:** The SMI represent a group with conspicuous life style diseases and intense drug use and abuse. Their somatic symptom complex by far exceeds that of the background population. It is our hope that this methodology may elucidate causes of premature death even among the non-mentally ill, especially in relation to life style behavior and psychological distress.

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ATYPICAL INTIMATE PARTNER HOMICIDES: A REPORT OF 5 CASES AND A FORENSIC PATHOLOGIST'S APPROACH

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In the context of affective relationships, intimate partner homicide (IPH) is a common cause of violence amongst women. Globally, as in Portugal, death arises due to gunshot or sharp trauma injuries. The authors present five case studies of IPH, showing a more diverse cause of death and of trauma types: **Cases: 1-**A man confessed to have killed his girlfriend, leading the authorities to the murder scene where a 20-year old female was found dead. Both external and internal findings were compatible with asphyxia. Furthermore, when dissecting the uterus, an embryo, found to be fathered by the aggressor through a paternity test, was discovered. The cause of death was smothering. **2-**A 22-year-old female was arguing with her boyfriend inside his car, and while striking each other, she was pushed out to the driveway, being then ran over by another car. The autopsy findings

were consistent with the information given and toxicological analysis were positive for alcohol (2,15 g/L). **3**-A 22-year-old female was found dead in a pension room, rented the day before by the alleged aggressor and victim's ex-boyfriend. During the autopsy, classical signs of asphyxia were found, as well as several neck and head internal injuries. Additionally, purple ecchymosis was noticed in the uterus cervix. Both the toxicological analysis and vaginal / anal sample swab genetic screening were negative. The cause of death was blunt force trauma. **4**-A married couple was found dead by their son-in-law after leaving a suspicious note on his kitchen. The man was hanged and near the woman was a fiber ribbon with a lace. The findings in the 88-year-old female were compatible with ligature strangulation. This was an uncommon case of dyadic death. **5**-A couple was found dead in a car that was retrieved from the river. The 58-year-old female had her wrists tied up with duct tape. The autopsy findings suggested death by drowning, confirmed through histopathology exam of the lungs. In conclusion, cases like those presented, illustrate that forensic pathologists need to be aware of the most common causes of deaths related to IPH, keeping in mind that less common cases should not be out of sight as to avoid errors in establishing the correct manner of death. That can be attained by always making a careful and detailed examination of the traumatic lesions, including morphological features and topographical distribution and also evaluate the need for complementary studies.

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EVALUATION OF SAMPLE COLLECTION TECHNIQUES TO RECOVER DNA FROM BLOODSTAINED CONSTRUCTION MATERIALS

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Recovering DNA from trace-amounts of blood that has been deposited on hard porous materials such as concrete can be problematic. Construction materials are often a composite matrix that contain a numerous ions that can have inhibitory effect on the PCR, making subsequent STR analysis challenging. Moreover, biological samples including blood can be become embedded within the material's porous matrix potentially reducing the amount of DNA recovered. This study evaluated the effectiveness of three collection techniques in their ability to recover DNA from minute volumes of blood that had been deposited on construction materials. Two techniques utilized swabs; the first technique used one swab (half wet, half dry) and the second used two swabs (one wet, one dry) to recover the sample. The third method evaluated tested the ability of FTA elute cards to recover the samples and their components through capillary action. FTA Elute cards contain a chaotropic salt that can lysis cells and keep proteins tightly bound as DNA is eluted from the matrix, making for a simple extraction process (a 30 minute incubation in water at 70°C). In comparison, the QIAamp DNA Investigator extraction protocol (Qiagen) was used to extract the DNA from swab collections. The project has shown that when 5 µL of blood was deposited on hard porous materials there is significant difference ($P<0.05$) between the three extraction techniques. Sample collection using one swab and two swabs yielded an average of 89 and 158 pg/µL genomic DNA respectively. In comparison, FTA Elute cards yielded an average of 665 pg/µL. This study demonstrates the potential of using FTA Elute cards as a collection tool, showing a significant improvement when compared to its traditional collection method counterpart, the swab. FTA Elute cards can provide a reliable, inexpensive and superior alternative to traditional methods, which will benefit the organization assigned to profiling.

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A STUDY ON FEMALE HOMICIDES FROM THREE PROVINCES IN SRI LANKA

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Introduction When death occurs due to violence, there is an immeasurable impact on members of families and communities whose lives are often changed irrevocably by these tragedies. Despite the deep rooted gender perceptions and assumptions in Sri Lankan society towards females, homicide of a female is condemned far greater than a male. Objectives To determine the association between age, socioeconomic, cultural background and etiology as well as the presence of sexual abuse/ rape/ intimate partner violence among the female victims of homicide. Methodology A retrospective descriptive study on alleged female homicides in three provinces, namely, Western, Southern and North Central was conducted using police records and post-mortem reports for a period of three (3) years (2013-2015) by perusing the records following approval from relevant stake holders. Data was obtained according to a pro-forma employing convenient sampling method and analyzed using Statistical Package for Social Sciences 16. Results Out of 99 female homicides studied 12% were less than 20 years olds while 19% were elderly. The majority (63%) were from rural areas. 41 % were house wives while 3% were professionals. The majority (56%) were married while 6% were widowed. The analysis of the time of the homicide revealed that 61% occurred after mid-day. The alleged perpetrator was the husband or ex-lover in 29% while it was a known person in 28%. The most common reason for the death was a family dispute in 21% while extra-marital affair was quoted in 12%. The analysis of the cause of death revealed that 21% was due to head injury, 19% due to neck compression, and 16% -due to sharp force trauma. . Rape and murder was found in 13% while intimate partner violence either by the husband or the co-habitant was recorded in 30%. Head injury and sharp force trauma are commonly associated with intimate partner violence while neck compression is the commonest cause of death in rape and murder. Conclusion Majority of Homicidal deaths of females were due to head injury or neck compression whereas the perpetrator was husband, ex-lover or a known person. The commonest underlying reason for killing of a woman is disputes in the family.

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USING IMOTIONS SOFTWARE TO IDENTIFY A CORRELATION BETWEEN EMOTIONS AND PHYSIOLOGICAL PROCESSES

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Emotional reactions are stimulated when humans are presented with a stimulus, triggering a series of voluntary and involuntary responses. Human emotions can be measured from facial expressions and physiological processes. The iMotions biometric platform is able to detect and analyze the responses of different individuals, which are personalized. Using iMotions allows for the quantification of seven basic emotions: joy, sadness, anger, fear, contempt, surprise, and disgust. Along with facial expressions, participants' galvanic skin response (GSR) and heart rate were measured using the shimmer kit's sensors. GSR refers to the phenomenon wherein the skin temporarily becomes a better conductor of electricity due to elevated sweat gland activity. The iMotions software allows for easy comparison of the emotions and the physiological responses of the participants by simultaneously displaying the facial expressions data along with the GSR and heart rate readings. Using iMotions and the shimmer kit, this project aims to identify a possible correlation between the participants' facial reactions and their physiological responses, namely, their heart rate and skin conductance,

when exposed to different stimuli. In this study, participants were shown videos associated with the seven basic emotions while their facial expressions were recorded and their heart rate/skin conductance data collected. The results of this research project could have several possible forensic applications, such as avoiding wrongful convictions and detecting possible threats. The iMotions software has great potential in forensic biometric analysis of human emotions.

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DIFFICULTIES IN PROVING BY AUTOPSY THE CAUSE OF DEATH BY INSECT ORDER OF HYMENOPTERA STING

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Introduction: Proving through autopsy a bee sting death is difficult. Sometimes we couldn't find the sting that inoculated the venom (the extinction of erythema or of local edema after death, location in hidden areas - holes, cavities, mucosae, folds). Sometimes, the support by unquestionable evidence (macroscopic, microscopic, tanatochemical, biochemical, serological) of an immediate hyper sensibilisation reactions (type I) can be difficult because usually, the issues are nonspecific. The diagnosis of death by bee stings is often one of exclusion, based mainly on historical data and less on the autopsy evidences. Material and method: The authors present a series of cases of Hymenoptera order insect stings (bees, wasps) and identify the elements that can establish the cause of death, showing the medico-legal algorithm of judgment for those cases. Results: We made a review of literature on deaths from bee and wasp stings and the collected data were compared to autopsy data from the case series presented in order to suggest an useful autopsy guide (guidelines on autopsy practice) in cases of death from anaphylaxis (shock or asphyxia). We have shown the steps to be followed and post-mortem laboratory exams to be carried out. Conclusions: Given the non-specificity of autopsy data in cases of death by bee or wasp stings, the proposal of an autopsy guide for supporting the cause of death in such cases is useful and could reduce the risk of error.

Disclosure: All authors have declared no conflicts of interest.

MAXIMIZING EVIDENCE RECOVERY AND MINIMIZING CROSS-CONTAMINATION IN SEXUAL OFFENCE EXAMINATIONS

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Whilst physical evidence is only one type of forensic evidence used in sexual offence investigations, it can be incredibly useful in identifying the perpetrator(s) of the crime. Therefore it is imperative that the quality of any physical evidence collected is beyond reproach in order to maximise the potential for achieving a positive outcome. The equipment used in evidence collection, and the mechanisms by which any samples are recovered should be regularly reviewed in order to ensure that they remain fit for purpose, especially as DNA profiling systems are continually evolving. The aims of this research were twofold. Firstly, to determine the impact that swab type has on the recovery of semen and touch DNA evidence in relation to sexual offences. Secondly, to evaluate the potential for cross-contamination of semen during the examination of female victims. Several different swab types were compared including cotton, nylon flocked, polyester, foam, and the endocervical swab. The efficacy of sample recovery was evaluated using sperm microscopy and DNA profiling using the AmpF/STR NGM SElect (Applied Biosystems) profiling system. A gynaecological model was used to determine the potential for artificial movement of semen during the examination process, specifically when using a speculum. Again, the potential for cross-contamination was evaluated using presumptive and confirmatory testing methods including DNA profiling. The results suggested that cotton swabs, although by far the most common swab material used for evidence recovery, were not the most effective at recovering spermatozoa or DNA evidence. Furthermore, the results indicated that there is the potential for movement of biological evidence during sexual offence examinations when a speculum is used. An alternative to the speculum, a Specimen Capture Device, was developed by the Author in an attempt to overcome this issue and the results of these experiments will be reported in this paper. The findings of this research have led to the development of a set of recommendations that could improve the quality and quantity of evidence recovered during the examination of sexual offence victims.

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INVESTIGATING TOUCH DNA RECOVERY FROM IVORY AS A METHOD TO IDENTIFY POACHERS AND TRAFFICKERS

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Recent successes in recovering fingermarks from ivory with the use of nanopowders has introduced a new method to identifying poachers and traffickers, aiding in the fight against wildlife crime. However, the environment could influence fingermark perseverance and therefore, even if developed, might not be useable. With the advances in DNA technology, DNA can be recovered from the skin cells deposited in a fingermark, producing a profile. The aim of this project is to identify a sequential, well-tested process to locate, extract, amplify and profile touch DNA from ivory. Both the external and internal surface of the ivory was considered because the texture is different and this can impact the perseverance of DNA on the surface and the recovery technique. Furthermore, the factors affecting longevity of the fingermark and DNA present were also considered, for example, sebaceous, endocrine and contaminated marks. During the project, different non-destructive techniques were used to locate the fingermark, followed by experimentation with the recovery and extraction of DNA using different methodologies such as silica columns and magnetic beads. The results are preliminary yet indicate positive outcomes, and are part of an ongoing body of work, adding to the portfolio of interdisciplinary work conducted at the University of Portsmouth. The Institute of Criminal Justice Studies works with the Faculty of Law and other partner agencies to collaborate our range of skills and build a more effective approach in tackling wildlife crime. This research highlights and maximises opportunities for trace evidence recovery, leading to an increase in knowledge about crimes relating to the illegal ivory trade. Touch DNA recovery within wildlife crime is a new but potentially valuable area of study that is worth further research. Recovering DNA successfully will impact on wildlife crime and the results will assist in investigations and identifying poachers and traffickers of ivory.

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EVALUATION OF INCEST CASES IN THE CHILD PROTECTION UNIT AT MARMARA UNIVERSITY HOSPITAL

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Introduction: Incest, which is the severest form of child sexual abuse, is defined as the sexual behaviors between close relatives whose marriage is illegal or describes inappropriate sexual behaviors within a family relation framework. Understanding cultural dynamics about this phenomenon will improve intervention strategies. In this study, detailed analysis of the incest cases in the Hospital-Based Child Protection Unit will be presented. **Method:** This is a retrospective study in which case reports between 2012 and 2015 were examined. Researchers investigated 80 cases

and classified the information that they include under these headings: demographic information about assaulter and victim (ages, relationship, occupation etc.), detailed information about the content of the cases (type, duration, how to emerge, attitudes of the other parent etc., mental health of the victim and physical evaluation. **Findings:** Victims were mostly females (83.75% of the) and the age range of all victims were 2-17 years old. In 28.75% of the cases, the assailants were the fathers and the second most cited assailants were cousins (21.25%). The most frequently reported types of abuse were non-consensual sexual contact (42.5%) and it was followed by anal assault (26.25%), and complete vaginal penetration (17.5%). **Discussion and Conclusion:** Although many prevention programs and scientific literature indicate that professionals and families should believe in children if they reveal sexual abuse, family members generally do not follow this suggestion. Further research may target to understand the dynamics that prevent family members from accepting the abuse. Besides, legal process is still too long to help the victim at the right time. Incest related dynamics, especially the ones which are related to familial management of the trauma changes in the course of time and it is important to realize these changes to organize intervention at child protection centers. Also, at each stage of the fight against incest, experts from different professions and different responsibility are required to be informed about incest related dynamics to work together effectively.

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THE EFFECTIVENESS OF DIFFERENT TAPING METHODS FOR FIBRES RETRIEVAL FOR ISO17020 ACCREDITATION

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Tape lifting for fibres at scenes of crime is common practice, particularly in major crimes. However, the particular effectiveness of certain tapes and the possible methods that may be employed to tape surfaces are not widely understood and, for many police forces, have not been validated. With the current push to validate all activities being performed at crime scenes for ISO17020 accreditation by 2020 in the UK, it is important that the tape lifting of particulates, particularly fibres, is part of the validation process. This paper will describe the initial validation studies conducted with West Mercia & Warwickshire police in the UK for the use of J-Lar and Crystal Tab tapes at crime scenes for retrieving fibres evidence. This validation study investigated the effectiveness of fibre retrieval upon a range of commonly occurring surface types using two tape types using zonal and 1 to 1 tape lifting techniques. The effect of temperature upon the retrieval rate of deposited fibres was also investigated to ascertain the potential limitations of using tape that had been stored/exposed to a range of temperatures (-5°C, room temperature and 35°C). This paper will report the recommendations made for the use of tape for fibre retrieval upon different surfaces in terms of tape type and method and outline any caveats or limitations of using such approaches in crime scenes. The process of validating retrieval methods at crime scenes in line with the UK Forensic Regulator's Codes of Practice and Conduct will also be discussed providing an insight into validation design and implementation.

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HOMICIDAL VIOLENCE AGAINST CHILDREN IN MISSISSIPPI: FOUR CASE REPORTS

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Attendees will understand the variation observed in homicidal cases as it pertains to violent crimes against children in the state of Mississippi. This presentation will impact the forensic science community by discussing four cases of homicide in which the violence was perpetrated against children aged 5 to 13 years. Case 1: The partially clothed body of a 5 year old female was found in an unoccupied mobile home by search teams the day after her abduction from her apartment complex. The post-mortem examination revealed evidence of blunt trauma to the face and extremities and penetrating peri-genital injuries indicative of sexual battery. Dependent lividity and regionalized petechiae were consistent with asphyxia due to ligature strangulation(hanging). A male resident/visitor at the complex was convicted for the crime. Case 2: A 7 year old black male and his mother were reported missing in late 2013. Their overturned and burning car was discovered, their bodies and that of the child's stepfather were found inside an abandoned house. The juvenile's cause of death was identified as a single shotgun wound of the right forearm into the back with injury to the upper extremity and thoracic region. Authorities believe that the stepfather was killed first, and the child and his mother were subsequently taken to the house and shot. The perpetrator was convicted on two counts of capital murder. Case 3: The decedent is an 11 year old male who was found unresponsive in the bathroom of his father and step-mother, and subsequently declared dead at the scene. Pertinent findings at autopsy were emaciation with blunt force injuries of the head, neck, torso and extremities of sufficient severity to cause death. Body weight and organ weights were abnormally low, and subcutaneous adipose tissue and mesenteric fat were scant. The stepmother received a life sentence for second degree murder; the boy's father was sentenced to 40 years in prison. Case 4: This 13 year old female and her mother were victims in a domestic murder-suicide carried out by the mother's live-in boyfriend. All three bodies were found at the residence by authorities after efforts to contact them had failed. The child died as a result of a close range perforating gunshot wound to the hands and forehead.

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VIOLENCE AGAINST VULNERABLE PERSONS: THE DEATH OF A TRANS-GENDERED INDIVIDUAL IN MISSISSIPPI

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After attending this presentation, attendees will understand the variation observed in homicide cases as it pertains to violent acts committed against vulnerable individuals in the state of Mississippi. This presentation will impact the forensic science community by discussing a case of homicide in which the violence was perpetrated by a 20 year-old male against a transgendered individual. In 2016, the body of a 28 year-old pre-operative male to female transgendered individual was found dead in a hotel room located on the Mississippi Gulf Coast. It was learned that the decedent had traveled to the area with friends and planned to attend a sporting event. External examination observation revealed female undergarments and accoutrements, and the presence of male genitalia; the testicles were descended into the scrotum, and appeared atrophic. Upon post-mortem examination, multiple sharp force injuries were identified. Approximately 190 individual stab and incised wounds were noted in the head, face and neck, axillary region, torso, chest and shoulders, back, and an extremity. Injury of the left lung, the right external jugular vein, the right subclavian vein, the larynx, and the left axillary vein were identified. There was also multifocal subarachnoid hemorrhage. Abrasions were noted on the face, neck, and chest. Defense-type injuries were present on the left hand and left upper extremity. Images released from the decedent's hotel's surveillance cameras led to the arrest of a suspect who has been charged with capital murder and robbery. Investigators believe the decedent had prior contact with the suspect before her death, and may have arranged to meet with the individual instead of attending the event with her friends. At the time of this writing, the suspect is currently awaiting trial.

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ESTIMATING AGE FROM DENTAL ERUPTION BASED ON ITALIAN SCHOOL CHILDREN: PERCENT TO PROBABILITY

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Dental eruption as an indicator of age in forensics/bioarchaeology is generally eshewed in favour of dental calcification since a greater number of progressive stages by indicator may be characterized. Notwithstanding, eruption data explicitly describe a transition event, which is to say, from a tooth being unerupted to erupted however these stages may be defined by a particular study. While longitudinal data are always preferable although tending to smaller sample sizes, simultaneous, cross-sectional data are able to describe these trends in a large and representative population sample. The approximately regular sequence of dental eruption may additionally provide constraits on error in estimation. *Adorni Bracesi and Noferi* (1964) examined a total of 5133 children in collapsed age groups between 6 and 12 years from nine elementary schools in the province of Florence. *Mela and Chantel* (1965) studied 3640 children, similarly grouped, from the Lanza and Susa valleys in the province of Torino. The authors of both reports followed compatible methodologies in enumerating the positions of erupted teeth in each quadrant. Here, the potential of eruption data are explored utilizing diverse models from traditional frequentist to more advanced methods (such as probit analysis) with a view to individual age estimation. Results strongly indicate the viability of eruption data for application in a medico-legal context with errors comparable to other commonly used methods.

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PSYCHOLOGICAL ASSESSMENT FOR ASYLUM SEEKERS IN FRANCE

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Asylum seekers in France must file a file at the OFPRA (French Office for the Protection of Refugees and Stateless Persons). There is no medical certificate necessary to constitute this file, but the medical certificate can be considered as a complementary element. Asylum seekers have often suffered physical trauma, but in almost all cases there is an impact on their mental health. We were interested in the possibility for asylum seekers to obtain a medical certificate in the different forensic services of France and if a psychological evaluation was proposed to them. After interviewing the different forensic services, we reviewed the literature on the psychological assessment of asylum seekers. In France, consultations for asylum seekers are not available in all forensic departments, and psychological assessment is never proposed. Psychological care can sometimes be proposed. Some asylum seekers are going to see doctors other than forensic pathologists and the certificates issued do not always correspond to a correct model of assessment. It seems to us that psychological repercussions are a major factor to be taken into account for an asylum seeker. If the medical certificate is not required to constitute the asylum application file, it is desirable that a psychological assessment be carried out by persons trained in forensic evaluation to standardize practices and improve care. Psychological evaluations are also the opportunity to begin the therapeutic process.

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MICROGLIAL STATUS IN HUMAN METHAMPHETAMINE USERS: PRELIMINARY FINDINGS IN A BRAIN IMAGING STUDY

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Background and Aim: Experimental animal data show that the widely used stimulant drug methamphetamine can damage brain neurones and also cause accompanying activation of microglial cells --- a common hallmark of neurotoxicity. However, it is still uncertain whether methamphetamine causes brain damage or gliosis in human users of the drug. Our **aim** was to establish by brain imaging (positron emission tomography; PET) whether microglial activation occurs in methamphetamine users during early abstinence by using a radiolabeled probe (^{18}F]FEPPA) that binds to the translocator protein (TSPO), a biomarker of microglial activation. **Methods:** Brain TSPO binding (V_T; [^{18}F] FEPPA with arterial sampling) was measured in 5 methamphetamine users (32 years, 2 females) and 11 healthy controls (30 years, 6 females). Saliva samples were collected to genotype a TSPO polymorphism (rs6971) which is linked to high (HAB) and mixed affinity binding (MAB) of [^{18}F] FEPPA. A magnetic resonance image was acquired for delineation of 10 regions of interest on the PET images. A statistical RM-ANCOVA controlling for genotype was conducted. **Results:** Scalp hair and urine toxicology confirmed use of methamphetamine in the drug users. Groups were matched with respect to age, sex and TSPO genotype. We found no main effect of group on FEPPA V_T ($p=0.21$) but a significant interaction ($p = 0.01$) suggesting that the hippocampus and amygdala might be associated with *lower* FEPPA V_T (22% and 17% respectively, NS, Cohen's d: 0.6 and 0.7). **Conclusion.** Our preliminary data provide no support for the notion, suggested by experimental animal findings that brain microglial activation is a feature of methamphetamine use in the human. In fact, the observation of a trend for lower TSPO binding in hippocampus and amygdala might suggest some region-dependent loss of microglia in the stimulant users. Possibly, brain microglial activation occurred early in the early stage of drug use whereas tolerance to glial activation could be a feature of the chronic condition. Alternatively, the extent of methamphetamine exposure in the subjects of our study might not have been sufficient to cause a neurotoxic response that would induce microglial activation, as is the case in experimental animal models. We emphasize that the sample size in our preliminary, ongoing study is small and that our conclusions may well be revised following recruitment of additional subjects (Supported by U.S. NIH DA 040066).

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ETHICAL AND LEGAL CONSIDERATIONS ABOUT THE AGE OF CONSENT TO MEDICAL INTERVENTION IN TURKEY

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In Turkey, different views emerge when interpreting the legislative regulations on the age of consent to medical intervention. Some suggest that, besides the capacity to understand and decide, being 18 years of age or older is required as a condition for a person to give consent to medical intervention as an individual. Others approach the issue differently by suggesting that the competence of the person to decide on medical intervention should be considered rather than a precise age limit. The first view is based on the Law on the Practice of Medicine and Related Arts issued in 1928 and the Regulation on Patient Rights issued in 1998. These legislations stipulate for the permission of the legal representative for medical interventions on minors. According to this view, there would be no distinction between a 8-year-old and a 16-year-old child in the matter of consent to medical intervention. The second view is based on the Turkish Civil Code. According to this view, deciding upon bodily integrity is considered as an individual right. Therefore, it is argued that a person with decision-making capacity can give consent to medical intervention alone, even under the age of 18. Discussion Determination of the existence of decision-making capacity would vary by several factors including the nature and the content of the medical intervention, and the development

and the education of the child. Therefore, it is difficult to specify the limit of the age to decide upon medical intervention by oneself. Waiting for people to turn 18 on the subject of medical interventions means ignoring the biological and mental development of humans. This would entail ethical and legal discussions about the right to make a decision upon bodily integrity and health. In this context, health care providers/institutions encounter both ethical and legal challenges. Furthermore, in the case of a requirement for the permission of the legal representative despite the capacity of a person to decide upon medical intervention, this person's right to health would be violated. Our oral presentation will address those discussions in Turkey, within the context of the Convention on the Rights of the Child and international documents on the right to health.

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HOMICIDAL VIOLENCE AGAINST WOMEN IN MISSISSIPPI

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After attending this presentation, attendees will understand the variation observed in homicide cases as it pertains to violent crimes against women in the state of Mississippi. This presentation will impact the forensic science community by discussing four cases of homicide (two double homicides) in which the violence against women was perpetrated by males. While the victims in each double homicide were killed by the same individual, the case specifics exhibit marked differences that are representative of the variability seen in the homicides processed by the State Medical Examiner's Office. Case 1 and 2: Two females, aged 68, were Catholic nuns and nurse practitioners who worked at a rural Mississippi medical clinic. The bodies of the women were found at their residence after they failed to report for work one morning. Both decedents showed evidence of sharp force injuries and sexual assault. Decedent 1 sustained multiple blunt force trauma to the face, head, neck, and extremities, with multifocal areas of subgaleal hemorrhage, and subdural and subarachnoid hemorrhage. Evidence consistent with strangulation was also observed. Sharp force injuries were present on the face, head, torso, extremities and hands. Post-mortem examination of Decedent 2 yielded stab wounds to the chest, neck and left leg, with significant injuries to the heart, right lung, and liver. Case 3 and 4: Decedent #3, age 69, provided cleaning services to her local church. She went there to clean the church, but did not return home. She was found dead inside the church after her husband went to the church to check on her. Autopsy findings indicated the presence of multiple gunshot wounds resulting in injuries of the lungs, heart, aorta, the pulmonary trunk and the esophagus. The day following discovery of Decedent #3, the body of Decedent #4, a 30 year old nurse, was found inside her home (located approximately 67 miles from the church) after the sheriff's department performed a welfare check. Evidence of blunt force injury (e.g., abrasions and contusions on head/neck and head/chest) and strangulation (i.e., petechial and other hemorrhage) were observed at autopsy. Respective investigations concluded that the same individual was believed to be responsible for both deaths as well a non-fatal shooting which occurred in the same neighborhood as the second homicide and multiple shootings in two other states. Although two individuals are in custody for the above crimes, at the time of this submission all cases have yet to be adjudicated.

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ALKALINE HYDROLYSIS IN FORENSIC ANTHROPOLOGY

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Skeletal preparation is an important step in forensic anthropology as it allows analysis of fine surface details present on bones and construction of a biological profile. Multiple techniques exist to prepare skeletal remains, but methods vary considerably and there is a lack of standardized protocol in the literature. Commonly used are maceration techniques which consist of depositing skeletal remains in a water solution, with or without chemical agents, and may require several days to several weeks to clean the remains. An alternative technique for body maceration, alkaline hydrolysis, is being used in some funeral homes as a replacement to traditional cremation. This technique consists of depositing the body in a solution of water and alkali. Under funeral services conditions, alkaline hydrolysis processes a fully fleshed body in less than twelve hours. However, the resulting bones are dry and brittle in order to be ground into "ashes" and handed over to the family. The purpose of this study was to evaluate the potential application of alkaline hydrolysis as a maceration method in a forensic context. If the alkaline hydrolysis process can be modified to clean human remains within a few hours without damaging the bones and fine surface details, this will allow forensic anthropologists to start the skeletal analysis sooner and better support the death investigation. In this experiment, macerations were performed on proximal and distal ends of pig femora, previously cut using a circular saw, a reciprocated saw or a band saw. The alkaline hydrolysis method was optimized by comparing sodium hydroxide to a combination of sodium and potassium hydroxides, at different concentrations, using three samples per method per concentration. Sodium hydroxide at 0.50% provided the best results, and was subsequently compared systematically with four alternate maceration techniques involving the soaking of samples in solutions of: 17.5% hydrogen peroxide, 10% alconox, 1.2% biotex, or warm water (control group). Five trials were performed per method, by alternating samples of proximal and distal ends. Preliminary results indicate that alkaline hydrolysis is faster than other methods used, albeit more damaging to the bone.

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A RISK BASED APPROACH TO MEASUREMENT UNCERTAINTY & DATA INTEGRITY IN FORENSIC DRUG ANALYSIS

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Weighing is a key step in qualitative and quantitative drug analysis and strongly influences the integrity of the final result. The standout prerequisite for traceable and accurate weighing is the effective calibration of weighing instruments, which also comprises the estimation of measurement uncertainty. Historically, many laboratories set their own calibration procedures due to the lack of nationally or globally recognized calibration guidelines. Based on international cooperation from subject matter experts in the field of metrology, efforts were made to globally harmonize the methodology to calibrate weighing instruments. The major benefit is the ability to estimate measurement uncertainty at the time the instrument is calibrated and also provide guidance to estimate uncertainty during day-to-day usage. This resulted in the calculation of the minimum weight becoming a key parameter for quantitative drug analysis. The minimum weight is the smallest amount of net substance that needs to be weighed in order to achieve a specified degree of accuracy. It ensures the overall analysis is not negatively impacted by an insufficient sample weight. To help meet requirements set forth by regulatory organizations it is also important to understand the benefits of incorporating the weighing process with an integrated data management system. In recent years an increasing number of assessments and internal audits have revealed incomplete data, lack of audit trails, and falsification of results. While most labs have turned toward LIMS systems with the idea of replacing the manual workflow, these systems are designed primarily to aggregate result data from an array of analytical tests - not automate and document bench top workflows or provide traceability to the measurement. Regulatory organizations have recognized the advantages of electronic data systems and have increasingly established further controls for the use of such systems all the way down to bench top instruments. The goal of reducing errors, simplifying processes, and reinforcing compliance can become challenging when directly integrating and automating bench top instruments. As regulators continue to tighten auditing approaches, it is

critical for forensic scientists to understand the key issues surrounding data integrity. This presentation will provide an overview on the harmonization of calibration procedures and the resulting concept of incorporating a minimum weight with measurement uncertainty. It will discuss the criteria for data integrity based on recent guidance issued by various regulatory agencies. It will provide practical solutions to improve data management processes and address many data integrity weaknesses typically found in Forensic laboratories.

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BURN-OUT AND PSYCHO-TRAUMA AMONGST STAFF IN A FORENSIC PSYCHIATRY INPATIENT PROGRAM: A PILOT STUDY

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For many years, attention has been given to the emotional distress of the professionals working in the health system. The burden carried by healthcare providers can lead to emotional and physical injuries. This burden is often due to the massive amount of work they have to accomplish and to being confronted by the suffering and death of patients. Specific to psychiatry, the burden seems to also be related to exposure to violence by some of the patients and resulting emotional trauma. Forensic psychiatry is a field where burn-out and psycho-trauma can easily occur. Indeed, this subspecialty exposes staff to patients who have committed criminal offences, who may suffer from severe personality disorder, and who may be treated against their will. The behaviour of these patients can be significantly violent due to their impulsivity, lack of insight and refusal to comply with the forensic/legal system. We conducted a study amongst nurses and allied staff working in a forensic psychiatry inpatient unit. We assessed their emotional distress using two scales: one related to burn-out (Maslach Burout Inventory) and one related to Posttraumatic Stress Disorder, in order to quantify the amount of distress these staff members have experienced. We also assessed their personality traits (Big Five Inventory), in order to identify a potential correlation between emotional distress and personality facets. This would allow the allocation of extra support for the staff/team members who present with more vulnerability to burn-out and psycho-trauma due to their personality traits.

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ELECTROPHYSIOLOGICAL RESPONSE OF PHORMIA REGINA TO CADAVERIC PIG VOLATILE ORGANIC COMPOUNDS

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During the process of decomposition, volatile organic compounds (VOCs) evolve from carcasses and are generally characteristic of the stage of decomposition. This has further implications entomologically as insects such as blow flies (Diptera: Calliphoridae) are reliant on these chemical signals to determine the suitability of the carcass as host or potential food source. Blow flies are typically the first family of Dipteran flies to colonize a carcass soon after death. Hence, the role of blow flies as primary colonizers has been exploited for the purposes of forensic investigations to help determine the period of time between colonisation of a corpse and its discovery, known as the minimum post-mortem interval (PMImin). Previous studies on the olfactory response of the black blow fly, *Phormia regina* (Robineau-Desvoidy), used known chemical attractants such as Swormlure to attempt to define it as a possible attractant for this species. However, the aim of this study was to identify specific VOCs from cadaveric pigs that cause an electrophysiological response, and consequently a behavioural response, in *Phormia regina* through analysis by GC-MS coupled electroantennography (EAG). VOCs were collected from two adult pig (*sus scrofa*) carcasses during the early stages of decomposition: fresh, bloat and active decay. The VOCs were introduced to female virgin *P. regina* fly preparations. The electrophysiologically-active compounds were determined by analyzing the resulting electroanntenogram for depolarizations and matching these depolarizations with the corresponding GC-MS chromatogram/mass spectrum. Three EAG-active compounds, toluene, bromobenzene and 3-hexen-2-one, were isolated from the fresh stage of decay. While polysulphides, dimethyl disulphide (DMDS) and dimethyl trisulphide (DMTS), were isolated from the bloat stage. Toluene, 3-hexen-2-one, and phenol were isolated from the active decay stage. Knowing the compounds that cause physiological responses in these flies early in decomposition is a useful investigative tool for determining a more precise minimum post-mortem interval.

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TWO CASES OF HOMICIDE IN MISSISSIPPI: A MATTER OF BEING IN THE WRONG PLACE AT THE WRONG TIME?

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After attending this presentation, attendees will understand the variation observed in random and non-random homicidal cases as it pertains to violent crimes against women in the state of Mississippi. This presentation will impact the forensic science community by discussing two cases of homicide in which the violence against women was perpetrated randomly and non-randomly. Case 1: The decedent, aged 57, and her 70 year-old husband were discovered beaten to death one morning in their home. A relative found their bodies in two different rooms within the house; both individuals were dressed in bedclothes. While the male spouse exhibited evidence of trauma similar to that documented in his wife, the female was found with various implements inserted into the chest and orifices. Pertinent findings at the female decedent's autopsy were blunt force injuries including lacerations and abrasions of the skin and vagina, and contusions and hemorrhages of the brain. A sharp force injury to the chest caused soft tissue and bone injuries; no penetration into the pleural cavities was evident. A 26 year-old male acquaintance of the couple was arrested in connection with the crime and was charged with two counts of capital murder; he is awaiting trial. Case 2: Visitors at an abandoned hospital noticed from a window what appeared to be an unusual object in the bushes outside the building. Upon closer examination, the object was determined to be the partially clothed body of the 69 year old female decedent. Post-mortem examination findings included evidence of early decomposition, the identification of a perforating gunshot wound to the head, and evidence of blunt force injury to the head, torso, and extremities. Physical evidence suggestive of sexual battery was noted in the blunt force injury sustained to the decedent's vaginal, pelvic, and anal regions. Some hours following the decedent's death but before discovery of the body, police stopped a vehicle for a traffic violation. The driver and passenger were subsequently arrested after authorities found a stolen firearm inside the car. The driver later admitted to killing the decedent in her home after briefly stalking her, and then moving her body to the hospital grounds. The suspect was charged with multiple felony counts, but escaped from jail before he could be tried. He was shot and killed during a home invasion he perpetrated following his escape.

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RAPID DNA TECHNOLOGY FOR GENERATING 27-LOCI STR PROFILES FROM INVESTIGATIVE SAMPLES

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The most powerful and reliable tool available today in human identification is STR profiling. ANDE has previously developed a first generation fully automated rapid DNA analysis system that produces STR profiles from

buccal samples for human identification in approximately 90 minutes with no manual processing steps or manipulations using a 4-dye and 16-loci, PowerPlex16 chemistry (Promega). Comprehensive validation testing by external laboratories was conducted and the system received NDIS approval for use on reference buccal samples. To accommodate the expanded set of CODIS core 20 loci, this system has now been enhanced by incorporating the ability to detect up to 6 dyes. This capability allows the system to use 27-locus FlexPlex chemistry that contains the CODIS core 20 loci along with UK, Interpol, European Standard, German and Australian core loci, and D6S1043, an important STR marker broadly used in China. The ANDE system with FlexPlex processes chips designed for both buccal samples and a wide range of sample types typically encountered at crime scenes, such as bloodstains, chewing gum, and touched items. Additionally, samples from sexual assaults, including neat semen and vaginal swabs subjected to preprocessing steps yield full profiles. In this presentation, the incorporation of 6-dye detection and the development of a highly efficient microfluidic DNA purification module in a rapid DNA system will be presented. The processing of a variety of investigative sample types will be discussed with resultant data being show to demonstrate the dynamic range functionality of the system with the FlexPlex chemistry. Methods to optimize sample success and minimize contamination will be discussed. Rapid DNA has the potential to dramatically improve societal safety by revolutionizing the speed and manner in which STR profiles are generated and searched to match criminal suspects with evidence samples, exonerate the innocent, and provide evidence in judicial proceedings.

Disclosure: All authors have declared no conflicts of interest.

FATAL ANGLE GRINDER - A CASE STUDY

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Introduction: An angle grinder is a portable power tool activated by an electric motor, using a high-speed rotation disc (from 6000 to 15000 rpm), which cuts, thins out, polishes and sands, especially in masonry and metallurgy. Studies have shown that the angle grinder is one of the most dangerous power tools and there has been an increased number of accidents caused by the use of this device. Most of these cases are due to the penetration of the high-speed disc after it's shattering from the main apparatus. There have been numerous traumatic lesions as a result of the use of this tool, with the most commonly affected anatomical segments being the head and face, potentially with fatal implications. **Case:** 65-year-old male victim, at home, when an angle grinder injured him after the shattering of its disc. He was found while still alive and was taken to the hospital. He died a few hours later diagnosed as hypovolemic shock due to the lesions to his head and face. The autopsy revealed a laceration of 10 centimeters in length, located on the left side of the face causing destruction of the ocular globe and the adjacent bone structure, resulting in left frontal lobe lesions. **Discussion/Conclusion:** Precision grinders are commonly utilized tools in professional, safe environments, but there has been a higher prevalence of fatal lesions amongst hobbyists, mostly due to misuse. In this particular case, the cause of death was hypovolemic shock due to facial and brain lesions by way of the shattering of the angle grinder disc, which hit the victim by accident.

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CASE STUDY: A MULTIDISCIPLINARY APPROACH IN BELGIUM

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Over the years the possibilities in the field of forensic science have grown exponentially. More and more analyses are now possible and smaller particles have become useful for further examination. Different forensic disciplines may be involved with a single piece of evidence. This impacts the way evidence should be examined. The priority and sequence in which items should be examined can be quite complex, especially in murder cases. A "chain examination" of the evidence as in one discipline after another, could in some cases be dangerous. One expert might not think of the consequences of his actions and traces might be lost forever. A multidisciplinary approach might be the only way to lower the risk of missing important evidence. Gathering all the experts around one table to investigate one single piece of evidence has become a new standard. and even though it is a very time-consuming process, examinations have never been so effective. Even though it might be the best approach, there are some challenges that need to be dealt with. Good communication between the experts is essential and choices have to be made. Which experts have to be gathered around the table? Will everybody be able to examine the parts of the piece they want? In what order can the traces be collected? In Belgium several cases have been handled in a multidisciplinary manner. During the presentation several of these cases will be discussed.

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'HIDE AND SEEK' FINGERMARK DEVELOPMENT ON LEATHER: VISUALISATION AND SPECIES DIFFERENTIATION

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The identification of individuals can be established via the uniqueness of fingermarks. While crime scene fingermarks can be plastic, patent or latent, the predominance of the last of these means that development methodologies for their visualisation are critical. Quite generally, selection amongst the numerous processes available is dependent upon target surface characteristics, such as porosity and colour, and environmental exposure conditions. Despite the availability of a number of techniques and reagents, some surfaces remain "problematical". A prominent example is leather, which is widely encountered in casework associated with violent crime (weapon sheaths, holsters, restraints), wildlife investigations (skins, hides) and acquisitive crime (wallets, clothing). Accordingly, the overall aim of the present study is latent fingermark visualisation on leather surfaces. Sub-categories of leather exist relating to source (fish, mammalian, reptile), authenticity (genuine or faux), physical surface properties (embossed, textured, smooth) and chemical finishes (dyes, waterproofing, patent, pearlised). It therefore seems appropriate that "leather" be considered as a diverse family of surfaces, for which different reagents may be optimum for fingermark development. Here we report investigations into such variations using two well-established application methods (powdering and cyanoacrylate fuming) associated with two novel reagents (PolycyanoUV and FPNatural1), whose observation is associated with opposite ends of the electromagnetic spectrum (UV and IR, respectively) and different modes of interaction (excitation and emission). Practically, the attraction of PolycyanoUV is its "one-step" application and of FPNatural1 is its potential for eradicating background interference. This presentation explores latent fingermark visualisation on diverse leather samples exposed to differing environmental conditions for varying time periods, in conjunction with reagent delivery mode and sequential treatment processing. These observations are supported by substrate microscopy in cross section and optical profiling in 2D and 3D, which reveal substantial variations in histological structure for bovine, caprine, cervine, ovine and porcine leathers. Further interesting insights include the distinction of leather from young and aged animals of the same species. The influence of these morphological differences on reagent efficacy will be discussed. Additionally, details will be included of a novel application method for FPNatural1. These fundamental insights ultimately lead to enhanced success rates for visualisation of latent fingermarks on leather surfaces. These offer the prospect of outcomes that could assist in the investigation of many offence types and provide valuable forensic evidence on previously unusable substrates. Furthermore, the practitioner recommendations will significantly impact international Criminal Justice Systems.

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TWO YEARS ASSAY OF LEGAL ABORTION IN SOUTH OF IRAN; CAUSES AND METHODS OF DETECTION

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Information on abortion levels can inform research and health policies. The rate of legal abortion and its causes vary widely across the countries in which legal abortion is generally available. However, legal abortion south of Iran has not been assessed recently. In Iran, forensic medicine administrations are legal references for determination and justification of legal abortion. Here, we aim to present most common causes and methods of detection for legal abortion in south of Iran for two years. In this study, totally, 980 cases were approved and justified to do legal abortion; 519 cases in 2015 and 461 cases in 2016. The mean age of fetuses was 16.42 ±1.917 weeks with the minimum and maximum of 11 and 19 weeks respectively (Mode=18 W.). The youngest and the oldest mothers were 16 and 47 years old respectively. Mean age of mothers was 29.56± 6.346 years. The most frequent causes for legal abortion were thalassemia major in 163 (10.25%) cases, down syndrome in 144(9%), hydrops fetalis in 109(6.85%), hydrocephalus in 89 (5.6%), hygroma cyst in 63(4%), anencephaly in 62(3.9%), severe oligohydramnios in 39(2.45%), omphalocele in 33(2.07%), poly cystic kidney in 33(2.07%), anhydramnios in 32(2.01%), lemon shape cerebellum in 28(1.76%) and cerebellar hypoplasia in 23 (1.45%) of the cases. Other less frequent disorders of fetus and mother were bilateral agenesis of kidneys, sever hydronephrosis, sickle cell anemia, herniation of visceral organs, anencephaly of one of twines, Edward syndrome and, Dandy–Walker syndrome. Several methods were used for screening of mentioned disease. The most widely used method for detection of hereditary defect in fetuses were ultrasonography in 602 (61.4 %) cases, genetic and molecular investigations in 209 (21.3%) cases, different approved rapid tests in 116 (11.8%), karyotyping in 57(5.8%), Eco-cardiography in 48 (4.9%) cases, QF-PCR in 8(0.1%) of the cases and, MRI in 1 case. Screening the mother and health fetus for a healthy parturition leads to have a better and healthy society and also lower costs troubles on families and government.

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HEMOGLOBIN A1C LEVEL AS POINT-OF-CARE TESTING IN POST-MORTEM DIAGNOSIS

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Glycated hemoglobin (HbA1c) is a good marker for monitoring glycemic control, and an elevated post-mortem blood HbA1c concentration might indicate long-term poor glycemic control. HbA1c level can be also tested as a point-of-care test. In forensic medicine, point-of-care testing is important for both autopsy and post-mortem inspection. This study evaluated HbA1c values in capillary blood and cardiac blood of post-mortem blood specimens as well as the usefulness of evaluating HbA1c levels as point-of-care testing in post-mortem examination. During autopsy, capillary blood was obtained from the fingertip or ear lobe, and cardiac blood was obtained from the inferior vena cava. We compared HbA1c values between post-mortem capillary and cardiac blood. There was a strong correlation between HbA1c values from post-mortem capillary blood and cardiac blood. There was also a strong correlation between HbA1c values of cardiac blood measured using the portable SD A1cCare and those measured using the Cobas Integra 800. Furthermore, as a point-of-care test, HbA1c testing showed stable values in cardiac blood after storage in a refrigerator for 4 weeks. The authors conclude that point-of-care testing for HbA1c can be a useful indicator at both post-mortem inspection and autopsy.

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DELAYED DEATH DUE TO AORTIC RUPTURE AFTER CHEST BLUNT TRAUMA: AN AUTOPSY REPORT

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A delayed death due to an aortic laceration after blunt chest trauma is rarely reported. Here we report a case of a delayed death due to an aortic laceration after a blunt chest trauma with the patient's clinical information and full autopsy findings. A 49-year-old man arrived at the emergency room after falling from a height of approximately 4 m. Multiple left rib fractures with a hemopneumothorax on his left side were found. After 13 hours from his admission, he complained of chest discomfort with the sudden development of massive blood drainage through his chest tube. A cardiopulmonary resuscitation was performed, where the patient then died and an autopsy was performed 36 hours after his death. On internal examination, a small laceration of the descending aorta with irritation of the tunica adventitia was revealed. Given the findings of an additional histologic examination and the aforementioned findings, we thought that the fractured fragments of the posterior ribs had irritated the tunica adventitia of the adjacent descending aorta for some time after the chest trauma and that a perforation had finally occurred.

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MENTAL HEALTH MISCARRIAGES OF JUSTICE: CRIMINALIZING SICKNESS IN THE 21st CENTURY

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Often times, crime and mental health intersect, and countless crimes are committed while individuals are in a state of mental distress. In addition, with the changing budgets for US states and the federal government, funding for mental health has seen a drastic decrease. This has caused many individuals to be left without treatment for their mental illnesses. These lapses typically occur at particularly vulnerable points in these individuals' lives. Without treatment, their symptoms will persist and most likely worsen, which will in turn result in more crime. The lack of facilities and resources for those suffering from mental illness will result in incarceration rather than medical treatment. Therefore, individuals will be forced into the justice system that is not particularly well-suited to adequately (or even appropriately) treat these individuals at every point of criminal justice supervision. It is imperative that those working in the justice system be educated about mental illness. This presentation delves in two years of research from a partnership of a licensed mental health practitioner and an applied criminologist that explores, in part, how to arm justice practitioners with an understanding of mental health, stigma, and crises. It will leave attendees with an understanding of what every stakeholder involved in the justice process should know or need to know to do their part to turn the tide on punishing those who are ill instead of attending to the root cause of their illness.

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IS AMITRIPTYLINE AN ANTIDEPRESSANT CAUSING SUICIDE?

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The Amitriptyline is a tricyclic antidepressant medicine, displayed in tablet form of white color. Like antidepressant, it almost inhibits the capture of serotonin and Norepinephrine the same proportion. It is used to treat an ample number of mental upheavals. These include greater depressive upheaval, being the tricyclic antidepressant more widely used and than it has at least equal effectiveness against the depression that the new

selective inhibitors of the capture of the adrenalin and the serotonin, anxiety upheavals (like the upheaval of panic and phobias). It has been found the Amitriptyline in serious poisonings and deaths. The cases consist of users of the Amitriptyline that after consuming several tablets of the medicine underwent depression of the central nervous system and then the death. The samples received from the autopsy were analyzed by liquid chromatography with spectrometry of masses in tandem (LC-ESI-MS/MS). The toxicological findings for the biological fluids were the following ones: in urine were detected Amitriptyline and its metabolites Nortriptyline. In peripheral blood was quantified the Amitriptyline and its metabolites. Although the Amitriptyline is used for upheavals of the depression, it has been used to commit suicide. Thus it is important to revalue its metering or relation damage-benefit of being used as nontherapeutic suicidal aims . The socialization of new toxicological findings is essential not only in the improvement of the knowledge but also in the sensibilización between the forensic community with respect to the tendencies of consumption associated to poisoning with Amitriptyline in Colombia.

Disclosure: All authors have declared no conflicts of interest.

BETTER BODY BAGS: INNOVATION IN THE DESIGN FOR BETTER ADAPTABILITY TO DIFFERING FORENSIC CONTEXTS

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The importance of the body bag in forensic settings is found in securing the identity of victims of natural disasters and war. Since its inception, the standard black body bag has been subject to minor modifications and sofar has only a limited adaptability to forensic contexts. Particularly in unrefrigerated conditions, which is often the case in humanitarian settings. Social Solutions Research Association has created a new forensic technology that ameliorates the current standard body bag, while remaining affordable and functional, termed the Better Body Bag. It's primary goal is to delay decomposition and improve visual identification by influencing three key variables. Additionally, it aims to improve the working conditions of humanitarian actors that manage the dead after catastrophes or armed conflicts. Firstly, the better body bag can hold a vacuum. The mechanism that is used limits the body from interacting with an exterior environment, including oxygen, restricting aerobic bacterial proliferation or insects. This vacuum is easily created with the help of a standard hand pump that does not require electrical infrastructure. Secondly, it controls the temperature inside the bag by having an outer light deflecting layer. Thirdly, it controls bodily fluids associated with decomposition by using a superabsorber pad, preventing any leaking in the rare event of puncture. Finally, the bag has a double closing mechanism composed of a zipper and a hermetical seal, providing also a stronger barrier to odours that can emanate from inside the bag. An additional improvement of the BBB is regarding its practicality in forensic procedures in supporting the handling, documentation, and identification of the deceased. A patented foil makes the bag 30% lighter than the existing model. Furthermore, the used foil decreases ruptures and punctures. Preliminary biological and load testing demonstrate, using qualitative markers of analysis on pig samples, that the bag successfully held a vacuum for 72+ hours and slowed decomposition. A peer-reviewed research to verify results is underway to explore the full potential of the better body bag. This includes collaborative with the International Committee of the Red Cross, who have been financially supportive and to whom the first hundred prototype bags were provided. Although currently the new body bag was created in the purpose of humanitarian action, the BBB could become a new standard in the proper management of the deceased worldwide where different forensic actors may benefit from the properties of this new bag.

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FORENSIC PROFILING OF FRAUDULENT DOCUMENTS: A FRAMEWORK TO DETECT AND TRACE BACK CRIMINAL NETWORKS

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The presentation introduces an innovative and effective crime monitoring framework based on forensic intelligence. It is designed to support the proactive detection and investigation of organized crime and terrorist groups that produce, disseminate and/or use forged and counterfeit identity or travel documents. In this framework, once a fraudulent document (e.g. passport, driver license, identity card or visa) is seized by a police or border protection organization, it undergoes a scientific and systematic profiling process that extracts, analyses and compares the documents material features. Profiles are stored in a shared database, their similarity is assessed and forensic findings are then integrated with alternative data to support crime analysis and crime intelligence. Such a forensic profiling process provides an objective and measurable mean to highlight links between different cases, to point to prominent modus operandi, as well as to identify the production of prolific forgers and forgery workshops. Thus, it enables to detect, investigate and trace back criminal networks across different jurisdictions. Using real case examples, the presentation describes the conception of the framework and how it is being implemented by forensic units of several police departments in Switzerland. The presentation exposes how the framework combines different profiling methods, taking advantage of visual and physical examinations of documents, chemical analysis, or computer imaging techniques. The latter profiling method is showcased in particular as it is the most innovative. The various results provided by the framework are illustrated, ranging from providing support to tactical investigations, to guiding strategic decision-making. Finally, the potential implementation of the framework at a transnational level as well as its use to process counterfeit currency or counterfeit credit cards are raised as future prospects.

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SEXUAL ASSAULT WITH BILATERAL EYE ENUCLEATION

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The purpose of the present study was to describe the circumstances of a 29-year-old woman, who was sexually assaulted, and suffered bilateral Eye Enucleation, ruled out self-inflicted injuries. Serious inflicted eye injuries associated with sexual assault are rare, although a number of case reports in the literature concern auto-enucleation. This is a complex case, where the victim was severely intoxicated with alcohol, in addition to suffering rape with multiple injuries at the genital and anal areas, she also suffered traumatic head blunt trauma, requiring hospitalization in intensive care, with a subsequent amnesia, with an unsafe testimony, given different versions about the circumstances about how the aggression occurred. Additional findings included the detection of seminal DNA samples from three different individuals, including her partner, which was a challenge to rule out the possible suspects, and determine the identity of the aggressor in the context of sexual violence or as a gender-based aggression.

Disclosure: All authors have declared no conflicts of interest.

MULTIPLE FATALITY RESPONSE TO NINE INDIGENOUS DEATHS IN A BURNED HOUSE IN PIKANGIKUM

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The Ontario Forensic Pathology Service and the Office of the Chief Coroner were engaged to investigate a single house fire in a remote community. A team was dispatched to recover the fire damaged remains of nine family

members; six adults and three children of known and differing ages. The decedents were transported to the Provincial mortuary for the purposes of conducting post-mortem examinations and establishing identifications. The remains were noted to have extensive fire-related injuries, were heavily fragmented and in some cases incomplete. The lack of material available for examination posed a challenge to dental identification despite having a closed population of individuals to identify in a multiple fatality incident. The dental identification team was provided with antemortem records for the six adults and two of the children by the local community nursing station. The records received were in varying states of completeness and quality. As a result, it was a requirement that the dental identification team cautiously review the entire antemortem record from the past to present and then recheck some of the records from present to past to verify that an accurate record of the dental conditions at the time of death was available for comparison. Following this review, the team developed a list of identifiable conditions and created an antemortem odontogram for each individual. The available dentition of each decedent was recovered, restored and reapproximated during the post-mortem examinations. Then, the dental identification team positioned and exposed numerous intraoral radiographs of the teeth and jaws; however, the incinerated, fragmented and incomplete nature of the available tissue made it impossible to make complete post-mortem odontograms for each individual. A total of six positive dental identifications were provided to the Identification Committee as well as, three dental age-at-death estimates for the children. This presentation will impact the forensic community by demonstrating the limits of the use of antemortem dental records for identification for other practitioners. It will also show how a team approach utilizing forensic anthropology from scene to dental assessment ensures that the most information is available to the odontologist, and not lost through mis-handling by non-experts. In addition, it will show how other skills such as age stratification and using an exclusion matrix can be useful in the final identification of decedents of a multiple fatality.

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FACTORS WHICH INFLUENCE JURORS' INTERPRETATION OF THE VALUE OF FORENSIC SCIENCE TESTIMONY

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This presentation will review the author's recent doctoral work on how jurors in homicide trials comprehend and place weight on forensic science testimony. The data was collected over 24 months in Maine by interviewing jurors about the forensic science experts who testified at the trial. The results of this research show, from the juror's perspective, that expert witness credibility influences the juror's determination of the reliability of the evidence presented. The research also highlights that how the expert testified, in a narrative form, by explaining probabilities or by using a demonstrative aid influenced how well the juror understood the evidence and, in turn, how reliable they determined the evidence to be.

Disclosure: All authors have declared no conflicts of interest.

ACCELERANTS ON SKIN POST FIRE

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The aim of this study is to assist fire investigators and members of the law enforcement community in understanding the importance of not jumping to conclusions at fatal fire scenes. Was this an unfortunate fire death or is there something more to it? It is intended to provide insight into the fact that accelerants utilized in these scenes may not be readily recognizable nor have they been totally consumed in the fire. The anticipated outcome will be to increase the knowledge of the recovery personnel with respect to the method of recovery and thereby improving the quantity and quality of critical evidence. It is anticipated that this study will have a positive impact both within the forensic community and the investigative community with respect to in the investigation of fire fatalities and the methodology applied to the recovery of deceased persons to preserve critical accelerant evidence. There is an understandable tendency for those involved in fire settings to become overwhelmed at the magnitude and destruction of the scene itself. Fire investigations are often complex and difficult to interpret, and, at fires where the loss is large, there is a potential problem that the investigator may become overpowered, fixated or pre- occupied, and, therefore, fail to take the necessary steps in the recovery of deceased persons. To avoid these serious situations, it is imperative to develop a systematic approach to the recovery, packaging and transportation of human remains and to understand that it is possible that the chemical signature of an accelerant may very well be present.

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FROM CAPITAL MURDER TO NOT-GUILTY: PATHOLOGY-RADIOLOGY CORRELATION.

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This presentation will focus on the importance of radiologic-pathologic correlation in suspicious deaths. A 5½ month old collapsed in the care of a close family friend who had recently returned home after his college graduation from an Ivy League school. Autopsy report described multiple intersecting skull fractures involving the parietal and occipital bones. No samples of the fracture sites had been taken at autopsy. All fractures were assumed to have occurred around the time of collapse. The caretaker was initially accused of capital murder; charges were later reduced to first-degree murder. A review of the autopsy photographs suggested that there were two separate fractures, simpler than described and of different ages. One fracture involved the right parietal bone and the second fracture involved the left occipital bone. A pathological review was performed and correlated with the radiology. This review confirmed that *both* fractures occurred before the day of collapse and that there were multiple wormian bones and sutural variants that had inaccurately assumed to represent fractures. The right parietal fracture was weeks to months old and the occipital fracture was probably days old consistent with a report of a fall off the bed five days before collapse. The patient's mother, a nurse, had taken the child to the hospital and later to her pediatrician, expressing concern about the child's condition after the fall. No imaging was performed despite the mother's concerns. This case report will reinforce to attendees that a complete pathologic evaluation must be performed in order to accurately document the pattern of injuries and the mechanism of injury. Careful correlation with high quality imaging before the autopsy begins can potentially guide where sampling should be focused. In cases with multiple skull fractures, the patient history such as a previous fall should not be ignored even if the fall appears minor. Autopsies are the final arbitrator in a suspicious death and are as prone to errors of cognitive bias as any interpretive medical test. It is essential that autopsy findings be extensively documented by photographs and body diagrams. An open mind despite suspicious circumstances, careful correlation with the radiology, and appropriate histology would have allowed for accurate aging of the fractures and could have avoided the inappropriate charging of the last person with the child. Though the caretaker was eventually found not guilty, the charges, media coverage, and trial caused irreparable harm to the caretaker and family.

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DEATH PENALTY AND THE DRUG WAR IN THE PHILIPPINES: CAN FORENSIC SCIENCE MAKE A DIFFERENCE?

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As part of his campaign promises during the 2016 Philippine elections, President Rodgrigo Duterte vowed to reinstate the death penalty for heinous crimes which had been abolished in June 2006 during the term of then President Gloria Macapagal-Arroyo. The very first bill to be filed in the 17th Congress by the President's allies was House Bill No. 1 which sought to impose the death penalty on certain heinous crimes. Initially, the lawmakers sought the death penalty for such crimes as piracy, qualified piracy, qualified bribery, parricide, murder, infaticide, rape, kidnapping and serious illegal detention, destructive arson, plunder, importation of dangerous drugs, sale and distribution of dangerous drugs, manufacture of dangerous drugs, possession of dangerous drugs, unlawful prescription of dangerous drugs, planting of evidence, and carnapping, After the death penalty bill was passed on third reading by the House of Representatives last 07 March 2017 with a vote of 216 in favor, 54 not in favor and 1 abstention, the imposition of the death penalty was limited to drug-related crimes. At present, the Philippines is on the verge of becoming the first country in the world where the death penalty had been abolished, re-imposed, re-abolished and once again re-imposed. This national issue has divided the country into two camps: pro-death and anti-death, with adherents and proponents raising strong arguments in support of their respective sides. This presentation would discuss the background of death penalty in the Philippines, the major arguments raised by each side, the evolution of the death penalty bill in Congress and the possible role of forensic science and forensic evidence if and when the death penalty bill actually becomes a law, particularly the legal and scientific issues with regard to drug-related crimes. Due to the final nature of the penalty, the reliance on testimonial evidence to support a conviction, and the high error rate in capital cases which the Philippine Supreme Court itself had judicially recognized in the case of People of the Philippines vs. Mateo (2004), where it found that decisions in 71.77% of the total death penalty cases elevated on automatic review from 1993 to June 2004 had either been vacated or modified, the role of objective scientific evidence in the Philippine criminal justice system becomes of paramount importance to prevent miscarriages of justice.

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SINAFI - FORENSIC IMAGE ANALYSIS INTEGRATED SYSTEM: A COMMON PLATFORM FOR FORENSIC PRACTITIONERS

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Currently, there is no standard tool for image forensic processing. Commercial specialized tools are typically high-priced and operate on a "black box" manner. On the other hand, open source solutions are usually designed for image editing and poorly suited to forensic analysis. Therefore, forensic experts are forced to deal with a set of different tools in order to perform their Jobs. Consequently, productivity is reduced and knowledge diffusion is not easy. As an alternative, we present SINAFI, a Forensic Image Analysis Integrated System designed by forensic experts and developed with the support of the Brazilian Ministry of Science, Technology and Innovation - Funder of Studies and Projects (FINEP) and the Technical and Scientific Directorate of Brazilian Federal Police. SINAFI is designed based on a modular concept with a stable core offering most of the required basic functions and specialized plugins connected through well-defined and documented extension points. The code is written in C++ and uses publicly available specialized libraries as QT, OpenCV, libjpeg and ffmpeg to efficiently handle multi-media evidences. The core-integrated tools include a hex viewer, a metadata analyzer, a flexible video player with frame extraction and stamping capabilities, a basic audio enhancing interface, a transcription adapted text editor and a still image analyzer supporting both processing and illustration. The core also provides additional functions as: (i) user authentication; (ii) evidence registration and hashing to reinforce the chain of custody and ensure evidence integrity; (iii) logging of evidence processing flow to provide repeatability and auditability; (iv) reuse of logged processing flows to increase productivity and knowledge sharing; (v) batch processing; and (vi) fast case report generation. The provided extension points allow for the development of a large scope of specialized plugins. As part of the original project it is foreseen the development of plugins related to different forensic tasks such as image authentication, camera calibration, photogrammetry, pattern recognition, image enhancement and facial comparison among others. Nevertheless, the system is open to contributions from the forensics community, being able to nest a large number of specialized tools. The main goals of SINAFI are standardization, productivity, transparency and quality improvement. Additionally, being multi-language (initially English, Portuguese and Spanish) and founded on a "white box" philosophy, it is intended to offer a common platform for forensic practitioners, both on the field and academics, to exchange experiences and contribute.

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DESIGN FOR NETWORK FILE FORENSICS SYSTEM BASED ON APPROXIMATE MATCHING

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Network forensics is a comparatively new field of forensics science. The growing popularity of the Internet means that computing has become network-centric and data is now available outside of disk-based digital evidence. To collect certain network data for forensics, real-time network file packet inspection becomes a hot topic as it is needed in many applications such as virus detection, intrusion and attack forensics. Real-time packet inspection is important as it is required in many applications such as spam and virus detection, intrusion and attack detection, and collection of statistics. To have an efficient inspection, most of the traditional techniques use exact matches on keyword and/ or white/black MD5 lists. However, it is well-known that exact matches may not be effective as for real-time inspection, we may only obtain an incomplete file due to packet loss or not enough time to reconstruct the whole file (most existing inspection methods work on packet level only, which may not be as effective working at the file level). On the other hand, approximate matching (e.g. fuzzy hashing) is known to be more robust to identify similar/incomplete files and has been proven to be effective in digital forensics. In this paper, we considered the challenge of similar file identification on network traffic using approximate matching (a.k.a. fuzzy hashing). We come up with a detection framework to cope with this situation and evaluate its applicability. We try to confirm that by using an appropriate approximate matching approach, it is feasible and effective to inspect real-time network file in order to identify files that should be identical. We improve the previous fuzzy hashing and apply it to network packet inspection in order to detect similar/identical files in real time. The solution can be easily applied and maintained since only file fingerprints (a.k.a. similarity digest) are calculated and stored. We analyze the network file traffic and obtain the experiment dataset from captured files. Then we evaluate the influence of several factors, such as algorithm precision, detection rate and index performance on approximate matching algorithm performance. At last we measure the algorithm precision and system throughput based on practical data. The main contribution of our work is to assess the practicability and reliability of applying approximate matching on network packet inspection. Our experiments with real data show that our solution achieves good usability in practical. In particular, on a typical file detection scenario, we obtained an algorithm throughput of over 46MB/s.

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ACCIDENTAL OR FATAL CHILD MALTREATMENT?

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The current study analyzed the documents of medical history and post-mortem external and internal examinations of autopsy, of a 3-year-old boy, whose dead is related to serious maltreatment, suffering severe polytrauma due to thoracic and abdominal injuries, with multiple injuries at different stages of evolution. Contrary to his mother´s version, that claimed that the injuries occurred due to playground accidents and explanations were adapted to the diagnostic findings, the prosecution assumed that the child had been killed intentionally. The essential points for checking the plausibility of the mother's story are presented, considering the possibility that the injuries could be caused by accidental causes, that could be ruled out. In this case, are outlined common diagnostic characteristics and patterns of non-accidental injuries. This is also an example of how the forensic pathologist, via the conclusion about the cause of death, highlighted the mother´s carelessness and neglect of the child. Results found an overwhelming presence of clinical sings of maltreatment and supervisory neglect in child neglect fatality.

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GENOTYPING CASEWORK TYPE SAMPLES USING AN INTEGRATED NGS STR ANALYSIS AND INTERPRETATION SYSTEM

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Next generation sequencing (NGS), which permits the massively parallel sequencing of millions of DNA fragments, will revolutionized genomics. NGS is capable of the analysis of the hundreds of loci useful for forensic genetic analysis and permits the recovery of more information from forensic samples than has been possible using standard methods. Commercial forensic genomics kits for the massively parallel sequencing of autosomal STRs, Y-STRs, X-STRs, identity-SNPs, phenotypic-SNPs, ancestry-SNPs and whole mtDNA genomes are in various stages of development for routine and specialized forensic casework use. Concomitantly the development of semi-automated robotic systems (e.g. the Thermofisher Ion Chef™) for template preparation and chip loading has eliminated the need for extensive labor-intensive workflows. Through the bespoke HID NGS Global Consortium, we previously investigated the efficacy of a turnkey sample-to-sequencing solution that employed in tandem the Ion Torrent Ion ChefT™ library and template preparation and chip loading robotic system and the simplified modular chip-based Ion S5™ sequencing system using a novel prototype HID-specific content panel. The Precision ID GlobalFiler™ Mixture ID panels consisted of 113 targets in the human genome (29 autosomal STRs, 1 YSTR, 43 autosomal and 2 Y chromosome SNPs, 2 Indels and 36 microhaplotypes) in a single reaction. Initial evaluation studies included concordance, sensitivity, casework and mixtures. All data was analyzed using Converge™ forensic analysis software, which is a customizable all-inclusive platform that permits integration of both CE and NGS data. Results indicated great promise for many of the marker types in being able to improve mixture de-convolution. Here, we report on advances made in both the STR-specific content panels as well as the Converge™ forensic analysis software. A novel NGS panel (Precision ID GlobalFiler™ NGS STR Panel v2) has been developed which contains 5 markers for sex/gender determination and 31 autosomal STR loci. Advances with this system include improved chemistry, modified bioinformatics to reduce artifacts and the use of SNPs in the flanking regions for increased discrimination. Additionally, we have employed the use of the next-generation Converge™ software v2.0, which *inter alia* provides significantly enhanced features to assist in the analysis and interpretation of mixtures and degraded DNA. Our results of testing the new STR panel on the semi-automated ION S5™ and ION CHEF™ platform in combination with the upgraded software on casework type samples (including mixtures) will be described.

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DECAPITATION IN HANGING

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The authors report two cases of complete decapitation due to hanging. The decapitated body of a 49-year-old man weighing 53 kg was found next to a hotel, and the head was 1.2 m away from the body. A rope (length, 3.5 m; diameter, 1.0 cm; nylon rope with a running noose), from the rescue and descent device of the room, was on an exterior wall of the hotel. Another decapitated body of a 50-year-old man weighing 74 kg was found floating on the river. The head was found the next day. A rope (length, 7.2 m; diameter, 1.0 cm; nylon rope with a running noose) was tied to a bridge located on the upper side of the river. In both cases, the neck had a sharply demarcated circumferential laceration, similar to that noted in cases of sharp force injury. However, the laceration was formed by Langer's lines, and internal examination revealed findings of overstretching injury and blunt force injury. These cases were determined to be those of complete decapitation due to hanging.

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POST-MORTEM CARTILAGE AND ITS POTENTIAL FORENSIC APPLICATIONS: A MOLECULAR EXAMINATION

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Introduction: The post-mortem (PM) properties of decomposing cartilage have been overlooked by the forensic community. This highly robust tissue possesses biophysical properties that make it ideal for forensic research. Situated along the surface of bones, articular cartilage is protected by a joint capsule containing synovial fluid and surrounding soft tissues which provide protection from the immediate environment. Moreover, the tissue maintains a low cell density, is aneural and avascular which makes it less susceptible to the immediate effects of autolysis and microbial invasion. The current study is a preliminary investigation of the long-term post-mortem biomolecular properties of degraded porcine cartilage in buried environments and its potential forensic applications. Both extracelluar (aggrecan) and cellular matrix components (chondrocytes) were evaluated. **Materials and Methods:** Several experiments involving the interment of fresh porcine trotters in shallow graves (30 cm deep) were conducted at two distinct locations exhibiting dissimilar soil environments. Cartilage extracts were removed from the metacarpo-/metatarsophalangeal (MCP/MTP) joints of trotters disinterred weekly over the course of six weeks. Tissue samples underwent chondroitinase ABC digestion for immunoblot analysis of aggrecan core protein. The protein to assess PM degradative changes over time. Cell vitality assays were also performed for cartilage cross-sections representing weekly PM samples. Corresponding tissue extracts were subjected to DNA gel electrophoresis and PCR using porcine specific primers for detection of a 171 bp fragment. **Results:** Soil environment did not generate differences in results. Cartilage extracts from PM trotters yielded increasingly degraded aggrecan for up to 42 days PM. The disappearance of aggrecan was found to coincide with joint exposure to the soil environment. Furthermore, the number of viable chondrocytes decreased with increasing PMI with live chondrocytes present for up to 35 days PM. DNA integrity gradually declined over six weeks with little detection of nucleic acid by 5 weeks PM. PM specimens subjected to PCR

demonstrated a 171 bp fragment for up to 2 weeks. **Conclusion:** The PM degradation of cartilage extracellular and cellular components are slow, ordered processes. PM aggrecan, chondrocytes and nucleic acid were observed well beyond the current 48- and 100-hours limitations posed by traditional PM soft tissues used for PMI determination. The detection of live chondrocytes at 35 days PM presents an alternative DNA source for establishing positive identification of unknown decedents. In spite of these results, examination of human cartilage is necessary for validating the forensic applicability of the above findings to forensic cases involving human remains.

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RURAL CRIME IN THE UK: WHAT WORKS TO PREVENT CRIME AGAINST SPECIES?

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Criminological research has historically been based on urban metropolises in developed countries. Minimal research focuses on crimes in rural settings, particularly in relation to crimes involving species, such as poaching, coursing and the rustling/theft of farm animals. The absence of research establishing whether crimes in rural areas conform to theories developed in urban cities brings into question the relevance and effectiveness of existing policy and methods for preventing rural crime. Rural crime is severely underreported in the UK with gross underestimations of the true emotional and financial cost to rural communities. The aim of the research is to better understand the rate of crimes against species in the UK (surveys and Police data), the methods of prevention that exist (systematic review), the features of the landscape that can make an area more vulnerable. The research also addresses how better targeting of forensics in rural areas could benefit rural Police and communities. By establishing the facts relating to species crime in the UK it is possible to better identify solutions for rural communities. The findings of a systematic review into what methods exist to prevent crime against species, particularly crime relating to farms and wildlife, will be presented, showing the severe lack of research that has been conducted internationally to address the effectiveness of prevention methods. In addition to this the preliminary results of a large scale survey supported and promoted by Farmers Weekly will be presented and the implications of these results to the understanding of species crime nationally discussed. The proposed work for the future and the impact of this research on policy, policing and resource allocation, as well as how traditional forensic techniques could be applied in novel ways to rural crime will be discussed.

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AIMS AND CHALLENGES IN THE IMPLEMENTATION OF THE LAW FOR THE SEARCH OF MISSING PERSONS IN PERU

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In Peru, thousands of people are still waiting for answers on the fate of their loved ones having disappeared during the 1980-2000 armed conflict. It is estimated that more than 15,000 people disappeared during the armed conflict, close to 3,400 bodies had been uncovered of which only approximately 1,900 have been identified and returned to their families. The ICRC family needs assessment revealed that having news about the fate of their loved ones and giving them a decent burial are priority needs. Struggles in the identification process and lengthy legal proceedings activated civil society and non-governmental organizations, including the ICRC, to promote the adoption of a restorative public policy to resolve this need. The recent approval of a law for the search of the missing persons in Peru and a related national plan, prioritizes humanitarian goals to those of criminal justice. Forensic investigations of remains would be done parallel to judicial proceedings, bringing hope to thousands of families, receive their bodies, and bury them following their own cultural, ritual and faith, with proper psychosocial support. This new law puts the Minister of Justice and Human Rights (MinJus) in charge of the organization and implementation mechanism. The objective of this presentation is to shed light as to the aims and challenges of this law in view of its implementation with a strategic approach that seeks to advance the process in an organized and efficient manner with the overall aim to provide families with answers in the short and medium term. The Peruvian authorities are not confronted with an easy task as they face multiple challenges: to organize within the public sector an efficient and cross-sectoral policy with an adequate budget in a centralist country and with institutions unaccustomed to coordinating; prioritize humanitarian objectives without limiting the possibilities of justice; devise a strategy that includes, but is not reduced to the media impact of big technological solutions (DNA as a magic formula of identification, software, etc.); organize a sustainable information management system, access to files; provide the families emotional support. The International Committee of the Red Cross (ICRC) is following the implementation of this law through support to MinJus and other ministries as well as supporting local partners, working to clarify the fate of the missing people and address the needs of the families, providing technical input to help these partners build their capacities.

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THE USE OF 3D DIGITAL IMAGING TO COMBINE PHOTOGRAPHIC, WOUND BALLISTIC AND BPA EVIDENCE

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In a homicide case where a young man killed his girlfriend with his service rifle, the position of the shooter was a key point for the debates, as the defense alleged an accidental discharge, whereas the prosecution sought a conviction for murder. The use of ballistic simulants, CT-scan data, photogrammetry, 3D scan of the crime scene and Blood Pattern Analysis allowed to narrow down a perimeter where the weapon may have been fired. The trajectory of a bullet fragment was first integated in the 3D digital reconstruction of the scene. Pictures from different surfaces taken in the laboratory where then added in the model to allow the analysis of the blood stain pattern, that indicated the approximate location of the head of the victim. Finally, the position of the mark of the ejected cartridge case on the wall was also put into the model. The deviation angle of 5.6 mm GP 90 shots in ballistic simulant as well as the ejection angle of the SIG 550 where then measured and represented in the model to position the weapon in reference to the various types of evidence. The 3D reconstruction of the scene allowed to combine the different types of evidence and give a visualisation of the results that would have been very difficult to convey by other means. Though used to verify the wound ballistic results of the simulants, the CT-scan data of the victim was not used in the final visualisation and the authors chose not to use a dummy to represent the perpetrator or the victim, to avoid arbitrary choices pertaining to their posture. Instead, the use of zones allowed to illustrate the uncertainty of the measurement and to weigh the hypothesis of the defense and the prosecution against one another without choosing one particular position for the protagonists.

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SYSTEMATIC ANALYSIS OF THE ROLE OF FORENSIC ERRORS IN WRONGFUL CONVICTIONS AND HOW TO MOVE FORWARD

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Over the past decades, many cases have emerged in which it was suggested that inadequately analysed, interpreted, or presented forensic evidence played a crucial role in wrongful decisions in court. These have fuelled the discussions and concerns about the current understanding of the reliability of a wide range of forensic methods currently utilised. Although it must be accepted that uncertainty is an inherent property of many analysis and interpretation processes, and that it is therefore unavoidable that wrongful convictions (and acquittals) happen, the growing body of research suggests that forensic evidence has often mislead the truth-finding process in ways which could have been prevented. Answering the question of whether the forensic community is currently doing 'the best it can' given the current knowledge bases therefore requires an assessment into whether the beliefs currently expressed in expert witness statements are 'good enough'. Many studies into wrongful convictions are based on in-depth analyses of specific criminal cases, implying that these are often only the 'tip of the iceberg', and highlighting the need for more systematic and comprehensive approaches. The current research therefore focuses on understanding the nature of misleading evidence by analysing all convictions and acquittals which were deemed unsafe by the Court of Appeal of England and Wales between 2010 – 2016, whereby forensic evidence played a crucial role. Two methods will be presented. Firstly, a preliminary study aimed to understand the value of gaining insight into successful appeal cases. Following these results, a more comprehensive automatic approach was developed to not only target successful appeal cases, but to also include cases where the judge did cast doubt on the forensic evidence, although this did not necessarily overturn the conviction. This research does not only identify issues within the forensic science domain and their impact on fair and reasonable truth-finding, but also presents a sustainable approach which can be used to study these within a single justice system over time as well as between different jurisdictions. The current presentation discusses how these results feed into the much-needed research culture within the forensic sciences, both in terms of directing the paths for expanding the empirical knowledge base as well as developing tools and frameworks to support and justify forensic reasoning and decision-making processes throughout the criminal justice system. Ultimately, moving forward requires a constant evaluation of the current practice and an international cooperation in tackling these significant and possibly shared issues.

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INJURY PREDICTION FOR VULNERABLE ROAD USERS USING COMPUTATIONAL BIOMECHANICAL MODELS

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Nowadays, computational accident reconstruction is a powerful tool for the investigation of the causes of such events and enables to determine the dynamic conditions of the accident, such as the speed or the maneuvers. However these tools have some drawbacks concerning vulnerable road users, such as pedestrians and occupants of two-wheelers. Human body computational models are required for the investigation of such type of accidents and forensic biomechanics is an important discipline, especially for the reconstruction of accidents involving vulnerable road users where the injuries must be considered. The correlation between injuries and biomechanical criteria is crucial to the determination of the causes of some accidents such as pedestrian impacts where the speed of the vehicle and the impact point location sometimes is required to be determined using the injuries. Such computational models are under development and forensic biomechanics is an area where knowledge from engineering and medicine should be interconnected. The main goal of this work is to develop methodologies that correlate the injuries of the victims described in the reports of clinical exams and/or medico-legal autopsies, with a biomechanical computational model. Several injury criteria are used, validated through the comparison between the results from both sources. Injury criteria were specified for each body segment (head, neck, thorax, abdomen, pelvis, upper and lower extremities). Different case studies were considered, and in each one a computational simulation using a biomechanical multibody model was validated. The injuries for each body segment were quantified using the AIS (Abbreviated Injury Score), except for the upper extremities, where only fracture occurrence was considered, based on the risk (expressed as the probability of fracture). The data from clinical exams and/or medico-legal autopsy reports with the results from the simulations are compared, globally using the mortality probability from the ISS (Injury Severity Score), and locally using the AIS. This enabled us to evaluate globally the life risk of the vulnerable accidents victims, and locally the injury severity in each considered body segment, producing good correspondence between the two sources of information. Accidents involving pedestrian and two-wheelers occupants are presented to demonstrate how this methodology is suitable for the reverse approach, i.e., use the victim's injuries severity data to optimize the accident reconstitution simulation.

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FORENSIC ADVISERS IN BELGIUM: A SUBSTANTIAL INCREASE IN EFFECTIVENESS

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The potential of forensic science is constantly evolving. Different forensic disciplines may be involved with a single piece of evidence, this impacts the way evidence should be examined. A variety of items can be seized by crime officers at the crime scene. The investigating judge decides how to proceed, but what is the optimal approach? Should each and every item be investigated or would it be better to be selective? What type or types of examination should be performed on each item? Is a multidisciplinary approach appropriate? In Belgium, it became evident that the line of communication between the judicial system and forensic scientists was not always transparent. Consequently, in 2010 the role of the forensic advisor was created. The priority and sequence in which items should be examined can be quite complex, especially in murder cases. The forensic advisor guides the magistrate through a list of questions based on case related information. A meeting between the different parties, tactical police, investigating judge, SOCOs, etc. is held and information is shared. Primary questions are gathered and an examination strategy is suggested by the forensic advisor. The relevancy of a particular examination is explained in a written report discussing the odds of getting the answers to certain predefined questions. When more results become available, additional meetings are held and the process is repeated until all questions are answered as well as possible. As such, transparency and good communication skills are key to the success of a forensic advisor. Finally, the forensic advisor produces a final report encompassing all the examinations that have been carried out and this is then peer reviewed by the various specialists that have worked the case. Since mid-2014 forensic advisor gained closer access to the justice department as they now have offices in several of the Belgian courthouses in Belgium. This proximity is of real value. (Smaller) Cases can be read faster and advice can be given taking into account all the information in the file as well as the benefit-cost ratio, which have led to a significant reduction of analysis and costs. This methodology has also lowered the risk of missing important evidence. It has led to a substantial decrease in costs and an increase in effectiveness. It has brought faster turnaround times and has achieved a higher level of satisfaction amongst our partners in the judiciary.

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DEVELOPMENT OF A LANDMARK IMAGE DATABASE TO IDENTIFY THE SHOOTING LOCATION OF PHOTOGRAPHS

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This study is aiming for development of a technique to specify the shooting location from photographs. When the GPS location data is recorded in the JPEG image header, the shooting location can be pinpointed. However, it cannot be specified when GPS coordinates are camouflaged or the coordinates are not recorded in the image file. In that case, it is necessary to estimate the shooting location from the image content. In this research, the authors are studying a method of specifying the shooting location by searching for images on the Internet which are similar to characteristic objects, such as mountains, buildings, etc., contained in a questioned photograph. In order to realize this, the authors developed dedicated software for collecting landmark images all over the world from the Internet and a database system to manage the stored images, as a first step. The image collection software is written in Ruby, which downloads images using keywords from the worldwide geographical database "GeoNames, Gazetteer Data". Using the developed software, we tried to collect images of 168 thousand points in 32 countries; about 5 million images were downloaded. The problem when collecting images from the Internet is that images which are not directly related to the place, such as person's face pictures, illustrations, etc., can be downloaded. Such unrelated images were deleted manually by visual confirmation; approximately 740 thousand images remained, and the residual ratio was about 14%. Since this confirmation is hard work, in order to continue the image collection, the function which can automatically drop unwanted images is necessary in the downloader; this function development is our future work. Next, the authors developed a dedicated database system for managing the stored landmark images using PostgreSQL. In the database system, the downloaded photograph files and information such as country name, place name, feature code, latitude and longitude of the place, downloaded URL, and license information of the photograph, are linked and managed. It is possible to retrieve images in the database using arbitrary queries such as place name, feature code, latitude and longitude and so on. Our next research task is, by utilizing this landmark image database, to develop and evaluate content-based image retrieval engines which can search similar terrain or building images involved in a questioned photograph.

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FORENSIC DNA ANALYSIS AND WILDLIFE INVESTIGATIONS: A PERFECT MATCH

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Forensic DNA analysis is an integral part of wildlife investigations since the goal of most illegal activity involving wildlife is to gain possession of biological material for the purposes of trophies, sustenance, medicine and/or, sale for profit. Wildlife investigations often feature complex multi-agency collaborations and can include multiple species and individuals. Thus, wildlife forensic DNA laboratories are required to have the capacity for individual identification and match assessment of multiple species and the ability for inter-agency cooperation. Unlike in human DNA forensics, where PCR kits are commercially available and a relative wealth of methodological and database resources exist, wildlife forensic laboratories are frequently required to develop in-house protocols and databases. Here we present the Alberta Fish and Wildlife Forensic Unit's (AFWFU) validation, analysis, and statistical methods for individual identification and match assessment using STRs for wildlife investigations. We also present case examples illustrating the complex nature of some investigations and highlighting effective inter-agency cooperation. Methods presented here can be broadly applied towards the development of new forensic laboratories (wildlife or human) in areas where few resources are available.

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MASS DISASTERS AND THE UTILITY OF RAPID DNA ANALYSIS

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Mass disasters typically result in the loss of lives with law enforcement and health officials bearing the responsibility of identifying the victims and reuniting families. This is often achieved using human identification STR profiling. Rapid DNA technology is a powerful tool for disaster victim identification because it offers fast STR results in non-laboratory environments with automated profile interpretation for immediate database searching and matching. The ANDE Rapid DNA System utilizes a 6-dye, 27 locus assay, making it a powerful assay for both degraded samples and kinship comparisons. The assay contains the expanded CODIS core 20 loci as well as additional loci routinely databased around the world. A number of disaster victim identification sample types have been successfully testing using fully automated rapid DNA analysis in field-forward and mobile locations without the standard accommodations of a laboratory. A wide range of sample types relevant to mass disasters have been evaluated and include bone, muscle, liver, and brain. Mock disaster samples as well as samples collected from controlled human decompositions yield full STR profiles. The utility of rapid DNA for mass disasters will be discussed, including the impact of tissue and bone degradation and strategies for sample selection. Short tandem repeat profiles from mock mass disaster samples generated by the fully automated rapid DNA system, including automated data analysis and interpretation, will be presented. Data supporting the use 27-loci profiles for kinship analysis will also be presented. In conclusion, this presentation will describe processes to enable rapid identification of human remains and kinship identification in mass disaster, field-forward settings. The ability of first responders, primarily individuals without backgrounds in laboratory-based forensic DNA analysis and genetics, to perform STR analysis as well as sophisticated genetic analysis offers the potential to change the current paradigm in disaster victim identification.

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STATISTICAL COMPARISON OF THE EFFICACY OF US STATE DNA DATABASES

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Forensic DNA databases are widely deployed and important in solving crimes in all 50 states of the USA. Although there are many commonalities in the application of DNA technology in the different states, there are also significant differences which could affect their performance. The goal of the present study was to compare statistical parameters of various state forensic DNA databases and identify factors correlating with the efficacy of such databases. A secondary data analysis was performed by using the available data in CODIS as of July 1, 2011. The analyses showed that for an examination of all 50 states: (1) the numbers of crimes aided by database matches and the numbers of profiles in databases were moderately correlated (correlation coefficient (r^2) of 0.556 and a Pearson's value of 0.746). There were notable outliers above the regression line (IL, NY, FL and VA) and below (CA, TX, NC and TN) (2) Another analysis, a graph of state population versus number of hits showed a correlation of (r^2) 0.222 and Pearson's value of 0.471. The relationship between these parameters could be also be interpreted as evidence of a logarithmic relationship so that for states with smaller populations, below but not above 5 million, there is a strong increase in number of hits with increasing population (3)

As would be expected there was a significant correlation (r^2) 0.610 and Pearson's value of 0.780 between state population and number of profiles in their databases (4) States with the highest "hit ratios" of investigations aided by database /number of NDIS laboratories were VA, OR, NY, FL and GA (5) States or districts with the highest "hit ratios" of investigations aided by database /state population were DC, VA, FL, NY and AK. In conclusion, this study has collected in one source quantitative comparisons that point at factors related to the productivity of different state databases. The application of regression analysis between paired parameters was useful in identifying state databases that were above average in numbers of crimes solved or aided through the use of DNA databases relative to the number of laboratories and DNA profiles collected in the state.

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JUVENILE DEATH AND FIRE: A PRELIMINARY LOOK AT CREMATION PROCESSES IN JUVENILE REMAINS

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Fire and burns are the leading cause of death in the home for children. According to World Health Organization mortality statistics for Canada, in the years 2002-2012, 211 juveniles (<14 years) died from events associated with fire. Children under the age of 4 have the highest fatality rates compared to other groups, with 96 of 211 total deaths. In forensic anthropological analysis, current research is undecided on the most appropriate techniques to recover and identify fragments of juvenile cremated remains. Existing sifting methods result in a >60% loss of diagnostic skeletal material and few studies have considered the differential burning patterns of juvenile remains in context to their different morphological, physiological and anatomical traits. These differences will influence the body in the burn environment; Therefore, it is necessary to ensure, for both forensic and moral reasoning, that the methods used are both reliable and accurate. This poster discusses the comparative heat induced change between juvenile and adult skeletal remains; and the impact this may have on forensic recovery and analysis.

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A COMPARISON OF DNA RECOVERY METHODS USING DNA 17 AND RAPID HIT DNA TECHNOLOGIES

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DNA evidence is a very well established forensic technique and contributes significantly to the identification of both victims and perpetrators in criminal cases. The technology available for DNA based forms of identification has continually evolved since its first iteration, to include the inclusion of more loci and more sensitive systems (DNA 17) and a faster turnaround time for results (Rapid DNA technology). The aim of this research was to compare the sensitivity of the current DNA profiling for the UK, DNA 17, with a system designed to generate a DNA profile in 90 minutes, Rapid DNA, for touch DNA samples. A range of surface types were handled for a defined period of time, and touch DNA was collected using a variety of recovery techniques, including cotton swabs, foam swabs and mini-tapes. The samples were analysed using the RapidHIT™ Human DNA Identification System (integenX) and the AmpF/STR NGM SElect (Applied Biosystems) profiling system. The quality of profile achieved, as well as electropherogram features, were evaluated to enable comparison. The results of this research will be reported fully in this paper. This research has been funded as part of an official partnership with Staffordshire Police Force and therefore will form part of the regional guidelines for evidence collection.

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A RAPID MULTI-TARGET SCREENING METHOD IN EMERGENCY TOXICOLOGY BY GC-MS AND LC-MS/MS

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Purpose: For intoxicated patients in the emergency room, it is important to identify toxicants within the golden hour. In order to establish the rapid method for simultaneous screening of multiple toxicants, GC-MS and LC-MS/MS were used to determine targeted and unknown toxicants in urine. The result by urine analysis was compared with the medical report by family to check the reliability of information. **Methods:** 204 urine samples were collected from emergency room of Chungnam National University Hospital. Urine samples are cleaned up by using Waters Ostro (pass-through mode) and examined by GC-MS or LC-MS/MS. After analysis by GC-MS, the library search for unknowns was conducted by in-house Mass spectral databases with the Automated Mass spectral Deconvolution and Identification System (AMDIS). In addition, Chemstation software was mobilized to identify toxicants. For LC-MS/MS analysis, the 3200 Qtrap LC-MS/MS and Cliquid software (AB sciex) was used for a simultaneous multi-targeted screening. **Result and discussion:** A rapid multi-target screening method by GC-MS and LC-MS/MS was developed to determine toxic substances in urine. By using Ostro extraction and in-house data base, it was possible to screen urines for toxic substances within one hour. With this method, 204 urine samples were examined and it was noted that zolpidem, acetaminophen and tramadol were the most frequently encountered drugs in emergency room patients. The targeted and unknown toxicants were well searched by in-house mass spectral databases and commercial ones in all specimen studied. **Conclusions:** A rapid multi-target screening developed in this study will use efficiently to detect toxic substances within 1 hour in emergency toxicology.

Disclosure: All authors have declared no conflicts of interest.

TONGUE AMPUTATION, AN UNUSUAL LINK OF HOMICIDE: A CASE REPORT

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The cases of defense bite with amputation of the tongue have been scarcely described in the legal medical field, in this report we describe a case of an adult woman who was last seen in the company of a security guard at her residence, who during the interrogation explains that both were kidnapped by unknown men, of whom he managed to flee. Two days later, the victim was found dead in a nearby site, in bloat stage of decomposition, with ecchymosis in the right mandibular region and areas of cadaverous anthropophagy. Next to the body was found, a fragment of muscular tissue with macro and microscopic features of a tongue. On the same day, the suspect went to the hospital, with a history of having been physically assaulted by strangers who gave him multiple kicks and also cut his tongue with a pincer, he was admitted for two days due to speech disability due to tongue lesion, which showed in its dorsal portion an irregular border wound with multiple cuts, which was sutured. In the forensic evaluation, he presented amputation of the tongue from the middle third portion, approximately 60%, with wounds of irregular borders and modified by stitches. He had no dental lesions neither nor oral mucosa. Because the wound was modified by stitches, it was not possible

to establish compatibility with the object that produced it. It was concluded in the autopsy report that the cause of death was a closed head injury. The Forensic Dentistry study of the tongue fragment reports three rectangular lacerations in its anterior portion, compatible, with human bite traces. DNA analysis of the tongue fragment didn´t exclude the suspect, implicated as donor of the detected genetic profile with a probability of coincidence of 99.99999%.

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UPDATED STATUS OF BITE MARK EVIDENCE IN THE UNITED STATES

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Haskell Pitluck Past President of the American Academy of Forensic Sciences, Member of the NIST OSAC Odontology subcommittee. The first appellate court decision involving bite marks in the United States was in 1954. That case involved a bite in a piece of cheese. Since that time, over 300 appellate decisions related to bite marks have been issued. The admissibility of bite mark evidence has been challenged on many levels for years. It was not until the 2009 National Academy of Science (NAS) report, "Strengthening Forensic Science in the United States: A Path Forward", that bite mark evidence has been under more severe criticism. In the eight years since the report, committees have been formed, studies have been done, cases have been discussed and reanalyzed. As of 2016,since presented in Auckland, New Zealand, no definitive solutions had been reached and the work is still ongoing. There will be a further OSAC meeting in April of 2017 which may help clarify issues and solutions. A report of that meeting will be presented. Is there a scientific basis for bite mark evidence to be introduced? and does there, in fact, need to be? Many times science and the law conflict in trying to reach a fair and just result. Is there an error rate in its use and, if so, how do you determine it? This presentation will discuss some facts, myths and misconceptions regarding bite mark evidence as well as its use in the justice system, including discussion of some of the cases that have been overturned. The challenges that have been continued to be discussed and presented to the Forensic Science Community will be examined.. What can we do insure that the legal and scientific community can reach a fair and accurate conclusion for all involved?

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ANALYSIS OF ABNORMAL CT SCANS USING VIRTUAL AUTOPSY SOFTWARE 'INVIVO5.4' BY ANATOMAGE

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Medical imaging techniques such as computerized tomography scans have a wide variety of uses, including forensic applications. As a person is passed through this circular machine, x-ray images are taken from multiple angles. These are then computer-processed so that cross-sectional views or 'slices' can be observed. These images are a great non-invasive way to analyze or diagnose injuries, trauma or even cause of death. This study is an analysis of two computerized tomography (CT) scans through the newest version of the three-dimensional medical imaging software 'Invivo5.4 Medical Design Suite' by the company Anatomage. One of these scans is of the abdominal cavity and the other is of the thoracic cavity with focus on the heart. This software has a wide variety of tools and applications. You can view the images in sagittal, coronal, and axial cross-sectional views at multiple levels. You can also rotate images, change brightness and contrast, add labels, and even measure distances and areas of interest. This software can allow for demonstration to colleagues or students in an academic setting, can be given to other professionals for a second opinion of injuries, can be used for later reference, and can be used in court proceedings for jury demonstration. In this study, the abnormal cases given by Anatomage were compared with normal scans of organs and tissues at the same location of the body. A side-by-side comparison can then be viewed and analyzed. This is a perfect tool for physicians and pathologists in the field of forensic medicine that can diagnose injuries and trauma through means that are completely non-invasive to the individual.

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STUDIES ON THREE SPICE DRUG PRODUCTS: VOODOO CHILD, BRAINSTORM, BARELY LEGAL

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'Spice' refers to designer drugs consisting of plant materials sprayed with different synthetic cannabinoids. Serious forensic and health problems exist with 'Spice'. The types of synthetic cannabinoid vary in different brands and different samples of the same brand. This presents problems in analysis and identification. Second, the toxicology of the 'Spice' brands and particularly the emerging ones is incompletely understood. For the Spice brands: Barely Legal, Brain Storm and Voodoo Child there is little information in the peer-reviewed literature concerning their composition and biological activities. It is hypothesized that the 'Spice' brands Barely Legal, Brain Storm and Voodoo Child contain different synthetic cannabinoids and alter cellular protein expression profiles and morphology. Methanol and chloroform extracts of the 'Spice' brands Barely Legal, Brain Storm and Voodoo Child were examined by using uv-visible, FT-IR and NMR spectroscopy and thin layer chromatography. In cell studies, human A549 lung cells and SW-13 adrenal gland cells were cultured in the absence and presence of the three spice brands. Lectin-binding fluorescence and immunofluorescence microscopy and gel electrophoresis were used to characterize A549 and SW-13 cells and proteins in the presence and absence of the three Spice brands and Δ THC. The results showed that uv-visible, NMR and FT-IR spectra of the three spice samples showed many similar absorption peaks but also differed and especially so in FT-IR spectroscopy. TLC showed fluorescent spots with similar mobilities common to all three samples but also differences. In terms of possible biomarkers for the effects of 'Spice', fluorescence microscopy detected Cannabinoid receptor type 2 proteins but not type 1 receptors in A549 and SW-13 cells. The plasma membrane complement system regulatory proteins CD46 and CD59 were detected on A549 and SW-13 cells. Different carbohydrate structures on glycoproteins of these cells were identified by lectins for further investigation of the biological effects of the 'Spice' brands . Comparison of the plasma membrane glycoprotein composition of controls and cells exposed to the Spice products and ΔTHC revealed only subtle or no changes by lectin staining of proteins separated by electrophoresis. Exposure to ΔTHC and Barely Legal Spice appeared to cause stronger Con A lectin binding by fluorescence microscopy to A549 lung cells than did exposure to Brainstorm Spice or Control cell culture media. In conclusion, different 'Spice' products were distinguished by TLC, Raman and FT-IR spectroscopy. Little difference in glycoprotein composition occurred in A549 cells after exposure to the Spice products.

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APPLICATION OF QUECHERS METHOD TO THE ANALYSIS OF PESTICIDE MULTI-RESIDUE IN HUMAN HAIR

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In case of pesticide poisoning/death incidences, it is very important to identify rapidly the unknown toxicant and determine its concentration for detoxification treatment or verification of death cause. Therefore, the establishment of an accurate, precise, rapid and simultaneous multi-residue pesticide analytical method is critically required. In this study, QuEChERS technique was applied for the analysis of 383 pesticides in human hair using liquid chromatography-tandem mass spectrometry (LC-MS/MS, SHIMADZU LCMS-8050) for forensic and toxicological investigation. The scheduled multiple reaction monitoring was optimized with positive/negative ionization mode on LC-MS/MS. To optimize the extraction step, all target compounds were spiked into 50 mg of pulverized human hair, extracted with acetonitrile (1 mL) with/without 0.1% formic acid, and incubated 3, 6, and 9 h (40 °C) respectively. Each extract was centrifuged and 0.6 mL of sample was concentrated to 0.06 mL followed by matrix matching (sample: acetonitrile, 4:1, v/v), before analysis. In extraction step, the target compounds which satisfied the recovery criteria (70-120%, relative standard deviation ≤20% at 50 pg/mg) in 3, 6, and 9 h incubated sample with acidified solvent were 321 (83.8%), 277 (72.3%), and 303 (79.1%) respectively. In un-acidified solvent in 3, 6, and 9 h incubation, 302 (78.9%), 241 (62.9%), and 217 (56.7%) pesticides were recovered within the criteria. To remove interference compounds as a second step, hair extract with acidified solvent (40 °C, 3 h, incubation) was purified using QuEChERS d-SPE (25 mg PSA and 150 mg $MgSO_4$) and Z-Sep w/$MgSO_4$ (50 mg Z-Sep and 150 mg $MgSO_4$) followed by concentration. In the recovery test at 50 pg/mg using d-SPE and Z-Sep w/$MgSO_4$, 276 (75.2%) and 211 (55.1%) analytes satisfied the recovery criteria respectively. Using acid solvent extraction and QuEChERS clean-up, pesticide multi-residue in human hair could be analyzed efficiently.

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HUMAN IDENTIFICATION AS A VALUABLE RESOURCE AGAINST OBLIVION

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Introduction: Honduras is facing a serious human crisis, mainly caused by economic and social inequality, high rates of violence, vulnerability to natural disasters, high rates of forced or voluntary migration, drug and human trafficking, among others. This has generated a large number of people who are missing, displaced and victims of human trafficking; It is estimated in general that Central America and Honduras in particular is an area of recruitment and arrival of victims of human trafficking, mainly to the United States and Mexico, for the purpose of sexual and labor exploitation as also organ trafficking, **Methodology:** That´s why the Direction of Forensic Medicine Of Honduras, has implemented an integrated human identification system that allows the integration of disciplines such as anthropology, dentistry, genetics, fingerprinting; Also supported by technological tools such as databases designed by the International Red Cross (ICRC), the addition to the DNA program for children (ProKids); As well as information management through the integration of the MFiSys software and the interconnection to the Honduran Civil Registry system through the Citizen Identification Registration Centers (CRICs). **Results:** This integration allows through human identification and the exchange of information with other countries in the Central American region, Mexico and the United States, a decrease in this manner. There is a positive impact by strengthening adoption processes by adopting mandatory biological linkage prior to adoption and is now focusing its efforts to promote the national registry of missing persons in order to provide Honduran families with the opportunity to reunite with their families, as well as to promote the necessary bereavement and grief, which uses "scientific" and "social" memory as a mechanism of grief. **Discussion**: This joint effort of different forensic disciplines, as well as cooperators, legislators and civil society is dedicated to all our unnamed, but never forgotten fellow citizens, in order to promote grief, reconciliation and non-repetition processes.

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UTILITY OF BACTERIA ASSOCIATED WITH HUMAN HAIRS IN FORENSIC INVESTIGATIONS

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Hair is one of the most commonly encountered physical evidence at the crime scene. Hair evidence is extremely valuable in association or exclusion of suspect to the crime scene or the victim, and can play critical role in narrowing down suspects based on identification of age, sex, and race, of an individual. Currently, microscopic analysis is performed for determination of age, sex, and race of hair evidence, but this method requires extensive experience, is subjective, lacks individualizing power, and has no known error rate. Often hairs that are left at the crime scene are rootless, which makes nuclear DNA analysis very challenging. Even with nuclear DNA analysis, it is not possible to determine if a particular hair originated from scalp or pubic region. In this situation, an alternative unbiased quantitative method for hair examination is needed. In this study, scalp and pubic hairs were collected from 14 donated human cadavers by the Office of the Chief Medical Examiner (OCME) in Richmond, Virginia. DNA was extracted from each hair samples using an organic method, and extracted DNA was quantified using the Qubit® dsDNA HS assay kit. Variable region 4 (V4) of 16S rDNA was amplified and sequenced on MiSeq sequencing platform using dual-index strategy and following manufacturer's protocol. Sequences were then analyzed using Mothur version 1.39.4 and statistical analysis was performed using R version 3.3.2. Preliminary results from this study suggest that bacterial structure associated with scalp hair is significantly different from bacterial structure associated with pubic hairs. Bacterial structure associated with pubic or scalp hairs from human cadavers were not significantly different between male and female. All samples except one, included in this study were collected from Caucasian individuals and hence any difference in bacterial structure associated with race was not determined. In conclusion, this study provides evidence that microbial data associated with human hairs has tremendous potential in development of a quantitative tool for hair analysis.

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Y CHROMOSOME AND MTDNA DIVERSITY IN A FRENCH-CANADIAN POPULATION AND LESSONS FOR FORENSIC GENETICS

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Knowledge of the dynamic of sex-linked markers (on the Y chromosome and mitochondrial DNA [mtDNA]) is necessary for multiple areas of genetics including forensics. However, fine-scale estimation of

frequencies, i.e. relevant to a specific population of interest, remains a challenge, as these markers are sensitive to genetic drift and founder effects. This limitation impacts on the interpretation of DNA evidence. Typically, one assumes that 1) reference samples used to calculate match probabilities are representative of the populations of interest and 2) the genetic diversity is stable over time and space, but these assumptions may not be true. Our objective is to test this empirically using the French-Canadian population from Québec. Models combining genealogical and molecular data can overcome limitations associated to limited samples in order to obtain a reliable estimation of frequencies, making it possible to test above assumptions underlying DNA interpretation. Those models allow to obtain a much larger coverage of the population from a small genetic sample. By linking long-term genealogical data from the French-Canadian population of Québec to Y chromosome data from 429 men connected to this genealogy, we were able to impute a haplotype for up to 400,000 men who lived between 1608 (i.e. the foundation of the population) and 1960. Likewise, we imputed a mtDNA haplotype to 2 million individuals from 875 genotyped individuals. We then determined how haplotype frequencies have changed through time and space in the population. Analysis of mtDNA showed that haplotype frequencies were relatively stable through time, but that they weren't distributed homogeneously on the territory. Differences between sub-populations were sometime more important when looking at a much finer scale. Results from ongoing spatio-temporal analysis of Y haplotype frequencies will also be presented. Those results are determining for forensic genetics because they challenge the application of haplotype frequencies from national or international databases to specific caseworks.

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DIFFERENT ASPECTS OF HUSBAND ABUSE IN CASES REFERRED TO FORENSIC MEDICINE ADMINISTRATIONS

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Although domestic violence is a phenomenon that has been existed between different societies for a long time, but at present, it seems this problem has become more prevalent. The aim of this study was to determine the epidemiology of husband abuse in Fars Province referred to the Fars province general administration of forensic medicine from 2012 to 2014.This cross-sectional study was designed to study population consisted of all men referred to a Fars province forensic medical administrations from 2012 to 2014. The instrument for data collection was self-administered questionnaire that its validity and reliability was calculated. The data analyzed by statistical software SPSS version 23.0 and the differences were statistically important at 0.05.In this study, 117 cases of husband abuse with an average age of 27.6 ± 5.68 years were studied, with an average age of their wives24.2 ± 4.96 years. Among the women, 6 (4%) had a history of addiction, 43 cases of smoking tobacco and also 15 cases of alcohol were reported. The persecution methods included the 89.99% mental and emotional abuse, 67 cases (57.2%) of non-compliance, scratches in the 31.88% of the cases, throwing objects in25.27% of cases, 8.45 % biting and one case of caustic (acid). In examining the causes of disagreement and wife abuse, 41.32% of the cases mentioned involved families' parties, 35.91% financial dependence on the husband's family, 41.44% of the husband's emotional attachment to family and 11.12% of the financial dependence on his wife. Forty six case (39.55%) cases cited financial problems and in 27.20% of the cases also feeling betrayed and wife abuse was mentioned as a cause of dispute. The increasing prevalence of domestic violence of wives against husbands is concerning. The proposed strategy to reduce domestic violence against men, are useful education before marriage. Life skills education in schools, health centers and especially the media will be beneficial. Detailed examination of underlying causes and psychological violence (husband Battering) in more studies with higher sample size is suggested.

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DESIGN AND CONSTRUCTION OF DIGITAL DEVICES FOR MEASUREMENT OF THE VOLUME OF BODY ORGANS

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Weight and volumes of the human internal organs are usually considered as the main criteria used at the autopsy to differentiate normal organs from the pathological ones. So, any deviation from the normal range of weight and volume of organs are indicative of some pathological changes and also helps in finding the relationship with trauma or disease. Measurement of the amount of volume of body organs is also important in forensic medicine. Generally, for measuring the volume of Unknown material we can measure the equal the volume of water. After the desired object is put in the water, the amount of thrown water can be measured. This novel device applies laser system and analyze input data by a software and shows us organs' volumes in cubic millimeters (cc).This system includes two parts of software and hardware. The system specifies the law of a fixed volume of water. The hardware tank with two layers of middle insulation area and also double layer doors to prevent cold and warming it. The walls are made of stainless steel and are corrosion-resistant. To determine the volume of water in this case, the initial volume of water is increased when the organ is put in the water and the amount of increase in height of water is measured with laser system. Laser data output is analyzed by the system's software and actual volume of organs will be shown with one-hundredth of a cubic millimeter error rate.

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CASES SIMILARITIES: THE CRUX FOR FIRE INVESTIGATION SUPPORT AND KNOWLEDGE SUSTAINABILITY

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Fire investigation is an activity in which actionable knowledge is gained through long practice. Experienced investigators accumulate a rich repository of expert knowledge about physical phenomena and human behaviour, as well as investigative processes and forensic methods. When investigating a new case, they tap into their memory of expert knowledge, looking for useful similarities with past cases. Have I seen something like this before? Do I have an effective solution to this problem? Weaknesses or gaps in an investigator's knowledge can result in missed or misinterpreted evidence. To obtain the best results, it would be necessary to tap into the memory of each experienced file investigator these questions, because they each possess unique knowledge from different cases. More often than not, when an investigator with a huge expertise forgets some cases or leaves the forensic service, part (if not most) of this capacity to link cases is lost. We aim to address this issue by developing a knowledge management system (or KMS) able to retain and retrieve the expertise of fire investigators in the department over time. This project takes place within the operational activities of the forensic service of a Swiss police. Before developing the KMS system, the way fire investigators establish links between a new case and past cases is examined and deciphered, especially considering the way similarities are established. In order to find valuable similarities between cases, we took notes of each time an investigator mentioned a previous case during case investigation. Moreover we built a repository of past cases in which search queries made by investigators were automatically recorded in order to identify keywords they used to find useful cases. Analysis of these records show that keywords could be quite diverse depending of the case investigated, the question under investigation (i.e. technical defect or arson), the step of the investigation, and the investigator (i.e. expertise, personal knowledge). This research is a first step in our project. Being able to find past similar

cases can provide a strong support to fire investigation permitting the investigator to beneficiate from shared knowledge he does not possess himself. Moreover, it will warn against mistakes that could be reproduced.

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A CASE OF FATAL ABUSE OF A SIBLING AND SUB FATAL ABUSE OF A SISTER

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Child abuse is common in Iraq. Approximately there are 7-12 fatal cases referred monthly to Baghdad, In this report I describe a case of fatal child abuse in a 12 years old girl. and during examination we found various types of physical injury (blunt trauma, stab wounds, burn, shaving, biting and other) varying in age. 3 days prior to death she was presented to Baghdad teaching hospital with illness thought to be as acute abdomen, she died after laparotomy. We knew that she had a younger sister; we suspected that she had the same type of torture, so I decided to help her sister by having her brought for medical assessment. Physical examination of the living sister, revealed two types of signs of trauma: scars, and a chronic auricle hematoma (cauliflower ear) Notes: I have all the pictures for the cadaver and her sister.

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USING STRUCTURED ANALYTIC TECHNIQUES TO MITIGATE BIAS IN FORENSIC SCIENCE

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Like any other human endeavor, forensic science suffers from cognitive biases, thinking patterns that lead to irrational or illogical decisions. Numerous wrongful convictions have been shown to be the result of cognitive biases on the part of the police, attorneys, judges, and scientists. Although these biases have been pointed out in every aspect of forensic science, few agencies have taken the time to alter or adapt their policies and procedures to offset the biases their scientists labor under. The human brain makes mental models, or frames, to deal with the uncertainty in complex situations, like criminal investigations. Mental models are necessary for people to process what otherwise would be a bewildering torrent of information. Sometimes called heuristics, they allow people to be mostly right about most things and have served an adaptive evolutionary purpose: Rustling in long grass on the savanna usually means a predator, not a friend. In structure thinking, however, mental models can cause investigators to ignore or reject important information or to not seek out missing information. With greater experience (which tends to reinforce the mental models) comes a greater chance of rigid thinking and less of a chance for transparent thought processes. Mental models lead people to perceive information consistent with their existing beliefs over contradictory, although more accurate, data. People are often unconscious of key assumptions guide and support their decisions. Cognitive biases, such as only seeking out information that supports one hypothesis ("The husband is guilty."), are implicit in mental models and heuristics. The intelligence community has addressed these problems with a set of methods that re-formulate information, challenge pre-existing assumptions, and explore alternative hypotheses and interpretations. Collectively known as structured analytic techniques, these methods are used to help prevent intelligence failures and provide supported outcomes through transparent processes. This presentation will provide an overview of structured analytical techniques and how they can be applied to forensic processes.

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PCR - CAPILLARY ELECTROPHORESIS IS A NEW METHOD FOR FORENSIC DIATOM TESTING

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There are many water bodies in and around the cities of China. The diatom test is commonly used in the analysis of cause of death. The traditional diatom test is an acid digestion method, however, the diatom detection rate using this method is low, and the method has operational risks and is controversial. In this research we selected primers and used PCR-Capillary electrophoresis technology to detect the number of diatom species in organs with different tissue mass. PCR-Capillary electrophoresis technology was used to identify diatoms in lung, liver and kidney, and to assess the effects of these diatom species. From 20 randomly selected experimental rabbits, which were drowned in the same location, the liver, kidney and lung from each rabbit were removed and diatom DNA was extracted from the tissues of these organs and subsequently amplified by specific primers of the diatom SSU gene. The diatom DNA was then analyzed using PCR-Capillary electrophoresis. When the amount of biomaterial was increased, the number of diatom species detected in the lung, liver and kidney gradually increased, and was statistically significant ($P < 0.01$). Bivariate correlation analysis showed a positive correlation between the quantity and types of diatoms. The proportion of diatom species detected in each group varied. When the quantity was greater than 0.9 g in the lung, samples which included two or more types of diatoms predominated. When the quantity was greater than 1.5 g in the liver, samples which included one or more types of diatoms predominated. When the quantity was greater than 2 g in the kidney, samples which included one or more types of diatoms predominated. The number of diatom species found in different organs with different tissue mass was significantly different, and provides a reference for the detection of diatoms using PCR-Capillary electrophoresis technology. This technique also has potential in the forensic identification of drowning.

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THE ULTITLITY OF GC COUPLED TO VACUUM UV SPECTROSCOPY FOR THE ANALYSIS OF EMERGING DRUGS

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GC-MS and LC-MS are commonly employed for the screening and confirmation of emerging drugs. In this vein the analysis of positional and stereoisomers can be particularly difficult due to possible similarity in MS fragmentation, potential scarcity of information from fragmentation and in some instances the lack of molecular ion using electron impact (EI). Therefore a chromatographic separation and additional detection techniques becomes of utmost importance for the identification of emerging drugs. Vacuum ultraviolet absorbance (VUV) spectroscopy is a powerful tool for characterizing the vibronic transitions of organic and inorganic compounds in the wavelength region of 125-240nm. This technique has been limited to niche research applications, mostly due to difficulty obtaining high quality absorbance spectra in this wavelength region. Recent advances in vacuum ultraviolet spectroscopy have allowed for the first ever application of this technology to gas chromatography. VUV detection, unlike GC detectors such as the flame ionization detector or the thermo conductivity detector, provides both qualitative and quantitative information. Furthermore, this qualitative information is complementary to MS and allows for the deconvolution of co-eluting peaks. GC-VUV has been investigated for the analysis of 30 synthetic cannabinoids and 35 synthetic cathinones. The synthetic cannabinoids studied consisted of twenty-two controlled synthetic cannabinoids as well as nine positional isomers of controlled JWH-018. In addition, 35 synthetic cathinones were studied, including 15 controlled drugs as well as 20 positional isomers from 10 sets of positional isomers of the controlled drugs. For the emerging drugs, excellent, overall chromatographic performance was obtained for

methanolic solutions. The addition of sodium bicarbonate to the injection solvent allowed for direct injection of hydrochloride salts of synthetic cathinones. Most solutes, including positional isomers and diastereomers, gave unique VUV spectra. Distinctive VUV patterns would prove very useful in the analysis of sub classes of both synthetic cannabinoids and cathinones and other unknown drugs. In contrast to EI MS detection for co-eluting compounds, the deconvolution of overlapping peaks via VUV detection allows full spectral identification of co-eluting solutes. VUV detection is excellent for quantitative analysis of seized emerging drugs, especially for synthetic cathinones which exhibit R^2 values ≥ 0.999, with a concentration range of well over an order of magnitude, and with limits of detection in the low µg/mL range. This work demonstrates that GC-VUV is particularly valuable to aid in the identification of emerging drugs, especially as a complement to mass spectrometric detection for the identification of positional isomers and diastereomers.

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UPDATE OF AN MS/MS LIBRARY OF NPS FOR QTRAP® INSTRUMENTS

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Since their first occurrence in 2004 Novel Psychoactive Substances (NPS) have swept the European drug market. The EMCDDA has established an early warning system in which over 560 substances, classified into different chemical classes such as phenethylamines, cathinone derivatives, synthetic cannabinoids, piperazines and tryptamines, are currently monitored. Due to the fast growing and changing NPS market a spectral library is needed for identification of mass spectrometric data from unknown compounds. The aim of this study was to update the existing MS/MS library developed by Ambach *et. al*, with newly emerged NPS and further to be able to identify substances in seized material (pills, powders, blotters) as well as in blood, using low resolution ESI-MS/MS. Substances for the NPS library were chosen in alignment with the list "Referenzsubstanzen_September_2016" provided by the "Schweizerische Gesellschaft für Rechtsmedizin SGRM"- Fachgruppe Forensische Chemie". Spectra of reference material were recorded following an 8.5 min chromatographic run on a Synergi Polar-RP column (50 × 2.0 mm, 4 µm) (Phenomenex). MS/MS-spectra were acquired using a QTrap 3200 instrument (Sciex) with positive electrospray ionisation. Enhanced product ion (EPI) spectra were recorded with collision energies 20, 35 and 50 eV and with collision energy spread 35 ± 15 eV. Background subtraction was performed for all spectra before inclusion in the library. The library in its current version contains data for 387 different compounds, including phenethylamines, amphetamines, cathinones, piperazines, synthetic cannabinoids, tryptamines, opioids, designer benzodiazepines, dissociatives, and others including available metabolites. An updated version of the library will come available in April 2017 containing additional 161 substances. Of these 549 substances 280 are scheduled in the Swiss "Betäubungsmittelverzeichnisverordnung, BetmVV-EDI, Anhang e". The MS/MS QTRAP library has an online presence at www.legal-highs.ch. PDF files of spectra for manual comparison and reference will be available online and the database file for the use with the Sciex Analyst software is available for forensic and clinical laboratories from the authors upon request. This research was sponsored by the Swiss Federal Office of Public Health (BAG project Nr. 15.029013). Substances were generously provided by the "Referenzlabor" at the Forensic Institute Zurich and the Institute of Forensic Medicine Freiburg in the course of the Prevention of and Fight against Crime (ISEC) program of the European Commission (JUST/2013/ISEC/DRUGS/AG/6421).

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THE SOURCES OF CONTAMINATION IN THE FORENSIC DIATOM TEST

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The diagnosis of death by drowning is still difficult in forensic pathology, especially for the highly decomposed bodies found in the water. According to the findings from external examination of the body, autopsy and laboratory investigations, we can conclude a death by drowning. Diatom test has been regard as supportive evidence for the diagnosis of drowning. However, it is controversial, not only for its present in the non-drowning bodies and absent in drowning bodies, but also for the risk of possible contamination. Diatom is a group of unicellular algae which can be almost found in all the water bodies. The previous studies suggested that laboratory contamination may have been the reason why diatoms were found in the tissues of non-drowning cases. and some other forensic expert said the contamination is inevitable in the process of diatom test. In our laboratory, some contamination also occurred before. In this poster, we demonstrated some resources of contamination and provided solutions. Autopsy is the most difficult step to control the contamination because some coroners don't pay attention to it. Reusable scalpels, haemostatic forceps, gloves would be the potential diatom contamination sources. By standardizing the autopsy process for sampling tissues, it is easy to be avoided. For our novel Microwave Digestion-Vacuum Filtration-Automated Scanning Electron Microscopy (MD-VF-Auto SEM) method, all the instruments, except the digestive vessels of the microwave digestion system, are single-used and tested to make sure there are no diatoms with them. After each digestion, we use the hydrogen fluoride to wash the vessels to be free of diatoms. The reagent, actually, the nitric acid, is the last one that we found there are diatoms in it. In 100ml of nitric acid, there is one or two diatom(s). Fortunately, this situation is not found in all kinds of nitric acid. Changing another brand would be a useful way to solve this problem. and test the reagents to make sure they are diatom-free. We can achieve a more accurate result if we knew the potential contamination better. It is very useful for the application of diatom test in the diagnosis of drowning.

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DETERMINATION OF IGNITABLE RESIDUES ON VARIOUS TEXTILE MATERIALS BY SPME-GCMC TECHNIQUE

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Various ignitable liquids can be used in order to start or accelerate a fire. The detection and identification of their residues is a key step in solving arson crime cases. Besides the classical methods used for sampling and extraction of fire debris, solid phase micro-extraction has proved to be a rapid, convenient and efficient technique which can be easily used on field with either liquid or solid samples. The present work presents an investigation about identification of remaining fuel residues on various kinds of fabrics. For this purpose, a small amount of three common ignitable liquids used as fire accelerant (gasoline, kerosene or diesel) was poured on different textile samples made of cotton, nylon, polyester and wool. After their impregnation the textile samples were then investigated at different periods, from 30 minutes to 4 hours. The ignitable residues were collected by SPME using a polydimethylsiloxane fiber, then separated by gas chromatography on a capillary column and detected by mass spectrometry. Due to their higher volatility, the gasoline residues were present in lower amounts in all the substrates, while the kerosene and diesel constituents were more persistent and could be detected even after a longer period. These less volatile fuels could be clearly identified on the basis of their characteristic chromatographic profile, even several

hours after the fire. On the other hand, the evaporation rate of the ignitable material depends on the ambient conditions and also on the properties of the textile material. Thus, under the same conditions, the remaining hydrocarbons could be detected at higher concentration when impregnated on synthetic materials such as nylon and polyester than on natural textile like wool and cotton. This result could help to select the most suitable fire debris samples during an arson investigation. In addition, the conditions of fire residue sample storage and transport are important to obtain significant and reliable results.

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ENDOVASCULAR PROCEDURES AND HYDROPHILIC POLYMER EMBOLI: UNDER-REPORTED CONTRIBUTORS TO MORTALITY.

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Background: Endovascular procedures are employed for many diagnostic and therapeutic purposes; often offering a reduction of morbidity and mortality over comparable open procedures. Recognized risks of endovascular procedures include thrombosis, vascular wall injury/vasospasm, traumatic organ injury, and other mediators of ischemia/infarction (e.g. air embolism, calcific emboli). Hydrophilic polymer coating is used on many endovascular devices; allowing for improved procedural maneuverability and reduced vasospasm. However, there is increasing evidence that polymer coatings may dissociate during procedural manipulation, resulting in hydrophilic polymer emboli (HPE) to distal small vessels or capillaries. To better understand the incidence and associated pathologies of endovascular adverse events in our region, we designed a retrospective autopsy review where endovascular complications may have contributed to death, and correlated these findings with review of pre-mortem radiologic imaging. **Design:** We completed a regional pathology database search wherein the decedent had an endovascular procedure within 90 days of death, from 2010-2016. This search yielded 110 autopsy cases, with slides for review in 100 cases. Approximately 3500 glass slides were reviewed. Two Radiologists reviewed patient imaging during the interval between endovascular procedure(s) and death, assessing for radiologic evidence of procedural complications such as infarction. **Results:** The average patient age in the study was 64.5 years with 65% males and 35% females. Of the autopsies included in our study, 96% were unrestricted hospital autopsies including examination of the head, thoracic, abdominal and pelvic organs, while 4% were heart only. We identified 32 cases where the endovascular procedure likely had some contribution to death: 14 cases of major mortality contribution, 8 cases of minor mortality contribution, and 10 cases of uncertain mortality contribution. We identified histologic evidence of HPE in 23% cases with slides. The involved organs included: kidneys (n=13), heart (n=8), lungs (n=8), spleen (n=4), brain (n=2), liver (n=2) and single findings in the pancreas, colon, stomach and adrenal gland. Significant calcific emboli were found in one case. There was radiologic evidence of post-procedural infarction in 23% of cases overall, 22% of cases wherein the procedure likely contributed to death, and 26% of cases having HPE histology identified. Notably, HPE was only cited in 13% (3/23) of the original autopsy reports. **Conclusions:** Adverse events during endovascular procedures can significantly contribute to mortality. Specifically, we found hydrophilic polymer emboli are an under-reported, and likely under-appreciated, contributor to patient morbidity and mortality. We advocate greater awareness of this important and occasionally fatal complication of endovascular procedures.

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HOUNSFIELD UNIT VALUES OF BASIC LIVER PATHOLOGIES IN POST-MORTEM COMPUTED TOMOGRAPHY

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Background: In the last decade post-mortem computed tomography (PMCT) has been established as a useful adjunct to forensic autopsy. PMCT allows for describing radiodensity of liver tissue based on Hounsfield unit (HU) value measurements. Relevant liver pathology may alter liver radiodensity. The goal of this study was to evaluate if post-mortem HU values of basic liver pathologies differ to post-mortem HU values of healthy liver tissue. **Methods**: PMCT whole-body datasets of 300 forensic cases were analyzed retrospectively. Liver HU values were measured in at least 5 liver segments in each case. Mean liver HU values of each case were correlated with macroscopic and histologic findings as well as post-mortem interval, gender and age. **Results**: HU values of livers exhibiting severe steatosis or cirrhosis significantly differed to HU values of healthy liver tissue. Slight pathologies such as mild steatosis or fibrosis did not exhibit HU values differing to healthy liver tissue. Post-mortem interval and age of the deceased did influence liver HU values. **Conclusion**: Liver HU value measurements may be used to detect basic liver pathology such as cirrhosis and severe steatosis in post-mortem computed tomography.

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ESTABLISHMENT AND APPLICATION OF THE PCR CAPILLARY ELECTROPHORESIS SYSTEM FOR DIAGNOSIS OF DROWNING

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PCR detection of drowning related bacterial DNA from organs of drowning victims has attracted huge interest from forensic scientist in recent years. Herein, we established PCR Capillary Electrophoresis (PCR-CE) method for amplifying hemolytic genes in *Aeromonas hydrophila (A. hydrophila)* for freshwater drowning diagnosis. Results were evaluated with Microwave Digestion-Vacuum Filtration-Automated Scanning Electron Microscopy (MD-VF-Auto SEM) which is regarded as the classic method for drowning diagnosis. With *A. hydrophila* cells, the sensitivity for the PCR detection limit was 0.98 pg for isolated target DNA in the PCR system we established. 40 cases (36 were freshwater drowning victims and 4 were natural death on land) were amplified with *A. hydrophila* hemolytic genes (AHH) primer whose products were analyzed with PCR-CE. Only the *A. hydrophila* could yield PCR products with 127 bp size, whereas the results from PCR products of Human, *Candida albicans* and 16 algae species were negative. The detection limit for the hemolytic genes was 10fg DNA, and detectable rates for diatom from 36 drowning cases were 100.0%, 97.2%, and 91.7% in the lung, liver and kidney, respectively with SEM, and 97.2%, 63.9%, and 55.5% for *A. hydrophila*. The positive rates for diatom tested by MD-VF-Auto SEM and *A. hydrophila* test by PCR-CE in the systemic circulation viscera were 97.2% and 83.3% respectively, which granted high potential for *A. hydrophila* testing by PCR-CE.

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SEXING JUVENILE REMAINS: A TEST OF CURRENT METHODS

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The creation of an osteobiography is essential in forensic anthropology. Included in such a report is the sex, age, height, ancestry and other

skeletal observations. While many osteological methods exist to assess these attributes in adult skeletons, few methods are as successful in assessing juvenile remains, especially sex estimation. Current methods of juvenile sex estimation are imprecise, with low statistical support resulting in their exclusion in many analyses or difficulties in individual identity. Moreover, many methods that do exist to sex the juvenile skeleton are completed on known populations. Little data exists on the applicability of such methods on different populations of unknown sex and age. In order to assess the use of juvenile sex estimation methods, I applied seven sex estimation methods to 84 fetal and juvenile specimens from the University of Alberta Osteology Collection. Two morphological methods were applied to the mandibles, both a morphological and a metric method were applied to the crania, and a morphological method and five metric methods were applied to the os coxae. While the success of each sexing method cannot be discussed due to the limited knowledge of the collection, the results of each method were compared to assess the consistency of sex estimation methods. Overall, the assessments of the os coxae appeared to provide the most consistent results. This research emphasized that the application of methods for sexing juvenile remains still requires a great deal of work for use in forensic anthropology.

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PRELIMINARY STUDY OF LAMINATED GLASSES BASED ON NANOCELLULOSE AND PVB FOR SAFETY GLAZING

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Nowadays, the development of new safety glazing is required to fulfill request due to increase natural disaster (civil safety), military conflicts and unfortunately terrorist attacks (military security). For now, these glazing are laminated with separator sheets of a co-polymer of the poly (vinyl butyral) (co-PVB). However, this method involves heavy and thick glazing, which is expensive. Thickness directly impact transparency and vision's quality (haze) that are main drawbacks for armoured vehicles. Our project is focussed on the improvement of the transparency, decreasing the weight and the thickness of glazing by adding TEMPO oxidized cellulose gel (TOCgel) in the co-PVB. Firstly, we developed separator sheets based on TOCgel and co-PVB and secondly we laminated them between two glasses. The separator sheets' mechanical resistant examined by tensile tests whereas laminated glasses behaviour has been by compression tests. Light transmission measured every project phase. A number of manufacturing methods' separator sheets was set up. Among them, separator sheets based on nanocellulose (nano.) and those based on nanocellulose plus poly (vinyl alcohol) (nanoPVA$_{100}$ and nanoPVA$_{50}$) showed the best mechanics properties about tensile strength, with a Young's modulus 4.5 times upper to the co-PVB for a lower elasticity of 2.5 times only. As regard to optical properties, light transmission is about 93 % for all these samples. Concerning laminated glasses, mechanical compression experiments exhibit a breaking load well above 5 kN for both nano. and nanoPVA$_{50}$ separator sheets where as we observed a 5 083 N breaking load for co-PVB. In addition, nano.'s and nanoPVA$_{50}$'s surface mass are, respectively, 8 times and twice lower than the co-PVB. Regarding laminated glasses' light transmission, all samples achieve 80 %. Next steps will address characterisations of glazing such as infrared, ultraviolet and visible absorption, refractive index study and haze observation. Finally, we will launch a ballistic comparison campaign on laminated glasses (method vs. co-PVB). To conclude this nanocellulose laminated glasses could be used on much safety field as anti-bullet glazing, anti-intrusion glazing as well in armoured vehicles.

Disclosure: All authors have declared no conflicts of interest.

IMPLEMENTATION OF A STRUCTURED DATABASE TO ASSESS TRANSFER TRACES VALUE AT ACTIVITY LEVEL

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This presentation aims at introducing the state of advancement of a project granted since 2016 by the Canadian Social Sciences and Humanities Research Council (SSHRC). While forensic science is generally focussed on associating a trace to its source, its relevance generally requires addressing the activity responsible for its genesis. Recent studies have shown the potential of a likelihood ratio approach and the use of Bayesian Networks (BNs) in order to address activity level's propositions in a rational and transparent manner. As only few researches have been led to help practitioners' and lawyers' implement and understand these models, their relevance for Canadian forensic scientists can be even questioned in regards to the geographical origin and timeliness of these publications or available databases. In order to tackle this issue and help forensic scientist address activity level propositions, a thorough review of existing peer-reviewed publications and studies concerning glass, fibers, paint, bodily fluids, chemicals and geosciences' samples is presently conducted. The data are classified by different criteria such as the year of publication, type of transfer, experimental conditions, population, background and distribution studies as well as models of interpretation. Every publication is then evaluated according to its relevancy with regards to a Canadian environment. Areas of research to be filled in order to bridge the gaps on transfer traces are identified. In the coming months, a user-friendly database collecting these parameters on activity level assessment will be created. This database will be available for consultation for laboratories, police agencies, lawyers and universities. We believe that it can be a useful tool to quantify the weight of evidence at activity level, but also to induce transparency opinion and serve as a potential tool for educational purposes. This project will lead to a forensic interdisciplinary cooperation bringing together natural sciences and social sciences, welcoming willing national and international partners who would like to share their approaches and empirical data, for the benefit of the safety and justice of Canadian citizens.

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FORENSIC DOCUMENT EXAMINATION IN INTERNATIONAL HUMANITARIAN AND HUMAN RIGHTS CASES

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Forensic document examination may not be the first forensic science that comes to mind in matters of international humanitarian law and human rights investigations. Anthropology, forensic pathology, odontology, scenes of crime, DNA and related fields are sometimes thought to be the only specialisations that have relevance to such investigations. Yet even a limited review of the jurisprudence (judgements and trial transcripts) of international tribunals and courts such as the International Criminal Tribunal for Rwanda, the International Criminal Tribunal for the former Yugoslavia, the Special Court for Sierra Leone and the International Criminal Court (ICC) disclose many examples of disputed documents. These disputed documents cover the range of forensic document evidence including handwriting, signatures, stamp impressions and other issues. Forensic document examination may assist in addressing the question of command or superior responsibility, for example who did or did not order or command persons to carry out certain activities. Documents are often involved; either directly in the activities that may constitute serious violations of international law, or indirectly by purporting to account for events. Possibly complicating the situation is that disputed documents are not usually restricted to a crime scene or scenes unlike some forensic evidence which may be concentrated in one locale. There is also the possibility that document examination has a role to play in the reparation phase of international justice. As an example, the ICC has mechanism

whereby individuals found to be criminally responsible for crimes in the ICC jurisdiction may be ordered to make reparations to the victims (individuals or groups) of the crimes. In this regard, the issue of asset recovery and tracing may be an avenue where document examination has a contribution to make to international justice. Some of the challenges of conducting document examination in international investigations will be explained with suggestions on mitigating these challenges. Language is an obvious limitation when the script of the questioned documents is one that the document examiner is not familiar with. Language challenges are also present if any forensic report has to be translated into another language, not to mention interpretation done at trial. Given that many of the disputed documents are in the custody of entities that will not provide the originals to the laboratory, copy quality then becomes a significant impediment to many examinations. Against all of this are the general challenges of logistics and security which are intertwined with all of the above.

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MALDI TOF MS IMAGING AS A NOVEL TOOL FOR ESTIMATION OF POST-MORTEM INTERVAL IN MUSCLE TISSUE

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Objective: Estimation of post-mortem interval (PMI) is very important in the forensic sciences. Although many approaches have been used for estimation of PMI, accurate PMI calculations are still difficult. It is significant complicated and difficult to determine the post-mortem interval. The environment conditions and death causes are important factors to influence the estimation of post-mortem interval. Thus, new methods are required to improve the accuracy of PMI estimation. **Methods:** Here, we present a novel matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) method that can be used for the estimation of PMI using molecular images and multivariate analyses. We also carry out the traditional HE staining for the observation of changes in rat and human quadriceps femoris muscle at different PMIs. **Results:** In this study, we found that from a PMI of 0 h to 144 h, the fibers in the muscle cells showed progressive changes, including gradual swelling, disintegration, and fracturing. Transverse striations were obscured as the PMI increased. For the generated images, the peaks at *m/z* 1511, 1543, 1564, 1586 in rat muscle tissues, and 1597, 2133, 2559, and 3241 in human muscle tissues showed marked decreases in intensity between 0 h and 144 h post-mortem. Using genetic algorithm (GA), supervised neural network (SNN), and quick classifier (QC) methods, we built 6 classification models, which showed high recognition capability and good cross-validation. The histological changes in all the samples at different time points were also consistent with the changes seen in MALDI imaging. **Conclusions** MALDI IMS with PCA can be used to estimate intermediate PMIs based on protein or peptide signatures in both rant and human muscle tissue samples. The MALDI IMS data and the histological changes were well correlated. The classification models constructed can be used for the estimation of PMI.

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AN OUTLOOK OF THE FORENSIC ENTOMOLOGY IN COLOMBIA CONTRIBUTIONS FROM TECNOLÓGICO DE ANTIOQUIA

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The first reference about forensic entomology in Colombia date to 1947, then in 1999 this scientific area is activated by the first national Workshop at the National Institute of Legal and Forensic Medicine (INML-CF) and since 2000 a long list of studies have been published. In 2004 the law 206 about physical evidence was contextualized and found a legal framework. Thus insects were included as biological evidence in the procedures, chain of custody and the prosecution manual of the INML-CF. National development of the discipline was evident in the largest cities and focused on the ecological studies of necrophagous successional fauna and basis on carrion flies. Colombia is a Megadiverse country and inhabit a vast number of organisms with forensic importance due to the geographical extension, topography, climate and environmental differences of landscapes, these fauna requires more basic research in order to provide reliable data to apply in the legal context; in this sense we propose a coherent agenda to contribute to the current knowledge. The Ciencias Forenses y Salud Research Group from the Tecnológico de Antioquia had been follow the progress based in three guidelines. 1. Biological systematics (dealing with taxonomic regards, dealing with morphological and genetically data-Barcode, new species and phylogenies), 2. Bionomic aspects (lifecycles, synanthropy and autoecology) 3. The chorological and biogeographical aspects. Based on our results we aim to point and to lead the use of the complex predictive models of the decomposition ecology to contribute to the local and regional forensic entomology.

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USING BIOAFFINITY-BASED CASCADES FOR THE DISCERNMENT OF BIOLOGICAL SEX FROM FINGERPRINT SAMPLES

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Fingerprint analysis traditionally refers to the process of comparing fingerprint patterns by an expert and/or an automated fingerprint identification system. Currently, the analysis ends with this matching methodology causing the field to be dependent on the presence of a stored matching print or a matching print from an individual that is physically present. Due to this limitation, a latent fingerprint may be judged to be too smudged or smeared to be of use. What is often overlooked is that those latent prints are created by sweat and sebum emulsions excreted by the fingertips. Those emulsions have their own unique chemical compositions for each individual making them possible biological samples for analysis. Our lab has developed a bioaffinity-based cascade for the determination of biological sexes from the chemical composition of the sweat/sebum left as the latent prints. The research presented here addresses the current limitations in fingerprint analysis using a bioassay system that focuses on the components of fingerprints. Bioaffinity-based assays have been developed for the determination of biological sexes from those components. In one assay, L-amino acid oxidase was used to target the amino acids present in the sebum and sweat left on latent fingerprints. Further research has led to the testing of authentic fingerprint samples collected from various surfaces as well as the development of other bioaffinity-based assays capable of differentiating between biological sexes via less complex systems. Other bioaffinity-based assays will also be developed in the future for the determination of other physical attributes such as age group and ethnicity.

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PROACTIVE FORENSIC SCIENCE: INCREASING THE CONTRIBUTION OF FORENSIC SCIENCE TO COMBATING CRIME

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By applying "out of the box thinking" we are trying to increase the contribution of forensic science to combating crime. One approach which is both feasible and proven is the concept of "proactive forensic science". Forensic science for the most part is reactive and responsive to crimes which have already been committed. A proactive forensic science is a conceptual change, a fundamental shift in viewing the scope and endeavor

of forensic science. Proactive forensic science does not wait for a crime to be committed for it to be called into action. To demonstrate this new concept attempting to be one step ahead of the criminals, we have prepared a novel class of potential pro-drugs derived from the stimulant cathinone. These compounds have never been described in the literature before and to the best of our knowledge, have never been encountered on the illicit drug market. However, based on their easy conversion to cathinone, we recommend their inclusion in the illicit-drugs acts before they become a real threat. Authentic examples from other forensic domains which demonstrate the potential of the new concept will be presented and discussed.

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ASSESSMENT OF SIGNATURE HANDWRITING EVIDENCE BASED ON RELEVANT DYNAMIC FEATURES

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This paper extends on previous research on the extraction and statistical analysis on relevant dynamic features (width, grayscale and radian combined with writing sequence information) in forensic handwriting examinations. In this paper, a larger signature database was gathered, including the genuine signature, freehand imitation signature, random forgery and tracing imitation signature, which are often encountered in casework. This paper presents three major improvements compared to previous work: the signature database was enlarged to twenty groups and 1654 signatures; Probability density distributions were estimated to show the variability of between- and within-writer; Likelihood ratios were calculated based on the relevant dynamic features. After the extraction of width, grayscale and radian features, principle component analysis of the variables describing the proximity between specimens, a two-dimensional kernel density estimation was employed to demonstrate the variability of within- and between-writer. In order to simulate practical conditions, simulation cases were generated based on the collected signature dataset. Three-dimensional normal density estimation was used to estimate the numerator and denominator probability distribution used to compute a likelihood ratio. The performance validation indicated that the LR-based system developed in this paper could be coherent, robust and rigorous in forensic handwriting examinations. The research based on the systematic study of width, grayscale and radian features of signatures has increased the understanding of the selectivity and reproducibility of Chinese signatures. Compared with the performance obtained with the systems in SigComp2011 (based on static features), the system presented in this paper (based on relevant dynamic features), is much more discriminative and allow to guide robustly as to whether or not a questioned signature when compared to five known specimens is a genuine or a forgery. As emphasised in this paper, the dynamic features brings a significant contribution to this task. This paper have shown that the handwriting is not only a static image, but relevant dynamic information in the handwriting is important in the quantitative measurement and statistical analysis of forensic handwriting examination. The LR based approach presented in this paper, alongside with measured indicators of performance (through the calibration), proved to be effective and robust in the particular context of source attribution. This research is a further step that trying to strengthen the scientific basis for signature comparison and assessment in forensic signature examinations.

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IMPLEMENTATION OF A PROBABILISTIC GENOTYPING SOFTWARE (STRMIXTM): GETTING EVERYONE ON BOARD

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An increasing number of forensic DNA laboratories are now moving toward probabilistic genotyping, an approach that allows to assess the probative value of DNA mixtures previously considered too complex for interpretation. However, the transition to this approach can be challenging not only for the validation team, but also for the DNA analysts and their clients (police departments and legal representatives). Beyond the usual validation steps recommended, we present how our lab (LSJML, Montréal, Canada) managed to get everyone on board for a smooth transition. **We really got to know our software** We delved into the extended output of the software to analyze various elements. For example, we assessed the uncertainty around the contributor's proportions as determined in the deconvolution process. **We put our software to the test so we could truly trust it** The ability to exclude non-contributors is an important aspect for a probabilistic genotyping software. We compared two-, three- and four-persons DNA mixtures with 300 000 randomly generated non-contributors. We also made these comparisons using an incorrect number of contributors (n+1 and n-1). **We developed tools to help our DNA analysts** We developed graphic tools to help analysts detect anomalies when looking at run diagnostics. For example, a chart was created to evaluate if the average log (likelihood) is good enough for a given mixture. Also, in order to help DNA analysts to gain confidence in the software, the drop-out probabilities as evaluated "manually" were compared to those determined by the software. Results show that both sets of values are very similar, although the software values benefit from the continuous model. **We allowed the staff to become at ease with the software by having a "running-in" period prior to implementation** Although theoretical training sessions were given to DNA analysts, we feel that they really ascertained what probabilistic genotyping could bring them when they had the opportunity to use it in their caseworks during a trial period. **We developed a way to convey the meaning of the probative value to our clients** Depending on the DNA result and the set of hypothesis, the probative value can range from zero to decillions (10^{33}) or more. We thought it was important to convey the meaning of those numbers to the court, but were not satisfied with the option of a verbal scale. Instead, we created a visual scale showing the numbers obtained relatively to the inconclusive zone and the trillions and more.

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DEVELOPING DATA TO TRANSFORM DEATH PREVENTION: LESSONS FROM THE FENTANYL CRISIS

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The BC Coroners Service (BCCS) supports public safety efforts by collecting information regarding the circumstances of all non-natural and unexpected deaths, including all accidental deaths related to illicit drug use, to identify risks to public safety and trends over time. Illicit drug deaths in BC have increased each year since 2012, but beginning in the latter months of 2015, the number of deaths began to escalate rapidly. This accelerated increase sparked an urgency amongst government, public health, the public, and the law enforcement community for a swift response. To support prevention efforts, the Coroners Service was challenged to provide reliable, detailed statistics about drug death fatalities in as close to "real time" as possible. This presentation will detail how BCCS met this challenge and the resulting changes in death prevention strategies that ensued. Key to provision of timely data were three steps: first, using existing BCCS technology to create a new coding scheme that would identify suspected illicit drug deaths as they were happening, and

would answer important questions being raised by public health and harm reduction agencies. Second, conducting a data reconciliation using two data sources – information from the Coroners Service investigations, and data from the Provincial Toxicology Centre (which conducts all toxicology testing for BCCS). Third, the Coroners Service capitalized on its contract with the Toxicology Centre to allow for an innovative process of "expedited toxicology" in circumstances where the coroner's scene investigation supports illicit drug use as the cause of death. The preliminary information available from this expedited process, provided in a few days rather than weeks, provides the information necessary for the Coroner to determine that the death is related to illicit drugs and to know which specific drugs are involved. Unique in Canada, BCCS was able to identify to stakeholders in something very close to real time that illicit drug deaths were becoming a growing and major public health concern and that illicit fentanyl was a burgeoning force in these deaths. This has resulted in proactive harm reduction efforts on a scale not previously seen in Canada, ranging from significantly increased availability of naloxone to the creation of new "overdose prevention sites" in key locations, to a variety of public safety messaging. The Coroners Service has also launched an innovative Drug Death Investigation Team committed to gathering consistent comprehensive information about each illicit drug related death to further inform meaningful and evidence-based prevention measures.

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FINGERPRINT ANALYSIS: CHEMICAL RECOGNITION OF AMINO ACIDS FOR IDENTIFYING ORIGINATOR ATTRIBUTES

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Fingerprinting was introduced to the field of forensic science over a century ago and has since become common practice for identification purposes. However, this area has seen minimal improvements since its establishment; it has stalled at simple visual comparison and matching, even though fingerprints – as samples of biological origin analogous to blood – have the potential to provide much more information. While the traditional approach is well established, it is not always applicable, for example, when only partial or smudged fingerprints are collected. In cases such as these, the biochemical composition of the fingerprints would be more useful than the image. The purpose of the approach presented here is to address the issue of a partial or smudged fingerprint as well as this issue of not having an immediate matching image or DNA profile. It has recently been demonstrated using enzyme cascades and chemical assays that the amino acid content in fingerprints can be used to differentiate between male and female fingerprint originators. The research displayed here further investigates the use of straightforward chemical assays which are fairly well-known, especially in the field of forensic science as they are similar to field kits used for the on-site analysis of drug samples and chemical reactions used for fingerprint development. With any multi-analyte system, it is possible for multiple amino acids to correspond to the same attribute and, therefore, can compromise the overall results. To eliminate this possibility, it is important for systems to be restricted to one analyte (amino acid) or a specific combination of analytes that are correlated to the desired originator characteristics. To do so, a chemical assay that targets a small group of amino acids was developed prior to focusing on a single amino acid. To insure that the methods presented here are practical and can be used on samples left on more than one particular surface, research showing the performance of the system on samples collected from various surfaces is also provided. The developed chemical assays also have the potential to be coupled with a portable apparatus for use directly onsite where the assay can subsequently be performed and the results interpreted by non-scientific personnel. This can be done in a manner that is similar to water test kits and the VOCkit system which is a strip containing several dozen indicator chemicals and is used by the Army for the detection of chemical threat agents.

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INTERPRETATION OF TRANSFER TRACES AT THE ACTIVITY LEVEL: FIBERS EVIDENCE

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While forensic science is generally focused on associating a trace to its source, its relevance generally requires addressing the activity level of its genesis in a contextual approach. The objective of this research is to identify and review literature and available models for such an interpretation, critically assessing their pertinence for the Canadian environment with the aim to provide assistance to practitioners and lawyers for interpretation. The study of fiber is particularly interesting in the context of this research given the ease at which fibers can be transferred between a person and an object, or from person to person. Being able to infer not only the source but also the transfer' activity for a case would be of great use. Publications on fibers' transfer give indications as to the activity responsible for a transfer, and they also provide background and persistence information. Although so many parameters are impossible to know for sure for the case at hand, offering practitioners and lawyers an user-friendly database to understand the state of knowledge close to the disputed issue and to help them build their likelihood ratios model or Bayesian Networks relevant for the case, would not only favor transparency of expert opinion, but also identify future research to be initiated. Through a thorough review of existing on-topic peer-reviewed publications and studies concerning fibers, collected data were classified by different criteria such as the year, population, type of transfer, experimental conditions and proposed models of interpretation, followed by an evaluation of the relevance of each article with regards to a Canadian environment. In the coming months, a database available for consultation through various activity level parameters will be created. The present poster aims at presenting the state of progress of this branch of the research granted by the Canadian Social Sciences and Humanities Research Council (SSHRC) which includes glass, fibers and bodily fluids, followed by other transfer traces which will be covered this next year. It will lead to a forensic interdisciplinary cooperation bringing together natural sciences and social sciences for the benefit of the safety and justice of Canadian citizens. This database will also serve as a potential tool for educational purposes.

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CREATING REPONSES TO SEXUAL ASSAULT IN DEVELOPING COUNTRIES

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Physical evidence plays an important role in the investigation and prosecution of sexual assault cases. Without tangible evidence, allegations of sexual assault crimes are often a matter of different assertions of the victim and the assailant. This presentation discusses best practices and concepts used in sexual assault investigations in settings around the globe. Effective sexual assault investigation contains elements of public health and public safety practices. Treating patients who arrive as sexual assault or sexual abuse requires medical practitioners to give the patient, who is also a crime victim, proper medical and psychological care while being mindful of the need to adequately document the patient's trauma, wounds, torn clothing, and other findings to help law enforcement and prosecution authorities investigate and prosecute the criminal. These

goals must fit into an existing framework of legal, infrastructure, and societal settings if they are to work in a particular country. Sexual assault crimes require the cooperation and collaboration of a number of specially trained professionals: physicians, nurses, forensic nurses, social service personnel, victim advocates, police, forensic scientists, and prosecutors. Often law enforcement and legal elements are unfamiliar with medical and social services aspects of the crime. Communication with stakeholders is important. If a region has no sexual assault investigation expertise, practitioners should consider establishing informal stakeholder groups as a means of developing expertise and enhancing capabilities. Public policy must be developed along with starting discussions between practitioners. Legislation will be needed to establish an infrastructure to deal with sexual assaults within the framework of a region's social and political norms. A government agency within the Ministry of Health or Justice could be assigned to develop practices and protocols to be used in these cases. Such protocols and practices can include a list of questions to ask the crime victim, a standardized evidence collection kit, and a requirement to collect DNA evidence. DNA testing has proved exceedingly effective in sexual assault investigations. DNA testing can be more effective if national DNA databases are used; however, the implementation of such databases requires legislation. Some groups may voice concern about the government gathering genetic information on its citizens. Some regions may collect DNA on arrest, like fingerprints and photographs. In regions where there is relatively easy movement between countries, the use of DNA databases where results can be easily compared between different countries is a consideration.

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CONTACT MACERATION: NEW POST-MORTEM ARTIFACT

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Body recovered from water, shows macerated skin when body had been in the water for more than several hours. Maceration is identified as pale, swollen, wrinkled skin first found on areas like knees and elbow where skin is thickened and winkled. Prolong contact of skin with water leads to passive diffusion of water in to the skin. Similar appearance is seen in some parts of some dead bodies recovered on the land without subjected to immersion in water. Such bodies showed pale, wrinkled skin is seen in axilla, groin, between buttocks and places where two body parts had been in contact. They are sharply confined only to contact area with a definite edge. Most probable explanation is that sweat and prolong tight contact of two skins leading to maceration of skin. When clothes are wet due to rain, splash of water, rapid recovery of body soon after drowning, maceration is only seen on the skin which were in contact of wet clothes for a longer period. Even though, term "maceration" was recognized only related to bodies recovered from water by forensic medicine practitioners, in real practice, bodies which were not recovered from water also had shown maceration in some body parts where water or sweat had been in contact with the skin for a longer period in tight contact manner. Same mechanism and appearance of maceration can be expected in those bodily areas. Such condition can be named as "Contact Maceration" due to the requirements of tight contact and moisture in the form of sweat or wet clothes. By studying body area with contact maceration, forensic medicine practitioner can recognize the position of the body part which were in contact with another body part or wet clothe. Knowledge of this new post-mortem artifact will be helpful to avoid confusions of nonmedical death investigators in relations to discolored bodily areas as well as to identify the body positions and body areas which were in contact with wet clothes. In some cases, axilla shows contact maceration with light green discoloration probably due to early putrefaction in contact macerated areas owing to rich microbial flora in axilla. "Contact Maceration" is a new post-mortem artifact seen as pale, swollen wrinkled skin with a definite margin where two skin had been in contact or skin had been in contact with a wet cloth over longer period.

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STUDY OF THE IN VITRO AND IN VIVO METABOLISM OF THE TRYPTAMINE 5-MEO-MIPT

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Since their first occurrence in 2004 Novel Psychoactive Substances (NPS) have taken over the online drug market. The initial appeal of NPS was that these substances were legally and easily available via the internet and were untraceable by commonly used immunoassay drug tests. Since tryptamines undergo extensive metabolism, no or very little of the parent compound can usually be detected in urine. Hence, the identification of NPS metabolites is a crucial step in the development of bioanalytical methods for the detection of NPS consumption. The synthetic tryptamine 5-methoxy-N-methyl-N-isopropyltryptamine (5-MeO-Mipt) has recently been abused as psychedelic and hallucinogenic drug in Germany and Switzerland. However, it has not been scheduled in both countries, yet – although other tryptamine analogues are controlled substances. This study presents a case of 5-MeO-Mipt intoxication and the structural elucidation of metabolites in urine, blood and in in-vitro experiments in human liver microsomes (HLM). The obtained blood and urine samples have been analysed for *in vivo* metabolites of 5-MeO-Mipt using LC-MS/MS and LC-high-resolution-MS/MS (LC-HR-MS/MS). Further, microsomal incubation experiments have been performed using HLM to detect and identify *in vitro* metabolites. The pills and powder samples confiscated from the intoxicated subject were analysed for their composition using FTIR, GC-MS, LC-HR-MS/MS and NMR. 5-MeO-Mipt was identified in two of the seized powder samples using all four methods. Eight different *in vitro* phase I metabolites of the synthetic tryptamine 5-MeO-Mipt were identified. The metabolic steps observed were, demethylation and hydroxylation of the parent compound, yielding M8, M9, M10, M5 and M6 and desisopropylation and demethylation of the metabolites M5 and M6 yielding M1 and M4, respectively. Based on the results of the forensic case samples, five phase I metabolites could be identified in blood and eight in urine. The five most abundant metabolites were formed by demethylation and hydroxylation of the parent compound, yielding M5, M6, M8 and M9. Further, metabolites were formed due to N-dealkylation and oxidation (M1, M2), and two phase II metabolites (glucuronides) were detected in urine (M11, M12). The parent compound was detectable in both blood and urine using LC-HR-MS/MS. Based on the results of this study we recommend metabolites M5, M6, M9 and M8 as biomarkers for the development of new methods for the detection of 5-MeO-Mipt consumption, as they have been present in both urine and blood samples. This research received financial support by the Swiss Federal Office of Public Health (BAG project Nr. 15.029013).

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EXTRACTION BY DISPERSIVE LIQUID MICROEXTRACTION FOR DRUGS DETECTION BY HPLC AND GC-MS

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Among the different microextraction techniques which are introduced during the recent years dispersive liquid-liquid microextraction (DLLME) gained much attention because of its simplicity, short extraction time, less organic solvent consumption and low sample volume which required for extraction. Despite of these advantageous, the major drawback of DLLME is that its application is restricted to the liquid samples such as urine. Therefore extraction of drugs from complex matrices such as blood or tissue samples required a primary liquid-liquid extraction (LLE) in order to bring these samples into the liquid form. One of the most appropriate solvents which is used for LLE process is 1-chlorobutane. By using of

this solvent different classes of drugs could be extracted from biological samples more efficiently. In this work the advantageous of using of 1-chlorobutane as a suitable LLE solvent and DLME as a microextraction technique are combined in order to enhance the extraction recovery of different drugs from biological samples including blood, bile, liver and gastric content. For LLE process, the pH of all the biological samples were adjusted at 9.20 using saturated borate buffer, then 10 mL of 1-chlorobutane was added and solution was shaken for five minute. After centrifugation for 5 minute at 3000 rpm the 1-chlorobutane layer was collected and back extracted using 5 mL of 1M of HCl. The aqueous layer was collected after 5 minute centrifuge at 3000 rpm and was basified with concentrated ammonia to pH 10. The DLLME was performed using a mixture of methanol: chloroform (2:0.3 v/v) as disperser and extracting solvents respectively. The obtained solution was centrifuged for 5 minute at 3000 rpm and sedimented chloroform was collected and evaporated to dryness under a stream of nitrogen. The residue was reconstituted in 30 µl of methanol and injected into the HPLC and/or GC-MS. The extraction recoveries were between 0 and 90% and obtained chromatograms were clean.

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IDENTIFICATION OF MEDICINAL PLANTS IN ILLEGAL TRADE THROUGH DNA BARCODES

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In biological sciences, comparisons of DNA sequences are an important facet of molecular phylogenetics and population genetics. The short nucleotide sequences of certain genes present in chloroplast or nuclear genome of plants play an eminent role in enforcing CITES and other National legislations which are functioning as regulatory bodies of medicinal plants in trade. There is an urgent requirement to develop Plant DNA barcode libraries and evaluate various parameters regarding quality evaluation of herbal drugs which can be adopted by forensic science laboratories to ensure accurate identifications of confiscated plants/parts or products in trade. The present study was designed to investigate the ongoing under cover trade in four different states of India famous for local herbal markets. So, an attempt has been made to develop DNA barcode database of important medicinal plant species of India. The developed database was then utilized to identify the plant product traded by various herbal markets. Herbal powders of restricted plant species were collected from the local markets of four north Indian states and compared with the developed DNA database. Reference plant species were collected from 4 different states of India. DNA extraction was carried out through column based kits (Macherey-Nagel, Qiagen) and CTAB method. Direct amplification from FTA paper was attempted to reduce the cost involved in the procedure. ITS2, matK, Ycf1 and rbcL genes were amplified using conventional amplification kits and universal primers. Sequence alignment and phylogenetic analysis was carried out using open source software. Results indicated that most of the samples collected from herbal market (68%) were from species other than labelled species. Only 32% of the samples were found to be authentic based on DNA sequence comparison. It was observed that two-third of samples were mislabeled with related/similar appearing species of the specific plant sample. The uncontrolled illegal trade of medicinal plants is susceptible to substitution and adulteration. DNA bar coding technology posses the potential to regulate as well as monitor these undercover illegal trade practices across national and international borders and play a pertinent role in effective enforcement of regulatory laws.

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KILLINGS BY THE POLICE IN FINLAND 2000-2016

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Police rarely kills people in Finland. In the years 2000-2016 seven persons were killed by the police. Of those persons six were killed with a firearm and one died of a natural cause with the use of an electroshock weapon as a contributing factor. During those same years two policemen were killed and one student policewoman was seriously injured in the line of duty. Outcomes of all the cases are analyzed.

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POST-MORTEM DRUG LEVEL INTERPRETATION USING PHARMACOKINETICS AND STATISTICS

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Abstract: A post-mortem drug level can be converted to an antemortem prediction interval if both antemortem and post-mortem levels are available on the same individuals. Little research has been done in this area with post-mortem levels all too often interpreted as toxic when in fact there are large differences between antemortem and post-mortem levels done by the same analytical methodology. The importance of knowing the difference between analytical results on blood, plasma, or serum are also demonstrated. To properly interpret post-mortem levels, the following steps are warranted: 1. Must first check to see if there is a difference between drug levels taken before death or very shortly thereafter to levels taken at autopsy or levels that differ between heart and femoral blood, 2. Must make a prediction or tolerance interval (prediction interval for the population) for the antemortem level based upon post-mortem levels, 3. Must know the patient's dose of medication, 4. Need to simulate drug levels based upon pharmacokinetic parameters such as dose, maximum drug concentration (C_{max}), volume of distribution, fraction of drug absorbed, half-life, route of administration, and absorption rate constant, where applicable, 5. Must take into account population variability by calculating a population prediction interval. The methodology is demonstrated for two different drugs, amphetamine and sertraline. A simple linear regression model on the logarithms of the antemortem and post-mortem levels was used for the conversion of post-mortem level to antemortem level and population prediction interval. Average drug levels were simulated based upon published studies for the patient's doses. Population prediction intervals were calculated on C_{max} values since they are lognormally distributed. The prediction intervals are then extrapolated to the rest of the drug level concentration-time curve. The two prediction interval sets are then compared to look for overlap. The prediction intervals can be thought of as an approximate probability for the next individual to be contained in that interval. If the two calculated intervals overlap, one can be reasonably confident that the individual was taking the medication as prescribed. If the intervals do not overlap, then the individual took a lower dose than the prescribed dose, antemortem-post-mortem differences exist, or the individual took an overdose which should be verified by pharmacy records and medication counts.

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CATEGORIZATION OF CHILD PORNOGRAPHY DIGITAL IMAGES

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Police investigations of child pornography are increasingly related and dependent on the analysis of digital files. Equipment such as desktops, laptops, cameras, smart phones, pen drives, among others, can store

thousands and even millions of images that should be analyzed to identify children or teenagers at pornographic scenes or victims of sexual abuse. Therefore, it is necessary to estimate the age of the people found in the images without having any contextual information, i.e., only using macroscopic elements as proportionality between the members and organs, or others physical elements. Frequently, it is not possible to say that a certain person has less than eighteen years old, especially in cases where there are teenagers since they have already reached a body development level that can often lead to an incorrect age estimate. Moreover, images do not show many parts of the body, face or, when they show, can be at unfavorable angles, or have low quality. Faced with this difficulty, the author suggests categorize the images found in three groups: i. Child pornography files: there is absolute certainty of the participation of children or adolescents, i.e., there is no doubt that the content of these files is child pornography. ii. Files suspected of containing child pornography: there is doubt whether it is a child or adolescent and not an adult. However, due to the difficulties in determining the age of those involved, it is not possible to report with absolute certainty the involvement of minors. iii. Files that do not contain child pornography: images not related to child pornography. The big question in this matter is how to have the absolute certainty of the involvement of minors to classify the suspicious files in the category *(i)*. In practice, such a decision is not as complicated as it sounds: child pornography files involving babies and children are easily identifiable by anyone, and there is no doubt that the person in the image is a minor, being easily classified under the category *(i)*. When there is teenager, who may already have pubic hair and developed body, it is usually more difficult to determine if such person is 13 or 18 years old. In those cases, where there is any doubt whether at least one of the parties involved is a minor, such files should be included in the category *(ii)*. All other non-suspect files will be in the category *(iii)*.

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QUALITATIVE AND QUANTITATIVE ANALYSIS OF BUPROFEZIN IN BLOOD SPECIMENS

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Buprofezin is an insecticide used for control of insect pests such as mealybugs, leafhoppers and whitefly on vegetable crops. It is a growth regulator, acting as an inhibitor of chitin synthesis. It is being especially toxic to aquatic organisms as well as non-target insects. It has been widely used in rural China and therefore related cases of poisoning or suicide have occurred frequently. At present, common detecting methods of Buprofezin are mostly used in the field of pesticide residues, and the samples are mostly soil, vegetables and fruits, excluding biological materials. In this study, we establish an analytical method has been developed for the identification and quantification of buprofezin in blood specimens. Human blood samples were extracted by ethyl acetate, the extracts were analyzed by GC-NPD and GC/MS(EI). It was demonstrated that the linearity was obtained in the concentration range of 0.1~10.0μg/mL with a correlation coefficient of 0.9982.The average recoveries of the proposed method ranged from 80.0%~98.0%.The limit of detection is 0.03μg/mL. The relative standard deviations of within-day and between-days were less than 8%.The proposed method is simple and accurate, which can be used in monitoring of buprofezin in blood specimens.

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EXAMINATION OF WRITING INKS VIA ANALYTICAL METHODS AND MULTIVARIATE ANALYSIS

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In this study fifty seven blue ballpoint pen ink samples were characterized by Attenuated Total Reflectance Fourier Transform Infrared Spectroscopy (ATR–FTIR) and discriminated on the basis of high performance thin layer chromatography (HPTLC) and ATR–FTIR spectroscopy. The method is coupled with multivariate analysis. This approach has proven out to be an effective tool for characterization of complex ink formulation and hence, ink's systematic discrimination with the help of multivariate analysis. The overall discrimination for blue ballpoint pen ink with non–destructive analysis of ATR–FTIR come out to be 99.69%, which is highly significant in comparison to both visual inspection of the spectra (DP = 97.93%) and destructive HPTLC chromatography (DP = 93.80%). The similar methodology can be applied in the real case work of forensic laboratories to check whether two entries of ink on a sheet of questioned document have a common origin or not. The low cost of analysis, handy operation, non–destructive, reliable and high resolution make this method a choice of instrument for forensic questioned document examination.

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DEVELOPMENT AND IMPLEMENTATION OF HUMAN REMAINS PROCUREMENT PROTOCOL AND DOG TRAINING PROGRAM.

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In the search for missing or clandestine human remains the field of Human Remains Detection (HRD) requires a multidisciplinary, scientific approach to specimen procurement and scent dog training protocol. The complex chemical signatures of decomposing human remains suggests the importance of utilizing an accurate representative sample, that would not include animal specimens, for imprinting and training speciality scent detector dogs. These chemical signatures vary between individual human remains, as well as between specific human specimens from the same individual. In lieu of access to scientific research facilities capable of housing entire human specimens, such as a body farm, the Nova Scotia Medical Examiner Service (NSMES) has devised a donation and procurement program in order to collaborate with the Royal Canadian Mounted Police (RCMP) dog and handler team for training purposes. The initial phase of this project began in April 2015 and highlighted the need for multiple variables to be taken into consideration. Along with training in a multitude of different environments, weather conditions, and search parametres; understanding the chemical complexities of decomposing human remains resulted in the development of additional specimen procurement research. For this secondary phase, three separate donors were chosen and received multiple specimen collection in an attempt to reproduce a representative sample of complete human remains on a smaller scale for HRD dog training. The collection of this representative sampling was undertaken in order to replicate potential complete human remains encountered at a death scene. An analysis of the procurement program through the NSMES suggests that human remains donation is well received in a unique multi-agency cooperative initiative, which could be expanded nationally.

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ANALYTICAL METHOD COUPLED WITH MULTIVARIATE ANALYSIS FOR EXAMINATION OF PHOTOCOPIER/WRITING PAPERS

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The present work explores the non-destructive application of ATR-FTIR technique for characterization and discrimination of 24 writing office paper samples purchased from the northwestern region of India. Three different regions of IR, i.e. 400-2000 cm^{-1}, 2000-4000 cm^{-1} and 400-4000 cm^{-1} were selected for differentiation by multivariate analysis. The discrimination is achieved on the basis of three principal components, i.e. PC1, PC2 and PC3. It is observed that maximum discrimination was procured in the wave number range of i.e. 2000-4000 cm^{-1}. Discriminating

power was calculated on the basis of qualitative features as well, and it is found that the discrimination of paper samples was better achieved by multivariate analysis rather than qualitative features. The discriminating power by multivariate method is 99.93 % and which is larger as ever achieved by any group for a present number of samples. Characterization is achieved by matching the peaks with standards of cellulose and inorganic fillers, usual constituents of paper. The present inexpensive analytical method can be most suitable for applying to the routine questioned/suspected document examination in forensic laboratories for the authenticity of paper because of its non-destructiveness nature, need no sample preparation, easily available, provides reliable and repeatable results make the present method is a choice of facilities for questioned document examination.

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25I-NBOH: AN ELUSIVE NPS FOUND IN BLOTTER PAPER SEIZURES IN BRAZIL

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Shortly after many members of the NBOMe drug family being prohibited in Brazil, forensic laboratories around the country started to receive seized blotter papers where 2C-I was detected by gas chromatography–mass spectrometry (GC–MS). Quantification analyses, however, demonstrated that 2C-I concentrations on those samples were much below the reported usual dosages, 14-22 mg. This inconsistency prompted a more detailed analysis. Liquid chromatography–quadrupole time-of-flight-mass spectrometry (LC–QTOF-MS), nuclear magnetic resonance (NMR) and Fourier transform infrared (FTIR) techniques were used to achieve a complete structural characterization of the new compound. Preliminary LC–QTOF-MS analysis showed a total ion chromatogram with one peak at 8.519 min. However, the ESI mass spectrum showed two exact mass ions: m/z 308.0142 $[M+H]^+$ (2C-I) and m/z 414.0561 $[M+H]^+$. Personal compound database and library (PCDL) search suggested that the heavier ion, compatible with the molecular formula of $C_{17}H_{20}INO_3$, represented the compound 2-({[2-(4-iodo-2,5-dimethoxyphenyl)ethyl]amino} methyl) phenol (25I-NBOH). Lowering the fragmentor voltage (FV) to less than 110V prevent the lighter ion (2C-I) to form. This finding combined with CID analyses suggested that the lighter ion, which coeluted with 25I-NBOH, was in fact an analysis artefact produced by 25I-NBOH degradation in the GC–MS injector and also in LC–QTOF-MS routine analysis when FV was set at 110V or higher. FTIR and NMR analyses helped to complete the characterization of this NPS present in the seized blotter papers. **Funding and supporting agencies** PCDF, PTC-GO, IC-PCMG, FPCIAA, FAPDF, FAPEG, UFG, PUCMG, University of Lincoln.

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SCIENTIFIC EVIDENCE OR JUNK SCIENCE

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There has been a continuing reference in recent years to at least some of the forensic sciences being "junk science." This presentation will challenge that description and will be a somewhat philosophical discussion of the basis for that challenge from the personal perspective of almost sixty years as a forensic scientist observing the use and misuse of science in the criminal justice system in Canada. The basic thesis will be that what is often referred to as "junk science" can be more accurately described as "junk testimony." An early use of the term "junk science" was in Peter Huber's 1991 book "Galileo's Revenge" where he described it thus: "Junk science is the mirror image of real science, with much of the same form but none of the same substance." A damning indictment indeed, but was it really science he was concerned about? What Huber described as "junk science" can arise from several sources including simple misunderstanding, unfounded concepts, inadequate methodology, poor performance, premature conclusions and - it must be acknowledged - occasional professional dishonesty driven by greed or - more frequently - ego. Each of these will be discussed more fully. Science is a process not a product. It consists of gathering information by careful observation, formulating a hypothesis based on that information, testing it through carefully designed experiments, accepting, modifying or rejecting the hypothesis and - often overlooked - periodically reviewing it. Scientists are keenly aware of the often tentative nature of their conclusions. Some non-scientists may consider science to be a body of facts which, once established, are embodied for evermore in the corpus of knowledge. Not so. Unlike legislative laws, which are instructive and lose nothing in being disobeyed, scientific laws are descriptive and are destroyed by one disobedient fact. The essence of science is a willingness to change beliefs in light of the evidence. As the 1993 report of the Carnegie Commission on Science, Technology and Government stated: "At the moment, the parallel paths of scientists and lawyers obey the rules of Euclidian Geometry and when they do cross, the result is often misunderstanding rather than constructive communication". There may be some merit in the two parallel paths not intersecting (or colliding), provided that, like the two parallel strands of the DNA molecule there are periodic cross-linkages which serve a specific function. My objective will be to provide an A, T, C or G to this topic.

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INVESTIGATION OF DIFFERENT SWAB TYPES FOR COLLECTION OF BIOLOGICAL SAMPLE FROM VARIOUS FABRICS.

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A wide variety of physical evidence can be collected at a crime scene that is deemed probative for collection and investigation: biological evidence, trace evidence. While material and manufacturing advances have resulted in a diversity of new materials, sampling and extraction efficiency from them varies significantly by substrate and sample type. The loss of biological material (i.e. DNA) for downstream processing can be 40 - 80% from the extraction process alone. Luna Innovations has therefore developed a unique nanofiber biospecimen capture material that dissolves in standard cell lysis or DNA extraction buffers. The unique nanofiber morphology results in high biospecimen capture, while dissolution allows for extremely high biospecimen recovery – both critical aspects for accurate analysis following forensic sample collection and processing. This material has been evaluated to determine the effectiveness of high surface area, dissolvable electrospun nanofibers on forensic sample collection and DNA recovery. Using prototype swabs compared to traditional cotton and flocked swabs, experiments were conducted that evaluated adsorption of high and low volumes of biological material (blood and dried cells) from glass slides and other porous surfaces, and subsequent DNA extraction using commercially available kits. DNA extraction was conducted using the Thermo Fisher MagMAX DNA Multi-Sample Kit or Thermo Fisher PrepFiler Forensic DNA Extraction Kit. The Quantifiler Human DNA Quantification Kit in conjunction with an QuantStudio 3 Real-Time Polymerase Chain Reaction (PCR) instrument was used to estimate the quantity of human DNA present in each sample.

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INTERPRETATION OF TRANSFER TRACES AT THE ACTIVITY LEVEL: GLASS EVIDENCE

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While forensic science is generally focused on associating a transfer trace to its source, its relevance generally requires addressing the activity level of its genesis in a contextual approach (quantitative transfer, persistence, recovery). Regarding glass fragments, besides their physical and chemical association between question specimen and comparison samples, the relevant parameters to address the activity level include random occurrence on analog supports, nature of the donor pane or object and the receiver matter, type of glass, number of glass fragments and groups, time and strength of contact, efficiency of the collection method, etc. Although so many parameters are impossible to know for sure for the case at hand, offering scientists and lawyers an user-friendly interface to understand the state of knowledge close to the disputed issue and to help them build their likelihood ratios models or Bayesian Networks relevant for the case, would not only favor transparency of expert opinion, but also identify future research to be initiated at activity level. The objective of this research is to identify and review literature and available models for such an interpretation, critically assessing its pertinence for the Canadian environment with the aim to provide assistance to forensic scientists and lawyers for interpretation through a user-friendly database. In order to create such a database, a thorough review of existing on-topic peer-reviewed publications and studies concerning glass particles has been conducted. The data was classified by different criteria such as the year of publication, type of transfer, experimental conditions, population, background and distribution studies and models of interpretation. The relevance of each article with regards to a Canadian environment has been evaluated. In the coming months, a database available for consultation through various activity level parameters will be created. The present poster aims at presenting the state of progress for the glass section of this research granted by the Canadian Social Sciences and Humanities Research Council (SSHRC), beginning with glass, fibers and bodily fluids, as other transfer traces will be covered in this next year. It will lead to a forensic interdisciplinary cooperation bringing together natural sciences and human sciences for the benefit of the safety and justice of Canadian citizens. This database will also serve as a potential tool for educational purposes for forensic scientists, police officers and lawyers.

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ACCESSIBILITY AND UTILIZATION OF HEALTH INFORMATION SERVICES ON WELLBEING AMONG PRISON INMATES

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The study assessed the accessibility and utilization of health information services on psychological wellbeing of prison inmates of medium prison, Makurdi, Benue State Nigeria. The study employed cross sectional survey method. The participants comprised 330 (67%) males and 161(32.8%) females. Their age ranged from 20 to58 years with mean age and SD of 36.4 years and 7.50 respectively. Health information system schedule (HISS), health services utilization inventory (HSUI) and mental health symptom checklist (MHSC) were used for data collection. Three hypotheses were generated and tested using regression analysis. It was found that health information system has no significant influence on psychological wellbeing of inmates. There was a significant positive relationship between health service utilization and psychological wellbeing. The revealed a significant joint influence of health information system and health service utilization on psychological wellbeing among prison inmates. Based on these findings, it was recommended that management of Nigerian prisons should encourage inmates to utilize the health care facilities available to them without fear so as to promote their physical and psychological well-being. Also, government should provide adequate health facilities in our prisons to promote the mental and general well-being of inmates.

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INFLUENCE VARIABLES ON THE AUTOMATED BALLISTIC COMPARISON EFFECTIVENESS

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When a crime is committed with a gun, forensic experts may have to match fired bullets and cartridge cases from the scene with each other, or with a firearm. In order to improve the time spent in the comparison process and to properly deal with open cases, forensic labs all over the world have tried to implement electronic systems able to perform automated ballistic comparisons, and so is the case with the Brazilian Federal Police. To assess the feasibility and accuracy of a future National Ballistic Database in Brazil, a reference database was implemented with test fired bullets and cartridge cases from pistols and revolvers. The hit-list for 1008 controlled comparisons involving .38SPL samples, and for 900 controlled comparisons involving 9mm Luger samples, were used to derive the quantitative effectiveness criterion of the system regarding ammunition features, revealing ammunition type which must be used in order to guarantee a higher effectiveness criterion and consequently the best correct gun identification probability. For .38SPL revolvers was observed that projectiles Brinell Hardness have huge influence in the system effectiveness, and so is the case with barrels type of 9mm Luger pistols. Of the controlled variables, regarding cartridge cases, none was observed as affecting meaningfully the system effectiveness. Additionally, the experiment was duplicated by engineering students of the University of Brasilia and once more the effectiveness criterions has been calculated. This procedure aimed at investigating if this type of database should be only handled by forensic experts as compared to personnel without any previous training in firearm identification. In the system studied only the projectiles secondary marks assignment procedure showed to be sensitive to the operators expertise.

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APPLICATION OF NANO MATERIALS FOR LATENT FINGERPRINTS DETECTION

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Fingerprints exhibit unique features for individuals identifications. But fingerprints left in the crime scene are usually invisible. With the development of nanotechnology, nano-sized and nanocomposites materials are highly attractive for latent fingermarks enhancement due to their ultra fine size and good functional features. In our studies, magnetic nanopowders and fluorescent nanocomposites were prepared by environmentally friendly and effective procedures (only several minutes), and the products were successfully used as developing powders for latent fingerprints detections. As-prepared nanomaterials were characterized using UV-visible absorption spectroscopy, fluorescence spectroscopy, infrared spectroscopy, TEM/HRTEM, SEM and XRD. After developing by as-synthesized Fe3O4 nanopowders, no matter on the painted metal or glass surface, the developed prints showed clear ridges and good contrast, even for the minutiae and pores. Our novel magnetic powder is uniform

and well-distributed (~90 nm), which could be applied to some porous surface even for rough surface. Filter paper and experimental table with tiny raised dots were taken as a rough surface, the obtained prints showed consistently ridge details and with little background staining. Furthermore, novel nitrogen and sulfur co-doped carbon dots@montmorillonite (C-dots@MMT) nanocomposites were also obtained by in short time (less than 20 minutes). These granules are around ball shape and possess fine uniform size, which is beneficial for latent fingerprints developments. The as-produced fluorescent powders were applied by brushing technique. As a result, strong contrast as well as clear and distinguishable ridge details were obtained. Due to the unique photoluminescence properties, the as-prepared fluorescent powders can be widely used to detect latent fingermarks deposited on various object surfaces, such as painted metal, glasses, plastic etc., especially for the surfaces with complicated colors. Satisfactory patterns and ridges with a bright violet-blue fluorescence were presented under UV light (365nm). Due to their good sensitivity, low cost and strong resistance to background interference, the as-prepared Fe3O4 magnetic nanopowders and C-dots@MMT fluorescent nanocomposites powders lead to satisfactory results with a facile operation which are actual alternatives to conventional powdering reagents. Furthermore, these nontoxic powders without any organic solvent and dyes can reduce the harm for the operators. Our on-going work will focus on these doped functional nanocomposites and exploring their applications in forensic chemical detections.

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BRAINSTEM AND CERVICAL SPINE IN ABUSIVE HEAD TRAUMA: A REVIEW OF THE SCIENCE AND THE CONTROVERSIES

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When direct impact is obvious, the pathologic mechanisms of lethal infantile blunt head trauma are much less difficult to evaluate, and significantly less controversial upon which to opine. However, allegedly non-impact (i.e. shaking) head trauma cases are extremely complicated and contentious. The "triad" of Shaken Baby Syndrome remains a topic of discussion, and experts debate the significance and pathophysiology of subdural hemorrhages, retinal hemorrhages, and anoxic encephalopathy, when found in concert. Research over several decades implicated brainstem and proximal cervical spinal cord injuries as core components of hyperflexion / hyperextension trauma. However, subsequent research suggested that previously unrecognized cervical nerve injuries may (a) serve as markers of severe whiplash, and/or (b) help to explain the pathophysiology of the triad. Despite facing tremendous scientific quandaries, forensic pathologists are often required to offer expert opinions about alleged head trauma in cases of suspected criminal infant death. Fundamental to the capacity to offer such medical judgements is a depth of understanding of the anatomy and core pathology of the brainstem, cervical spinal cord and nerve roots, and the controversies / criticisms of the major paradigms of abusive infantile head trauma. Furthermore, it is critical that forensic pathologists who perform pediatric autopsies possess knowledge of the autopsy and histologic techniques necessary to evaluate the infant brainstem and cervical spine. Inexperienced pathologists facing evaluation of such complex specimens should strongly consider consultation before offering any opinions on the significance of apparent pathologic findings, particularly those located in any anatomic segment of the cervical spine.

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DEATH DURING INDIGENOUS TREATMENTS: CHOKING WITH A HALF OF LIME

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Thirty-six years old female was suffering from convulsions decided to follow indigenous treatments. After beating with a coconut flower by the indigenous practitioner, a lime was cut over the mouth. Indigenous practitioner told patient to swallow the cut lime, put cut pieces in to the mouth and pushed deep with the cutting instrument. She struggled and found to be dead. During the post-mortem examination, multiple patterned contusions due to coconut flower and abrasions were found externally. Larynx was obstructed with half of a lime. This case shows that conscious female adult also can die due to choking if a food particle is forcefully pushed deep in to the mouth. Magistrate had returned the verdict of homicidal choking. This case shows a fatal complication of indigenous treatments warrants health education and regulations on indigenous treatments.

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TWO CASES OF NON COMPACT CARDIOMYOPATHY FOUND AT AUTOPSY IN SRI LANKA

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Even though different types of Cardiomyopathy are sometimes discovered during post-mortem examinations of sudden deaths, one type named "Non-Compact Cardiomyopathy" (NCC) is very rarely found during medico-legal practice. NCC is a myocardial disorder, which is thought to occur due to the failure of left ventricle (LV) compaction during embryogenesis resulting two-layered ventricular wall, comprising a thinner compact epicardial layer and an inner non-compacted layer, with prominent trabeculations associated with deep, intertrabecular recesses that communicate with the ventricular cavity but not with the coronary circulation. Author had found only two cases in his carrier. They were two years and three years old children who had been found dead on admission when brought to the hospital for treatments for difficulty in breathing. Post-mortem examinations of both showed pericardial effusion, cardiomegaly and severe multiple trabeculations with deep intertrabecular recesses of ventricular myocardiums. Causes of death were ascertained as heart failure due to Non-Compact Cardiomyopathy in both cases. Patients suffering from Non Compact Cardiomyopathy can develop heart failure, arrhythmia or embolic phenomena at any age. Histo-pathological examination helps to confirm the diagnosis of NCC or identification of normal variation of prominent ventricular trabeculations. Awareness of this rare condition is essential for medicolegal practitioners.

Disclosure: All authors have declared no conflicts of interest.

A CONGRUENT MATCHING PROFILE SEGMENTS (CMPS) METHOD FOR BULLET SIGNATURE CORRELATIONS

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Toolmarks produced on bullets fired through a gun barrel, called bullet signatures, are primarily striated. Striations are defined as contour variations, generally microscopic, on the surface of an object caused by a combination of force and motion where the motion is approximately parallel to the plane being marked. Since the early 1990's, computer-aided optical systems have been developed to aid firearms examiners by processing large volumes of firearms related evidences more efficiently, which has been widely used in the National Integrated Ballistics Information Network

(NIBIN). Developments of correlation algorithm and commercial systems in firearms identification have also been reported. A Congruent Matching Profile Segments (CMPS) method is proposed at NIST for bullet signature correlation and error rate estimation. After certain image preprocessing procedure, resulting 3D striation signatures are compressed into 2D profiles for representing the individual characteristics of bullet LEAs. The CMPS method is based on the principle of discretization. The entire compared profile has been divided into segments, and then correlate with the whole reference profile. CMPS method utilizes the pattern congruency of the correlated profile segment pairs between the reference and the compared profiles. For each segment of the compared profile, a best matched position is identified based on the topography similarity, which is quantified by cross correlation function maximum CCF_{max}. The pattern congruency is determined by the distance between those segments of compared profile and the whole correlated reference profile, with a pre-set threshold. If any two or more such distances calculated from their corresponding segments with their counterpart in the reference profile fall in certain threshold, they are congruent. A set of test bullets fired from 10 consecutively manufactured gun barrels including 10 pairs of KM bullets for training and 15 unknown bullets for tests. The total correlations include 46 known-matching (KM) and 549 known-non-matching (KNM) comparisons with a total of 595 image pairs correlated by the CMPS method. Initial tests shows a wide separation between KM and KNM distribution without any false conclusion. The CMPS method also enables an approach to estimating error rates based on statistical fitting of CMPS distribution models, and statistical analysis of the total number of the profile segments N, the number of the Congruent Matching Profile Segments CMPS, and the statistical distribution of the identification parameters.

Disclosure: All authors have declared no conflicts of interest.

THE MINNESOTA PROTOCOL ON THE INVESTIGATION OF POTENTIALLY UNLAWFUL DEATH (2016)

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The 1991 United Nations (UN) Minnesota Manual on the Effective Prevention of Extra-legal, Arbitrary and Summary Executions, through widespread usage, became known as the Minnesota Protocol. The Minnesota Protocol has been used by national, regional, and international courts, including the European and Inter-American Courts of Human Rights, as well as international organizations and NGOs around the world. It describes how states should investigate possible violations of the right to life under international human rights law. Since the publication of the 1991 Protocol, there have been many significant developments in international law, investigative practice, and forensic science. To ensure that it retains its relevance and reflects these advances, in 2014 the UN Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns, and the Office of the UN High Commissioner for Human Rights (www.ohchr.org) initiated a process to revise and update the Protocol. The task of revision was given to an international team of legal and forensic experts supported by a high-level advisory panel; these include some of the experts leading and participating in the IAFS this year. The revised Minnesota Protocol on the Investigation of Potentially Unlawful Death (2016) is, by necessity, a very different document to the one published in 1991. It describes the triggers for an investigation, which still includes killings by state agents, but also extends to all those who may have been killed unlawfully, whether or not the state may be held to have any responsibility under international law for the death. It applies both in time of peace and during armed conflict, although specific provisions govern investigations into deaths caused during the conduct of hostilities. There are five main parts to the body of the Protocol. These address, respectively: the Aims and Scope of the 2016 Minnesota Protocol; the International Legal Framework; Professional Ethics; the Conduct of an Investigation (covering General principles of investigations, the investigation process, interviews and witness protection, recovery of human remains, identification of dead bodies, types of evidence and sampling, autopsy, and the analysis of skeletal remains); and Detailed Guidelines on certain areas (crime-scene investigation, interviews, the excavation of graves, autopsy, and the analysis of skeletal remains). The proposed presentation would seek to publicise the existence and content of the new Protocol, and to encourage its wide dissemination.

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GENDER DIFFERENCES IN PERSONS WITH A MENTAL DISABILITY WHO GO MISSING

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Background: Researchers are beginning to investigate the social and behavioral risk factors among persons with a mental disability in order to improve health promotion for this vulnerable population. Missing persons with a mental disability may become disoriented, injured, or the victims of foul play. Individuals with severe mental impairments at time that they go missing may severely injure or kill themselves, especially within the first 24 hours after they go missing. Gender factors may help to explain whether individuals with a mental disability are at increased risk of going missing. **Methods:** The present investigation is part of the Missing Persons Project, which is based on a random sample of 998 missing-persons reports that were filed between 1991 and 2011 and published in the North American Missing Persons Network and the National Center for Missing & Exploited Children websites. This study tests the null hypothesis there are no gender differences among persons with a mental disability who go missing. Each missing-persons report was coded using a 228-item protocol. The coded data were entered into a data file and Chi-Square and correlational analyses were then performed using Systat 9 for Windows program (1999). **Results:** The null hypothesis was rejected. Males with a mental disability (63.07%) were more likely to go missing than females with a mental disability (36.93%) (Chi-square=19.93, df=1, p<.000). These results remained statistically significant after controlling for possible intervening factors. **Conclusions:** These findings suggest that males with a mental disability are more likely than females with a mental disability to go missing. This investigation assesses the implications of these findings for enhanced health promotion and educational interventions.

Disclosure: All authors have declared no conflicts of interest.

A CASE STUDY OF THE CHANGE IN THE PROFILE OF COMPUTER FORENSIC EXAMINATIONS

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The use of cell phone has been increasing in the last decade worldwide. In Brazil, in the year of 2014, access to the Internet through cell phones surpassed for the first time the one realized by computers. After that, the trend has continued mainly because cell phones have accumulated functions that were once divided among several devices. Smartphones, as they are known, can replace photo cameras, GPS devices, recorders, music players, storage devices, among many others. In addition, they replace computers for most activities, such as access to e-banking, social networks, websites, and instant messaging. Therefore, the commitment of crimes using smartphones maybe can follow this trend. Thus, the author conducted a study in the profile of forensic computer examinations in a Brazilian Federal Police computer forensic lab, using data from 2011 to 2016. From 2011 to 2013, the number of forensic examinations in cell phones decreased. During this period, most of the examinations were in basic cell phones, which do not have much aggregated information and where considerable amount of information (cell tower use and call list, for example) could be obtained requesting the telephone providers. However, from 2014 to 2016, there was a growth of almost 350% in the number of cell phones examinations. On the other hand, HDD and flash memories

forensic examinations remained almost constant from 2011 to 2013 and increased approximately 30% from 2014 to 2016. Besides, precisely in the year 2014, the number of cell phones forensic examinations exceeded the HDD and flash memory, coinciding with the fact that it was the first year Internet access in Brazil by cell phones surpassed the access by computers. Due to this trend of computer forensic examinations, the computer forensic experts from the laboratory had to seek knowledge to examine such devices, as well as the need for investment in new software and equipment. The challenges do not stop, whereas in the future is expected an even greater growth in the use of smartphones, as well as the use of cryptography. To deal with this scenario, the computer forensic experts of the lab have adopted the following strategies, but not limited to them: use report templates, use a combination of tools in the digital report, made the digital report easier to use, and try to get the phone password with its owner. As a result, productivity has increased and backlog decreased.

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FATAL RAPUNZEL SYNDROME: GASTRIC AND INTESTINAL TRICHOBEZOAR IN A BOY WITH TRICHOTILLOMANIA

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Trichobezoars (hairballs) is a rare disorder that more commonly occur in girls. Trichobezoars usually form in the stomach but rarely pass into the intestines, in a condition referred to as Rapunzel syndrome. Here, we present a 6-year old boy with a history of iron deficiency anemia and trichotillomania who died of intestinal perforation due to gastric and jejunal trichobezoars.

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MISSING IN CEMETERIES - HUMANITARIAN IMPACT OF INHUMATION PRACTICES IN ARMED CONFLICT AND MIGRATION

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The International Committee of the Red Cross (ICRC) is an impartial, neutral and independent organization which is working in accordance with and promoting International Humanitarian Law in favour of victims of armed conflicts, other situation of violence and catastrophes. The objective of this presentation is to draw attention on the emerging problematic of the (mis)management of unidentified or unclaimed human remains in graveyards where inadequate practices are leading to a second or third – 'administrative' - disappearance, hindering the location and retrieval of bodies and the possibility of providing answers to their families. Also this presentation aims at describing the plausible relation between the thousands of cases of missing people reported every year and the vast number of bodies that are buried unregistered in cemeteries annually, in the contexts under analysis, and to present strategies on how this gap could be reduced. Causes are manifold, from the sheer number of missing and deceased persons from conflict and migration, legal frameworks which do not define the institutional responsibility for unidentified or unclaimed bodies, the complex interaction of involved actors such as forensic practitioners, prosecutors and local authorities, to the lack of resources, whether it be suitable grounds, equipment or trained workforce and the ignorance or even disregard of the domestic legislation and best practices recommendations. Drawing examples from Mexico, Guatemala, Honduras and Colombia, where bodies are not seldom dumped without coffins and any documentation in unregistered mass graves, impeding the traceability and, future investigations, attendees will become familiar with an issue not limited to a particular context but rather a regional challenge. ICRC forensic humanitarian action, which attempts to enhance the local capacities for proper and respectful burials according to the rites, culture, beliefs and religion of the families of missing persons will also be exemplified. In cooperation with other institutions and governmental entities, ICRC is promoting the creation, adaptation and application of the legislation, good scientific practice throughout the search for, recovery, identification, disposition and hand over of human remains, as well as setting up corresponding infrastructure like mortuaries and burial niches at cemetery grounds. All that with the objective of meeting the needs of the families of missing persons and acknowledging their right to know.

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CHEMICAL ANALYSIS OF FALSE IDENTITY DOCUMENTS: A NEW CONTRIBUTION TO FORENSIC INTELLIGENCE?

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The use of a polymeric substrate in the manufacture of travel and identification documents is becoming more and more widespread and popular across the world. Polymers have various characteristics that facilitate the use of many security elements and techniques. However, this does not make these documents forgery- or counterfeit-proof, and they are still altered by various criminals and even terrorists to mask their identity and carry out their activities. The presentation introduces the method and results of a master research study that aims to evaluate the relevance and contribution of polymer analysis in a forensic intelligence framework. Combined with visual examination and description of the documents, non-destructive to destructive analysis methods were used on sets of genuine and false plastic driving licenses to provide information on the chemical composition of documents (substrate, printings, imitated security elements). A qualitative high-performance liquid chromatography combined with a quadrupole time-of-flight analyzer (HPLC-QToF) method was also developed to analyze the additives present in the plastic substrates, hence obtaining a chemical profile of the cards studied. The results of such forensic analysis methods have the potential to provide insights and intelligence on the various modus operandi used by criminals to forge documents. It provides as well the ability to link false documents seized at different places and times, eventually leading to identify criminal networks. It enables also to review and increase detection methods of false documents, and even to guide the design of future documents and their control. This presentation will assess the contribution of chemically profiling documents in regard to the results obtained by comparing documents through visual and physical profiling methods only. The presentation discusses also the opportunity and relevance of implementing such profiling methods for real casework. Analysis of polymers are used here with identity documents but may prove to be as much of interest for counterfeit credit cards and counterfeit money-related cases in countries that have plastic currency as well, such as Australia, New Zealand and Canada.

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DETECTION OF METHAMPHETAMINE OR COCAINE FROM MOUSE FEMURS BURIED IN SOIL

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Bone samples are used for toxicological analysis of decomposed or skeletal remains. To determine the relationship between the concentrations of methamphetamine or cocaine in bone and those in blood or muscle,

we studied the methamphetamine or cocaine concentrations in mouse femur and compared these concentrations with those in heart blood and femur muscles. We also studied temporal changes in the concentrations of methamphetamine or cocaine in buried femurs. Male ddY mice were intraperitoneally injected with methamphetamine at doses of 1, 5, or 10 mg/kg or with cocaine at doses of 5, 15, or 30 mg/kg, once a day for 7 days (n = 25 per group). Heart blood samples were collected under general anesthesia by cardiac puncture, and the femoral muscles and femurs were also removed. Femurs were buried in soil and left in a chamber maintained at 16.3°C and 62% humidity for 0, 7, 30, 90, or 180 days (n = 5 at each time point). Five hundred microliters of heart blood or 0.5 g femoral muscle were analyzed using liquid chromatography-tandem mass spectrometry (LC-MS/MS). Femur samples were sterilized with distilled water and acetone, and were dried at 50 °C for 24 h. The dried femurs were pulverized with a bead homogenizer and were evaluated using LC-MS/MS. In all mice groups, methamphetamine or cocaine concentrations in femur samples were higher than those in heart blood and femoral muscle samples. Significantly higher concentrations of methamphetamine or cocaine were determined in femur samples of mice administered a dose of 1 or 10 mg/kg methamphetamine ($p < 0.05$), 15 mg/kg cocaine ($p < 0.05$). Methamphetamine or cocaine were detected in all femur samples after a burial period of 7–180 days, methamphetamine or cocaine concentrations in buried femur samples were significantly lower than those in femurs without burial ($p < 0.05$). Therefore, this study indicated that methamphetamine or cocaine present in the body of a user at the time of death can be detected by analyzing a bone sample of the victim if the body has been buried in soil.

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FIRST CASE OF U-47700 AT THE SOUTHERN MINNESOTA REGIONAL MEDICAL EXAMINER'S OFFICE

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Background: Trans-3,4-dichloro-N-(2-(dimethylamino)cyclohexyl)-N-methylbenzamide (U-47700) is an opioid analgesic developed at a pharmaceutical company (Upjohn) in the 1970s. U-47700 is selective for the μ-opioid receptor and has around 7.5 times the potency of morphine in animal models. Case Report: A 24-year-old man was found deceased on living room floor. He had a known history of illicit drug use and was found holding a lighter and a pipe. His last known contact was the previous night. Large jars of marijuana and mushrooms were found in his residence, along with multiple oils and powders. The oils and powders were labelled as 5-MAPB (1-(benzofuran-5-yl)-N-methylpropan-2-amine), and U-47700 Findings at autopsy were largely unremarkable. However, there were healing puncture wounds in the right posterior hand and left posterior forearm, as well as multiple pock-like scars on the left forearm. Blood and urine specimens were subjected to a thorough qualitative analysis. Screening was performed for illicit drugs including opiates, cocaine, barbiturates, benzodiazepines, buprenorphine, methadone, amphetamines, fentanyl, phencyclidine, and cannabinoids by immunoassay. Acidic, basic, and neutral drugs were screened for by liquid-liquid extraction followed by GC-MS electron impact detection. Carboxyhaemoglobin was assayed by spectrophotometry, and volatile alcohols were assayed by GC-FID. The preliminary toxicology testing identified a blood ethanol of 28 mg/dL. Urine ethanol and all other screens were negative. Based on the scene findings, additional toxicology testing for psilocin was performed by high performance liquid chromatography/tandem mass spectrometry, and screening for novel psychoactive substances including 5-MAPB, was performed by gas chromatography/mass spectrometry, but did not identify the presence of these drugs. At the time the analysis was performed a standard for U-47700 was unavailable in our laboratory, but a reference GC-MS spectrum was available "on-line" and matched the spectrum obtained from the seized powder. Using the GC-Ms data generated from the acidic, basic, and neutral GC-MS drug screen in urine, an extracted ion chromatogram using the m/z of 125, 110, and 84 identified in the reference spectrum yielded a potential peak of interest. Because of the commutability of GC-MS spectra, a reference spectrum for U-47700 was obtained from another laboratory, and when run against our case file we were able to obtain a Q match of 95 for U-47700 in the decedent's urine. In addition, a blood sample was sent out to a reference laboratory for quantitation of U-47700, and yielded a result of 597 ng/mL. Conclusion: The cause of death in this case was determined to be U-47700 toxicity, and the manner of death was accident.

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A MACHINE LEARNING-BASED ASSESSMENT OF THE NUMBER OF CONTRIBUTORS IN DNA MIXTURES

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The deconvolution of DNA mixtures remains one of the most critical challenges in the field of forensic DNA analysis. In addition, of all the data features required to perform such deconvolution, the number of contributors in the sample is widely considered the most important, and, if incorrectly chosen, the most likely to negatively influence the mixture interpretation of a DNA profile. Unfortunately, most current approaches to mixture deconvolution require the assumption that the number of contributors is known by the analyst, an assumption that can prove to be especially faulty when faced with increasingly complex mixtures of 3 or more contributors. In this study, we propose a probabilistic approach for estimating the number of contributors in a DNA mixture that leverages the strengths of machine learning. To assess this approach, we compare classification performances of six machine learning algorithms and evaluate the model from the top-performing algorithm against the current state of the art in the field of contributor number classification. Overall results show over 98% accuracy in identifying the number of contributors in a DNA mixture of up to 4 contributors. Comparative results showed 3-person mixtures had a classification accuracy improvement of over 6% compared to the current best-in-field methodology, and that 4-person mixtures had a classification accuracy improvement of over 20%. The Probabilistic Assessment for Contributor Estimation (PACE) also accomplishes classification of mixtures of up to 4 contributors in less than 1 s using a standard laptop or desktop computer. Considering the high classification accuracy rates, as well as the significant time commitment required by the current state of the art model versus seconds required by a machine learning-derived model, the approach described herein provides a promising means of estimating the number of contributors and, subsequently, will lead to improved DNA mixture interpretation.

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BULLET CALIBRE AND TYPE ESTIMATION BASED ON BALLISTIC DAMAGE TO SUS SCROFA (LINNAEUS) LONG BONE

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The calibre of bullet used in the commission of crime cannot be ascertained from a wound in soft tissue, and cannot be reliably determined from the damage done to the flat bones of the cranium. This study proposes that bullet calibre can be obtained from ballistic damage to long bones. Secondarily, the damage created by two different bullet types, lead and copper jacketed, is also explored. Thirty fresh pork shoulders (*Sus scrofa),* in three groups of ten, were shot using one of three calibres using a handgun. These three calibres were of two bullet types, either lead or full copper jacket. Each pork shoulder was shot through the intact humerus with either a 0.22 round-nose lead bullet, 9mm full copper jacketed bullet,

or a 0.38 round-nose lead bullet. The long bones were subsequently defleshed and examined in order to determine if the resulting damage can be used to estimate bullet calibre and type of bullet used. The damaged bone was reconstructed to the fullest extent possible from the resulting bone fragments. The minimum diameter of each entrance wound, as well as the general fracture pattern, was recorded for each specimen. A Kruskal-Wallis nonparametric test was used to compare the median entrance wound measurements for each calibre. These quantitative data indicate that it is possible to differentiate between 0.22 versus 9mm and 0.38, but it is not possible to isolate a 9mm copper jacketed bullet from a 0.38 calibre lead round-nose bullet. Diagnostic features in the bone fracture patterns allow for the differentiation of damage inflicted by a lead bullet and a copper jacketed bullet. When a lead bullet strikes bone, comminuted fractures are the primary type of damage, but to a lesser degree than when a copper jacketed bullet is used. Bone spalling is seen in the damage to long bone inflicted by a copper jacketed bullet, but not when a lead bullet is used. It is proposed that this is due to the energy propagation of the two bullet types through the bone tissue. There must be more rigorous testing of these results, however, as a preliminary study, we have has shown that bullet type can be ascertained through long bone damage, and the damage from a 0.22 calibre bullet can be discerned from that of a 0.38 or a 9mm bullet.

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DO RESUSCITATION ATTEMPTS OF INFANTS AND CHILDREN CAUSE BRUISES OF THE NECK?

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Objective: To determine whether resuscitation efforts of infants and children cause bruises of the neck. Design: Retrospective cohort study Setting: Office of the Medical Examiner, Kalamazoo, Michigan Decedents: 260 infants and children between zero and ten years of age who underwent resuscitation attempts before being pronounced dead between 2008 and 2017 Outcome measures: Autopsy reports and photographs of decedents. Methods: Examination of autopsy reports and photos to determine how many of the decedents had neck contusions. The cause and manner of death were also recorded. Results: Contusions on the neck in resuscitation attempted children were absent in 252 of the 260 decedents (97%). Neck bruises were not identified in any deaths classified as natural (37; 14%), undetermined (119; 46%), or suicide (1; <1%). Seventy-eight of the deaths classified as accident and 17 of the deaths classified as homicide did not have neck contusions. Of the eight deaths with neck bruises (3%), two were classified as accident and six as homicides. Six of the 23 (26%) necks were bruised in the deaths classified as homicides. In the two accidents (a motor vehicle collision and a dog attack), the injuries were clearly compatible with the trauma from the vehicle crash and the dog's mouth on the neck. The contusions in the homicides were consistent with inflicted injuries, although defense experts proposed in two of the homicides that resuscitation procedures caused the neck bruises. In no cases with neck contusions was evidence found to support the insinuation that resuscitation caused the injuries. In three of the eight deaths (the dog attack and two homicides), the neck contusions were noted by first responders, before resuscitation. Conclusion: Bruises on the neck are unusual in children resuscitated before being pronounced dead. The absence of bruises in all children without inflicted injuries strongly argues against any implication that neck contusions are a result of resuscitation.

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FRONT END DNA ANALYSIS ENHANCEMENTS: COLLECTION, RECOVERY, SAMPLE INTEGRITY AND IMPROVED WORKFLOW

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DNA typing has revolutionized the analysis of forensic biological evidence as well as positively impacted on standard practices of the forensic sciences. While there have been substantial technological developments in the portion of DNA typing regarding identification of genetic markers, less effort has been devoted to the front end of the process. Yet, the collection and recovery of DNA are the most critical parts of the DNA analysis process. All assays require sufficient DNA (both quantitatively and qualitatively) and the maintenance of the integrity of a sample (i.e., reducing sample degradation and minimizing contamination) once it is collected. Typing success is directly related to the amount of effective DNA template available. Better methods are needed to recover DNA, especially for addressing the most challenged of samples. We have developed a number of workflows to improve DNA typing exploiting COPAN's 4N6FLOQSwab™, Nucleic Acid Optimizer baskets (NAOBaskets™), microFLOQ™ Direct Swabs (for direct amplification), and antimicrobial system. Our approaches allow for 1) better release of DNA from the swab which increases downstream DNA typing success; 2) less sample manipulation which reduces the risk of contamination and increases DNA yield; 3) reduction of time that the swab is exposed to the air after sample collection (by reducing the need for drying) which reduces risk of contamination; 4) a decision process for determination of what samples to consume; 5) better options for less consumption of limited samples; 6) higher maintenance of DNA integrity; and 7) a faster turnaround time with an overall reduction of cost. The important features to consider and results obtained to effect an efficient process of DNA recovery and workflow will be presented. Using these improved sample collection and extraction tools result in an unequivocal enhancement in DNA typing success and more effective workflows for the forensic laboratory.

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RATIONALIZATION OF B & E CASES PROCESSING: INCREASED SUCCESS RATES IN OBTAINING VALID DNA PROFILES

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In order to improve casework DNA analysis turnaround times, the *Laboratoire de Sciences Judiciaires et de Médecin Légale* (LSJML) implemented measures in 2014 to target and prioritize certain types of exhibits, considering success rates in obtaining a valid DNA profile, as well as the seriousness of the offense. Following the implementation of such measures, a study was carried out on more than **1,000** B&E cases in order to assess their effectiveness by comparing DNA analysis success rates before and after implementation. Success rate for obtaining a valid DNA profile increased from **55.5%** (in 2013) to **73.5%** (in 2015) by targeting certain types of exhibits. This represents **18%** of increase in success rate while analyzing **8.6%** less samples. In addition, current success rate was evaluated for various categories of exhibits (biological substances / clothing / manipulated objects), different biological substances (blood / saliva / other) and different sampling methods (swab / cutting / shaving). Almost **85%** of biological samples (mostly blood and saliva) gave a valid DNA profile that could be used for comparison. Wearer's DNA profiles were highlighted in **45.4%** of samples taken from clothing. Success rate for manipulated objects (touched DNA) is evaluated to **21.5%**. Further analyses were also carried out to evaluate success rate of various types of saliva samples (cigarette butt, neck bottle, food, etc.). Unlike similar studies in the literature, success rate was not assessed via indirect

measurement (percentage of DNA profiles uploaded in a databank) but rather by a direct measure (assessment of success rates for each sample), thus, reflecting better the reality. This study shows that the measures implemented had a major and beneficial impact on the DNA analysis success rates and led to a huge improvement in our casework turnaround times.

Disclosure: All authors have declared no conflicts of interest.

NATIONAL INSTITUTE OF JUSTICE: SUPPORTING IMAGING TECHNOLOGIES IN MEDICOLEGAL DEATH INVESTIGATIONS

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Over the past 15 years, forensic radiology has evolved from an unstructured process of using clinical radiology and imaging techniques for medicolegal death investigations (MDI) in special cases to a recognized forensic discipline within forensic pathology worldwide. Forensic imaging can produce valuable evidence for the evaluation of non-accidental injuries resulting from child abuse, elder abuse, domestic abuse and assault. Implementing advanced imaging technologies in the MDI process will offer great benefits to an agency; including, a reduction in the number of gross autopsies needed, a mechanism to address the shortage of forensic pathologists, a decrease in the number of biohazard exposures, the ability to honor cultural traditions, increase diagnostic information captured and allow for permanence of record, among others. The use of advanced imaging technologies in forensic pathology has been a standard practice for Japan, Australia and many countries in Europe; however this is not standard practice in the United States. The National Institute of Justice (NIJ) is taking part in addressing this need by engaging with practitioner and research communities on an international level. The NIJ is supporting cutting edge research; has hosted a technology transition workshop at the University of New Mexico's Office of the Medical Investigator through NIJ's Forensic Technology Center of Excellence (FTCoE), and is supporting an international working group, the International Forensic Radiology Research Summit (IFRRS). The latter event brought together leading forensic pathologists and radiologists from around the world to discuss the state of the art in research and practice, identify gaps and challenges, and formulate a plan to address those gaps and challenges. The IFRRS was initiated through a collaborative effort between the NIJ and the Netherlands Forensic Institute (NFI). In 2011, NIJ entered into a Memorandum of Understanding with NFI. The relationship aimed to advance cooperation and information sharing for the development of effective solutions and priorities to improve forensic science. NIJ and NFI identified a mutual priority need focusing on research and practice in forensic imaging. In 2016, NIJ, NFI, and leadership from the Joint Congress of the International Society for Forensic Radiology and Imaging, and the International Association of Forensic Radiographers, convened the IFRRS, and plan to further the charge. This presentation will describe NIJ's efforts to date in supporting advanced imaging technologies for forensic pathology and future directions of the NIJ to assist in advancing research and facilitating transition to practice.

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ELDER SEXUAL ABUSE: TWELVE YEARS IN PRACTICE

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The French population is projected to increase from 66.6 million on 1 January 2016 to 73.6 million in 2060. Today, people aged 65 and over represent 18.8% of the total population, this is likely to increase to 23.6 million by 2060.The incidence and prevalence of elder abuse are increasing and cases will become more frequent as the world population age. Manifold publications bear upon elder abuse but few studies deal specifically with sexual abuse of older people (SAOP). The aim of this retrospective and descriptive study is to enhance the data about SAOP, to compare our results with the little literature available and finally to improve the early detection and appropriate management of the victim. The cases' inclusion criteria were the following: (a) women; (b) at least 60 years of age (although the WHO defines old age after 65, we retained 60 to increase our population size), (c) alleged non-consensual penetration and/or sexual touching. The study received ethical approval from the ethical research committee of Bordeaux University Hospital. The records of 67 females aged 60-94 years alleged non-consensual penetration and/or sexual touching were evaluated at the Emergency Medical Unit for Victims of Assaults (CAUVA) of Bordeaux (France). The victims, aged 70 on average, were generally single (n=32) and pensioners (81.25%) with a disability (58.46%). Most of them were assaulted by a known person acting alone and mainly at the home of the victim. Acts of penetration were predominantly vaginal-penile (57.57%) and involved many genital injuries without necessarily non-genital lesions but with frequent psychological destabilisation (66.67%). Sexual violence on older people is poorly described in the literature and seems to be under recognised in the medical community. This specific violence, frequently under reported by victims, especially with disability must be investigated and necessarily by a multi-disciplinary approach in a clinical forensic unit.

Disclosure: All authors have declared no conflicts of interest.

MANAGEMENT OF SCENE OF CRIME, A CASE STUDY OF NIGERIA SETTINGS

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Management of Scene of Crime, How Police Officers Manage Scene of Crime in Nigeria.

Disclosure: All authors have declared no conflicts of interest.

A RETROSPECTIVE STUDY OF MYOCARDIAL BRIDGE CASES DETECTED IN TFMC FROM 2003 TO 2016

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In order to analyze the relevance of the detection rate of myocardial bridge and the time, the characteristics of the population (including sex, age, physical condition), the relationship with the cause of death, etc., 88 cases detected in Hubei Tongji Forensic Medicine Centre(TFMC), China, during the period from 1 January 2003 to 31 October 2016, were retrospectively studied. For each case, thorough autopsy and pathological examination was performed. The final conclusion was reached by comprehensive analysis of the investigation report, clinical history, autopsy and pathological findings and the toxicological report of the case. During this period, a total number of 88 cases of myocardial bridge were detected. The average detection rate was 0.5% before 2009. From 2010, the detection rate increased significantly (all> 1.3%), which reached a peak in 2015 (6.1%). Almost all myocardial bridges were found in the left anterior descending coronary artery, only 1 was found in the left circumflex coronary artery. The average length of mural coronary artery was 2.3cm. For the detected cases, there were 79 males and 9 females (M: F ratio = 8.8: 1). Age in majority was 40-49, accounting for 28.4%. In physical condition, there were 59 cases (67.0%) combined with other heart disorders, and 6 cases (6.8%) with other diseases. As for the cause of death, sudden death contributed to 60 cases, including 39 cases involving myocardial bridge with heart disease and 7 cases independently caused death by myocardial bridge. Other causes of death include disease, mechanical injury, mechanical asphyxia, poisoning and electric shock. There were five cases still in mystery without apparent clue

to the cause of death. In conclusion, this study indicated that most patients with myocardial bridge were combined with other heart diseases at the same time, which made great threat to life and easily led to acute cardiac insufficiency or even death. The significant increase of the detection rate after 2009 may be related to changes of identification thoughts and focuses of forensic pathologists. As the detection rate of myocardial bridge in the autopsy is much higher than in clinical, the data above would be helpful for epidemiology research.

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HABITS OF WRITING HEADING BASED ON EDUCATION LEVEL IN HANDWRITING EXAMINATION

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Handwriting is a conditioned reflex and occurs without paying attention. At the beginning of learning handwriting, the learner copies some defined patterns and styles which leads the fingers to find their own style. At the beginning of the learning process, fingers tend to imitate other styles and eventually create its own differences besides developing its own characteristics from the individual. It is commonly seen that people who do not require handwriting in their lives tend to use the styles they learned in their childhoods, whereas, people who often use handwriting in their daily lives develop and eventually have their own styles. The purpose of this study is to analyze the ways how two groups with different level of education write headings and to identify the effect of education level when writing headings. 20 volunteers (elementary school and university graduates) have been asked to copy and write the same heading they were given on a A4 size white sheet paper, using the same pen (*Pilot*, 0.7mm, black). The length of the letters, upper line spacing, top and bottom margins of the sheet have been measured by the same researcher three times. The averages of these values have been evaluated with *SPSS 16.0.* The minimum, maximum and the average lengths of the headings are 3.3mm, 10.4mm and 5.77mm respectively, with a standard deviation of 2.07. In the light of the information gathered from the study, there is no significant difference which can be related to the level of education of the writers volunteered in this study, considering the length of the letters, upper line spacing, top and bottom margins of the sheet ($p=0.324$, $p=0.395$, $p=0.456$, $p=0.395$ respectively).

Disclosure: All authors have declared no conflicts of interest.

EVALUATION OF THE CHILDREN FOR CRIMES AGAINST PROPERTY

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Children and young people dragged into crime are very important and international problems for all of the countries. It has been reported in several studies about children committed crimes that approximately 20% of them committed crimes repeatedly, male gender was predominant among them, children living in extended families and being in a low socio-economic status and educational level were risk factors. In our study, it has been evaluated by examining the files and cartons of decisions of cases in which judging is completed between the dates 01.01.2007 - 31.12.2010 in the Ankara 1st Children's High Criminal Court that socio-demographic and criminal characteristics of 180 children who were accused of crimes against property as defendants. All of the children who are the perpetrators of crimes against property are male. Their ages vary between 12.2 and 17.9 and the mean value is calculated as 16.2 (SD = 1.34). It is determined that 60 % of them are in 16-18 age group and being incompatible with their age group, 90 % of them are in primary education level. Economic conditions of the families of all children are appointed as poor and for the 60 % of them, conditions are even worse. In general, it is known that the most committed crimes of juvenile delinquency are crimes against property. The most important objective in juvenile delinquency is to prevent re-offending by children and to take necessary steps for reintegration of children into society. Education, parental support programs, improving public awareness and youth centers are important for the prevention of juvenile delinquency. By social monitoring of the children who are under the risk of being dragged into crime, the situation of dragging into crime should be prevented.

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MUSCLE PROTEIN DEGRADATION IN PMI ESTIMATION - RECENT ACCOMPLISHMENTS AND CHALLENGES

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Estimation of the post-mortem interval (PMI) is one of the most challenging aspects in forensic routine work. Available methods to date are often limited to a certain timeframe or are sometimes insufficient due to individual preconditions or the circumstances of, and after death. The search for additional methods and respective post-mortem biomarkers is thus a central topic in forensic science and has become of increasing interest since the rise of sophisticated molecular biology approaches in the last decades. Recently, we have proposed a muscle protein degradation based approach that in the meanwhile has justified its qualification by first successful application in a forensic case. Respective impacts of individual and environmental influencing factors reveal a task that necessarily has to be addressed to achieve significant practical relevance in PMI estimation. Especially the applicability to a large heterogeneity of cases requires an appropriate evaluation of the sufficiency and the limitations of a method. Currently, we are proceeding with targeted analysis in animal models to assess standardized degradation patterns and to investigate the role of influencing factors, but also with human material to evaluate the validity of the results for the use in actual cases. We are also developing standard protocols and are optimizing the working procedures to facilitate worldwide reproducibility and ultimately application in forensic fieldwork. We present an overview of our recent results and accomplishments, outline the general requirements of novel approaches for time since death estimation and discuss the specific challenges of muscle protein degradation for the use in routine work. A special focus is on the transferability of data obtained from standardized animal models to the application in human cases and the targeted research on influencing factors.

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DEVELOPMENT OF A DISSOLVABLE SWAB FOR INCREASED BIOSPECIMEN RECOVERY

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Swabs are routinely used by crime scene investigators and forensic scientists for the collection of biological evidence for analysis. The most commonly used swab for collection of biological specimens is the sterile cotton swab due to its ease of use, low cost, and ability to collect on multiple substrates such as wood, fabric, and metal. Although cotton swabs readily adsorb biological material, they exhibit low efficiency of DNA sample release. While material and manufacturing advances have recently resulted in a diversity of new forensic swab types and materials, sampling and extraction efficiency from these swabs varies significantly by substrate and sample type. The loss of biological material for downstream

processing can be 40 - 80% from just the swab extraction process. Dissolvable swabs were developed to address these limitations. Using prototype swabs made from sheets of electrospun nanofiber material, experiments were conducted that evaluated adsorption of high and low volumes of biological material (blood and dried epithelial cells) from glass slides, and subsequent DNA extraction using commercially available forensic analysis kits. Both manual and automated DNA recovery was investigated. DNA extraction was conducted using the QIAGEN® QIAamp® DNA Mini Kit or QIAGEN EZ1 Robot. The Quantifiler® Human DNA Quantification Kit in conjunction with an Applied Biosystems® 7500 Real-Time Polymerase Chain Reaction (PCR) instrument was used to estimate the quantity of human DNA present in each sample. Following DNA quantification, a full STR profile was run on all samples of DNA recovered from the dissolvable swabs using GlobalFiler™ PCR Amplification Kit and analyzed using GeneMapper™ ID-X software. Dissolvable nanofiber swabs were shown to have excellent performance in cellular adsorption (99%) and in DNA extractions (82%). All DNA samples recovered from dissolvable electrospun swabs were also capable of producing full, high-quality STR profiles. The results of these experiments demonstrate the potential usefulness of high surface area dissolvable nanofiber swabs for both enhanced biospecimen capture and increased DNA recovery of biological evidence.

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THE METABOLIC SYNDROME IN A POST MORTEM PERSPECTIVE - A STUDY OF THE SURVIVE COHORT

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Background: Individuals with severe mental illness (SMI) (schizophrenia, bipolar disorder and major depression) have a markedly increased risk of morbidity and mortality compared to the background population. Individuals with a psychiatric disorder have an increased prevalence of metabolic derangement and one in every third with a psychiatric disorder suffers from the metabolic syndrome (MetS) compared to one in every fifth of the background population. Furthermore, individuals with schizophrenia have a diminished life expectancy of up to 20 years partly from cardiovascular disease (CVD). The SURVIVE study is a major, Danish, nationwide study on deceased individuals with a known or suspected psychiatric disorder where a forensic autopsy was performed. The overall aim is to investigate risk factors for premature death among these individuals – including obesity, MetS and CVD. **Material and methods:** Over a period of two years we included deceased individuals with a known or suspected psychiatric disease where a forensic autopsy was performed. Based on police reports, registry data, macro- and microscopic findings and data from forensic chemistry analyses, we determined the prevalence of MetS and correlated it with gender, psychiatric diagnosis and the degree of CVD. **Results:** In total 101/416 (24.3%) individuals suffered from MetS. The prevalence of MetS among women (51/159 (32.1%)) was significantly higher than among men (50/257 (19.5%); p=0.005; OR(95%CI)=1.96(1.24;3.08)). MetS was present in 38/142 (28.8%) of individuals with schizophrenia, 5/16 (31.5%) with bipolar disorder, 13/57 (18.6%) with major depression and 45/198 (22.7%) among individuals with other psychiatric disorders with no significant difference between groups. Among individuals with severe CVD 17/48 (35.4%) had MetS; among individuals with moderate CVD 37/129 (28.7%) and mild CVD 14/67 (20.9%) suffered from MetS. Among individuals with no CVD 33/172 (19.2%) suffered from MetS. **Conclusion:** We found a higher prevalence of MetS in individuals with schizophrenia compared to other SMI and a significantly higher prevalence of MetS among women. However, more than two thirds of individuals in our study with moderate to severe CVD did not suffer from MetS. This warrants further investigation into which factors that better predict the prevalence of CVD in a group of individuals with excess morbidity and mortality. With this study we present a novel approach on determining ante mortem conditions in a post mortem setting.

Disclosure: All authors have declared no conflicts of interest.

ROLE OF THE EGYPTIAN FORENSIC MEDICINE AUTHORITY IN THE MYSTERY OF EGYPT AIR FLIGHT CRASH IN 2016

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On the early hours of the 19th of May 2016, the Egypt Air flight MS 804, flying from Charles de Gaulle airport in Paris-France, to Cairo-Egypt, had lost its connection with radar. Sixty-six people were on board, including crew and passengers. A few hours later it was found to be crashed 281 Km far from the Egyptian Coast, and 3000 m in the Mediterranean Seabed. The Greek ministry of defense recorded that the flight carried out a 90-degree turn to the left and a 360-degree turn to the right, falling from 11.3 to 4.5 Km. Several investigating trips were sent to the crash scene by the Egyptian Forensic Medicine Authority "EFMA", in cooperation with the official French forensic team. Flight debris and human shreds were collected by the ROV. Collected exhibits and suitable samples for DNA were preserved in plastic bags/tubs in -10°C. The teams were formed of medical examiners, DNA and post-explosion analysis experts. Back to the lab, the DNA unit had extracted, amplified, and analyzed all the targeted samples. DNA investigations had identified sixty-four out of sixty-six from who were on board. On the other hand, exhibits, either shreds or debris were screened, extracted separately by ultrasound, cleaned-up by SPE and analyzed upon the schematic post-explosion steps. Nitrobenzene, mono nitrotoluene traces were detected on GC-MS using two different columns and methods. TNT and DNT traces were detected by the aid of LC-QQQ.

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FORENSIC ASPECTS OF CHILD ABUSE IN EGYPT.

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Child Abuse and neglect represent a major problem locally and globally. Child Abuse may be physical, sexual, emotional or neglect occurring in one or multiple forms. Although Egypt has achieved progress on the level of protection of abused children and taking actions to prevent it, child Abuse death is still a serious problem. In spite of the lack of sufficient national statistics, our institute faces an increased number of such cases. In this abstract, we are presenting 5 child Abuse cases that suffered a brain hemorrhage and/or subcutaneous hemorrhage. Child Abuse deaths demand a full autopsy with dissecting the back and the limbs searching for hemorrhage all over the body, especially subcutaneous and intramuscular hemorrhage.

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ETHICAL DILEMMAS IN FORENSIC MEDICAL PRACTICE

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Forensic medicine can be defined as application of principles and practice of medicine to aid administration of justice. The forensic practitioners are obliged to practice basic medical obligations towards the individual patients, judiciary and to the public while balancing their responsibilities to these parties. Unlike in clinical practice the patient is not presented for treatment but for forensic evaluation. Even so, it is expected to practice the same ethical standards like that of any other medical discipline. Consent for medico legal examination, confidentiality of the findings, patient's

autonomy, beneficence, non-maleficence and justice are important ethical principles that need to be considered in such context. The forensic practitioner may be the first and the only physician to evaluate a patient who may also have critical needs. Therefore, there is an obligation to act in the best interest of the patient and to attend to his/her critical needs. However, attending to the needs of the patient may be viewed as taking undue interest or being fractional by the judiciary. On the other hand, as this is a medical profession, responsibility to patients should displace the interest of third parties. Forensic Pathology, i.e. examination of the dead for medico-legal purpose if considered in the context of doctor patient relationship the main question that can arise is whether there is actually a doctor patient relationship since the examinee is already dead. It is worth to consider whom a forensic pathologist owes a duty to. While there is a duty towards the judiciary to find out the truth about the cause and manner of death there is a duty towards the relatives of the deceased to reveal the true findings specially after having a contact with them at the preliminary inquiry. Preserving a good professional relationship with colleagues while maintaining honesty, impartiality and integrity in the doctor patient relationship is extremely important specially when handling cases of medical negligence. Many of the conclusions made in forensic practice are matters of opinion and therefore, disagreement is expected which can lead to personal friction. If forensic practitioners follow the basic principles of medical ethics, while maintaining highest standards based on scientific evidence they can overcome the majority of the conflicting issues and can perform their duty in administration of justice.

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CORONARY ARTERY ABNORMALITIES AS THE CAUSE OF SUDDEN CARDIAC DEATH: A 20 YEAR REVIEW

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Background: Sudden cardiac death is defined as a death due to cardiac etiology that occurs within 1 hour of the onset of symptoms. Abnormalities to the coronary arteries occur in approximately 0.2 to 8.4% of the population, and carry a significant risk of sudden death. **Materials and methods:** The medicolegal database of the Forensic Pathology Department at Hamilton Heath Sciences between the years 1996 and 2017 was reviewed. The cases attributed to sudden cardiac death due to coronary artery abnormality were extracted. We reviewed the cases for type of coronary artery abnormality, age, sex, symptoms prior to demise, circumstances of death, significant atherosclerotic disease, and toxicology. Two cases also underwent molecular studies. **Results:** Our review resulted in 17 cases (70.6% male), with the age of demise ranging from 14 years to 71 years of age (mean = 41 years old, median = 46 years old). 14 of the cases occurred in the years 2007 -2017 and only three were reported in the previous decade (1996-2006). The most commonly affected artery was the right coronary artery (RCA), and the most common type of abnormality of the RCA was the origin of the right coronary artery from the opposite aortic sinus (R-ACAOS). The LCA was the second most affected coronary artery in our study, with acute angle take off and high take off being the most frequent finding. Multiple anomalies were present in 9 cases (52.9%). The most common combination was acute angle take-off/high take-off combination found in 3 cases. Spontaneous coronary artery dissections were present in 5 of our cases. The anatomical location of the dissection was most commonly in the LAD (4 cases), with only one other case showing a dissection of the Posterior Descending Artery. **Conclusion:** Although literature maintains that L-ACAOS are associated with higher incidence of SCD, our study shows that R-ACAOS, including those deemed to be low risk by classification can be causes of SCD. A thorough examination of the origin and course of the coronary artery should be conducted during the autopsy. This will lead to increase in the detection of these abnormalities as the cause of SCD especially in the younger population.

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ENHANCED RAMAN ANALYSIS OF BALLPOINT INK ENTRIES BY THIN LAYER CHROMATOGRAPHY

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Raman spectrum is often used in ballpoint ink entries analysis. However, the raman signal of some ink entries is not strong enough, and it is often affected by fluoresce of the paper. In this paper, raman analysis was carried out on the spots after the colorants in the ink entries were separated by high performance thin layer chromatography. Stronger raman signals and Improved sensitivity were achieved and the influence of fluoresce despaired. Ink entries of 19 different ballpoint pens were drawn on copy paper and stored for more than a week. Dissolved in methanol, the ink entries were separated by thin layer chromatography with silica gel GF254 plates. The developing solvent: n-butanol: ethanol: water: glacial acetic acid (18: 2: 1: 1). Then raman spectrum of the spots was obtained by A Foster & Freeman 685-2 micro-Raman spectrometer with 685nm diode laser. The excitation energy was 100%, acquisition time and the number of repetition conditions was optimized to result the strongest raman signal. Of the nineteen samples, three show no significant raman signal even separated by TLC. In the rest of other sixteen samples, Raman peak can be detected in the first separated spot ($Rf = 0$), of which the Raman spectrum is basically consistent with the spectrum of its corresponding sample. Accordingly it can be demonstrated that the first separated spot of the ball-pen ink is the reason of its Raman reaction. According to the strength of the Raman signal at 725cm^{-1}, 1391 cm^{-1}, 1415cm^{-1}, the 16 samples can be distinguished. The results show that the first spot (Rf = 0) of the ball-pen inks were the reason why the ball pens have Raman response. It is confirmed that Raman reaction of ball-pen ink is markedly enhanced by this method, But with low chromatographic separation efficiency the first spot may be a mixture of multiple ingredients, and further study should be performed.

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EFFECT OF DIGITAL MEDIA ON OBTAINING KNOWLEDGE ON SEXUAL RIGHTS/OFFENCES: A STUDY FROM SRI LANKA

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Introduction: Being a part of the traditional South Asian society, Sri Lankan youth is bound to face many difficulties in obtaining knowledge on sexual and reproductive health (SRH) due to associated taboos and myths. In a socially and culturally restricted society, digital media i.e. internet and mobile phones provide easily accessible sources of information on SRH with better confidentiality. **Objectives**: To describe SRH knowledge related to sexual rights and offences and to determine the effect of mobile phones and internet in obtaining them. **Method:** A Cross sectional descriptive study was conducted using a self-administered questionnaire among undergraduates including Faculty of Medicine, Faculty of Science, Faculty of Commerce and Management, Faculty of Social Sciences and Faculty of Humanities of University of Kelaniya. **Results:** Out of total 498 undergraduates, 213 (43%) were from Faculties of Medicine and Science while the male to female ratio of the study population was 1:3. Majority (96%) of the study population were not aware of laws and legal aspects related to rape/sexual assault. One third of participants stated that a parent or a guardian can give consent for sexual intercourse on behalf of one or both parties. According to the 26% of males, reproductive health decisions of a woman are vested in males after marriage (p=0.0088). Premarital sex is only accepted by 20% of the study population with a statistically significant difference between males and females (p=0.0136). Further analysis of knowledge regarding consent for sexual intercourse revealed

that 58% of the females and 67% of the males were not aware that the consent is not valid if given under the influence of alcohol (p=0.0025). Out of the study population 40% stated that legal aspects on SRH were obtained from books and magazines while 26%, 22% and 13% stated to have obtained from school, friends or elders and mobile phones or internet respectively. **Conclusion:** The university entrants of the study population have many lapses in their knowledge on sexual rights and offences. Although mobile phones and internet are potential sources of knowledge on SRH with convenience and better confidentiality, this study did not reveal that they were preferred by the students which could be due to a limitation in the research methodology.

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FORENSIC HUMAN IDENTIFICATION IN SYRIA

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Identification of human remains became more and more important according to the increasing of number of disasters, crimes, wars and the subsequent massacres, and for its important for both, legal and humanitarian. Application of forensic sciences including identification requires scientific dedicated staff in addition to the existence of appropriates conditions such the place where forensic sciences and identification will be applicable later, but in countries wallow in war with a hundreds of murders daily such Syria with the horrific circumstances that happen and the absence of security and protection,lead to a many issues of practicing forensic sciences specially human identification .

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EXAMINATION OF SEXUAL ASSAULT SURVIVORS BY FORENSIC NURSES AND COLLECTING PHYSICAL EVIDENCES FROM CRIME SCENE

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Forensic Nurses play multiple roles in providing justice to the Sexual Assault Survivors. After immediate medical aid and noting general mental condition of survivor, Forensic Nurses help in linking the crime with criminals by examining, collecting, preserving, documenting/photographing the physical evidences and later on deposing in the Court of law and in turn helping in the administration of justice to the innocent victims. Forensic Nurses are well qualified with specialization in Forensic and Nursing fields. After providing prompt care to the sexual assault survivors they assess and evaluate various types of injuries suffered by the victims, nature of assault, time lapse, check whether the survivor has bathed/washed herself since the assault. They collect forensic evidences in the form of foreign material like grass, mud, pubic hair, scalp hair, blood, semen or any stains left on the clothes of the victim or at the crime scene, collect loose scalp and public hair by combing, examine nail scrapings and clippings for epithelial cells of suspects, collect blood and urine for grouping, match blood stains with the scene of crime, detection of drugs or alcohols, collect swabs from the vulva, vagina, anal openings for ano-genital evidences if any, collect suspected seminal deposits on the pubic hair of the victim, collect swabs for microbiological and other necessary tests. Thus the role of Forensic Nurses is very significant.

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NONDESTRUCTIVE DIRECT DETERMINATION OF MA TABLES BY DIFFUSE REFLECTANCE NEAR-INFRARED SPECTROSCOPY

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A new method has been developed for the fast and non-destructive direct quantitative determination of methamphetamine and caffeine in seized methamphetamine (MA) tablets using partial least-squares regression analysis of diffuse reflectance near-infrared spectra. Data were obtained from untreated tablet samples placed in the integrating sphere with a 7 mm-diameter hole plastic plate accessory. A heterogeneous population of 45 samples, previously analyzed by a reference high performance liquid chromatography (HPLC) method, was employed to build the calibration model and to have a separated validation set. For MA quantification, based on the use of first-order derivative spectra data for a calibration set of 35 samples, after standard correction (detrending), in the wavelength range from 10000 cm^{-1} to 4000 cm^{-1}, 5 PLS factors were enough to obtain a linear correlation coefficient for calibration of 0.990. The root-mean-square error of calibration (RMSEC), root-mean-square error of prediction (RMSEP), and root-mean-square error of cross-validation (RMSECV) for methamphetamine were 0.64% w/w, 0.68% w/w, and 1.3% w/w, respectively. For caffeine quantification, first-order derivative spectra data, after standard correction (detrending), in the wavelength range from 10000 cm^{-1} to 4000 cm^{-1}, 5 PLS factors were enough to obtain a linear correlation coefficient for calibration of 0.993. The RMSEC, RMSEP, and RMSECV for caffeine were 0.74% w/w, 0.77% w/w, and 1.6% w/w, respectively. The study showed that MA tablets can be individually analyzed by NIR with high accuracy.

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THE DEGRADATION OF BASIC DYES IN BALLPOINT PEN INK ENTRIES IN THREE YEARS

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To evaluate the degradation of basic dyes in ballpoint ink entries that underwent natural aging of three years, a LC-HRMS method was established for the analysis of crystal violet, basic blue 7, victoria blue B and their degradants in ink entries. Ink entries of fifteen blue ballpoint inks were made and preserved in a drawer in our lab for three years. The aged ink samples, as well as fresh ones written by the same fifteen ballpoint pens on the same type of paper, were analyzed by the LC-HRMS method. As a result, crystal violet presented more apparent degradation than basic blue 7 and victoria blue B. Among the fifteen inks, seven had more de-methylated products of crystal violet in aged ink samples than in fresh ones, where the de-methylated products could also be detected. The peak height ratio of degradants to crystal violet increased 2%~5.3%. On the other hand, victoria blue B and basic blue 7 had barely degraded in the tested samples. Therefore, crystal violet and its degradants are more promising to be applied in forensic practice. Moreover, after three years, the degradant of crystal violet that lost four methyl groups, and the degradant of basic blue 7 that lost two ethyl groups came into existence in some samples. The detection of these two degradants is also an index for reference when judging the ink age.

Disclosure: All authors have declared no conflicts of interest.

DNA RADAR: REVELATION OF SURNAMES FROM DNA SAMPLES WITH NEXT GENERATION SEQUENCING

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DNA RADAR™ is an innovative next generation sequencing (NGS) assay that provides a complete human identification solution in a single assay. Included are STR markers for CODIS & ENFSI and SNP phenotype markers for blood type, hair, eye color and ancestry. Most importantly, the technology employs proprietary, patent-pending predictive tools to reveal the likely surname(s) associated with the DNA sample. Data will be presented on samples processed as part of a single tube, addition only workflow utilizing standard laboratory equipment and an Illumina MiSeq sequencer. Analysis by Kailos Blue, a complete analytic and reporting software package, provide results on how the incorporation of unique molecular identifiers (UMIs) enables the determination of the representation of original DNA templates, increasing the sensitivity and specificity of the results and the ability to reduce stutter in STR calling. Results will be presented from the development and validation of the assay on unknown samples of varying quality, mixtures and input amounts for the determination of surnames.

Disclosure: All authors have declared no conflicts of interest.

CORRELATION OF CELLULAR AUTOLYTIC CHANGES IN BONE MARROW WITH POST-MORTEM INTERVAL

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Introduction: Estimation of post mortem interval is of great importance in forensic investigations. Determining time since death is extremely difficult and accuracy can never be met. Most of the methods currently employed are temperature based algorithms, rigor mortis, livor mortis, thanato-chemistry etc. But the uncertainties attaching to traditional means of establishing the time since death have directed attention to the chemical changes in the body fluids like cerebrospinal fluid and vitreous humor along with various cellular changes in the body tissues. **Materials & Methods:** In this prospective study of 100 autopsy cases, the sternum was detached. Using needle, bone marrow was aspirated and was put on frosted slides and a smear was prepared and stained with Leishman stain. The stained slides were observed for the cells and cellular changes. One thousand cells were counted per slide and various parameters like cell count, cell morphology, cell autolysis and cell depletion were noted. These cellular changes in the bone marrow were compared with the post mortem interval. **Results:** Time related changes in morphology were observed in erythroid, myeloid/granulocyte and megakaryocytic cells. The cellular morphological changes were observed in all the cells as post-mortem interval increased. The mean erythroid cell count was maximum, accounting for 531.93. No appreciable changes in the cellular morphology were detected in the bone marrow during the first 5 hours after death. Based on our observations, the various autolytic cellular changes were graded GI to IV separately for Nuclear and Cytoplasm changes. The mean post-mortem interval for nuclear changes for all the lineages was 15.28 hours and for cytoplasmic changes was 15.85 hours. Nuclear changes were not so evident till 5 – 7 hours, but break in the cytoplasm membrane and vacuolation was visible starting from 5th to 16th hours. In 37 cases, the cellular lines were totally not appreciable due to complete autolytic changes. **Discussion:** The study of the viability and morphological changes seen in the cells of various body tissues could provide useful information regarding post-mortem interval. The pyknotic erythroid, myeloid and megakaryocyte series as well as the cytoplasmic changes in the bone marrow show time related changes which gave some indication of the post-mortem interval up to 16 hours after death in our study. Similar studies around the world are warranted in this field before the cellular changes could be considered in estimating the time since death.

Disclosure: All authors have declared no conflicts of interest.

APPLYING HPTLC, RAMAN, SEM TO DETECT GRAFTING OF PAPERS AND ESTIMATE AGE OF THE DOCUMENT

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In Vietnamese civil transactions, there are various forms of debit documents. In this particular case it is required to confirm the intactness and age of the debit document . The debit paper has a value of 1.400.000.000 VNĐ (est. 70.000 USD) - dated on Jan 21st, 2012 - has the suspicion of having abrasion at the two contact edges of the paper, then graft of two parts was glued by adhesive. At the bottom right hand corner of this paper it contains only signature and the written full name of the borrower by blue ball-point ink. The first examination resulted in confirming the signature and full name were written by the borrower herself. However it was suspected that the age of the signature and full name could not have been January 2012 because the boat purchase between two sides had been finalised in 2009. In 2013, the boat seller used this debit paper as a proof before the Judge to request for debt collection. The thickness at the two contact edges of the paper was measured and determined to be unequal. The continuousness of the paper fibres and glue traces were examined on the SEM 4500 Jeol. Dyes of ink and its remaining solvents were examined and identified in HPTLC against the standard samples with different solvent systems and on the absorption substance Silicagel 60 F_{254}(Merck), while the intensity and area of dyes traces were evaluated with support of CAMAG Complex 4's HPTLC system. The dyes and remaining ink solvents were also compared to referent substances by Raman Spectroscopy (HORIBA Jobin Yvon). Using the above methods and instruments, it was determined that the blue ball-point ink was not written in January 2012, but written in the period from October to November 2009. There was an abrasion at the two contact edges of paper, then the graft of two parts was glued by adhesive.

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AN UNUSUAL CASE OF SUICIDE IN A YOUNG AMATEUR SKYDIVER

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Deaths associated with parachuting are very uncommon and the vast majority of them are accidental. We report an unusual case of suicidal death in a 26 year-old experienced amateur skydiver with no significant past medical history, whose body was found dead on an airfield after a 4000-meter freefall jump. According to witnesses, the victim's parachute did not open and his body remained in a stable freefall arched position until ground impact, before bouncing once on the ground and falling back a few meters away. The backpack the victim was still carrying contained the main and reserve parachutes still packed. Post-mortem examination showed a severe multiple blunt trauma with a significant antero-posterior flattening of the body, consistent with a high-energy impact with the ground. Extensive abrasions were arranged symmetrically on the front of the body, thus in favor of a ground impact in a stable "belly-down" position. Upon internal examination, there were numerous skeletal fractures associated with soft tissue hemorrhages and severe injuries to the internal organs. Neither additional injuries that could have been inflicted to the victim prior to the jump nor any evidence of previous natural disease that could have precipitated or contributed to the death were noted. Toxicological analysis was negative. Police investigation revealed that weather conditions were good on that day and the victim had died during his third consecutive jump. It also showed that he had recently experienced marital problems and that he had expressed suicidal

thoughts in text messages sent to his wife just before jumping out of the plane. An expert examination of the parachuting equipment ruled out any evidence of gear malfunction such as incorrect packing or failure of the chute. In addition, it showed that the automatic activation device (ADD) allowing the reserve parachute to be automatically deployed at low altitude if the skydiver has not released his main chute had been disabled prior to the third jump, without any evidence of criminal intent to be found. On the basis of the autopsy findings, testimony of witnesses and police investigation data, manner of death was considered to be suicide. This case stresses the fact that although very few suicides have been reported among parachutists, every skydiving fatality should require a thorough forensic investigation involving a multidisciplinary approach to allow the forensic pathologist to determine the exact cause and manner of death in light of all the available relevant information.

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EXAMINATION OF THE HANDWRITING OF IDENTICAL TWINS

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In forensic sciences, several researches on identical twins have been made, and some features of twins have become a matter of curiosity by scientists. In terms of forensic sciences, one of the points that draw attention in this context is the similarities / dissimilarities of the handwritings of twins, that is, the handwriting of twin pairs. Purpose of the study is to determine the similarity of identical-twin pairs to handwriting, to identify whether genetic similarities are a distinctive feature on handwritings, to clarify the gender effects on twins, and to evaluate the reflections of twin's handprints on the scientific truth that two handwriting ca not be exactly the same. The research population of this comprises a total of 100 volunteers who subject to the comparisons consisting identical twins with at least middle school graduation and aged over 18 years. They are allowed to write contain the whole alphabet characters in the Turkish alphabet, and also allowed to write "Ataturk's Speech to Youth" on a white paper with / without stripes. These handwritten texts have been evaluated by handwriting examination methods, especially comparing the letters "a, b, d, g, m, r, ş, u, v, y, z" which exhibit the feature of dissimilarity. The handwritings were examined visually according to the examination criteria of forensic sciences by using a magnifying glass and a ruler, and the obtained data were classified by numbers and ratios. The data were processed in SPSS 20.0 V. to determine the statistical analysis between the sexes, age groups, occupational groups, education levels, duration of living with the couple in the same household (year), frequency of using handwriting, and the sameness of hand that the pair is actively using and when writing in the samples. There were no statistically significant differences in the results between the twins' handwriting similarity ratios and the variables listed above. As a result, the letter "d" is found to be most similarly used letter while the letter "m" was determined as the most dissimilarly used letter by the respondents. The results showed that similarities between the handwritings of twin women pairs were more evident than the similarities of handwritings of twin male pairs. The judgments that the two handwritings cannot be exactly alike and the letters show the dissimilarity are supported by the results of the handwritings of the twin pairs.

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RESTORATION OF LEAD FILLED CHASSIS NUMBER OF VEHICLES PREFERABLY USED BY TERRORIST

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In Pakistan, the vehicle theft/robbery is quite common (approximately we receive 1200 vehicles every year for examination) and usually what the robbers do, they obliterate the chassis and the engine numbers of stolen vehicles. During course of investigation, the Police recover the stolen vehicle and sent it to Forensic Science Agency, Lahore for chemical treatment so that the original chassis and engine numbers could be restored. In Pakistan, robbers use different techniques to obliterate the chassis numbers (grinding, self punching, cut & weld, metal filling etc) and one of them is obliteration by filling lead / silver metal in original chassis number and then punching a new chassis number on it. In country like Pakistan it is highly probable that the terrorists may use these tempered vehicles for terrorist activities to hide the identity of vehicle from law enforcement agencies (**In certain cases terrorist used tempered vehicles in terrorism**). As per the limitation of existing techniques for restoration of chassis number, the frequency of such cases is continuously increasing with every passing year, causing difficulties for law enforcement agencies in investigation of such heinous crimes. Also the restoration of metal-filled numbers is quite difficult task for Firearm and Toolmarks examiners. One interesting study was made on hundreds of vehicles to restore the metal-filled obliterated numbers which remained quite helpful in restoration of metal-filled numbers and in parallel this technique equally remained successful for law enforcement agencies. This paper describes the chemistry and technique which are helpful for firearm examiners in restoration of metal-filled numbers.

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UV-VIS-NIR SPECTROSCOPY AND MULTIVARIATE ANALYSIS FOR FORENSIC EXAMINATION OF TEXTILE FIBERS

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The present work is designed to discriminate the different types of textile fiber samples by using UV-Vis-NIR spectroscopy and stereo zoom microscopy. Microscopy provides a clear distinction of fibers on the basis of the structural features. Several solvents for extraction of dyes has been used that show different efficiency for different fiber samples. The conditions used for dye extraction from the fiber are also optimized. Two approaches, i.e. visual comparison of peaks and multivariate analysis have been proposed to differentiate the textile fibers. The UV-Vis-NIR spectra of the dye extracted from different fiber samples give some useful clues about the differentiation of dye present in the fiber sample. From the peaks obtained through UV-Visible spectroscopy, the discrimination power of the samples was achieved to be 83.63 percent for cotton fibers (black), and 94.28 percent for the wool fibers. The multivariate analysis has further enhanced the discrimination power considerably. Welch T-test was used as a validation tool to show the inequity between the samples that shows the close relationship in the scatter plot. Thus, the discrimination of fibers by multivariate analysis seems to be an effective in the cases where fibers show similar morphology and are unable to differentiate via visual comparison. The present work also highlights the importance of UV-Vis-NIR spectroscopy for the analysis of textile fibers encountered in forensic cases.

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Y CHROMOSOME STR TYPING: A DISTINGUISHING TOOL FOR EXCLUSION IN CASEWORK OF SEXUAL ASSAULT

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The sexual assault cases are on a rise in India's national capital Delhi, and so are the cases where men are falsely implicated for the same. The number of reported cases of rape has shown an approximate fivefold increase in the span of last 10 years. There are many cases that go unreported owing to the stigma attached to such cases. There are also cases where women misuse these laws for monetary gains, to exact revenge or to malign someone's reputation. Hence, any sexual assault case should be investigated with utmost care and in an impartial manner

so as not to miss a single piece of evidence. Here, we present a case study where the crime scene showed sign of violence. This case was suspected to be positive at the initial stage. The presence of Y-peak on Amelogenin locus in Identifiler STR in vaginal swabs of victim raised doubt about the case being positive but Y-Filer STR helped in distinguishing the male contributor from the alleged accused. This conclusion strongly indicates the power of Y-STRs in forensic DNA analysis that not only helps in identification of perpetrator but also in exclusion of the innocent who are falsely accused in criminal cases, thereby saving their lives.

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ORGANIZING A PROFICIENCY TEST ON STAMP EXAMINATION IN ACCORDANCE WITH ISO/IEC 17043 REQUIREMENTS

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In document examinations, stamp and stamp impressions examinations are based on matching defects and design details on the questioned and control samples. These examinations are routinely carried out by document examiners around the world. International proficiency tests for questioned documents examination have been available for decades while similar programmes specifically focus on stamp impressions examination are rare, this presentation reported a recent proficiency testing programme on stamp impressions examination in accordance with ISO/IEC 17043 by an accredited provider. In this proficiency testing programme, a total of twenty-four forensic laboratories registered for the programme and twenty-three of them submitted their results for performance evaluation. Apart from giving details on the design and operation of the proficiency testing programme, this presentation also aimed to provide the limitations and difficulties encountered in sample preparations, homogeneity test and stability test of the testing materials. Moreover, various comments and feedback received from the participant laboratories, particularly in respect of examination approaches, challenges faced by the participants in forming conclusions and their suggestions for further improvement would also be evaluated. The outcome of the programme was encouraging and should be able to support the interest of proficiency testing providers in organizing similar programmes in the near future.

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VIRTUAL AUTOPSY: AN ESSENTIAL TOOL IN GUNSHOT WOUNDS, EVEN NOT IMMEDIATELY LETHAL

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Through the examination of gunshot wounds in a man dying 7 months after the assault, we describe the role of CT-scan data collected before death to identify wound paths and confirm the causal relationship between the initial lesions and the later death. A 24 years old male was admitted to the emergency department after a non-lethal gunshot wound. He was conscious but had three wounds: two wounds in the abdomen (left anterior lower thoracic and right sub-costal along the axillary line) and one in the right thigh. The intra-abdominal wound path was described by the surgeon as left to right. This interpretation was transcribed on the initial medical certificate. At autopsy, the examination of these scars rose doubts on the interpretation of the surgeons regarding the direction of the intra-abdominal ballistic path. Indeed, a linear scar observed on the right side evoked an entry wound whereas a star-shaped scar in the left anterior lower thoracic region looked more like an exit wound, in contradiction with the initial medical certificate. On the basis of this discrepancy, radiologists involved in post-mortem imaging were asked to reformat and reinterpret with the forensic experts the CT-scan performed when the patient was admitted 7 months earlier, to help present evidence to the magistrate. With these data additional to the autopsy report, forensic experts fulfilled their mission more pertinently, in circumstances where a body with scars had changed through time and with a medical file containing early information transcribed by practitioners with no ballistics training.

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EFFICIENT WAVEBANDS FOR THE DETECTION OF OBLITERATED WRITINGS BY MID-INFRARED HYPERSPECTRAL IMAGING

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This is the study of a method for the optical non-destructive detection of obliterated writings. In a previous study, I found many obliterated writings that could not be detected by using the conventional methods of visible and near-infrared spectroscopic photography, but could be detected by mid-infrared hyperspectral imaging. However, when analyzing the hyperspectral data by peak-area mapping, the detection will not be successful if the value of the wave number used for the calculation is slightly different from the correct value. Therefore, I studied a method to find wave numbers that are effective in the accurate detection of obliterated writings efficiently. One of the necessary conditions for the detection of obliterated writings is that absorption peaks of writing inks are not suppressed by the absorption spectra of paper. Therefore, it is necessary to find the absorption peaks of writing inks that are not suppressed by the absorption spectrum of paper, while taking into consideration the fluctuation in absorption spectrum of paper depending on the position. I wrote characters on papers using 220 types of writing instruments. For each character, 50 points with and without the writing ink were measured by using a mid-infrared hyperspectral imaging apparatus. The mean value and the standard deviation of the paper spectra were calculated, and the fluctuation range of the paper spectra was obtained. Subsequently, I searched wave bands in which many spectra of the writing ink largely deviated from the fluctuation range of the paper spectra. Accordingly, it was possible to find the absorption peak of the writing ink that is not suppressed in the absorption of paper. In addition, the same analysis was carried out for the second-order differentiation of each spectrum. Approximately half of the ink used in this study had at least one absorption peak that was not buried in paper absorption, and the characters could be detected even on paper. Moreover, such peaks were distributed between 1000 and 1800 cm^{-1}. However, this is merely a necessary condition for detecting obliterated writings. Absorption by obliterated ink must also be taken into account when detecting obliterated writings. However, since all of the wave bands used for the detection of obliterated writings in previous studies were also included in the wavenumber bands discovered in this research, the results of this research can be used for the discovery of an efficient waveband that can be used for the detection of obliterated writings.

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DIATOM TEST IS STILL A RELIABLE METHOD FOR THE DIAGNOSIS OF DROWNING

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The diatom test has been used to provide valuable information for the diagnosis of drowning in forensic sciences. However, there are always arguments both for and against using the test. One of the concerns is that diatoms cannot be recovered from some cases of drowning. and some forensic experts found that there are a few diatoms present in the

organs of non-drowning bodies. The argument about diatom test resulted in what so called "War of diatoms". A century past, diatom test remain controversial. We developed a novel method called "Microwave Digestion-Vacuum Filtration-Automated Scanning Electron Microscopy () method" which improved the sensitivity a lot. In a study of 115 drowning cases, diatoms could be detected in 100% of lung tissues samples and in 97% of distant organ samples (The liver and kidney were both tested positive) of the drowning victims. the numbers of diatom in the lung, liver, kidney, and water samples were 67729.52±127399.30 valves/10 g, 20.33±33.16 valves/10 g, 20.54±32.35 valves/10 g, and 9779.29±17091.94 vales/10 ml respectively. The lung tissues had diatoms approximately 7 times the average amount of those in the water samples. Generally, the high positive rate means the high false positive rate. In our study, we used disposable materials and instruments, removing the superficial tissues to eliminate the potential contamination during autopsy and laboratory handling process. And, we also have analyzed under MD-VF-Auto SEM method the diatom content in the lung, liver and kidney tissues of non-drowned human bodies. With the increasing of non-drowned cases being tested, there are few diatoms in the lung, liver, and kidney tissues. Quantitative analysis showed that the number of diatoms in the tissues of drowning victim is much larger than that of the non-drowned bodies, especially in the lung tissues. Qualitative and quantitative analysis of diatoms in the organs could increase the accuracy of diatom test.

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FENTANYL INVOLVEMENT IN SUDDEN DEATHS IN THE PROVINCE OF ALBERTA 2011 TO 2015

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Background and Aims: Morbidity and mortality in relation to the abuse of fentanyl and fentanyl analogues has been increasing at an alarming rate, particularly in western Canada. Our aim was to categorize and quantify all sudden deaths in the province of Alberta in which fentanyl was detected on toxicological analysis over a five-year period (2011 to 2015 inclusively). **Material and Methods:** Using a medical examiners database, we listed all cases in which fentanyl was detected on toxicological analysis from 2011 to 2015 inclusive. We then categorized and quantified demographic data, manners of death, concomitant drugs of abuse, as well as the presence of fentanyl analogues. Prior to 2016, the manner of death in cases of acute drug intoxication was ruled 'unclassified'. For the purposes of this study and in accordance with new guidelines from 2016 onwards ruling such deaths as 'accidental', we re-classified most unclassified cases as accidental deaths. Only cases where fentanyl was detected were included in this study, regardless of the cause or manner of death. **Results:** From 2011 inclusive to 2015 there were 14, 43, 90, 132 and 301 cases respectively (0.4% of ME cases in 2011 to 8% in 2015). Cases where the manner of death was ruled (or reclassified) as accidental due to acute fentanyl toxicity or combined fentanyl with multi-drug toxicity accounted for 6, 29, 67, 114 and 249 accidental death cases from 2011 to 2015 respectively. The number of accidental deaths involving blunt trauma or multiple injuries has gradually increased from 2013. Two cases of drowning were also reported in 2015. The number and variety of drugs concomitantly present with fentanyl dramatically increased in 2015. Cocaine overtook ethanol as the most common concomitant drug from 2013 to 2015. In 2015, the variety of "other" drugs dramatically increased. Concomitant heroin use also emerged in 2015, with 19 cases being reported. Detected fentanyl analogues included 3-methylfentanyl and acetylfentanyl. **Conclusions:** We have noted a dramatic increase in the number of medical examiners cases where fentanyl was detected since 2011. Interestingly, this rise correlates with the introduction of the less easily abused Oxyneo in substitution of Oxycodone. We have also noted a dramatic use of cocaine with fentanyl, as well as the use of a large variety of other drugs in 2015. These findings indicate the urgency of the current fentanyl crisis, and will hopefully guide critical intervention.

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MEDICAL ASSISTANCE IN DYING: TRENDS, CHALLENGES, LESSONS & FUTURE CONSIDERATIONS

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On June 17, 2016, legislation was passed in Canada to amend the Criminal Code enabling clinicians to provide Medical Assistance in Dying (MAiD) to eligible patients. The need for reporting, monitoring and oversight of MAiD deaths was identified by the Supreme Court of Canada to ensure transparency, foster public trust and inform future public policy. In Ontario, these deaths are reported to the Office of the Chief Coroner. MAiD deaths, being a new type of death with serious implications, required a unique and different approach from current investigative procedures for coroner cases. The end result was the formation of a stand-alone MAiD team, consisting of a team lead, three nurse investigators and a dedicated administrative assistant. This marks the first time in Ontario that registered nurses with coroners' investigative powers and duties are conducting death investigations. The team's goal was to implement the least intrusive investigative approach to balance the requirement for reporting, monitoring and oversight, while respecting the needs of patients, families and clinicians. Aggregate data was collected and will be shared with audience participants to illustrate trends [demographics, setting, type (clinician-administered versus self-administered), underlying condition and regional distribution]. Like any complex social issue, challenges arise: cases will be presented that will demonstrate some of the unique challenges encountered in the first year, including the progression from simple to increasingly complex cases, as well as the incorporation of organ and tissue donation following administration of MAiD. Lessons learned have led to ongoing improvements in the MAiD review process, which helps to ensure the safety of vulnerable persons and society, while providing dignity to those patients pioneering the way for future MAiD deaths.

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REAL WORLD FRONTAL IMPACTS INVOLVING INFANT OCCUPANTS

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The Western Motor Vehicle Safety (MOVES) Research Team in partnership with Transport Canada and the London Health Sciences Trauma Program has been conducting a study of collisions involving injured pediatric passengers since 2015. Mechanisms of injury and the performance of restraint systems are a major focus of the pediatric study. Field investigations have been conducted on 25 real world frontal impacts involving restrained infants less than 2 years of age. The frontal impacts were high severity collisions with a velocity change (delta-V) ranging from 30 km/h to 84 km/h (average 49 km/h). All of the children in this series were seated in the rear occupant compartment and were restrained in forward-facing or rearward-facing child seats. Most of the properly restrained children were provided good protection by the child safety seat and were not seriously injured; however, four infants aged 2 to 7 months seated in rearward-facing infant carriers sustained serious head injuries due to interior contact. This finding was consistent with crash tests of anthropometric test dummies in rear-facing infant seats that observed elevated head accelerations in some cases due to interior contact. Two infants seated in forward-facing child restraints sustained serious cervical injuries that may have been prevented if they had been seated in a rearward-facing child seat.

Disclosure: All authors have declared no conflicts of interest.

THIRD-GENERATION AIRBAG DEPLOYMENT: INJURY PATTERNS IN FATALLY INJURED DRIVERS

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To determine the real-world performance of driver's third generation frontal airbags with and without seatbelt use on injury patterns in fatally injured drivers, case files from the Office of the Chief Coroner for Ontario for investigations done in 2011-2012 were reviewed. Fatal injury patterns among third- generation airbag motor vehicle collisions (MVCs) compared to first/second- generation airbag deployment and airbag non-deployment MVCs were analyzed. One hundred ten cases met the inclusion criteria. The odds of sustaining craniocerebral, cervical spinal, thoracic and abdominal injuries were not statistically different when controlled for airbag generation and deployment status or seatbelt status; however, there were an increased risk of fatal thoracic injuries overall in the third- and second- generation cases. Seatbelt usage reduced the risk of all injuries except abdominal injuries among belted drivers in the cases of third- and second-generation deployment.

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VETERINARY FORENSIC PATHOLOGY: CASES FROM AN EMERGING DISCIPLINE

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Animal may be victims, evidence or perpetrators of a crime. When discovered at scenes of serious crimes against people, animals are often both victim and evidence. Internationally, submissions of animals to veterinary diagnostic laboratories from law enforcement agencies have dramatically increased over the past 15 years. Reasons for this are speculative but factors likely include changes in legislation and mandatory reporting of suspected animal abuse by veterinarians. Yet, animal abuse rarely occurs in isolation – when animals are abused, people are at risk and when people are abused, animals are at risk. Animals may be sentinels for domestic abuse and cruelty to a pet is a recognized mechanism of psychological control over a partner: no species of animal is immune to these crimes. The link between animal abuse and concurrent or predicted interpersonal violence is well established. Medical examiners, investigators and attorneys, however, may not be aware that veterinary pathologists are employed at universities or diagnostic laboratories to perform postmortems, or that some have developed expertise in the pathology of animal abuse and neglect. Veterinary pathologists in this emerging subspecialty are in the fortunate position of learning from examples of systemic failings in medical forensic pathology, such as inadequate oversight, training and certification. They can also benefit from the recent advances in several jurisdictions to rectify these issues. Cases submitted to the Animal Health Laboratory, University of Guelph Ontario Canada by law enforcement agencies for post-mortem will be used to illustrate examples of animal cruelty and the context in which they arose.

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RECONSIDERING SPECIAL STAINS IN FORENSIC HISTO-ANTHROPOLOGY

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Histological analysis as applied to forensic anthropology has largely been centred around polarized light microscopy, and increasingly, the use of scanning electron microscopy and laser scanning confocal microscopy (LSCM). Age estimation, and determining the nature of the sample (faunal v. human bone) have been the focus of most histological work. Paleopathologists have begun to reintroduce the use of stains to elucidate microstructure, as either preferable to, or in tandem with, light microscopy, in order to narrow the scope of differential diagnoses. Pathologists have a range of special stains available for use, tailored to the diagnosis of specific conditions, but anthropologists, have not applied special stains to histo-anthropological work, likely because of the assumed constraints of the absence of soft tissue. This research aims to demonstrate the value of special staining techniques to the field of forensic anthropology by illustrating the information that can be gained from mineralized bone tissue, and surviving soft tissue, when the following special stains are applied to bone samples: Hematoxylin and Eosin (H&E), Goldner's Trichrome (GT), Toluidine Blue (TB), tartrate resistant acid phosphatase (TRAP87) and Basic Fuchsin with fluorophore dyes Alexafluor 488 and SlowFade Gold. Samples of fresh, skeletonized, human and porcine and ancient (3rd C AD), human bone were embedded in methyl-methacrylate, and stained with H&E, Goldner's Trichrome, Toluidine Blue, TRAP 87, and Basic Fuchsin both with and without fluorophore dyes following previously published protocols. Stained and unstained samples were examined under light microscopy, with and without polarized light, and laser scanning confocal microscopy. Results indicate four main areas of improved visualization using stained versus unstained protocols. First, performance and accuracy of standard histomorphometry of mineralized bone were both improved in stained setting, regardless of stain used. Second, in investigating diagenetically altered bone it was noted that 'gross' microstructural features, such as cement lines, are maintained, allowing for determination of human versus non-human origin, improved age estimation, and the presence or absence of some pathological conditions (i.e. specifically those which disrupt normal bone deposition). Third, detection of surviving soft tissue, even in highly decomposed environments, allowing a 'pre-test' before embarking on more expensive soft tissue (e.g. DNA, or isotopic analysis). Lastly, using LSCM, the stained samples allowed for improved imaging and detection of targeted organic and mineral structures over unstained samples. Following this presentation, it is recommended that forensic anthropologists expand on the use of special stains to maximize data extracted from histological bone samples.

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COMBINED USE OF PMCT 3D RECONSTRUCTION AND 3D-DESIGN SOFTWARE FOR POSTMORTEM BALLISTIC

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In deaths from gunshot wounds, forensic and ballistic experts have a duty to deliver clear information to the courts. Computed Tomographic (CT) Scan obtained before autopsy has become the technique of choice for multiplanar localization of the bullet, and also for 3D reconstructions. We present the combined use of CT and an animation software to represent the victim in movement in order to establish the compatibility of the injuries sustained with the statements of the protagonists. We also provide with a method for calculating the firing angles in order to refine the ballistic expert report and to give precise answers to the judicial authorities, in particular in crime reconstructions.

Disclosure: All authors have declared no conflicts of interest.

THE CHEMOMETRIC ANALYSIS OF FUEL COMPONENTS TO CLASSIFY UK PETROL AND DIESEL USING GC-MS AND FTIR

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The identification and classification of fuel is extremely important in a forensic context as it may help police forces to identify different fuel sources in various fuel related offenses. In this study petrol and diesel samples are analysed in order to identify chemical composition and additives with the aim of obtaining a set of compounds that will allow forensic scientists to classify fuels from different brands. The study was performed using petrol and diesel sold in the city of Lincoln (UK) during four seasons (winter, spring, summer, autumn). Twenty four (24) super unleaded petrol, thirty-two (32) unleaded petrol and thirty-five (35) diesel samples, representing eight (8) different brands were analysed by gas chromatography-mass spectrometry (GC-MS) and Fourier transform infrared spectroscopy (FTIR). Principal component analysis (PCA) and linear discriminant analysis (LDA) were subsequently applied to classify all the samples according to their brands and seasons. From the results, methyl *tert*-butyl ether (MTBE) and ethyl *tert*-butyl ether (ETBE) were identified as the additive more preferably added in super unleaded petrol samples that can be used to aid in the separation. The inconsistency in the amount of some petrol compounds, such as isooctane, was also observed and used to establish differences among petrol samples. In diesel, the distribution of fatty acid methy ester (FAME) contents showed the effect of seasonal variation as these were found in all spring, summer and autumn samples, but not found in all winter ones. The selection of a reduced number of key fuel compounds and additives was also shown to be sufficient to allow a classification among the different fuel samples with a high accuracy (from 80-100%) using PCA-LDA. Thus, the results obtained from this study provide very useful information for forensic investigations in order to identify the brand of the fuel. Additionally, the selection of a reduced number of key components may be of help in those cases when a small number of variables might be required for classification of fuels.

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A METHOD FOR DETERMINING SWEEP WIDTHS FOR FORENSIC SEARCHES

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Searches for missing persons or human remains frequently depend on the detection of relatively unobtrusive traces on the ground. However, there has been very little study of the range within which a searcher can identify such traces effectively. In this paper, we present a method for determining the "sweep widths" of a searcher's path for several types of evidence. Sweep width — the band within which the number of items the searcher fails to detect is identical to the number she does find outside the band — is the simplest measure of search effectiveness and is important for determining the optimal spacing of searchers and for assessing a completed search's thoroughness. Here we demonstrate with an experiment that involved a wooded environment "seeded' with objects that searchers could be expected to look for. After many searchers have traversed the test area along a predetermined path and recorded their detections on an iPad, we use a Python script that automates analysis of the data tables, determines the detection function for each type of search object, and calculates the sweep widths. Sweep width varies substantially with the size and type of search object.

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GEOPHYSICAL HIGH RESOLUTION METHODS APPLIED TO STUDY OF SIMULATED GRAVES IN COLOMBIA, SOUTH AMERICA.

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In many Latin American countries, there is a significant number of missing people and some of them have been victims of enforced disappearance. Currently in Colombia, there are about 75,000 missing people. It is estimated that approximately 21,000 of these are enforced disappearance many of them due to conflict with illegal armed groups. This problem is also present in 89 countries around the world. Several countries have reported findings of a variety of both individual and mass burials, at different depths and depositional environments. The search for burial sites in Colombia, such as mass and individual graves, in the vast majority of cases is still undertaken in the traditional methods, which corresponds to take trial excavations and using a steel soil probe in places where eye witnesses indicate that there could be a grave. Therefore, criminal investigations often have failed and the searching commission teams had not positive findings in more than 90%, in sites where probably there are human remains or relevant evidences. That situation does not contribute to forgiveness of Colombian community, which need to find the missing persons to support the post-conflict process after the peace agreements. We have applied *in situ* geophysics high resolution techniques to analyze physical magnetic and electric properties of simulated graves. The study is integrated with the constantly monitoring of environmental conditions. The experimental work has been developed in two regions with different weather conditions in Colombia which simulate the characteristics of several critical zones, where the probability of buried bodies is high according to previous statistical studies [1]. We will present our results which demonstrating that geophysical methods give a high reliable information to find the missing people, providing very accuracy procedures without intrusive practices. Our findings permit improves the judicial commissions tasks to search graves in Latin America supporting by the geophysical science [2]. [1] Equitas.org.co. (2017). MESP Un RADAR para encontrarlos | Equitas. [online] Available at: http://equitas.org.co/blog/mesp-un-radar-para-encontrarlos [Accessed 9 Mar. 2017]. [2] Carlos Martín Molina et. al. *Preliminary results of sequential monitoring of simulated clandestine graves in Colombia, South America, using ground penetrating radar and botany*. Forensic Science International. 248, 61-70. (2015).

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A STUDY OF ERROR IN THE ESTIMATION OF THE ORIGIN OF A RADIAL SPATTER PATTERN

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The origin of a radial spatter pattern of blood is estimated by the analysis of discrete blood deposits within the pattern, which are produced by individual airborne blood drops. The major (D) and minor (d) dimensions of these typically ovate deposits are measured and used to calculate the approximate angle at which each airborne blood drop impacted the substrate. Geometric models, the foundation of the so-called impact angle calculation, is based upon the oblique projection of a sphere onto a plane. Alternatively, the cross-sectional dimensions of a cylindric section, formed by the intersection of a plane and right circular cylinder, is another geometric model that produces an equivalent result. The *arcsine* of the width/length ratio of the dimensions of the cylindric section or spherical

projection, is equal to the angle of intersection or projection; i.e., d/D = $\sin^{-1}$ (angle). These models are the basis for the approximation of an airborne blood drop trajectory at impact with a flat surface. The ratio of the dimensions of the resultant elliptical deposit are used to calculate the so-called impact angle, the acute angle between the tangent of the trajectory at impact and the substrate. Several assumptions are required for use of the model; these are outlined and assessed in this study. Defibrinated ovine blood was used to create blood deposits on various surfaces; experimental variables include incident angle, height of fall, blood drop mass, and substrate effects. The dimensions of each deposit were measured by hand (estimation with the unaided eye) and digitally using a "best-fit" ellipse in Microsoft® Excel or similar software. The calculated ratios of both measurement techniques were compared to the expected ratio for each variable. Error was assessed with a Student's t-test (two-sample, unpaired) to determine statistical significance.

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PERSISTENCE OF ORGANIC GUNSHOT RESIDUES EVIDENCE

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Gunshot residues (GSR) are a potential form of evidence in cases involving questions relative to the association of a person of interest (POI) to a firearm-related event. Daily, in most forensic laboratories, GSR analyses focus on the detection and characterisation of the inorganic components (IGSR) which are mainly particles composed of lead, barium and antimony originating from the primer. However certain particles cannot be assigned to IGSR with a high degree of confidence due to possibilities that they may have been derived from industrial and domestic sources. Moreover, the increasing prevalence in the use of heavy metal-free ammunition will challenge the current protocols used for IGSR analyses. This evolution in the firearm environment raises a number of issues in IGSR investigation as such ammunition fails to produce typical inorganic particles. In order to provide complementary evidence to IGSR particles, the current study focused on the organic components (OGSR) arising from the propellant of the ammunition. To study the persistence, five compounds well-known as being part of OGSR were chosen: Ethylcentralite (EC), Methylcentralite (MC), Diphenylamine (DPA), 2-nitrodiphenylamine (2-nDPA) and N-nitrosodiphenylamine (N-nDPA). This study assessed the retention of OGSR traces on the POI's hands. This information is crucial for a suitable interpretation of OGSR evidence by taking into account the activity, the chronology and the circumstances of the case. Several time intervals between firearm discharges and GSR collection were studied in order to assess the influence of time and activity on the detection of OGSR traces. Intervals ranging from t0 to 4 hours were chosen and two ammunition calibres which are frequently encountered in casework in NSW, Australia, .38 special and .45 ACP, were studied. The preliminary trends and results will be presented and discussed in a forensic and interpretation point of view. The overall project aim is to ensure an appropriate integration of OGSR trace evidence into an interpretation framework suitable for legal procedures as recommended by the recent ENFSI Guideline for Evaluative Reporting in Forensic Science.

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ESTABLISHING THE FIRST HUMAN DECOMPOSITION FACILITY IN AUSTRALIA

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Taphonomy involves the study of human remains from the time of death to the time of discovery. The aim of research in this field is to better understand the physical, chemical, and biological processes of soft and hard tissue decomposition. The process of decomposition is inherently impacted by the surrounding environment, including climatic conditions, geological formation and the ecological community. At present, the only facilities that conduct human decomposition research are based in the USA (colloquially known as 'body farms') however their data cannot be extrapolated to Australia due to our distinctly different environment. This presentation will discuss the development of Australia's first human decomposition facility that uses donated cadavers to study the process of decomposition in our local environment. The facility involves collaboration between universities, police agencies, and forensic science services in Australia and New Zealand and encompasses a range of disciplines including forensic chemistry, molecular biology, microbiology, anthropology, archaeology, anatomy, pathology, entomology and palaeontology. The facility officially opened in 2016 as a national research and training centre that will revolutionize the way in which criminal and death investigations are conducted in Australia. A greater understanding of the decomposition process can assist police and forensic investigators to better search for, locate, recover, and identify victim remains. Such research is particularly important for investigations involving missing persons, as well as victims of homicide, genocide, or mass disaster.

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ANATOMICAL TAPHONOMY AT THE SOURCE: ALTERATIONS TO A SAMPLE OF TEACHING SKULLS AT A MEDICAL SCHOOL

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Former osseous anatomical teaching specimens have the potential to end up under forensic examination if they are divorced from their original context and turned in to or seized by law enforcement. A likely original source for some of these remains is a medical school, where students routinely examine human skulls to study anatomical structures. Many of these skulls, however, eventually end up in private hands, through theft, donation, sale, loss, or retirement of instructors who had these skulls in their keeping. Once these skulls come under the notice of law enforcement, they must be treated as suspicious until proven otherwise, just as any other type of unidentified remains. The original preparation of former anatomical teaching specimens and the effects of repeated manipulation leave behind multiple taphonomic alterations. Many former anatomical teaching specimens are obvious regarding their origin due to taphonomic alterations easily discernible even to non-specialists (e.g., distinctive labeling from the anatomical supplier or anatomical mounting hardware). Some, however, are not as identifiable regarding their origin, due to subsequent taphonomic processes (e.g., handling, burial, or repurposing of the remains into display or ritual items) that may obscure or overwrite the taphonomic changes from the original processing. The origin of a given skull as an anatomical teaching specimen (thus not normally requiring additional investigation, identification, or repatriation) therefore is not always straightforward and may require comparison with taphonomic characteristics of skulls known to be from this source. To determine the taphonomic characteristics of former anatomical teaching skulls, a sample of 84 currently in use at the Boston University School of Medicine was examined for a broad suite of traits. Taphonomic characteristics that can be used to distinguish former anatomical teaching skulls include the

presence of mounting hardware, drilling, regular vault sectioning, plastic reconstruction, pen and pencil markings, labeling, patina buildup from handling, and shelf wear. These characteristics may be used to distinguish skulls from this source from other common sources that end up under forensic examination, including former trophy, ritual, or cemetery skulls.

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VIOLENCE AGAINST WOMEN IN INDIA – A FORENSIC PERSPECTIVE

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Violence against women in India is widely prevalent, mainly because Indian society is traditionally patriarchal in nature. It takes several forms such as physical violence, emotional abuse, sexual assault, honor killing and dowry related abuse and deaths. Physical health outcomes include chronic pelvic pain, headaches, injuries [from lacerations to fractures and internal organs injury], irritable bowel syndrome, miscarriage, pelvic inflammatory disease, permanent disabilities, self-injurious behaviors, STDs including HIV and unwanted pregnancy. Mental health effects include anxiety, depression, eating disorders, fear, low self-esteem, obsessive-compulsive disorder, PTSD and sexual dysfunction. Fatal effects can include suicide, homicide, maternal mortality, and HIV/AIDS. Indian Government has enacted a number of legislations in the past decade to curb such violence against women. Some major legislations are "*The Protection of Women from Domestic Violence Act 2005*", "*The Protection Of Children From Sexual Offences [POCSO] Act 2012*" and "*The Criminal Law (Amendment) Act, 2013*". *The Protection of Women from Domestic Violence Act 2005* provides for the first time in Indian law a definition of "domestic violence". The definition is broad and includes not only physical violence, but other forms of violence too, e.g. emotional, verbal, sexual, and economic abuse. It is a civil law meant primarily for protection orders. It is not meant to penalize criminally. The act does not extend to Jammu and Kashmir [J&K], which has its own laws. J&K enacted in 2010 an equivalent law, "*The Jammu and Kashmir Protection of Women from Domestic Violence Act, 2010*". *The Protection Of Children From Sexual Offences [POCSO] Act 2012* aims to protect children from offences of sexual assault, sexual harassment and pornography and to provide for establishment of special courts for trial of such offences. *The Criminal Law (Amendment) Act, 2013* widened the definition of rape. Earlier, the only kind of rape recognized in India was penetration of vagina by human penis. Now penetration vagina, urethra, anus and mouth by human penis are considered rape. In addition, penetration of vagina, urethra and anus by any other human organ e.g. a finger, tongue etc and even by a foreign object e.g. a pencil are considered rape. Several new varieties of rape have also been introduced, such as a rape which results in persistent vegetative state [PVS] of the victim. The paper argues that these legislations offer too little too late. The deficiencies become more apparent, when these legislations are compared and contrasted against those from other nations.

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A NOVEL METHOD FOR VISUALIZING FINGERPRINTS ON ABSORBENT SURFACES - "CONTACT NINHYDRIN"

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The Presentation summarizes the development of a novel method for rapidly visualizing fingerprints on absorbent surfaces (paper). The method is highly portable, rapid and produces high quality fingerprints on absorbent surfaces and involves no solvents. This, one-step procedure, uses a treated piece of card stock having been dipped in a solution containing Ninhydrin and additives and allowed to dry. This Ninhydrin sheet is placed in contact with the fingerprint containing substrate and is enclosed in a microwaveable sandwich containing a moisture source. A simple piece of diaper, dampened, but dry to the touch can be used as source of sufficient moisture to heat the contents of the sandwich in a microwave oven. We have also developed a simple moisture carrier sheet (Delaq sheet) that contains a deliquescent solid that holds sufficient moisture for the method for months, if kept in a humidified container. The boards that contain the package, (sandwich) must freely pass microwave energy and the heating need be only gentle, defrost on most ovens. The "sandwich" holds the reactant materials together under gentle pressure to facilitate the two phase reaction. This sandwich is placed in simple microwave oven and microwaved for two to six minutes, then allowed to cool for a few minutes. When opened, fingerprints are visualized on the substrate with no noticeable darkening (purple) of the background. This Contact Ninhydrin method does not cause most ballpoint pen inks to run and is therefore suitable for use where document examination may be needed. This new method has significant advantages of speed and portability over solution methods currently widely used. The method is suitable for use at a crime scene since all the necessary materials can be easily carried in a briefcase, as long as there is a microwave available in the crime scene van or at the scene. Since fingerprints absorbed into absorbent surfaces may often be recoverable after an extended period of time, their recovery can be useful even in cold cases. The primary advantages of the "Contact Ninhydrin" method are: speed (sandwich can contain multiple substrate sheets), portability, no liquid solutions needed for development, two phase reaction means little or no colorization of substrate, materials easily prepared and stable at room temperature, does not run most ballpoint pen inks.

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EVALUATION OF HSI VISIBLE/NEAR IR SPECTROSCOPY AS FORENSIC TOOL FOR AUTOMOTIVE PAINT DISTINCTION

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Spectroscopies have been widely used in Forensic Science to analyze fingerprinting, gunshot residue, bloodstain, paints, inks and adhesives. Hyperspectral chemical imaging is a fast and non-destructive method that provides spatial and spectral chemical information of a particular specimen. Recently, researchers have evaluated the characterization and classification of automotive paints using Principal Components Analysis (PCA) performed in Infrared and Raman spectroscopies data. However, up to date, there is no report in regard the discrimination power of such trace evidence using Hyperspectral Imaging Visible/Near Infrared Spectroscopy (HSI-VIS/NIR). Therefore, this work evaluated the potential of HSI-VIS/NIR combined with PCA as a forensic approach to discriminate automotive paints. In total, 38 samples from twelve brands and a variety of colors (white, silver, red, grey and black)were analyzed, including different color shades. HSI-VIS/NIR data was acquired directly onto the paint chip's surfaces. PCA was individually performed in distinct color datasets and could discriminate 100% of the white, silver, red and grey samples collected from different brands or from the same manufacturer with different color/shades. Furthermore, the PCA reliability for the identification of similar paint chips was successfully tested using fragments of silver and grey samples collected from different vehicle sources with common brand, color and shade. In agreement with the literature, the automotive black paints presented a much lower discriminating power (0.625) because the spectra did not provide enough reflectance suitable for differentiation. Overall, these new findings support the idea of using HSI-VIS/NIR as a fast, easy and efficient alternative technique to other spectroscopies for accurate forensic assessment of automotive paints.

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XRD ANALYSIS OF SOIL BENEATH RABBIT CARCASS: AN IMPLICATION TO FORENSIC SCIENCE

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X-ray diffraction is a versatile technique for the study of the mineral component of the soil. In soil more than 2200 minerals have been described. The minerals proportion and alteration show that the soil is a strong tool for the forensic investigation and also can estimate time since after death or burial. The presence of certain type of minerals in particular decomposed soil was due to the seepage of body fluid into the soil, this fluid carry all minerals from carcass to soil. The most soil types share common minerals as Quartz, Magnetite, Illite, Pyroxenes, Muscovite, Aluminium oxides sulphates, Carbonates, Zeolite and Clay minerals. Due to diverse nature of soil, it is being a crucial part of the forensic science. Chemical and physical characters of soil are skilfully serving for forensic purpose. An experiment was conducted to study the mineral proportion of soil underneath decomposing carcass. Eight kilogram rabbit carcass was used as the experimental model to study the changes in soil during carcass decomposition. The soil samples were collected beneath the decomposed carcass according to stages of decomposition (bloated, active decay, decay and skeleton). The soil were analysed with the help of X'Pert PANlytical X- Ray Diffractrometer. Both (controlled and decomposed) soil types were analysed at 4°to 50° angle position. Total 13 major minerals viz. Muscovite 2M1, Zeolite, Albite, Doloresite, Phengitic,Illite 2M1, Zeolite Rho (Rb exchanged, dehydrated) Natrolite, Magnetite, Quartz low, Simpsonite, Zeolite Rho (Cs,$^{-}$ Sr exchange) and Piezotite were reported from the controlled and carcass decomposed soil. The minerals were similar in the controlled soil and bloated stage carcass decomposed soil excluding Piezotite and Zeolite Rho (Rb exchanged, dehydrated) were present in bloated stage carcass decomposed soil. In decay stage carcass decomposed soil Illite 2M1, Nitrolite, Simpsonite, Doloresite, Phengitic and Zeolite were found which are not present in the controlled and bloated stage carcass decomposed soil. In active decay carcass decomposed soil Illite 2M1 and rest of the mineral same as in decay stage carcass decomposed soil were present. The skeleton stage carcass decomposed soil was characterized by abundant Muscovite 2M1 and Phengitic. The Quartz was totally absent in skeleton stage carcass decomposed soil.

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AN ELEPHANT QPCR ASSAY FOR FORENSIC PURPOSES

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Real-time PCR is most commonly used in the forensic community to quantify small amounts of human DNA in evidentiary samples. In the growing field of wildlife forensic genetics, real-time PCR is utilized primarily for identifying the species of origin from illegally traded animal by-products. Although DNA sequencing of mitochondrial DNA is the most common approach for species identification, it can be costly. Utilization of a multiplex real-time PCR assay can be a fast, inexpensive, and robust approach to species identification that can aid law enforcement in prosecuting crimes against animals. African (*Loxodonta africana)* and Asian (*Elephas* maximus) elephant populations are categorized under Appendix I or II of the Convention on the International Trade of Endangered Species (CITES), respectively. An Appendix I listing includes species that are threatened with extinction, thus trade of these plants and animals is highly restricted. Species not facing extinction that require extra attention and regulations so that they don't become exploited and over utilized are listed in Appendix II. The primary reason for the decline of these two animals is the illegal trade of their ivory. Other reasons for the decline in the elephant population are deforestation and human conflict. In wildlife crime laboratories, oftentimes species of origin can be determined by morphology. This method is limited by the expertise of the taxonomist and the condition of the animal product. Ivory is commonly carved into small figurines and trinkets. Elephant meat, hair, and hide are traded which can make it difficult to identify the species. These limitations have led to the development of genetic tests to identify species of origin in wildlife investigations. African and Asian elephants do have highly similar genomes; however in portions of their *cyt b* gene, variation exists. In this study a dual-genus, real-time PCR assay to identify elephant DNA for forensic purposes was developed. Following the assay development, a rigorous developmental validation was conducted according to current community recommendations set forth by the Scientific Working Group for DNA Analysis and Methods (SWGDAM). The completion of this work provides an assay that can generate data of evidentiary quality for wildlife crime laboratories.

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THE USE OF A SYNTHETIC OLIGONUCLEOTIDE FOR CREATING A STANDARD CURVE FOR QPCR ASSAYS

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Quantitative PCR (qPCR) had broad applications in molecular diagnostics, gene expression studies in medicine and microbiology, and forensic biology. Detection of target amplicons during qPCR is facilitated through the use of a non-specific DNA binding dye (*e.g.*: SYBR Green) or sequence specific DNA probes (e.g.: TaqMan® probes). Regardless of application or detection method, a standard curve must be generated from known quantities of the target sequence. Current methods for creation of a standard template include: genomic DNA, linear PCR amplicons, or cloned target sequences. Each method has inherent advantages and disadvantages. An approach that overcomes the drawbacks of these methods is the construction of a synthetic oligonucleotide of the target sequence. Synthetic oligonucleotides can be purchased in lengths of 125 – 2000 bp. This double-stranded product is affordable and easy to obtain. Using a synthetic oligonucleotide as a DNA standard can be useful for difficult to obtain DNA samples that would be used to create a standard DNA fragment through traditional methods. In this study, we have incorporated a synthetic oligonucleotide as a DNA standard in a qPCR assay, which decreases time, reagents, and cost of creating a standard sequence. Comparisons between the use of a synthetic oligonucleotide and a traditional standard template will be presented. The cost and time savings as well as the reliability with using a synthetic oligonucleotide makes this approach attractive to those developing qPCR assays.

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THE BONE IMPACTOR: AN INSTRUMENTED DEVICE FOR SIMULATING BLUNT- OR SHARP-FORCE TRAUMA

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Forensic investigators commonly interpret bony fracture patterns to estimate the force required to generate that trauma. Unfortunately, these estimates have been limited to qualitative values such as "low", "medium" or "high" force. This work presents the "Bone Impactor", a new experimental forensic device specifically developed to simulate blunt- and sharp-force trauma injuries and to permit a more quantitative relationship between force and trauma to be established. Recently, another group has developed a similar system using a pendulum design to create knife wounds; however, forces are estimated using velocity and the mass of the implement as opposed to being measured directly. The objective of this study is to create a device which produces impact events, at various velocities, while using instrumentation to record the applied force and velocity time-histories. An interchangeable implement holding system

has also been incorporated allowing the user to substitute between assortments of blunt or sharp implements. The machine design will be described in some detail along with the results of the commissioning and validation tests. Preliminary results for both blunt- and sharp-force trauma events will also be presented. The experimental results of this device can present a great contribution to forensic science by allowing investigators to directly link the applied force and velocity with the observed fracture patterns.

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SUICIDE FATALITIES DUE TO SHARP FORCE INJURIES IN ONTARIO, CANADA: A RETROSPECTIVE STUDY OVER 4 YEARS

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Sharp force injuries (SFIs) are caused by pointed or sharp-edged objects and include stab wounds and incised wounds. A retrospective study was performed on post-mortem examination data of 137 sharp force suicide deaths against 23,242 total number of autopsies recorded by the Ontario Forensic Pathology Service, Canada, between the period of 2011-2014. This study had two main purposes. Firstly, the purpose of this study was to identify an age group, as well as sex, that are at a higher risk of dying from sharp force suicides, when compared to one another as well as other manners of death. Other manners of death consisted of 138 cases, and included suicides (non-sharp force), accidental, homicide and natural deaths. Secondly, the purpose of this study was to determine if non-fatal injury wounds and evidence of self-harm are more common amongst sharp force suicides than other manners of death. The results of this study show that in Ontario, more individuals between the ages of 37-55 die from sharp force suicide than those ages 18-36 or 56+. The 37-55 age group made up 45% of sharp force suicides but only 30% of other deaths. In addition, it was found that more males died from sharp force suicide between 2011-2014 in Ontario than females. Males accounted for 85% of these deaths. In comparison, males made up only 64% of other deaths. Non-fatal injury wounds were seen commonly amongst sharp force suicides; these injuries were present in 58% of cases. There was only one case amongst the other manners of death where non-fatal injury wounds were present, which was a non-sharp force suicide. Lastly, evidence of self harm was seen rarely amongst both sharp force suicides and other manners of death, 6% and 5% respectively. This indicates that evidence of self-harm may not be a very useful factor in distinguishing sharp force suicides from other manners of death.

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REAL-TIME DATAFLOW PROCESS PLATFORM FOR NETWORK FORENSICS

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Today's network forensics are struggling to bring together enormous volumes of heterogeneous data from all kinds of logs and network traffic, and to analyze the huge amount of data in real time. We present the design of a real time dataflow process platform using a combination of open source tools that captures, retains and analyze high amount of network activities and logs to further support network forensic. Our proposed platform is now being used in a large company in China and has been proved to achieve high performance and can be used in real time with the maximum throughput of around 5Gb/s. Main modules, their functions, and the relationship between different modules are shown as follows: 1) Data Bus: Kafka is used as data bus. Kafka is a distributed, partitioned, replicated commit log service. It provides the functionality of a messaging system, but with a unique design. A single Kafka broker can handle hundreds of megabytes of reads and writes per second from thousands of clients. Kafka is designed to allow a single cluster to serve as the central data backbone for a large organization. It can be elastically and transparently expanded without downtime. 2) Extract-Transform-Load: Most data are collected from different source systems and each separate system may use a different data organization and/or format. Elasticsearch, Logstash and Kibana will be responsible for data extract and presentation. Data normalization contains data extract, data transform and data loads, also known as ETL. ETL consumes data from the Kafka queue and extract, transform and load data. 3) Data Duration: For post hoc forensic analysis, raw data needs to be stored for a period of time for afterward correlating analysis. Intermediate and final analysis results also need to be stored. Data storage provides a platform to analyze data at different levels of specifications. We choose HDFS as data warehouse to store collected data for data duration purpose and further deep analysis. 4) Deep Analyze: Spark Streaming is perfect for data deep analyze, is a fast and general engine for large-scale data processing. and Spark Streaming in our system is built on Tachyon and will interact with HDFS. The proposed platform has been proven to be good in performance and stability as well as flexibility. Many other containers and applications can be easily added onto this architecture. Meanwhile, this architecture is easy to deploy and maintain for companies and organizations.

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USING HANDWRITING TO INFER A WRITER'S COUNTRY OF ORIGIN FOR FORENSIC INTELLIGENCE PURPOSES

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Forensic science has traditionally focused the majority of its resources and objectives towards addressing court-related questions. However, this view restricts the contribution of forensic science to one process and results in a loss of information as the investigative and intelligence roles are largely neglected. A change of perspective and expansion of the contributions of forensic science is required to take advantage of the benefits of abductive and inductive thought processes at the initial stages of the investigation, as well as the traditional deductive thinking employed in the evaluation stage. A forensic science discipline suffering from this imbalance is handwriting examination, which may be characterised as a time consuming and subjective process that is mostly carried out towards the end of the investigation for the purpose of judicial proceedings. Individual and habitual characteristics are the major handwriting features exploited, however alternate information concerning the author's native language could potentially be used as key elements in an intelligence framework. This research focused on the detection of characteristics that differentiate Vietnamese and English Australian writers based on their English handwriting. The study began with the extraction of handwriting characteristics from the writing of people from the two populations. The data was analysed using a logistic regression model and a classification and regression tree (CRT), which recognised four class characteristics that were capable of distinguishing between the two nationalities. The logistic regression and CRT models were capable of correctly predicting 95.9% and 93.2% of cases, respectively. Their predictive capabilities were then tested and supported using 'blind' specimens, which were conditions chosen in order to mirror casework settings. It appeared that using the four class characteristics, the two models were capable of differentiating English Australians from Vietnamese. This proof of concept research demonstrated the plausibility of exploiting this additional information from a handwriting trace and taking advantage of it in an intelligence-led framework.

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AN ATTEMPT TO BLACKMAIL THE NEW ZEALAND GOVERNMENT BY CONTAMINATING INFANT FORMULA WITH 1080 POISON

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Operation Concord was a major police investigation into a credible threat to contaminate infant milk formula with sodium fluoroacetate (1080 poison). 1080 is used in New Zealand to control mammalian pests and protect the native forests and wildlife. The oral dose sufficient to be lethal in humans is predicted to be between 2 -10mg/kg. In November 2014, threat letters were sent to the CEO's of two companies associated with the dairy industry, New Zealand's second largest export earner. Accompanying each threat letter was a plastic bag containing milk powder contaminated with 1080, in sufficient quantity that if ingested was estimated to result in the fatality of at least 30 infants. The blackmailer threatened to release 1080 into New Zealand's dairy exports to China and one other unnamed market if the use of 1080 in New Zealand did not desist by the end of March 2015. In addition to the serious safety issues identified, the financial impact of the threat was viewed as potentially catastrophic for the reputation of the New Zealand's dairy industry. In June 2016, a letter that retracted the threat was sent to one if the investigating Detectives. The provenance of the letter was known, which allowed advanced DNA analysis techniques such as Low Copy Number (LCN), Minifiler and Y-STR to be employed on samples taken from the retraction letter. This DNA testing identified a suspect. Of the 55 1080 samples collected by Detectives, 45 could not visually be excluded as being a source of the threat sample. Forensic Isotope Ratio Mass Spectrometry (FIRMS) was used to analyse the chemical composition of the 45 reference 1080 samples and the threat 1080 samples. When compared, 5 reference samples could not be excluded as being the source of the 1080 sent with the threat letters. 3 of the 5 1080 samples could be directly linked to the suspect identified by the DNA testing. The forensic testing provided tangible evidence to identify a suspect, and later link him with the 1080 sent with the letter. The complex investigation spanned 11 months, and culminated in the arrest of a local businessman. Operation Concord was a runner-up at the 2016 IACP Excellence in Criminal Investigation Awards.

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HISTOLOGY OF TEARS OF SMALL VEINS UNDER SUBDURAL HEMATOMAS IN THE INFANTILE 'TRIAD SYNDROME'

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Introduction: The source of subdural bleeding in and the pathogenesis of the infantile triad of encephalopathy, retinal bleeding and small subdural haemorrhages (SDHs) are controversial. The SDHs are thin, bilateral, paramedian and do not have significant space occupying effects. This abstract reports histological evidence of venous tears/ rupture of paramedian 'arachnoidodural' veins in such cases. **Materials and Methods**: Four triad cases were examined: Cases 1 (male [m]), 2 (m), 3 (f) and 4 (m) respectively, aged 5, 6, 12 and 15 months, presented with clinical evidence of the triad and died 2, 3, 2 and 4 days after hospital admission. All cases had a complete autopsy, including detailed examination of the brain, dura, spinal cord and eyes. This report concentrates on the microscopic findings in paraffin sections of multiple en face levels from circumscribed paramedian arachnoid/subdural blood staining, corresponding to sites where cerebral veins cross the subdural 'space' to the dural sinuses. The sections were stained with hematoxylin and eosin, a trichrome, and/or CD31 immunohistochemistry (an endothelial marker). **Autopsy Findings:** Encephalopathy, optic nerve sheath and retinal haemorrhages, and thin layer subdural bleeding were confirmed in all cases. Cases 1 through 3 had no other recent head or body injuries. Case 4 had a recent right occipital fracture and left frontal and right occipital intrascalp bleeding. Cases 2 and 3 had small old subdural membranes. Case 1 and 4 had thromboses in the tributaries and lateral recesses of the superior sagittal sinus. Under the subdural blood in cases 1 through 4 respectively were 3, 3, 4 and 1 small discrete areas of paramedian subarachnoid and subdural blood staining. Two, 2, 2 and 1 of these lesions respectively contained torn/ruptured small and medium-sized veins. The edge of each tear/rupture had a vital reaction, including fibrin-platelet debris, nuclear fragmentation, neutrophils, and nonocclusive venous thrombosis. In some areas the tears were at the site of the trans-arachnoid passage of the draining cerebral veins. **Conclusion:** The subdural bleeding associated with the triad is the result of venous tears/rupture, possibly where the vessels cross the arachnoid. The vital reaction excludes a post mortem artifact. These histological findings do not prove the pathogenesis of the venous lesions; theoretical considerations include traumatic 'shear' injury, congestive rupture, dural venous plexus immaturity, a primary structural venous defect, or a combination of these possibilities. (Extravasation of contrast from 'bridging' veins is described in published reports of autopsy venograms in triad cases.)

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NEW DEVELOPING REAGENT FOR LATENT FINGERMARK VISUALIZATION: FULLER'S EARTH (MULTANI MITTI)

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A number of methods have been reported in the literature for the development of latent fingermarks on different surfaces. This paper reports a new and simple powdering method which is non-toxic and has been employed on different substrates successfully for the development and visualization of latent fingermarks up to the time period of 6 days in varying temperature conditions. In this investigation a less expensive, simple and easily available fuller's earth (Multani Mitti)powder has been used to decipher the latent fingermarks on different substrates namely black cardboard box, clear glass, coverslip box, steel surface, laminated wooden sheet, clear plastic, colored plastic bag and surface of highlighter pen. It is observed that it gives very clear results on majority of substrates and can be successfully used for the development and visualization of latent fingermarks.

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FORENSIC EXPERIMENTAL STUDY OF ASSESSMENT OF POSTMORTEM INTERVAL (0-72 H) IN SKIN BIOPSIES

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Introduction: Determining the post-mortem interval is usually based on macroscopic-morphological criteria (cadaveric phenomena); more objective methods are often difficult to access in daily practice; therefore we analyze the usefulness of the histopathological examination of the skin as an objective method for determining the post-mortem interval. **Materials and methods:** 23 patients and 92 skin biopsies were analyzed. All samples were taken in a maximum time of 6 h post-mortem. Biopsies were classified into 4 groups according to the post-mortem interval, with 23 biopsies in each group: 1 (1 to 6 h.); 2 (25 to 30 h.); 3 (49 to 54 h.); 4 (73 to 78 h); 21 histological criteria were analyzed with Fisher test and Principal Component Analysis. **Results:** Skin biopsies of 23 individuals who died (mean age 51.6 years, 15 males and 8 females) were analyzed.21 histological criteria were analyzed by Fisher test; statistical significance ($p < 0.001$) with a reliability of 94.61% was achieved in 15 of the 21 parameters studied. With the 15 selected parameters, a principal component analysis established that there were differences among the 4

analyzed groups. **Conclusions.** The skin histological changes may be used as a parameter in the forensic evaluation of the early post-mortem interval.

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DOCUMENTING BLOODSTAINS BENEATH PAINT LAYERS USING MULTI-SPECTRAL FORENSIC PHOTOGRAPHY TECHNIQUES

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The development of forensic photography techniques can aid agencies in the documentation of information regarding crime scene cleanup. This study compared reflective infrared, reflective ultraviolet, and fluorescence photography in the documentation of bloodstain patterns that had been concealed beneath layers of architectural paint. High Dynamic Range (HDR) photography, as well as a chemical analysis of all four paint types using Raman, Fibre Optic Reflectance, and Attenuated Total Internal Reflectance-Fourier Transform Infrared Spectroscopy was performed. The photography results for reflective infrared were negative; reflective ultraviolet for two of the four paint types were positive. Fluorescence photography had the most definitive visual information for the two white paints but were concluded negative for black and maroon. HDR was concluded to be negative for reflective infrared and reflective ultraviolet; however, results for fluorescence were positive. Finally, spectroscopy results supported visual information as well as providing spectral data relevant for understanding specific chemical observations.

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3D MORPHOLOGICAL ANALYSIS OF SHARP-FORCE TRAUMA IN FORENSIC CONTEXTS

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Precise and flexible visualisation methods are essential to accurately assessing the morphological features of sharp-force trauma. Today, many forensic laboratories are equipped with a Scanning Electron Microscopy (SEM). One of its major applications is sharp-force trauma analysis. However, the significant variation that is observed in toolmarks seen in forensic cases cannot be resolved with this single method. The limitations of SEM for trauma analysis have been left largely unchallenged. Firstly, the monochrome, 2-dimensional images eliminates critical information essential to the analysis. Secondly, SEM is destructive to the sample; it requires sectioning the bone, and the high-pressure vacuum results in dehydration and micro-cracking. Finally, SEM fails to cope with taphonomic modifications. The surface changes on the bone, associated with different burial environments, impair the visualisation of morphological features required for analysis. Despite these limitations, there has been little research to explore alternative methods, in part due to the relative novelty of 3D imaging methods, and the uncertainty around macroscopic imaging. Additionally, the current (unfit) paradigm of the forensic sciences has fostered a lack of standardisation and protocols; for example, destructive methods like SEM are still used in common practice. This paper introduces 3D-photogrammetry as a more suitable and adaptable method for sharp-force trauma analysis. The interactive, 3D, photorealistic models cope with the morphological, preservation, and taphonomic challenges encountered in using SEM. Moreover, the standard 3D-photogrammetry method was customised; macro lenses, various light sources, a rotating-stage image capture, and post-processing filters maximised resolution and visible surface detail. In this study, 3D-photogrammetry methods were tested on three different sample sets (*n=32; n=14; n=10)*, consisting of experimental and archaeological cut marks, and taphonomy. Using two 3D-photogrammetry methods (Structure from Motion (SfM) and Reflectance Transformation Imaging (RTI)), and SEM the samples were modelled and measured for accuracy. Structure from Motion (SfM) and Reflectance Transformation Imaging (RTI)) were demonstrated to be excellent at visualising sharp-force trauma, and surface texture and colours on the bone. When compared to SEM, these methods modelled valuable 3D, colour, and texture data. Despite being a macroscopic class of imaging, an accurate analysis of sharp-force trauma was still made in 78% of cases. These methods represent valuable additions to the imaging toolbox. The non-destructive, cheaper, and more flexible analysis, combined with the interactive 3D model output, preserves the evidence, and adapts to morphological and taphonomic variations. Ultimately, they provide a precise and flexible analysis of sharp-force trauma.

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COLCHICINE DESTROYS THE INTESTINAL BARRIER FUNCTION AND INDUCES ENDOTOXIN SHOCK

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Colchicum autumnale, commonly known as Meadow saffron, is an autumn-blooming flower that contains colchicine in its leaf and bulb. The appearance of the leaf closely resembles Allium victorialis, commonly known as Alpine leek that is eaten as a wild vegetable in spring. Therefore, Colchicum autumnale has been mistaken and resulted in poisoning death in Japan. On the other hands, the mechanisms of colchicine poisoning death have not been clear. In this study, we have tried to reveal the molecular mechanism underlying colchicine poisoning death. In the histopathological analysis of the autopsy cases of colchicine poisoning, aberrant cell divisions were frequently observed in the intestinal epithelium. In the submucosal layers of an intestine, vasodilation and stromal edema were observed. Additionally, when we analyzed the levels of endotoxin and TNFα in the serum of these cases, both of them were higher in colchicine poisoning cases than the other autopsy cases. In the cell culture of human colon cancer cell line Caco-2 that mimics intestinal monolayer, colchicine reduced the expression of ZO-1 protein which was the key molecule of the tight junction. To evaluate the effect of colchicine on the intestinal barrier function, D-mannitol intestinal permeability test was performed. Briefly, the colchicine or saline was orally administrated into male C57Bl/6 mice. Then 24 hours later, small intestines were taken from these mice, and H^3-D-mannitol was enclosed into them. They were incubated in the culture medium, and H^3-radio activities leaked from the inside of intestines were enumerated by liquid scintillation counting. The results showed that H^3-radio activities were 3-5 times higher in colchicine-treated mice than saline-treated mice, indicating that colchicine treatment destroyed the intestinal barrier function. In conclusion, colchicine interferes the tight junction that has important roles in the intestinal barrier function, and further induces endotoxin shock. Thus, an analysis in the serum endotoxin or TNFα level might give important information in the forensic autopsy of colchicine poisoning.

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COMPARING FOOTWEAR EVIDENCE AND THE POWER OF THE 3RD DIMENSION

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The use of 3D imaging has the potential to transform the analysis of footwear evidence. Using freeware products such as DigTrace () developed

by the authors it is now possible to create accurate and precise 3D models for footwear impressions using nothing more than twenty to thirty oblique photographs. In this presentation we demonstrate the technology and use a series of case studies to illustrate its application to a range of different forensic scenarios. This project was supported by a UK Natural Environment Research Council Innovation Award with project partners from the UK Home Office and the UK National Crime Agency. We demonstrate how comparison of 3D images, either multiple tracks or a track with a shoe sole, can be achieved and illustrate the advantages over other methods. For example, given a line of multiple tracks made by one individual using software such as DigTrace you can compute an average 3D track from the population. Similarly, using the same technology you can compare a track to a 3D model of a suspect's sole. Multiple measurements and statistical analysis are possible providing a revolutionary toolkit for the forensic practitioner specialising in footwear evidence.

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CAN SPECIES–LEVEL ORAL BACTERIOME COMPOSITIONS BE USED FOR HUMAN IDENTIFICATION INTO FAMILY UNITS?

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Introduction: Metagenomic studies for microbial identification have received significant attention as targets that could be used to identify or exclude humans involved in criminal activities. In this study, we sought to determine the core oral bacteriome of three African families at the species-level and to differentiate the families. **Methods:** Oral samples were collected from three families identified as (OL, MT and PE) comprising 8 adults three times. DNA was extracted and 16S rRNA V4 region amplified using custom barcoded primers prior to sequencing with Illumina MiSeq. Quantitative Insights into Microbial Ecology (QIIME) pipeline was used for 16S rRNA recognition. Distribution of taxonomic categories at different levels of resolution was done using the ribosomal RNA database. The core species were defined as taxa present in all subjects and over 0.2% in abundance. Common species identified in each family were used to find species that are unique in each family using the Venny 2.1.0 software. **Results:** On average 148 species representing 11 phyla were identified from the three families. Firmicutes (49.53%) was the most abundant followed by Proteobacteria (32.27%), Bacteroidetes (7.56%), Actinobacteria (8.98%), Fusobacteria (1.60%), Candidatus Saccharibacteria (0.03%), while Spirochaetes, Tenericutes, Synergistetes, Acidobacteria and Chlamydiae were less than 0.01%. Twenty-two, 26 and 27 common species were identified from OL, MT and PE respectively. Thirteen common core species were identified comprising *Haemophilus parainfluenzae* (20.44%), *Porphyromonas catoniae* (14.55%), *Actinobacillus porcinus* (12.73%), *Rothia mucilaginosa* (9.14%), *Lautropia sp.* TeTO (8.30%), *Haemophilus influenza* (7.26%), *Granulicatella elegans* (6.59%), *Rothia dentocariosa* (6.08%), *Streptococcus gordonii* (5.78%), *Granulicatella adiacens* (4.93%), *Corynebacterium durum* (2.98%), *Bergeyella sp*. AF14 (0.91%), and *Prevotella oris* (0.25%). Four species (*Neisseria elongata*, *Parvimonas sp*. oral taxon 393, *Peptostreptococcus stomatis*, *Veillonella sp*. oral taxon 780) were found exclusive to OL. Similarly, 8 species (*Neisseria flavescens*, *Neisseria wadsworthii, Eikenella corrodens*, *Cardiobacterium hominis*, *Veillonella atypical*, *Prevotella nigrescens*, *Fusobacterium nucleatum*, *Alloprevotella tannerae*) were exclusive to PE. The MT had *Atopobium parvulum, Actinomyces sp*. ZSY-1, *Kingella oralis*, *Gemella morbillorum*, *Parvimonas micra* and *Leptotrichia goodfellowii*. Three species (*Capnocytophaga sp*. oral taxon 329, *Leptotrichia hongkongensis*, *Streptococcus thermophilus*) were found in OL and PE, while four species (*Actinomyces massiliensis*, *Prevotella nanceiensis*, *Pasteurella pneumotropica*, *Capnocytophaga sputigena*) were in MT and PE. Two common species (*Aggregatibacter segnis* and *Fusobacterium periodonticum*) were present in OL and PE. **Conclusion:** The results have demonstrated that oral core bacteriome has the potential to provide insight in investigative processes. More samples with large family units are needed to confirm our findings.

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INDANEDIONE METHODS FOR FINGERMARK DETECTION: NORMAL TREATMENT, VACUUM DEVELOPMENT AND DRY-TRANSFER.

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1,2-Indanedione is generally considered to be the single best method for the detection of latent fingermarks on porous substrates. It has been termed a "dual" reagent, meaning that the reaction product is both coloured and highly photoluminescent, which greatly improves contrast and sensitivity when developed marks are recorded in the luminescence mode. The reagent is generally applied to paper substrates as a solution, with development then achieved by heating in an oven or heat press. However, the use of solvents and heat can be problematic for certain substrates (e.g., thermal paper) and may compromise other forms of physical evidence such as DNA, writing inks, and chemical residues (e.g., explosives or illicit drugs). Solvent-less application techniques such as vacuum development and dry transfer methods have become an area of research interest due to the potential destructive nature of traditional solvent-based treatments. In addition, solvent-less techniques can be applied in situations where the transport and use of large quantities of solvent need to be avoided. Presently, there is only one published study on vacuum indanedione development. This study found that the advantages of using vacuum sublimation for indanedione treatment include no interference with foreign contaminants in the fingermarks (such as illicit drugs or explosives) or diffusion of ink on the document, and it does not interfere with any traces of DNA that may be present. Indanedione, when applied in this manner, was also found to not interfere with subsequent forensic document examination. Other published research has proposed that indanedione can be applied using a solvent-free method referred to as "dry-transfer". With this method, the paper item is sandwiched between indanedione-impregnated sheets. This "sandwich" is then placed in a press (with or without heat, depending on the substrate) until development occurs. The purpose of this study was to compare the three indanedione application methods – (i) conventional solvent-based method; (ii) vacuum development; and (iii) dry-transfer – across a range of paper substrates, including thermal paper, and for aged latent fingermarks collected from a number of donors. The results from this comparison will be presented.

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WHEN DID HE DIE? A TALE OF LIPID DEGRADATION

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Determining time since death provides invaluable information for investigators, the use of soft-tissue biomarkers such as lipids and their degradation patterns is one method that may demonstrate predictable patterns and could be used for estimating the post-mortem interval. The aim of this research was to investigate these markers in tissue samples. Soil samples taken from below human remains were also analysed to determine the leaching of lipids into the surrounding soil environment and to compare the lipid breakdown patterns in both mediums. Two human donors were placed on a soil surface at the Australian Facility for Taphonomic Experimental Research (AFTER) located at the outskirts of Sydney, Australia. Donor 1 had been frozen prior to deposition whereas donor 2 was fresh. Tissue samples were collected from three different regions of the remains; the upper arm/chest, lower abdomen and the buttocks/upper thigh using biopsy needles. Soil samples were taken below

the remains in the same three regions. Sampling occurred for an overall period of over two months post-placement. Both tissue and soil samples were analysed using GC-MS/MS. A difference in the visual changes of decomposition between the fresh and frozen donor was found with the fresh donor progressing through the decomposition process in more distinct stages than the frozen donor. A suite of lipid biomarkers including saturated and unsaturated fatty acids and acid analogues, sterols and sterol analogues were detected. Preliminary results suggest that over time, there are changes in the lipid chemical profiles between different sites on the body, which are different to the soil samples. Inter-site differences with the tissue samples are more pronounced, contrary to the soil samples. The use of human lipid biomarkers could provide more information about the progression of decomposition, particularly where differential decomposition occurs which makes visual estimations of post-mortem interval challenging. Monitoring lipid changes in soil might also aid in the determination of time since death in cases where remains have been scavenged intentionally or unintentionally after the onset of decomposition.

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RESEARCH ON APPLICATION OF TRACES TEST IN TECHNICAL APPRAISAL OF ROAD TRAFFIC ACCIDENT

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Objective: The purpose of this paper is to apply the methods and techniques of trail inspection to the technical appraisal of road traffic accidents, and to increase the quantitative indicators of technical appraisal of road traffic accidents. **Method:** Through the analysis of 2000 different types of road traffic accident technical appraisal projects, the corresponding identification methods and technical support of different types were extracted. **Result:** The technical appraisal of road traffic accidents belongs to the comprehensive appraisal type, which requires multi - professional and multi - direction cooperation. Technical appraisal of road traffic accidents requires the help of various technical methods and techniques in forensic science field. Trace inspection is an important foundation. Trace test method, in order to better make scientific judgments. **Conclusion:** From the development of technical appraisal of road traffic accidents, it is necessary to study the combination between trace test and road traffic accident technical appraisal more deeply and make full use of the traces which have already matured. Test evidence supporting the role of technology, but also open up road traffic accident technical appraisal more open prospects for development.

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ANALYSIS OF URDU HANDWRITING AND IT'S RECOGNITION

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In this Study, a structural method of recognising Urdu handwritten writing characters is proposed. The main problem in the cursive writing identification is the segmentation into characters and into representative strokes. When we divide the cursive parts of the words, we take into account the appropriate properties of the Urdu grammar and the segments connecting the characters with each other along the writing row. The main alphabets of Urdu are quite similar to that of Arabic; however, the problem determined was to detect disguises and forgeries in the Urdu writing specimens. For this collection of the data of different people on how they write the basic alphabets in Urdu writing and observe the change in alphabets with time. The data gathered for this is more than 20 candidate characters with similar shapes. Then the analysis follows, that checks the sample via goal-directed feedback control.

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DNA MIXTURE ANALYSIS IN INBRED LEBANESE COMMUNITIES. ASSESSMENT OF EXPERT DNA MIXTURE SOFTWARE.

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The evaluation of forensic DNA mixtures faces interpretational challenges as to the ability of correctly resolving a mixture and identifying the possible DNA profiles of the different contributors. Multiple genotype possibilities, homozygosity and allele sharing between contributors increase the number of possible profiles and render the statistical analysis particularly complex. Additional DNA mixture challenges include allele drop out, allele stacking, and stutter production. Endogamy and consanguinity could also be a source of supplementary complexity by increasing allele sharing and homozygosity. The Lebanese population is characterized by high endogamy and consanguinity rates with averages equal to 82% and 32 to 42% respectively. Using an in-house software "DNA Mixture and Matching Simulator", electronic DNA mixtures simulations with two contributors were performed among nonrelated members of the same village in 6 different villages with high endogamy and consanguinity practices. Villages were selected from the different geographical Lebanese areas where the inhabitants of each village belong to different religious communities with different levels of endogamy and consanguinity. At least 1% of the village population was sampled. Profiling was performed with three different profile sizes: 16, 23 and 28 STR systems. 28 individuals were falsely included in different DNA mixtures using 16 STR systems. The number of false inclusions was reduced to 6 individuals using 23 STR systems. All DNA mixtures were solved using 28 STR systems. Physical DNA mixtures from the previously mentioned cases involving DNA mixtures with two contributors, were performed. The resulting 16, 23 or 28 STR systems mixed profiles were subject to analysis using various DNA mixture expert software, namely: TrueAllele which provides a quantitative analysis of mixed DNA samples from three contributors. LR mix studio that is capable of analyzing complex DNA mixtures, 3. GeneMapper IDX mixture analysis software and 4. DNAMIX. The present study, confirmed the need to assess DNA mixtures investigations while taking into consideration endogamy and consanguinity. Recommendations as to DNA mixture analysis were issued for local forensic uses and for other populations with high rates of endogamy and/or consanguinity.

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COMPARISON BETWEEN THE CANADIAN AND FRENCH COURT ORDERED PSYCHIATRIC ASSESSMENT

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The psychiatric assessments ordered by a criminal court are intended to help the justice system to deal with people who suffer from a mental health condition. From the assessment report, the court expects to get relevant information in order to tailor its final decision. The primary goal of the sentencing is to protect the society; however, in our view, it is always beneficial if the sentencing enhances some rehabilitation process for the accused. The court ordered psychiatric assessments are often defined by the criminal code of the country; thereof, the types of assessments depend on social and political history of the country. The scientific research in the field of the criminology also plays a role in defining what is relevant. Indeed, the professionals have improved their knowledge in identifying the origin of the criminal behaviors and in evaluating the risk posed by the offenders. In this presentation, we aim to compare the Canadian and the French forensic psychiatry system. Comparing both systems is interesting because France is considered as one of the oldest modern justice systems, and many of the forensic concept are inherited from it or its European neighbours. On the other hand, Canada is one of the countries where the modern forensic psychiatry is born, implementing the actual scientific concepts of criminology. Identifying the pros and cons in both systems may

help improve the practice in each country.

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ASCENDING AORTIC RUPTURE THROUGH A PENETRATING ATHEROSCLEROTIC ULCER: A RARE CAUSE OF SUDDEN UNEXPECTED DEATH

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Spontaneous rupture of the ascending aorta through an atherosclerotic lesion without preexisting aortic aneurysm, dissection, or history of trauma is very rare. Without prompt aortic repair, all cases result in sudden death with a definitive diagnosis made only intraoperatively or during autopsy. The phenomenon has been uniformly found in individuals with hypertension. The author reports a sudden unexpected death caused by spontaneous rupture of the ascending aorta in a 57-year-old man with a medical history of hypertension and gout. The ascending aortic wall showed a longitudinal intimal tear measuring 0.6 cm in length and rupture of the ascending aorta through an atherosclerotic ulcer, resulting in massive hemopericardium. Chronic hypertension and penetrating atherosclerotic ulcer of the ascending aorta were the apparent underlying etiologies of the aortic rupture in this case. This case illustrates not only the association between an ascending aortic rupture and a penetrating atherosclerotic ulcer of the ascending aorta with a silent death, but also raises awareness of possible such deaths.

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AUTONOMOUS VEHICLE HUMAN FACTORS ETHICS IN THE UNITED STATES

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In 2014, almost 90 people per day died in a motor vehicle accident in the United States [Fatality Analysis Reporting System]. This is significantly reduced, mainly due to the adoption of seat belts and airbags as safety features designed to prevent fatalities. Current control system innovations have added numerous sensors and cameras to assist drivers and avoid collisions. The National Highway Traffic Safety Administration (NHTSA) has found that 75% of all collisions are due to driver recognition and decision errors [2008 NHTSA Crash Causation Survey to Congress]. A proposed solution to these driver recognition and decision errors is autonomous control, thus removing a major cause of collisions. When we review the laws from state to state regarding highly automated vehicles (HAVs), we see a myriad of different laws across the United States. NHTSA foresees a system wherein states would treat HAVs as the "driver" of the vehicle. In the interim, the Model State Policy is suggesting that states only allow testing, and require an application and approval before companies desiring to test autonomous vehicles are permitted to begin testing. The policy recommends statutes requiring HAVs to comply with general vehicle regulations and be driven, when not in autonomous mode, by licensed human drivers possessing special training regarding HAV's capabilities. Overall, this Model State Policy urges states to start addressing issues arising with increased use of HAVs but recommends that states current use be limited to testing. The ramifications of the HAV are not only tied to the legal world, but also tie into how our moral codes mesh with technology. The HAV presents an interesting ethics conundrum for society as it will be guided by lines of objective code rather than a moral "code". Will HAVs replace the human driver? A human may be forgiven for making a wrong split second decision, but HAV designers do not have this luxury, as they have the time to predict situations and program the correct response [Lin]. In the event of two bad choices, HAVs will make decisions that may involve human lives in a split second. How would the HAV weigh a pedestrian's human life compared to its passengers? What factors would go into making its decision? This question and many others like it will require more thorough dialogue with government, industry, academia and the public.

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AN EASY WAY TO DIE. PLANT POISONS IN SRI LANKA: A CASE REPORT

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Introduction: Sri Lanka is a tropical country in South Asia. It has a great plant diversity. Unfortunately, Sri Lanka affected with thirty years of civil war and lost thousands of valuable lives and still recovering from after-effects of war. The number of lives losing due to suicides has become significantly high. Sri Lanka is one of the countries in the top of the list of having highest suicidal rates. Among several methods of suicides, plant poisoning is a common method. During the period of war many people migrated to several countries. Canada was a popular destination for these immigrants. Therefore, forensic practitioners, including forensic pathologists, coroners and toxicologists should be aware of common poisonous plants in Sri Lanka. **Case report:** A dead body of 28 years old, widowed lady with 2 children was presented to General Hospital Mannar in Northern Province of Sri Lanka. She has lost her legal partner during the civil war in 2004. Few years later she had a love affair with an unmarried man. But his family members objected to this affair as it was not accepted to their social norms. Ultimately, he broke up with her and planned to marry another girl. When she came to know about this, she has requested him to come to an abandoned place where they have been frequenting in the past. When he arrived, he found her unconscious. There was 8 crushed raw yellow oleander seeds and opened sugar pack nearby. She was rushed to hospital but pronounced dead on admission. Autopsy revealed partially digested, multiple, white pieces of yellow oleander seeds in the stomach. Toxicology testing revealed yellow oleander poisoning. Death is attributed to acute poisoning of yellow oleander (Thevetia peruviana).

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SUDDEN UNEXPECTED DEATH OF A YOUNG ADULT MALE DUE TO CARDIAC HAMARTOMA; A CASE REPORT

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Introduction: Sudden cardiac deaths are very common presentations to forensic pathologists worldwide. However, deaths due to primary cardiac tumours are extremely rare. Among them, cardiac hamartomas are even rarer. We report a sudden, unexpected death of a young adult male due to an occult cardiac hamartoma. **Case report:** A 28 year old male was found dead near his residence. He was last seen leaving a religious gathering alone and on foot after dark. The area is in close proximity to a jungle inhabited several species of venomous snakes. His death was suspected to be a result of a venomous snake bite. He was a manual labourer, in good health and physical condition, and had reported no previous illnesses or discomfort. At autopsy, there were no external injuries and no puncture wounds suggestive of a snake bite. There was a fine, white froth over the nostrils and within the trachea, with mild pulmonary edema. There was a yellowish, oval shaped mass on the lateral aspect of the left ventricular wall of the heart (1.0 x 0.6 cm). The cut surfaces of this mass showed nearly full-thickness involvement of the ventricular wall with ill-defined borders. The remaining organs were unremarkable.
Histology revealed well demarcated tumour composed of hypertrophied mature cardiac myocytes lying in a disordered fashion mixed with fibroblasts, blood vessels and fat in different proportions. The various

elements were disorganized, but well differentiated, and showed minimal mitotic activity, which are features suggestive of a hamartoma.

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THE RELEVANCE OF MATHEMATICS IN FORENSIC SCIENCE

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The work of a forensic scientist involves reconstruction of criminal events, the posing of plausible hypothesis that lead to discover the truth about those events and their causes. They must have arguments and evidence to prove the truth of his hypothesis; they should have a reasoning that allows inferences that lead to reasonable conclusions. Forensic science is a conjunction of several disciplines including psychiatry, anthropology, entomology, toxicology, biology, chemistry, psychology, and law, among others. Some of these disciplines even have the family name of forensics as is the case of forensic chemistry or forensic psychology. In many forensic researches or investigations mathematics has a relevant role in getting into conclusions, in establishing or reconstructing criminal facts. But the role of mathematics does not end here, mathematical reasoning, considered as a special form of reflexive thinking could be of major importance for a forensic scientist. Considering mathematics as a body of knowledge on abstract objects as numbers, figures, equations, and the like, that can serve as a tool for problem solving, a science that helps on the understanding of some phenomena, and a language to communicate ideas, we claim that it has a relevant role in forensic science. In this work we are going to elaborate on the role of mathematics in solving forensic cases, in the understanding of some forensic phenomena, and its use as a language in some academic papers on forensic science. Taking all these as the introduction of what we call Forensic Mathematics. This work had the support of the Program PAPIME, project PE105616.

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MYOCARDIAL BRIDGING OF CORONARY ARTERIES: SUDDEN UNEXPECTED DEATHS IN A 38–YEAR–OLD WOMAN

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Myocardial bridging is a congenital anomaly that occurs when a portion of coronary artery passes intramural through myocardial tissue. It represents an embedded coronary artery and primarily involved in the left anterior descending coronary artery. In some cases its association with certain cardiac complications and resultant sudden deaths has been reported. However, its role as a cause of death is rare and still controversial. The author reported the case of sudden unexpected death in a 38–year–old woman with previous healthy history. The reported case involved in a single bridge of coronary artery running deeply and lengthy through the myocardium, thus aggravating cardiac complications and rendering the death in this woman. Since no other possible causes of death could be found in the present case, her death was attributable to fatal arrhythmia secondary to acute transient occlusion of myocardial bridging of the coronary arteries. The presence of the myocardial bridge by itself is not predominant, but it is certainly a contributing factor to a sudden cardiac death.

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FATAL CARDIAC PERFORATION BY LEAKED PMMA CEMENT AFTER PERCUTANEOUS VERTEBROPLASTY

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Percutaneous vertebroplasty is a minimally invasive technique, described for the first time in 1987 by Galibert, consisting of percutaneous injection of a biomaterial, usually polymethylmethacrylate (PMMA), into the collapsed vertebrae via a transpedicular approach. The aim of this technique is to obtain pain relief and mechanical stability of the vertebral body that has been compromised by compression fractures, tumors or bone metastases. Although percutaneous vertebroplasty is an efficient treatment, cement leakage can occur frequently and this is the main cause of complication; in particular the risk of cement entry into the venous system and the spinal canal is the potent major hazard of this technique. The reported incidence paravertebral leakage of cement ranges widely, from 10% to 73% of treated vertebral bodies, with venous leaks occurring in 24% of cases (epidural veins, prevertebral veins, vena cava). Only a few cases of pulmonary embolism caused by percutaneous vertebroplasty have been reported in literature although the incidence of pulmonary embolism caused by cement from this procedure is unknown because patients do not undergo routine chest imaging after the procedure. In rare cases, the cement embolus can migrate to the cardiac chambers or to the main pulmonary arteries. A 72 y.o. woman affected by osteoporosis with a 12-week history of severe back pain caused by multiple thoracic vertebral compression fractures. Her past history included reduction mastoplasty. Percutaneous vertebroplasty was performed at T10-T11-T12 with percutaneous radioguided injection of 8 cc polymethyl-methacrylate (PMMA) directly into the fractured vertebral body via left transpedicular approach. The patient developed a sudden cardiac arrest three hours after surgery. Despite the prompt resuscitation attempts the woman died shortly after. A complete hospital autopsy was performed the following day; after opening the pericardial sac a copious cardiac tamponade due to the perforation of the wall of the right atrium by a needle-like foreign body of a few millimeters was found. Similar longer foreign bodies were found in the main branches of both pulmonary arteries. Cardiac tamponade due to perforation of the right atrium from embolized PMMA after vertebroplasty was pointed out as cause of death. While still in a semi-fluid state, the bone cement migrated to the right atrium through the venous system and the cement solidified in the cardiac chambers, resulting in the formation of multiple foreign bodies. One of this perforated the right atrium, others passed through the tricuspid valve in the right ventricle and then in the pulmonary arteries.

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INTER-PROFESSIONAL COLLABORATION SURVEY - THE GLOBAL NETWORK OF A CANADIAN FORENSIC SPECIALIST

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To promote the meeting (IAFS) and the Canadian Society of Forensic Science Special Sessions within the meeting, and to promote the IAFS theme inter-professional collaboration. An informal survey primarily of Canadian forensic specialists was meant to obtain a snapshot of the environment to see what inter-professional collaboration exists not only between different forensic specialisations but also for other scientific professionals outside of the forensic community. Questions about the forensic scientists' community in so far as their network of colleagues in different geographic regions of the world and specialisation will be presented. Forensic specialisations that apparently do not have as much in common can benefit from greater inter-professional collaboration and knowledge. This collaboration may extend far beyond what is directly in the specialists' work and into other areas such as: instrumentation,

experimental methodology, education, interpretation of evidence and interaction with the legal system. The survey is not intended to be one that is statistically robust as the ability to sample the population of forensic specialists is limited by several factors including geographic sampling, response rate, and the specific time period that this survey is done in 2017.

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AN ANTHROPOLOGICAL STUDY OF ALCOHOL INDUCED PSYCHOSIS

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This was clinic based cross sectional descriptive study. The study consisted of 1000 alcohol dependent patients. The main aim of the study was to find-out the prevalence of alcohol induced psychosis. The mean age of the sample was 30.74 years and majority of the patients were below 40 years. Majority of the patients were males (92%), married (88%), Hindus (92%). They had 8 years mean of education. The majority were from below class II socioeconomic class. About the 68% patients initiated consumption of alcohol between the age group of 30-40 years. About 52% were consuming alcohol for a period between 10-20 years. Female alcoholics had later age initiation of alcohol consumption, long duration of alcohol consumption and longer years consumption prior to becoming alcohol dependent. Alcohol induced psychosis were present in 37% patients. The age at initiation of alcohol consumption, the duration of consumption, and the duration of consumption prior to becoming dependent did not have any bearing on the onset of alcohol induced psychosis.

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RETENTION OF SAW MARKS ON BONE IN WATER AND THE POSTMORTEM SUBMERSION INTERVAL

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This study examined taphonomic trends in riverine (moving) and lacustrine (still-standing) freshwater environments in Mississauga, Ontario. 114 defleshed medallions of bone containing 228 sawn surfaces were produced from pig (Sus scrofa) femora and subsequently exposed to either moving or still-standing water for a 6-month period. Differences were significant for colour change ($p < .001$) and sawn surface erosion ($p = .007$) between moving and still-standing freshwater. This data suggests that bone surfaces erode faster in riverine environments, whereas lacustrine environments stain bone surface sooner. The results provide data for a method of estimating a post-mortem submersion interval for bone exposed to freshwater after decomposition has occurred, and can help facilitate forensic investigations in cases of water deposition or deposition of dismembered remains in freshwater environments.

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MORPHOMETRIC CHARACTERIZATION OF THE SUPERIOR LATERAL INCISOR FOR SEX DETERMINATION

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Introduction: Forensic Odontology has emerged as an invaluable tool for human remains identification; in recent years, lateral incisors have been used as a tool for determination of racial tendency but its usefulness in gender estimation has not been analyzed. **Materials and methods:** We performed linear measurements (estimation of left and right superior lateral incisors width and length) and morphological estimations (3 variables) in a sample of 200 individuals, aged 18-25, and coming from the state of Veracruz, Mexico. Statistical analysis was performed using Shapiro test, Wilcoxon test and Classification Tree construct. **Results:** There was statistical difference in all metrical variables using Wilcoxon test ($p<0.005$) with a classification percentage above 95% in men and 89% in women. There was no statistical difference in morphological variables. **Conclusion:** Metrical parameters in superior lateral incisors seem to be a useful tool for gender estimation in dental samples. Morphological parameters included in this study did not seem to be useful for gender estimation.

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CARDIOMYOPATHIES AS A CAUSE OF SCD IN EGYPT; RECOGNITION AND PREVENTIVE STRATEGIES NEEDED

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Objectives: This study aimed at evaluating the epidemiological characteristics and pathological features of different types of cardiomyopathies in Egypt, highlighting the role of the forensic pathologist in identification of cases of cardiomyopathies that should be a starting point for their families for a possible genetic study aiming at prevention of sudden death. **Introduction:** Cardiomyopathies are primary disorders of cardiac muscle. They include: dilated, hypertrophic, restrictive and arrhythmogenic right ventricular cardiomyopathy. They are considered as a fundamental cause of cardiac death in children and adults. Their initial mode of presentation could be sudden death. It is a devastating event that happens in people who are often keen sport practitioners and considered very healthy. Difficulty in picking-up affected survivors is an inherent risk for SD . Cardiomyopathies are mainly hereditary or, at least, diseases where a genetic substratum is suspected. Hence, the diagnosis of these diseases at autopsy and the identification of cardiomyopathies-related SCD would be a starting point for their families for detection of diseased members and prevention of sudden death. Only few observational studies have assessed this problem all over the world. To our knowledge, this is the first study in the Middle East that investigates the epidemiological characteristics of cardiomyopathies. **Methodology**: All cases with sudden cardiac death (SCD) due to cardiomyopathies during the period from the beginning of January 2010 untill the end of December 2014 (5 years) were included in this study. All hearts underwent detailed gross and histological examination. Circumstances of death, medical history, and post-mortem pathological findings were thoroughly investigated. **Results**: Out of 535 cases of sudden cardiac death, there were 22 cases (4.1%) diagnosed as having cardiomyopathies; sudden death was their first presentation. Eighteen cases (81.8%) were male, with the 4th decade being the most affected age (11 cases, 50%);severe physical activity and exertion were evident in death circumstances of 14 cases (63.6%); Pathological evaluation revealed that hypertrophic cardiomyopathy was the most frequent type, being diagnosed in 10 cases (45%). **Conclusion:** Cardiomyopathies are an infrequent cause of sudden cardiac death. Most deaths are in children and adults, so cases are of high social impact that demands multidisciplinary research and resources. In all cases of SD, forensic autopsy should be done. Forensic study is the key to identifying an affected family and the starting point regarding assessing them.

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IMPACT OF AUTOMATED METHODS APPLIED TO DNA PROFILING WORKFLOW MANAGEMENT

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In forensic laboratories, manual DNA profiling workflows often involve "case ownership" that starts at sample storage retrieval and extends through processing and data analysis, to final report writing. This workflow often involves a high degree of manual input, which is time-consuming, subjective and prone to human error. Robotic instruments can automate sample processing and increase sample throughput through batched parallel processing. This is demonstrated by the Texas Department of Public Safety in Houston, TX, who reported validation of its Hamilton AutoLys STAR-plus liquid handling workstation in 2014 for use in forensic casework[1]. They showed that the automated processing workflow met their criteria for accuracy, precision and reproducibility compared to manual liquid handling for all target volumes. While the obvious advantage of automated processing includes a higher throughput of samples processed in a given time period, additional benefits were derived from labor efficiencies and standardization. Fixed labor costs comprise a significant portion of the forensic lab budget, so one key benefit of an automated system is enabling reallocation of manual labor to other activities. Automated sample processing reduces active labor time and eliminates the need for time-consuming verification checks by separate personnel. This frees personnel to focus on other tasks, thereby increasing productivity, and also reduces fatigue, which may further contribute to sources of error. Additionally, the increased throughput aids turnaround times (TAT) as it reduces or eliminates storage stop points related to instrument availability or batching requirements. Automation improves standardization of DNA profiling workflow traceability and documentation compared to manual methods. Barcoded samples maintain traceability through the workflow without risk of mis-labeling or transcription errors. This improves reliability of results, reduces active labor time associated with manual documentation and enables fast identification of the appropriate personnel needed for court testimony. Automatically generated worklists also reduce risk of error from manual input and processing methods and reduces the need for time-consuming verification checks. Generated reports are output in a consistent format without manual transcription errors or verification checks; and if integrated with laboratory information management system (LIMS) software, data can be sent to other peripherals or stored and recalled quickly. Here, we report implications of the automated processing method in context of labor savings and other key performance indicators in the overall DNA profiling workflow.

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PARTICULARITIES OF THE DYNAMICS OF SUICIDE IN ROMANIA. COMPARATIVE STUDY FOR TWO COUNTIES.

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Intruduction: In most countries suicides are within the top ten causes of death and they represent the second leading cause of violent death after road accidents. Romania occupies a middle position in Europe, with a rate ranging from 11 to 14 suicides per 100,000 inhabitants, but two particular aspects are to be taken into consideration in the past 10 years: big differences between the geographical areas (with mostly Hungarian population and other areas) and the change of male - female ratio. We have chosen for the comparative study two Romanian counties with a paradoxical trend of suicides: Ilfov and Covasna. Small counties, dominant rural areas, with small towns, located in different areas of the country, the first being one of the richest, with a population of Romanian origins, the second, one of the poorest, with predominantly Hungarian population. In the last 10 years, the suicide rates increased in Ilfov and decreased in Covasna. **The Purpose of the Study:** Identifying the factors that could explain the suicide rate fluctuation in the two counties, meaning its spectacular increase in Ilfov and decrease in Covasna. **Material and Method:** The study is retrospective, centered on factorial analysis. We studied medico-legal documents, medical and police investigation data, case by case, of all suicides in both counties in the period between 2005 and 2015. The analyzed variables were: gender, age, ethnicity, urban - rural, place and method of suicide, existential trajectory, psychiatric / somatic pathology (according to medical documents), previous suicide attempts, social-economical issues, stressful events, contextual factors listed by the WHO, somatic pathology (found at autopsy), blood alcohol and other psychoactive substances level at the time of death, periodicity and the character of indigenous / nonindigenous of the suicidal person. SPSS 18 for Windows was used. **Results:** The factors of classical analysis have similar scores to those in previous studies. Relative differences occur in contextual factors analysis (an important factor is the "loss" status with or without starting a "new") and significant differences occur in the analysis of population migration. Ilfov received a large number of nonindigenous, with a maximum in the period of 2008 - 2012; Covasna lost its native element without receiving nonindigenous . **Conclusions:** The factors which stronglly influenced the suicide rates fluctuation were represented by population migration, the contextual factors of "loss" model and the absence of an adequate psihoprofilaxis.

Disclosure: All authors have declared no conflicts of interest.

ASSOCIATION BETWEEN SCN5A GENE AND SUDDEN UNEXPLAINED NOCTURNAL DEATH SYNDROME IN THAI CADAVERS

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In order to investigate the association between *SCN5A* gene and sudden unexplained nocturnal death syndrome (SUNDS) in Thai cadavers, genomic DNA was extracted from blood samples of 12 unrelated SUNDS subjects and 151 unrelated healthy control cadavers. Subjects were divided into 3 subgroups, as follows: subjects who resided in regions other than Northeastern Thailand (DR group; 99 subjects), age-matched subjects who resided in Northeastern Thailand (NE group; 28 subjects), and subjects who resided in Northeastern Thailand with age greater than 40 years (NE^+ group; 24 subjects). Genomic DNA of SUNDS cases was screened for genetic variations by polymerase chain reaction and direct Sanger sequencing for the entire 28 coding exons of the *SCN5A* gene. Sequence alignments with *SCN5A* reference sequence were then analyzed and all detected variants were further analyzed for potential functions by computational programs. A total of twelve variants of the *SCN5A* gene were identified, including six polymorphisms and another six variants previously reported to be related with cardiac conduction defects. These identified variants were also genotyped in control subjects using high resolution melting (HRM) analysis, and some samples were selected for further sequencing to determine definite variations. The genotype and allele frequencies of a synonymous variant (rs1805126) showed significant difference between SUNDS and NE sub-controls, in addition to showing significant difference between SUNDS and controls, and between SUNDS and NE^+ sub-controls in genotype frequency only – all of which suggests that this variant may be associated with Thai SUNDS. In addition, haplotype analysis revealed strong linkage disequilibrium among the identified polymorphisms (rs1805126, rs7429945, rs4073796, and rs4073797), suggesting that these variants may co-segregate. Given the preliminary nature of this data, further study is needed to confirm these results and to further elucidate the association between these variations and SUNDS in Thai population using a larger number of SUNDS cases and healthy controls. Additionally, further investigation of the association

between *SCN5A* common polymorphisms and SUNDS, including electrophysiological investigations, may also be needed, and rare variants residing outside the coding exons of *SCN5A* gene that may have a potential role in its function need to be clarified and explained.

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PERSISTENCE OF SPERM: WHAT THE LITERATURE REALLY SAYS

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Background: The forensic literature gives a misleading picture as to how long sperm can be recovered from body cavity swabs taken during a sexual assault exam. Based on a review of the scientific literature, most of the articles state that spermatozoa can be detected up to seven days in the vaginal cavity. However, there are a small number of published accounts relating that spermatozoa can be detected much later than a week in the vaginal cavity. The conflicting literature can cause confusion as to when reliable semen results can be obtained from swabs collected during a sexual assault exam. **Methods:** A literature review was performed to determine the veracity of two separate claims that spermatozoa can be recovered from the vaginal cavity up to seventeen days and nineteen days post coitus. **Results:** The source that cited a seventeen day recovery was traced to an Italian article written in 1891. With some investigation we were able to track down the original article and determine that this claim is dubious at best. The claim of finding spermatozoa nineteen days post coitus was traced to a conference abstract from 1977. The nineteen day findings were regarded as 'possibly correct' because very few spermatozoa were routinely observed after day ten. In the same reference, the authors report on post coitus times of one month to many months where spermatozoa were found may not be a reliable observation because there were a high number of spermatozoa detected that did not show degenerative changes that would be expected. **Conclusions:** During our search of the literature, we found two outliers cited several times in an effort to illustrate that semen can persist outside of the traditionally accepted time frame of seven days post coitus. However, the original sources that mention these figures are typically not cited directly in the literature. Instead, the literature articles cite various secondary sources to illustrate these claims. We also found that these articles relied on data generated from surveys from study participants. It is our recommendation that scientists do not rely solely on secondary sources and to be aware of the limited value of studies based upon self-reported data. The USACIL also has a research section that collaborates with practitioners to facilitate research projects that result in informative data for the bench working scientist.

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FORENSIC STUDIES ON HANDWRITING WRITTEN WITH UNACCUSTOMED HAND

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Handwriting is an acquired skill and is a complex neuromuscular function. Practically, writing becomes automatic to the point where the operation not only requires almost no conscious direction but is frequently beyond the control of the mind or the hand. This is evident that when someone tries to disguise his/her handwriting in various ways. Among the large number of to disguise, to disguise by writing with unaccustomed hand is also reported. It is thought that, resultant writing being pictorially different; the unaccustomed handwriting may not be possible to be identified. A very little research wok has been reported in the scientific literature about the forensic identification of writing written with the help of unaccustomed hand. Therefore, handwriting of 200 skilled writers of both the sexes has been obtained written by both the hand. Writing with unaccustomed hand is said to be the writing which has been written by the hand other than the one with which one writes in normal routine. Writings written with accustomed hand and unaccustomed hand of the same person have been compared for general features as well as individual features with the aim if there is any significant change in general features beyond natural variations. Also attempt has been made to establish whether there is any significant change in stroke formations with respect to individual characteristics. It has been observed that there are significant changes in the general features of the writings with respect to line quality, alignment, slant etc while individual features have not been changed leading to a conclusion that even though the general appearance of the writing may change while writing with unaccustomed hand, it is possible to identify the author of the writing. Results in detail will be discussed during the presentation.

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DETERMINATION OF TYPE OF FIREARM WHEN ONLY 12G SHOTSHELL CASES ARE SUBMITTED IN LABORATORY

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Forensic Firearm identification is the most significant field of Forensic Science. Firearm examiners usually compare shotshell/cartridge cases with the test fires of submitted firearms. There are number of types of 12G guns, for example single barrel shotguns, double barrel shotgus, repeater shotguns, pump action shotguns, shotgun pistols and many more. Many cases submitted in Punjab Forensic Science Agency which are related to the determination of the type of weapon used in the incident. In cases, where firearms are not recovered by the police, but shotshell cases are recovered from crime scene, then investigation officer acquires helps from firearm examiners for the kind of firearm used in the incident. This paper actually depicts the difference in certain characteristics of 12G shotguns which are transferred to shotshell cases during firing process and may be helpful for determining the type of firearm used in the incident. A study was conducted on 12G shotguns (double barrel, single barrel, shotgun pistol) in Firearm and Toolmarks department of Punjab Forensic Science Agency to study their characteristics on shotshell cases. Test fires were produced using all said shotguns and were collected for examination under comparison microscope. It is to kept in mind the all shotguns were having different firing mechanism particularly the handmade shotgun pistol. When all shotshell cases were examined under comparison microscope, there were certain characteristics that were found to be in sufficient agreement with each other. The following results were drawn: 1.The firing pin impressions on the shotshell cases fired in double barrel shotguns were showing sharp drag upon primer. 2. The firing pin impressions on the shotshell cases fired in single barrel shotguns were showing no sharp drag. 3. The firing pin impressions on the shotshell cases fired in the shotgun pistol were changing its locations because of uncontrolled motion of firing within its housing. Another very important marks of the nail appeared on breechface of shotshell cases that have been fired in shotgun pistol, this mark appear because of manufacturing design which distinguish it from rest of shotguns. From above discussion, we conclude that in cases where only shotshells cases are submitted in the lab and type of shotgun is asked by the investigation officer, the firearm examiner must examine these points to approximate the type of firearm used in the incident. This can be useful in narrowing down the investigation.

Disclosure: All authors have declared no conflicts of interest.

A STUDY INTO THE ESTIMATION OF BLOODSTAIN AGE USING CHANGES IN COLOUR MODEL PARAMETERS'

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Whilst DNA profiling and blood pattern analysis are useful methods in addressing source and activity issues associated with the reconstruction of events and the subsequent evaluation of evidence in cases of violent crime, there is currently no single reliable method of estimating a timeframe for when a particular bloodstain was deposited at a crime scene or on clothing. Since such information may be useful in providing intelligence in an ongoing investigation, as well as corroborating or refuting the account given by a suspect accused of being the perpetrator of a violent crime, the desirability of a reliable method of bloodstain estimation is self-evident. The results of a recent study by the authors, investigating the correlation between time and changes in the colour parameters of bloodstains deposited on different substrates and environmental conditions are presented and discussed.

Disclosure: All authors have declared no conflicts of interest.

A RETROSPECTIVE STUDY OF ROAD TRAFFIC ACCIDENT (R.T.A) ON THE HIGH WAY AT BOGRA DISTRICT.

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The motto of this study is to find out the incidence of mortality of people due to road traffic accident in Bogra district during the year 2006 – 2010. One hundred and five autopsy cases of road traffic accidents were recorded from Forensic Medicine department of shaheed Ziaur Rahman Medical College, Bogra. The RTA cases were from different districts of the alleased district. Data was Collected from autopsy reports and Hospital records. Data was analyzed with to the age, sex of the victim and also part of the body involved1. The Data was also analyses with regard to the Thana of the district . It is analyzed that most of the death record were due to head injures (57.14%) with relation to sex. Males were the main victim (80% - 95%)2. It is seen that Sadar thana is the main and most important thana of this district(30.48%). **Introduction:** The Road Communication in Bangladesh is the most important route of Communication . Thousands of People choice roads for their transport, The People who avails their Communication road, must fall in traffic Accidents1. A Large variety of Injures are sustained by Persons involved in Road traffic Accidents. The Pedestrians are the major victim of Road traffic Accident.1 Material and method During the years of 2006-2010, one hundred and five cases of road traffic accident were categorized within the jurisdiction of Shaheed Ziaur Rahman Medical College, morgue . The detailed analysis of these cases were taken from medical Records & the evaluation of autopsy reports. **Result:** In this study, it is seen that the majority of the victim were male (80.95%).The Commonest age group involved was 21-30 years (38.10%). In case of injures, and the different parts of the body involved .Death was due to head injuries were more prominent. It was found that death in case of RTA was due to intracranial Hemorrhage or fracture of the skull (57.14%). Discussion Bus Communication in our country is most earliest, cheapest and preferred mode of transport. Thousands of people commute daily by bus. In this retrospective study in Bogra district, it is seen that male are prominent victim in RTA & the age group of 21 – 30 yrs. The most common injury in general were on the head regions as a result of intracranial haemorrhage. Most commonly found intracranial haemorrhage was sub dural haemorrage is 57.14% .

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APPLICATION OF MODIFIED QUECHERS SCREENING METHOD PRIOR TO LC-MS/MS DETERMINATION IN WHOLE BLOOD

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In recent years, cases of insomnia have increased. Patients are also increasingly more aware about protecting themselves, and so they are demanding higher quality and quantity of sleeping pills. Presently, benzodiazepines and Z–drugs are widely used in the treatment of insomnia in many countries. However, criminals have used these drugs to carry out crimes such as anesthesia robbery, rape, and murder. Benzodiazepines and Z–drugs have also been detected in some cases of mixed drug abuse . Therefore, it is necessary to establish more effective drug screening and quantitative methods. A fast and easy screening method has been established for the determination of benzodiazepines, z-drugs, and metabolites in blood via ultra performance liquid chromatography tandem electrospray ionization triple quadrapole-mass spectrometry (UPLC–TQ/MS). In the present study, an optimized QuEChERS (Quick, Easy, Cheap, Effective, Rugged and Safe) method is used for the pre-treatment of samples. In our modified QuEChERS method, the concentration step is omitted. The blood samples are extracted with 0.1% acetic acid and dehydrated by adding anhydrous magnesium sulfate. Our work's two primary goals are to: (a) develop an easy and quick method to extract various analytes like benzodiazepines, z-drugs, and their metabolites from blood specimens; and (b) to apply this screening method to real specimens and analyze them via UPLC–MS/MS. The targets were performed on a ZORBAX Eclipse PlusC18 (2.1 mm×100 mm, 1.8 μm) analytical column by gradient elution with a mobile phase of 0.1% formic acid - 0.1% formic acid/acetonitrile, then ionized with positive electrospray (ESI+), and finally detected under a multiple reaction monitoring (MRM) mode. Chromatographic separation was obtained in less than 5 min. The experimental method outlined in this paper was validated to show high accuracy, linearity, and repeatability. LODs varied from 0.5 to 2 ng/mL. This method can therefore meet the demands of high speed and accuracy in real-life cases.

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SPONTANEOUS HAEMOTHORAX IN VON RECKLINGHAUSEN DISEASES: A FATAL CASE.

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Von Recklinghausen's neurofibromatosis is a well recognised entity characterised by abnormal cutaneous pigmentation and multiple skin tumours. It is a hereditary disorder originating in the neuroectoderm and mesoderm and although transmitted by a dominant gene, it is expressed in about 80% of those who have the gene. Different associated complications have been described in this pathology such as central nervous system and osseous system involvement, benign and malignant schwannomas and other types of malignant tumours. Although generally regarded as a benign and chronic condition, neurofibromatosis can be associated with acute life-threatening vascular and neurological complications, sometimes fatal. Vascular involvement has been well describe in the setting of neurofibromatosis but it is rarely encountered in the clinical practice. The incidence of vascular lesion in NF 1 has been reported to be only 3.6%. Arterial lesions associated with Von Recklinghausen's disease are classified into two categories in relation to the diameter of the vessels. Larger vessels such as the aorta, carotid, etc. are surrounded by neurofibromatous or ganglioneuromatous tissue whose proliferation weakens the media and injures the elastic tissue, leading to aneurysms formation or stenosis. On the other hand, a NF 1-associated arterial dysplasia involving smaller vessels

and not related to neural malformation has been described. Massive haemorrhages in the patients with Von Recklinghausen's disease is a rare but potentially lethal complication. Bleeding in the abdominal cavity, retroperitoneum and in soft tissue have been reported, being caused by the rupture of friable vasculature as a result of either vascular invasion by neurofibromas or arterial dysplasia. Also massive haemothorax due to erosion of the intercostals vessels by a schwannoma, or due to the formation of microaneurysms at the intercostal artery has been described. Spontaneous rupture of the pulmonary arteries has been described in literature to the best of our knowledge once in 1882 from von Recklinghausen in a 55 y.o. woman who dead from haemorrhage due to a pulmonary artery aneurysm. We report the case of a 52-year-old woman affected from Von Recklinghausen' disease with a few days history of mild left shoulder pain who was taken to the Emergency Department because of the acute onset of severe right back pain followed by syncope and shock. Physical examination revealed hypophonesis of the left haemithorax with signs of hypovolaemia (cutaneous pallor, tachycardia, severe hypotension) and anemia with haemoglobin level of 8.6 g/dl. There was no history of previous trauma. Massive left haemothorax due to the rupture of the apical segmental branch of the left pulmonary artery was observed at contrast-enhanced CT and multiplanar 3-D reconstruction. The patient conditions worse further and a pulseless electrical activity was recorded. Cardiopulmonary resuscitation was unsuccessful. A complete post-mortem examination was performed 24 hours after death. At external examination multiple cutaneous cafe´-au-lait spots were observed. Massive left haemothorax with a collapse of the ipsilateral lung was observed at gross examination. A mediastinal haematoma of about 12 cm involving the left pulmonary artery until the left pulmonary ilum was appreciated. Standard microscopic study with hematoxilin and eosin was supported by immunohistochemical stain with S100 and MIB1 for neurofibromatosis. Acute haemorrhagic shock due to the rupture of aneurism of the apical segmental branch of the left pulmonary artery was pointed out as the cause of death.

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PATTERN OF SEXUAL ASSAULT IN GHARBIA GOVERNORATE (EGYPT) DURING THE PERIOD BETWEEN 2011-2014

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Background: Sexual assault is a unique type of interpersonal violence with profound effects on the victims. In Egypt, there is no accurate epidemiological study on sexual assault. Objective: The aim of this work was to study the pattern of sexual assault in Gharbia Governorate, Egypt, during the period from the start of January 2011 to the end of December 2014. Subjects and methods: This study was conducted in Tanta Department of Forensic Institute of Ministry of Justice. It included collection of retrospective data of cases of sexual assault during the period from the start of January 2011 to the end of June 2014. Cross section study of sexual assault cases was also done to cover the period from the start of July 2014 to the end of December 2014. Complete history taking and full general and local examination was done for all the studied cases. Results and conclusion: Total number of sexual assault cases was 229 over the studied period. The mean (SD) age of victims were 16.54%±8.76 years ranging from 3 to 63 years. Most cases (63.3%) fall in the age group of less than 18 years. Most cases were females (76%) and came from urban areas (63.3%). Unmarried cases constituted 83%. Spring was relatively a vulnerable season for sexual assault (31.4%). The most frequent type of assault was complete vaginal penetration (41%). Most cases (91.3%) were considered extra-familial outside the family relations and only one assailant was responsible (7.6%). The most common type of physical injury was abrasion (46.75%), whereas the least was bites (1.29%). Most cases (68.6%) were examined within 10 days after the assault. Hymnal tear was the commonest injury on vulvovaginal examination. Anal examination revealed chronic habit of anal sex in 18.52% of cases. The present study concluded that unmarried females under the age of 18years from urban areas constituted the major victims of sexual assault in Gharbia Governorate, Egypt. Rape was the commonest reported assault. Logistic regression analysis revealed that age, gender and marital status were good predictors of sexual assault.

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ANTIOXIDANT EFFECT OF GRAPE EXTRACT AGAINST POTASSIUM DICHROMATE OXIDATIVE DNA DAMAGE IN INTESTINE

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Background: Chromium usage is increasing worldwide. Oral exposure to hexavalent chromium Cr (VI) in animals and humans causes various health hazards. Cr (VI) compounds are classified as class I human carcinogens. Antioxidants were reported to inhibit chemical carcinogenesis. Grape seed proanthocyanidin extract (GSPE), naturally occurring compounds, have antioxidant, anti-inflammatory, anti-allergic and anti-tumor activities. Objectives: Accordingly, this work was conducted to investigate the antioxidant effect of GSPE against oxidative DNA damage induced by potassium dichromate on small intestine of adult male albino rats through biochemical and microscopic study. Study design: Forty adult male albino rats were included in this study and divided into four equal groups. Group I served as control group. Group II received 100mg/kg/day GSPE. Group III was treated with 15mg/kg/day potassium dichromate. Group IV received both K dichromate and GSPE in their previous doses. All animals were treated orally by syringe feeding method for two months. Body weight, plasma and tissue malondialdehyde (MDA) and total thiol (T-SH) of all studied groups were measured. In addition, light microscopic examination of small intestine using hematoxylin and eosin stains and immunostaining for detection of p53 positive cells as well as scanning electron microscopic examination were carried out. Results: The current study showed that adult male albino rats treated orally with potassium dichromate showed decrease in body weight, significant increase in plasma and intestinal tissue MDA and significant decrease in plasma and intestinal tissue thiol level. All these changes were associated with severe histological alterations in the wall of the small intestine especially the duodenum with significant increase of p53 positive cells. GSPE were found to counteract the toxic effect of potassium dichromate by attenuating oxidative stress and DNA damage. Conclusion: It is concluded that GSPE is promising as an agent that can potentially reduce K dichromate induced toxic effects in small intestine through its antioxidant effect.

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AUTOPSIC EXAMINATION CASES OF ACUTE ESOPHAGEAL NECROSIS: BLACK ESOPHAGUS

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Acute esophageal necrosis, also known as black esophagus, is a rare pathological condition of unknown etiology characterized by a complete circumferential black discoloration of the entire esophageal mucosa. Distal esophageal involvement with proximal extension ending sharply at the gastroesophageal junction is the most common presentation. The pathogenesis of black esophagus is not fully understood but it is hypothesized that low systemic perfusion plays a dominant role. Histological examinations reveal diffuse necrosis of the esophageal mucosa throughout the submucosal layer. Three cases of black esophagus are described to show how it differs from Barrett's esophagus and esophageal varices with respect to autopsy and histological findings. Pathology findings in all cases included necrotic epithelium, tissue and fibrinopurulent exudate consistent with acute necrotizing esophagitis. In all cases complete necrosis of the esophageal mucosa including the basement membrane was present. A sharp zone of demarcation by

inflammatory cells consisting predominantly of neutrophili granulocytes and scattered macrophages was seen in the upper layer of the submucosa but none of the cases showed signs of an accompanying vasculitis or microthromboses detectable in any of the layers of the esophageal wall.

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3D RECONSTRUCTION OF INTERNAL DAMAGED PAINT BY OPTICAL COHERENCE TOMOGRAPHY

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Automotive paint is an important trace evidence in many criminal cases. For example, in many hit-and-run cases, the escapers would repaint the damage area of the vehicle in order to conceal the crime. Therefore, it is very useful to detect and reconstruct the internal damaged part of repainted automotive paint that are usually invisible to naked eyes. Optical coherence tomography (OCT) is a new forensic technology, which can achieve non-destructive, high-resolution and most importantly cross-sectional imaging. In this study, we applied three-dimensional (3D) OCT technology to detect and reconstruct the internal damaged area of repainted automotive paint by a custom-built spectral-domain OCT system with ~6 μm axial resolution and 100dB signal-to-noise ratio (SNR). The repainted sample was prepared artificially by damaging, polishing and repainting with one layer of base coat to make a similar visual appearance. We first obtained the two-dimensional (2D) cross-sectional images to roughly locate the damaged area and then performed 3D OCT renderings to reconstruct the structure of the damaged part. It is demonstrated that OCT technology manages to reconstruct the internal damaged paint through its 3D volumetric imaging ability, and thus provides more valuable information, in a faster way, at a lower cost, to unveil the truth.

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CAPTURE AND ANALYSIS OF 3D FOOTWEAR EVIDENCE: NEW HORIZONS AND OPPORTUNITIES

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Footwear impressions provide an important source of evidence within a range of criminal investigations. They may place a suspect's footwear at a crime scene or link multiple crimes leading to vital criminal intelligence. Despite rapid advances in other areas of forensic science, the techniques and tools used to capture and analyse footwear evidence, have hardly changed in over a hundred years. Tracks are still cast in plaster, photographed and compared visually in order to match a footwear sole to a particular make or model of shoe. This is beginning to change and the 3D imaging of traces now offers a superior approach to the capture and analysis of footwear evidence. Until now however, the prohibitive investment in terms of equipment, software and training has meant that it could only be applied, if at all, in serious cases using specially trained personnel or contractors. Recent algorithmic developments in digital photogrammetry have dramatically improved three-dimensional imaging, allowing easy operational deployment. Bulky and expensive three-dimensional scanners are no longer required. A good 3D model can now be created by a crime scene photographer simply taking a few extra moments to collect additional oblique photographs of a footwear impression. Consequently, three-dimensional analysis of footwear impressions is now possible at a routine operational level, but still remains the exception rather than the norm. Software costs and training still limit its use. By translating academic research into ancient footprints and technical 'know-how' into a freeware software product – DigTrace () – the authors have placed 3D imaging at the disposal of every police force or forensic agency allowing it to be applied to any footwear evidence whatever the severity of the crime. This project was supported by a UK Natural Environment Research Council Innovation Award with project partners from the UK Home Office and the UK National Crime Agency. DigTrace is an integrated software solution for the capture and analysis of 3D data in a forensic context, catering for the complete workflow of analysis of footwear evidence at a crime scene, from creating three-dimensional models via photogrammetry, visualising those models and making a range of measurements, to computing mean tracks and/or comparing directly individual tracks or track populations. DigTrace is a unique product set to enhance global security by improving forensic practice, as well as criminal intelligence gathering and ultimately prosecution

Disclosure: All authors have declared no conflicts of interest.

IMPORTANCE OF FIBERS TO CRIME RECONSTRUCTION AND INVESTIGATION

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This presentation will focus the importance of fibres to forensic science and to crime reconstruction. In crimes that involves direct contact between victim and offender, there is high probability that clothes' fibres are exchanged, which would be used as proof of contact. This presentation is based on a fibre population study carried in the centre of London, and its conclusions ground the need of these type of studies to forensic investigations. With them, it is possible to find if a certain fibre is very common or not, and estimate the likelihood of that fibre have come from someone else from the offender. If fibres can be used to help the investigation in contact crimes, fibre population studies are fundamental to forensic science. These studies must be performed frequently because fashion is always changing, and it is important to follow it. This research was carried in the centre of London, at London South Bank University (LSBU). Around 3 000 fibres were tapped from LSBU seats and analysed with different techniques. This place (university) was chosen because it is very representative of European fibres' population due to their foreigner students. Each fibre was analysed individually and classified accordingly. Fibres were analysed and all fibres similar to the controls were exclude from this fibre population study. After classification of all fibres, a fibre population was performed with the use of statistics. From the population study, it was possible to conclude that the majority were natural fibres (82%), most of them of blue coloured cotton. The importance of this type of studies is verified by their statistic value: the frequency of fibers will help in casework and will help forensic scientists to make a correct assessment about the case. The more common the fiber is, the less evidential value it will have in casework as opposed to fibers which are considered rare, by its differential characteristics, which will have strong evidential value. In this presentation, a perspective from Europe will be presented and bring to debate results from all around the world.

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KNOWLEDGE AWARENESS AND PRACTICE REGARDING ARSINOCOSIS AMONG THE CHCP OF BANGLADESH

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Widespread contamination of arsenic in Bangladesh has been jeopardizing the health of millions of people. Toxicity with arsenic in drinking water has occurred in many countries of the world causing people to be afraid of this hazardous health problem. This cross sectional study was done to assess the level of knowledge awareness and practice regarding arsenicosis

among the community health care providers of Bangladesh in four Districts in Chandpur, Nilphamari, Jessore and Lalmonirhat. 210 community health care providers were interviewed by a structured questionnaire and were selected using purposive sampling. The study period was January 2014 to December 2014 This study suggests that refresher training will help them increase knowledge, awareness and practice about arsenicosis. Majority (77.6%) community healthcare providers' age group was 31-40 years. Most (80.9%) respondents were female and the remaining male. Regarding educational status, the majority of respondents (76.2%) had passed H.S.C level. The study revealed that 69% of respondents had knowledge about arsenic while 31% did not know about arsenic. All (100 %) respondents knew that the red mark tube well was the source of arsenic contaminated water in Bangladesh. Regarding knowledge about arsenic contaminated districts, majority (71.4%) respondents had knowledge, while 28.5% did not. The study revealed that the majority (71.4%) respondents had knowledge about signs and symptoms of arsenicosis and 28.5% did not. Regarding knowledge about red and green mark tube well, 88.1% respondents knew the meaning of red and green tube well while 11.9% respondents did not. In this study most (95.3%) community health care providers attended the arsenicosis patient. 23.8% respondents thought that arsenicosis is a communicable disease and 23.8% said that arsenicosis is a hereditary disease. 71.2% respondents said that arsenicosis is a preventable disease while 28.2% said that it is a not preventable disease. The study showed that all (100%) respondents said that red labeled tube well cannot be used for cooking and drinking and green labeled tube well can be used for this purpose. Most (90%) respondents practiced to advice arsenicosis patients to avoid drinking the red mark tube well water. Regarding practice of medication in pregnant women, 52.3% respondents advised patients not to take Vitamin A,E and C, while 47.7% respondents advised to take these vitamins. Concerning practice of arsenic kit test, all (100%) respondents did not know how to operate arsenic kit test.

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GENDER DIFFERENCES IN INTIMATE PARTNER HOMICIDES

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It is well known that Intimate Partner Homicide is a gender-based crime and that there are significant differences between male and female offenders. These differences are noted in the crime scene characteristics, previous violence situations but also at sentencing. Sentencing is the process that decides the sentence of a certain offender for his criminal actions and it can be quite different from case to case, depending on its circumstances. These sentencing differences are very important to analyse so that we can understand how offenders are being sentenced and why are these sentences different in similar cases. In the forensic science field, it is well known that crime scenarios are very important to establish the truth of events and therefore the presence or absence or certain evidence (such as body or crime weapon) might be relevant to the sentence of the offender. Also, gender differences in intimate partner homicides have been commonly reported in literature. It is globally accepted that female offenders have lower sentences than man and that there are other circumstances (such as victim's age) that can influence sentences. In this communication, I propose to do a literature review of the gender differences of intimate partner homicides and their sentences; and also, to explore, for the first time in Portugal, the differences in the Portuguese homicides, focusing particularly on the evidence present at crime scenes. In Portugal, sentences are decided individually by judges that have the duty of deciding the actual sentence within a certain sentence range (having in mind mitigating and aggravating facts if they exist). There is no sentencing guideline system, as in England for example, and therefore the sentences can be subjective and cause discrepancies. It will be interesting to find what are the reasons that might cause these discrepancies (if they exist). Circumstances in which homicide occurs will also be explored, with a gender perspective to understand what impact in sentences they have (victim's age, race, ethnicity, presence of weapons…) and how are they different in male and female offenders.

Disclosure: All authors have declared no conflicts of interest.

GROSS AND HISTOPATHOLOGICAL DIFFERENTIATION OF ANTEMORTEM AND POSTMORTEM ELECTROCUTION BURN MARK

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Background: Electrocution burn mark at autopsy is diagnosed on the basis of gross and histopathological examination, such as an avascular, hard to touch blister/crater; streaming of nuclei with hyperchromasia of the basal epithelial layer of skin and of the dermal appendages, coagulative necrosis of cells, metallization, and homogenization of dermis. Sometimes, it becomes difficult to differentiate an antemortem and post-mortem electrocution burn mark at autopsy, in cases where a homicide being concealed as accidental. With the fact in mind, the reported study was undertaken to find out differentiating features of antemortem and post-mortem electrocution burn mark with the help of histopathology and gross examination. **Material and Methods:** Ethical clearance for the study was obtained from Institution ethics committee. A special electrical instrument was built to produce electrocution burn mark on the dead bodies with controlled voltage and amperage supply. The current was passed at 220 V and 100mA for 1-2 second using electrodes. Marks were produced over hand, abdomen and thigh of 25 fresh dead bodies (death within 24hrs of death). 25 cases of electrocution deaths with electrocution wounds were included for comparison. Skin lesions were sampled and preserved in 10% formalin solution. Slides were prepared and stained with hematoxylin-eosin stains. All the slides were studied under light microscopy by two independent observers. Intraepidermal and sub epidermal separation; coagulative necrosis of the epidermis; nuclear elongation and hyperchromasia of epidermal cells; homogenization of the dermis; nuclear elongation and hyperchromasia of hair follicles, sweat glands, sebaceous glands and blood vessel endothelium were studied for histopathological changes with grading of changes. **Results and Discussion:** On gross examination of the electrocution burn mark, there was no difference in the appearance of antemortem and post-mortem wound, neither any difference was found between the two groups in histopathological features; except, sub epidermal separation which was seen significantly more in post-mortem wounds and, homogenization of dermis (with involvement of more than 2/3rd of its thickness) which was seen significantly more in antemortem wound. No difference was seen between post-mortem wounds produced within 2 hours of death (supravital period) and those produced after 2 hours of death, in gross or histopathology. These findings suggest that the changes in the skin are due to physical effect of heat produced by electrocution energy causing dermal expansion and not a vital reaction. The difference in grade of involvement of dermal features was due to different level of heat effect.

Disclosure: All authors have declared no conflicts of interest.

PATTERNS OF HOMICIDE IN KUWAIT: A RETROSPECTIVE DESCRIPTIVE STUDY FROM 2003-2009

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Objective: To investigate the patterns of homicide in Kuwait, an Arabian Gulf state with a wide variety of multi-ethnic communities. **Subjects and Methods:** This descriptive study was conducted over a period of seven years, from 2003 to 2009, and involved a total of 470 reported homicide deaths referred for medico-legal examination. The effects of all

demographic factors on each aspect of the homicides, including age, sex and marital status, were studied using various statistical methodologies. **Results:** This study demonstrated that both the pattern and the rate of reported homicides were high, accounting for 8.2% of all unnatural deaths (total of 5,703 cases). Of the 470 reported homicides, stab wounds (180, 39%), firearms (89, 19%), blunt force injuries (81, 17%) and smothering (#71, 15%) were the most common causes. Strangulation was among the least common cause of death. Moreover, this study demonstrated that the level of violent homicides was higher in Kuwait compared with other Middle Eastern countries (138 per 100,000). **Conclusions:** This high prevalence of homicide may be attributed to the unrestricted availability of firearms following the Iraqi war of 1990. Nevertheless, these findings demonstrated that the government of Kuwait must take urgent measures to reduce firearm ownership of both legal and illegal firearms and knives. Moreover, the difficult living conditions faced by men of the expatriate workforce must be assessed, and action must be taken to improve said conditions as a means of preventing these individuals from resorting to crime

Disclosure: All authors have declared no conflicts of interest.

A CASE STUDY OF EXTRACTING BLOOD PALMPRINT BY USING BLOOD AUTO AUTOFLUORESCENCE

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Diagnosis of blood autologous fluorescence spectroscopy is an important research topic in bio-photonics. It is widely used in the diagnosis of biological tissues and has achieved some results in the early diagnosis of lung cancer, colon cancer, uterine cancer and gastric cancer. In the criminal crime scene investigation work, the use of this method is still in the exploratory stage for us. In a criminal crime scene investigation process in 2015, in order to use the methods of taking photos to non-destructive extract the weak blood palmprint on the white wall better, the technicians use the blood autofluorescence phenomenon and ultraviolet fluorescence technology for fixed extraction. Technicians use the 340nm long wavelength ultraviolet irradiation of the blood palmprint with the medical research results of blood autologous fluorescence excitation - emission band of 340-460 nm, then the blood palmprint is excited to show visible fluorescence at this time; The visible fluorescence get into the camera lens through the yellow filter which is before the digital camera lens, and the long-wave ultraviolet is absorbed by yellow filter, so the digital camera sensor only records the visible fluorescence emitted by the blood of palmprint; At last we can extract the detailed and clear blood of palm ridge by digital image processing. This method not only improve the appearance and the extraction rate of the blood palmprint, but also can provide better conditions for the "reuse" of physical evidence. The success of the case lies in the technicians through the judgment, breaking the use of 415nm ray of blood traces of evidence of the routine; combine medical theory and research, combine the ultraviolet fluorescence photography technology and digital image technology, integrate the reasonable illuminating method and digital image processing technology successfully.

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STUDY OF DEATH BY FIRE ARM INJURY

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It is a retrospective study of death by fire arm injury which was carried out in forensic medical college Bogra. The period of study was from 2006 to 2014. In this study cause of death, manner of death and nature of death were mentioned. The total number of death in that's period were 11 (eleven). Manner of death (homicidal, suicidal or accidental) were mentioned. Firearms (Rifles or smooth bored) were mentioned.Result- In Fire arm injuries causes of death were homicidal in ten (10) and one was suicidal among (11) Post mortem examination of dead bodies were done in Shaheed Ziaur Rahman Medical College Morgue. prerequisites for autopsy. (inquest report, Chillan, commanding certificate and requisition) were prepared by investigations police officer and magistrate sent to us for autopsy. External examination and detail dissection of the bodies were done with the help of mortuary attendant. **Result:** 11 (eleven number of fire arm wounds dead bodies were autopsied from 2006 to 2014. Manner of death, nature of death, age and sex were mentioned. Bullets. cartridge & and card board were collected **Discussion:** In our study death due to fire arm wounds were all almost homicidal among eleven but only one (1) was suicidal. Homicidal firearm wounds are common in our country, suicidal wounds are rare. Homicidal firearm wounds are occurred because of terrorism, political issue, struggle for rights, adultery exchange of money and properties. Cartridges and bullets were recovered from dead body after dissection and handed over to escort police. All bullets and cartridges were of short gun's. Two (2) fire arm wounds were found in chest in two dead bodies and fire arm wounds were found in temporal and occipital region of the head in nine (9) dead bodies. In America two third (2/3) of homicides are caused by fire arm injuries. In America peoples commit suicide by fire arm, drugs, and hanging. 54% of all suicidal death are caused by firearm in America.[4] **Conclusion:** Homicidal fire arm wound s are common in our country. Most of them are declared as an encounter or cross fire. Incidence of death due to fire arm injuries are increasing gradually day by day because of terrorism and availability of fire arms without registration. Deaths were due to shock and hemorrhage resulting from firearm wounds.

Disclosure: All authors have declared no conflicts of interest.

STUDY OF CAUSE OF DEATH AND IDENTIFICATION IN EXHUMED BODY

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It is a retrospective study carried out in the department of forensic Medicine in Shaheed Ziaur Rahman Medical College, Bogra. The study period was from 2006 to 2014,In this study cause of death,manner of death and identifications were mentioned. Total exhumed bodies were 16 (sixteen) in member, Among them females were 4 (Four) and Males were 12 (twelve), Ratio of male and female was 3: 1. Result - In sixteen exhumed bodies cause of death were established in five (5) in cases. Identification were established in three (3) exhumed bodies by DNA profiling. **Result:** Total no of exhumed bodies were 16 sixteen. from 2006 to 2014. There is no time limits for exhumation in Bangladesh. In our study 4 (Four) were second autopsy, one for identification and 11 (eleven) bodies were exhumed for public hue and cry, and harassment of the related persons to take revenge. Cause of deaths were established in 5 (five) exhumed bodies. In others cause of death were undetermined or not ascertained. There was a interesting exhumed body from sherpur upazila. In that body no injuries were found externally and internally. Viscera's were collected and sent to mohakhali chemical analysis centre and chemical analysis report revealed presence of organophosphorus compound poison in liver and kidneys but not in stomach and intestine. Death was due to infusion of organophosphorus compound (insecticide) poison through i/v fluid. Identification of two exhumed bodies were done by sending hairs, long bongs to Dhaka medical college in forensic medicine department. By DNA profiling and finger printing from hair and long bones identifications were confirmed. Cause of death in one exhumed body was head injury and homicidal, In three exhumed bodies deaths were due to violent asphyxia resulting from hanging. In one (1) exhumed body cause of death was asphyxia resulting from infusion of organophosphorus compound (insecticide) poison through i/v fluid. It was homicidal in nature. **Conclusion:** It is very difficult to establish the cause of death in exhumed bodies because of decomposition, saponification and skeletonisation. If first autopsy is done carefully and in good intention, questions of second autopsy generally will not be arose. We should perform autopsy with skill and care to find out the cause manner and mode of death.

Disclosure: All authors have declared no conflicts of interest.

CDC/FBI JOINT CRIMINAL-EPIDEMIOLOGICAL INVESTIGATIONS WORKSHOP COURSE EVALUATIONS: DATA ANALYSIS

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CDC and FBI have conducted Joint Criminal-Epidemiological Investigations Workshops to develop relationships and promote interagency collaboration between public health, law enforcement and other agencies prior to and during the response to incidents involving biological threats. This study explored the association between the presence or absence of hindrance in applying joint investigations practices on the job with the number of years in reported roles, role of participant and workshop location. Data were collected from the 2013-2015 workshop participants who completed course evaluations. Four variables were extracted, and descriptive statistics were calculated, and differences in the number of years in role across different factors were evaluated by Kruskal-Wallis test. Logistic regression analysis was performed to evaluate the association between presence or absence of hindrance and the other variables. Of the 975 workshop participants, 72.61% completed course evaluations. For numbers of years in role, overall mean was 12.41 ($SD = 9.87$), median was 10.00 and range was 1-44. More than half of the participants were in public health roles (53.67%). A little more than half of the participants reported a hindrance in applying joint investigations practices (51.83%). Kruskal-Wallis tests showed that significant differe

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SEPTIC CAVERNOUS SINUS THROMBOSIS FOLLOWING A MINOR HEAD INJURY: A RARE CAUSE OF MEDICO-LEGAL DEATH

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Septic cavernous sinus thrombosis (SCST) is an uncommon consequence of head and face infection, but a rare complication after craniofacial fracture. SCST may result in a catastrophic outcome unless a prompt diagnosis is made and appropriate treatment is given. Early access to medical care and a high index of clinical suspicion are essential if a positive clinical outcome is to be achieved. Few cases have been reported in the English language medical literature and, surprisingly, no cases of SCST have been published in the forensic literature. Here, I report the case of a 13-year-old girl with a 3-day history of a minor fall at her left forehead prior to presentation at a nearby hospital. As a result of the fall, she sustained an abrasive contusion wound at her left forehead and watery rhinorrhea with subsequent progressive headache, fever, nausea, vomiting, and left eye proptosis with blurred vision. One day prior to hospital admission, she developed drowsiness, high-grade fever, severe headache, and left ocular pain with marked periorbital swelling and paralysis of extraocular eye movements. She was treated in the hospital for 10 days, where she then expired as a result of her fall. Postmortem examination revealed the cause of death to be end-stage sepsis with metastatic septic emboli to other organs and extensive cerebral ischemia and infarction secondary to SCST following a minor closed head trauma.

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FATAL ACUTE HEMORRHAGIC BOWEL INFARCTION CAUSED BY MESENTERIC VENOUS THROMBOSIS

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Acute mesenteric venous thrombosis (MVT) is a rare, but life-threatening medical phenomenon. MVT is normally characterized by insidious onset, with non-specific signs and symptoms. A high index of clinical suspicion is required for diagnosis and emergency surgery is necessary to optimize the chances of patient survival, especially in the people aged more than 70-years-old. Surprisingly and based on my review of the literature, no case of fatal acute mesenteric venous thrombosis has been reported in the forensic literature. Almost all cases reported in the medical literature have been associated with underlying risk factors for venous thrombosis, such as hypercoagulable state, certain cancers, and stasis of the blood flow. Here, I report the case of a sudden unexpected death due to extensive intestinal ischemia and infarction with massive abdominal hemorrhage caused by acute mesenteric venous thrombosis in a 72-year-old man without underlying risk factors.

Disclosure: All authors have declared no conflicts of interest.

INDIVIDUAL CHARACTERISTICS WITHIN FIRING PIN IMPRESSION OF 7.62X39 CALIBER RIFLE

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The Firearm and Toolmarks is the most significant field of forensic science. Firearm examiner compare the empty cartridge cases with the test fire cartridge cases to identify the questioned firearm. 7.62x39 caliber rifles are famous for their simple action and locally available in Pakistan. Most of the gun crime is committed by criminals using the said rifle. One case consisting of 7.62x39 caliber rifle and twelve cartridge cases were submitted by police officer in firearm and tool mark department of Punjab Forensic Science Agency, Lahore to identify the firearm. The parcels were photographed and unsealed. According to laboratory SOP's the evidence were properly marked. Test fires were produced using laboratory ammunition. Test fired cartridge cases war collected and compared with evidence cartridge cases under comparison microscope for side by side comparison. There were no breech face marks upon test fire cartridge cases, but the reproducibility of these marks on evidence cartridge cases were sufficient. Moreover, the quality of reproducibility of breech face marks were depending upon ammunition surface. These circumstances may confuse a firearm examiner if he is not enough trained. Ejector, extractor and chamber marks were also missing. Firearm examiner must be familiar with the potential areas like breech face marks, ejector marks, extractor marks, firing pin impression and individual characteristics within firing pin impression. In this case, individual characteristics within firing pin impression were examined and they found to be in really good agreement with each other. Also the shape and overall periphery of the firing pin impression were excellent on both evidence and test fired cartridge cases. These were the impressed marks of firing pin of the submitted rifle. The absence of other marks like breech face, ejector and extractor may be due to the improper burning of gun powder. In such cases. the firearm examiner should not base an elimination, rather he should check the shape, location and size of firing pin and most important the impressed marks within firing pin impression. Upon the basis of similarity among the individual characteristics within firing pin impression, the submitted cartridge cases were identified as having been fired in the said rifle.

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VALUE OF POSTMORTEM CT IN THE DIAGNOSIS OF TENSION PNEUMOTHORAX DUE TO ACUPUNCTURE

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Background: Acupuncture is a well-known form of complementary and alternative medicine (CAM). There are plenty of evidences for its efficacy in treatments of chronic pain conditions, such as neck and back pain, osteoarthritis, and chronic headache etc with a good safety margin. Rare cases of serious adverse events (AEs) such as pneumothorax are described in the literature. Acupuncture-related pneumothorax (PTX) is a poorly reported complication of thoracic needling. Because of delayed presentation, this complication is thought to be under-recognized by acupuncturists and is largely addressed by hospital and emergency room personnel. **Case history:** In the presented case, a 52 year-old male was taken to hospital due to gasp and dyspnea, which happened during the acupuncture treatment for cervical discomfort in a Chinese medicine clinic. Physical examination: Blood Pressure (BP) 179/94mmHg, Heart Rate (HR) 86 beats/min, $SpO_2$54%. The patient had clear consciousness, gasp, anepia and low respiratory murmur accompanied by some wheeze in both lungs. **Postmortem CT findings:** Before autopsy, we performed full-body CT scanning for the deceased, which showed that the whole lungs were compressed to 10%-20% of original size and the pulmonary density was significantly elevated. In the meantime, mediastinal compression and collapse of heart and major vessels were found. **Autopsy findings:** External examination revealed good nutritional and developmental condition of this individual without severe mechanical injury. Multiple pinprick injuries due to acupuncture and quasi-circular marks due to cupping were detected on the skins of shoulders, back and waist. Through autopsy, bilateral pneumothorax test turned out to be positive and we found the whole lungs were highly compressed to the mediastinum and back chest wall. Compression and dextroposition of heart was detected, which is close to the mediastinum. Abnormal hydrothorax was failed to be found, and other organs did not show disease or injury lesions. **Histological findings:** A few lymphocytes' infiltration was observed below local epicardium, while myocardial infarction was not detected. Local atelectasis, congestion of alveolar capillary and edematous fluid within alveolar space were observed. Other organs just exhibited congestion instead of specific disease or trauma. **Toxicological examination:** Ethanol, common toxicoids or drugs were not detected in the blood and gastric content of the deceased. **Cause of death and conclusion:** The cause of death was considered to be acute respiratory and circulatory failure due to cardiopulmonary compression and restricted respiration, which were caused by tension pneumothorax. Therefore, the post-mortem CT scan has diagnostic value on the tension pneumothorax.

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CLASSIFICATION TRENDS AMONG CONTEMPORARY FILIPINO CRANIA USING FORDISC 3.1

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Misclassification of Hispanics using the Fordisc computing software has previously been demonstrated, and is likely associated with the population and Western colonial histories of Latin America. The Philippines in Asia experienced similar histories, and was largely under consecutive Spanish and American rule for more than 400 years up into the mid-20th century. Historical documents suggest intermarriage was commonplace, although the exact genetic constitution of modern Filipino populations is unknown. We hypothesize that given these historical similarities, Filipinos represent a potentially admixed population drawn from both Asian and European parental pools. Here, for the first time, we perform an analysis of classification trends among contemporary Filipinos by Fordisc 3.1. The Filipino case samples (n=93) are drawn from recently disinterred cemetery remains in the capital city of Manila, many of which have known identities from associated tombstone epitaphs. Eighteen standard craniometric measurements covering neuro-, basi-, and splanchnocranial regions were selected. Samples from the Forensic Data Bank were used as reference sets, covering populations from Europe, Africa, the Americas, and East and Southeast Asia. Test cases with five or more missing variables were omitted from the analysis, resulting in a final sample size of 28 females and 43 males. Individuals with measurements greater than three standard deviations from the reference samples were rerun through the program with the outlying variable(s) omitted. Combining groups continentally as Asian, European, African, and indigenous American with Hispanics treated as a separate, admixed population due to high European influence, Filipino females primarily classified into Asian groups (29%), followed by Hispanic (21%) and indigenous American (18%) groups. Filipino males primarily classified into Asian groups (56%), followed by indigenous American (19%) and European (14%) groups. With sexes combined, Filipinos classified most commonly into Asian (45%), indigenous American (18%), and European (14%) groups. In general, Filipinos classified as Asian, with some grouping as Asian-derived (i.e., indigenous American), European, or Asian-European admixed (i.e., Hispanic) populations, lending support to our hypothesis of post-colonial admixture effects. These results may help us better understand the evolutionary, population historical, and statistical reasons for Fordisc 3.1 results, and warrant further research into considerations of colonialism and admixture within ancestry estimation in forensic anthropology.

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ISOLATED INTRACEREBELLAR HEMATOMA - SPONTANEOUS OR TRAUMATIC?

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An elderly male was a victim of an assault by another male. He had received blunt force trauma from fists and also kicks with a shod foot whilst he was lying on the ground. He may have had a transient loss of consciousness at the scene but was found to have a Glasgow Coma Scale score of 15/15 at the Accident & Emergency Department. He was admitted to the Neurosurgical ward for observation and was noticed to have a raised blood pressure but was otherwise stable. Several hours later, he was found to have a sudden deterioration and GCS was said to be 8/15. Emergency CT-Scan showed a unilateral cerebellar hematoma. Emergency craniotomy with clot evacuation was performed but the patient remained unconscious. Despite a second surgical intervention, he remained unconscious and died several weeks later. At autopsy, the forensic pathologist described a cavity in the affected cerebellum. There was no fractures of the skull and no evidence of other intracerebral or intracerebeelar hemoorhages. The assailant was charged and convicted of murder. Was this truly a traumatic lesion?

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EVALUATION OF DNA FROM BLOOD TREATED WITH VARIOUS CLEANING AGENTS

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The ability to generate forensically usable full DNA profiles from blood or other biological fluids which have been treated with commonly available household cleaning agents is a commonly encountered problem in forensic science when attempts have been made to eradicate biological evidence at crime scenes by cleaning. As such, the aim of this project was to determine

if quantifiable amounts of DNA could be obtained from dried blood which had been adsorbed onto fabric and treated with various household cleaning agents. Objective: To determine if quantifiable DNA can be obtained from blood once treated with cleaning agents Method: Single blood drops were dried on cotton and treated with household bleach, disinfectant, all-purpose cleaner with bleach, all-purpose cleaner without bleach and water for 6 hours, 24 hours and 48 hours. The DNA was then extracted using DNA IQ by Promega, quantified using Plexor HY by Promega and amplified using Powerplex 16HS also by Promega. Results were analyzed for locus dropout, allele drop out and quantity of DNA extracted. Results: It was determined that 3ml of bleach was sufficient to degrade the DNA found in 1 drop of blood and because of the acidity of disinfectant, it was capable of degrading DNA with increasing time and volume. All-purpose cleaner without bleach was incapable of degrading DNA despite being more effective at removing bloodstains than bleach. All-purpose Cleaner with bleach showed decreased degrading effect when compared to bleach. Conclusion: As expected bleach was observed as the most effective cleaning agent at degrading DNA. However, despite a cleaning agent containing bleach, amplifiable DNA was extractable depending on length of time and volume of cleaning agent used to treat the bloodstain with.

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THE CONSENSUS STANDARDS CREATION: A GLOBAL CONCERN IN FORENSIC SCIENCES

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"Strengthening Forensic Science In The United States: A Path Forward", published by National Research Council of NAS in February 2009, pointed that there were serious deficiencies in the current United States forensic science system and many subjects actually were not reliable in Forensic practice. Based on the impact of the report that criticized some forensic science disciplines, the SWGs and the steps that the profession has taken since in forming a standards organization and improving the practice of all forensic science disciplines. In 2015, the European Network of Forensic Science Institutes (ENFSI) published a guideline for evaluative reporting. The document specifies the principles and requirements for fair, balanced and robust reporting practices when the forensic expert is asked.(http://enfsi.eu/sites/default/files/documents/external_publications/m1_guideline.pdf) In China, similar to in the United States, the current standardization Administration is led by the government. However there were fewer corporate and group standards. In 2015, the State Council issued a plan to deepen the standardization of work reform. In this presentation, I will present some key component of the plan and argue that the forensic profession needs to build a national standard Association to establish the overall management, and gradually promote the profession service standards, management standards and technical standards, which should be imposed to all forensic scientist.

Disclosure: All authors have declared no conflicts of interest.

BIOMONITORING FOR ARSENIC AND LEAD IN SINGLE HAIR STRANDS BY LA-ICP-MS

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Introduction: The aim of this work was to develop matrix matched hair standards and a LA-ICP-MS technique for determination of the As and Pb in a single human hair using single spot scan mode. The As along the hair of a person who had been treated with arsenic trioxide (As2O3) in leukaemia was monitored in a single hair strand using LA-ICP-MS. These results established a good foundation for studying when drugs enter the body. **Method:** The laser ablation system was optimized using the NIST 612 Trace Elements in Glass standard reference material. Preparation of matrix matched laboratory hair standards. 34S was used for internal standard. The calibration curve was obtained by plotting the observed ratio of analyses ion intensities to 34S+ intensities versus the accurate metal concentration determined by ICP-MS. The limit of detection (LOD) was calculated by the ablation of 10 washed native unexposed hair strands. The hair sample was ablated by single spot scan mode. The diameter of the spot was 55μm, and the distance between two spots was 15μm. **Results and Discussion:** (1) Linearity. Previously determined element concentrations in hair were plotted against 75As+(208Pb+)/34S+ signal intensity ratios and the linear calibration curve showed a correlation coefficient of 0.9970 (for As, 6.91~134.5mg/g), 0.9986 (for Pb, 3.21~30.3 mg/g) and 0.9998 (for Pb, 15.54~136.79mg/g) (2) Precision and Accuracy. Quality control hair strands (QC1 and QC2) were analyzed by LA-ICP-MS, assessed precision(QC1:LAs 2.53%,Pb 1.49%. QC2:As 5.56%,Pb 2.31%.) and accuracy (QC1:As 90.70%,Pb 97.91%. QC2:As107.43%,Pb 98.14%). (3) Application. In order to determine the ability of this method to provide spatial distribution of as along the hair strands and to infer the time of the drug entering the body, the hair sample collected from a volunteer who had been treated with arsenic trioxide (As2O3) in leukemia and were not occupationally or environmentally exposed was entirely ablated from root to tip. Informative As-distribution profiles of hair strands were obtained. LA-ICP-MS of the patient's hair resolved five peaks corresponding to each dose of As2O3. Good agreement was found between the estimated time and the actual time. This study demonstrates that our method using single spot scan mode may be used to monitor the exposure history over the most recent months and infer the time at which drug entered the body. Our study may help clinicians or forensic scientists to ascertain the degree of poisoning and determine the date of poisoning with relative accuracy.

Disclosure: All authors have declared no conflicts of interest.

ROLE OF FORENSIC MEDICINE IN EVALUATING NON-FATAL VIOLENCE AGAINST WOMEN BY THEIR HUSBANDS IN JORDAN

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Objective: Intimate partner violence against women is a major health problem in most nations but to date there has been little awareness of the extent or seriousness of this issue in Jordan. Forensic medical practitioners play a significant role in diagnosing, evaluating and reporting these cases. The Jordanian judicial system is dependent on forensic reports. This study aims to assess the role of forensic medicine in evaluating the physical injuries sustained by women who are abused by their husbands. **Method:** A retrospective review of 158 forensic reports of Jordanian women alleging assault by their husbands and who were seen at Jordan University Hospital over the period 2010- 2015. **Results:** Of the 158 women who presented, 87 had multiple injuries. The majority of injuries were soft tissue injuries, but others included fractures, tympanic membrane perforation, burns and neck contusions. Twelve women were pregnant at the time of the assessment. The period of incapacity caused by these injuries (an important factor for the Jordanian judicial system) was between 1 and 14 days. **Conclusion:** Intimate partner violence can present with a range of injuries from relatively minor to potentially disabling or life threatening. Forensic medicine has a role in documenting and evaluating these injuries and advising the judicial system in these cases. These are all key elements in increasing the awareness of the nature and extent of this behaviour and its impact on women (and men) and the wider society.

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ALCOHOL DEPENDENCY RESULTING WOMEN TRAUMA: VIOLENCE AGAINST WOMEN

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Problem Statement: Women who have experienced intimate partner violence (IPV) are at greater risk for physical and mental health problems including posttraumatic stress disorder (PTSD) and alcohol dependency. On their own IPV, PTSD and alcohol dependency result in significant personal, social and economic cost and the impact of all three may compound these costs. Researchers have reported that women with these experiences are more difficult to treat; many do not access treatment and those who do, frequently do not stay because of difficulty maintaining helping relationships. However, these women's perspective has not been previously studied. The purpose of this study is to describe the experience of seeking help for alcohol dependency by women with PTSD and a history of IPV in the context in which it occurs. **Methodology & Theoretical Orientation**: An inter subjective ethnographic study using hermeneutic dialogue was utilized during participant observation, in- depth interviews and focus groups. An ecological framework was utilized to focus on the interaction between the counselors and the staff to understand this relationships and the context in which it occurs in central Uganda. **Results**: The women in this study were very active help seekers. They encountered many gaps in continuity of care including discharge because of relapse. Although the treatment center was a warm, healing and spiritual place, the women left the center without treatment for their trauma needs and many without any referral to address these outstanding issues. **Conclusion**: Women with alcohol dependence and PTSD with a history of IPV want help however the health and social services do not always recognize their calls for help or their symptoms of distress. Recommendations are made for treatment centers to become trauma- informed that would help this recognition.

Disclosure: All authors have declared no conflicts of interest.

THE PREVALENCE OF BLOOD BORNE VIRAL INFECTIONS AMONG AUTOPSY CASES IN JORDAN

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Background: Morgues are high risk areas for the spread of infection from the cadavers to the staff during the post-mortem examination. Infection can spread from corpses to workers by the airborne route, by direct contact, or from needle and sharp object injuries. **Objective:** Knowledge about the prevalence of these infections among autopsies is prudent to appreciate any risk of transmission and to further enforce safety measures. **Method:** A total of 242 autopsies were tested. Age ranged from 3 days to 94 years (median 75.5 years, mean 45.3 (21.9 ± SD)). There were 172 (71%) males. **Results:** The cause of death was considered natural in 137 (56.6%) cases, accidental in 89 (36.8%), homicidal in 9 (3.7%), suicidal in 4 (1.7%), and unknown in 3 (1.2%). Hepatitis B surface antigen was positive in 5 (2.1%) cases. Hepatitis C virus antibody was detected in 5 (2.1%) cases and the hepatitis C virus polymerase chain reaction was positive in 2 of them (0.8%). HIV antibody was not detected in any of the cases. **Conclusions:** Autopsies can be associated with exposure to blood borne viruses. Autopsies performed during the study period were tested for hepatitis B surface antigen, hepatitis C virus antibody, and human immunodeficiency virus antibody. Positive tests were subsequently confirmed by polymerase chain reaction. There is low prevalence of infections with these viruses in our autopsy cases. However, the risk of transmission remains a threat. Healthcare workers in the forensic departments should adhere to standard precautions.

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FORENSIC CONFRONTATION: INTERNATIONAL MURDER PROSECUTION INVOLVING AMERICAN EMBASSY SECURITY

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The primary goal of this presentation is to illustrate a representative prosecution of a case under the Uniform Code of Military Justice involving the death of a Panamanian citizen by a U.S. Army Soldier who worked at the American Embassy. The victim's body was discovered in the early morning hours on a Panamanian police training area where the officers were practicing small-arms marksmanship. The victim was the known girl-friend of the American Soldier providing training that same day at the shooting range. The victim died of blunt force trauma. The Defendant claimed that she jumped out of the truck, he stopped the vehicle but failed to put it in park, causing it to roll back on top of her. The Defendant provided few details and there was no evidence available to determine the location of the actual death. Attempts to collect digital or electronic evidence were not successful. The Panamanian government conducted an autopsy, but no X-rays were taken. At a later date, when the forensic pathology expert was hired, the prosecution was unsuccessful in its efforts to exhume the body for an X-ray. BioMedical engineering analysis was conducted at Fort Bragg, North Carolina on the defendant's vehicle. Testing involved a series of inspections/examinations of the vehicle as well as simulations to replicate the various theories and explanations given by the Defendant. Subtle physical evidence that was previously overlooked revealed a surprising twist. At trial, the Defense provided expert testimony related to the manner, cause, timing, and location of the death of the victim. The hiring of a forensic engineering expert by the U.S. Army was essential in challenging the defense testimony. After this presentation, attendees will understand the principal phases of a military court-martial, the critical role of forensic evidence experts in the pre-trial stages of the case, and their use as "back-stop" to defense theories. It will also impact the forensic science community by explaining the relationship between the forensic scientist and the military prosecutor and the expert's ability to inform the military judge or jury's decision.

Disclosure: All authors have declared no conflicts of interest.

DEVELOPMENTAL VALIDATION OF A NEW 6-DYE STR 25-PLEX FOR CASEWORK AND DATABASE SAMPLES

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STR profiling has now been applied in various aspects of human identification and paternity testing to help forensic laboratories and law enforcement agencies solve and prevent crimes. As national DNA databases continue to grow and international cooperation increases, a common set of core loci is required to facilitate data sharing and to minimize adventitious matches. In this study, a new STR 25-plex typing system, including 24 autosomal STRs (D1S1656, D2S1338, D2S441, D3S1358, D5S818, D6S1043, D7S820, D8S1179, D10S1248, D12S391, D13S317, D16S539, D18S51, D19S433, D21S11, D22S1045, CSF1PO, FGA, Penta D, Penta E, TH01, TPOX, vWA, D11S4463) and Amelogenin, was developed. The included 24 STRs belonged to the main international DNA databases (CODIS, ISSL, ESS-extended, UCL, GCL and NCIDD) except D6S1043 (specially chosen for Chinese population) and D11S4463(a non-CODIS STR loci). Developmental validation studies were performed according to the SWGDAM guidelines and the Chinese National Standard (CNS) "Basic Quality Requirements of Forensic Science Human Fluorescent STR Multiplex PCR Testing Reagent" (GA/T815-2009). Developmental validation indicated that the STR 25-plex typing system was reproducible, accurate, sensitive and robust. The sensitivity testing of the system was such that a full profile was obtainable even with 0.125ng of human DNA. Specificity testing was demonstrated by the lack of cross-reactivity with a variety of commonly encountered animal species and microbial pool. For the stability testing, full

profiles can been obtained with humic acid concentration ≤60ng/μL and hematin <400μM. For the forensic evaluation of the kit, 24 autosomal STRs included followed the Hardy–Weinberg equilibrium. Since 24 autosomal STRs were independent from each other, PM was 3.5434×10^{-28}, TDP was 0.999 999 999 999 999 999 9999999 69863, CEP was 0.999 99999 375. Aforementioned results suggested that the new STR 25-plex typing system is polymorphic and informative, which provides efficient tool for national DNA database and facilitate international data sharing.

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DIGITAL EVIDENCE AUTHENTICATION SYSTEM USING SMART PHONES

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The importance of digital evidence in criminal investigations is increasing significantly. However, authentication service of digital evidence more increased because of its potential for manipulation. Although the integrity verification method for digital evidence is proposed in the previous work, only the integrity verification models for the digital evidence collected not created or recorded at the site are presented. We developed a system, when a investigators or polices take a picture even while recording video/audio at the scene by using a smartphone, time stamp, location information, the hash value is sent to the authentication server un neutral organization, not to the investigation agency, immediately. Moreover, calculate hash value(called a second hash value) of the data stored on the server during one day and publish on an website or newspaper so that there is proven about data integrity. The developed system is organized two phase. First phase is to request a verification data(such as time stamp, local information, signature information, hash value, etc) of created digital evidence. First phase is organized in the following step. 1. Photo, video recording, voice recording with smartphone at the crime scene 2.The hash value, time stamp, and location information of the photo, movie, and voice file are transmitted to the digital evidence authentication server 3. Next day, generate second hash value for hash values stored on the server during previous day 4. and then, the second hash value is posted on the website and newspaper Second phase is to verify stored data for target data, the sequence of verification of the digital evidence is as follows 1. Request validation target file to server 2. Compare the hash value stored in the server after calculating the hash value of the verification target file 3. When there is the same hash value, issue a certification which is described the several types of information(time stamp, location, signature, hash and etc) Finally, proposed authentication system is able to prove the integrity of the digital evidence. Additionally, our authentication system is able to verify the collected digital evidence by connecting Write Block OTG to your smartphone. As a system that can verify the integrity of digital evidence is developed and applied, it is expected that the legal debate about the manipulation of digital evidence in the court will be resolved.

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USING NUTRIENT FORAMINA TO DISCERN HUMAN FROM NONHUMAN LONG BONE FRAGMENTS IN FORENSIC ANTHROPOLOGY

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Long bone shaft fragments can be found isolated in forensic contexts, such as fatal fires and mass disasters. When diagnostic anatomical landmarks are not visible, the assessment of a human or non-human origin of fragments may be challenging. However, the presence of nutrient foramina on those fragments that do not show any diagnostic landmarks can make the assessment of the origin of the bone still possible. Macroscopic evaluation and micro-CT scanning were used in this study to differentiate human from non-human nutrient foramina on long bone shafts. Nutrient foramina are small openings in the bones through which the blood vessels reach the marrow cavity. There are very few studies focused on the utility of nutrient foramina for the identification of bone fragments in a forensic context. Number, location and direction of nutrient foramina are usually taken into consideration in clinical and surgical contexts, and only in a limited way in comparative anatomy. The long bones of human and non-human subjects of different ages and both sexes were employed for this study. The non-human species included in the study - chicken, duck, sheep, pig, and deer - were chosen because the shafts of their long bones share similar characteristics with the human ones, making their identification potentially challenging if they are found in a fragmentary state. The primary nutrient foramina of the long bones were macroscopically evaluated to assess their location and appearance; their direction was assessed with a hypodermic needle. Micro-CT images were used to measure the angle of the nutrient canal at the level of the cortical bone and to determine the shape of the canal entrance. Location and direction of nutrient foramina were proven to be different between human and non-human bones; however, these two features might not be exploitable in case of very fragmented samples. The shape of the canal entrance and its angle at the cortical bone obtained from the micro-CT scannings were useful parameters, though the foramina appearance was the most reliable for the origin identification. In some cases similarities were observed between species; for a correct identification of a fragment, it is advisable to use all the features considered in this study and combine the data, as one parameter on its own may not be enough. This research proves that nutrient foramina can be considered as a reliable bone feature for the distinction between human and non-human fragmented and incomplete long bones.

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FORENSIC INNOVATION CENTRE: A UK MODEL FOR ACADEMIA, POLICE AND FORENSIC SCIENCE COLLABORATION

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The changing profile of forensic science provision in the UK has enabled agencies engaged in criminal justice activities to investigate novel and alternative ways of working together collaboratively. The University of Portsmouth and Hampshire Constabulary have enjoyed an informal close working relationship over a number of years and this was formalised in 2015 with the development of a business partnership that has seen operational police staff relocate to Portsmouth's city campus site. The Forensic Innovation Centre was born in University estate, which provides state of the art accommodation - comprising an interactive, two-bedroom apartment teaching space and working space for operational police staff. As Honorary Lecturers, some Constabulary staff share their expertise with undergraduate and postgraduate students and many are mentors for a suite of work experience internships and volunteer placements offered across a range of their disciplines, including Crime Scene Investigation, Digital Forensics and Scientific Services. These unique opportunities have led to employability improvements for students, in some cases culminating in employment. The natural progression from the success of this partnership has been to engage with a commercial forensic services provider to complement the police and academic basis of the Forensic Innovation Centre. 2017 has seen the signing of a contract to progress a tripartite agreement with Key Forensic Services Ltd. This arrangement neatly encapsulates a series of solutions for both the public and private aspects of the criminal justice sector. Police forces are facing times of austerity and real demands to reduce their expenditure by committing to tangible cost savings and so look to industry to identify methods by which to achieve this. Private companies need to work in conjunction with service providers to identify where best to target their investments. Both the private and public agencies can rely on the support of the academic community to evaluate, document and ultimately publish findings. This model of mutually beneficial collaboration to progress forensic research is being emulated by other such agencies across the UK. This paper

presents the model as a template for consideration by international colleagues. Additionally, the model has led to the development and sharing of knowledge transfer - the Forensic science Innovation Technology - Information Network (FIT-IN) which aims to develop cohesive, collaborative engagement to further common understanding across all those engaged with forensic research and development.

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CHILD FORENSIC ATTITUDE SCALE AND REASONS BEHIND UNDER-REPORTING CHILD SEXUAL ABUSE IN SAUDI ARABIA

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Medical evaluation of children for concerns of child sexual abuse (CSA) requires specialized skills and training including forensic interview skills. In this paper, variations in professional's attitude toward child sexual abuse is studied to evaluate disagreements in conclusion of assessment of CSA cases. The cross-sectional study was conducted at law enforcement and prosecutor's offices, hospital based child protection centers, and educational institutions throughout Saudi Arabia. Sample (N=327) was selected randomly from National Family Safety Program (NFSP) database of professionals in the fields of healthcare, social service, law enforcement, medical examiner, and education who were involved with suspected cases of CSA as part of their job or were in a profession that puts them in contact with such cases. The Child Forensic Attitude Scale (CFAS) was used as a measuring tool and computer based survey was used for data collection. Results from this study revealed high specificity of professional's in assessment of CSA cases, which was found in sensitivity/specificity analysis. There were significant differences in attitude subscale scores by gender and specialty of the participants with health care professionals found to be more concerned about under calling abuse than other professionals. High specificity of professionals toward suspected cases of child sexual abuse could affect final judgments and hence could contribute to low reporting rates. Strategies can be implemented to control the influence of subjective factors including self-awareness of personal biases and team approaches of assessment.

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STUDIES OF THE METABOLISM AND DISTRIBUTION OF METHYLONE BY LC-MS

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A specific and sensitive liquid chromatography-electrospray ionization-ion trap mass spectrometry (LC-ESI-ITMS) method was developed and employed for the studies of metabolism and distribution of methylone in rats. The determination and quantitative analysis of methylone in urine, plasma and liver were accomplished individually at first, the precursor and major product ion of methylone was monitored in positive ion detection mode as m/z 190.1 with LC-ESI-ITMS. Secondly, the method validation of the analysis of methylone in urine, plasma and liver was performed and the results showed that the method had good precision and repeatability. Furthermore, the urinary metabolites of methylone in rats were investigated by analyzing urine specimens after administrating to rats with LC-ESI-ITMS, totally four metabolites of methylone were obtained. In addition, the distribution of methylone in rats was examined after oral administration, and the result showed that the concentration in urine was higher than other parts. The studies in this article indicated that the approach mentioned here could be applied in the identification of forensic evidence, and also could be benefit to the research of illicit drugs in medical, pharmaceutical and forensic investigations.

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FORENSIC EXPERIENCE OF SAUDI NURSES; AN EMERGING NEED FOR FORENSIC QUALIFICATIONS

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Forensic nursing was recognized as a nursing subspecialty after the perceived need for forensic nurses to bring about their nursing duties while at the same time helping legal authorities to deliver justice. With the increased rate of cases that are presenting to the forensic centers in Saudi Arabia, there was a need for the presence of nurses to work side by side to physicians. This study was aimed at determining the forensic qualifications of nurses working in emergency departments in the area of Dammam and their knowledge about principles of forensic nursing. A self-administered questionnaire was distributed to registered nurses who are working in Emergency departments of secondary hospitals in the area of Dammam. Questions included knowledge, awareness and attitude toward forensic nursing. A total of 96 participants responded to the questionnaire with females representing 78% (*n*: 75). Diploma was the highest earned nursing degree in 95% (*n*: 91) of participants. Only 33% (*n*: 32) were aware of the term forensic nursing and the majority of the respondents gave invalid or didn't know the answers to knowledge questions. A total of 77% (*n*: 74) agreed that they are not adequately trained for handling forensic cases. Saudi nurses need forensic education. The presence of qualified forensic nurses would help delivering optimal forensic services and would assist in bringing justice.

Disclosure: All authors have declared no conflicts of interest.

FORENSIC MEDICINE CASE REPORT- TALE OF A DEAD CHILD

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Though the subject of Forensic Medicine is applied since time immemorial but at times a particular case becomes a head scratcher for the investigating agencies. when a clue is picked by an intelligent officer or rather an officer who had his brain cells alert at a particular time, the whole lot of things are digged out and then the things related to the case are meticulously joined together with the help of experts of various fields and the culprits are nabbed. having faced with the similar situation a child was declared to have been picked up by culprits from infront of his house and there was no witness in the case. the child remained untraced for two years while the culprits were closely walking around with family members and knew what the investigating agencies were doing on daily basis. For two years there was uncertainty about the health of child and growing unrest among the general population with the mounting pressure on the investigating agencies. finally one clue and slowly the events started unfolding and culprits were nabbed but the child was lost forever. this case highlights the forensic work of the forensic experts in shimla which is a capital of Himachal province in India.

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TERRORISM AND ARMED CONFLICT

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Armed conflict and terrorism damage economic development through disruption of economic activity, trade, and the destruction of human and

physical resources. They also can affect foreign aid allocation to developing countries like Africa, but the likely net effect of this is not obvious. On the one hand, donors may be discouraged and reduce aid. On the other hand, donors may provide more aid, for instance as a reimbursement for counter-terrorism efforts that benefit the donor country. This article aims to identify the net effect using data for a panel of countries. It finds that armed conflict does have a large and negative effect on bilateral and multilateral aid, but that bilateral donors seem to turn a blind eye to violence occurring in oil-exporting countries. Further, the article finds that while transnational terrorism tends to increase bilateral aid, bilateral donors seem indifferent to domestic terrorism. In contrast, multilateral aid is found not to react to transnational terrorism, but does react to domestic terrorism.

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IDENTIFICATION OF SPERMS ON HUMAN SKIN AFTER DEATH

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Sperm identification is mandatory in sexual crime diagnosis either in dead or living cases. The attention of forensic scientists usually directed to the vagina for semen detection despite the importance of semen deposition on the skin. Postmortem identification of sperm on human putrefied skin is still under investigation. Sperm Hy-Liter ™ depends on fluorescent monoclonal antibody technique which is used to identify human sperm heads in forensic stains. This method has the potential to eliminate sperm visualization problems in traditional morphological method. Therefore, the present study aimed to compare between traditional method (light microscope and staining via hematoxylin/eosin) and fluorescence-based method (by using fluorescent microscope and staining via Sperm Hy-Liter™) for post-mortem identification of sperms on human skin at different time intervals. A piece of human skin was divided into three groups; the first was a negative control while semen was spread on the second and third groups. The first (control) and second groups were stained by hematoxylin/eosin for light microscopic examinations. The third group was stained by Sperm Hy-Liter™ then examined under fluorescent microscope. Sperm identification was up to 110 days based on Sperm Hy-Liter™ and fluorescent microscope, while it was up to 12 days via using hematoxylin/eosin and light microscope. The results of present study revealed that fluorescent monoclonal antibody technique has great potential to identify sperms for longer period. This could make a great difference not only in identification of type of crime "sexual assault" in dead cases but also in identification of the assailant. Further studies are recommended in order to verify not only the accuracy of the used method on skin of dead body but also to evaluate persistence of spermatozoa on different body sites and fabrics.

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THE THANATOMICROBIOME LEADING TO THE DETERMINATION OF THE CAUSE OF DEATH IN CRIMINAL CASEWORK

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Determination of the precise cause of death is one of the most important clues required for criminal investigations; however, establishment of accurate causes of death, specifically, enforced deaths such as homicide and suicide is the most challenging and complex task of forensic investigators. The proposed solution is to link the abundances of 16S rRNA genes, representing specific microorganisms in internal organs of cadaver samples, to the cause of death. To date, relatively few studies have investigated the human microbiome associated with death, commonly referred to as the "thanatomicrobiome" (*thanatos*- Greek for death). We rationalized that since microorganisms are one of the major driving forces of body decomposition, the abundance of certain microorganisms might well serve as accurate sensors after death. We hypothesized that time-dependent succession of microbial signatures within internal organs have the proficiency to be more predictive of the cause of death than current techniques. In this study, we demonstrated that the relationship between post-mortem microbial succession is measurable and viable in a human thanatos system. Our thanatos model assessed liver and spleen samples from 64 human remains from actual criminal casework with post-mortem intervals ranging from 3-78 hours. To distinguish the composition and diversity of thanatomicrobiomic signatures, we extracted DNA for cadaver livers and spleens and performed PCR targeting the V4 region (Class I) of the 16S rRNA gene using bacterial primers 515F-806R. The benefit of this type of bioinformatics study is that these unprecedented results allow for the discovery of more rare taxa that can be compared across causes of death. The findings of a comparison of the thanatomicrobiome of female and male corpses' liver and spleen samples show that there are significant differences ($p < 0.05$) among causes of enforced death in both unweighted and weighted Unifrac ADONIS tests. Furthermore, in four drowning cases, *Clostridium sardinense* and *Photobacterium damselae* were the only bacteria detected, and similarly in overdose cases, only *Clostridium perfringens* was found. This study is the first to establish an innovative way to incorporate molecular pathology in ascertaining the cause of enforced deaths and the microbial processes that are involved. Our results will support the creation of the Human Postmortem Microbiome Project (HPMP), a consortium that endeavors to cultivate forensic and criminal investigative tools and databases for forensic investigations.

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PROTECTIVE EFFECTS OF CO-ENZYME Q10 & FLAXSEED OIL AGAINST ASPARTAME HEPATOTOXICITY IN RATS

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Aspartame (ASP) has been recognized as a low caloric dietary sweetener used in day life. Although it has been approved as an additive in many dry food applications, there is a great debate about its safety. It is proved that ASP has the ability to induce hepatic oxidative stress and hepatic structural deformities. Therefore, this study aimed to examine the hepatoprotective effects of Co-enzyme Q10 (CoQ10) and flaxseed oil (FSO) against ASP hepatotoxicity in rats. Male albino rats were divided into 4 groups; group I (control) had free access to food and water, group II received ASP dissolved in distilled water, group III received CoQ10 in distilled water with ASP and group IV received FSO with ASP for 60 days. ASP caused a marked rise in serum liver transaminases, alkaline phosphatase, total protein and total bilirubin with reduction in serum albumin. It also caused decrease in liver reduced glutathione level, superoxide dismutase and catalase activities while it induced lipid peroxidation, which indicated by marked increase of malondyaldehyde and nitric oxide. These results reflect ASP hepatic intoxication. Concurrent supplementation of either CoQ10 or FSO with ASP protected the liver from ASP damage which detected by improvement in all affected biochemical parameters. These results were supported with the histopathological and immunohistochemical examinations of the liver tissue which prove hepatoprotective effects as a result of co-treatment with CoQ10 and FSO.

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AN EXAMINATION OF THE SPATIAL DISTRIBUTION OF THE FRAGMENTS CREATED DURING A EXPLOSIVE ATTACK

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Throughout the course of a forensic investigation following an explosive attack, the identification and recovery of tissue fragments is one of extreme importance. There are few universally accepted methods to achieve this end. This project aims to address this issue through the examination of the resulting spatial distribution of the tissue fragments produced by an explosive event. To explore these requirements, several pilot studies were conducted, using data from controlled explosions using pig carcasses undertaken in the UK. These studies charted the spatial distribution of tissue debris following an explosion. An amount of 3kgs in military grade explosive was chosen to create the maximum amount of fragmentation. This amount and type were chosen in that it not only creates enough fragmentation before evaporation of the forensic evidence, but also the blast created by a military grade explosive is one of the more powerful types. This would allow the distances and pattern spread that was recorded to be a guideline for forensic recovery of associated with an explosive amount of an unknown size and quality. Through the use of a total station to record the location of the resulting forensic evidence, the collected data was analysed using both ArcGIS and R Studio. The observed patterns suggested that the distribution remains fairly consistent in trials under similar environmental conditions. This indicates potential for some general guidelines for forensic evidence collection (for example, the distance from the explosion that a search should cover).

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SPECTROPHOTOMETRIC DETERMINATION OF TRIAZOLAM WITH CHARGE TRANSFER REACTION

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A spectrophotometric method for determination of triazolam was developed based on a 1:1 charge transfer complex of 7,7,8,8-Tetracyanoquinodimethan(TCNQ) in acetone solution under 50 °C for 50 min, The complex compound maximum absorption wavelength was 846 nm. Standard curve was A = 14.469 + 0.340 C. The correlation coefficient R was 0.9219, the minimum detectability was 0.0008 mg mL^{-1}, Beer. s law was obeyed in the range of 0.0008 mg mL^{-1} ~ 0.375 mg mL^{-1}, relative standard deviation (RSD) was 0.002% and recovery was 97.31%.

Disclosure: All authors have declared no conflicts of interest.

CHILD PORNOGRAPHY IN COMPUTER FORENSICS: WHAT ARE THE MOST RELEVANT PIECES OF DIGITAL EVIDENCE?

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Computer forensics involving child pornography are increasing year by year. This kind of digital evidence is crucial for computer forensics experts to unravel the related crimes, considering the country laws. The possession of child pornographic files and its sharing are crimes in many countries. Therefore, in a computer forensics analysis, there are many digital pieces of evidence that experts must find. This study shows some of the most relevant digital evidence in cases of child pornography in computer forensics. First, the forensic expert must look for images and videos of child pornography stored in the digital devices. Thus, it is possible to use some techniques, like comparing hash values, searching for common pedophilia keywords, using nudity detection in images, and even motion detection in videos. The EXIF information in images can be very useful to determine if the device user has produced some pictures. After finding the possession evidence, the computer forensics expert must look for file sharing evidence, analyzing logs of (i) Peer-to-Peer programs (like Kazaa, Shareaza, Ares, Limewire, uTorrent, eMule, BitComet); (ii) instant messaging programs (such WhatsApp Web, Skype, ICQ, GTalk, Facebook Messenger); (iii) history of Web browsers (like Chrome, Internet Explorer, Firefox); (iv) e-mail programs and Webmail cache (such Gmail, Outlook, Thunderbird, Hotmail, Yahoo!), and; (v) programs to access the Dark Net and Deep Web (like Tor, Onion). In fact, there are many programs to download and upload files, which can be used to share illegal content. Therefore, the study of the newly available tools is always important to the forensic expert. However, one of the most relevant evidence in these cases is to proof the intention of the user to obtain this kind of illegal content. Therefore, the forensic expert must search for the keywords used to reach these illegal files, like Web browser keyword/form list, keywords of sharing programs and visited sites, among others. In some cases, the forensic expert may find texting, sexting, and child grooming evidence, which are imperative in cases of child exploitation and child sexual abuse. The evidence found in digital devices related to child pornography is very relevant to the solution of these cases. There are many ways to find child pornography evidence in digital devices and the computer forensics experts must be aware. After all, in some cases, the computer forensics analysis can be the only method to discover the sexual abuse of children, allowing the aggressors punishment.

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MOBILE FORENSICS: BREAKING USER PASSWORD IN ANDROID DEVICES THROUGH RECOVERY PARTITION SUBSTITUTION

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One of the main challenges on computer forensics is the analysis of smartphones, which in the most cases, are locked with user-defined passwords. The forensics expert needs to discover or bypass the lock to gain access to internal smartphone data. In Android, the most-used methods for smartphone lock are Patterns, PINs, and Passwords. This study presents a new method to discover the user lock in some Samsung smartphones with Android up to version 6 (Marshmallow) and with an external memory card slot. Android has three types of initialization modes: Normal, Download and Recovery, depending the keys pressed during boot. The strategy is to replace the Recovery partition of the smartphone, using a custom recovery, called in some cases of Clock Work Mode (CWM). In some Samsung models, it is possible to replace the Recovery Partition using the Odin Software, initializing the smartphone in Download mode. After replacing the recovery partition, the expert must initialize the smartphone in Recovery mode. The new custom Recovery offers the option to back up the entire data of the internal memory of the smartphone to the external memory card. Therefore, the forensic expert most use a blank memory card in the smartphone slot to store the backup. With the internal data of the smartphone, the forensic expert can discover the defined lock, using some forensic techniques and a brute-force attack in the case of PIN/Password protection. If the smartphone is locked with a Pattern, the expert needs to get the hexadecimal value stored in the "data/system/gesture.key" file, comparing it with a Pattern Dictionary, which contains all Pattern combinations, easily discovering the defined Pattern. By the other hand, if the smartphone is locked with a PIN or Password, the expert needs to analyze some files, like "data/system/password.key" (which stores the password hash), "data/system/device_polices.xml" (which stores the password mask and size) and also find the password salt, which can be stored in "/data/data/com.android.providers.settings/databases/settings.db" or "data/system/locksettings.db-wal" files, depending on the Android version. With all that information, the forensic expert needs to brute-force attack the PIN/password, using a program like Hashcat. Hashcat is a free brute-force password attack program, which supports hundreds of password types, including MD5 and SHA-1, typically employed in Android. In the most cases, only a few minutes attack is necessary for Hashcat to

discover the PIN/Password, allowing the forensic expert to gain access to the smartphone and finally starts the forensics analysis of the device.

Disclosure: All authors have declared no conflicts of interest.

DEVELOPMENT OF FORENSIC MEDICINE AND FORENSIC SCIENCES IN ARAB REGION

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Background: Forensic practice in the Arab world was old as history. About 3000 B.C. Imhotep was the Grand Vizier, Chief Justice, and Physician to King Zozer, and as a side-line he was also architect of the first great Pyramid at Sakkara. He was the first great man combining the sciences of law and medicine; he might be described as the first medicolegal expert. As for the laws and codes that govern medical practice and medical responsibility Hammurabi, the king of Babylon from 1792-50 B.C.E., was the first to issue medical laws in history. Since then the Arab countries developed different administrative structure that run forensic Medicine practices as well as criminalistics and crime scene investigations. Some countries have medicolegal institutes; others have different administrative bodies to rum forensic practice which are affiliated to ministry of health, ministry of justice, general attorney office, or judicial department. Others are affiliated to Ministry of Interior. Lately, Sudan has developed an independent body, Medical Justice Authority that will run forensic practice in the whole country. Crime scene examination office is always a separate body and part of Ministry of Interior. Arab countries have been passed and are passing through a lot of challenges that affect forensic practices. The aim: of the present review is to describe how scientists of this plateau, from ancient to modern times, contributed to the development and progress of forensic sciences. Methodology: Literature review and structured questionnaire

Disclosure: All authors have declared no conflicts of interest.

EVALUATING THE IMPACT OF DIFFERENT WAYS OF PRESENTING TRAUMA EVIDENCE IN COURT: A PILOT STUDY

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Injury in a forensic context is described, interpreted and recorded typically through written, photographic and radiological means. Explaining pathological findings such as the severity and extent of injury in a court situation can be difficult as the trauma and the impact on the deceased individual are often complex. Consequently, as part of evidence presentation to courts, forensic experts may, in addition to verbal description, use a range of photographs and/or radiology reports and images to convey the extent, magnitude and causation of injury. Radiological material may include traditional black and white cross-sectional images, annotated traditional black and white cross-sectional images, colour-coded cross-sectional images, 3D reconstructed images, annotated 3D reconstructed images, colour coded 3D reconstructed images, paper and digital versions of the former, moving video versions of the former and more recently, physical models using 3D printing. In many cases experts refer to the radiological findings in the belief that they provide an easy to comprehend depiction of injury that is considered by them to be less confronting than direct anatomical photography. However, the impact of different ways of presenting trauma evidence in court has not been adequately investigated. This presentation outlines a pilot study that presents verbal descriptions, black and white and/or colour photographs, 3D reconstructed CT images, and a 3D print of head trauma to a range of different people. The aim is to evaluate whether the choice of how trauma evidence is presented has an impact on understanding of legal practitioners (prosecutors, defense lawyers and judges) and the lay public (potential jurors) of trauma findings.

Disclosure: All authors have declared no conflicts of interest.

THE DETECTION OF CATHINONE AND ITS METABOLITES IN RABBIT URINE BY LC-MS/MS

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Khat is an evergreen shrub grown commonly in Africa. As a natural stimulant, using Khat is mainly prevalent in some countries of Africa and the Arabian Peninsula and also exists in some countries of Europe and America. In 2012, fresh Khat was seized by Chinese Guangzhou Customs for the first time. Since then, thousands of kilograms Khat were obtained by Chinese police. There were many experimental researches had shown that long-term use of khat would produce behaviors as amphetamine-like stimulant. It is considered that chewing Khat should also influence human body health, mental state and driving action. In this article, the analysis of cathinone and its metabolites in rabbit urine was studied. Following the determination of cathinone and norephedrine in dry leaves, the paper finished relevant animal model experiment. The rabbits were subjected to intragastric administration. A single oral dose of 200 mL extraction water solvent (50g dried Khat leaves were crushed and soaked with 200mL water, cotton gauze filtered) was administered to rabbits. Urine samples were collected from 3h to 48h after administration. A 300μL urine was mixed with 900μL volume methanol to remove protein after centrifuging at 10000 rpm for 5 min, an aliquot of 10 μL of the supernatant was used for LC-ESI-MS/MS analysis. The result proved that cathinone is the main component in 3h urine sample. Moreover, as the main metabolite of cathinone, both cathine and norephedrine could be identified in 5h urine. Those mainly metabolites could be still detected in 48h test samples. In the past, many researches are focused on the pharmacology of Khat abuse, however, body fluids of drug abuser often need to be detected and monitored in forensic toxicology. Modes of using Khat concluded chewing, ingesting khat by making a drink from dried leaves or smoking dried leaves. It is important to confirm the time and the concentration of detection in urine or blood by different ways of using. This study can help to be testified of khat abuse.

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THE DETECTION OF EXOGENOUS DRUG IN FINGERPRINTS AFTER DEVELOPMENT WITH POWDERS AND ADHESIVE LIFTERS

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The analysis of fingerprint deposits has wide worthy and prospect in both forensic science and medical science. Development of latent fingerprints involves treatment to allow the often invisible ridge detail to be visualized. The application of powders or adhesive lifters to latent fingerprints is a simple, common method for their development. In order to study the effect of development of latent fingerprint on determination of drugs in fingermarks, liquid chromatography-mass spectrometry (LC-MS) has been used based on the high sensitivity and fast speed of analysis. There are more reports of it in the application of drugs detection in fingerprints. In this article, the analysis of exogenous drug in fingerprints after development with powders and recovery with adhesive lifters was studied. For study the influence of development of latent fingerprint on determination of drugs in fingermarks, six common development methods were experimented. Three commercial powder scrub development methods, polybutyl cyanoacrylate fume display method, gummed tape transfer extracted method and TiO2 powder visible method were applied in the development of fingermarks on clean glasses which were obtained from drug-free user who had contracted

with mixture of MA powder and other adulteration materials, we can see that the amount of MA in fingermarks treated with six development methods were all reduced slightly comparing with untreated fingermarks, but the influences were very weak to the quality detection. Extreaction of MA in development fingerprints is from 22.7 to 79.9% at added craystle MA, is from 60.8 to 107.6% at added lower MA standard solvent. Development methods in commercial powder could not influence the quality examination of exogenous drug in latent fingermark. Furthermore, in order to evaluate the influence of the amount of residues for pressing times, we can see that the peak areas were sharply decreased in the fingermarks from the first time to the fifth time on all substrates, while MA could also be detected on smooth glass even at the fifth time. Therefore, chemical information could be obtained from the sweat deposited in a fingerprint using the method developed in this article, and also it has shown potential advantages in many areas.

Disclosure: All authors have declared no conflicts of interest.

RECONSTRUCTION OF OBLITERATED SERIAL NUMBERS IN POLYMERS

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The main objective of this research project is to develop a new method to recover obliterated information in polymer materials. Our goal was to provide an effective method that would allow the reconstruction of serial numbers in polymer objects of forensic interest such as firearms or automobile parts. The recovery of obliterated serial number remains an active area of research in fields such as forensic science, counterfeiting and manufacturing. Indeed, as conventional techniques for metals are not transferable to plastics, there is currently no reliable method available for polymers. Since plastics tend to replace steel and alloys as the main component of objects, there is a real need of such a technique. During the marking process of a serial number, plastic deformations are induced in the material. These deformations consist in residual mechanical strain and may still remain detectable after the obliteration even if the original marking is no longer visible. Our approach consists in using vibrational spectroscopy imaging, a non-destructive technique, to monitor the strain in polymers resulting from the marking process. This analytical technique is sensitive to chemical bonds and strain will be indicated by a shift in some spectral peaks corresponding to the affected chemical bonds. Therefore, we can use this method to study the deformations in a material and recover the obliterated information. Our experimental results first show that vibrational spectroscopy techniques allow the detection of mechanical strain in polymers. We are then able to perform the recovery of an obliterated letter with Raman spectroscopy imaging in different polymer samples such as polycarbonate, polyethylene and nylon, commonly used in the fabrication of firearms. Through cross-section experiments, we determine the detection threshold of the method. This study reveals that the color of the polymer under study (black or white) does not have a significant impact on the results. This non-destructive method demonstrates a very strong potential for direct application in forensic science and many other fields to efficiently recover obliterated serial numbers in polymer materials.

Disclosure: All authors have declared no conflicts of interest.

WILDFIRES OF ELECTRICAL ORIGIN, DEATHS AND LITIGATION

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Wildfires of Electrical Origin - Death and Litigation Prof. Helmut G. Brosz Director, Institute of Forensic Electro-Pathology 2017 IAFS Toronto, Canada

After attending this presentation, attendees may better understand some causes of wildland fires resulting in deaths, injury, and litigation, resulting in a more effective understanding of forensic methods and issues. Spoliation issues will also be discussed. California, Australia share a high number of deadly wildfires caused by or involving power lines, property destruction and business interruption. The millions of dollars of loss invariably result in civil litigation if a chance monetary recovery is likely. Criminal litigation is also likely if the circumstances exist. The following issues and activities should be considered ; vegetation clearances, conductor properties, catenary sag and tension of power lines before and after a fire and line-to-line and line-to-ground voltages and tracking evidence, field testing Contaminated insulation, bushings and lighting arresters,surveys of lines and the ground, codes and standards. Lightning,. Animals and birds sometimes cause short circuits on lines and at hardware on poles. The Topanga Canyon wildfire of 1993 near Malibu, Los Angeles County CA., burned 19000 acres, 739 structures and cars and killed three people; and, provides an example of a criminal arson investigation gone awry. The Cavendale fire of 1996 burnt about 3000 acres of mostly vineyards. as well as a few structures. Did a tree grow into a line or did a line sag into a tree? Over $30,000,000 was at stake in the ensuing litigation. Some wildfires have spawned significant litigation involving Electric Utilities. Wildfires are here to stay, death, destruction, litigation and the rebirth of forests and fields continues.

Disclosure: All authors have declared no conflicts of interest.

FITNESS TO DRIVE AFTER DRIVING UNDER INFLUENCE OF ALCOHOL AND/OR DRUGS: VALUE OF HAIR TOXICOLOGY

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Background: High blood alcohol level or the combination of alcohol with drugs and/or medication are the main risks for getting involved in a traffic accident. In Belgium there is an absolute zero tolerance for drug use while driving and alcohol use is limited (<0,5 g/L). Legally, a period of 6 months of drug abstinence or limited use of alcohol is a prerequisite for regaining fitness to drive status. **Objective**: Compare ethylgluconuride (EtG) and drug metabolite levels in hair with self-reported alcohol/drug use or urine and blood analysis to assess the fitness to drive status. **Method:** Retrospective study of 68 drivers convicted for driving under the influence of alcohol and/or drug with recurrence within 3 years in Belgium. Hair analysis was compared with self-reported alcohol/drug use and urine and blood analysis. For drugs, an urine immunoassay was used. For alcohol, classic liver enzymes, carbohydrate deficient transferrin (CDT) in blood and the presence/absence of ethanol in urine/blood were tested. A CDT of > 1,6% was considered recent, excessive alcohol use. In hair EtG and drug metabolites were qualitatively and quantitatively determined. An EtG of > 30 pg/mg was set as excessive, chronic alcohol consumption (+/-60 gram pure alcohol/day). **Results:** Despite the knowledge that a clinical examination with toxicological analysis would be performed, half of the examined group overtly lied about their alcohol and drugs use. Urine showed that 3 subjects (4,4%) recently used alcohol and 12 (17,6%) drugs. CDT was elevated in 15 cases (22,1%). In total, 70,6% of the cases were, from a legal point of view, considered "not fit to drive" after analyzing self-report data, urine, blood, and hair analysis. In this group the medicolegal assessment could be based on self-report alone in 29,2% of the cases. Urine analysis accounted for an additional 14,6% not fit to drive and blood analysis for another 16,6%. If hair toxicology wasn't performed 39,6% of the not fit to drive cases would have been considered "fit to drive". Hair analysis detected excessive EtG and drug metabolites in these cases. Hair analysis showed an elevated EtG in 66,7% of those not fit to drive and drug metabolites in 25% of these cases. **Conclusion:** Hair can be used as a noninvasive direct marker of alcohol and drug use over a longer period.

In our series, almost 40% of those considered not fit to drive would have wrongly been considered fit to drive without hair toxicology.

Disclosure: All authors have declared no conflicts of interest.

A STUDY ON THE DISCRIMINATION OF COPY PAPER USING NON-DESTRUCTIVE OPTICAL INSPECTION

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One of the most fundamental topics in the field of document forgery research is the methodological study on the discrimination of paper. Approach on paper discrimination is important regardless of written documents or printed documents but is very limited. Although there are numerous studies on paper, more various studies using non-destructive inspection are needed from the viewpoint of forensic science that do not allow destruction.

In this study, we have observed various copy papers commonly used in document production through several kinds of optical inspections and explained the results. As a result, we were able to identify and classify the types of major copy paper brands in Korea.

Disclosure: All authors have declared no conflicts of interest.

INTIMATE PARTNER VIOLENCE AMONG EGYPTIAN PREGNANT WOMEN: INCIDENCE, RISK FACTORS AND OUTCOMES

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Background: Violence against women is the most widespread yet under recognized human rights violation in the world. It is an important global public health problem and particularly women of reproductive age. Studies regarding violence against women in Egypt show that this problem is widespread. WHO 2001 review of national studies on women subjected to physical violence by an intimate partner showed that 34.4% of Egyptian women have been subjected to this form of abuse **Aims:** To assess incidence and risk factors of intimate partner violence (IPV) during pregnancy among a sample of women from Egypt and to evaluate its impact on maternal and fetal adverse health outcomes. **Materials and Methods:** A prospective cohort, hospital-based study was conducted among 1,857 pregnant women aged 18 – 43 years attending the Obstetrics outpatient clinic of Suez Canal University Hospital (SCUH) during any period of pregnancy. After obtaining ethical approval women were followed up until delivery and for one month thereafter for assessment of neonatal outcome. Women were investigated using an interview questionnaire. The questionnaire contains five main items: demographic characteristics of women, intimate partner characteristics, assessment of IPV during current pregnancy, and assessment of maternal as well as fetal/neonatal adverse outcomes. Women were also examined to detect signs of violence and identify injuries. **Results:** Exposure to IPV during pregnancy was reported among 44.1% of the studied women. Emotional violence was the most common form. Women exposed to violence were of younger age, higher parity, and lower educational level. Their partners were older, less educated, and more likely to be addicted to drugs and alcohol. Women were also found to have significantly higher incidence of adverse pregnancy outcomes (miscarriage, preterm labor, and premature rupture of membrane), and fetal/neonatal adverse outcomes (fetal distress, fetal death, and low birth weight). A total of 297 cases had been exposed to physical violence (15.9%) *vs.* 32.6% and 10% exposed to emotional and sexual violence, respectively. The most common form of physical violence was kicking. Contusions were the most common type of wound (43.1%). Most of the wounds were induced by a heavy blunt object (64.3%) while rough objects were used with 26.6% of cases to induce abrasions. Contused wounds represent 19.5% of all wounds. Four women had firearm injuries. Conclusion: Violence during pregnancy is prevalent among Egyptian women. Exposure to violence was a significant risk factor for multiple adverse maternal and fetal health outcomes.

Disclosure: All authors have declared no conflicts of interest.

MORPHOMETRICS, CRANIOFACIAL DISEASE GENES, AND THE QUEST FOR THE GENETIC BASIS OF FACIAL MORPHOLOGY

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It has been shown that many aspects of the American criminal justice system result in bias, leading to wrongful convictions. This bias often surrounds the identification of a suspect and may have continued or compounded effects during the remainder of the criminal proceedings. The application of new, objective methods using DNA to identify suspects could eliminate bias stemming from eyewitness testimony and malpractice in suspect identification by providing an alternative method. This could lower the number of misidentified suspects arrested and taken to trial, leading to a subsequent reduction in wrongful convictions. This research introduces a low-cost method for identification of genes that may prove useful for prediction of facial morphology from DNA. This prediction capability would provide a novel way to exploit DNA samples from unknown remains or that are found at crime scenes that do not result in database hits. Candidate genes for facial morphology were identified from those implicated in craniofacial disorders and selected single nucleotide polymorphisms (SNPs) within them were genotyped within a normal population. Facial morphology was captured from landmarks mapped onto 2D photographs. Variation in distance between pairs of landmarks was analysed as a function of genotype for each SNP. Results showed that specific inter-landmark distances varied significantly (alpha =.05) between genotype groups for two of the SNPs investigated, indicating these genes may influence those aspects of facial morphology. The first of these SNPs is located in the POLR1C gene, implicated in a form of Treacher Collins syndrome. This disorder's phenotype includes hypoplasia of bones in the mid and lower face. The second is located within the LMNA gene, implicated in Restrictive Dermopathy, whose phenotype includes abnormalities of the midface. The SNP in the POLR1C gene indicated an effect on several measurements of the mid and lower face. These were a mixture of overlapping and discrete measurements reflecting height, width, and depth of facial features. The other SNP, located on the LMNA gene, indicated an effect on measurements of the midface around the nose. LMNA's effect was only seen for measurements reflecting the height and width of facial features. It was concluded that the POLR1C gene may play a role in development of bones of the mid and lower face and the LMNA gene may have some effect on morphology of the midface, specifically the nasal region. A more complete understanding of facial genotype-phenotype relationships could form the basis for accurate facial predictions.

Disclosure: All authors have declared no conflicts of interest.

NMR ANALYSIS AND QUALITATIVE CONFIRMATION OF ILLICIT DRUGS IN MIXTURES

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Currently, gas chromatography coupled with mass spectrometry (GC-MS) is the most common method for confirming the presence of illicit drugs in forensic laboratories. The purpose of this research is to investigate

the capability of nuclear magnetic resonance (NMR) spectroscopy for rapid confirmation of suspected illicit drugs that have been cut with a variety of compounds. The primary benefit of replacing GC-MS with NMR for qualitative drug confirmation in the forensic laboratory setting is a significant reduction in the time required to obtain a confirmed identification of the illicit substance(s) present in a sample. An average GC-MS analysis including sample preparation can take anywhere from 30 minutes to an hour, with the chromatographic separation being the time-intensive step. By using NMR correlation spectroscopy (COSY), illicit substances can be structurally confirmed even in the presence of cutting agents, thus eliminating the need for lengthy chromatographic separations. An entire COSY NMR experiment, including sample preparation, can be completed in approximately 10 minutes. To assess this potential method, measured amounts of an illicit drug and cutting agent were mixed and then relabeled by a third party to ensure sampling randomization. The illicit drugs investigated in this study include cocaine•HCl, amphetamine hemisulfate, and methamphetamine•HCl – common narcotics with significant in situ representation in the field. Cutting agents included aspirin, caffeine, and acetaminophen as well as household substances like flour and sugar. An initial assay of each mixture was carried out using a typical presumptive color-testing scheme. Once a presumptive identification of the controlled substance was obtained, the mixture was then prepared for qualitative NMR analysis for confirmation of the colorimetric test results, and analyzed using standard proton (^{1}H) and COSY NMR experimental parameters. The spectra obtained from the mixtures were interpreted and compared with the NMR spectra of pure drug standards obtained using the same instrumentation. This technique was used to analyze multiple blind samples and resulted in the correct identification of all illicit drug(s) present, indicating that COSY NMR has the potential to provide similar results to GC-MS but in a fraction of the time.

Disclosure: All authors have declared no conflicts of interest.

ACCELEROMETER AND GYROSCOPE PROTOTYPE PROPOSAL TO IMPROVE FORENSICS WORK IN BRAZIL

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Airbag systems are common among modern automobiles. In the advent of a collision, abrupt changes in acceleration are detected by this system, triggering the inflation of the airbags. During the collision, information such as acceleration and velocity are collected and saved for post-accident forensics. This data can only be extracted and read by specialized equipment that requires access from a Vehicle Identification Number (VIN) database information. Unfortunately, most cars manufactured in Brazil do not have a VIN that matches this database, hindering the utilization of commercial Airbag Data Readers. Thus, forensics currently performed on traffic accidents in Brazil basically relies on *in loco* vestiges left after the event. This work presents a low-cost prototype that allows forensics teams to gain insight into accident information, previously inaccessible. When installed in a vehicle, this device constantly collects accelerometer and gyroscope measurements, recording data in a non-volatile memory (EEPROM). When acceleration or gyro measurements typical of accident situations are detected, it saves data from 10 seconds before and 10 seconds after the beginning of the abnormal reading. The accident information recorded is highly detailed with a total of 10,912 samples of each sensor – accelerometer and gyroscope – available in each Cartesian axis (X, Y, and Z). The crash information stored was manipulated with a program capable of reading this data and plotting several results into graphics. Another program also renders a 3D model that shows the movement of the vehicle registered by the gyros, and the direction and magnitude of the accelerations. Successful tests are described to demonstrate the correspondence of a real movement into a virtual 3D movement. The prototype and respective computer programs proposed facilitate forensics works and improve forensic analysis accuracy by giving better and greater insight into the dynamics of the accident. Since automotive industry in Brazil usually do not cooperate releasing information about crash data "hidden" inside airbag modules, this work presents a discussion, as a future goal, about the importance of making laws that enforce the need of a black-box device in vehicles, like the presented one, capable of providing data in a public way.

Disclosure: All authors have declared no conflicts of interest.

A RAPID CHEMICAL ODOUR PROFILING METHOD FOR THE IDENTIFICATION OF ILLEGAL WILDLIFE PRODUCTS

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Illegal poaching causes great harm to species diversity and conservation. In many cases the seized animal part is unidentifiable and requires laboratory analysis such as isotopic fingerprinting or DNA testing. The lack of a rapid and accurate portable device able to identify wildlife parts in-field represents a major hindrance in the enforcement and prosecution of wildlife trafficking. The ability of dogs to alert to different wildlife species demonstrates that there is a detectable difference in scent profile of illegally traded animals and their parts. This difference was exploited in order to develop a rapid screening method for distinguishing seized wildlife parts from different species that might not be readily identified via morphology. The method was developed using volatile organic compound (VOC) analysis conducted via solid-phase microextraction (SPME) and comprehensive two-dimensional gas chromatography – time-of-flight mass spectrometry (GC×GC-TOFMS). Wildlife samples were analysed using SPME-GC×GC-TOFMS and multivariate statistics were applied to identify groupings in the data set. It was found that a range of wildlife species could be separated based on their odour profile. The method was able to distinguish, for example, black rhinoceros horn samples from white rhinoceros horn samples. Additionally, seized suspected ivory samples were also compared to known ivory samples for a real-case scenario. The ability to separate a variety of species, both reference and seized objects demonstrated the future capability of the method. The chemical odour profiling method has great potential as a rapid screening method in order to combat and track illegal poaching and trafficking of wildlife parts. The current method forms the basis for the long-term goal of developing a portable odour profiling device that can be used by frontline personnel to rapidly identify the species of wildlife contraband at the point of detection.

Disclosure: All authors have declared no conflicts of interest.

INVESTIGATING THE INFLUENCE OF FIRE MODIFICATION ON THE ODOUR OF DECOMPOSITION

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Scent-detection canines are employed by law enforcement agencies all over the world. These dogs may be used for general patrol, search and rescue or they may be trained to detect a specific class of contraband (e.g. illicit drugs, explosives, firearms or accelerants). Cadaver-detection dogs, a specialized type of scent-detection canine, are commonly employed by law enforcement to locate human remains in cases of missing persons, suspected homicides, and following natural or man-made disasters. The ability of cadaver-detection dogs to locate human remains relies heavily on their recognition of decomposition odour; however, very little is known about the odour of burnt human remains and the ability of cadaver-detection dogs to locate such remains. Severely burnt human remains may arise as the result of natural disasters such as bushfires (i.e. in the absence of an ignitable liquid) or as a result of arson-related crimes (i.e. often in the presence of an ignitable liquid – to cause loss of life, dispose

of a body, destroy forensic evidence, or conceal identification). While many of the odour compounds produced by burnt human remains will change based on the uncontrolled variables of combustion, it is hypothesized that several key compounds will be consistently present after burning and may be the compounds used by cadaver-detection dogs to locate burnt remains. In this study, the chemical odour profiles produced from both unburnt and burnt remains (burnt in both the absence and presence of gasoline) were investigated. After burning the remains were left to decompose naturally on the soil surface. Due to the legal and ethical restrictions related to burning human remains, domestic pig carcasses were used as human odour analogues. Samples were collected periodically from the headspace above the decomposing pig remains using sorbent tubes, and were analyzed using thermal desorption – comprehensive two-dimensional gas chromatography – time-of-flight mass spectrometry (TD-GC×GC-TOFMS). Distinct differences in the odour profiles of the unburnt and burnt pig carcasses were initially observed; however, as decomposition progressed the odour profiles were found to converge. As hypothesized, several key combustion products were also discovered to be consistently present after burning. Overall, this research aims to provide recommendations to law enforcement agencies for the development of appropriate training aids for cadaver-detection dogs that may be tasked with the search and recovery of burnt victim remains, a task which is essential for providing closure to a victim's family.

Disclosure: All authors have declared no conflicts of interest.

LEGAL BAN APPLICATION OF FEMALE GENITAL MUTILATION:FEMALES ATTEND FAMILY MEDICINE CENTERS EGYPT

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Background: Female genital mutilation has drowned increasing international attention in the recent decades, including new laws against its practice in countries within and outside Africa **Aim:** Curbing the processes of female genital mutilation (FGM) phenomenon. **Subjects and Methods**: Cross-sectional descriptive study was conducted upon 175 married females attending different family medicine centers in Ismailia governorate, Egypt, seeking for different medical services; participants should have at least one daughter. A pre-designed questionnaire was presented to each participant. The questionnaire was anonymous, and confidentiality was preserved. Participants were interviewed and asked about their basic socio-demographic information including; age, residence, level of education and marital status, data concerning their knowledge about the anatomical parts removed in FGM, consequences of FGM and their knowledge about the banning law of FGM, their attitude toward FGM, and data about their practice of FGM, reasons of its practice and non-practice. The Institutional Research Ethics Committee approved the study and written informed consent was obtained from all participants **Results:** Participants were almost equally distributed between urban and rural areas. The majority were married (88.6%), most of them (39.4%) are in the age group >30-40, nearly half of them (44.6%) don't know what is removed in FGM, 70.3% of the participants know that FGM is prohibited by the Egyptian law, the majority of the participants (69.7%) approve the practice of FGM; for religious reason (67.2%) and culture/social reason (54%), 41% of participants don't have/not intend to have their daughters cut. Physicians are the main operator of FGM (91%), procedure of FGM took place mainly in private clinics and girls' mothers are the main decision maker (83%). Regarding complications of FGM; physical complications represents 58.7% and psychological complications represents 14.3% of complications. **Conclusions:** The problem of FGM is deeply grounded in the culture; its cause is a mix of religious, cultural and social factors within families and societies.

Disclosure: All authors have declared no conflicts of interest.

ACCELEROMETER AND GYROSCOPE PROTOTYPE PROPOSAL TO IMPROVE FORENSICS WORK IN BRAZIL

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Airbag systems are common among modern automobiles. In the advent of a collision, abrupt changes in acceleration are detected by this system, triggering the inflation of the airbags. During the collision, information such as acceleration and velocity are collected and saved for post-accident forensics. This data can only be extracted and read by specialized equipment that requires access from a Vehicle Identification Number (VIN) database information. Unfortunately, most cars manufactured in Brazil do not have a VIN that matches this database, hindering the utilization of commercial Airbag Data Readers. Thus, forensics currently performed on traffic accidents in Brazil basically relies on *in loco* vestiges left after the event. This work presents a low-cost prototype that allows forensics teams to gain insight into accident information, previously inaccessible. When installed in a vehicle, this device constantly collects accelerometer and gyroscope measurements, recording data in a non-volatile memory (EEPROM). When acceleration or gyro measurements typical of accident situations are detected, it saves data from 10 seconds before and 10 seconds after the beginning of the abnormal reading. The accident information recorded is highly detailed with a total of 10,912 samples of each sensor – accelerometer and gyroscope – available in each Cartesian axis (X, Y, and Z). The crash information stored was manipulated with a program capable of reading this data and plotting several results into graphics. Another program also renders a 3D model that shows the movement of the vehicle registered by the gyros, and the direction and magnitude of the accelerations. Successful tests are described to demonstrate the correspondence of a real movement into a virtual 3D movement. The prototype and respective computer programs proposed facilitate forensics works and improve forensic analysis accuracy by giving better and greater insight into the dynamics of the accident. Since automotive industry in Brazil usually do not cooperate releasing information about crash data "hidden" inside airbag modules, this work presents a discussion, as a future goal, about the importance of making laws that enforce the need of a black-box device in vehicles, like the presented one, capable of providing data in a public way.

Disclosure: All authors have declared no conflicts of interest.

DEVELOPING A METHOD FOR THE COLLECTION AND ANALYSIS OF BURNT REMAINS

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In suspected arson cases a body may be intentionally burnt in order to cause loss of life, dispose of a body, destroy forensic evidence, or conceal identification. Upon the discovery of burnt human remains, fire investigators and forensic practitioners are tasked with the challenge of establishing the cause of the fire as accidental, natural, incendiary (i.e. arson) or undetermined. In most arson-related cases, ignitable liquids are used to accelerate and promote the spread of fire. Therefore, if arson is suspected, the investigation typically involves the forensic analysis of the burnt remains for the detection and identification of an ignitable liquid to provide evidence to support the incendiary claim. After discovery, human remains are typically placed into a body bag for transportation from the crime scene to the morgue for further analysis. In this study, a method was developed for the collection and analysis of burnt remains using body bags, sorbent tubes, and thermal desorption – comprehensive two-dimensional gas chromatography – time-of-flight mass spectrometry (TD-GC×GC-TOFMS). At present, gas chromatography – quadrupole mass spectrometry (GC-qMS) is considered the gold standard for fire debris analysis in forensic laboratories worldwide. However, due to the

highly complex and unpredictable nature of fire debris, traditional one-dimensional GC-qMS often produces chromatograms that display an unresolved complex mixture, containing only trace levels of the ignitable liquid among numerous background pyrolysis products. This unresolved complex mixture can interfere with pattern recognition necessary to verify the presence and identification of an ignitable liquid. To combat this challenge, GC×GC-TOFMS was applied in order to provide improved resolution, separation of matrix interferences, enhanced sensitivity, improved characterization of dynamic range, and ordered chromatograms that produce distinct patterns of structurally-related compounds assisting in sample classification. Preliminary results demonstrate that the odour of pigs burnt with gasoline can easily be differentiated from both body bag controls and pigs burnt without gasoline using volatile profiling and a variety of multivariate statistical treatments. Overall, this method demonstrates the use of a body bag as an integral addition to the fire debris analysts' packaging arsenal, which is generally limited to metal cans, glass jars and nylon bags that are often too small for an intact human cadaver. This method also allows samples to be collected before the remains are removed from the scene, limiting the chance of contamination and the loss of volatiles due to microbial degradation or further weathering.

Disclosure: All authors have declared no conflicts of interest.

EXPECTATIONS UNFULFILLED

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Expectations unfulfilled By: Fawzi A. Benomran Introduction: Tedious as it might be, obligatory death scenes visits by the Forensic Medical Examiner in Dubai is both essential and rewarding. Round the clock work is required to realize that goal, which is implemented according to a duty roster. In many obscure death scenes attended, the decision of the forensic medical examiner regarding the manner of death disagreed with initial impression by police. Solving an obscure death scene is attributed to exploiting all available variance of knowledge, such as circumstantial evidence, background information, inspection of the body and its surroundings and external examination of the body (s) in situ. Material and Method: Death scenes, of different causes and manners have been presented. In each case, the audience will be walked through evidence that leads eventually to a certain decision about the manner of death. It emphasizes that a preliminary impression might be a far cry from actual facts. Examples of different manners of deaths are displayed to show that each manner can occur from a variance of causes. Results: Careful scene examination and analysis of background information, along with autopsy findings unraveled facts in all cases, although, in view of the unusual presentations, the preliminary impression by the police was inconsistent with the final results. Cases of strangulation by heavy machinery, suspicious fall from a height, suspicious death from sharp instruments, a case of ligature strangulation staged to simulate suicidal hanging, a death from ischemic heart disease occurred in scenario suggesting homicide and several interesting cases are included. Conclusions: A certain manner of death can happen from different causes, and a certain cause of death can come about in more than one manner. Crime scene and death scene visits by the forensic pathologists proved to be of value in establishing the manner of death. Key words: Crime scene investigation; manner of death; forensic medical examiner and the crime scene

Disclosure: All authors have declared no conflicts of interest.

DETECTION AND DOCUMENTATION OF FRACTURES IN THE DECEASED CHILD

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The finding of fractures in deceased children, particularly the very young, can have profound medicolegal implications if the fractures are indicative of inflicted injury. The radiological, clinical, histological, and anthropological aspects of the fracture may provide useful information as to the mechanism and/or relative age of the injury. Correlation with published studies, and the experience of the pediatric and radiological communities, may prove essential in assessing whether a fracture might be accidental, or whether the child may have a medical condition mimicking or predisposing to fractures. By bringing a variety of medical and forensic specialists together to examine all aspects of fractures—including accidental fractures, conditions that might mimic fractures, and conditions that can predispose to fractures—the forensic pathologist develops a deeper understanding of how fractures occur and how they heal. Examination of the skeletal system of the deceased child, particularly in cases where physical abuse may have occurred, is a critical part of the post-mortem examination—yet the traditional autopsy is limited in its ability to detect some of the most common abusive bony injuries. Integration of proper radiographic imaging, followed by resection and appropriate handling of bony abnormalities, is key in assessing osseous trauma in the infant and small child. Since some injuries, particularly metaphyseal injuries, would not be discernible with a traditional autopsy approach, radiographic imaging of the deceased child is essential. The presence of healing fractures in the setting of fatal visceral trauma may distinguish a single acute event from a pattern of inflicted injury. Though many pathologists may have little experience handling or interpreting bony injuries, most bony findings can be readily removed at autopsy, and subsequently decalcified and subjected to histological evaluation with very little investment in special techniques or tools. Correlation of the radiographic, gross, and microscopic findings is invaluable to the radiologist, pediatrician, anthropologist, and pathologist alike. Through the use of specific case studies fully illustrated with radiographs, gross images, and corresponding histology, this presentation will ensure attendees understand the need for thorough post-mortem radiography in the evaluation of death in infants and small children, recognize the most common abusive fractures in this age group, correlate the gross and microscopic findings of fractures with the radiographic findings, and recognize the role of gross and microscopic evaluation of fractures in assessing cause and manner of death in the pediatric population.

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SCREENING, IDENTIFICATION AND FUNCTIONAL ANALYSIS OF RNA MARKERS FOR EARLY PMI ESTIMATION

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Accurate estimation of post-mortem interval (PMI) is the important and difficult area in forensic research. Currently, more and more published papers mentioned that the methods of using quantitative PCR detection of the housekeeping gene mRNA levels to estimate PMI. However, most of the available markers have not been systematically selected and can only work effectively on later PMI, so practical applications of many studies are limited to a great extent. To provide sensitive RNA markers for early PMI (EPMI, within 24 hours) estimation, we first examined all the mRNAs in human brain specimens with different EPMI through high throughput sequencing and observed 75 differentially expressed mRNAs. With the help of qPCR, we further validated these differently expressed mRNA in large scale human specimens and rat models. We found that Ddx18, Cdc25b, Gpx3, Pten and Pawr were significantly up-regulated with prolonged PMI, while Mmgt1, Dock9, Tubb2a and Rere were down-regulated within 24h. Our data indicate these sensitive mRNAs play important roles in EPMI, including hypoxia, apoptosis, energy metabolism and cell components degradation, and can serve as biomarkers for precise EPMI determination.

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CARDIO-VASCULAR COLLAPSE OF A GIRL DUE TO IDIOPATHIC GASTRIC RUPTURE.

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Spontaneous gastric perforation of a normal stomach is an extremely rare event especially in the preschool age group and mainly reported in the Chinese and Japanese literature. In our opinion this is the first report in the field of forensic medicine. A little girl with congenital periorbital heamangioma have got a normal growth and development since 22 months, when she developed one episode of high grade fever in a night, so treated with impression of a viral infection and O.T.C medicine prescribed for her. After few hours with coffee ground vomiting, abdominal distension, lethargy and cold extremity transferred to a pediatrics hospital. Investigations such as CBC, blood gas and abdominal x-ray achieved, and baby transferred to a referral pediatric surgical center with a very poor condition. She was arrested on arrival and CPCR was ineffective. As the diagnosis was disputed and she was died less than 24 hours after initiations of symptoms, after handling of formal processing, the body transferred to Shiraz forensic medicine department. In medico-legal autopsy sever peritonitis, pneumoperitoneum, trapped air bubble in subserosal tissue with a big hole (round perforation) in fundus of stomach was seen. More investigations during autopsy performance, to detection of underlying causes of gastric perforation such as blunt trauma, swallowing of foreign body especially coin batteries(watch battery or button cell), was done which was negative but samples for histopathologic and microbiological studies and toxicological analysis was taken. In this unique case report we are going to clear more details of the case, accompaniment with documented photography, after providing of meticulous review of literatures.

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CLOSED CIRCUIT TELEVISION (CCTV) BASED GAIT ANALYSIS FOR HUMAN IDENTIFICATION

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Gait analysis is the measurement and assessment of human locomotion including both walking and running. Human gait contains biometric signatures that can be used for human identification. Recognition of people through gait analysis is an important research topic, with potential applications in video surveillance, tracking, and monitoring. This recognition process has a unique advantage over other biometrics: it has potential for use at a distance when other biometrics might be at too low a resolution, or might be obscured as other features are unstable as clothing, shoe, surface, illumination, and pose can easily be changed that will usually decrease performance of identification. Also, at times series of footprints are left at the scene of a crime forming a recognizable gait cycle. Individual characteristics of the footprints and gait, like numerous creases, flatfoot character, horizontal and vertical ridges, corns, deformities, step length, stride length, and stance phase, swing phase, step time, stride time, cadence, and velocity observed on closed circuit television (CCTV) can help the forensic examiner in cases pertaining to criminal identification. It would be useful to perform comparisons between disguised perpetrators and suspects, by applying anatomical and biomechanical knowledge, the gait of perpetrators, as recorded on surveillance video will be analyzed. By studying the single body segments during gait, we were able to give a statement concerning the gait patterns. However, it is difficult to draw conclusions from a study of a single subject. It is important to set up the gait database. Further observation of larger subject sampling would be useful to provide enhanced knowledge advancing the understanding of forensic gait observed in crime scene gait patterns and on CCTV. The main objective of this research is to evaluate the fusion of static and dynamic biometrics for gait recognition supported by detailed survey. With the results obtained through analyses and evaluations, the research will aim to evaluate the systematic risk and error of gait recognition; redesign, construct and test a view-based approach to recognize humans from their gait. Meanwhile, improvement opportunities for enhanced recognition performance will also be explored.

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ELECTROCUTIONS AND ELECTRICAL HOMICIDE

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CASE 1: Electrical Homicide or Lightning? An 11/y/o male was found deceased, face down next to an energized 480 volt aluminum/glass bus shelter and streetlight pole and he was believed to have been electrocuted. The State laid a complaint/charge of Negligent homicide: Based on defective Bus shelter wiring. The defense: 1) Research conducted by the author determined that there were 52 lightning strikesin the preceding 24 hrs. 2) The running shoe fabric and the foot had a perforation consistent with electrical breakdown due to lightning. 3) The deceased's electronic wrist watch was found inoperative. The scene photo of the deceased's left shoulder at the scapula area exhibited a patch of redness, which did not present on autopsy. The defense's (my) conclusion was that: The deceased was killed by lightning,. The jury dismissed the negligent homicide complaint against all 3 defendants. **CASE 2:** Did Eric Rudolph (the Atlanta Olympic Bomber) electrocute a Federal Agent? A federal agent was found deceased in a sitting position with his head against an electric stove in his cabin. He was part of a large contingent of agents looking for Eric Rudolph, the Atlanta Olympics bomber. It was suspected that the stove had been tampered with by Rudolph. Testing by the writer concluded that the necessary conditions for an electrocution did not exist. The cause of death was attributed to a combination of medical issues and the ingestion of significant quantities of "Ma Wong "an ephedra containing herbal remedy. Eric Rudolph was captured on May 31, 2003

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POLICE OVERSIGHT: SOCIOLOGICAL IMPACTS OF THE CORONERS INQUESTS

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Police use of force review in unexpected deaths of citizens in the criminal legal system ideally functions to see if the criminal and other rules for police use of force were applied. This conference paper is looking at the complementary no blame, no liability socio-medical & medico-legal Coroner's Inquest towards finding underlying antecedent sociological determinates in the causal chain. What is the meaning of the Coronial death classification (homicide, suicide, natural, accidental, or undetermined) towards police oversight, along with the other findings about cause and antecedent factors? My data, n = 190 of Canadian Inquests of police operations deaths, as well as reviewing AU/UK inquests, had outlier findings that had me, as a serving police officer asking: what do those findings mean? The means of death of John Caleb Ross, shot by Ontario police in April 2014 was a 'suicide'. The October 2007 BC airport death of Robert Dziekanski lists the cause of death as cardiac arrhythmia, but finds the means is 'homicide' in a case where a police firearm was not used. What can we in policing learn from using a complimentary sociological analysis in the causal chain? My social autopsy goal using (1) Inquest data and (2) symbolic interaction/ grounded theory methods is to build on the therapeutic jurisprudence arguing the role of Inquest to police best practices. Sgt Vincent Eagan, York Regional Police Ontario Canada & graduate student Royal Roads University

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A TIME COURSE STUDY DEMONSTRATING MULTI-RNA CHANGES TO ESTIMATE POSTMORTEM INTERVAL

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Precisely determining the post-mortem interval (PMI) is a critical step in criminal cases. Using the specific degradation pattern of RNA to estimate PMI is becoming a hotspot recently, however, the post-mortem changes of RNA are much more complicated in real cases. For this purpose, highly conserved RNA markers are detected in both rat and human tissues to efficiently transfer animal data to real cases. In detail, RNA was extracted from human and SD rats' brain tissues with different PMI and the transcript levels of 10 RNA markers, including mRNAs, microRNAs, 5S rRNA and U6 snRNA, are detected by qPCR to screen valid biomarkers for PMI estimation. Using the geNorm, we find that brain-specific microRNAs and 5S rRNA to be optimum reference markers because these are less affected by prolonged PMI. Among other tested RNA markers, β-actin and gapdh mRNA are significantly correlated with PMI. After preliminary verification in human tissues, mathematical models are established to describe the characteristic relationship between β-actin and observed PMI, and the relatively low estimated error of large scale validation shows the accuracy and reliability of this mathematical model. In conclusion, our results show that PMIs can be accurately predicted in human cases when using effective biomarkers and this multi-RNA marker based mathematical model may serve as a practical tool for precise PMI estimation.

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DETERMINATION OF SCOPOLAMINE AND ATROPINE IN WHOLE BLOOD BY LC-MS

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A novel and rapid method for the determination of scopolamine and atropine in human blood by ultra performance liquid chromatography-mass spectrometry (UPLC-MS / MS) was established. Human blood samples were precipitated with acetonitrile, vibrated, and centrifugated respectively. The supernatant was filtered with a 0.22 μm organic membrane, and then detected. Gradient elution was performed on an Agilent Eclipse Plus C18 column. The mobile phases consisted of 0.1% formic acid aqueous solution and acetonitrile. The flow rate was 0.4 mL/min and the column oven was maintained at 40°C. The method aiming at the detection of scopolamine and atropine is linear from 1 to 100 ng / mL, and the linear coefficients were 0.9997 and 0.9968. Precision and accuracy were acceptable at any quality control level and the average recoveries were 93.99% and 97.71%, respectively. The method is very sensitive, and limits of detection (LOD S / N = 3) of scopolamine and atropine were all 0.2 ng/mL. The lowest limit of quantification (LOQ S / N = 10) was 1 ng/mL. The method is very fast, easy to perform, and cheap as it only requires deproteinization of blood sample with acetonitrile, which could be used for identification and quantification of scopolamine and atropine in human whole blood.

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DIRECTIONS OF FORENSIC SCIENCE RESEARCHES IN THE REPUBLIC OF BELARUS

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In 2013 the Republic of Belarus created a unified system of state forensic examination divisions that is the State Forensic Examination Committee (SFEC). SFEC has a scientific organization named the State Institution "Scientific and Practical Center of the SFEC" (SPC). SPS is intended to provide scientific, methodological and information support of forensic activities by way of carrying out fundamental and applied research. In 2017 SPC has been implementing 12 research projects. Some of them are justified by specifics of belarussian legislation, for example development of the guidelines to examine price sources and price formation in construction activity when performing forensic economic examinations. Part of the researches is aimed at ensuring the quality of forensic science activity. Thus we develop technical and other requirements for the organization of forensic units; guidelines for the evaluation of measurement uncertainty, and guidelines for interlaboratory comparisons in forensic activity. The majority of the research concerns the development of actual directions in forensic sciences. These studies have different focuses. The research of signature images in copies of documents aimed at development of common approaches to the handwriting image copies examinations depending on the scanning and printing technology and conditions. The world problem is the unauthorized removal of animals from their natural environment. The study of moose, roe deer, deer STR-polymorphism is intended to the development of reliable methods of biological trace forensic identification of deer family representatives in cases of poaching. Our country pays much attention to the prevention and combating extremism. The verbal extremism is a special type of extremistic activity. In Belarus comprehensive research of verbal works to address specific forensic tasks has not been made. In this regard we perform scientific research of verbal extremism in the information space of Belarus intended to create the methodology of the complex forensic psychological and linguistic examination. Finally, Laboratory of Forensic Psychiatric Researches develops the methodology of the re-commit socially dangerous acts risk assessment by people suffering from mental disorders in accordance with medical history data. The implementation of this research will improve the approach to the appointment of coercive care of security and treatment. Thus, forensic science researches in Belarus have expressed diverse practical orientation and can improve overall scientific and methodological level of forensic laboratories of the SFEC. Scientific and Practical Center of the SFEC is open for international cooperation with various organizations to develop new directions in forensic sciences.

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METABOLITE PROFILES AND SPECIFIC MARKERS IN URINE SAMPLES FROM ILLICIT HEROIN USERS

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Background: 6-acetylmorphine (6-AM) and 6-acetylcodeine (6-AC) are specific metabolites of illicit heroin that rapidly transform into morphine and codeine (with its glucuronide compound) in few minutes to hours. Besides morphine and codeine, other alkaloids, such as papaverine, noscapine, thebaine, and tetrahydrobenzylisoquinoline are also present in opium poppy. These alkaloids might undergo acetylation reaction when morphine is converted to illicit heroin. Other metabolites formed by the acetylation of these alkaloids could serve as new markers in the body fluid to confirm illicit heroin intoxication. **Methods:** Solid phase extraction (SPE) and liquid chromatography-quadrupole time-of-flight instrument (LC-QTOF/MS) were used to simultaneously quantify morphine, codeine, heroin, 6-AM, 6-AC, morphine-3-glucuronide (M3G), morphine-6-glucuronide (M6G), and codeine-6-glucuronide (C6G). The auto MS/MS mode of the instrument was used to search and confirm the specific markers in the urine samples. **Results:** In method validation, the linear dynamic range (weighting factor of 1/X) was as follows: morphine, M3G, and M6G (10–1500 ng/mL); codeine, 6-AM, and C6G (5–1500 ng/mL); heroin (5–1000 ng/mL); and 6-AC (5-500 ng/mL). Recovery of SPE at 70, 300, and 1000 ng/mL were in the range of 87.7–101.5% for all compounds. Twenty urine samples from heroin users were analyzed using an accurate method. The quantitative analysis results of total morphine were 0–2% for 6-AM, 2–13% for morphine, 73–91% for M3G, and 2–17%

for M6G and of total codeine was 0–3% for 6-AC, 2–15% for codeine, and 84–98% for C6G. Of these, 17 samples were positive for 6-AM (85%) and 13 for 6-AC (65%). Both in positive and negative modes of ion polarity, markers from the metabolism of 10 acetylation compounds of thebaine with 139 probability metabolites were found. The detection rates were in the range of 0–100%. Although we have already found that 1 marker ($C_{23}H_{22}O_{10}$, m/z 458.12130) in positive and negative modes and 2 markers ($C_{17}H_{14}O_7S$, m/z 362.04602 and $C_{18}H_{16}O_7S$, m/z 376.06167) in negative mode were positive for all samples (100%), more samples and researches are still needed to confirm these results. **Conclusion** The markers we found in this study might pave the way for a new approach to confirm the abuse of illicit heroin. Our findings could provide a robust method to quantify all the metabolites simultaneously and verify the markers specific for the intake of illicit heroin, poppy-seed-containing foods, or drugs containing morphine (including brown mixture, the famous cough drug in Taiwan) to solve the problems in distinguishing the drug/product used.

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SINGLE METAL DEPOSITION VS. PHYSICAL DEVELOPER, A COMPARISON OF TWO FINGERMARK DETECTION TECHNIQUES

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Single-metal deposition (SMD) and physical developer (PD) are two advanced fingermark detection techniques that can be applied on porous substrates. The first one involves gold nanoparticles, whereas the second one relies on silver particles to detect the marks. PD has been used for decades around the world. It is a very sensitive technique that works well on aged marks, even if the item has been wet. On the other hand, SMD has for a long time been considered as too tedious and time consuming for a routine use. However, a new optimised version of the SMD (SMD II) [1] has recently been published, with a less lab-intensive and more effective procedure. This study presents an extensive comparison of the two techniques on multiple porous substrates. The assessment is made according to the second research phase of the IFRG guidelines (optimisation & comparison) [2]. The efficiency of both techniques is assessed when placed in sequence after routine amino acids detection techniques. Considerations such as the cost, reagent stability and ease of application are also considered for the final evaluation of the techniques. [1] Moret, S., & Bécue, A. (2015). Single-Metal Deposition for Fingermark Detection – A Simpler and More Efficient Protocol. *Journal of Forensic Identification*, 65(2), 118-137. [2] International Fingerprint Research Group (IFRG) (2014). Guidelines for the Assessment of Fingermark Detection Techniques. *Journal of Forensic Identification*, 64(2), 174-200.

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LC AND LC-MS/MS METHODS FOR SYNTHETIC CANNABINOIDS IN NOVEL "SPICE" DRUGS

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Synthetic cannabinoids are compounds in herbal products marketed as "Spice" and acting as agonists of cannabinoid receptors CB1 and/or CB2. In many cases, they are significantly more potent than tetrahydrocannabinol (THC, the principal psychoactive constituent of cannabis plant). Most of them were developed by scientists for high therapeutic activity, but in recent years, underground laboratories developed these compounds for illicit use as marijuana substitutes. Along with non-controlled status, these compounds were rapidly and widely publicized by drug-using communities, resulting in explosive growth in use of these drugs. Our study aimed at simultaneous detection and determination of 10 common synthetic cannabinoids. In China, our report is the first one using HPLC-MS/MS to analyze synthetic cannabinoids, and also the first one reporting simultaneous determination of more than 3 synthetic cannabinoids in novel "Spice" drugs by HPLC. Samples were dissolved by methanol, ultrasound-assisted extracted and filtered through 0.22μm membrane filter, and showed good stability under room temperature, freeze and three cycles of freeze-thaw conditions. In the method using HPLC, a Shim-pack XR-ODS C_{18} (4.6×250mm, 5μm) column was used at 45°C. The mobile phase system contained methanol-acetonitrile (50:50) and water, and the percentage of organic phase changed between 66% and 89.1% in a linear gradient elution. The detection wavelength was 220nm. All compounds (including 10 synthetic cannabinoids and THC, CBN, CBD) were completely separated and determined in 33 min. Good linear relationships were obtained when concentration was in the range of 1~100 μg/mL (LODs: 0.1~0.5 μg/mL). The intra-day relative standard deviations (RSDs) were ranging from 0.15% to 1.4% and the inter-day RSDs were 0.55%~2.0%. In the method using HPLC-MS/MS, mass spectra character and proposed fragmentation of 10 synthetic cannabinoids were studied. The extraction was separated on an Agilent Poroshell 120 EC-C_{18} (3.0mm×50mm, 2.7μm) column at 30°C, using methanol - water as mobile phase. ESI(+) and ESI(-) mode were used at different time segments. Under the optimized conditions, good linear relationships were obtained in the range of 1~100 ng/mL for 7 cannabimimetics under ESI(+) mode (LODs: 0.01~0.025 ng/mL), and 10~1000 ng/mL for 3 synthetic cannabinoids under ESI(-) mode (LODs: 0.1~0.2 ng/mL)s. The intra-day RSDs were less than 3.2% and the inter-day RSDs were less than 6.3%. This study provides a reliable reference for qualitative and quantitative analysis of synthetic cannabinoids in novel drug samples. Both methods have been applied to real cases and proved to be accurate, precise, sensitive and fast.

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FILICIDE: CLINICAL AND QUALITATIVE UNDERSTANDING OF PARENTS WHO KILL THEIR CHILDREN

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Filicide refers to a theoretical construct which defines the death of one or more children, by one or both parents. The present study (exploratory study) focused on the investigation, analysis and psychodynamic characterization of parents who committed filicide and on the understanding of the motivations leading to the occurrence, to therefore promote the discussion about the potential risk factors which can be considered in these situations. Regarding the empirical study, a methodological design was developed based on mixed methods research design (quantitative/qualitative) as it uses multiple data collection and processing techniques. The sample was based on a total of ten participants (parents) who were imprisoned, in Portugal, for having committed filicide. As a methodological design, there was an attempt to characterize the participants' psychic functioning, more specifically: the characterization of personality dynamics; characterization of cognitive and neuropsychological functioning; characterization of the quality of attachment. Methodologically, there was a resort to administration and application: a semi structured interview, socio-demographical questionnaire and documentary analysis; the Rorschach test; Symptom Checklist 90-R [Portuguese version] (SCL-90-R); Clinical Inventory of Self-Concept (ICAC) and Levenson's Self Report Psychopathy Scale [Portuguese version] (LSRP-VP); WAIS-III (sub-tests Vocabulary/Cubes); Standard Progressive Matrices; Montreal Cognitive Assessment (MoCA); Adult Attachment Scale [Portuguese version] (EVA). A synthesis analysis leads to the conclusion of the filicide act in a double dimension: as a result of a premeditated act or accidental. Regardless this double dimension, the filicide act seems to integrate an array of *disobjectualization* and destructiveness in a context of child-parent relationships. Contrary to

other homicides, in the case of filicide, mostly, no psychopathic tendency indicators stand out, and therefore is a crime which, specific to the intrafamily context, seems to be consequent of violent and/or dysfunctional relational patterns. Adding to this, is a conjugality of violent, negligent and/or abusive parenting with psychodynamic functioning, guided by cognitive constraints and by psycho-affective impoverishment which depletes the ability to invest in the parenting process, with relational mutuality. The filicidal act can be equated as a destructive and evacuative act against the feeling of threat and annihilation of aggravating intolerable psychic suffering, which is materialized into a child who will undergo acts of violence, promoting an *objectal* discontinuity leading to the discontinuity of the *Self*. The filicidal act will be a type of suicidal violence, which does not contemplate the elaboration of guilt, but a persecutory guilt (promoting continuous processes of violence, acted or contained, entropically exposing psychic suffering).

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THE PARADIGM SHIFT IN ELEMENTAL ANALYSIS OF MODERN PAINTINGS FOR FORENSIC PURPOSES

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Information about chemical composition of materials used in artwork is crucial for proper evaluation of the authenticity. Identification of pigments, which are the most distinctive part of paintings, is presently based on qualitative analysis by physicochemical methods. Chemical analysis of pigments allows only for group identification. Therefore, information about rarity and variability of pigments used by specified artist and applied in a given historical period determines the evidential value of results from chemical analysis. Research was focused on chemical variability of paints presently used by artists. Most popular acrylic paints, differed by colour and type, were chosen for investigations. Content of main elements was revealed by X-Ray Fluorescence (XRF). Moreover Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry was used for the determination of minor and trace elements content. Additionally Raman Spectrometry was used to confirm composition of paints. Results show that modern acrylic paints differ strongly in elemental composition, which allows for effective discrimination. In many cases composition of modern paints does not confirm with traditional recipes. Manganese oxide, which was typical component of yellow and brown paints, was not detected in many modern umber and sienna paints. Zinc oxide was detected in titanium white paints, which indicates that purity and uniformity of composition of paints strongly depend on the manufacturer. Moreover, modern Naples yellow paints do not contain lead antimonite, i.e. the main component of traditional Naples yellow pigment. The composition of paints has been gradually changed through the ages. Presently such changes are connected with amendments in law for health and environmental protection. Lack of lead, mercury and arsenic in paints is consequence of the toxicity. It seems that similar situation will be with cadmium based paints, which are popular from 19th century. Cessation of production of lead, arsenic, mercury and cadmium-based paints significantly reduce number of pigments and elements relevant for identification. Exclusion of the elements with high atomic numbers will greatly reduce the effectiveness of XRF analysis. Therefore, qualitative analysis will not be sufficient and should be supplemented by quantitative analysis, especially of trace elements, which indicate source or origin of paint. Forensic analysis of paintings should be focused on impurities and inclusions in pigments. Valuable information will be provided also by chromatography, because mineral pigments are commonly being replaced by organic compounds. Acknowledgements: Research was supported by National Science Centre of Poland from funds granted within post-doctoral internship based on decision no. DEC-2013/08/S/ST4/00560.

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THE MAKING OF THE DNA HIT OF THE YEAR AWARD

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Gordon Thomas Honeywell Governmental Affairs (GTH-GA) has created an annual program to announce the "DNA Database Hit of the Year" award. GTH-GA has formed an exclusive partnership with Thermo Fisher Scientific to announce the annual award each year during Thermo Fisher Scientifics' annual Human Identify Solutions (HIDS) Conference. The award celebrates the extraordinary value of criminal offender DNA databases by identifying the most impressive DNA database hit cases throughout the globe. The inaugural "DNA Database Hit of the Year" award was announced during the 2017 HIDS conference in Vienna, Austria in May of this year. During the IAFS presentation, Tim Schellberg, President of GTH-GA, will cover three subjects related to the 2017 "DNA Database Hit of the Year" award. First, Tim will explain the reasons for establishing an international award to celebrate the "DNA Database Hit of the Year". Particularly he will discuss why it is necessary for the 54 countries that have operational National DNA databases to show, through real cases, the value of these databases to the remaining countries that have yet to implement DNA database programs. Second, Tim will explain the process that caused over fifty government agencies throughout the world to submit cases towards the competition, and how the finalists and winner were selected. Finally, Tim will present case overviews from the top five cases, including the winner. During this discussion, he will describe the details of the cases, and their scientific and investigative significance.

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SCIENTIFIC AND HUMANITARIAN ROLE OF FORENSIC MEDICINE IN COLOMBIAN ARMED CONFLICT

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In Colombia, forensic activity is concentrated in the National Institute of Forensic Medicine and Forensic Sciences, a governmental organization which has direct representation in the main cities and in the largest towns of the country through one hundred and forty offices. There are three large forensic areas in which the Institute provides expert services: pathology, clinical and psychiatry and auxiliary laboratories. It is an institution with 102 years of history in Colombia with a constant development that has allowed a categorical change in the forensic approach of different daily events under judicial investigation. The socio-political situation of the country in the last 50 years that has included a complex internal armed conflict with guerrillas, paramilitary and the phenomenon of drug trafficking, is one of the crucial factors in the development of forensic medicine in the country. In the last 20 years, forensic expert work has been implemented based on the proper management of physical evidence, allowing their collection and documentation, with the aim of support criminal and judicial investigation of the cases, responding to the needs of the accusatory system. Other recent challenges for Colombian forensics are Transitional Justice processes related to a 50-year history of internal armed conflict. The first began in 2005 with a legal framework approved by Congress the country to facilitate the process of demobilization of paramilitaries groups in Colombia. The product of this process was the exhumation and study of more than 6,000 skeletonized bodies buried in illegal graves. The peace process has recently begun with the FARC-EP guerrilla group. A huge new forensic challenge for the institute aimed to contribute to human identification and construction of justice, truth and reparation. To achieve this goal the Institute have been developed standardized operational procedures in forensic medicine in accordance with the "state of the art" and main international recommendations. Several specialized training programs have been implemented in addition to a monitoring system of quality in forensic pathology. There is also a quality management model with certification programs for experts in

forensic pathology and accreditation of forensic laboratories according to national and international standards. Accumulated experience in the complex situation of Colombia and the evolution of forensic medicine in the middle of the armed conflict will be explained during the presentation.

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A REVIEW OF EMPIRICAL METHODS IN FORENSIC PATHOLOGY

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Forensic Pathology (FP) is a relatively young field of research, so there is a lack of definitive empirical models. The high standards found in clinical research or molecular research, namely large-scale double-blinded placebo studies, positive and negative controls for multiple types of tests to reaffirm the same theory, are often not seen in FP. Although the autopsy has been used as medical teaching tools for centuries, much of the teaching relating to FP is still based on case studies, and not necessarily an empirical model. This literature review aims to look at the challenges of creating experimental models, the currently existing empirical models, and the value of having reference models.

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THE DISPOSITION OF JOHN AND JANE DOE IN A SMALL MARITIME JURISDICTION

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Introduction: Bodies that present to the pathologist for post mortem examination may not be immediately identified by the coroner. Such bodies are by convention designated "John Doe" or "Jane Doe" or "Male X" or "Female X". The purpose of this study was to determine how these cases are ultimately disposed. **Methods**: Decedent autopsy records spanning 19 years (1994-2012) with the names John or Jane Doe, or similar designation were reviewed. The epidemiologic characteristics of the decedent, significant post mortem findings, nature of autopsy protocol, cause of death and subsequent identification were extracted and analysed. **Results:** Of 4926 cases received for post mortem examination 32 cases (0.65%) were initially unidentified designated John or Jane Doe. Except for burn victims, the bodies were mostly intact. None of the cases were restricted to limbs or body parts only. Non-identification was due to advanced decomposition or destructive thermal injury. Most bodies were recovered in June (6), April and December (5 each). Location: Five decedents were found indoors, 7 were found in or near water and 6 were found in house fires. The rest were found in places other than their homes. All underwent complete post mortem examinations including radiologic examinations. Toxicology: Toxicologic testing was performed in 22 cases. The reasons why toxicologic testing was not performed in the other 10 cases are unclear. Gender: At post mortem examination, 22 decedents were male, 9 female and 1 body was of undetermined gender. Twenty nine decedents were adults, 2 were children and one of unknown age. Case of death: In 14 cases the cause of death was undetermined: 7 drowned, 6 died by thermal injury or smoke inhalation, 4 due to blunt force trauma and 1 due to drug toxicity. Identification: The majority of decedents were subsequently identified (22) either by dental records or DNA comparisons with living relatives. One person was of aboriginal ancestry while the rest were white. All but one identified decedent had been resident in the province, which simplified identification, by using existing medical and dental records. **Conclusions**: Unidentified decedents presented for post mortem examination are most often adult white males and comprise a minuscule fraction of total cases. This may be due to the smaller transient population in the area compared to other maritime jurisdictions in North America. The majority of decedents are ultimately identified. However the cause of death remained undetermined in almost half of cases.

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A NOVEL USE OF CORONER DATA TO CREATE A TOXICOLOGY SURVEILLANCE SYSTEM IN PREGNANT WOMEN

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Introduction: Existing studies in the literature analyze self-reported use of substances or utilize prenatal laboratory testing to assess the prevalence of illicit substances in pregnant women. Our study explores a novel use of quantitative autopsy toxicology to understand trends and associations in maternal mortality. **Methods:** This study was a retrospective review of pregnant women referred to the Clark County medical examiner from 2000-2015. Medical records were reviewed. These patients were all confirmed pregnant by autopsy diagnosis, and underwent whole blood toxicology analysis. Statistical analysis was performed using student t-test for continuous variables and chi-square for categorical variables. **Results:** 67 women were included in the analysis. 40% had positive toxicology for any drug, and 28% were positive for illegal drugs. Methamphetamine was most prevalent (16%), followed by ethanol (15%). Individuals not receiving prenatal care had a significantly higher prevalence of illicit drugs 44% vs. 7% (p=0.0121), ethanol 25% vs. 3% (p=0.0437), and methamphetamine 30% vs. 7% (p=0.0051). A positive marijuana result in those not receiving prenatal care, though increased, did not reach significance at 16% vs. 7% (p=0.689). Some other trends were noted in the data. 30% (n=20) had documented mental illness. Further, the first trimester had the highest prevalence of illicit drugs and ethanol. Also, 39% (n=26) were victims of domestic violence with non-married women significantly more so than married women (p=0.0001). **Conclusion/Implications**: As Vital Statistics does not record routine toxicology in non-overdose cases, a toxicology surveillance system using Coroner data would provide important insights into the growing national problem of substance abuse in pregnancy.

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MUTATION RATES OF Y-STR LOCI AND INCIDENCES OF NON-PATERNITY AMONG PURPORTED PATERNAL RELATIVES

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Collection of family reference samples (FRS) for comparison to unidentified human remains relies heavily upon the family members providing a valid family history. Oftentimes, relatives may be unaware of certain familial relationships or they chose to not share this information with the reference collector. Since 1992, the Armed Forces DNA Identification Laboratory (AFDIL) has collected family reference samples, primarily whole blood and buccal swabs, to aid in the identification of U.S. service members missing from past military conflicts. Over 450 sets of family members who reported to be paternally related to both the service member and each other were evaluated using Y-STR testing. Evaluations were based on regularly applied testing, occurring in the course of DNA testing of paternally related individuals. The profiles generated for each set of paternal relatives were compared for consistency at all loci. Mutation rates at each locus were calculated and compared to previously published rates. A standard degree of non-paternity, approximately 1%, was associated with this data set. Due to previous issues with self-reporting, families were queried as to the possibility of being unrelated or not sharing a paternal relative. Some families were able to confirm non-paternity, while others were unaware of any possibility of being unrelated. Issues of non-paternity

do not necessarily carry social repercussions in the United States, as much as they may in other countries. It is however notable the degree to which individuals were either unaware of issues, or unwilling to report it to the collectors. It is recommended to collect DNA references from at least two individuals for each DNA testing modality (i.e., two maternal relatives for mitochondrial DNA analysis or two paternal relatives for Y-STR analysis), in order to confirm or verify the purported relationships. This is especially necessary for lineage markers, as some lines of inheritance may be cryptic, and not apparent through a single testing modality.

Disclosure: All authors have declared no conflicts of interest.

AUTOSOMAL STR DATA OF 15 AMPFISTR IDENTIFILER™ LOCI IN SOUTHEAST OF IRAN

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Allele frequencies of the fifteen STR loci included in the AmpFlSTR® Identifiler™ PCR Amplification Kit (D8S1179, D21S11, D7S820, CSF1PO, D3S1358, TH01, D13S317, D16S539, D2S1338, D19S433, VWA, TPOX, D18S51, D5S818 and FGA) were evaluated in Sistan and Baluchestan province population, located in the southeast of Iran. Method: DNA was extracted from peripheral blood samples on FTA® classic cards using manufacturer protocol. PCR products were typed using ABI PRISM 3130 Genetic Analyzer (Applied Biosystems, Foster City, CA). Hardy-Weinberg equilibrium was tested for each marker and the forensic statistical parameters were calculated for this population survey. Result and Conclusion: No deviation of Hardy-Weinberg equilibrium was found except for CSFIPO (P-value=0.004) and D18S51 (P-value=0.043).The highest discriminating power was calculated for D2S1338 (PD=0.966) and the most power of exclusion was 0.768 for D18S51.Therefore, these 15 loci are informative for human identification in the population of Southeast of Iran.

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RNA/DNA CO-ISOLATION AND DIFFERENTIAL EXTRACTION OF SPERM CELLS IN MIX SAMPLES

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Samples from sexually assault cases often include a mixture of epithelial cells from the victim and sperm cells from the assailant. Differential lysis is an efficient method to separate sperm cells from epithelial cells. In addition, the forensic identification of human body fluids and tissues by means of messengers RNA (mRNA) profiling is increasingly applied to casework samples. In this study, after differential extraction procedures in mixed samples with vaginal cells and sperm cells, it was investigated that whether DNA/RNA co-isolation was possible or not to show specific mRNA markers of vaginal secretion and seminal fluid in two fractions. Simulated crime scene samples were prepared by transferring from 1 to 10 µl of semen to a cotton swab including vaginal epithelial cells. Firstly, female vaginal epithelial cells were extracted only with ATL solution (qiagen), and separated from sperm cells by centrifugation. and then, sperm cells fraction and vaginal cells fractions were isolated with DNA/RNA co-isolation kit. mRNA markers of protamine 1, protamine 2, kallikrein 3, semenogelin 1, and transglucomutase 4 from seminal fluids, mRNA markers of human beta defensin, and mucin 4 from vaginal secretions and 16S-23S rRNA intergenic spacer region of Lactobacillus gasseri and Lactobacillus crispatus were investigated in two fractions. The mRNA profiling results: Protamine 1 and 2 were found in the sperm fractions of vaginal swabs containing both 1 µl and 10 µl seminal fluids from semen markers. However, none of the vaginal secretion markers were identified. On the other hand, the whole seminal and vaginal secretion markers were found in the upper fractions of all samples. DNA profiling results: DNA profiling results of two individuals were detected in the sperm fraction of vaginal swabs containing 1 µl seminal fluids. It was found that the ratio of female/male DNA was 3/1 according to peak heights. Female/male DNA ratio was found 1/2 in the vaginal swabs containing 10 µl seminal fluids. In conclusion, each specific mRNA markers of two different cell types could be identified with differential extraction of sperm cells and then with DNA/RNA co-isolation. The results demonstrated that presence of semen mRNA markers observed in lower phase and upper phase may provide information about mixed samples containing azospermic semen.

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DEVELOPING FINGERPRINTS WITH TWO 1,2-INDANEDIONE-ZINC CHLORIDE FOMULATIONS: A COMPARISON

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Fingerprints are a critical component of crime scene investigations that can link suspects and victims to a crime scene. There are a variety of different visualizing techniques that can make latent prints visible. 1,2-Indanedione-zinc chloride (IND-Zn) is a chemical used for fingerprint development for porous surfaces; however, there is dispute over whether or not additional humidity should be used during IND-Zn fingerprint development. The Royal Canadian Mounted Police (RCMP) formula uses humidity in their protocol, while the British Home Office does not. In this research, we conducted a series of experiments comparing the IND-Zn formulations from the RCMP and the British Home Office, with a focus on the use of humidity. We compared formulas across three aging periods and five different substrates and applied a grading scheme that scored prints from zero to four to quantify differences in print development and ridge detail. A total of 1,380 fingerprints were scored across conditions and between formulas. A chi-squared test indicated significant differences between the UK and Canadian formulas in terms of fingerprint quality. Closer examination revealed significantly higher scores using the UK formula on printer paper, envelope, and cardboard substrates. There was no difference between formulas on newspaper. These results suggest the British Home Office formula produces higher quality fingerprints than the RCMP's current formula. As a result of this work, the RCMP will be replacing their current protocol with this more suitable formula for a Canadian climate.

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THE EFFECTS OF INFECTION AND POSTMENOPAUSA ON THE PRESENCE OF LACTOBACILLUS IN VAGINAL SPECIMENS

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The identification of body fluids origins is very important in forensic cases for the reconstruction of the crime scenes and obtaining how the event occurred. In addition to serological test, RNA based methods were developed in identification of body fluids and stains. The use of bacteria in the identification of b body fluids has also been investigated and studies have shown that some vaginal bacteria may be used in the identification of body fluids. In this study, the effects of vaginal infection and postmenopausa on the presence of *L. gasseri*, *L. crispatus* and *L. jensenii* bacteria in vaginal swab specimens were investigated. Vaginal swab samples from 91 volunteers who received written and verbal consent were included for this study. The samples were classified into 30 control groups,

31 infectious groups, and 30 postmenopausal age groups. RNA isolation, cDNA synthesis and PCR were performed in 16S-23S rRNA intergenic spacer region of Lactobacillus species, respectively. The products after PCR were carried out in capillary electrophoresis. The chi-square test between the groups was used. *L. gasseri* was found in 28 of 30 cases in the control group, in 21 of 31 cases in the infection group and in 15 of 30 cases in post-menopausal cases. The statistical analysis revealed that there was a significant decrease in the incidence of *L.gasseri* in both the infection group and the postmenopausal group ($p<0.001$). *L. crispatus* was detected in 29 of 30 cases in the control group, in 26 of 31 cases in infection group and 16 of 30 postmenopausal cases. The rate of detection of *L. crispatus* in the postmenopausal group was lower than that of the control and infection group ($p<0.001$). *L. jensenii* was found in only 15 of 30 cases in the control group, 14 of 31 cases in the infection group and only 2 of 30 cases in the postmenopausal. Statistical analysis showed that there was a significant reduction in the detection rate of bacterial strain in the postmenopausal group according to the control and infection group ($p<0.001$). In conclusion, negative results cannot be used to exclude vaginal secretion because of the being unidentified any of Lactobacillus types in 12.9% of the samples taken from individuals having infection and in 46.6% of the samples taken from postmenopausal. However, it is thought that positive results may be important especially because of no serological methods have been found in identification of vaginal secretion until now.

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MULTIPLE FATALITY RESPONSE AND THE INDIGENOUS COMMUNITY

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Historically, the interaction between the government, the health care system and the police force with indigenous people in Canada has been fraught with racism, discrimination and neglect. The death investigation system in Ontario encompasses all three institutions, leading to unique challenges in dealing with deaths in indigenous communities. Combined with the remote location of many northern First Nation reserves, the lack of resources such as running water, proper housing or adequate fire services, multiple socioeconomic factors as a result intergeneration trauma and the lasting effects of assimilation policies, tragedies such as these continue to occur. However, improved communication with families and community members, positive relationship-building and mutual understanding between the death investigation team, the scientific community and the indigenous population can serve to increase timely and culturally appropriate responses to these situations. This coordinated effort can be used as an example for other members of the forensic community to build better relationships with indigenous people by fostering mutual understanding and respect, facilitating the process of death investigation. The outcomes of these investigations can also identify root causes affecting deaths in these communities and point towards preventative solutions. Attendees will learn about the approach to death investigation in remote communities, the challenges faced by the death investigation team and indigenous people from socioeconomic, historical and current viewpoints, as well as identifying culturally appropriate and respectful outcomes when dealing with deaths in these communities.

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MICROBIAL DNA EXTRACTION FROM FORENSIC SAMPLES: A TEST OF THREE METHODS

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This presentation will provide the forensic community with information concerning the use of simple and user-friendly extraction methods for microbial analysis that could be easily implemented into a crime laboratory's workflow. Recent advancements in technology, such as next generation sequencing (NGS), allow for the identification of culturable and unculturable microbes. In addition, NGS can monitor changes in microbial communities over time and yield information regarding community diversity and structure. New information concerning microbial communities can deliver a vast amount of information that can advance forensic investigations by providing new methods of human identification and post-mortem interval estimation. The ability to extract microbial DNA from samples is the first and arguably most critical step for metagenomic analysis. Therefore, this study examined different extraction methods, solid-phase and organic phenol-chloroform, to determine if they are able to extract similar microbial diversity and abundances, providing the same results at the end of the analysis. In this study, samples from 12 pig (*Sus scrofa)* humeri and 12 pig ribs were divided into a total of 24 humerus and 24 rib samples. From June to November 2015, cut bones and waterproof dataloggers were submersed in water and left outdoors; water temperature was recorded hourly. Samples of submerged bone were collected at 500 accumulated degree days (ADD) intervals. Bone samples were ground into a powder, and microbial DNA was extracted using three methods: organic phenol-chloroform, DNeasy Blood and Tissue Kit (Qiagen Inc., Hilden, Germany), and ChargeSwitch® gDNA Plant Kit (ThermoFisher Scientific, USA). 16S rDNA variable region 4 was amplified with dual-index primer pairs. Amplified products were pooled together in equimolar concentrations for 2X300 paired-end sequencing on Illumina's MiSeq platform. Sequence data analysis was performed via Mothur version 1.36.1 pipeline. Results indicated that, at the class level, humerus samples had 6 microorganisms included exclusively in organic phenol-chloroform samples, 8 microorganisms in DNeasy Blood and Tissue Kit samples, and 3 microorganisms in ChargeSwitch gDNA Plant Kit. Together, these methods extracted 33 common microorganisms. At the class level, rib samples yielded 6 microorganisms included exclusively in samples extracted via organic phenol-chloroform, 7 microorganisms in DNeasy Blood and Tissue Kit samples, and 2 microorganisms in ChargeSwitch gDNA Plant Kit samples. Together, these methods extracted 40 common microorganisms. Based on the presence or absence of microorganisms alone, any of the three proposed methods could be used by crime laboratories to recover microbial DNA from forensic samples.

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DETERMINATION OF THE AGE OF IRON BASED INK: A FEASABILITY STUDY

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Iron Gallotanate inks are a staple of writings from the 14th to the 18th century. Although they are not commonly found today on business or personal writings, they are important when it comes to historical and collectible items. These inks are made by mixing a source of iron with gallotanic acid, classically sourced with the addition of Oak galls. The ink is either colorless or slightly grey, unless an additional dye component is present. As time progresses from application of the ink onto paper, the iron present oxidizes and changes color to first black and then brown. It was hypothesized that the correlation between ink color and Iron oxidation state could be used as a method for the detection of fraud. It was determined experimentally through analysis of Iron based ink of varying ages, including those that were artifiially aged by heat, that the oxidation state of the Iron present contained a correlation with age, but not with color. The analysis of the Iron based ink was carried out by X-ray Photoelectron Spectroscopy (XPS). The procedure did involve removal of small portions of the written line, with subsequent determination of the oxidation states of Iron present in each of the writing samples. It was noted that the color progression from black to dark brown to lighter brown was consistent among authentic writing samples of varying ages with a corresponding Iron oxidation state. Alternatively, writings that were artificially aged illustrated an inconsistency between ink color and Iron oxidation state. Further work is proposed to associate a specific Iron oxidation state with a date range to facilitate the

examination of a suspect writing for the determination of authenticity or fraudulence.

Disclosure: All authors have declared no conflicts of interest.

TEENS & SPICE: SYNTHETIC CANNABINOID ASSOCIATED FATALITIES IN ADOLESCENTS

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Synthetic cannabinoids (SCs) are commonly abused by adolescents with reported past-year use in high-school students between 3-10%. Standard adolescent post-mortem toxicology does not include routine SC analysis and thus the true burden of fatalities related to SCs is

unknown. Retrospective case review included scene investigation, interviews, autopsy and toxicology. SCs were confirmed by liquid tandem mass spectrometry (LC-MS/MS). Fatal blood SC levels in this case series ranged from 11 ng/g to 12 ng/g with 4/5 cases having no other discernable cause of death on autopsy. This review of the literature adds toxicological findings of 2 SC adolescent fatalities, including the first reported case of sudden cardiac death in an adolescent male caused by dilated cardiomyopathy attributed to habitual SC use. With synthetic drug use on the rise forensic experts should have a high index of suspicion for the possibility of SC intoxication in adolescent fatalities with no other discernable cause.

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CHALLENGES IN IDENTIFICATION OF EXHUMED SKELETONISED HUMAN REMAINS OF A CHILD: A CASE REPORT

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Abstract Background and Aim Foul play and evil acts exist in the world and most deeds go unnoticed especially in developing countries where there are challenges with the justice system relating to investigation concerning exhumed bodies. Exhumation is a term used to describe the lawful excavation of a body from the grave after burial and this is done for various reasons ranging from identification of the victim to criminal investigation (including cause and manner of death) as well as closure for the family. This paper discusses a case of a baby who was stolen from her parents at 5 months of age and sold to an unregistered orphanage and later resold to a childless couple. The childless couple returned the baby on grounds of an unknown illness to the orphanage where he later died and was clandestinely buried. After some months, an investigation by the state security agencies led a team to exhume the remains of the baby to determine possible cause and manner of death, categorically link to the original family and eventually prosecute offenders. The whole process also aimed to achieve closure for the original family as much possible. This paper discusses various challenges encountered during exhumation and using various aspect of forensic pathology, anthropology, odontology and DNA analysis in identification of an individual. **Methodology** The grave site was identified by the alleged receiver and seller of the stolen baby who claimed to have personally buried the deceased in front of the Motherless Babies Home. The grave site was marked/mapped and carefully dug out to expose a baby cot containing skeletonized remains. **Results** Estimated age of the baby was made using bone length estimation and tooth eruption estimation with DNA analysis. The baby's age was estimated at 8 -12 months. **Conclusion** More attention is needed to develop the forensic science infrastructure in Nigeria, so as to aid forensic investigations and human identification. This will go a long way in the deliverance of justice especially in cases of missing persons and homicide.

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CHANGING PATTERN OF SELF-POISONING DEATHS IN SOUTHERN PROVINCE SRI LANKA

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Objectives: To identify the epidemiological features of poisoning patients and to compare the epidemiological data from 2012 to 2015 with 2002 to 2006. **Methods:** A retrospective study was conducted on intentional self-poisoning patients admitted to teaching hospital, Karapitiya (THK). In the retrospective study, these data were obtained from a review of the hospital records. Cases were identified by manual search through the hospital record room. The poison was identified from the history, containers, transfer letter, and/or clinical toxidrome. Previous studies have shown that the poison stated on history is confirmed to be present in more than 80% of cases (1). We determined the substances ingested and the demographic data of 4790 admissions from 2012 to 2015 and 5490 admissions from 2002 to 2006. **Results:** The 5-year age band with the highest number of cases was 16 – 20 in women and also the same in men. Self poisoning was common in males (51%) than females between 2012 and 2015. The most common type of poison ingested was medicines (44%) and this was even higher in females (56%). Paracetamol poisoning was reported in 64% of medicinal poisonings. Overall case-fatality was 2.8% (n=134) which was higher in males (3.1%) than females (2.5%). 36.5% of all deaths were due to Pesticides. From 2002 to 2006, a total of 578 patients died of self poisoning. The case fatality was 8.6% and 3.6% of deaths were due to medicines while 83.4% of were due to Pesticide. Of the 1056 patients admitted due to pesticide poisoning from 2002 to 2006, 422 deaths were reported (39.9 %). Average number of patients admitted due to poisoning per year between 2012 and 2015 was1198 and from 2002 to 2006 it was 1098. **Conclusion:** Percentages of Pesticides ingestion has been declined. Drug poisoning (the commonest was paracetamol) and other poisons have become more popular, especially among females. Deaths are rare since the medicines commonly taken are of low toxicity or easily treated and mortality rates were almost equal to developed countries. There is no much different between poisoning incidences between two comparing time durations. Even though the motility rates bring down by the effective measures taken by the health authorities, further more effort need to be applied to demotivate the incidence of self poisoning. Eddleston M, Gunnell D, Karunaratne A, de Silva D, Sheriff MH, Buckley NA. Epidemiology of intentional self-poisoning in rural Sri Lanka. *Br J Psychiatry* 2005;187:583-4.

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FAMILY DOCTORS' PERSPECTIVES ON CHILD ABUSE RISK FACTORS AND REPORTING PROCESS: A QUALITATIVE STUDY

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Introduction: Family doctors have a chance to identify child abuse and neglect early due to their regular meetings with children and their parents. However, the literature indicates that emergency physicians, not family doctors mostly report child abuse cases. Interviews to understand family physicians' perspectives on risk factors and reporting process were executed. **Method**: Researchers had a semi-structured in-depth interview with fifteen assistant doctors at Family Medicine Department at Marmara University Hospital. Interviews were recorded with the permission of the participants and decoded. Written material was used to create themes.

Findings: Participants thought that physicians had an important role in identifying child abuse and neglect and they were especially interested in physical and psychological findings in identifying child abuse and neglect. Among these findings, physical scars on child's body child's language problem, hyper- or insensitive parents against their children are mentioned. Most of the participants indicated that they are aware of child abuse in their occupational experience and they had some suspected cases. However, they did not prefer to report these cases. Participants said that they did not know to whom they had to call, especially when they work at institutions other than hospitals. Besides, not knowing what would happen to them in the legal process, being worry about child's situation after reporting and, a probability of the wrong accusation were among the reasons that prevent the doctors to report the abuse cases. Participants skipped most of the risk factors that were indicated in the literature.
Discussion and Conclusion: Determining family doctors' concerns about reporting child abuse cases is as important as understanding their level of knowledge on child abuse and neglect. Both undergraduate and graduate education must include a deep level of information about abuse risk factors, different appearances of abuse types and risk factors in practice, bureaucratic process and know-hows of the reporting process.

Disclosure: All authors have declared no conflicts of interest.

A CUSTOM-DESIGNED MEMBRANE FILTER FOR ENRICHING DIATOMS IN FORENSIC DIATOM TEST

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Diatom test provides supportive evidence for the diagnosis of drowning. Centrifugation is the key step to enrich the diatoms in the digestive solution of tissues. In our previous study, we found that approximately 34% of diatoms are discarded during centrifugation at 4,000 rpm for 15 min. This may be one of the reasons that Pollanen found that diatoms of the bone marrow are demonstrated in only one third of freshwater drowning. In order to avoid diatom loss in the enrichment process, we introduced a membrane filtration method and custom-designed a membrane filter to collect diatoms in the digestive solution (). The size of diatom in the natural environment is > 1 μm. Theoretically, all the diatoms in the digestive solution will be collected on the membrane. A single-used filter with filter bowl (220 ml), filtration membrane, filtration pedestal and bedding was designed to make the filtration process easier. and possible cross contamination brought by the reused instrument has been eliminated. The reclaiming rate of the filter has been tested. The results showed that the reclaiming rate of the custom-designed filter and centrifugation is 108.3±15.8% and 61.6±7.1%, respectively. The custom-designed filter has been proven to be more superior to the centrifugation, with the difference being statistically significant.

Disclosure: All authors have declared no conflicts of interest.

EXPERTISE, CONTEXT, AND DE-BIASING: FACTORS THAT AFFECT BLOODSTAIN PATTERN INTERPRETATION

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Contextual bias in forensic examinations can contribute to misleading and erroneous opinions. We compared novice and expert bloodstain pattern analysts' use of contextual information for determining the likelihood of bloodstain pattern evidence occurring under two given hypotheses. One hypothesis represented the ground-truth pattern type; the other represented an alternative, but possible, pattern type. Using an online survey, analysts were presented with 12 bloodstain patterns, one-at-a-time. Using a scale of 0 (extremely low likelihood) – 100 (extremely high likelihood), analysts rated the likelihood of the pattern occurring under each hypothesis, twice. For half of the patterns, analysts made their first pair of ratings after viewing a pattern in the absence of contextual information, before being provided with this information and making a second pair of ratings. For the remaining patterns, analysts made their first pair of ratings after viewing the pattern alongside contextual case information, and were asked to make the second pair of ratings ignoring that information (i.e., to de-bias themselves). The contextual information was designed to represent various sources of information encountered in forensic examinations: scientific, non-scientific, and colleagues' opinions (e.g., peer-review). This information either suggested the ground-truth pattern type or the alterative pattern type. Pattern type, information source, and context direction were counterbalanced. Exploratory analysis of data available at submission indicates that both novice and advanced analysts rated the bloodstain pattern evidence as having a higher likelihood of occurring given the ground-truth hypothesis than the alternative hypothesis. Scientific evidence had the greatest influence on likelihood ratings, with ratings increasing and decreasing in line with the contextual information. In general, participants tended to overestimate the influence of non-scientific and peer-review information, but underestimate the influence of scientific information. A full analysis of the completed data set will be presented, and the implications of the findings discussed.

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DETERMINING THE RELEVANCE OF CONTEXTUAL INFORMATION IN FORENSIC HANDWRITING EXAMINATIONS

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Forensic science is facing a paradigm shift whereby the human element in forensic examinations must be acknowledged and the potential for extraneous information to unduly influence the examiner must be addressed. The National Commission on Forensic Science has called for forensic disciplines to identify sources of information that are relevant and irrelevant to the decision-making process. This identification is an important first step to developing contextual information management protocols that aim to minimize the potential for bias in forensic examinations. To develop protocols that are feasible, practical, and efficient, it is first important to solicit forensic experts' views on this issue. We interviewed forensic document examiners from law enforcement, independent and private agencies from the USA, New Zealand and Australia. Our aim was to understand current methodologies for forensic handwriting examinations, the relevance (and irrelevance) of contextual information for these examinations, and strategies for—and challenges to—managing contextual information. We will present the findings from this research and present recommendations for contextual information management in forensic handwriting examinations.

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CONSULTING EXPERTS IN EUROPEAN CRIMINAL PROCEEDINGS IN COMPARATIVE REVIEW

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Expert with specialized knowledge may play several roles within criminal trial. Typical aim of expert activity is issuing an opinion evidence after formal appointment by judicial body. Furthermore, forensic experts can act as consulting experts and they are able to assist either prosecution or defense in carrying actions during trial. Such experts can provide consulting, support, guidance and analytical services, which can be especially important during assessment of opinion of expert appointed by court. Use of consulting experts within criminal trial is ensued from general rules of evidence in "common law" countries and it is typical aspect of activity of experts. Nevertheless, position and application of consulting experts in "civil law" countries is not always clear in regard to specific penal regulations. Thus, comparative studies on use of consulting experts in criminal proceedings in Poland, Germany, France and Italy were performed. The study provides descriptions and analyses of approaches to the use of consulting experts in criminal proceedings. Research shows that regulations and main rules related to forensic experts are generally similar in compared European countries, but indeed they differ in some important issues. In Poland there is not specific and precise regulations connected with activities of consulting experts. Usually consulting experts are working informally for judicial body. Additionally article 198 § 1 of the Polish code of criminal procedure, which allows for call an expert to participate in any evidential activity performed by judicial body as it is needed, can be used as basis for appointment of consulting experts. Moreover, on the basis article 308 § 1 forensic expert can take part in crime scene investigation as consultant. Similarly, German and French codes of criminal procedure do not contain specific regulations in this field. However, consultation of judicial body with an forensic expert beside court session is prohibited in Germany. The most complexed regulations related to consulting expert activity can be found in Italian code of criminal procedure (c.c.p.). Consulting expert (*consulente tecnico*) can be appointed by both parties (Articles 225–233 c.c.p.). They pose a large entitlements, i.a. right to interview forensic expert, to submit proposals, comments and objections to the court, to verify an opinion of forensic expert. Police and prosecutor have also right to appoint consulting expert to perform solely specific evidence actions (art. 348, 359 c.c.p.). Opinions and suggestions of consulting experts are assessed by court during trial and can be directly used as evidence.

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3D DOCUMENTATION OF A CLANDESTINE GRAVE: A COMPARISON BETWEEN MANUAL AND 3D METHODS

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Traditionally, clandestine graves are documented step by step manually, using instruments such as a camera, measuring tape, and a compass. There are various hand mapping techniques which include compass and tape, baseline and triangulation. The difficulty with these methods, albeit cost effective, is that they are time consuming, tedious and require at least 3 personnel to accomplish. With the emergence of 3D scanning in the forensic science field, anthropologists can now rely on alternative methods for documenting clandestine graves. The purpose of this research is to document a clandestine grave, using traditional methods, photogrammetry, laser scanning and structured light/hand scanning and compare manual versus 3D methods. More specifically, this research will be comparing the baseline technique to a photogrammetric model made with an iPhone and a DSLR camera, the FARO laser scanner and various hand scanners. Variables such as time, cost, expertise required and the accuracy of measurements will be compared between both manual and 3D methods.

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THE STR DECODE PANEL: ENHANCED STR MIXTURE DE-CONVOLUTION USING MASSIVELY PARALLEL SEQUENCING

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Short tandem repeat (STR) mixture de-convolution of complex biological samples is limited in its ability to resolve component contributors in DNA evidence. Various improvements in polymerase chain reaction coupled with capillary electrophoresis (PCR-CE) chemistry and downstream statistical analyses have been developed and implemented to attempt to better resolve two or more person DNA mixtures. However, CE outputs describe variation solely based on allele size and do not exploit the full genetic information contained within target markers. The advent of massively parallel sequencing (MPS) for typing forensically-relevant STR loci has drastically impacted our understanding of allele diversity by identifying sequence variation within STR repeat and flanking regions. Recent literature has described STR sequence variation in large population groups and has demonstrated that there are enormous amounts of diversity and complexity within the currently utilized STR markers for forensic genetic analysis. However, some of the current core CODIS loci lack intra-allele sequence diversity. Thus, there is a need to explore novel STRs to complement existing markers as increased variation can facilitate mixture de-convolution. The STR DECoDE (DNA EnhanCed DEconvolution) panel is a novel panel of highly polymorphic STR markers that have high heterozygosity, reduced allele length spread, and sequence variation to improve resolution of complex of mixtures. The implementation of the STR DECoDE panel, in conjunction with current core CODIS markers, will allow the forensic scientist to more effectively address the challenges of interpretation of some complex mixture samples, increase the number of resolved profiles being compared to reference and suspect profiles, and expand the DNA database by increasing the number of forensic samples uploaded. The benefit from the DECoDE STR panel will be an increase in the number of investigative leads and the overall resolution of more crimes.

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KIDS, DRUGS VEGAS: A NOVEL TOXICOLOGICAL SURVEILLANCE SYSTEM IN ADOLESCENTS USING AUTOPSY DATA

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Introduction: Substance abuse in society presents a preventive medicine dilemma, as the new frontier of illicit drug abuse may be prescribed, bought unlawfully, over the counter or simply a prohibited substance. Studies in literature analyze self-reported use of substances or utilize emergency room data to assess the prevalence of illicit substances in adolescents. This is the first time global toxicology surveillance will be done on adolescents from 10-18 years using quantitative post-mortem data. As Vital Statistics does not record routine toxicology in non-overdose cases, this data is novel and can provide insight into prevalence, trends, and associations with positive toxicology in adolescents. **Methods:** This study was a retrospective review of all adolescents referred to the Clark County medical examiner from 2000-2015. All decedents underwent autopsy, whole blood toxicology analysis and medical record review. Statistical analysis was performed using student t-test for continuous variables and chi-square for categorical variables. **Results:** This toxicological surveillance data showed positive toxicology in 47.2% (n=262) and 35.1% (n=195) prevalence of illicit drug use in all adolescents (n=555) referred to the Clark County medical examiner from 2005-2015. The most used

substance in adolescents was found to be marijuana in 28.1% (n=156), followed by opiate use in 20.3% (n=113), and benzodiazepine use in 10.9% (n=61). The most prevalent cause of death was gun violence in 27.5% (n=153) in which illegal drugs were present in 46.4% (n=71). In addition 35.4% (n=197) of adolescents had a history of mental illness in which illegal drugs were found in 47.7% (n=94) and illicit prescription drugs in 39.6% (n=78). **Conclusion/Implications:** Las Vegas is the 29th largest city in the United Sates and we believe this cohort is relevant to similar sized cities with a comparable demographic. Our data is descriptive, and thus is subject to over interpretation, cause-effect inferences should not be drawn. Finally, the population of study as decedents of adolescent death appear to be high risk for positive toxicology however we believe the inclusion of all causes of death, inclusive of non-violent death give an accurate overall descriptive picture of positive toxicology adolescents. Adolescent death has a high prevalence of positive toxicology regardless of the manner or cause of death. Novel findings regarding associations with adolescent mortality, positive toxicology, and mental illness bring to light missed opportunities for intervention. This study highlights high-risk associations to help target adolescents from metropolitan cities that would benefit from increased screening and intervention.

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AIRBORNE METHAMPHETAMINE SAMPLING USING CAPILLARY MICROEXTRACTION

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The clandestine manufacture of drugs such as methamphetamine, and the resulting contamination of the homes used as clan labs, is a global issue of serious concern. The need for a fast and reliable method to detect methamphetamine, and quantify the extent of contamination, at these sites is evident. In this study, we investigated the use of the capillary microextraction (CME) devices developed by Almirall et al. to sample methamphetamine vapor, at concentrations expected at former clan labs. The CME devices consisted of strips of polymer coated glass fibre filters, housed in a thermally stable capillary tube. Controlled flows of gas were drawn through the CME devices to sample methamphetamine vapor in the concentration range of 0.42- 4.2 μg m^{-3}, which was produced by an in-house custom-built vapor generator. The sorbed methamphetamine was analysed using a gas chromatography-mass spectrometer (GC/MS), fitted with a Chromatoprobe thermal desorption unit. A series of experiments were conducted to assess the sensitivity and reliability of the vapor sampling method, particularly in comparison with dynamic Solid Phase Microextraction (SPME) sampling. The CME devices showed good reproducibility (RSD< 15%) for methamphetamine vapor sampling, and a curvilinear pre-equilibrium relationship between sampling times and peak area, which could be utilised for calibration purposes. Under identical sampling conditions, the CME devices were approximately 30 times more sensitive than the dynamic SPME method. Capillary microextraction offered a number of advantages over traditional air sampling methods, including lower cost, ease of use, and fast sampling times. The devices were also reusable, although a gradual loss of sensitivity over time indicated the need for an internal standard. Consecutive sampling of methamphetamine, and its deuterated analogue, d9 methamphetamine, showed no competitive displacement. We were then able to demonstrate that capillary microextraction devices, pre-loaded with an internal standard, could be used to sample methamphetamine vapor to provide an internal standard. These could be used for reliable methamphetamine vapor sampling at former clandesting laboratories.

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CHILDHOOD ABUSE HISTORY AND PARENTING–EFFICACY IN PREGNANT WOMEN: ATTACHMENT AND THEORY OF MIND

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Introduction: The starting point of the study is the idea that some people who experienced trauma may be under risk of not mentalizing the others. So, pregnant women who experienced childhood abuse and/or neglect may have anxiety about their motherhood efficacy, especially when it comes to understand the needs of the newborn. We investigated the dynamics among childhood trauma, motherhood sufficiency, attachment type, and theory of mind. Method: Two hundred six healthy pregnant women with the mean age of 28.75 (SD=5.61) participated into the study voluntarily. The research was executed at Marmara University Hospital with the permission of local ethical committee. Childhood Trauma Questionnaire, Parenting Self-Efficacy Questionnaire, Relationships Questionnaire, and Eyes Test were the research tools. Findings: Most of the participants (98.3%) were married and 25.9% (n=72) of them had previous miscarriage history. Most of the women planned the current pregnancy (73.8%). 36% (n=103) of the women was classified as abused and the rest was non-abused. Abused group had higher scores in preoccupied and indifferent attachment styles. Non-abused participants indicated higher level of safety, happiness, and powerfulness expectancy during prospective labor. There was not any significant differences between abused and non-abused groups in Eyes Test correct answer mean scores. Only *parenting skills* and *understanding baby's emotions* dimensions of parental self-efficacy questionnaire showed significant difference between groups. Conclusion: There is a relationship between abuse history and having an anxious attachment style in adulthood and literature indicates that assaulters in abuse cases are mostly acquaintances. This may cause abuse/neglect victims not to generate safe schemas of close relationships and this may be related to expectancies about their own parenting. This study did not revealed any differences in theory of mind test between groups but indicated correlation between attachment style and theory of mind. We suggest future researchers to use tests that measure theory of mind specifically in parent-child duo. Besides, attachment type and capacity of mentalizing the others emotions and needs worth investigating to understand abuse/neglect cycle in generations.

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DEVELOPMENT OF AN ELECTRONIC EXPLOSIVE DETECTOR USING MICROFLUIDIC PAPER-BASED ANALYTICAL DEVICES

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This presentation will discuss the development and evaluation of both a portable electronic explosive instrument and a functional paper-based microfluidic device (μPAD) for the detection of bulk nitro-aromatic explosives. CorelDraw X6 was used to design the μPads and a Fuji Xerox ColorQube 8870 printer was used to print the wax patterns onto the filter paper Whatman Grade 1. The printed μPads were melted into the filter paper with a swing-away heat press at 150˚C for 40 seconds. The optimal concentration of pyrene for the application to the μPads was 0.5mg/mL in methanol:water (80:20). The pyrene fluorescence on functional μPADs is stable at temperatures between 25˚C to 80˚C; and the shelf life of μPADs can be extended when stored in a plastic air and light proof satchel in the presence of a desiccant. The detector system uses a white and a UV-LED (310nm) light sources and a colour and light sensors. An electronic system was used to compare the changes in light and colour when explosives are put in contact with the active microchip triggering an alarm. All parameters

and controls can be easily adjustable using a touch screen display and all data is automatically saved to an SD memory card. The drop in total light was used to detect 9 nitro-aromatic explosives standards, with limits of detection varying from 0.1 to 1 µg. The portable detector was also successfully tested in the presence of 11 military grade explosives: 2,4-DNT; 2,6-DNT; TNT; Tetryl; picric acid; 2-Nitrotoluene (2-NT); 3-Nitrotoluene (3-NT); 4-Nitrotoluene (4-NT); Composition B (TNT+RDX); 2,4-Dinitroanisole (2,4-DNAN) and Wabox (2-NT, 3-NT, 4-NT, NG, 2,6-DNT, 2,4-DNT, and TNT).

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CHARACTERIZATION OF CANNABINOIDS USING HIGH-RESOLUTION MASS SPECTROMETRY FOR NON-TARGETED SCREENING

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The rapid proliferation of novel psychoactive substances (NPS), in particular synthetic cannabinoids, is a global issue for law enforcement and analytical toxicologists attempting to detect and identify these compounds. With increasing pressures from changing legislative measures and in order to circumvent them, clandestine operators often modify known NPS to create completely novel analogues which are not capable of being detected by forensic drug and toxicology laboratories using conventional targeted screening methods. The purpose of this study was to investigate the collision-induced dissociation (CID) pathways of over 40 synthetic cannabinoids by high-resolution mass spectrometry (HRMS) for non-targeted screening purposes. Neat standards (1 mg/L) were analysed using a Waters Corporation ACQUITY ultra-performance liquid chromatograph (UPLC) coupled to a Waters Corporation XEVO G2-S quadrupole time-of-flight mass spectrometer (QTOF-MS). CID experiments were performed using data-independent acquisition (DIA) with Waters MS^E using two functions: Function 1 utilising a low collision energy of 6 eV and Function 2 a collision energy ramp of 10-40 eV. In general, the major product ions for all analytes were formed from the β-cleavage of the carbonyl group (present in all analytes) to form an oxonium cation. Naphthyl containing analytes, such as the JWH series, formed product ions at *m/z* 155.0491 ($[C_{11}H_7O]^+$) and *m/z* 169.0648, 183.0804 185.0597 for methyl, ethyl and methoxy homologues, respectively. Analytes containing the 2,2,3,3-tetramethylcyclopropyl moeity such as UR-144 and XLR-11 had a product ion at *m/z* 125.0691. In addition, diagnostic product ions were present corresponding to PICA-, PINACA-, CHMICA-, CHMINACA-, FUBICA- and FUBINACA-type compounds at *m/z* 214.1226 ($[C_{14}H_{16}NO]^+$), 215.1179 ($[C_{13}H_{15}N_2O]^+$), 240.1383 ($[C_{16}H_{18}NO]^+$), 241.1335 ($[C_{15}H_{17}N_2O]^+$), 252.0819 ($[C_{16}H_{11}FNO]^+$), 253.0772 ($[C_{15}H_{10}FN_2O]^+$), respectively. Furthermore, characteristic neutral losses were observable such as 116.0949, 130.1106, 131.0946 and 145.1102 Da for AB-, ADB-, MMB-/AMB- and MDMB-type analytes, respectively. These diagnostic product ions and neutral losses can be used to interrogate sample data to potentially detect novel synthetic cannabinoids derivatives.

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FORENSIC BIOLOGY - THE EFFECTS OF FINGERPRINTING TECHNIQUES ON DNA ANALYSIS

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Objectives: To investigate the effects of white and black fingerprint enhancement powders, swabbing solutions and wet and dry swabbing techniques on the recovery and profiling of DNA. **Methodology:** A total of fifty three samples were collected from two volunteers after receiving ethical approval. Twenty five samples were collected from each participant and three from the researcher. Buccal swabs were taken as controls. Each individual exerted their fingerprints for 10 seconds on glass slides and wooden blocks. Using the dusting technique white and black powders was applied to surfaces with fingerprints. Two solvents, Triton X-100 and distilled water were applied to swabs. Wet and dry swabbing methods were used to collect the fingerprints from the glass and wooden surfaces. Two (2) mm^2 of each swab was placed in different tubes and DNA extraction was done using the DNA IQ kit (Promega). DNA was quantified and analyzed using the ABI 3130 analyzer 9Applied Biosystems). RESULTS: This study showed that wet swabbing recovered more DNA than dry swabbing. The use of Triton X-100 recovered more DNA compared to distilled water. The use of Black fingerprint powder and white fingerprint powder did not affect the recovery of DNA. Glass surfaces retained more DNA than wooden surfaces. Partial DNA profiles were obtained after black and white fingerprinting powders were applied. The study also showed that it is possible to obtain DNA profiles from stored fingerprinting backing card. **Conclusion:** Fingerprinting techniques do not affect DNA analysis. More DNA was collected when using Triton X-100 on glass surfaces than using distilled water on wooden surfaces. Longer exertion time is recommended in an effort to obtain full profiles. This study shows that DNA profiles from fingerprints can be obtained even after fingerprinting powders were applied and can be used to identify criminals when fingerprints from crime scenes are not clear or partial. Authors: Krystal James, Insp. Gregory Williams and Prof. Wayne McLaughlin.

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METRIC PAIR-MATCHING OF CALCANEI IN COMMINGLED REMAINS CASES

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Pair-matching has traditionally been based on visual assessment and relies largely on the experience of the observer (1-3). Recent research has focused on metric assessment for objectivity and increase the accuracy and repeatability. Pair-matching using quantitative and statistical methods relies on the ability to characterize normal size and shape relationships among skeletal elements (1,2). Osteometric sorting of skeletal remains is possible for long bones, such as the femur and humerus, and smaller bones, such as metacarpals, and has reduced the number of potential pairs requiring visual assessment (1,2,3). Research involving the pair-matching of tarsal bones is limited. The current study expanded on Thomas and colleagues' (2013) method for pair-matching calcanei, which is based on metric analysis and utilization of a statistic (M). Left and right calcanei from 70 males and 69 females were measured (N=278) from the white South African population group. Six calcaneal variables were assessed and the maximum value of M, and 90th and 95th percentiles of M for each variable were tabulated for assessing possible pairs. The values of M for males and females exhibited no statistically significant difference between the sexes, therefore pooled M statistics can be utilized to pair-match. All pairwise comparisons were calculated, i.e. M was calculated between left calcanei and all right calcanei (N=139; including the correct homolog) in the sample. Values of M were compared to the 90th percentile of M, 95th percentile of M, and the maximum value of M; this resulted in a reduction in the number of potential pairs requiring visual pair-matching up to 86%, 83%, and 73%, respectively. Using the maximum values of M to mark inclusion/ rejection, false rejections of the proper pair occurred in up to 2% of the 139 comparisons. Further analyses will compare this data to the coloured and black South African population groups and the use of pooled values of M will be explored. These results may have the potential to assist in the re-association of individuals from commingled remains cases, no matter the population group nor admixture of the sample. **References** 1. Byrd JE, Adams BJ. Osteometric sorting of commingled human remains. J Forensic Sci. 2003; 48(4):717-24. 2. Byrd JE. Models and methods for osteometric sorting. In: Recovery, Analysis, and Identification of Commingled Human Remains. Springer; 2008. p. 199-220. 3. Thomas RM,

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FOCUS VARIATION WITH INTEGRATED FORM REMOVAL FOR FORENSIC COMPARISON OF BULLET STRIATIONS

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This paper presents a novel focus variation FV instrument method to acquire and process bullet surface datasets for forensic comparison. The objectives of the current work are to apply new 3D instrument technology with integrated form removal and processing with wavelet filtering to improve ballistic striation matching. In the field of firearm identification much work has been done on methods to measure and discriminate between the characteristic striations which are imparted to a bullet during firing.

The test bullet group for the current work comprised 19 bullets fired forensically from 9mm pistols, 8 designated test object bullets, and 11 designated test sample bullets. Each test object was compared with 1 test sample fired from a different pistol (known non-matches). Three of the 8 test objects were also compared with 1 test sample fired from the same pistol (known matches). An AliconaTM IFM G4 focus variation instrument with rotary 4th axis was used to acquire point cloud (3D) data sets for bullet comparisons. The acquired data sets were annular (1.4mm wide) and initially processed with an integrated script written to operate on the FV instrument. This initial processing is termed "unwrapping". The unwrapped files are then processed in SurfstandTM software to isolate the D5 wavelet surface frequency band; between Fn/32 and Fn/16 (where Fn is the highest frequency of the surface). At optimal alignment "cross correlation max" CCFmax and difference parameter Ds are calculated as correlation metrics to compare surface striations for discrimination. For the bullet test group presented, unambiguous individual discrimination is achieved by applying the criterion; values of CCFmax >66% indicate a match unless they are combined with a Ds >100 then a non-match is indicated. CCFmax offers spatially sensitive point for point surface correlation but is scale insensitive while Ds lacks any spatial information it is sensitive to scale. Thus it is clear that for reliable discrimination these two correlation metrics need to be considered together. The current method has the advantage over many existing techniques that a given region of bullet striations can be compared with the whole surface of test bullet in a single process to give single best match correlation. It also helps to avoid the possible adverse effects on correlation from the distorting influence of Gaussian filters. A larger sample of bullets will be required to show the general significance of the technique but good individual discrimination is seen for the presented test sample.

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THE APPLICATION OF QUESTIONED DOCUMENT EXAMINATION IN THE AUTHENTICATION OF CHINESE PAINTING

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Chinese painting, also known as *guóhuà* (meaning "national painting"), is an ancient and unique painting genre of China. After thousands of years of development, Chinese painting has accumulated rich and mature techniques of expression and retained a large number of exquisite masterpieces of art. It is an important carrier of traditional Chinese culture. Chinese painting is generally classified as figure painting, flower and bird painting, and landscape painting. The critical elements of a Chinese painting include composition, brushwork, inscription and seal, and the artistic conception is the spirit. In modern times, masterpieces created by famous artists such as Wu Changshuo, Qi Baishi and Pan Tianshou are of unique styles and appeal to both refined and popular taste. Taking chicken, birds, fish, insects and other "farm treasures" as the theme, contemporary artists have created a variety of art works. Due to the special artistic value and considerable economic value of Chinese painting, the art market is filled with fakes of famous art works. Once litigation arises, the authenticity of questioned paintings needs to be determined. Different from traditional painting and calligraphy appreciation, the forensic expertise of calligraphy and painting use the methods for examining handwriting, seals, printed documents, altered documents and document materials comprehensively, as well as the traditional methods of calligraphy and painting appreciation, to make a scientific judgment on the authenticity of the questioned art work. In this paper, the forensic examination of 130 questioned calligraphy and painting art works was introduced. The questioned art works were claimed to be created by a well-known late contemporary artist of Chinese painting. The characteristics of inscription, name seal, composition and brushwork of the questioned art works were compared with those of the original paintings preserved by the relatives and the printed copies issued by official publishing houses. The formation of inscriptions and name seals, and the characteristics and changes of handwriting and seals of the questioned and known paintings were elaborated comparatively. Learning from the traditional methods of calligraphy and painting appreciation, the typical paintings that took chicken, birds and fish as the theme were further analyzed from the aspects of composition, brushwork and expression form of lines and colors. This practice explores an approach to the application of questioned document examination technology in the authentication of Chinese painting, and provides a way of thinking and examination for the authentication of calligraphy and painting works.

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RULER DROP TEST AS A TOOL TO DETERMINE POOR REACTION TIME IN DRUNKEN DRIVERS OF SRI LANKA

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Introduction: Sri Lankan law recognizes drunk driving as an offence. However, determination of drunkenness is either by performing a medical examination to determine that he/she is under the influence of alcohol or performing a breath test by an approved device. The ruler drop test, a simple test to assess the reaction time, has been introduced to the Guidelines for Clinical Examination for Drunkenness by Government Medical Officers prepared by the College of Forensic Pathologists of Sri Lanka. However, no formal study has been carried out in Sri Lanka to assess the response to this test among normal Sri Lankan population. **Objective:** The aim of the study was to determine the standard reference norms for ruler drop test as a test of reaction time among the general public of Sri Lanka, in order to use it as a tool to assess poor reaction time among drunken drivers. **Study design:** This cross sectional descriptive study was carried out among randomly selected 903 individuals of different ages, with and without non communicable chronic diseases and who had not consumed alcohol within the last 12 hours. The test was explained and demonstrated by the investigators. The examinee conducted the ruler drop test three times on dominant hand and the best was taken as the value. **Results:** Out of 903 individuals 768 (85%) were less than 60 years of age while 135 (15%) were 60 or more than 60. 415 (46%) of the sample were having some form of chronic diseases. 113 (12%) showed a poor reaction time or could not catch the falling ruler at or before 22cm level, which is identified as a positive point for alcohol consumption according to the guideline. 97.5% of the individuals could catch the falling ruler at or before the level of 13.7 cm. There was no significant association

of old age (P=0.479), sex (P=0.96) presence of chronic diseases (P= 0.580), level of education (P=0.377) or chronic substance abuse (P=0.17) with poor reaction time. **Conclusions:** Only 88% of the study group showed a good visual reaction time. There is no correlation of the tested variables with the poor reaction time. When 95% confidence interval is considered the value to be considered as poor reaction time among Sri Lankan general public needs to be changed to 13.7 cm. The study needs to be further expanded to include individuals under the influence of alcohol.

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BATCH VARIATION WITHIN SEIZURES CONTAINING MULTIPLE COCAINE BRICKS: A CASE STUDY

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From South America, cocaine is trafficked throughout the world. The cocaine is usually shipped as compressed bricks weighing approximately one kilogram and imprinted with a logo. When the police seize multiple cocaine bricks imprinted with the same logo in a single case, many questions arises. Do the bricks originate from the same clandestine laboratory? How many different production batches are present within bricks that on the exterior look the same? Is it possible to conclude whether two production batches within a seizure originate from the same laboratory? In this case study, these and more questions will be investigated. The alkaloid and residual solvent profile batch variation within three large cocaine seizures in which the seized one-kilogram cocaine bricks contained the same logo will be examined. The three cases consist of 36, 84 and 100 cocaine bricks, respectively. Each cocaine brick will be profiled according to its alkaloid and residual solvent content using gas chromatography-mass spectrometry (GC-MS) and headspace GC-MS.

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RESEARCH ON KEY TECHNOLOGY OF FACE RECOGNITION

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Because the monitoring video acquires the data without intervention, it is unable to control the unfavorable factors, such as gesture, light and shade, making the algorithm of face recognition more difficult and the accuracy of face recognition algorithm lower. Among them, because the shooting angle is fixed in the video, the gesture such as the profile and looking up and down belongs to one of the most common and unfavorable factors, and with the increase of face deflection angle, the difficulty of the face recognition algorithm increases dramatically. Therefore the primary problem to be solved in surveillance investigation is the face recognition in the case of different gestures. On this practical problem, this paper presents the application of 3D face rectification technique to solve the problem of gesture and deflection angle in this paper. Based on this face recognition algorithm, the recognition rate is increased effectively. In this paper, the technology of face sharpness can effectively restore the fuzzy face, restoring facial details and improving recognition rate.

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APPLICATION OF ESDA IN DETERMINATION OF TAMPERING

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Objectives: To highlight the importance of ESDA in determining alleged tampering in a questioned note book and to discuss the circumstances in which ESDA can be a significant tool in cases involving tampering where conventional use of VSC does not produce promising results sufficient to prove alleged tampering. **Background:** One of the most demanding fields of Forensic Document Examination is to prove alleged tampering in a disputed document using a variety of techniques. When examining a piece of writing for alleged tampering, one of the things the examiner looks for is any difference in writing instrument/ink used, this will consequently result in one of two findings i.e., the writing instrument(s) used in the area of the questioned writing is similar/same, or more than one (different) writing instruments have been used. In the latter scenario, the interpretation is usually easier, whereas in the former, there may be no tampering or tampering using the same or similar enough writing instrument. The examination may become complicated when the suspected tampered area of writing involves writing instruments having similar enough ink composition to evade differentiation by commonly used non-destructive methods. Such disputed documents prove to be more demanding for the document examiner, and the use of alternate techniques accompanied by problem solving approaches become essential. **Method:** The authors of this paper selected a case that involves successful detection of tampering (alteration) in the disputed note book. The case presented a common problem involving use of same or similar enough inks/writing instruments for tampering that conventional use of video spectral comparator (VSC-6000) was unable to prove tampering in the disputed note book. Based on preliminary examination of the disputed entry, the examiner was sure that 'something' was suspicious about the specimen and continued to investigate. At last, the examiner processed the page underneath the disputed page of the note book by using Electrostatic Detection Apparatus (ESDA^2). Use of ESDA^2 resulted not only in a number of findings sufficient to prove tampering in the questioned note book but also provided probative evidence to the investigation. **Conclusion:** Use of ESDA^2 seems to be an ideal technique in cases where no significant visually apparent signs of tampering were present. Tampering (alteration) done with same and/ or similar type of ink/writing instrument but lacking normal and natural writing flow, consistent writing pressure and involving suspicious pen lifts may be successfully revealed by using ESDA^2.

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DETERMINING THE PRESENCE OF SPERMATOZOA FROM MALE DNA FRACTIONATION DURING DIFFERENTIAL EXTRACTION

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The Centre of Forensic Sciences (CFS) implemented a 'Direct to DNA' (DTD) approach for the examination of relevant vaginal, oral, rectal and external genitalia swabs from sexual assault examination kits in 2012. Using this approach no preliminary serological screening for semen is performed but rather swabs are directly subjected to differential extraction and quantitation using a dual quantification system. Decisions regarding the next steps in processing each sample are based solely on the quantity of male DNA detected and its ratio to the total human DNA in the sample. In the absence of serological results it is of value in many cases to determine whether semen is present in the sample and whether the male DNA profile may be attributed to this body fluid. We examined the fractionation of male DNA from various different body fluids between

'epithelial' and 'sperm' fractions following differential extraction. Based on these results we identified criteria under which a DNA profile can be reliably attributed to spermatozoa. A total of 18 blood samples, 129 saliva samples, and 78 semen samples were processed. The maximum amount of male DNA observed in the 'sperm' fraction of a semen-free sample was 10.41ng and the greatest percentage of total male DNA in the 'sperm' fraction was 7.7%. The minimum percentage of male DNA in the 'sperm' fraction for a sample containing semen was 52.6%. This research supports a 50% threshold of male DNA in the 'sperm' fraction following differential extraction as a conservative criterion enabling the scientist to opine in the absence of serological results that spermatozoa are present in a sample. This general threshold is applicable to all sample types (underwear, clothing, swabs, condoms) tested. We further demonstrate that enrichment calculations must be based on the measured quantity of male and total DNA in each fraction; apparent enrichment based on electrophoretic ratios alone may be erroneously interpreted to indicate the presence of spermatozoa in a semen-free sample.

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SURVEILLANCE AND EPIDEMIOLOGICAL STUDY OF ILLICIT DRUG-RELATED FATALITIES IN TAIWAN (2001-2015)

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A retrospective study of 5236 (19.6%) substance abuse-related fatalities (3872 cases of illicit drugs-related and 1364 cases of alcohol-related) collected from 26655 medico-legal autopsy cases during 2001-2015. The manners of death of 3872 illicit drug-related fatalities includes: accidental cause of death (2070 cases), suicidal cause of death (804 cases), homicidal cause of death (384 cases), natural cause of death (404 cases) and unknown cause of death (210 cases). The group consists primarily of male with 2668 (68.9%) drug-related fatalities with an average age of 39.5±0.4 years. The illicit drug abuse patterns of in Taiwan have become multifarious. In addition to methamphetamine and heroin, multiple-drugs abusers became the major category of illicit drug-related fatalities including, ketamine (16 cases in 2007 to 107 cases in 2015), flunitrazepam (FM2; from 12 cases in 2005 to 74 cases in 2015) and zolpidem (from 16 cases in 2005 to 45 cases in 2015) and became the major trend with contaminated syringe injection to induce bacterial emboli with great diversity of infectious diseases including AIDS, myocarditis, bronchopneumonia and hepatitis, etc. Mephedrone, PMMA, PMA, 5-MeO-MiPT, ethylone, methylone, 4-methylethcathinone (4-MEC), methylone (bk-MDMA), 4-fluoroamphetamine (4-FMA), 4-chloroamphetamine (4-CA), methedrone, MDPBP and have been recognized as emerging new psychoactive substances (NPS) in Taiwan. From 2013 to 2015, there is increased NPS abuse cases, such as ethylone (0 to 31 cases), PMMA/PMA (1 to 41 cases) and methylone (3 to 13 cases). These trends and results will arouse public attention and play a crucial role for the sketching the government's strategic of the anti-drug scheme. T*his work was supported by Ministry of Justice, project no. 106-1301-05-04-02.*

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OPTIMISATION OF DNA PROFILING IN SEXUAL OFFENCES – AN CROSS-DISCIPLINARY APPROACH

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Allegations of sexual offences against women and vulnerable people continue to rise globally. Despite recent research efforts to explore and identify preventative solutions, the treatment of the victims, the investigative response and judicial outcomes frequently fall below the standards expected, consistently generating poor conviction rates. It is accepted that positive outcomes in sexual offence cases are contingent on good communication and collaborations across a multifaceted and cross-disciplinary array of experts working together. This presentation demonstrates the benefit of adopting this ethos in associated forensic science research, unifying stakeholders and optimising research to areas that best support the investigation. The focus here is on the processing and utilisation of DNA across the investigation process. The use of DNA in this regard is well established. However within forensic science, structural changes, inadequate funding and constrained resources continue to isolate key organisations and impair their capacity to generate published research and meaningful impact on frontline practice. Whilst scientific advancements continue to evolve despite these challenges, the absence of partnerships between academics, the police and forensic service providers propagates independent research projects that are highly specific and low impact, that are unsuccessfully embedded into practice and inhibit the dissemination of knowledge on a holistic platform. This lack of contingency can be demonstrated through the rapid advancement in DNA profiling technology, for which its position within sexual assault investigations is unquestioned. Whilst its application is absolute, the implementation and distribution of new technologies have not been without criticism. The introduction of DNA17 and Y-STR profiling has undoubtedly progressed investigative potential, however without the support and training to reinforce this degree of development throughout the criminal justice system, how well prepared is our structure for change? This presentation will discuss and deliberate how this isolated and independent style of research can be remodelled using a contextual design framework, a novel way of identifying and conducting meaningful research in forensic science. By utilising collaborations between academics, the police and forensic service providers, a processing continuum from the users perspective will be expanded upon, identifying fundamental variations and inefficiencies within rape investigations. It is from this design that requirement based research, dissemination of knowledge and associated outcomes will be tailored to fit and embedded into frontline practice, unifying organisations to improve communication, funding availability and forensic awareness.

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MICROSCOPY OF TRACES ON TAPE LIFTS WITH HIGH OPTICAL RESOLUTION

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Recovery of traces is a crucial first step in many forensic investigations. Tape lifts have become a standard means to recover fibre traces, gunshot residues, and DNA traces. Hitherto, tape lifts are used mainly to recover fibres. Traces collected on tapes can be investigated microscopically, but the detail that can be resolved is limited. Therefore, relevant traces are normally isolated from the tape and prepared by other means, e.g. in a microscope slide. Isolation of traces is time consuming and the incompatibility of current tapes with high resolution microscopic investigation is therefore an important limitation of tapes used for tape lifting. In a current research project, we have tested many tapes for the following requirements -high optical quality, compatible with high resolution microscopy -compatible with polarisation and fluorescence microscopy -compatible with UV/Vis spectrometric studies -compatible with later analyses by other (non-microscopic) technique, such as dye analysis, ICP-MS, PCR, SEM, etc. -available in large areas at a reasonable cost -easy application in case work In the current contribution, we will summarise the results of this project. We have found a tape that provides a very high optical quality and provides good applicability. We will present an overview of the tapes investigated and the selection of an optimal tape. We will present the results of microscopic and microspectrometric studies of traces collected on these tapes. In addition we will discuss the isolation of traces from these tapes and results of studies into the compatibility of

the used tape with additional techniques, such as ICP-MS. Finally, we will comment on the future possibilities these tapes may offer.

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COMPLEMENTARY STRATEGIES IN DNA IDENTIFICATION OF SPECIFIC CASES OF MINA DISASTER VICTIMS

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The deadliest hajj disaster in the history of pilgrimage happened on 24 September 2015 and over 400 Iranian pilgrims suffocated in Mina, Mecca, Saudi Arabia. Because of the loss of identity documents and identification issues of victims, 461 bodies supposed to be Iranian were transferred to Iran for further DNA matching process and identification. According to the instructions for genetic identifications, close relatives of victims were identified and blood samples were collected on FTA cards for autosomal S.T.R analysis. The AmpFlSTR Identifiler ™ kit was used as the commonly commercially available S.T.R kit (Applied Biosystems, USA). All victims were identified except two brothers, one of them has a son. DNA profiles have shown an exceptional pattern between DNA profiles of this two brother and alleged son. Of the fifteen autosomal loci analyzed between both the victims and the son, just in one locus (CSF1PO) none of the heterozygote alleles inherited from one of the victims to the son. Due to one similar case, reported in American Journal of Forensic Medicine and Pathology in 2013 by Forensic Genetics Laboratory of Mashhad, Iran, additional autosomal S.T.R loci were analyzed using 24Plex investigator IDplex™ kit (Qiagen, Hilden, Germany). Two more exclusions found in the additionally examined loci (SE33 and D2S1024) which clarify the paternity case. Following use of INDELs markers included in DIPlex ™ kit (Qiagen, Hilden, Germany) the disputed father confirmed. This condition much more happened in populations with high rates of consanguinity which leads to loss heterozygosity in informative loci within families. We concluded that DNA identifications in the populations with high rates of consanguinity, need additional autosomal locus and different markers such as INDELs, for the higher power of discrimination, especially for close relatives.

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CORRELATION OF POSTMORTEM LODOX RADIOLOGICAL IMAGES AND LUNG PATHOLOGY: A PROSPECTIVE AUTOPSY STUDY

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Background: The LODOX Statscan is a whole-body digital X-ray scanning device which was adapted for medical usage. The LODOX has an established role in the field of Forensic Pathology where it shows high sensitivity and specificity for the detection of skeletal pathology and foreign bodies. The role of the scanner in the detection of soft tissue pathology in the lungs of adults has not been reported and this study aims to review the radio-pathological correlation and the applicability of LODOX as a viable screening tool in the detection of lung pathology in post mortem cases. **Methods:** We prospectively reviewed cases which were referred for medico-legal autopsy between November 2012 and March 2013 to the Tygerberg Forensic Pathology Service mortuary, Cape Town, South Africa. One hundred and fifty-nine cases (159) met the prescribed inclusion criteria and underwent LODOX scanning as well as macroscopic and microscopic evaluation of the lungs as permitted by the Inquests Act 58 of 1959. The macroscopic and microscopic variables were considered the "gold standard" when compared with the results of the LODOX. The sensitivity, specificity, positive and negative predictive values were assessed. **Results**: The most common radiographic patterns reported were the presence of ground glass opacities and consolidation. Overall, the results of our statistical analysis showed a low to moderate sensitivity (26.3% to 50.4%) of the LODOX feature of ground glass opacity in the prediction of microscopic pathology (oedema, acute inflammation, chronic inflammation and features of diffuse alveolar damage). Similarly, low to moderate sensitivity (19.7% to 65.5%) was noted for the LODOX feature of consolidation ($p < 0.05$). This value was slightly lower than that reported for pneumonia using conventional X-rays in the ante-mortem period. Additionally, these LODOX patterns have a high probability of representing oedema or autolytic/decomposition change. Generally, LODOX predictions were better at excluding pathology which was not present rather than confirming pathology which was present. **Conclusions:** Despite post mortem scanning by LODOX offering excellent evidentiary value in the demonstration of a pneumothorax it shows low sensitivity and specificity in the detection of lung pathology. Thus, the LODOX, as with other radiological applications, has limited value as a "stand alone" test in the evaluation of lung pathology in the post mortem period. Further prospective study is advised to better define the role of the LODOX in the detection of soft tissue pathology and its applicability of use in the setting of Forensic Pathology.

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RECOVERY OF FINGERMARKS FROM METALLIC SURFACES USING A SCANNING KELVIN PROBE

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Latent fingerprint evidence is a significant tool used to provide a means of potentially identifying individuals in criminal investigations. Traditional techniques to recover latent fingerprints from metallic surfaces do not consider the metal surface properties and instead focus on the fingerprint chemistry. The Scanning Kelvin Probe (SKP) technique is a non-contact, non-destructive method, used under ambient conditions, which may be utilised to recover latent prints from metallic surfaces and does not require any enhancement techniques or prevent subsequent forensic analysis. SKP may be used to record a volta potential map of the surface by contact potential difference (CPD) measurements with a resolution of the probe diameter (50 – 300 µm in this study). Where a fingerprint ridge contacted the metal, the CPD contrast between the background surface and the fingerprint contact area was 10 - 50 mV. This CPD change was used to recover fingerprints from flat Brass, Nickel, and Copper metal surfaces. Scanning Electron Microscope (SEM) scans were used to identify the fingerprint contact areas through Sodium, Chlorine and Oxygen EPMA. The fingerprint can also be observed in the backscattered electron image as the carbon deposits from the fingerprint scattered the electrons less than the surrounding metal surface. Additionally, for the Copper sample, the fingerprint is shown clearly in a Cathodoluminescence scan as it blocks the photon emission at band gap (2.17 eV) from the underlying Copper Oxide (Cu_2O) surface. Measurements were performed on the untreated metal surfaces and compared to traditional forensic enhancement techniques such as vacuum metal deposition (VMD) using Au-Zn and Au-Ag. Using VMD, the CPD change ranged from 0 - 150 mV between the dissimilar metal surfaces affected by the fingerprint. In general, SKP worked best without additional enhancement techniques. Results obtained were very encouraging and suggest that the Scanning Kelvin Probe technique, which does not need vacuum, could have a place as a first stage analysis tool in serious crime investigation.

Disclosure: All authors have declared no conflicts of interest.

THE CONTRIBUTION OF FORENSIC PATHOLOGY IN THE TREATMENT OF CAUSTIC INGESTION

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Background: Human exposure to caustic substances is usually due to accidental or suicidal injuries. Ingestion of caustic agents can cause serious damages of the Upper gastrointestinal tract. requiring the use of resuscitation and specific surgical techniques. **Objective:** Caustics are substances that cause both functional and histologic damage on contact with body surfaces, burdened with immediate and delayed mortality. The main purpose of this study, is to identify the mechanism of death after an acute caustic poisonings or late complications, **Materials and methods:** A retrospective study. conducted over a period of 04 years, from January 2012 to December 2015.12 cases of caustic ingestion were, autopsied at the Legal Medicine department of CHU of Sidi Bel Abbes Algeria. **Conclusions:** The ingestion of caustic is a serious medical and surgery emergency may affect the prognosis immediately. Based on the results of this study we emphasize on the contribution of forensic pathology to the reduction of morbidity and mortality during the acute phase.

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AN APPROACH ADOPTED IN UNEXPECTED ESCALATION OF CRIMES REQUIRING FORENSIC SCIENTIST EXAMINATION

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The paper aims to present to attendees relevant results of a two-year experimental solution developed to face the increase of robberies in Post Offices and Automated Teller Machines (ATM) of public banks in Brazil. After presenting the results, forensic community will understand that some low cost solutions can result in immediately responses for ordinary problems faced by forensic science in investigation cases. These solutions can be replicated in others countries, including countries with restricted budgets. In this specific case, was established an expert forensic unit to support police investigation. This workforce need special training and professional support to address effectively crimes of this nature. A selection of a restricted group to improve the scene of crime examination was the first step. The paper also discusses the costs, benefits, advantages and disadvantages for the expert forensic unit. The data suggests that there is evidence showing quality increase of services, timely processing of cases and ensuring the integrity of chain of custody. This new strategy has improved police efficiency and aims to elucidate bank and post office robberies in Brazil.

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DETECTING 1,4-BUTANEDIOL IN BEVERAGES

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The compound 1,4-butanediol (1,4-BD) can be a prodrug for gamma-hydroxybutyric acid (GHB), a date-rape drug. Since the schedule I classification of GHB by US DEA on March 13, 2000, several other analogs which are more readily available have been developed to elicit effects similar to GHB, including 1,4-BD. Due to increased public awareness, an inexpensive colorimetric test for the detection of "date rape" drugs such as GHB and ketamine, in beverages has become available. By adding drops of the suspect beverage to the test spot, it turns a dark blue color if there is 1,4-butanediol, ranging from 0.1% to 30%, in such drinks. Although 1,3-propanediol and 1,5-pentanediol can give false positives, a color change for tested drinks should serve as an ample cause for caution.

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THE ROLE OF THE FORENSIC NURSE IN ELDER ABUSE

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The population is aging and it is estimated that 4-10% of seniors experience abuse. While there are various forms of abuse such as financial, physical, sexual and emotional, often there is more than one happening at the same time. Forensic nurses can play a key role in the medico-legal care of these vulnerable individuals. They possess an understanding of the unique dynamics or factors involved in these sometimes complex relationships between the elder and the aggressor while having an appreciation for the relevant legal aspects. Forensic nurses also have the ability to assess, identify, document and photograph injuries in the living victim and collect forensic evidence based on the details of the abuse. Additionally these unique healthcare providers have the knowledge, experience and skill to assess risk and to work with community partners to plan for safety for the victim. This presentation will look at the prevalence of elder abuse and the complex dynamics often at play, discuss various forms of abuse and indicators in living victims, and discuss case studies to demonstrate the unique role that forensic nurses play in elder abuse medico-forensic care.

Disclosure: All authors have declared no conflicts of interest.

INVESTIGATING THE WEATHERING PATTERNS OF BIODIESEL

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Vegetable oil and B100 biodiesel fuel were tested in order to characterize any bacterial and thermal weathering patterns and to test the applicability of ATR-IR and Raman spectroscopy for fire debris analysis. During the first section of this experiment, the bacterial degradation pattern of vegetable oil was tested. Six solutions of vegetable oil/bioddiesel and dichloromethane were left to incubate in the presence of soil containing bacteria for a period of 34 days, with one sample being examined every 7 days, starting at day 0. The samples were analyzed using ATR infrared spectroscopy to show weathering patterns as the molecules degraded. Data suggested that the triglyceride molecules broke down starting from the carbon chains until around day 34, resulting in a collapse of several major IR peaks. A linear relationship was discovered in the growth of the peak at 721.7 cm^{-1} over time that could potentially prove useful in the determination of the age of an oil of biodiesel spill or bio-diesel accelerated arson. Thermal degradation patterns of vegetable oil and B100 biodiesel fuel were investigated using IR and Raman spectroscopy.

Disclosure: All authors have declared no conflicts of interest.

TOWARDS THE DEVELOPMENT OF SEMI-SYNTHETIC STAINING FOR THE DETECTION OF ERASED TATTOO ON THE LIVING

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Voluntary distinctive marks such as tattoos make it possible to affirm a person's affiliation to a group, to indelibly wear one's story or to transform

all or part of one's body into a work of art. Tattoos can help establish the identity of a victim of a crime or of the offender. Thus, the removal of tattoos can pose a problem for the identification of a person. Even if histological restoration techniques are possible on a corpse, the challenge remains to develop a safe and painless method to be used on a living person.

The project consists of developing luminescent derivatives of curcumin and to test their potential application to the identification of erased tattoos using skin penetration differences between the affected areas during the process of tattoo eradication (necrotic areas) and the unaffected areas. These compounds are produced mainly by acylation of the hydroxyl functions of the aromatic nuclei of curcumin. The diacetylated analogs of curcumin were obtained with an average yield of 70%. The various tests carried out describe the fluorescence of the product, its solubility in non-toxic solvents for living organisms and their absorption in porous materials. Antiproliferative activity assay on various types of cells (HaCat, DU145, MCF-7, MDA-MB-231 and SKOV3) will also confirm that the molecules themselves are not toxic for the living.

Disclosure: All authors have declared no conflicts of interest.

PROPOSALS DEATH CERTIFICATION

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Background: The death certification continues to be debated within the medical profession and the judiciary one, as well. To sign such a document is not a trivial procedure and it can result in serious consequences, such as administrative and judicial hassle, medico-social concerns, epidemiological complications tc... the aim of this work is to elaborate improvement proposals of the death certification. **Methods:** The investigation was documented from death certificates signed by GP that led to a Forensic autopsy at the Forensic unit of the University Hospital of Sidi Bel Abbes.We have analyzed A total of 50 death certificates between January 2014 and April 2014. **Conclusion:** Based on the results of this study we emphasize on the contact of GP with forensic pathologist and on the continuous medical training for GP. Finally, it is important and advisable to give more power to the forensic pathologist.

Disclosure: All authors have declared no conflicts of interest.

FEMALE GENITAL MUTILATIONS: A TYPE OF VIOLENCE AGAINST WOMEN AND VULNERABLE SUBJECTS

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Violence against women continues to persist despite numerous attempts to prevent it. There are still many hurdles to overcome with regard to gender equality. Existing forensic services has been proven inadequate to sufficiently address the vast crimes against woman and children, victims of sexual violence, sociocultural crimes, abusive religious rituals. One aspect concerns devastating traumas resulting from female genital mutilation (FGM) practiced in the women original countries and, nowadays, even in the immigration acceptance Countries. The World Health Organization (WHO) estimates that 100-150 million women underwent FGM and 3 million girls are at risk every year. Although governments recognize in FGM an act of violence against women with violation of human right, cultural issues intrude in the debate. In Italy, the problem exists, as in many other European and international countries. The n.7/2006 Italian law severely punishes those who practice FGM; however, more than 10 years later, no significant results have been reached by the Justice. This phenomenon represents a challenge for healthcare system and evidence-based studies could be more important in order to better identify it and to create a protocol for its correct management. In the protocol we are developing, a multidisciplinary study of this phenomenon (forensics, gynecologists, and lawyers) is scheduled. The purpose of the study is to quantify and describe FMG, through the work of forensics and gynecologists, as much as possible, in persons coming in our region (Lombardy - Northern Italy) for clinical reasons or as asylum seekers. It became evident the widespread lack of knowledge of these practices in the clinicians. Lawyers' role consists in analyzing cases and facilitating the identification of this phenomenon proposing a prevention program based on increasing the knowledge of the consequences of female genital mutilation of young women. Moreover, with the collaboration of physicians, lawyers' objective is to establish training courses for healthcare professionals.

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THE RIP BULLET: PRESENTATION OF CASES AND DISCUSSION OF THIS NEW NOVEL AMMUNITION

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We present three fatal gunshot wound cases in which the victims were shot using the novel ammunition R.I.P. (Radically Invasive Projectile) bullet, produced by G2 Research Ammunition Company. After attending this presentation, the audience will gain familiarity with the wounds, unique radiographic appearance, and the potential risks associated with handling/removal at autopsy associated with this novel ammunition. In Chicago, between November and December 2016, three individuals were shot with R.I.P ammunition. All the victims were black males ranging in age from 20 to 32 years. One of the victims was shot with both R.I.P and the more common copper jacketed bullets. The entrance wounds and exit wounds were typical in appearance to other gunshot wounds. Trocar/base fragmentation, within the bodies, varied among the cases, and an unexpanded/un-fragmented R.I.P round was recovered from a thick article of clothing in one case. Removal of the trocars was as hazardous as with other hollow point ammunition, and caution is always advised. The most unique feature of the R.I.P was its appearance on radiographs. The trocars and base, can be missed or mis-interpreted on x-rays, especially if the body has clothing with radiopaque embellishments, or if the body habitus results in sub-optimal views. The R.I.P. bullet, was introduced in 2014, and marketed as "the last round you will ever need". It is a solid copper, hollow point, computer numeric control (CNC) - machined round that is designed to fragment depending on the caliber into six or eight trocars, which along with the base will result in seven or nine wound paths upon impact with soft tissue. In the wound course the base continues in a straight path penetrating up to 15 – 17 inches (38.1 cm – 43.18 cm), while the trocars continue in separate tangential directions with an up to a 6-inch (15.24 cm) spread and 4 – 5 inches (10.16 cm – 12.7 cm) of penetration. When passing through hard surfaces (wood/bone) the bullet is not supposed to separate and maintains its integrity. From available testing information, the bullet will perforate hard surfaces but will not necessarily fragment appropriately upon striking soft tissue due to the hollow chamber being clogged or changing the shape of the trocars. Every year there are new bullet types produced by ammunition companies, the forensic community is often the first to see the real-world application of these designs and needs to keep abreast of what is available.

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RIGOROUS STUDY OF FINGERMARK RECOVERY USING A SCANNING KELVIN PROBE

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Traditional techniques to recover latent fingerprints from metallic surfaces do not consider the metal surface properties. The Scanning Kelvin Probe (SKP) recovers latent fingerprints best, in an energy map of the surface, from metallic surfaces without further enhancement techniques, under ambient conditions. As a non-contact, non-destructive technique, SKP does not prevent subsequent forensic analysis. The Contact Potential Difference (CPD) change was used to recover fingerprints from a variety of flat Brass, Iron and Copper metal surfaces. Further instrumentation was developed to allow rotational SKP scans to record fingermarks on an Iron Rod and a Brass cartridge cleaned post firing. The measurement configuration was optimised to undertake scans within a stable relative humidity and temperature environment to prevent natural atmospheric deviations from adversely impacting the resulting fingerprint images. The quality of the fingermark images produced using SKP is high and the ID point recovery was equivalent to the same area fingerprint shown in ink on paper. The data quality is sufficient to recover 1st, 2nd and 3rd level detail. The Scanning Kelvin Probe latent fingermark recovery technique provided on average over ten 2nd level detail ID points per planar sample and 30 ID points were found between a thumb and forefinger print on the Brass Cartridge. The contact fingerprint area available on a cartridge is reduced but the number of ID points found was consistent with the same area on the planar scan and there is the opportunity to recover two prints from the cartridge surface area. Ten different donors were used as test-subjects. The ridge contrast for most participants was 50 ± 10 mV on Brass and Iron planar surfaces but one of the donors had a much greater CPD contrast of 85 ± 5 mV. A fingermark on a flat Brass surface was rescanned 5 months after initial placement; there were originally nineteen 2nd order ID points detected and all nineteen were present when rescanned so there was no detrimental impact on the ID information. This is the first time a rigorous study of SKP fingermark recovery using a variety of different donors has been performed. Results obtained were very encouraging and suggest that the Scanning Kelvin Probe technique could have a place as a first stage analysis tool in serious crime investigation.

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INFRARED PHOTOGRAPHY - AN AUXILIARY TOOL IN BLOODSTAIN PATTERN ANALYSIS

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Introduction: The more complicated a forensic case turns out to be, the more important additional information becomes. Infrared photography allows for both the documentation and the analysis of findings within the infrared wavelength area. It can reveal relevant information that the naked eye cannot detect. It is comparatively cheap, comes along without harmful radiation or chemical reactions, is applicable within a short time frame, and can easily be carried to every crime scene, lab, or physical examination. The resulting pictures are of high resolution, brilliant quality, and fulfill the criteria for being accepted as evidence at court. Handling and applications will be explained on example cases as well as possibilities and pitfalls. **Methods:** Infrared photography was additionally used in cases where bloodstain pattern analysis was supposed to be performed on dark clothes of people involved in a crime. For this purpose, a digital single lens reflex camera modified for infrared photography was used. The pictures were taken in manual mode and stored as raw data file. Depending on the contrast of the surface, ISO-setting was chosen between 100 and 2000. The focus was either adjusted manually or by using the camera´s autofocus. Afterwards, the photos were altered in an image-editing program with regard to contrast and exposure. **Results:** Due to strong absorption of infrared light, bloodstains appeared dark. Dark textiles, however, reflected infrared light and became bright. The resulting contrast between traces and textiles permitted performing bloodstain pattern analysis and the reconstruction of the course of events. **Discussion & Conclusions:** Modern infrared photography is an important tool in bloodstain pattern analysis and should be used additionally in routine casework. It is portable and usable in every crime scene or lab. The results are valuable evidence for the criminal proceedings at court concerning the reconstruction of happenings and the role of people involved in a crime.

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DEATHS IN CUSTODY IN ISRAEL – INVESTIGATION UNDER CONSTRAIN AND MISTRUST

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Deaths in police custody often attract a large amount of public interest and are frequently associated with controversy related to the circumstances of death and whether the death could have been avoided. Investigation of these cases is of high importance in order to assure that there is no violation of human rights including the right to appropriate medical attention in persons whose liberty was removed from by the state, and thus they are unable to seek medical treatment freely. When dealing with these cases in Israel two major issues arise: investigation under limited autopsy ability due to religious reasons and lack of trust in state institutions especially in cases of deaths of security prisoners: - In Israel there is religious opposition to autopsies by both religious Jews and religious Moslems, so performing an autopsy in these cases may be limited. - Approximately a third of prisoners are security prisoners (as defined by the Israeli prison system, most of these prisoners are Palestinians), and death in custody of these prisoners raises wider attention due to the political background and constant suspicion of abuse of human rights. While death in custody had been researched in many counties never has this issue been medically reviewed in Israel. We sought to investigate the death causes of prisoners and detainees in the past years, and determine if there is a distinction between different groups of prisoners in that respect (prisoners belonging to minorities compared to those from the general population, security prisoners compared to criminal prisoners, aged prisoners to younger ones etc). Also, we sought to examine in which cases there was a tendency to perform a full autopsy as compared to a limited investigation due to the limitation described above. In order to do so we reviewed cases of deaths in custody brought to the forensic institute in Israel between 2001 and 2016. There were 241 cases brought to the institute - autopsy was performed in almost 70% of cases. We present the data obtained from the review of these cases, and discuss how we deal with the situations described above, including through collaboration with our Palestinian colleagues in some of these cases.

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STUDY ON SURVIVORS OF DOMESTIC VIOLENCE PRESENTED TO BASE HOSPITAL, AVISSAWELLA, SRI LANKA

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At present, gender based violence has been recognized as a health issue in Sri Lanka and centers to provide consultancy services for women and under-aged children who were subjected to sexual and gender based violence and seeking medical treatment at the Hospitals were established during last decade. "*Mithurupiyasa*" at base hospital Avissawella, Sri Lanka is one of these centres managing a large amount of such victims every month. **Objective** The aim of this study is to describe the types, injury patterns and consequences of domestic violence among women and girl children presented for management at Mithurupiyasa in Base Hospital Avissawella. **Methdology** A retrospective descriptive study based on case records of the victims of gender-based violence presented to the "*Mithurupiyasa*" at Base Hospital Avissawella, during a period of 3 months. **Results** Out of 102 individuals 55 (54%) were between 31 to 40 years of age while 70 (69%) were married women who were abused by their husbands. 58 (57%) of the sample were unemployed house wives. 97 (95%) presented following physical abuse and associated sexual abuse was reported among 48(47%). Injuries were located in the head or face together with upper extremities in a majority 84(82%) while they were contusions and abrasions among 73(72%). Majority 59(58%) had been subjected to forceful sexual intercourse while there were 24(24%) who had faced unnatural sexual offences. Abuse has been continued for more than 6 years among a majority (99%) with no complaint made to the police among 33(32%). There was a significant association of the duration of abuse and the legal actions (P=0.017). Morbid jealousy (60%) and influence of in laws (56%) were identified as the main underlying reasons for violence. Substance abuse was reported among 71 (70%) the perpetrators. Out of them 67 (65%) reported adverse consequences of domestic violence among their children. Psychological consequences were observed among 85(83%) with suicidal threats in 55%. Psychological consequences are significantly associated with sexual abuse (p=0.01). **Conclusions** Domestic violence is associated with serious adverse psychosocial consequences that need prompt management. Yet, unsurfaced long term repeated suffering is common among Sri Lankan women who really does not want any legal actions. These findings should be taken into account and the management should be mainly aimed at rehabilitation of both parties and decreasing the adverse effects of domestic violence.

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A REAL TRACE EVIDENCE CASE PRESENTED AS A COMIC

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Samples from a real case involving the murder of two men left at night beside a solitaire road were submitted for soil comparison to our lab. Although the soil analysis provided a positive association between the K&Q samples it was an unexpected paint chip the one that finally helped to solve the case. The way the events happened provided an ideal argument for making a comic out of them.

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FATAL PULMONARY THROMBOEMBOLISM – PREVALENCE OF RISK FACTORS IN ONTARIO MEDICOLEGAL AUTOPSY CASES

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Pulmonary thromboembolism (PTE) is a thrombus (antemortem blood clot) that is lodged in an artery of the lung and has originated from a distant site, usually from deep veins of the leg. A retrospective study was performed to identify and evaluate emerging and classical risk factors of pulmonary thromboembolism (PTE) using Ontario medicolegal autopsy reports from 2011 to 2014. The emerging risk factors included diabetes, opioid use and dehydration which can increase thrombus formations due to their effect on blood flow and/or in producing hypercoagulable states. In addition, autopsy reports of non-PTE deaths (matched by year) were reviewed and compared to PTE deaths for demographic characteristics and risk factors in the medical histories. There were 287 cases of autopsy-confirmed PTE deaths, representing an incidence of 1.23% in the four years. The modal age groups were 40 to 49 years and 50 to 59 years (range: 19-94) with a male to female ratio of 0.95:1 for the PTE deaths. There was only one case with an identified genetic risk factor, Factor V Leiden mutation. The results of this study show that a significant proportion of PTE cases had classical risk factors, including: obesity (48.1%), prior surgery (22.0%), immobility prior to death (14.6%), cancer (12.9%), and oral contraceptive use (5.90%), when compared to the non-PTE group. However, diabetes, opioid use and dehydration were not significant risk factors for PTE when compared to the non-PTE deaths, nor did they have an additive effect. Although, the incidence of PTE was low, diagnosis of PTE or deep vein thrombosis prior to death was only present in 7.3% of PTE cases. In addition, in approximately half the cases, the source of the deep vein thrombus was identified. This indicates that the evaluation of a patient's medical history for risk factors is essential for the proper diagnosis of PTE to prevent sudden death. The significance of this project is that it can aid pathologists in using predisposing factors in their cause of death statements for PTE deaths, and it can allow for clinical consideration for at-risk individuals. In addition, a scoring system can be created using these risk factors to correctly diagnose patients with PTE, thus reducing morbidity and mortality associated with pulmonary thromboembolism deaths.

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WHEN YOU SEED VIOLENCE YOU HARVEST VIOLENCE- ADOLESCENT PARRICIDE. CASE PRESENTATION

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Violence is a learned behavior and the family has been considered its primary training ground. Family violence is a widespread social phenomenon recognized all over the world and parricide is one of its extreme consequences. Although parricide is a rare event, it impacts negatively all members of the family. Parricide is the murder committed by the child against one or both his/her parents, motivated either by the child's severe mental disorder or his/her attempts to protect him/herself or other family member from violence. Usually, the child suffered previously prolonged abuse physical, emotional and/or sexual. The authors present the case of a 15 years old boy that killed his father by blowing him repeatedly with a metal bar. The father was a violent person who used to beat his wife and sons. The night he committed the crime, he witnessed a highly traumatic experience, when he saw his father beating to death his mother and threatening to kill him. After the incident, the boy called the police and recognized the murder. The medicolegal psychiatric examination revealed that the patient was a hard working student without any history of mental illness. The complex psychiatric examination concluded that he suffered an acute stress reaction on the background of repeated psychical and emotional abuse and that his judgment was abolished at the moment

he committed the crime. This case shows that violence breeds violence and highlights the necessity of effective efforts to prevent and combat family violence.

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IDENTIFICATION OF 9MM CARTRIDGE CASES ON THE BASIS OF STRIATED EJECTOR MARKS

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During firing process, Firearms produce unique microscopic markings (individual characteristics) on ammunition components. The potential marks for identification of firearms are usually breech face marks, ejector marks, extractor marks and most significant the firing pin impression. In this case study a 9mm pistol was identified upon the basis of a striated ejector mark that was repeatedly occurring on test fires as well as evidence cartridge cases. Firing pin impressions on evidence cartridge cases and test fires were different but ejector marks were in sufficient agreement with each other. Further these results were verified using the Automated Ballistics Identification System (ABIS).

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CASE STUDIES ON NEW PSYCHOACTIVE SUBSTANCES IN SINGAPORE

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New psychoactive substances (NPS) have emerged worldwide during these few years. This trend was also observed in Singapore, whereby it has increased 6 folds from 2011 to 2016. Analysis of NPS is challenging as they appear in various unknown forms and complex matrices such as ecstasy tablets, liquids and powdery substances. Hence, complacency of using a default analytical procedure or a widely heralded gold standard technique such as Gas Chromatography-Mass Spectrometry, might no longer be sufficient and in some instances, can even lead to misidentification. The possibility of a compound having structural isomers made the identification more even challenging, requiring rigorous analytical schemes even though reference material is available in the laboratory. As a result, appropriate sample preparation, combination of analytical techniques and thorough data interpretation are required. The challenges and methodology implemented in our laboratory for the identification of NPS will be presented through four case studies: (a) differentiation of bk-DMBDB from its possible isomers; (b) differentiation of 2-furanyl fentanyl from 3-furanyl fentanyl; (c) conversion of 4-AcO-DMT into psilocin in basic extraction and (d) effect of pH on the sample preparation of Mexedrone.

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CLINICAL DIAGNOSIS VERSUS AUTOPSY DIAGNOSIS IN HEAD TRAUMA

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The correct and complete diagnosis is essential for the adequate care and the favourable clinical evolution of the patients with head trauma. **Purpose:** To identify the error rate in the clinical diagnosis of head injuries as shown in comparison with the autopsy diagnosis and to identify the most common sources of error. **Material and method:** We performed a retrospective study based on data from the medical files and the autopsy reports of patients with head trauma who died in the hospital. We collected: demographic data, clinical and laboratory data and autopsy findings. To quantify the concordance rate between the clinical diagnosis of death and the autopsy diagnosis we used a 4 classes classification, which ranged from 100% concordance (C1) to total discordance (C4) and two classes of partial discordance: C2 (partial discordance in favour of the clinical diagnosis- missing injuries in the autopsy reports) and C3 (partial discordance in favor of the necroptic diagnosis- missing injuries in the medical files). Data were analyzed with SPSS version 2.0. **Results:** We analyzed 194 cases of death due to head injuries. We found a total perfect concordance between the clinical death diagnosis and autopsy diagnosis in 30.4% of cases and at least one discrepancy in 69.6% of cases. Increasing the duration of hospitalization directly correlates with the amount of the imaging investigations and these in turn correlates with an increased rate of the diagnosis concordance. Among the patients with stage 3 coma who associated a spinal cord injury, we found a partial diagnosis discordance in 50% of cases and a total discordance in 50% of cases, possibly due to the need for conducting emergency imaging investigation and the need for surgical treatment. In cases with partial and total discordant diagnosis, at least one lesion was omitted in 45.1% of the cases. The most commonly omitted injuries in C2 cases were subdural hematoma, intracerebral hematoma and ventricular hemorrhage (21.6%). In C3 cases the most omitted injuries were subarachnoidian hemorrhage and skull base fractures (17.9%). **Conclusions:** The clinical cause of death is not always concordant with the autopsy diagnosis. Autopsy may, in addition to providing useful elements for the police investigation, to identify the inconsistencies in diagnosis, the injuries frequently skipped and the factors favoring the discordance rate between the clinical death diagnosis and the autopsy diagnosis, making it a valuable tool for improving the clinical care of the patients with head trauma.

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ASSESSMENT OF HEART WEIGHT AND HEART WEIGHT/BODY PARAMETERS COEFFICIENT IN SOUTHERN IRANIAN ADULTS

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The organ weight is one important indicator to discern normal condition from abnormal in forensic pathology as well as in clinical medicine. In this study, we investigated heart weights of southern Iranian, which can be fundamental sources to be compared with abnormal cases of the organs. Body parameters and heart weights 501 Southern Iranian adults (385 males and 116 females) during ordinary post-mortem examination, were measured. The weight of hearts in males were significantly more than those of females. The hearts became heavier in weight, as one got older and heart weights of the males were at the age of 76-85 and for females at the age of >85 years old. The weights of heart had no correlation with body weights but there was correlation between heart weights with individuals' BMI and body length. The results of this study can be considered as useful anatomical data for autopsy investigations, clinical practices and research in southern Iranian.

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SUDDEN DEATH DUE TO ARRHYTHMOGENIC RIGHT VENTRICULAR CARDIOMYOPATHY: A STUDY OF 40 AUTOPSY CASES

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Arrythmogenic right ventricular cardiomyopathy (ARVC) is an increasingly recognized entity in forensic practice, characterized by replacement of

myocardium by adipose or fibroadipose tissue and sudden death. This is the first series documenting ARVC as sudden cardiac death (SCD) in 40 separate autopsy cases from forensic practice in China. There were 21 males and 19 females, and mean age at death was 35 years. SCD is the first manifestation of most patients and no previous family and medical history in all cases. Acute stress, increased cardiac workload and alcohol is common involved trigger. The mean heart weight was 381 g (range from 240 to 590g) and 9 cases had relative heart hypertrophy. Microscopic abnormalities consisted of replacement of myocardium by adipose infiltration in 65% of cases and fibroadipose in 35% cases. 80% cases were restricted to the right ventricle, with biventricular subtype in the 20% remaining cases. Inflammatory cell infiltration was found in 27.5% cases, but myocyte necrosis was found in only one case. In 12.5% of cases, the cardiac conduction was infiltrated by fibrosis, adipose or both. There is still no consistent autopsy criterion for the diagnosis of ARVC. Combination of gross and histological examination with post-mortem genetic analysis is recommended to assist in identifying ARVC.

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FATAL ANAPHYLAXIS AS AN UNUSUAL PRESENTATION OF HEPATIC HYDATID CYST: AN AUTOPSY CASE

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Hydatic disease is a parasitic infestation caused by a tapeworm of the genus Echinococcus. Liver is the most common localization of the Echinococcusgranulosis cyst. The disease may remain clinically silent for many years. Sudden death due to unrecognized hepatic hydatic cyst is rarely reported in the literature. The most common fatal complications are anaphylaxis. Non traumatic leakage of cyst contents in the blood circulation is an uncommon factor for anaphylaxis, and is rarely reported in available literature. We describe anaphylaxis in a 26 years old lady with medical history of asthma, who presented dyspneaafter a minimal effort, followed quickly by loss of consciousness. She deceased on her arrival to hospital. The forensic autopsy revealed a macroscopically non ruptured hydatic cyst in the right part of the liver, in close contact with the vena cava. The diameter of the cyst was about 10 cm, with multivesicular content and bloody fluid cyst. No evidence of pulmonary embolism was found. Sudden death in this case was attributed to anaphylactic shock caused by non traumatic intravascular spread of the cyst material. Although the condition is uncommon, the possibility of complicated hydatic disease should be taken into consideration in cases of unexpected death especially within children and young adult in endemic areas.

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MULTIDISCIPLINARY FORENSIC CASE CO-ORDINATION AT THE NFI IN THE NETHERLANDS

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As an intake co-ordinator at the Netherlands Forensic Institute (NFI), I would like to apply for a poster presentation on multidisciplinary forensic case co-ordination at the NFI at the IAFS 2017. At the Netherlands Forensic Institute we, as intake co-ordinators, are concerned with advising the applicant (mostly police and/or public prosecutors), as well as the intake of cases, screening applications for content, organizing and chairing forensic intake meetings, planning the preliminary investigation of exhibits in various departments and co-ordinating multidisciplinary forensic cases as required, among other things. In a forensic intake (FIT) meeting the following persons are always involved: the intake co-ordinator (IC) as a technical chairman, experts from the NFI, police forensic investigators, tactical detectives and the prosecutor. During a FIT meeting, the content of the case is reviewed and various research possibilities are discussed in response to a clear research question. Following this meeting, the decision can be made to have the case co-ordinated internally at the NFI, overseen by the IC. We, as the IC, have started co-ordinating cases over a year ago. However, we are also still searching for some sort of best practice. I would like to, through a poster presentation, explain how case co-ordination is currently regulated in the Netherlands by the NFI. This also means discussing, when a case meets the qualifications for co-ordination, how it will be handled by the intake co-ordinator, the tasks and responsibilities of the intake co-ordinator within the case co-ordination, but also what to expect from the police, NFI-experts and the prosecuting officer. We aim to discuss the problems we encounter within the case co-ordination, why we believe it could have added value to the case investigation, and to ask other participants at the conference how case co-ordination is regulated by them, if it at all, and if so what are their experiences. After attending this presentation, attendees will have an understanding of the manner in which multidisciplinary forensic case co-ordination is conducted in the Netherlands and the potential impact on investigations. This presentation can have an impact on the forensic science community by presenting and sharing our vision of multidisciplinary forensic case co-ordination, and will open the discussion in order to improve this area of expertise.

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POPULATION GENETICS OF 30 INDELS IN HAN CHINESE POPULATION FROM ZHEJIANG PROVINCE

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Insertion/deletion (InDels) markers can serve as a useful supporting tool to short tandem repeat (STR) typing systems for human identification. The Qiagen DIPplex Investigator kit, which contains 30 biallelic autosomal InDels and amelogenin, has been developed for forensic use. To estimate the genetic diversity of the 30 markers in Han Chinese individuals living in Zhejiang and to further evaluate their applicability in forensic science, 246 unrelated Han Chinese from Zhejiang were genotyped at these loci. No significant departures from Hardy-Weinberg equilibrium were observed at these loci in these participants. The combined power of discrimination was over 0.99999999 and the combined probability of exclusion was over 0.9901. Results demonstrated that the 30 InDel markers could be used as a supporting tool for the human identification of specific Han Chinese individuals from Zhejiang. The genetic differences and phylogenetic relationships among Han Chinese from Zhejiang, Han Chinese from five other areas, nine minority ethnic groups, as well as two other East Asian populations were also investigated. Two InDel markers, HLD39 and HLD40, showed significant allele-frequency differences between Han Chinese from Zhejiang and ethnic minorities. Further analysis can be used to evaluate their role in forensic science.

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SEXUAL HOMICIDE: AN UNUSUAL CASE OF MECHANICAL ASPHYXIA BY THREE DIFFERENT METHODS

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Sexual homicide is one in which there is physical evidence of sexual activity which has occurred in close temporal and physical proximity to the murder or when there is a legally admissible statement by the perpetrator of sexual activity. Sexual homicide is a relatively rare crime of violence. The reporting rate of sexual murder constitutes between 1-4% of the overall annual homicide rate in the United States, Canada, and the UK.

We report the case of the sexually-motivated homicide of a 27-year old woman, caused by three different forms of mechanical asphyxia: ligature strangulation, manual strangulation, and chocking. Each of these three methods were performed simultaneously and in varying combinations to cause the death of the victim. In addition, toxicological blood examination revealed a nontoxic level of methamphetamine. All these criminal offences were carried out by one single male perpetrator during sexual activity. These asphyxial activities had been carried out before repeatedly by both parties in order to enhance sexual drive, but to a lesser extent.

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AQUATIC DECOMPOSITION IN FRESH WATER

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Introduction: Limited research has been done on the process of decomposition of human remains recovered from water. There is no reliable method for determining the time elapsed since death, the post-mortem submersion interval (PMSI), for bodies recovered from water. This study aims to increase the accuracy of determining the PMSI of human remains recovered from fresh water in the Netherlands. **Materials and methods:** In this retrospective study, data was collected from case files of bodies recovered from fresh water in the Netherlands in the time period of 2006 to 2014. Cases with a known PMSI and color photographs were included. An Aquatic Decomposition Scoring list (ADS) was applied on the cases to quantify the degree of decomposition. **Results:** Photographs of sixty-seven human remains recovered from fresh water were included. The photographs were scored by using the Aquatic decomposition score (ADS) developed by Van Daalen and de Kat (Journal of forensic science March 2017). The LADS (Limb ADS) showed the highest correlation of ($r=0.712$, $R^2 = 0.569[P<0,001]$). The BADS (Body ADS) showed a high correlation of ($r=0.698$, $R^2 = 0.569[P<0,001]$) and the LogADD (Log Accumulated degree days) versus the FADS (Facial ADS) had the lowest correlation of $\rho=0.574[P<0,005]$. **Conclusion:** The Aquatic decomposition (ADS) was applied to photographs of bodies recovered from fresh water. The LADS (limb ADS) showed a high correlation with the accumulated days degrees. Using the ADS can contribute to determining the post mortem submersion interval.

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THE ESTIMATION OF THE POSTMORTEM INTERVAL: A PHYSICOCHEMICAL MODEL

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Over the last few decades, different methods for determining the post-mortem interval (PMI) in the early period have been described through the biochemistry of the vitreous humour. Recent studies in this field focus on the correlation between increased potassium and hypoxanthine [Hx] concentration and PMI. Despite the numerous papers published in this regard, there is no consensus on what should be the method of choice due to the existence of factors that may influence the determination of this interval. Different conditions, such as ambient temperature, have been used by different authors as correction factors for estimation, improving the prediction. Taking into account the difficulties of knowing the latter and the easy measurement of the weight, which logically influences the time it takes to cool down, we have developed a new model to estimate the PMI. This model takes into account the concentration of potassium in the vitreous humour, the weight and the rectal temperature of the deceased. The contribution of the aforementioned variables is conformed using an additive model. As a result of this work, a method is provided that allows the estimation of the PMI in the early period in a precise, fast and easy way.

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A COMPARISON OF SUICIDE BY SELF-IMMOLATION BEFORE AND AFTER REVOLUTION OF JANUARY 2011

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Introduction: Suicide by self immolation is a violent and spectacular way of suicide. The causes are complex. However, it's often linked to social and political protest acts. In Tunisia, the suicidal self immolation of Mohamed Bouazizihas triggered a revolution against the political regime and was followed by several suicides using the same way. This study aims to assess the prevalence of suicide by immolation in our town, to establish the victims' profile related to suicide by self burning and to compare this profile before and after the Tunisian Revolution. **Materials and methods:** We conducted a descriptive, retrospective and cross-sectional study including all cases of self-immolation that occurred over a period of 10 years (2006-2015) and examined in the Department of Legal Medicine of the HabibBourguiba Hospital in Sfax (Tunisia). **Results:** A total of 64 cases were collected with an average prevalence of 0.35/100000 habitants/year. The average age was 31.6 years with male predominance (82.8%). The majority of victims weresingle (65%) and semi-skilled or jobless (73.4%). 31.2% of victims had a psychiatric history. Most of them were suffering from schizophrenia. 20% of cases had a history of previous suicide attempt. The most reported reason of suicide was the family conflicts (17.2%), followed by psychiatric diseases decompensation or financial problems (14.1% and 10.9% respectively).The most cases of suicide occurred in public places or in private domicile.82.8%of victims were hospitalized. The average body burned area was 69.7%. The comparative study before and after the revolution of January 2011 revealed that the number of cases of self immolation has tripled after 2011. Concerning the victim's profile, the significant variations were observed in the gender of the victims, the reasons and the places of suicide. **Conclusion:** After revolution the suicide by immolation increased significantly. Therefore, we need to establish urgent measures of prevention, a national suicide registry and a national instance responsible for follow up of this phenomenon.

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ARE YOU FINE? TRAINING IN ASSESSMENT OF PERSONAL INJURY BASED ON BIOMECHANICAL ANALYSIS

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Musculoskeletal disorders are one of the most common injuries that provoke disability after traffic and work accidents. Very often conventional diagnostic techniques do not show apparent injuries at organic level. This situation forces clinicians to work in uncertainty which could produce inappropriate evaluations and treatments with a negative impact on the Health Systems as well as patients. Currently, biomechanics is among the fastest growing research fields in two areas: the evaluation of work

accident sequels and minor injuries occurred in traffic accidents. The importance of biomechanics lies in obtaining objective information used for clinical treatment planning, its control and determination of symptoms that do not correspond to the real state of the patient. AREYOUFINE? project has developed, implemented and set the basis for a new Body of Knowledge, focused on biomechanical analysis methodologies, in order to improve clinical and forensic assessment of the main prevalent musculoskeletal disorders. In the initial stages of the project we have carried out a thorough analysis of different medico-legal processes which involve the Bodily Harm Assessment in nine European countries. This meant identifying the institutions, actors and legal frameworks implicated in the evaluation of bodily damages and their medical assessment. Additionally, an analysis of the training needs in this field has been carried out by means of a study in which participated 458 potential users from 13 countries. This information was used to select and adapt the formative needs of the project. A Quality Committee formed by external consultants of recognized prestige in the world of legal medicine and clinical assessment, not directly related to the project development, has participated in the evaluation of the course contents. Finally, a pilot course has been carried out to validate the quality, utility and applicability of contents. Sixty forensic experts in this area from 4 EU countries have participated in this course. The consortium is composed of six institutions thus guaranteeing interdisciplinary skills: two Universities with expertise in Forensic Science (USC) and Law Sciences (SSSUP); a research centre of reference in biomechanics and its application in medicine (IBV), which is the coordinator of the project and finally a reference institution in developing of methods for health management systems (CIOP). Additionally, two international associations: CEREDOC, which represents the national associations of doctors and lawyers working in judicial and insurance fields, and the International Academy of Legal Medicine (IALM). This project is funded by European Commission ERASMUS+, project number 2015-1-ES01-KA202-016294

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COPAN CPA200™ SEMI-AUTOMATED CARD PUNCHER – VERSION 2 PERFORMANCE

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Introduction: The CPA200™ is a semi-automated punch system designed to process human blood or saliva samples, spotted on filter paper or cards, in forensic/genetics laboratories. CPA200™ offers punching accuracy and delivering of each punch into micro-wells plates, flexibility to process different card shapes and dimensions, samples traceability using barcode reader and camera control and integration into laboratory SOP and LIMS. After releasing CPA200™ in 2015, Copan NewLab Engineering developed the CPA200™ Version 2 (V2), currently available on the market. The CPA200™ V2 was developed after collecting all the requirements received from North America, Europe and Asia end-users. New features were added like extra punch of already processed cards, extra cleaning strike, resume protocol after interruption, customizable number of cleaning strikes, plate layout cloning, automatic export of reports, renewed graphic software interface, speed performance improvement and better compatibility with different brands of 96-wells plates. The objective of this study was to demonstrate that the CPA200™ V2 can generate punches from saliva or blood samples deposited on cards or collector devices, to obtain human DNA profiling while preventing cross-contaminations and DNA carryover between wells/samples. **Methods:** In this study, saliva and blood samples from different donors were spotted on Whatman® FTA® cards (FTAC), Copan NUCLEIC-CARD™ Color (NCC) for saliva, Copan NUCLEIC-CARD™ White (NCW) for blood and Bode Buccal DNA Collector (BBC) for saliva. Five 96-wells microplates were filled with punches performed by the CPA200™ following a ½ zebra + ½ checkerboard pattern, composed of negative control punches from blank cards alternated with punches from (1) NCC with saliva; (2) indicating FTAC with saliva; (3) NCW with blood, (4) non-indicating FTAC with blood, and transferred into empty wells; (5) BBC with saliva transferred into wells prefilled with Prep-n-Go™ Buffer. One cleaning punch was done from blank cards between consecutive samples to clean the puncher and avoid cross-contaminations. All punches were amplified with GlobalFiler® Express PCR Amplification Kit on Veriti® 96-well Thermal Cycler and fragments were analyzed on Applied Biosystems™ 3500 Genetic Analyzer. Data was analyzed with GeneMapper ID-X v1.4. Results **Conclusions:** When performing a zebra-checkerboard plate pattern with the CPA200™ V2 instrument, 100% of complete and reproducible DNA profiles were obtained from punches obtained from the three different sample card types spotted with saliva and blood samples. No cross-contamination or foreign alleles were detected in the samples. Additionally, no random carryover contamination was detected in any of the negative control punch.

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A STUDY ON WOMEN REPORTING OF SEXUAL CRIMES TO A POLICE IN AN URBAN AREA OF SRI LANKA

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Introduction: Fear of sexual violence can affect the very nature and quality of women's lives in a social context but at a personal level they experience significant long- and short-term physical, emotional, psychological and reproductive health problems. Reporting of sexual violence to criminal justice system in any society follows the iceberg phenomenon due to associated social stigma. Although reporting of sexual crimes to the police has increased over the years in Sri Lanka, the conviction of perpetrators in a court of law is very low **Methodology:** A descriptive study using an interviewer administered questioner on women reporting sexual crimes to the police was conducted. The study was aimed at finding the demographic associations of victims who reported sexual crimes to police and their perpetrators as well as the nature of crime and the underlying reasons for the crime in a socio-cultural context. Data was gathered from 11 police station in Kelaniya Police division from the Western Province Sri Lanka. **Results:** During the study period (2014 April-August) 164 women who reported sexual crimes revealed that majority (66%-n=109) were between 18-35years of age while 4 %(06) were elderly. Although 86% have passed either G.C.E.(Ordinary level) or Advanced Level exam only 42% (67) were employed. 62% of the study sample were married. The most commonly reported sexual crime was sexual harassment 47%(78) which has mainly taken place at the work place followed by rape (15%-24). Grave sexual abuse and unnatural sexual offences accounted for 06 cases while 9%(15) were related to trafficking. 43% were victimized at their own house. Workplace sexual harassment was also associated with sexual bribes while sexual harassment via mobile phones or internet were also reported. Analysis of the alleged perpetrators revealed that 28% were unknown while 78% were known persons. **Conclusions:** Sexual violence may not be completely understood and explained by the few factors that are studied. Young, unemployed women are among the majority reporting the victimized sexual crimes. The commonly reported crime was sexual harassment while the victim knows the perpetrator in a majority. Due to many adverse effects of sexual violence on an individual as well as on the community it is crucial to consider factors associated with it widely not only among the individuals who report the violence but also among the unsurfaced survivors.

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A DESCRIPTIVE STUDY ON SEXUAL AND GENDER BASED VIOLENCE (SGBV) AMONG SRI LANKAN POLICE OFFICERS

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Introduction: Reporting of SGBV to the criminal justice system is a difficult decision to any woman in Sri Lanka given the socio-cultural and gender perceptions in the society. Stigmatization attached to intimate partner violence, tolerating because of children as well as economical dependency of a woman have been key factors that prevents a woman reporting to police of the domestic violence she has undergone. However, over the years reporting of SGBV and intimate partner violence in Sri Lankan police has increased. Although Prevention of Domestic Violence Act was available from 2005 in the country, the use of it has been very minimum according to research. Objective To find out the weather police officers are aware of the concepts of SGBV and the perception of their awareness regarding the effects of domestic violence and the legal and social remedies available to respond effectively. **Methodology:** A descriptive study based on interviewer administered questionnaire was carried out in Kelaniya and Rathnapura Police divisions of Sri Lanka during the months of May-July 2016. Data was obtained according to a pre-designed questionnaire. Convenient sampling method was employed and data was analyzed using Statistical Package for Social Sciences. **Results:** Out of the 100 police officers who participated, male: female ratio was 7:3. Majority (84%) were aware of the offences related to SGBV and its effects. Although 92% were aware of the existence of the domestic violence act, 35% stated that they have an above average knowledge while 14% stated that their knowledge was poor. 52 police officers stated that they had never used the act for SGBV so far, while 48 stated they had perused it at least once. Only 5 officers had indicted cases under this act. **Conclusions:** Poor knowledge regarding the domestic violence act is observed among a majority, 11 years after its introduction. Thus, wider awareness programs and regular in course training on the laws of SGBV are identified as needs.

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FORENSIC TESTS PROTOCOL TO ANALYSE FAILURED TIRES FROM ROAD ACCIDENTS

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The statistics point out a correlation between road accidents and tires failure. The tires are complex composite materials having appreciable amounts of rubber, carbon black, silica and other components, which are susceptible of physical chemical characterization. Their performances, and consequently the security level, rely on these features. In order to establish a protocol for forensic characterization, tires were studied in detail. Sampling and physicochemical characterization procedures were analyzed. Samples from scrap tires, from Portuguese roads, not involved in accidents as a matter of legal jurisdiction, were characterized by infrared spectroscopy (ATR-FTIR) thermogravimetry (TG) and scanning electron microscopy(SEM). Additionally, samples of the collected tires rubber were subjected to accelerated weathering tests in a UVB chamber to simulate aging. The data from characterization techniques showed that thermogravimetry is particularly useful for tire analyzing showing aging degradation of the elastomers. The same technique also allows the identification and quantification of the of rubbers mixture of the tire.

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IDENTIFICATION OF SKELETONIZED REMAINS: A MULTIDISCIPLINARY APPROACH FOR CHALLENGING CASES BY CMP

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After this presentation, attendees will gain a better understanding of the necessity of a multidisciplinary approach, as applied by the Committee on Missing Persons in Cyprus (CMP), to resolve the identifications of skeletonized human remains, especially in cases where challenges are encountered pertaining to the evidence recovered. This presentation will impact the forensic community by demonstrating the diversity of challenging factors in cases under investigation, and by highlighting the need for the application of multiple different approaches coherent to the complexity and context of a case in order to achieve identifications. The CMP is a bi-communal body established by the Greek-Cypriot and Turkish-Cypriot communities with the participation of the United Nations. The CMP's objective is to recover, identify and return the remains of 2001 Cypriots reported missing during the inter-communal fighting of 1963-64 and the events of 1974. At present, the CMP identified and returned the remains of 747 individuals. Disappearances of entire families, primary clandestine burials, or burials that have been disturbed and the remains were transferred to secondary locations, superficial burials with surface scattering of remains across kilometers and severe natural or intentional alteration of remains are a few of these challenges that need to be addressed, in order to maximize the potentials of positive identifications. Typically, testimonial information related to the history of an event leads to the location of the grave site. If a burial is located, the accuracy between the testimonial information and the recoveries is evaluated. Laboratory analysis is carried out with no background information, apart from the documented archaeological findings, to minimize bias in the interpretation of evidence. Following the collection of *post-mortem* data, the sorting of commingled remains and the evaluation of the MNI represented in a case, bone samples are selected for genetic analyses. Subsequent to the comparison of bones and relatives genetic profiles, a preliminary match is obtained. Consistency in the *post-mortem* and *ante-mortem* data and pertinent information determines the tentative outcome of a positive identification. When the evidence recovered is limited, or severely altered to produce sufficient data, identifications may be precluded, or resolution may not account for all potential candidates. Information pertaining to the circumstances of disappearance needs to be revised in the light of the recovered findings and the anthropological and genetic data. The resolution of a case is based on the reassessment of all information available, through the employment of a multidisciplinary approach.

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CLINICAL AND AUTOPSY FINDINGS OF FATAL POISONING WITH DATURA SEEDS

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Datura plants cause poisoning in addition to properties and therapeutic applications in consumer and contain hyoscine, hyoscyamine, scopolamine and atropine muscarinic receptors blocks peripheral and central anticholinergic properties respectively. In this report, a case of death due to poisoning by eating Datura seeds diagnosed with poisoning and autopsy is presented. 24-year-old man after taking Datura seeds in order to benefit from the Datura plant some health benefits such as fatigue, headaches and back pain and an unspecified amount and showed symptoms of alertness, lower blood pressure and reduced sensory reflexes to treat will be transferred to the hospital. Hematuria other clinical signs and symptoms of bleeding in the digestive system were revealed. Despite the use of the treatments such as blood transfusions and medications including

benzodiazepines, these treatments were not effective, and death came to him. Necropsy findings included yellowing of the skin, pallor, bleeding, bleeding under the conjunctiva, jaundice in the sclera, signs of restoration in the chest, and minor scratches and a bruise on the right side and parallel to the surface of the abdomen and waist were observed. Traces of blood out of the penis was also found. Finally considering the history of consuming the Datura seed, clinical and para clinical findings as well as necropsy findings with GC-MS confirmation of availability of hyoscine, hyoscyamine, scopolamine in victim's blood, the cause of death for him was reported poisoning with Datura seeds.

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USING MINUTIAE COUNTS IN FINGERMARK QUALITY ASSESSMENT: OPERATIONAL AND PSYCHOLOGICAL PERSPECTIVES

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It is commonly the role of fingermark enhancement practitioners to select which developed fingermarks to submit to the fingerprint bureau for comparison against persons of interest in a case. Through doing so the practitioners act as a filter aiming to submit marks that are of potential evidential value (commonly, marks which are sufficient for comparison), and discard those that are of no evidential use. Previous research has investigated this process through a comparison of laboratory practitioner and fingerprint examiner mark quality assessment and found that this process can be inefficient and vulnerable to the unwanted effects of intrinsic and extrinsic contextual information. Reported practitioner rationale for submitting or discarding fingermarks illustrated a reliance on sufficiency of second level detail, including numerical thresholds of characteristics. It is, therefore, important to establish whether there are differences in the outcomes of this measure of quality between laboratory practitioners, and between laboratory practitioners and fingerprint examiners, and to establish the role that this may play in the efficiency of the fingermark submission decision. This study examined the use of numerical thresholds within the process of fingermark submission decision making from an operational and psychological perspective. Laboratory practitioners and fingerprint examiners within two UK laboratories were provided with a series of fingermark images are were asked to state the number of minutiae present in each fingermark. This study sought to ascertain the level of variability within practitioner and examiner groups in relation the number of minutiae observed within each fingermark, and to establish the relationship between the minutiae counts of the practitioner and examiner groups. Findings illustrate considerable variability in reported minutiae count, indicating subjectivity in this process, from both a laboratory practitioner and fingerprint examiner perspective. The relationship between practitioner and examiner minutiae count will be presented in the context of reported practitioner expectations and in terms of standard UK workflow practices. The results provide empirical data to indicate that there are challenges to the use of minutiae count as an objective measure of mark quality and mark submission threshold. The implications of this finding are discussed in terms of significance for mark submission best practice, operational efficiency, and the underlying psychological theory of decision making.

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FORENSIC STUDY OF CHILD ABUSE AND NEGLECT IN KUWAIT.

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Child abuse and neglect is such a prevalent and widespread problem in Kuwait. The drastic behavior against children is unfortunately inflicted through the care givers especially the parents. As a result, many professionals, especially in the forensic field, are involved in the study and management of such cases with the ultimate goals of recognizing children at risk, diagnosing those cases that have occurred, preventing initial or subsequent injury and bringing perpetrators to justice. The aim of this paper is to review child abuse from the forensic point of view in Kuwait for living and death cases. Some cases managed in the forensic medicine department in state of Kuwait will be discussed. Autopsy was done in suspected child abuse and neglect cases, which was conclusive in most of cases. The application of the new Kuwaiti law for child protection will be discussed with the role of the forensic medicine.

Disclosure: All authors have declared no conflicts of interest.

INFANTICIDE IN SOUTH TUNISIA: A 13 YEARS STUDY

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Introduction: Infanticide is an universal and underestimated phenomenon. In Tunisia, an Islamic country where unmarried pregnancy remains unaccepted by the society, many laws were enacted to protect the children born outside marriage and their mothers. Unfortunately, these measures remain insufficient. The objective of this study is to estimate the prevalence of infanticide in our town, to establish the victims' profile, and to recommend preventive measures. Materials and methods: A descriptive retrospective study concerning 13 cases of infanticide examined between 2004 and 2016 in the department of forensic medicine in Habib Bouguiba Hopsital in Sfax, Tunisia. Results: 46% of the victims were male and 31% were female. The sex of 3 victims was undetermined because of advanced putrefaction. The infanticide happened in rural areas in most of the cases. The majority of the victims were born full term. Half of the corpses were hypo trophic while the remaining half were eutrophic. The average size at birth was 49,2cm. No malformation was found. Essential care was rarely provided. Post-mortem lesions were observed in 38% of the cases. Hydrostatic docimasia was positive only in 2/3 of the cases. In many cases, it was made difficult by the advanced putrefaction. Infanticide by omission was the most frequent mechanism of death represented by voluntary negligence of the new born. The remaining deaths were caused by fatal injuries and mechanical asphyxia. Head injuries were the most frequent lesions. In 31% of the victims, signs of mechanical asphyxia were present. This was essentially caused by ligature and manual strangulation. Conclusions: Few studies treated the subject of infanticide and emphasised on its increasing frequency. Which obligates us to deepen our knowledge of this phenomenon to elaborate more efficient preventive measures. Such measures require the collaboration of social, medical and judicial partners.

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SEXUAL ASSAULT IN A CHILD REVEALED BY PERITONITIS

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Background: Child Sexual Abuse diagnosis has been likened to a "jigsaw puzzle". Physical evidence obtained by an appropriately qualified examiner can support criminal prosecution and child protection, especially in cases of crime denial by the victim or her family. This case report documents an unusual case of instrumental anal penetration in a child, revealed by peritonitis. **Case report**: An 11-year-old girl presented to the emergency for severe abdominal pain. The physical examination found clinical signs of peritonitis. A CT-Scan revealed a peritoneal effusion. At surgery, an abundant fecaloïd peritoneal effusion was observed with a perforation in the anterior wall of the rectum 10cm away from the rectal bulb. Peritoneal

toilet, suture of the perforation and left iliac colostomy were performed. The hypothesis of anal penetration was raised by the surgeon but the patient explicitly denied any anal penetration. The surgeon reported the case to the local authorities which required a forensic and a psychiatric examination. Clinical examination of the anus revealed a perianal erythema and a recent fissure at 5 o'clock position without defloration. The patient's psychological interview revealed that she was sexually abused by her cousin with transanal stick penetration. The aggressor was 12 years old, and used to sodomize her with her consent. **Conclusion:** This case highlights the importance of doing a systematic genital and anal examination in case of peritonitis. We support a collaborative and multidisciplinary pediatric sexual assault protocols to appropriately diagnose and manage pediatric victims of sexual assault.

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SOCIODEMOGRAPHIC AND CLINICAL PROFILE IN ELDERLY SUICIDE VICTIMS: 34 AUTOPSY CASE STUDIES

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The elderly suicide is a major public health problem that is gaining more and more ground, given the aging population problem. This has rarely been the subject of forensic studies in Tunisia. The aim of our study was to identify the sociodemographic and clinical characteristics of elderly suicide victims over 60 years and determine what factors might increase suicide risk in this population. We conducted a retrospective and descriptive study on suicide victims aged 60 and over, autopsied in forensic medicine department of the Habib Bourguiba hospital in Sfax, on a ten-year period between January 2006 and December 2015. We identified 34 cases with an average age of 66 years. The sex ratio was 2.77. Suicide victims were alone in 38.2% of cases. They were inactive professionally in 32.4% of cases. Almost half of suicide victims (44.1%) had a psychiatric history, 40% of depressed pace, 26.7% of bipolar disorder and 13.3% of schizophrenia. Three main factors have been identified as precipitating the passage to suicidal act in our sample: family conflicts (26.5%), financial difficulties (11.8%) and the loss of autonomy (5.9%). Suicide methods were in order of frequency: hanging (50%), immolation and drug intoxication (11.8%), hit by train and poisoning (8.8%), jumping from height (5.9%) and drowning (2.9%). In 55.8% of cases, suicide took place at home. Elderly suicide seems a huge but largely preventable public health problem. Its prevention is essentially based on the identification of risk situations and the detection and treatment of depression: major suicide risk factor in this population.

Disclosure: All authors have declared no conflicts of interest.

TRAUMATIC RUPTURE OF MCA FOLLOWED BY SAH: TAILORED APPROACH WITH POST-MORTEM ANGIOGRAPHIC FINDINGS

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We present the case of a 23 year old man who suddenly collapsed during a physical fight with his friends in drunken state. The post-mortem CT with angiography revealed acute basal subarachnoid hemorrhage with rupture of the left middle cerebral artery. On autopsy, the head, face, mandible and neck showed multifocal hemorrhages with fracture of the hyoid bone, and the pathologic findings of the brain was consistent with CT findings. However, the rupture site was not identified macroscopically and on histologic examination, a microscopic rupture was identified at the proximal portion of the middle cerebral artery, and possibility of arteriopathy was considered. This case illustrates that other parts of intracerebral arteries, other than the vertebral arteries, can be the culprit of rupture, that the rupture site may be confirmed only on histologic examination, and that the post-mortem angiographic findings can be helpful to target the site of vascular injury. Therefore, we suggest that histologic examination of the basal intracerebral arteries as well as the vertebral arteries be critical to medicolegally ensure the death of traumatic basal subarachnoid hemorrhage, and that post-mortem angiography can be an effective and adjunctive tool for tailored approach to find the vascular injury.

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GEOCACHING: A RARE CAUSE OF ACCIDENTAL HANGING

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Accidental hanging is rare across all age groups, and it is even rarer in the adult population (except cases of autoerotic asphyxia). Although this type of hanging is a rare entity, it is occasionally reported in literature. It is very difficult to differentiate between suicidal and accidental hanging. Circumstantial evidence alone can sufficiently indicate the accidental nature of occurrence. In the present case a 55-year-old male was accidentally hanged while rappel on a climbing lane railway bridge. The abseiling order was an effort to find geocaching container, hidden in the middle of one of the pillars of the bridge. Geocaching is an outdoor recreational activity, in which participants use a Global Positioning System (GPS) receiver or mobile device and other navigational techniques to hide and seek containers, called "geocaches" or "caches", at specific locations marked by coordinates all over the world. It is known that during this game the player is exposed to different hazardous situations because the caches are often hidden in hard to reach places such as the pillar of the said railway bridge. The interest in the case is the fact that a man filmed on camera his abseiling, so it was very easy to reconstruct his troubles with climbing rope and therefore also mechanism of death. The autopsy revealed ligature mark around head passing but not tending to slog mouth, abrasion on the chin, and typical signs of suffocation. An absolutely rare finding was a ligature mark on tongue. Toxicological evaluation of the blood was negative. This case reports a rare case of accidental hanging in an adult male and demonstrates the riskiness of this type of outdoor sport activity.

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BURNING THE INFANT BECAUSE OF POSTPARTUM PSYCHOSIS; A CASE REPORT AND REVIEW OF LITERATURE

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The patients with bipolar disorder of postpartum psychosis suffer frank psychosis, cognitive impairment, and grossly disorganized behavior that represent a complete change from previous functioning. A 32 years old woman who burned her 5 months girl using petroleum, had been married for 2 years and they had low socioeconomic status. The past history of the woman shows no previous mental or major physical illness, nor addiction. She showed confused and felt sound of buzzing ears. She also needed to repeat the questions for her and had also no knowledge about the calendar time. She mentioned that was unable to suffer loneliness and felt

hallucinations, dysphoria and danger while she was alone. She told her husband that she heard suspicious voices commanding her to kill herself and her infant girl; these hallucinations began 2 days after the offspring and remained for 5 months with her. Blurred and dark vision were other mentioned symptoms. She had been referred to psychiatric specialist for several times with detection of postpartum depression and finally, she had been ordered to be hospitalized in a psychiatry hospital and undergo needed treatments. But, she avoided to continue and complete her treatments. Finally, after investigation by psychiatry department of forensic medicine administration and also based on past history of the patient, postpartum psychosis was diagnosed and for more treatments she was referred to psychiatric hospital. Therefore, it is critical not to leave alone patients with postpartum psychosis and it is necessary to quickly identify and treat such symptomatic patients.

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ASPHYXIA OR ETHANOL-INTOXICATION? A FORENSIC PATHOLOGICAL AND TOXICOLOGICAL CASE REPORT

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While suspect A and B had kidnapped and been torturing a victim, suspect A covered the victim's nose and mouth with wet towel, afterwards found the victim unconscious. Then suspect B had brought 2 bottle of Chinese wine with high alcohol, filled it into the victim's mouth and dumped him onto road side. Trying to create an accident of death by ethanol intoxication. Police had found the decedent and autopsy was performed. Bleeding spots were found on palpebral and conjunctiva of both eyes, epicardium of posterior wall of the heart as well as the gastric mucous. Mushroom-like froth was found in tracheal cavity and nasal cavities. A small amount of bloody fluid with alcoholic smell laid in the stomach. Toxicology was performed on the decedent's heart blood. Results were negative for the presence of illicit drugs, narcotics and psychotropic medications. However BAC had reached 1680mg/100mL. Suspect A argued that victim was in coma but not death after oral nasal covered, cause of death was ethanol intoxication. While suspect B insisted it was asphyxia by oral nasal covered. Under this situation the judge invited forensic specialist to provide opinions, which are: 1.Victim has swallowing activity and ethanol intake when wine was filling into his mouth, he was in agonal stage but not death. 2."Drink in " 2 bottle of wine couldn't result the BAC in this high level according to the Widmark's formula. But this high BAC in this case can be induced by the wine intake, which can be explained by post-mortem redistribution and diffusion. 3. Signs of asphyxia were revealed by autopsy and ethanol intoxication was confirmed by BAC detection. 4.Cause of death was determined to be asphyxia combine with ethanol intoxication from oral nasal covered and alcohol filled in. Case review reminds us that thorough autopsy and pathological analyses are essential, biological samples of all kinds must be collected and detected especially in cases involved drug or alcohol. Cause and manner of death must be determined with all results by investigation and examination.

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MODERN POSSIBILITIES OF USING THE DATA OBTAINED DURING FORENSIC EXAMINATION

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One of the goals of forensic medicine is to improve the quality of medical care for the population. Current Russian legislation in the field of forensic medical examination strictly regulates the procedure for autopsy. According to this order, each autopsy is accompanied by the registration of more than 600 morphometric parameters, as well as specific characteristics of certain types of lesions. All these data, in our opinion, can be used to improve the methods of diagnosis and treatment. **Goal**. In our study, we tried to show the practical significance of the data obtained from a forensic study of a corpse for the needs of orthopedics and sports traumatology. **Materials and methods**. In the course of the study, we performed an autopsy with a standard registration of morphological parameters, and also supplemented it with dissection of the soft tissues of the corpse in 6 additional localizations, playing a role for the development of degenerative diseases of the musculoskeletal system and sport injuries. There was also a histological examination and medical documentation (if available). **Results**. As a result of the research, we categorised the investigated corpses according to the morphometric parameters, established patterns in the development of degenerative diseases and traumatism and evaluated the morphological results of treatment, if this was done in-vivo. **Conclusion**. The obtained results made it possible to propose a number of changes to the standard diagnostic and treatment guidelines for degenerative diseases of the musculoskeletal system and sport injuries. This approach to the use of autopsy data, in our opinion, can be used on a huge scale. The big date methods in this matter will allow using a huge amount of morphological information from autopsies in clinical practice.

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IMPACT OF MEDICOLEGAL REPORTS ON LEGAL REDRESS OF TORTURE VICTIMS IN SRI LANKA

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Introduction: The actions related to redress of torture victims formulated through court proceedings account for a significant reorientation of the victim in his/her own community with self-respect and dignity. A well-documented medico-legal report on the findings of the victim is of paramount importance in this task. Objective As all torture victims will be eventually assessed by medical/medico-legal practitioners in the country, we thought of assessing the impact of these medico-legal reports on the final judgement of the superior courts and hence the legal rehabilitation offered by the said courts. **Methodology:** We analysed 65 Supreme Court decisions on infringement of Article 11 of the Sri Lankan constitution reported in Sri Lanka law Reports from 1978 to 2006. Medico –legal reports of the relevant victims have been submitted to courts in all cases reviewed. **Results:** It was revealed that the opinions expressed in medico-legal reports have been accepted by courts in all cases decisions as objective scientific evidence of committing torture. In all the above mentioned cases the victims were examined by full time forensic physicians. The content of the medico-legal report specially relating to injury description and interpretation of injuries has been quoted in the final case decision. The full content of the medico-legal report appeared in few case decisions (5 cases) which were entirely based on the opinions expressed in medico-legal reports. It was also observed that the content of the medico-legal reports were arranged in accordance to format described in the Istanbul protocol. Another significant observation was that the medico-legal reports compiled by the junior non-forensic doctors were deficient in content and courts have rejected their findings in several occasions (3 cases) in view of second opinions expressed by more senior full time forensic physicians on the same cases. **Conclusion:** The results clearly demonstrate that the meticulously prepared medico-legal reports submitted by qualified experienced forensic practitioners have a significant impact on the judgement in fundamental case decisions in Sri Lanka. As opinions expressed in medico-legal reports pertaining to alleged torture cases will have a direct impact on the case decisions, it is important to make arrangements to direct all alleged torture victims to be assessed by full time forensic physicians initially for a better outcome. It is also important to maintain a periodic training programme directed at non forensic doctors serving in various parts of the country to uplift their examination and documentation skills on torture victims.

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THE ANALYSIS OF ORGANIC EXPLOSIVES IN VAPOUR SAMPLES USING A LAB-ON-A-CHIP INSTRUMENT

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The detection and analysis of explosives and explosive-related compounds is a heightened priority in recent years for homeland security and counter-terrorism applications. This study aimed to evaluate the use of a commercial Lab-On-a-Chip (LOC) instrument (Agilent Bioanalyzer 2100) for the analysis of explosive vapours. A simple method to collect explosive vapour residues was developed using a glass vial (2 mL) containing different amounts of the target explosives (1 mg/mL). Standards were diluted in 100 µL of acetone to facilitate the evaporation. The top of the vial was covered with a circular 0.5 cm diameter filter paper (Whatman number 1) and submitted to different temperatures ranging from room temperature to 80 ^{0}C for 15 minutes. Following evaporation, the filter paper chads were folded and inserted into the LOC well containing the separation buffer for direct analysis, avoiding any further extraction step. Separations were performed on the standard DNA 500 microchips filled with 10 mM borate buffer containing 50 mM SDS and 2% (v/v) of the Agilent Bioanalyzer DNA dye®. The dye was used as a background for indirect detection by fluorescence quenching using laser-induced fluorescence. The three target explosives, 1,3,5-Trinitrobenzene, 2,4,6-Trinitrotoluene and Tetryl were successfully detected. Results show that a minimum temperature of 40 ^{0}C is necessary to vaporize the compounds using this solvent. Limits of detection under 10 ppm were observed when heating the vial to 80 ^{0}C. The use of a filter paper to collect the explosives residues provides an inexpensive approach for the detection of explosives in the headspace. The ability to analyze explosive mixtures rapidly and at relatively low cost using the Bioanalyzer instrument makes this approach a viable alternative method for explosive screening. The LOC device does not require pumps or gas for its operation and can analyse up to 12 samples in under 30 minutes. This along with its low weight, small size and robust nature gives it excellent potential for portable use in mobile laboratories.

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A PRELIMINARY ASSESSMENT ON MEDICO-LEGAL EXAMINATIONS OF DETAINEES IN SOUTHERN SRI LANKA

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Introduction: The examination of a torture victim is always a challenging task for a government medical officer as he/she has to maintain impartiality while being an employee of the state. The world medical association resolution adopted in 2003 and amended in 2007 on the responsibility of physicians in documentation and denunciation of acts of torture and ill-treatment reiterates this fact. **Objective:** The detainees of special detention camps in southern province of Sri Lanka are usually referred for medico-legal examinations. As examination of detainees from special detention camps for alleged torture is an optimal premise to assess the dual responsibility of forensic physicians, we decided to review all case records of our department pertaining to medico-legal examination of detainees to reappraise the performance levels. **Method:** We analysed 1319 medico-legal case records pertaining to detainees referred from Boossa detention camp to the Ruhuna Deptartment of Forensic Medicine Galle during 2007-2010 time period with regard to locus of examination, facilities available at the locus, interpreter status, duration of examination, documentation of findings and for the opinion/interpretation expressed. **Results:** The consultant judicial medical officers (JMOs) were rarely involved in examining detainees. Majority of detainees were examined by assistant JMOs without any supervision. The detainees were predominantly examined within the detention camp itself. A room within the camp was provided for examination purposes and it had no facilities required for standard clinical forensic examinations. The fellow detainees were used as interpreters and the officials of the detention camp were present within the locus of examination throughout the procedure. The privacy of the detainees was given minimal significance. **Conclusion:** The results clearly show that medical officers involved in examining detainees referred from Boosa detention camp have not followed the standards laid down by the Istanbul protocol for examination of torture victims. All histories recorded in medico-legal examination forms were very brief and confined to few lines though these victims were detained for months/years. Recorded histories also lack authenticity as they were obtained under sub optimal conditions. Most of the detainees had multiple scars which need accurate timing for the purpose of legal redress. However assistant JMOs who were postgraduate trainees in forensic medicine were not in a position to offer firm opinion on timing of scars and their causation. Since detailed accounts of arrest and detention of victims were not available, it was difficult to establish the connectivity of the history and the examination findings.

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WASTEWATER MANAGEMENT: TO REDUCE MEDICO-LEGAL IMPLICATIONS USING INTEGRATED FORENSIC INTELLIGENCE

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Challenges with waste water management are not new and need urgent attention of researchers and policy makers to reduce the burden of medico-legal complications. The global scenario of waste water management is very alarming considering the literature and data available from various studies by scientists. Currently, highly developed countries treat nearly 70% of the generated waste water followed by underdeveloped (28%) and poor countries (8%). The consequence of Minamata City of Japan (1952) is such an example wherein large population was affected with psychiatric and neurological disorders. Minamata disease was caused due to accumulation of methyl mercury in fish and shellfish. Methyl mercury in turn was released by Chisso Corporation, as a by-product of the acetyldehyde manufacture. In order to compensate the health damage compensation act was accorded in 1973 and relief money was paid to the victims. Another incident of natural calamity was observed on March 2011 in Japan due to the leakage of 100 tonnes of radioactive water from a storage tank of Fukushima nuclear plant. Many such happenings are frequently occurring all over the world resulting dreadful situations and concomitantly leading to societal damage at various fronts. Waste water streams in India are heavily polluted with organic and inorganic toxicants such as antibiotics, pharmaceuticals, pesticides, herbicides, endocrine disruptor hormones etc. Conventional standalone methods of waste water treatment are not providing the solutions to tackle the current situation. Seamless integration of multidisciplinary intelligence is utmost required to overcome the challenges of waste water management. Interestingly, recent advancements in forensic science are not only being implemented to solve the criminal endeavours in the medical field but also in analyzing the trace amount of toxicants drained in wastewater by the industries and domestic effluent as well. The present study is being done to review the possible interplay of forensic technology to treat waste water and also to interpret and detect various pharmaceuticals and chemical mixtures being discharged in waste water for which no strict government policies are in place to reduce the burden of medico-legal issues in particular.

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MICROHAPLOTYPES: THE NEXT GENERATION FORENSIC DNA MARKER

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Short Tandem Repeat (STR) DNA mixtures can be challenging to interpret. Factors complicating their interpretation include but are not limited to, sample degradation, allele sharing between contributors, allele drop-out, preferential amplification of smaller alleles within a locus, and PCR artifacts such as stutter. The relative simplicity of typing STRs combined with their highly polymorphic nature, have also resulted in their common use for relationship testing. However, given their elevated mutation rate (several orders of magnitude higher than SNPs) STRs are not ideal markers for this type of analysis. Massively parallel sequencing (MPS) of STR alleles has been proposed as an option to address some of the issues with mixture deconvolution outlined above. Yet, experimental data has shown that interpretation of STR sequences from MPS platforms is not as straight forward as originally anticipated particularly when dealing with significantly imbalanced mixtures primarily because complex STR sequences propagate multiple stutter products. Microhaplotypes (MHs) are loci of two or more SNPs within a short distance from each other (<300 nucleotides) with three or more allelic combinations. MPS methods, by allowing clonal sequencing of individual strands, can distinguish the parental haplotypes at a locus in a sample, which essentially can be considered alleles. MH alleles within a locus all have the same size, do not generate stutter fragments, and have a much lower mutation rate than STRs which make them better suited for degraded/inhibited DNA, DNA mixtures, and in relationship testing respectively. Synthetic mixtures and forensic type samples were genotyped with a MPS assay (Thermo Fisher HIDS Early Access Ion AmpFliSeq GlobalFiler ™ Mixture ID Panel) that included MHs, STRs and Individual Identification SNPs, in parallel with conventional capillary electrophoresis (CE) analysis of STRs (GlobalFiler™). Other mixtures were tested with a 36 MH panel alone and compared to STR typing on CE. Results showed that MHs outperformed both MPS and CE STR typing by detecting the presence of minor contributors in mixtures of 2, 3 and 4 persons, at a 40 to 1, 10 to 1 to 1, and 10 to 1 to 1 to 1 ratio, respectively. Furthermore in forensic like samples, where STR analysis simply indicated the possible presence of a minor contributor but not enough for a comparison, MHs clearly detected the presence of a minor and generated a profile that was suitable for comparison and that yielded a random match probability comparable to a full STR CODIS profile.

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MEDICOLEGAL MANAGEMENT OF 9 MASS AVIATION DISASTER IN TAIWAN (1989-2014)

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Mass aviation disaster is a major issue that requires extensive collaboration of experts to categorize the types and manage the disaster including forensic pathologists, forensic anthropologists, forensic genetics and odontology accompanied with aviation experts, urgent rescuing teams and supporting groups. Experiences of elected nine aviation crashes of passenger aircraft during 1989-2014 were reviewed and analyzed. In addition to unique mid-air disintegration (CI-611), four crashes(GE-235, SQ-006, CI-204, FA-CTR) during initial climbing or takeoff (2/4 human error, 1/4 mechanical failure, 1/4 environmental effect), four crashed (CI-676, FA-7613, FA-7601, GE-222) during approaching (2/4 human error, 2/4 environmental effect) were reported. All fatalities were identified by anthropological methods including forensic odontology, subsequently after 1998, CODIS STRs profiling system were applied in everybody fragment to match with paternity for CI-676, FA-CTR, SQ-006, CI-611, GE-222 and GE-235, unless it is clearly identified. This report is to demonstrate (deceased/total person on board) of CI-204 (54/54), FA-7613 (6/17), FA-7601 (16/16), CI-676 (202/202), FA-CTR (13/13), SQ-006 (83/122), CI-611 (225/225), GE-222 (48/58) and GE-235 (43/58). After establishment the computing program of Aviation Disaster Management System, an automatic input of number of seat, injury pattern of each passenger, anthropological and DNA profilers matching with family member of fatalities as well as survivals during the disaster management is available in Taiwan. The survivability of passenger and crew member on-board is highly correlated with the patterns of crash. In addition to the focusing on deceased collection and identities, medico-legal investigation plays an important role during the investigation of the mock-up of the aircraft wreckage and useful to correlate with survivability of passenger is part of the responsibility of medical examiner to investigate the cause of the airplane crash. *This work was supported by Ministry of Justice(Taiwan), project no. 106-1301-05-04-02.*

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ROAD TRAFFIC FATALITIES IN CHILDREN YOUNGER THAN 14 YEARS IN PRETORIA, 2005-2014.

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Introduction: According to the World Health Organization (WHO), 1.25 million people die each year in road traffic fatalities (RTFs). Internationally, the largest contributory cause of accidental deaths in children is as a result of RTFs. The majority of children in RTFs succumb to head injuries. Preventative strategies such as seat belts and child restraint devices could reduce a significant portion of these deaths in infants and children. In 2013, South African legislative provisions did not mandate child restraint devices in children younger than 3 years. The aim of our study was to review all children younger than 14 years of age who died in RTFs. **Materials and methods:** A retrospective descriptive case audit was conducted on all RTFs in children up to 14 years of age who was admitted to the Pretoria Medico-Legal Laboratory (PMLL) from January 2005 through December 2014. **Results:** Two hundred and sixty eight children were included in the study. This comprised 1.2% of the total annual case load. One hundred and nine (40.7%) were passengers in vehicles, 151 (56.3%) pedestrians and there was 3 cyclists and 4 quad bike fatalities. The majority (65.5%) died before the age of 6 years. Head injury was the cause of death in 157 (58.5% of the cases). Only 99 cases (36.9%) were admitted to hospital. In 49 of the passengers, no restraint was used. Twenty one passengers were ejected from the vehicle. The majority of children who died as pedestrians were aged between 2 and 10 years. **Discussion:** Several publications have indicated the advantage of correctly applied restraint devices in decreasing the mortality of children involved in RTFs. In our study, most infants died as passengers and 35% of all children fatally injured in RTFs were less than 3 years of age. This was the age not included in the legislative provisions mandating the use of child restraint devices prior to the amendment in 2015. The finding that most children died prior to admission to hospital, reiterates the fact that the current amended legislation should be enforced more stringently and urgent consideration should be paid in ensuring road safety for children as pedestrians.

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ETS SHOWS THE HIGHEST STABILITY AMONG ETHANOL'S NON-OXIDATIVE METABOLITES IN POSTMORTEM HUMAN BLOOD

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Background: The non-oxidative metabolites of ethanol: ethyl glucuronide (EtG), ethyl sulfate (EtS), phosphatidylethanols (PEths) and fatty acid ethyl esters (FAEEs), have been viewed as biomarkers of alcohol consumption. However, there is still a lack of systemic study on their post-mortem stability, which restricts their application in forensic cases. This research aimed to compare the stability of these four types of biomarkers in post-mortem blood. **Methods:** Three groups were set as follows in terms of the level and the source of ethanol: blank group, ethanol spiked group and ethanol positive group. Each group contained six blood samples without anticoagulation or preservative from different corpses. The stability of the non-oxidative metabolites of ethanol in these blood samples was investigated under 37°C, 25°C, 4°C and -20°C. The levels of the metabolites were tested every 24 h continuing for 7 days. **Results:** EtS showed high stability at all the temperatures. Other three metabolites all had some problems in stability. EtG was not detected in blank group, but slightly generated in ethanol spiked group at 37°C and degraded in ethanol positive group at 37°C and 25°C. PEths were not detected in blank group, but generation was discovered in some of the samples in ethanol spiked group. In ethanol positive group, PEth levels fluctuated at 37°C, decreased at 25°C and increased at -20°C. FAEEs generated slightly in blank group and obviously in ethanol spiked group at all temperatures. In ethanol positive group, FAEEs were degraded at 37°C and 25°C but generated at 4°C and -20°C. **Conclusion:** EtS showed the highest stability among ethanol's non-oxidative metabolites in post-mortem human blood, and could be used as a reliable biomarker of ethanol consumption.

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VALIDATING THE EFFECTS OF FINGERPRINT PRODUCTS AND TECHNIQUES ON DIFFERENT SURFACES IN JAMAICA

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Background: Fingerprints are used to identify individuals in both criminal and civil investigations. Police forces within the Caribbean region utilize a range of fingerprint powders, chemical enhancement products and techniques to develop and enhance fingerprints. Such products and techniques have not been validated within the Caribbean region. As a result Police forces, universities and forensic science laboratories are not clear on what powder and technique better suited for the different substrate. **Objective:** To investigate on which surfaces fingerprint powders and chemical enhancements work best and what techniques should be employed while applying fingerprint powders and chemicals onto the different surfaces. **Method:** Seven different powders (regular black and white, red and orange fluorescent, white magnetic, red magnetic fluorescent and black magnetic fluorescent) and one chemical enhancement (ninhydrin) were applied to different types of surfaces, unfinished wood, white paper, plastic hard and soft, metal, cardboard, glass, glossy paper (porous and non-porous) using methods applicable for each. A grading system was used to grade the fingerprints **Results:** Regular black powder and black fluorescent magnetic powder were the most effective on all substrates – porous and non-porous tested. Both provided excellent contrast between the ridges and background. The black fluorescent magnetic powder provide excellent ridge detail with good contrast to background was the most suitable for fingerprint enhancement on the unfinished wood. Ninhydrin was very effective on most of the porous substrates tested. It provided very good contrast on white paper but no development was observed on metal, colored plastic and unfinished wood. Clean, detailed prints were obtained when brushing was done in the direction of the ridges. **Conclusion:** The regular conventional black powder and black fluorescent magnetic powder were the most effective on the substrates that were examined. The twirling technique was more effective than brushing or powering from side to side. **keywords:** Fingerprint, validation, surfaces, powdering, grading system

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PROCEDURE RELATED DEATHS AT THE PRETORIA MEDICO-LEGAL LABORATORY

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Introduction Legislative provisions regarding so called anaesthetic/ procedure associated deaths differ significantly between countries. In South Africa, procedure related deaths are legally defined as "the death of a person undergoing, or as a result of, a procedure of a therapeutic, diagnostic or palliative nature, or of which any aspect of such a procedure has been a contributory cause". The change in legislation (in 2008) broadened the cases to be included for medico-legal investigation and served to protect the patients. In these cases where the death follows a medical procedure, there is a tendency on behalf of relatives to raise suspicion pertaining to the possibility of medical negligence. Methods: A prospective descriptive case study was conducted on all procedure related deaths admitted to the Pretoria Medico-Legal Laboratory. The study period was one year. Results: One hundred and fifteen cases were included in the study. These cases comprised 6.15% of the total case load. Most deaths occurred amongst decedents aged between 50 – 59 years. Slightly more deaths occurred in the public health sector. The majority of the deaths occurred intra-operatively and with the administration of general anaesthesia. Fifty deaths occurred during elective procedures, 49 followed emergency procedures and 12 during trauma surgery. In 29 cases (25%), possible negligence was considered by the attending forensic pathologists. Most of the latter deaths occurred in the private health sector and the procedures were conducted by qualified specialists. The initial pre-operative condition was deemed good or fair in nearly 50% of these cases. In 9 cases new pathology was identified at autopsy. These cases of possible negligence were referred for review by a specialist in the appropriate clinical speciality. Discussion: There is lack of international standardised definitions and classification of deaths following medical procedures. Previous studies emphasised the importance of investigating these cases in the medico-legal fraternity. The findings of our study concur with previous publications which indicate that in the majority of these cases, the possibility of medical negligence is ruled out following medico-legal investigation. The meticulous documentation of all findings during autopsy and, when negligence is considered, timely referral for specialist scrutiny, may improve the standard of health care.

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HOW SOIL CLAY CAN HELP TO SOLVE CRIMES: NEW PERSPECTIVES FROM ROUTINE ANALYSES

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Soil traces are useful as forensic evidences because they frequently adhere to individuals and objects associated with crimes and can place or discard a suspect at/from a crime scene. Soil is a mixture of organic and

inorganic components and among them soil clay contains signatures that make it reliable as forensic evidences. In this study, we hypothesized that soils can be forensically distinguished through the analysis of their clay fraction alone, and that samples of the same soil type can be consistently distinguished according to the distance they were collected from each other. To test these hypotheses 16 Oxisol samples were collected at distances of between 2 m to 1.000 m from each other, and 16 Inceptisol samples were collected at distances of between 2 m to 300 m. Clay fractions were extracted from soil samples and analyzed for hyperspectral color reflectance (HSI), X-ray diffraction crystallographic (XRD), and for contents of iron oxides, kaolinite and gibbsite. Data was submitted to multivariate analysis and results were from 65% to 100% effective to distinguish between samples from the two soil types. Both soil types could be consistently distinguished for forensic purposes according to the distance samples were collected from each other: 1,000 m for Oxisol and 10 m for Inceptisol. Clay color and XRD analysis were the most effective techniques to distinguish clay samples, and Inceptisol samples were more easily distinguished than Oxisol samples. Soil forensics seems a promising field for soil scientists as soil clay can be transformed into forensic evidences by using routine analytical techniques from soil science.

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RESEARCH PROGRESS OF MULTI-COPY Y-STR LOCI IN FORENSIC SCIENCE

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As one of the most important markers used in forensic science, Y-STR has been applied widely, especially single-copy Y-STR loci. However, multi-copy Y-STR loci often display high genetic polymorphism, allowing them to enhance the discrimination capacity of current technique. Each of those Y-STR loci contains 2-4 copies that distribute among non-recombination region of Y chromosome, with the nomenclature for them includes C-type and E-type. For the purpose of investigating the distribution of allele frequency among different populations, worldwide samples has been used to study the multi-copy Y-STR loci both in China and abroad, especially those included in commercial kits (Yfiler, PowerplexY, etc). Nevertheless, related studies are still far from sufficiency. Moreover, we reviewed current multiplexes that involve multi-copy Y-STR markers, and pointed out the importance of constructing a multi-copy Y-STR multiplex. Despite of demerits, multi-copy Y-STR loci are still of great value to forensic science. We may carry out future research on general allele frequency, multiplex construction and so on, for comprehensive exploration of the useful Y-STR markers in the practice of forensic science.

Disclosure: All authors have declared no conflicts of interest.

THE DEVELOPMENTAL VALIDATION AND APPLICATION OF DNATYPER Y24 PCR AMPLIFICATION KIT

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Objective The technical target of the homemade DNATyper™ Y24 kit (DYS19, DYS385a/b, DYS389I/II, DYS390, DYS391, DYS392, DYS393, DYS437, DYS448, DYS456, DYS458, DYS635, Y GATA H4, DYS438, DYS439, DYS460, DYS447, DYS527a/b, DYS444, DYS522, DYS617) was tested and its forensic application was estimated in this paper. **Methods:** The validation of DNATyper™ Y24 kit was carried out in terms of genotyping method(primer dosages, annealing temperatures, cycle numbers) and technical index(precision, accuracy, peak height balance, stability, species specificity, sensitivity, adaptability for various samples and mixture). **Results:** The most appropriate amplification conditions of DNATyper™ Y24 kit are 10 μL of amplification volume, 1× primer, 59°C annealing temperature, 28 times cycle. The DNATyper™ Y24 kit got accurate and stable genotyping results, and was of good repeatability, and was highly specific for human DNA, and was can be obtain STR genotyping results from 0.125 ng DNA. The kit could be adaptation for various samples and consistency for different batches of reagent. **Conclusions** All above results demonstrated that the DNATyper™ Y24 kit was suitable for criminal cases and inspection and DNA database in forensic practice.

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REPORTING TO THE CORONER; NATURAL DISEASE AND COMMON TRAUMA RELATED DEATHS IN VICTORIA, AUSTRALIA

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The Victorian coronial process is integral to the independent investigation of unnatural and sudden deaths, public health and safety and the administration of justice. Over the last five years, deaths and fires notified to the Coroners Court of Victoria have increased by approximately 1,500 (~25%). It is anticipated that this trend will continue due to factors such as; increasing overall population, population ageing and a reluctance on the part of general medical practitioners to certify the cause of deaths in the absence of a tertiary level health care diagnostic evidence base. A re-evaluation of the legislative basis and operational factors that determine reporting of deaths to the Coroner and the subsequent forensic medical work load demands has been undertaken by the Coroners Court of Victoria, The Victorian Institute of Forensic Medicine and the Coroners Council. This review has taken into account the level of resources available to these agencies and the related legal/legislative obligations, in particular the public health and safety role set out in the preamble to the *Coroners Act 2008* (Vic) and in S64(2)(ha) of the *Victorian Institute of Forensic Medicine Act 1985 (Vic)*. This paper reviews the existing threshold requirements for the coronial investigation of deaths in Victoria as well as the need for improved training of medical practitioners regarding the types of deaths that need to be reported to the Coroner. The paper identifies potential areas for legislative reform as well as operational improvements in managing cases of common trauma in the elderly (fractured neck of femur etc.) and natural disease related deaths where invasive forensic pathology procedures might be unwarranted. The role of new technology such as post mortem CT scanning and post mortem CT angiograms will also be presented.

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EPIDEMIOLOGY OF SPINAL TRAUMA IN NORTH-EASTERN PART OF ROMANIA

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The continuous scientific and technological progress leads to an increased incidence of trauma. Among various types of trauma, the spinal injuries constitute a particular category in terms of increased morbidity and mortality. Aim: To identify the epidemiological pattern of the spinal trauma in the North- Eastern part of Romania in order to provide data which could be used in designing the strategies to reduce the incidence of this type of trauma. Methods: We conducted a retrospective study using data collected from 426 autopsy reports concerning deaths due to spinal trauma issued by the Institute of Legal Medicine from Iasi, Romania. Given that Iasi is the most important city in the North-Eastern part of Romania, many cases of severe trauma are referred to the university clinics in this city and all the patients who die in these clinics undergo post-mortem examination at the Institute of Legal Medicine from Iasi. We collected socio-demographic

data (gender, age, life environment), clinical data (patient's condition at the admission in the hospital, clinical diagnosis, duration of hospitalization, level of the clinical and laboratory examination) and medico-legal data (the circumstances in which the injuries occurred, association with other trauma, autopsy diagnosis, BAC in samples collected at autopsy). Results: Men are more affected by spinal trauma than women (3.71: 1). The frequency of the spinal trauma increases with age, the average age in our study group being 55,3 years. Most of the injured persons are from rural areas where the blue-collar works are more frequent compared to the urban areas. The spinal injuries occurred mainly due to traffic accidents and the falls, the first affecting more frequently the older persons and the latter the younger ones. The most affected part is the cervical spine which sustains about 70% of the injuries either isolated (52%) or associated with injuries in other regions of the spine (18%). Conclusion: Specific strategies are necessary to prevent and to limit the high mortality and debilitating long-term consequences associated with the spine trauma. Our study provided data which are concordant in many aspects with the results of other similar studies and which could be used in designing the primary, secondary and tertiary prevention strategies for patients who have suffered spine trauma.

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FORENSIC SCIENCE AS AN ACADEMIC DISCIPLINE

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Hans Gross advocated forensic science as the science and method of investigation to be part of the fundamental education of investigating magistrates in Vienna in 1895. From a fundamental and methodological scientific endeavour, it became a kind of add-on discipline to chemistry, physics, biology at the end of the 20th century. One apparent motive was to try to attract more students in response to decreasing student numbers within established scientific disciplines. This came in the wake of successful and popular TV shows, but the focus remained on a specialist view from those disciplines sometimes even limited to one type of trace evidence with the almost single mantra: identification in an almost purely experimental fashion. Traces, physical remnants of criminal activities, are seldom pristine and pose numerous questions related to the activities as well as the identities that need critical thinking and development of strategies to cope with the uncertainties created by less than complete vestiges in a situation where the ground truth is never known. It can only be hypothetical and the questions direct towards methodological approaches. The presenters have seen and explored many avenues and have no ready solutions but can offer perspectives on which academic education can effectively supply the forensic scientists of today and tomorrow.

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A COMPARATIVE ANALYSIS OF MIRNA EXPRESSION IN HUMAN WHOLE SALIVA AND HUMAN SALIVA-DERIVED EXOSOMES

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MicroRNAs (miRNA) are expressed in a tissue specific manner and stable compared to mRNA. In the forensic field, microRNA profiling has started to draw attention as a tool for body fluid identification. Some body fluids such as blood and semen can be recognized by measuring expression of the specific miRNA. However, there have been no saliva specific miRNA to distinguish between saliva and other body fluids. Exosomes are small vesicles and found in various body fluids including saliva. Exosomes are also reported to encapsulate specific miRNAs. Therefore, we proposed a hypothesis that salivary exosomes contain miRNAs which can be used as saliva specific markers. In this study, we compared the expression profile of the miRNAs between whole saliva and salivary exosomes and extracted the miRNAs that exhibited specific expression in salivary exosomes as candidates for saliva markers. We obtained whole saliva from eight volunteers and isolated exosomes from whole saliva. After total RNA was extracted from whole saliva and salivary exosomes, miRNAs were reverse transcribed and cDNA from eight donors were combined to produce pooled samples. Expression level of the 1088 miRNAs were measured via real-time PCR and 734 miRNAs were quantified both whole saliva and salivary exosome. 36 miRNAs were found ten times more or higher in salivary exosomes than whole saliva.

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FORENSIC MEDICINE AND THE ROYAL COMMISSION INTO FAMILY VIOLENCE IN VICTORIA AUSTRALIA.

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The report from the Royal Commission into Family Violence was tabled in the Victorian Parliament on Tuesday 29 March 2016 and was released to the public on Wednesday 30 March 2016. The report contained 227 recommendations in total. The Victorian Institute of Forensic Medicine's submission to the Royal Commission highlighted the degree to which forensic medical services are underutilized by police, courts and a range of government social support services. We made a number of recommendations designed to increase the take up of forensic medical examinations for family violence victims. The Commission's report, at recommendation 101, explicitly agreed with the need for greater access to forensic medical examinations for victims of Family Violence. An improved rate of clinical forensic medicine examinations being recognised by the Royal Commission as providing the courts with evidence that might corroborated victim allegations and would assist the police in assessing the likelihood of further risk of serious or fatal injury. This paper outlines the range of activities now undertaken by the Victorian Institute of Forensic Medicine that are designed to target the forensic medical topics addressed by the Royal Commission into Family Violence. From an operational perspective, these activities include: - The promotion of forensic medical access pathways to Police including expansion in the use of 'Multi-Disciplinary Centres' for forensic assessment and care provision. - Contributing to the Victoria Police code of practice for the investigation of 'Family Violence' to assist in the identification of those cases that would medically or evidentially benefit from a specialist forensic assessment. - The inclusion of forensic medical expertise in the strategic criminal investigation of high risk offenders. - The development of a 'Web Portal' for Victoria Police to provide on-line advice on accessing Forensic Medical Services. From an academic perspective, these activities include: - The development and delivery of a training program on 'Violence in the Family Home' for a range of government and private agencies. The topics covered by this program include; managing consultations with victims of violence, identifying risk scenarios, forensic injury interpretation and the evidential importance of injury documentation. - The formal Integration of 'Family Violence' topics and related medical-legal issues into the Monash University Masters in Forensic Medicine. - Establishing a research program investigating incidences of violence/elder abuse in care environments as part of our 'Health Law and Ageing Research Unit' in the Department of Forensic Medicine at Monash University.

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DISCRIMINATION OF SINGLE POLYESTER FIBERS BY SYNCHROTRON RADIATION MICRO X-RAY FLUORESCENCE ANALYSIS

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Single polyester fiber samples are very important samples for criminal investigation. However, there are many cases having difficulty in forensic discrimination of single polyester fiber samples. Microspectroscopy that color measurement is possible is effective for identification of single fibers, but is not effective for white fiber. It is known that various metal catalysts are used for polyester production. However, since the concentration of metallic elements of the catalysts is ppm order, it is difficult to detect them in single fibers by analytical equipments in laboratory. Therefore, in this study, synchrotron radiation micro x-ray fluorescence spectrometry (μ-SR-XRF) that is non-destructive technique for trace elemental analysis of small samples was applied, and discrimination of the single fiber samples was conducted. The samples were obtained from 25 kinds of clothing which are widely used in Japan. μ-SR-XRF was carried out using analytical equipment which we developed for criminal investigation at BL05SS of SPring-8. Since trace elements in single fibers could be excited effectively, an incident x-ray beam of 20 keV with a size of 2 μm × 300 μm was prepared by means of K-B mirrors. As a result, we succeeded in detecting many trace elements such as Ti, Mn, Co, Zn, Ge, Zr, Nb, and Sb. Ge and Sb are derived from polymerization catalysts. Co, Mn, and Zn are derived from ester exchange catalysts. Ti, Zr, and Nb are derived from decluttering agents. High accuracy discrimination was possible by comparing the trace elements of catalysts in the samples. It is found that μ-SR-XRF is a powerful technique for non-destructive discrimination of single polyester fibers.

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EVALUATION OF FORENSIC HISTORY TAKING FROM THE CHILD IN CASES OF CHILD PHYSICAL AND SEXUAL ABUSE

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Background: Suspected child physical abuse, sexual abuse and neglect are not uncommon presentations. As part of the assessment of these cases, a forensic medical history may be taken. This forensic history is used not only to determine the steps necessary to address the child's wellbeing but also to direct the forensic examination. Currently, there is no clear consensus on whether or not a forensic medical history should consistently be considered an integral element within the paediatric forensic evaluation. This study examines the value derived by the medical practitioner taking a forensic medical history rather than relying on hearsay evidence when a child presents for an assessment.

Methods: A retrospective review of paediatric cases seen by the Victorian Forensic Paediatric Medical Service (VFPMS) between 2014 and 2015 was undertaken. 274 forensic case reports were reviewed and the data was entered into an Excel spread sheet and analysed using chi squared tests within STATA®.

Results: With increasing age of the child, a forensic medical history is significantly more likely to be taken. Additional information is made available to the medical practitioner than what would otherwise not have been provided if the medical practitioner relied only on the interview conducted by the police. Discrepancies observed between the official third parties (police or child protection) report of what a child has said and what the child says to the medical practitioner decrease with age, as do discrepancies observed between the child's version of events and a third party's (e.g.. parents, caregivers, friends) version of events. **Conclusions:** The study showed that by taking a forensic medical history from the child additional information can be obtained. Further, that there is a value in the examining medical practitioner taking a forensic medical history from children in cases of child physical and sexual abuse and neglect.

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AN INVESTIGATION OF TAPHONOMIC CHANGES AND DECOMPOSITION RATES OF FROZEN REMAINS: A PORCINE MODEL

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There has been much international research concerning the determination of the post-mortem interval (PMI) in arid and temperate environments, many of these studies have concluded that temperature is one of the most influential variables driving the decomposition process. However, the effect cold treatments, such as freezing or refrigeration, have on decomposition has received little attention, presumably because temperatures below zero degree Celsius are believed to slow or stop microbial and invertebrate activity. The few studies present in the literature that center on the decomposition of cold treated remains are mostly international in origin and unconnected, with no consensus as to whether the decomposition process and rate is even affected by frozen or refrigerated temperatures. A majority of these studies have, however, suggested that frozen remains tend to disarticulate at an accelerated rate and are more prone to external decay where as fresh remains exhibit putrefaction from within, or internal decay. The purpose of this research was to investigate the decomposition process between frozen and unfrozen remains in an Australian environment to: a) Determine the presence of visual identifiers upon exposure to freezing, and b) Determine if PMI calculations are affected by exposure to freezing. A summer and winter study was conducted in the Hawkesbury region of New South Wales, Australia, with two frozen and two unfrozen *Sus Scrofa* (domestic pig) carcasses placed on the grounds surface and left to decompose over a 12 week period each season. Soft tissue changes were recorded and 'scored' and PMI determined using previously published 'standard' methods. Results indicate that there is an 'outside-in' decomposition pattern in the frozen remains, where skin decomposes but partial internal organs are observable. This contrasts with the apparent 'inside-out' pattern of the unfrozen remains. Postmortem interval calculations show no significant difference suggesting that freezing has no measurable effect on the PMI. The results of this study contribute to the increasing knowledge of taphonomic factors affecting decomposition in Australian environments.

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THE DEVELOPMENT ON TRACE FINGERPRINT DETECTION USING BI-FUNCTIONAL NANO-COMPOSITE POWDERS

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We have developed bi-functional nano-composite materials using conventional ion-exchange reaction. The bi-functional nano-composite materials consist of organic fluorescent molecules and inorganic 2-D layered materials. The nano-composite powders show that not only enhanced fluorescent property but also increasing adsorption properties between trace fingerprint and inorganic 2-D layered materials. The bi-functional nano-composite powders were characterized by powder X-ray diffraction (XRD), Fourier transformed infrared (FT-IR) spectroscopy, thermal analysis (TG-DTA), elemental analysis (CHN/ICP-OES). Fluorescent property of the obtained powders was studied with diffuse reflectance UV-vis and Fluorescence (PL) spectroscopy. The bi-functional nano-composite powder showed a characteristic red emission at wavelength 617 nm. We detected and visualized trace fingerprint with forensic light source on the non-porous surfaces of glass and polymer film. Also we detected trace

fingerprints with forensic light source on the porous surfaces of paper money and credit card receipts.

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FORENSIC GERIATRICS: THE WORK OF THE MONASH UNIVERSITY/ VIFM HEALTH LAW AND AGEING RESEARCH UNIT.

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In 2015 a 'Health Law and Ageing Research Unit' was established at the Victorian Institute of Forensic Medicine/Monash University Department of Forensic Medicine headed by Professor Joseph E Ibrahim. This unit was established in response to the growing need for expertise in aged care in forensic medical practice and to help establish a research base that would provide an evidence for preventable death and injury policy in this health sector. Geriatrics and aged care expertise is especially applicable to key areas of forensic medical practice including; Traffic medicine, the investigation of medical treatment related deaths, OH&S aspects of residential care and fitness for interview. The Unit is responsible for education and research that prevents injury and improves health care and quality of life for older people particularly those in residential care. We have both an epidemiological and jurisprudential research program that investigates the forensic aspects of rights, choice and freedom for older people. The Unit comprises a multi-disciplinary team with expertise in forensic investigation, public health, health care, aged care and law and is led by Professor Joseph Ibrahim assisted by Dr Lyndal Bugeja and A/Prof David Ranson. The Unit's program is focussed on delivering: a reduction of injury and premature deaths; promotion of respect for older persons' choices and; supporting the development of the workforce providing aged care services. Current research activities include: Death from physical restraint in nursing homes, death from choking on food, suicide in nursing homes, resident on resident aggression in nursing homes, sexual assault in nursing homes, deaths due to absconding from nursing homes and dignity of risk i.e., right to take a risk that improves quality of life but may be potentially harmful to the resident or others. The growing aged population also presents the community with a range of medico-legal and jurisprudential challenges around legal culpability, autonomy and community safety particularly as the number of people with dementia grows. This paper outlines the emerging challenges in this field and the areas in which expertise in aged care contributes to forensic medicine and the safety of the elderly in our community.

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THE OPTIMAL TIMING OF FORENSIC EVIDENCE COLLECTION FOLLOWING PAEDIATRIC SEXUAL ASSAULT

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Background: Forensic evidence collection following an alleged sexual assault has an important medico-legal role. Despite the advent of DNA profiling, research into the optimisation of forensic biological specimen collection is limited. This has led to inconsistent and variable guidelines for forensic evidence collection. The guidelines in this jurisdiction (Victoria, Australia) recommends specimens be collected up until 72 hours post assault. The aims of this study were to determine the optimal times post alleged sexual assault for the collection of forensic biological evidence in paediatric cases (aged 0-17 years). **Methods:** A retrospective review of paediatric sexual assault cases seen by the Victorian Forensic Paediatric Medical Service (VFPMS) between 1 January, 2009, and 1 May, 2016, was undertaken. Specimen site and collection times post assault were collated from VFPMS medico-legal reports and compared with the forensic evidence analysis results reported by the Victoria Police, Forensic Services Department. In addition, a survey of recommended forensic specimen collection times post assault in the different Australian jurisdictions was undertaken for comparison. **Results:** Within the 6 year 5 month period studied there were 122 cases consisting of 562 different forensic specimen samples that were collected and analysed. 62 (51%) of cases produced one or more positive forensic result and, of the 562 specimens collected, 153 (27%) were positive for either foreign DNA, spermatozoa, semen or saliva. Foreign DNA was more likely to be found if forensic specimens were collected during the first 24 hours after the assault as compared with those collected at 25-48 hours ($p<0.005$). A similar result was seen when comparing spermatozoa results between 0-24 hours and 25-48 hours ($p<0.002$). Foreign DNA was not identified beyond 48 hours post assault and spermatozoa was not identified beyond 36 hours. Saliva and semen were not identified beyond 24 hours. The youngest victims with positive forensic evidence were 2-3 years old. The survey of current forensic specimen collection practice in Australia shows that the guidelines for forensic evidence collection in child sexual assault cases is highly variable between jurisdictions. **Conclusions:** Our results highlight the importance of collecting forensic specimens as a matter of urgency, regardless of age, within the first 48 hours post alleged assault. Although there is need for further research, the findings indicate a need for the re-evaluation of current guidelines for specimen collection in paediatric sexual assault cases.

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FORENSIC ANALYSIS OF IONS IN POST-MORTEM BLOOD BY ION CHROMATOGRAPHY AND STATISTICAL APPLICATION

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Cause of death is a main subject in various cases in forensic field. As forensic chemists, we routinely examine body fluids such as blood, aqueous humor etc. taken at autopsies and try to detect toxic and/or high level substances that could make someone dead. So it is necessary to know the normal range of analytes in those biological materials. In this study we collected blood samples which were supposed to be died not by drug intoxication an certain diseases. We analyzed anions and cations by ion chromatography, though originally included in blood, may make post-mortem changes. For a pre-treatment of blood samples, we used the ultrafiltration method with 3 kDa membrane filter. We got the concentration ranges of ions, which were Na^+, K^+, Mg^{2+}, Ca^{2+}, Cl^-, SO_4^{2-}, Br^-, NO^{3-}, PO_4^{3-}. ANOVA was used to see if there was any difference in ionic concentrations amongst different groups with additional cases of ketoacidosis symptom for comparison. Then, those data from blood samples were applied to discriminant analysis (DA) by SPSS with values of Na^+, K^+, Mg^{2+}, Cl^-, SO_4^{2-}, PO_4^{3-} which showed a significant difference ($P > 0.05$). Final graph through statistical process showed meaningful separation and we applied ion analysis data of unknown cases to th DA result to know where they would be located on the graph as points. Ion concentration range data can be used as a valuable reference in forensic analysis report and the statistical result can also give us additional information on assumption about kind of death in unknown cases with further study.

Disclosure: All authors have declared no conflicts of interest.

BICUSPID AORTIC VALVE: SWORD OF DAMOCLES OVER THE HEARTS OF VIGOROUSLY TRAINING ATHLETES

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Bicuspid aortic valve (BAV) is the most common cardiovascular congenital anomaly with a prevalence of 0.5 to 2% in the general population. It is

frequently an incidental finding in asymptomatic individuals however, 1/3 of all BAV individuals develop valvular complications in their lifetime, including aortic stenosis, aortic regurgitation, and infective endocarditis. Although BAV is primarily a valvular disorder, it is important to realize that this anomaly also plays a role in development of aortic wall abnormalities, with aortic dilatation and risk of aortic dissection with rupture. Although BAV can be a sporadic defect, high heritability and a high incidence of familial clustering support a genetic origin. We report two cases of sudden deaths of trained athletes in which clinically unrecognized BAV played a crucial role on the mechanism of aortic/cardiac death. First case was a previously healthy 29-year-old male, a competitive triathlete, who presented with tearing chest pain and died suddenly. The autopsy revealed massive hemopericardium resulting from dissecting aneurysm of the aorta. The aneurysmatic ascending aorta measured 5.8 cm in diameter. Examination of the cardiac valves showed BAV. Morphologically, equally-sized and shaped aortic cusps were apparently enlarged, focally thickened, with two commissures and no raphe between the undeveloped left and right coronary cusps. Second case was a 41-year-old male, a former professional ice hockey player and current ice hockey coach, who died suddenly during hockey training. At autopsy, BAV with two unequally-sized cusps and central raphe from fusion of the commissures was noted. The endocardium below the aortic valve showed patchy lipoid plaques and fibrosis. There was marked left ventricular hypertrophy, conspicuous pulmonary edema, and mild three-vessel coronary artery disease. Cause of death was attributed to acute left ventricular failure sustained as a complication of BAV. A normally functioning BAV does not usually represent a limitation for practicing sport. The stress of regular and intense training on an abnormally structured aortic valve may accelerate its early deterioration and facilitate the development of potentially life-threatening complications. Therefore, athletes with BAV warrant regular and close cardiologic monitoring, to avoid a fatal outcome. Once valvular, myocardial, or aortic complication occurs, clinical course is often unpredictable and sudden unexpected death is an appreciable risk even in previously asymptomatic patients. These case reports emphasize the importance of recognizing BAV in the population vigorously engaged in sports and increases awareness of appropriate treatment when necessary.

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FROM THE BORDER TO THE GRAVE: NEW DESIGNER DRUGS IN NEW ZEALAND

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The implementation of the Psychoactive Substances Act 2013 and subsequent removal of readily available "legal high" products from sale has created an underground designer drug market in New Zealand. These substances can be purchased online and smuggled into the country. These drugs are often novel compounds, with no documented history of psychoactive effects or health-related implications. The Customs - ESR Screening Laboratory, located at Auckland Airport, was designed as a partnership between the New Zealand Customs Service and ESR, the sole forensic service provider in New Zealand, to provide a rapid screening service at the border. Novel designer drugs are routinely encountered during the analysis of suspicious consignments at the Customs - ESR Screening Laboratory. Identification of these substances can be difficult, as reference materials are generally unavailable, and there is a lack of published data due to the compounds being so new. A project was undertaken at ESR, in conjunction with the University of Auckland, to identify a number of these designer drugs and develop a Designer Drug Database that could be used in the future identification of these substances encountered at the New Zealand border. The aim of the project was to enhance the border detection capabilities of Customs, through using the Designer Drug Database at the Customs - ESR Screening Laboratory, and in doing so provide rapid and comprehensive transfer of information to enable informed decisions to be made by Customs and other agencies. This would prevent potentially harmful substances crossing the border, thereby eliminating the harm they could cause to New Zealanders.

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MANUAL 3D DIGITAL FACIAL RECONSTRUCTION: VALIDATING THE PROCEDURE

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In the context of forensic anthropology, facial reconstruction is an approximate tool enabling to depict an appearance of the deceased from skeletal remains. It is particularly favored in cases when other identification methods fail. Recently, advances made in digital technologies have built the base for reconstructing facial appearance virtually in 3D environment by manual, semi-automated or fully-automated approach. The manual reconstruction procedure is grounded on the scientific principles but operator´s interpretation of resulting face is presented in a varying degree. The present study aims to quantify differences in outcomes of a digital manual facial reconstruction procedure if the input factors vary substantially. The studied sample consisted of a CT-generated skull of a person unknown to operators. Virtual 3D facial reconstructions were conducted manually by two methods - the anatomical method, based on modeling facial muscles, and the statistical method by using average values of facial soft tissue thickness. The latter was conducted twice with two different sets of average values of facial depth. The three reconstruction approaches were performed independently by two operators. The results were compared according to the used method, average values of soft tissue thickness and operator. The differences in reconstructed 3D digital models were quantified by the nearest neighbor distance metrics and visualized by the means of 3D visualization tools, both featured in Fidentis Analyst software. Ultimately, the results were confronted with available photographs and 3D facial scan of the person. The acquired results provide important insight into bias occurring in manual 3D facial reconstruction procedures. This may shed light on the accuracy of the facial reconstruction procedure encountered in forensic anthropology.

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MICROHAPLOTYPES: A POSSIBLE BIOGEOGRAPHIC ANCESTRY PREDICTOR FOR FORENSIC DNA EVIDENCE

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Microhaplotypes (MHs) are short regions (<300 base pairs long) that have 2 or more single nucleotide polymorphisms (SNPs) with 3 or more allelic combinations. Recombination is unlikely due to short distances between the SNPs in MH. The mutation rate is less than that of short tandem repeat (STR) markers. MHs sequencing is also not affected by polymerase slippage, thus eliminating the common analysis artifact of stutter, which complicates complex mixture interpretation. The goal of this project was to evaluate if a selected panel of MHs- using Massive Parallel Sequencing (MPS) technology- together with individualization, could effectively predict biogeographic ancestry. Individuals from three populations, European-Americans (EAs), African-Americans (AAs), and Southwest Hispanics (SWHs), were selected for sequencing. A panel of 33 MH was used on individuals of each population. Samples were sequenced on an Ion S5™ MPS platform using a 530 chip. The initial library preparation was conducted manually, but templating was carried out on an Ion Chef™. Allele frequencies from a database of 58 populations, provided by Dr. Kenneth Kidd, were used to calculate the random match probability (RMP) of each profile in each individual population. The SWH did not have a category in Dr. Kidd's database, so the samples were bootstrapped.

The average RMP of all samples in all populations highlighted tended to be higher in the populations individuals self-identified as. For example, AAs had the highest RMP in African populations. Likelihood ratios (LR) were calculated for all sequenced individuals by dividing the highest RMP obtained from the three US populations by the second highest in that same set. The number obtained represented how much more likely it is to observe that profile if the individual is of the population at the numerator vs. the one at the denominator. For SWHs, given the admixed nature of this population, the method predicted the incorrect population 38% of the time (always EA instead of SWH), using an LR threshold of 1000. The SWH and AA populations should include more individuals to reach n=100. Also more populations and more MHs specifically selected for their ancestry informativeness should be included in the assay. Yet, the data supports the hypothesis that MHs can be used for biogeographic ancestry inference. Once enhanced and optimized, this tool has the potential to provide investigators with useful information in cases where the STR profile from crime scene evidence does not match any of the suspects or generate database hits.

Disclosure: All authors have declared no conflicts of interest.

THE ANALYSIS OF ILLICIT DRUGS IN SYDNEY WASTEWATER

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Illicit drug consumption and trafficking is a major global problem. In this context, wastewater analysis offers objective and complementary information to illicit drug agencies by monitoring trends and pattern of illicit drug consumption. The first objective of the study was to investigate the temporal and geographical distribution of illicit drugs in Sydney. The second objective was to explore possible similarities/differences in consumption between this study (Sydney area), a study conducted around Australia and one conducted in Switzerland by different researchers. Wastewater specimens located in four different sewage treatment plants in the area of Sydney were collected in March 2016. Thirteen selected illicit drug target compounds were extracted using solid phase extraction, followed by analysis using liquid chromatography coupled with tandem mass spectrometry. The amount of illicit drug compounds measured in the wastewater was used for the estimation of the consumption. Temporal and geographical analyses were conducted to obtain a better understanding of the type and amount of illicit drugs consumed in Sydney. Trends and geographical patterns in illicit drug consumption in Sydney were observed. Indeed, the analysis of Sydney wastewater revealed that methamphetamine was consumed the most, followed by cocaine, 3,4-methylenedioxyamphetamine (MDMA) and morphine, among the illicit drugs targeted in this study. Weekly patterns were also observed (e.g. for MDMA and cocaine) where the consumption was higher during the week-end than during the week. The geographical analysis showed a higher amount of illicit drugs consumed in the eastern part of Sydney (except methamphetamine which was more consumed in the southern part of Sydney). This could be due to the fact that this region is very demanded by young adults, surfers, students and tourists, and many wealthy people are settled there. The comparison of our study to the study conducted around Australia showed a high consumption of methamphetamine and MDMA in Sydney in comparison to the diverse areas investigated in the different States and Territories. The comparison between Sydney and Switzerland revealed a different consumption in these countries, in line with the indicators of the traditional market. For instance, cocaine is predominant in Switzerland, whereas methamphetamine and MDMA are dominating in Sydney. The authors suggest that the information obtained through wastewater analysis can be of great importance for law enforcement agencies as it provides a complimentary and more objective estimation of the illicit drug consumption and by extension information about the size and the evolution of the related illicit market.

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UNNATURAL DEATHS OF GIRL CHILDREN AND FEMALE YOUTH; A STUDY FROM THREE PROVINCES IN SRI LANKA

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Introduction: Death of a child, an adolescent or a youth whether male or female is a sensitive and traumatic event to witness due to its long lasting effects to many lives. Children and adolescents are considered vulnerable because their wellbeing is dependent on the elders. Moreover any form of violence resulting death of a child provokes a massive social response and even demands severe punishments of perpetrators. **Objectives:** To describe the age related associations to different types and circumstances of unnatural deaths of girl children (0-18 years) and young women (18-24 years) as well as to describe etiologies of the deaths and their relationship to the cause of death. **Methodology:** A retrospective descriptive study was conducted on unnatural deaths of females less than 24 years of age from Western, North Central and Southern provinces employing convenient sampling. Records of Inquirers into Sudden Deaths, post-mortem reports and police information over a period of three (03) years (2013-2015) were perused with approval from relevant stake holders. Data was obtained according to a pro-forma developed and analysis was done using Statistical Package for Social Sciences. **Results:** Out of the 56 deaths of children and young adults included in the study, the majority (64%) belonged to the category of youth (age 15-24 years) while 18% were below the age of 5 years and 18% were between 5-14 years. Half the deaths (48%) had been reported from rural areas of the selected provinces and 38% were from low income backgrounds. Analysis of the manner of death revealed 54% suicides, 25% homicides and 18% accidents. The perpetrator was a known person to the victim in 10 of 11 homicidal deaths. Both suicidal and homicidal deaths were commonly observed among the youth category with suicides being statistically significant (p=0.001). Poisoning was the commonest cause of death seen among the youth (41%) and it was also the commonest cause associated with suicides (57%). Analysis of the 30 suicidal deaths revealed 8 deaths related to love affairs, while family disputes (guardians) amounted to 6 deaths. **Conclusion:** The highest number of unnatural deaths was seen among the youth category with a statistically significant number of suicides. Love affair and family related problems were the commonly observed underlying etiology for such deaths among young adults.

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SUICIDE BY FATAL PENTOBARBITAL INTOXICATION IN ONTARIO FROM 2012-2015

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A finding of a fatal level of pentobarbital in a coroner's case where the case history had not indicated such drug use prompted a review of fatalities in Ontario attributed to pentobarbital toxicity from 2012-2015. Twenty deaths were identified; the number of fatal pentobarbital deaths ranged from three to eight cases per year over this time period. In eleven of the twenty cases identified, there is clear evidence that the drug was purchased over the internet from Mexico or China and imported into Canada. In four of these cases, it appears that the pentobarbital was labelled as a different, innocuous chemical to facilitate crossing the border without scrutiny.

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FORENSIC ADVISORS – ROLE AND USEFULNESS IN THE JUDICIAL PROCESS IN BELGIUM

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At the National Institute for Criminalistics and Criminology (NICC) in Brussels, Belgium, forensic advisors are acting as advising body to the prosecutor to improve the communication between the latter, the forensic experts and the front line forensic practitioners. Forensic advisors are generalists in forensic science, with a broad culture of the potential contribution of traces and a solid scientific background. Their aim is to provide assistance in developing the best strategy to support the investigation, by focussing on the most useful traces to be submitted for analysis considering the information of the case. They advise for but also against analyses, as they are in the privileged position to not adhere to a commercial business. In this position, the forensic advisors' choices regarding the traces to be analysed is based on their potential utility in terms of information to the case. This role of forensic advisor is innovative and unique in its structure. It is assumed that this role improves the end-to-end process of forensic science practice (from the scene of crime to the production of evidence for court), especially the investigation and prosecution phases of the judicial inquiry. Preliminary scrutiny based on the appreciation from forensic advisors of the impact of their duty and on perceived benefits from prosecutors and forensic experts, has highlighted the usefulness of this role for the justice system. Yet, no meticulous study has been conducted so far to decompose the pivotal aspects of this particular role, to assess its true potential and to advocate a framework for the implementation of this role in different operational environments. The object of this study is twofold: (1) to evaluate the usefulness of the contribution of the forensic advisors – the decision-making strategy put in practice by forensic science generalists positioned between forensic science practitioners and prosecutors – through a scientifically founded approach, and (2) to formalise a framework allowing the selection of cases for which such a contribution could provide an added value.

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TRIAGING FACTORS FOR BIOLOGICAL TRACES

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Although providing significant contribution to the judicial inquiry, the practice of forensic science is strongly affected by budget constraints as it often entails costly and (sometimes) time-consuming analyses. From its detection and collection at the crime scene, a number of decision steps are passed before a trace can contribute to the investigation or the court. Among the several decision nodes, the triaging decision – deciding which traces should be analysed and which not – is especially important when handling large amounts of traces with limited resources. It consists of a means of distributing the personal and financial resources to the most important cases. This step is particularly crucial regarding biological traces. Indeed, the analysis of biological traces for DNA profiling is often performed by external laboratories, incurring additional costs. Notwithstanding, the factors governing the triaging of traces have never been thoroughly studied. Often, factors related to the propensity to obtain a good analytical result prevail as selection criteria, such as the nature of the matrix of the trace (blood versus contact trace for instance). Another recurring factor for the decision to analyse a trace is the confirmation of the identity of an already known suspect. While relying on objective or statistical data, these factors do not necessarily favour the provision of added value of information for the inquiry. In our study, the focus was set on the utility of the clue as added value to the case and triaging factor. Overall, the factors included in the decision to analyse a biological trace were scrutinised. The results of our study indicate that the influence on the triaging decision of the factors suggested in the literature could not be confirmed. In addition, the information potential of the clue to the case, considering the case circumstances, were taken into account and the overall contribution of forensic science to the judicial case could be assessed. These results put forward the benefices of considering the triaging step as an intelligence-based decision, anchored within the investigation process.

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EXPEDITED TOXICOLOGICAL TESTING IN ONTARIO DEATH INVESTIGATION – RESULTS OF A PILOT PROJECT

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Pathologists from the Ontario Forensic Pathology Service (OFPS) perform medicolegal autopsies, many of which require toxicological results from the Centre of Forensic Sciences (CFS) to determine the cause of death. The median turnaround time for a toxicology report to be completed is 30-40 days which impacts the overall time to complete an autopsy report. A pilot project was conducted, using cases for which drug(s) were either suspected to have caused the death, (Category I), or for those in which drugs were expected to be ruled out, (Category II). Fifty cases were selected for the pilot project. Various aspects of the submission process were streamlined to allow for this expedited testing to occur. Toxicological analyses targeted a set of 54 of the most frequently encountered drugs using LC-MS/MS. Preliminary toxicology results were provided to the OFPS within 26 hours and a final report was provided at an average of 5.7 days (range 1-8). Decreasing the turnaround time for toxicological reports provides the potential for more timely autopsy and coroner's reports.

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COPAN 4N6DEVICES FOR RESOLVING THE MYSTERIES OF CRIME SCENE INVESTIGATIONS

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Background: Properly collected, stored and analyzed forensic specimens are important for maintaining nucleic acids integrity for DNA profiling. Copan developed: 1) The 4N6FLOQSwabs™ (4N6FS) to facilitate forensic sample procurement; 2) The NAOBasket™ a semi-permeable basket used with the 4N6FLOQSwabs™ (NAO) for efficient sample release and nucleic acids optimization. 3) The NUCLEIC-CARD™ White (NCW) and COLOR (NUC), a chemically treated paper that allows room temperature (RT) long term storage of DNA from buccal swabs or blood samples for forensic human identification. The objectives of this study were 1) to compare the 4N6FS, NAO, NCW and NUC to traditional devices for recovery, storage and preservation of DNA traces for genetic and crime scene investigations. b) Report forensic cases investigated with 4N6FS. **Methods:** In this study buccal/saliva and blood traces were prepared on contaminated surfaces and deposited on NUC and NCW. Samples were collected from each trace using 4N6FS and traditional swabs. After collection, swabs were stored in tubes and tested at baseline and after 2 weeks. Buccal/saliva and blood aliquots were used as reference. Swabs were processed as per nucleic acids extraction method and others with the NAOs for nucleic acid recovery. Disks (1.2mm) were punched from the cards. Case reports included sample collection from gloves, scarf, and jackets left behind in 2 robberies and samples collected with 4N6 sub-ungueal from under the nails of a cadaver. All samples were extracted with the PrepFiler Express on the AutoMate Express, amplified with the Human Quantifiler Trio on the 7500 and profiled with the Identifiler Plus on the 3130 Genetic Analyzer

(Thermo Fisher). **Results:** 4N6FS recovered almost 100% of DNA after storage in the presence of contaminants compared to less than 10% with traditional swabs. NAO recovered over 30% more DNA from swab compared to traditional swabs processing. NUC and NCW enabled RT storage of nucleic acids from saliva and blood for genetic DNA profiling. The 4N6FS isolated the DNA profiles from gloves, scarves and jackets left at the crime scene and the 4N6 nails FS allowed identification of victim and aggressor profiles. **Conclusions:** 4N6FLOQSwabs™ are increasing and preserving DNA and can be used for genetic and crime scene samples collection and preservation. NAOBaskets™ are increasing DNA recovery especially from touch DNA samples. NUCLEIC-CARD™ Color for saliva and White for blood are enabling RT storage of nucleic acids for DNA profiling. 4N6FS identified DNA profiles from evidences left on the crime scenes.

Disclosure: All authors have declared no conflicts of interest.

ION MOBILITY SPECTROMETRY VERSUS ION TRAP TANDEM MASS SPECTROMETRY TO DETECT NARCOTICS ON PASSPORTS

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Nowadays, there is an increasing need to gain a better knowledge of illegal drug trafficking at national and international levels. It is crucial for Customs and Border Protection services and law enforcement agencies to be able to estimate the nature and volume of importation of illicit compounds. As a proof of concept, this Australian study investigated the feasibility of developing a method for routinely screening the external surface of passports at Customs for the presence of drugs. In a forensic intelligence perspective, this would provide valuable information about the importation of illicit material and their provenance. The identification of individuals in possession of drugs is already implemented at Customs using screening tools. This study looked at the possibility of obtaining general qualitative information from passports surfaces instead of focusing on targeted individuals, using similar technology. An experimental design was built to determine if powdered drugs could be detected on the surface of contaminated passports, using automated and rapid screening tools. Two different portable instruments using Ion Mobility Spectrometry (IonScan, Smith Detection) and Ion Trap Tandem Mass Spectrometer (DS1100N, Hitachi) technology were used and compared to each other in these experiments. They were selected because they are routinely deployed at Customs for the detection of explosives and narcotics, as well as their ease of use and fast response. The findings will be presented and compared, and their implementation at Customs for routine use will be discussed in the context of illicit drug intelligence.

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THE ANALYSIS OF CUTTING AGENTS IN AUSTRALIAN SEIZURES OF COCAINE AND HEROIN OVER SIX YEARS

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Being able to determine the chemical composition of illicit drug seizures is crucial information for Police and law enforcement agencies, especially for intelligence purposes. Due to the dynamic nature of cocaine and heroin markets, the trafficking of these two plant-based drugs is complex, and it is challenging to establish trends over time based on chemical analyses. The investigation of compounds added during or after manufacture, such as cutting agents, could complement the knowledge of cocaine and heroin trafficking networks. Cutting agents, namely adulterants and diluents, are often detected in seized material, and are a source of valuable information as they can inform on: - The degree of purity of the illicit drug; - The nature and number of added compounds during the manufacturing process. This can ultimately help to get a better understanding of the market structures of these drugs. This study looked at the feasibility to identify trends over six years (2008-2013) of adulterants and diluents from cocaine and heroin seizures performed at borders by the Australian Federal Police (AFP). Findings regarding the overall composition of cocaine and heroin seizures as well as their purity over time will be presented, and the main observed patterns from adulterants and diluents will be discussed for both drugs from a forensic intelligence point of view.

Disclosure: All authors have declared no conflicts of interest.

IDENTIFICATION OF FEMALE-SPECIFIC BLOOD STAIN USING 17B-ESTRADIOL TARGETED APTAMER-BASED SENSOR

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In forensic field, the blood stain evidence obtained from the violent crime scene was very important role that it provided a decisive clue to solve the case through forensic analysis such as genetic identification. However, the massification of the collected samples in the crime scene made it difficult to genetic identification. Herein, we reported the activatable aptamer sensor targeting 17β-estradiol to detect the female specific blood specimens as forensic methods. This aptamer sensor (0.2 nmoles/$\mu\ell$) could easily distinguish the female specific blood using variable light source (495 nm) in crime scene blood samples, but not the male blood. In particular, it was able to detect the young female (10s - 40s aged) blood in whole female blood samples, but not the older female (50s or more aged). and then, genomic DNA was extracted from the female blood samples collected by this method, it was performed the quantification and short tandem repeat (STR) genotyping. As a result, we confirmed that fluorescence interference due to this aptamer sensor did not occur. Therefore, application of this aptamer sensor may help to collecting the samples selectively at the crime scene evidence, and consequently the genetic identification can be easily performed.

Disclosure: All authors have declared no conflicts of interest.

FORENSIC EXAMINATION OF RUBBER STAMPS

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The sole objective of a forensic document examiner is to assist in the discovery and proof of the facts in any investigation, or legal inquiry, involving genuineness of a document, or any part thereof. A document is usually questioned because its origin, its contents, or the circumstances and story regarding its production arouse serious suspicion as to its genuineness and a careful examination may show conclusively that the document is authentic. Rubber stamp identification as it relates to document examination is similar to handwriting and typewriter identification. With the development of technologies such as digital signature and electronic coding, the cases pertaining to rubber stamp identification might not be as prevalent in the western world as they are in developing countries like India, where rubber stamps are still extensively used to authenticate or to verify the genuineness of a document. Identification of a particular stamp, possible source and circumstances of production are the aims of any initial examination. Rubber stamps may be individualized through any of the steps in manufacturing process even back-tracking to the imperfections in the metal type faces. More commonly, individuality occurs from use, misuse, wear and even age of the stamp. In the present study, an attempt has been made to study the

various defects in the rubber stamps, their frequency, causes and factors thereof. Steps in the manufacturing process and causes of defects leading to identification of a rubber stamp are discussed.

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AGEING CONTUSIONS IN LIVING – A PRELIMINARY REPORT

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Introduction: Contusions composed of a major group of mechanical injuries produced by blunt force impacts. Aging of bruises is very important in framing chargers against perrpetrators and the current methods are based on their colour changes that significantly varies according to different schools of thought and also subjected to perception of the observer. **Objectives:** To work-out an appropriate objective reference scale of colour changes and other parameters of skin contusions for local setting **Materials and Methods:** Injuries of blunt force impact [contusions] on body surface in otherwise healthy victims, referred to Forensic Medicine Unit of the Karapitiya Teaching Hospital, with reliable circumstantial evidence about exact time of its infliction, were electronically recorded by using full spectrum digital camera with optical filters of different wavelengths. Re-examination was carried out where feasible. The colour of the contusion and control region were quantitively measured with standard colorimetric analyzer according to CIE L*a*b* system under D 65 Daylight. The skin temperature and moisture levels of the affected areas were also measured using standard industrial grade equipment. These records were then analyzed against timing of injuries using SPSS software. **Results:**There had been 40 cases with 3 – 96 hours after the incident. Red colour lesions were observed in 14 victims with up to 24 hours old lesions and in two cases with 72 hours old contusions. Five cases with purple blue lesions had injuries of 48 – 72 hours and another five cases had bluish lesions since the incident. The Δ values of L-Lightness, a- Red/Green and b- Yellow/Blue compared against the control regions showed significant difference ranging from 1 to 15 points depending on the time interval. The skin temperature was 0.1 -0.2 degrees higher within 24 h compared to control region and 0.3 – 0.5 degrees higher in lesions of 72 hours. The moisture level of the contused area varies upon location of the injury. **Conclusions:** The Δ values of L-Lightness, a- Red/Green and b- Yellow/Blue could be used as criterion for estimation of age of a contusion. A continuous survey covering broader contingent of cases with assessment of all other parameters is essential to arrive at more reliable conclusions about timing of injuries.

Disclosure: All authors have declared no conflicts of interest.

USING DRONES FOR 3D ON-SITE BODY DOCUMENTATION. EXPERIMENTS INSPIRED BY REAL-LIFE FORENSIC CASES

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Investigation of death events requires mandatory employment of a variety of forensic documentation procedures, which capture the presence and conditions of physical evidence, occurrence of events and contextual information. The recent substantial progress in digital imaging technologies permitted modifying protocols which had relied almost exclusively on traditional digital photography. Particularly, drone-mounted aerial photography and post-processing treatment of digital photographs on principles of photogrammetry have been cited as the most critical innovations in outdoor forensic scene and on-site dead body documentation. Yet, extending aerial documentation protocols with photogrammetry is yet to be proposed. The present study has been inspired by real-life forensic cases having involved individuals who had fallen off a cliff at an abandoned limestone quarry located at the Brno city limits, Czech Republic. For its leveled overview to the city the quarry is a popular, albeit treacherous, gathering site. Three mock forensic scenes were constructed at the site using a dummy, human skeletal remains and crime scene equipment. The two-fold project aimed to propose a drone-based protocol for outdoor forensic scene photography and to test applicability of drone-based photography for 3D scenery and on-site body documentation. For the purpose, a commercial drone DJI Phantom 2 equipped with a GoPro hero 4 digital camera was employed. The aerial documentation was further enhanced by close-range on-ground imaging using a Nikon 7000 camera equipped with an 18-105 mm lens. The final set of images was ultimately processed with Agisoft PhotoScan® program in order to generate 3D textured digital models. The generated point cloud of approximately two million vertices was appended by texture files (jpeg, 4096 x 4096 pixels) and scaled using the meter scale placed in the scene. This study represents the very first attempt to combine aerial photography with principles of single-camera photogrammetry in outdoor forensic scene documentation. Employing the drone enabled to document small-to-large areas of the forensic scene in a relatively short time span. Although dependent on a rather time-consuming image post-processing phase, the 3D photogrammetry approach produced large-scale 3D models mapping the landscape and vegetation encompassing the forensic scenes. It also provided photorealistic 3D surface records, where all parts of the mock forensic scenes were present and clearly noticeable. Altogether, the acquired results shed light on benefits and costs of employing unmanned aerial drones for crime scene photography and for innovative three-dimensional on-site documentation techniques.

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NEW FORENSIC SCIENCE STUDY AT THE UNIVERSITY OF WARSAW

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In 2007 Law School Department of Criminalistics and five University of Warsaw faculties (among them Biology, Physics, Chemistry and Psychology) created a separated unit *Forensic Science Center*. Its purpose was to carry out research, make expertizes for courts and The Prosecutor Office of the Republic of Poland and also to prepare and conduct forensic science study. Unfortunately, the last aim has never been fully achieved. So far only forensic science classes, courses and seminars have been offered within law studies, security studies and criminology but there was no full forensic science study at the University of Warsaw. Next academic year it is going to be changed since Forensic Science Center will open a new, highly interdisciplinary *Forensic Science Program,* which will last for two years and will offer students the Master of Science in Forensic Science (MSFS). Thanks to new facilities and modern laboratories of the Faculties of Physics, Biology and Chemistry the curriculum will prepare students for a wide variety of forensic disciplines. Three main specializations are foreseen: criminal justice and general criminalistics, forensic biology and genetics, forensic chemistry. The program will be the best example of interdisciplinary cooperation between diverse branches of knowledge, including science, law and psychology.

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HOW TO FINGERPRINT A 300-YEAR-OLD MUMMY

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Fingerprints rank among the most commonly employed characteristics enabling to establish identity of a dead body. Although in early stages of body decomposition obtaining fingerprints can be a relatively straightforward task and essentially in agreement with fingerprinting a living person, in heavily decomposed, water immersed, burned or mummified bodies it possesses a number of challenges. Due to

post-mortem alterations of the skin, e.g., rigor mortis, imbibition, skin slippage, the conventional "inked-and-rolled" fingerprinting of the deceased becomes less suitable. Although a variety of alternative procedures applicable to these cases have been proposed – rehydration, epidermal skin removal, casting, photography in oblique light, direct reading or radiography, none of them is particularly appropriate when the skin has lost its elasticity, is extensively creased and application of casting substances or chemical solutions allowing rehydration is strictly prohibited. The present study intends to demonstrate difficulties met while fingerprinting Baron Franz von der Trenck (1711-1749), a 300-year-old mummy, whose remarkably well-preserved soft tissue layers bear skin ridges on both hands and feet. Yet, due to the rigidity and extensive wrinkling of the volar surfaces the fingers and toes are virtually "unprintable". In order to obtain fingerprints the surface was recorded with an Atos Capsule 3D scanner. This provided a 3D mesh, which was carefully edited to eliminate errors and holes. Two enhanced technologies were employed to "imprint" the recorded surface – 3D sculpting and 3D printing. For the former, the edited mesh was processed in Zbrush software using the Cavity Masking tool. This yielded a binary 2D image reflecting the surface ridge pattern and a "straightened" 3D surface. As an alternative approach, a 5x enlarged physical replica of the finger volar surface in the form of a rubber membrane of 0.5 mm in thickness was built by the technology of 3D printing. Stretched on a soft polyurethane block shaped into a large finger pad, the membrane was coated with white powder and imprinted with a translucent duct tape. After arranging the tapes on see-through foils the imprints were digitized with a flatbed scanner and enhanced in an image analysis program. While both approaches provided readable post-mortem fingerprints, the 3D sculpting technique was far less laborious and more time-effective.

Despite the fact of being viewed potentially as a curiosity in the forensic settings, the present case study lays down the foundation of incorporating an advanced 3D virtual approach into post-mortem fingerprint processing.

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RESEARCH ON THE TRACKING CODES OF THE DOCUMENTS PRODUCED BY COLOR LASER MULTI-FUNCTIONAL PRINTERS

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The tracking codes technique is a non-destructive examination on questioned document examination. Previous studies have shown that, the color laser printed document may appear tracking codes, and the tracking codes are different in regularity, pattern, and lattice features among diverse brands of printers, so the tracking codes can be used for the primary identification of different brands of laser printers. Laser multi-functional printers, refers to the collection of two or more than two functions of laser printer, usually with print, copy, scan, fax and other functions, it is more convenient than a single-function printer. Examined by the microscope and multi-wavelength light source of video spectral comparator, the color printed and color copied documents of laser multi-functional printers will also appear tracking codes. Even more interesting is that research shows that even in the same one laser multi-functional printer, the tracking codes of the color printed and color copied documents are different. For some of the laser multi-functional printers, tracking codes of the color printed and color copied documents are different in regularity, but some of them are completely different. At the same time, the color copied document will retain the tracking codes which previous time the color printed document left on it, although sometimes they may be not clear. The widespread use of laser multi-functional printers are both opportunities and challenges to the study of questioned document examination. These information reflected by the tracking codes can be used for non-destructive examination.

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SCREENING FOR SNPS IN HIGHLY DEGRADED DNA BY USING AMPLIFIED FRAGMENT LENGTH POLYMORPHISM

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Short tandem repeat (STR) analysis is generally used for human identification of forensic samples, however, standard STR analysis is prone to failure since DNA is frequently degraded by various environmental factors. Recently, single nucleotide polymorphism (SNP) analysis has attracted attention for human identification since the shorter amplicons are better suited for degraded samples. Though various SNP loci are used for analysis of degraded samples, it is unclear which ones are more appropriate. To identify SNPs that are resistant to degradation, we artificially degraded DNA obtained from the buccal swabs of six volunteers and the K562 cell line by heat treatment. As the first step for the SNP screening, small DNA fragments are generated from genomic DNA. We focused on the amplified fragment length polymorphism (AFLP) method, which is a PCR-based DNA fingerprinting technique that can be performed without any DNA sequence information. DNA fragments were produced from genomic DNA by digestion with EcoRI/MseI restriction enzymes, oligonucleotide adaptors were bound to the DNA fragments, and the target DNA fragments were amplified by PCR. Then, the PCR products were separated by electrophoresis on 15% polyacrylamide gel. We selected AFLP bands with similar electrophoretic mobility in both the heat-treated and untreated samples, and DNA extracted from these bands was directly sequenced. Base local alignment tool (BLAST) and the single nucleotide polymorphism (dbSNP) were used for searching SNPs. DNA degradation increased as the duration of heat treatment increased, and STR profiling completely failed after 6 h of heating. We used the 6-h treated samples as highly degraded DNA for following experiments. When the AFLP band patterns were compared between 6-h heat-treated and untreated samples, nine common bands were detected. The sequences of the DNA fragments of these common bands included 22 SNPs. Moreover three SNPs (rs144344421, rs163621, rs12293045) were showed as more than 0.01 of minor allele frequency. The DNA sequences and SNPs detected in heat-treated and untreated samples were considered to be resistant to degradation. Some of identified SNPs might be useful for human identification of extremely degraded DNA by severe environment.

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**CHEMOMETRICS APPLIED TO CHEMICAL PROFILES OF COCAINE SEIZURES:
A FORENSIC INTELLIGENCE APPROACH**

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Forensic intelligence is becoming a valuable tool to assist police forces in disrupting and preventing criminal activity. It can provide a better knowledge and understanding of crime systems in general and illegal drug trafficking in particular. In an intelligence perspective, it is hypothesised that the systematic comparison of chemical profiles of cocaine specimens would permit to establish trends as well as links between seizures, thus ultimately impacting on the knowledge of the illegal trafficking of cocaine in Australia. This study focuses on the chemical profiles of cocaine seizures performed by the Australian Federal Police (AFP), between 2008 and 2013. Exploratory research was undertaken and an efficient model was built to assess the feasibility of classifying cocaine specimens based on the different chemical profiles, using different chemometrics, such as pre-treatments and similarity measurements. The best results were obtained when employing alkaloids profiles of specimens, as it enabled the best discrimination between linked and unlinked specimens, as well as the lowest false positive and false negative rates. The proposed model

will be presented, by reviewing the different steps and various parameters influencing such a statistical approach, and the overall relevance and impact of such outcomes for law enforcement, security and public policy will be discussed.

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SUITCASE CONCEALMENT: AN ANALYSIS OF THE TAPHONOMIC PROCESSES AND THEIR EFFECT ON PMI ESTIMATION

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In cases of homicide, suitcases provide concealment and may ease the transport of a body with minimal likelihood for detection. In order to create a minimum post-mortem interval estimate (mPMI), it is first necessary to understand the unique taphonomic processes that occur when a body is concealed within a suitcase. In this study, the experimental carcasses consisted of pig (*Sus scrofa*) heads, which were concealed within either hard shell plastic suitcases, or fabric suitcases; the control pig heads were left on the surface of the ground to decompose naturally. Starting on day three of each study period, and continuing every other day until day 15, three suitcases of each type were removed from the field for analysis of the entomological activity inside the suitcases and the decompositional stage of the pig head. Additionally, the ambient temperature and the temperature inside each type of suitcase was recorded by temperature data loggers throughout the duration of each study period. The study was repeated twice, once in May and once in August 2016. Temperature comparisons revealed that the hard shell plastic suitcases reached significantly (<0.001) hotter temperatures than both the ambient temperature and the temperature inside the fabric suitcases. Insect activity began immediately on the control samples during both study periods; however, during study one, insect activity was not present inside the fabric suitcases until days 3-5, and did not occur inside the hard shell suitcases until days 5-7. During study two, insect activity inside both types of suitcases was present by day 3, but not guaranteed to occur until day 4 or later. Some differences in insect species were noted between the controls and the suitcases, as well as between both types of suitcases. Most notable was the presence of a number of fly species that are generally associated with late decomposition inside the suitcases. Additionally, while beetles were present on the control samples, none were found inside the suitcases. All control samples mummified within days, while all of the experimental samples experienced wet decomposition often resulting in skeletonization by day 15. This study has shown that, not only does concealment within a suitcase change the taphonomic history of the body enclosed, but that the type of suitcase also influences the taphonomic factors that the body will experience. Ultimately, this study will aid in the ability to better predict the mPMI for cases in which a body is concealed within a suitcase.

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DETERMINING A NEW METHOD FOR ESTIMATING THE PMI OF DECOMPOSED REMAINS FOUND IN TEMPERATE AUSTRALIAN

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At present, a reliable method for estimating the post-mortem interval (PMI) of decomposed remains in an Australian context using taphonomic changes occurring during decomposition alone is currently unavailable. Decomposition rates of human remains are climate dependent, therefore the current published methods developed internationally may not be useful for determining PMI in Australian environments. The aim of this study was to assess the validity of previously published methods in a temperate Australian climate and develop a method that is more appropriate in an Australian context. Between 2014 and 2016, pig carcasses, as an analogue for human remains, were left to decompose on a soil surface during the seasons of Summer and Winter (8 pigs per season, 32 in total) in Greater Western Sydney. Soft tissue changes were recorded at regular intervals during each season and scored according to previously published methods. Temperature data was recorded daily using data loggers and an onsite weather station. A new Western Sydney specific model for determining PMI was also developed using all new data collected. This presentation will discuss the validity of using published methods in determining PMI in an Australian environment and how they compare to the accuracy of the newly developed Western Sydney method.

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ANALYTICAL INTERFERENCE IN MOLECULARLY-IMPRINTED POLYMER SPE (MIP-SPE) AND UPLC-QTOF-MS

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Molecularly imprinted polymers (MIPs) provide a medium with high selectivity binding sites for analytes with specific structural features. Accordingly, MIPs have been promoted as selective solid-phase extraction (SPE) media for extractions of targeted analytes that may serve to minimize matrix effects while providing desirable reagent and pH stability. A key limitation of MIP-SPE, however, is the bleeding and detection of residual template molecules from the polymer matrix detected by more sensitive instrument platforms. Here we report template bleeding and interference with analysis of selected amphetamine-related stimulants (ARSs) in aged/post-mortem blood by UPLC-qTOF-MS. Ephedrine (EPH), a toxicologically important analyte, was observed to leach from a commercially available MIP across extracts of numerous drug-free blood and aqueous matrices (250 uL sample volume), increasing apparent instrument EPH response by more than 25% at real EPH concentrations of 20 ng/mL. Mixed-mode SPE (MMSPE) and Filtration Pass-Through Extraction (FPTE) analyses of various drug-free aqueous and decomposed blood matrices confirmed the MIP as the source of the EPH interference. While the extraction selectivity provided by MIP technology is remarkable, the potential for template leeching as a significant source of interference of selected analytes may be very high and should be characterized and disclosed by all vendors.

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HOMICIDAL DEATH INVESTIGATION AT WORKPLACE – THE MALAYSIAN EXPERIENCE.

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Violence and crime are becoming quite common nowadays. Such deaths are of public interest, particularly to family members and relatives. This is a case of a 41-year old male, who was severely beaten to death at his workplace, and was investigated consequently. Further discussion revealed multiple injuries and the implicated objects used, which formed a learning experience. The employers have statutory responsibilities for enforcement of a method to control the risk of peer group pressure, and to help reassure that risks to workers are properly curb, and criteria adopted such that corrective actions are taken to wrongdoers.

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ELEMENTAL INHOMOGENEITIES IN SAMPLES OF FLOAT GLASS AND THEIR RELEVANCE TO FORENSIC INVESTIGATIONS

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One of the premises on which the forensic analysis of glass is based, is that panes of glass are homogenous in their physical and chemical properties. This premise is essential to determining a quantifiable criterion for discriminating between the known and recovered samples. In the course of performing elemental analysis on float glass samples associated with forensic investigations, the CFS has encountered several examples that exhibit significant elemental inhomogeneity. These variations were observed along the cross section of the glass, and are believed to be associated with the common glass manufacturing flaws called 'reams'. Elemental analysis was carried out on the glass samples by laser ablation inductively coupled mass spectroscopy (LA-ICP-MS) using a 213 nm laser with a beam diameter of 55 µm and an analytical menu of 22 elements. For this study, each sample was ablated in spots located every 100 to 150 µm along the entire thickness of the cross section, beginning at 50 µm below the float surface. The elemental concentration results for the analyses were then displayed graphically as a function of depth below the float surface. Although measurable inhomogeneities have been found to be common in glass samples analysed at the CFS, here we present only the most anomalous examples. The most common inhomogeneities were observed for Cerium, Zirconium, Cobalt and Tin. According to the exclusion criteria for float glass discrimination defined in ASTM method E2927, elemental variations may become problematic when they approach or exceed a relative range of about 20%. In these cases, the variations are such that they could result in a false exclusion (type I error) if no special accommodation is made. In light of the prevalence of these elemental variations, it is recommended that the protocol for forensic glass analysis by LA-ICP-MS on known samples include distributing the ablation spots along the full cross section in order to best characterise the bulk composition of the glass.

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A STUDY INTO FINGERMARK RECOVERY METHODS FROM SUBMERGED KNIVES IN DIFFERENT AQUATIC ENVIRONMENTS

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There are inherent challenges to overcome when visualising and recovering fingermarks of evidential value from submerged items. This is due to many variables, not least the destructive effect of the water. There is little research looking at the survivability of fingermarks in submerged environments and fewer still researching the effect of varying water types and environments on the marks in differing contexts. This study focuses on identifying the best methodology for recovering fingermarks from knives submerged in different aquatic environments, examining the effect of different bodies of water and the texture of the substrate on the development and visualisation of the mark. The aim of this project is to improve the effectiveness of forensic methods for underwater investigations, and to raise awareness across the Police and the Criminal Justice System of what the evidence potential is, impacting on how underwater investigations are conducted. A variety of methodologies have been used and different sequential processes were evaluated to produce the best results for each water type and each knife type. The outcome provided a detailed comparison of ridge detail development, producing practice guidance for future case work. By demonstrating that water does not remove fingermarks and identifying the best methodology for each environment and surface texture; these results have a significant impact on forensic practice, which will aid criminal investigations and increase knowledge of this type of crime scene.

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A MINIMALLY-INVASIVE INTERNAL GAS RESERVOIR MONITORING METHOD FOR POSTMORTEM EXAMINATIONS

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Volatile organic compounds (VOCs) produced by human and animal remains has been under investigation for many years, and has focused largely on the gross emission of VOCs from the overall cadaver. However, there has been minimal emphasis on how these VOCs accumulate internally during early stage decomposition, and whether the trends involved in such evolution could be valuable in a medicolegal setting. VOCs may provide previously unrecognized information about the taphonomic state of the remains and potentially for post-mortem interval estimation. The long-term goal of this research is to develop a routine method that could be implemented in post-mortem examination using a minimally-invasive sampling procedure implemented prior to surgical examination. This would be accomplished using (1) whole body post-mortem multidetector computed tomography (PMCT) to locate internal gas reservoirs, (2) laser-guided gastight syringe withdrawal, (3) injection of withdrawn gas into a prepared vial, (4) solid-phase microextraction of the sample and (5) comprehensive two-dimensional gas chromatography – time-of-flight mass spectrometry (GC×GC-TOFMS) analysis. The objective of this study was to investigate optimization of the SPME and GC×GC-TOFMS parameters to develop a method that will be deployed in future large-scale research studies. SPME fiber extraction, internal standard approach and sample stability were tested. Optimal fiber type and exposure time were determined for the SPME sampling. In addition, introduction parameters (desorption time, desorption temperature, and split ratio) were optimized. An internal standard approach was developed using a mixed deuterated standard to provide quality control in chromatogram alignment and normalization for large-scale studies requiring batch sample analysis. VOCs in the collected samples were found to be stable for six weeks or longer. Finally, a range of samples collected from five cases were investigated. The extent of variation between samples from a single individual was less than the amount of variation between individuals, which indicates that sample variation could be coming from other extrinsic factors (e.g. taphonomic state, post-mortem interval, environmental conditions) or intrinsic factors (e.g. height, age, weight, gender). Further research on a large cohort of individuals is necessary using the optimized method to understand the impact of these factors. Due to the widespread accessibility of PMCT at medicolegal centers worldwide, this has the potential to become a valuable post-mortem examination tool in the future.

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DEADLY INTOXICATION BY INFLAMMABLE SUBSTANCES: ABOUT A CASE OF DRUG ADDICTION

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In Algeria the phenomena of drug addiction is a scourge that is becoming increasingly alarming and is not specific to any one particular layer of society. On the contrary, it can be found in all walks of life. Adolescents are the most vulnerable of course, and because drugs are expensive, adolescents commit acts of aggression to procure the means to obtain these substances. These acts of aggression frequently target other adolescents. Consequently, this category of society is seen as easy game for dealers who wish to sell their merchandise in colleges, high schools and universities. At the same time, there are other addicts from less favourable backgrounds, who inhale inflammable products and organic solvents such as glue, sprays, ether and acetone. These products are dangerous and unfortunately, are readily available. In the wake of this, the

authors propose to study an interesting case of addiction which took place in Oran (second largest city in the west of Algeria) on November 1st. 2015. We were requisitioned by the judiciary police to proceed with the reception of the body of a young man in a public garden on the outskirts of the city. The body was lying on its side on the ground next to a bench. Nearby was a container of cigarette lighter gas. Examination of the body showed no trace of suspicious violence. The body was then transported to the morgue where an autopsy was performed. An internal exam revealed general congestion of the viscera with an oedema of the lungs. Blood, urine and gastric contents were tested for drugs in the forensic police laboratory and this revealed the presence of inflammable substances (butanol, propanol and ether). At the end of our necropsic examination, and taking into account the drug test results, we concluded that the death of this young man was due to an acute oedema of the lungs as a results of a massive intoxication of inflammable substances.(The poisonous inflammable gas came from the container that was recovered near the body). It is noted that the deceased was inhaling these substances while in the company of another adolescent, witness to this drama. This unusual form of addiction causes real problems in prevention of such incidents as these substances are readily available and inexpensive, contrary to classic forms of drugs (psychotropics),for which the commercialization is illegal. Faced with this evidence, we suggest recommendations to the public authorities in order to avoid similar tragedies in the future.

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LUMINESCENT SILICON OXIDE NANOPARTICLES FOR FINGERMARK DETECTION

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In the constant endeavour to find new and more efficient fingermark detection techniques, nanoparticles applications have been attracting a lot of attention mainly because of their small size, tunable surface characteristics and versatile optical properties [1]. Metallic nanoparticles, metal oxides or semiconductor nanocrystals have been studied and applied with varying success over the past decades. However, despite all efforts, few publications present clear supporting evidence of their superiority over standard and commonly used techniques. Further, very few methods based on nanoparticles have been used in real casework. This situation can be explained by the fact that nanoparticles are often designed for other applications outside forensic science, and are then tentatively applied onto fingermarks with limited success. By taking into account the highly specific constraints of fingermark detection, this study focuses on a promising nanoparticles type: silicon oxide. It regroups all the necessary properties for an effective detection tool and offers several advantages over the other nanoparticles already used in the field. Silicon oxide nanoparticles have versatile surface modification abilities; various functional groups can be grafted onto their surface, leading to precise targeting of the fingermark secretion components. Their optical properties can be tuned to fulfil forensic optical requirements by introducing a luminescent dye in their inner structure. This study presents the synthesis of silicon oxide nanoparticles and their subsequent application to detect fingermarks on non-porous substrates. The focus will be directed towards designing a user-friendly and cost-effective technique that can be implemented in practice. The main advantages over traditional techniques will be presented. [1] Bécue A., Cantú A. A. (2012), Fingermark detection using nanoparticles, In: Lee and gaensslen's advances in fingerprint technology, 3rd ed., Ramotowski, R. S., Ed., CRC Press LLC; pp 307-379.

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THE STATUS AND THINKING OF X CHROMOSOME GENETIC MARKERS IN FORENSIC SCIENCE

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Human X chromosome is a medium-sized chromosome, the length is about 153Mb, which has about 1100 coding genes, and it is about 5% of the human genome. In 2005, Dr. Mark Ross completed the sequencing work of human X chromosome, which lays a solid foundation for the X-STR study. The X chromosome genetic markers occupy an indispensable position in forensic genetics. At present, more than 50 X-STRs have been applied in forensic genetics. With their sex-linked genetic characteristics, they have been applied in the complex paternity testing cases and disasters. Dayse A.S. used 15 autosomes and six X-STRs to identify the mother-child relationship with only the mother's wreckage, confirming that the likelihood rate was significantly higher than that of the autosomes. Chiara T. used 16 autosomal STRs and 4 X-STRs to identify half-sisters, demonstrating that X-STR is more effective than autosomal STR in such cases. In some special cases, researchers have applied the autosomal STR, X-STR and mitochondrial SNP to identify the complex relationship. In some major disaster scene, there is need for genetic identification, the traditional method depends on the triple body of parents and child, when the triple body is absent, we can combine autosomal STR and X-STR for genetic relationship identification, this technical solution has played an important role in the 6.1 Oriental Star shipwreck accident and 8.12 Tianjin port Explosion. The application of X-STR is fit for China's national conditions, and also has good application prospects. The future of the X-STR genetic markers should focus on the actual application. Based on the establishment of X-STR's use standard, more X-STR should be detected. By combining the autosomal STR and X-STR loci, more efficient and accurate judgments can be made in practical cases which can provide clues and evidence for the case. X-STR, autosomal STR and Y-STR can be simultaneously detected in one system through the platform of second-generation sequencing, which can ensure the high sensitivity of the detection and make it easy to get comprehensive judgments, this platform is especially fit for the difficult sample and degradable sample, the platform of second-generation sequencing will become a new direction of X-STR test.

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COPAN NUCLEIC-CARD™ PERFORMANCE WITH DIRECT STR ASSAYS

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Background: Copan NUCLEIC-CARD™ White and COLOR (Copan Italia Spa) has been on the market for several years as long term storage devices of DNA from buccal swabs or blood samples for forensic human identification. Both NUCLEIC-CARD™ types are customized products and optimized for manual and automated punching. Originally the performance of NUCLEIC-CARD™ was done only with the Thermo Fisher AmpFLSTR Identifiler Direct PCR typing chemistry. The objective of this study was to evaluate the performance of NUCLEIC-CARD™ White and COLOR using direct PCR amplification and STR profiling technologies available commercially for forensic human identification. **Methods:** In this study a pool of buccal swabs and blood samples from different donors were used to test both Copan NUCLEIC-CARD™ types for the analysis of autosomal and Y chromosome STR markers with the PowerPlex Fusion 6C System (Promega), the GlobalFiler Express (Thermo Fisher), the Investigator 24plex GO! (Qiagen), the PowerPlex Y23 System (Promega) and the YFiler Plus (Thermo Fisher) chemistries. Forty microliters of buccal pool were deposited on NUCLEIC-CARD™ COLOR, while 40ul of each blood sample were deposited on NUCLEIC-CARD™ White cards for each donor. Two 1.2mm discs/card were punched with the CPA200 automated puncher to test with each of the five STR profiling technologies. **Results:** Full balanced profiles were obtained with both buccal samples on NUCLEIC-

CARD™ COLOR and blood samples on NUCLEIC-CARD™ White with all five STR typing technologies, within the recommended parameters of the manufacturers. Less PCR cycles (1 or 2) were used with the NUCLEIC-CARD™ White for blood samples, compared to the NUCLEIC-CARD™ COLOR for saliva samples. **Conclusions:** The data obtained demonstrated that both Copan NUCLEIC-CARD™ White and COLOR had a good performance with the Promega PowerPlex Fusion 6C System, the Thermo Fisher GlobalFiler Express, the Qiagen Investigator 24plex GO!, the Promega Y23 PowerPlex System and the Thermo Fisher YFiler Plus kits. Copan NUCLEIC-CARD™ White and NUCLEIC-CARD™ COLOR can be used as reference samples, for DNA data bank and for judicial court cases in forensic human ident

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A NEW CALORIMETRIC IDENTIFICATION OF BENZODIAZEPINE: USING COBALT THIOCYANATE AS REAGENT

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A highly specific and easy to perform cost effective color test for benzodiazepines class has been developed. This color test gave green color with eight benzodiazepines i.e. nitrazepam, temazepam, diazepam, bromazepam, clonazepam, estazolam, lormetazolam, alprazolam, whereas developed colour was absent in other controlled or pharmaceuticals substances tested during study. In this color test, first of all one drop of concentrated hydrochloric acid was added to test substrate. Then two drops of cobalt thiocyanate reagent were added in subsequently which resulted in an immediate appearance of green colour. So this test can be very helpful as a presumptive screening tool for Benzodiazepines in suspected illicit samples.

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ACCIDENTAL GENITAL TRAUMA IN FEMALE CHILDREN IN JORDAN AND THE ROLE OF FORENSIC MEDICINE

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Objective: To evaluate the frequency and the nature of genital trauma in female children in Jordan, and to stress the role of forensics. **Methods:** This is a cross-sectional study conducted between March 2008 and December 2011 in Jordan University Hospital, Amman, Jordan. Sixty-three female children were examined for genital trauma after immediate admission. The mechanism of injury was categorized and reported by the examiners as either straddle, non-straddle blunt, or penetrating. **Results:** Straddle injury was the cause of injuries in 90.5% of patients, and contusions were the significant type of injury in 34% of patients, followed by abrasions in both labia majora and labia minora. Only one case suffered from non-intact hymen and 2 had hematuria. These 3 cases (4.7%) required surgical intervention and follow-up after 2 weeks. **Conclusion:** Straddle injuries were the main cause of genital trauma and rarely affect the hymen; however, due to the sensitivity of the subject and the severity of the traumas, forensic physicians should provide consultation and cooperate with gynecologists to exclude or confirm hymenal injuries, where empathy is necessary to mitigate tension associated with such injuries for the sake of the child and the parents as well, along with good management of the injury type.

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POTENTIAL MISCARRIAGE OF JUSTICE DUE TO HIERARCHICAL ERROR MESSAGES FOR ETHANOL BREATH TESTING

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All evidential breath-alcohol testing (EBT) instruments are subject to potentially yielding false elevations in their breath-alcohol test result due to mouth-alcohol contamination of the subject's breath sample despite manufacturers' efforts to incorporate mouth-alcohol detection systems. Consequently, in addition to the EBT instrument's mouth-alcohol detection system, additional safeguards are often employed: a 15-20 minute observation period and a dual breath testing protocol. To eliminate external sources of mouth-alcohol contamination, an observation period of the subject for a period of 15-20 minutes is normally conducted to ensure nothing is placed into the subject's mouth. This same observation period (if it is truly an observation period and not simply an unobserved waiting/deprivation period) also serves to potentially detect internal sources of mouth-alcohol contamination in subjects experiencing vomiting, belching, or burping. However, even the direct observation of a subject may not detect internal refluxing of residual ethanol-containing stomach contents and/or vapor through an open lower esophageal sphincter (LES) that has been weakened in subjects with gastroesophageal reflux disease (GERD). Dual breath test results that differ by more than the normal biological variability of +/- 0.020 g/210 L are indications of mouth-alcohol contamination, radio frequency interference, or some unknown problem with the subject's testing procedure and should require additional testing of the subject following a second 15-20 minute observation period. The notification of error messages on the instrument's digital display and/or on the printout and their hierarchical order of dominance for the detection of mouth-alcohol, no 0.020 g/210 L agreement, etc. is a software option that can vary as a function of both the manufacturer and the individual governmental agency that purchases/operates the EBT instrument. One potential miscarriage of justice can result if the EBT instrument is programmed to only exhibit a "MOUTH ALCOHOL" error message briefly on the digital display during the detection of mouth-alcohol contamination in the subject's second breath sample and the printout contains only a "Difference > 0.02 Disapproved" error message. The hierarchical suppression of a printed "MOUTH ALCOHOL" error message can result in the EBT instrument operator retesting the subject without conducting a second observation period for the mouth-alcohol contamination to dissipate. The authors will present the results of a case involving this particular situation in a jury trial that is pending at the time of the preparation of this abstract.

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CORRECTIVE RAPE AND ITS MEDICOLEGAL ASPECTS

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Corrective rape is defined as rape of gay men and lesbians to "cure" them of their sexual orientation. The term was first coined in South Africa [in the early 2000s] where this practice is prevalent. The practice is becoming prevalent in India too. Most of the perpetrators of this act are people from the family — brothers, cousins. Sometimes even parents encourage these acts. Curiously there is a strong contradiction between South Africa's law [it was the 5th country in the world to legalize same-sex marriage] and what actually happens on the streets. The trauma from such incidents often compel victims to cut off ties with their families or even run away from home. Victims find it traumatizing to speak of their brothers/ cousins turning rapists and prefer to delete the incident from their memories and cut off ties with their families. Because the perpetrators are mostly relatives, these incidences almost never get reported. The paper discusses some case studies from South Africa, India and other countries. Medicolegal aspects of this kind of rape are also highlighted. The two most important cases from South Africa are those of Eudy Simelane, a lesbian from South Africa. In 2008, she was gang-raped and stabbed to death. Her

naked body was dumped in a stream in the Kwa Thema township outside Johannesburg. She was targeted because of her sexual orientation. Then again in 2011, Noxolo Nogwaza, 24, was raped, and stabbed multiple times with glass shards. Her skull was shattered. Her eyes were reportedly gouged from their sockets. She had been seen earlier that evening in a bar with a female friend. In India, corrective rape is dealt with u/s 375 and 376 of Indian Penal Code [IPC]. Even if the victim tries to shield the perpetrator, asserting that she does not want to lodge a police case against her relative [or wants to withdraw a complaint lodged earlier on impulse], she cannot succeed because rape is a non-compoundable offence.

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FINLAND AND INTERNATIONAL FORENSIC FACT-FINDING DURING THE SECOND WORLD WAR

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During the Second World War, Finland contributed two specialists of forensic pathology to two different international forensic fact-finding teams, which monitored, verified and also investigated the remains of victims of violence at Katyn and at Vinnytsia. Due to the nature of the victims, the work at the first expedition is part of the history of forensic pathology (victims were Polish prisoners of war), and the work of the second expedition (victims resulted from the Soviet internal repression and were its nationals) is mostly forgotten. Finland also requested once assistance from a neutral State, Sweden, to investigate the bodies of the Finnish civilians, who were killed, mutilated and raped during the Continuation War at Seitajärvi village, Lappland, by the Soviet guerrilla fighters. After the Continuation War, the experts who participated to Katyn and Vinnytsia expeditions, were investigated and pressured by the Armistice commission. The results of the Seitajärvi –investigations were later submitted to the United Nations War Crimes Commission and later added with a testimony from the Finnish officer, who was leading the troops who found the victims. However, due to the post war developments the Seitajärvi-incident was not investigated further by the UN War Crimes Commission and materials remains in its sealed archives.

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D4N6FLOQSWABS™ ALLOWS REPEAT TESTING OF ORIGINAL TRACE COLLECTED FROM CRIME SCENE

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Background: Since the introduction of the 4N6FLOQSwabs™ for crime scene trace collection, requests have been received from forensic laboratories on the inability to cut a portion of a 4N6FLOQSwabs™ for testing and store the other portion for repeat testing or for record retention. Copan developed the Divisible (D) 4N6FLOQSwabs™ that has an innovative shaft to allow the separation of the swab in 2 halves for evidence collection for crime scene investigations. The objectives of this study was to validate the D4N6FLOQSwabs™ for easiness of use, ability to separate the swab and quantity and stability of DNA collected by both halves of the swab from crime trace investigation. **Methods:** For this study, testing was done to evaluate the use of the D4N6FLOQSwab™ for crime scene trace collection. Traces were prepared by spotting volumes of saliva and blood on glass and tissue and left to dry. D4N6FLOQSwabs™ and 2 4N6FLOQSwabs™ were used to collect the traces. During collection the followings were evaluated: tightness of the-swab-shaft; optimal volume of water for pre-wetting the swab; proper procedure for homogeneous collection; easiness of swab separation after collection; ability to collect both traces from both substrates. After collection, D4N6FLOQSwabs™ were divided into 2 halves: one half was tested at zero time, the other half was placed in its own tube and tested after 2 months at RT. 4N6FLOQSwabs™ were also tested at both times. At T0 and after 2 months, nucleic acids were extract with the PrepFiler Express on the AutoMate Express, amplified with the Human Quantifiler Trio on the 7500 Real Time PCR and profiled with the Identifiler Plus on the 3130 Genetic Analyzer (Thermo Fisher). **Results:** D4N6FLOQSwabs™ didn't separate during collection, was easy to separate when used wet or dry with both traces and substrates. The optimal volume for pre-wetting the swab was 15 µl for glass, dry was better for tissue substrates. The optimal collection procedure was wetting the flocked tip and scraping the trace with the tip then rolling the swab on the trace. At T0 almost 50% of DNA was recovered from half of the D4N6FLOQSwabs™ comparing to a 4N6FLOQSwabs™. Similar amounts of DNA were obtained from the other half of the D4N6FLOQSwabs™ after 2 months at RT comparing to T0, DNA was stable on the stored swab. **Conclusions:** The D4N6FLOQSwabs™ is an innovative device for crime scene trace collections that allows repeat testing or record retention of the original trace.

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THE 14TH JULY 2016 TERRORIST ATTACK IN NICE

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The 14 July 2016 terrorist attack in Nice was a devastating event. The terrorist intentionally bumped his large truck into the pedestrians along more than 2 km on the "Promenade des Anglais". There were 84 victims + the assailant. Two victims died later. This work aims to describe the organization and the forensic care required by this terrible event. The process at the crime scene, the tight link between the DVI chain (devoted to the identification) and the forensic pathology chain (devoted to the issue of the cause of death and other questions asked by the Prosecutor), the communication with the families and the role of the students of medicine are underlined. The 84 victims were positively identified within five days. The aftermath period raises several issues as the gathering of the families around the deceased, the psychological and medico-legal management of the victims and the psychological risks to health workers.

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INVESTIGATION OF ART WORKS PIGMENTS IN FORENSIC PRACTICE

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Sculpture or painting are always a welcome addition to the interior. They can also be one of the commodities where we can invest financial resources. A growing market with modern artworks of a high price leads to the creation and selling of artwork counterfeits. Expert assessments of private experts that usually accompany the purchase do not always constitute a one hundred percent guarantee, although they include information about the originality of the painting. One of the important information about a painting is pigments analysis of individual color layers. Within the framework of the project Comprehensive Instrumental Methods for the Assessment of an Artwork's Authenticity, a Material Database of the 20th century (VI20172020050) database of pigments used in the first half of the 20th century (including synthetic organic pigments) and modern binders will be made. Extenders and other additives will be studies as well. Changes in material composition of grounds (e.g. different mixtures of calcite, chalk, gypsum, zinc white and barium sulfate) on commercially prepared primed fabric supports will be documented. Data from the database will be compared with results obtained from the analysis of the paintings of selected Czech modern painters (e.g.. Otakar Kubín, Josef Šíma, Jan Zrzavý) from the collection of the National Gallery in Prague. Chosen artworks will be analyzed with non-invasive techniques (X-ray fluorescence, fiber optics Raman spectroscopy) but also samples will be taken and analyzed using optical microscopy, scanning

electron microscopy with X-ray microanalysis, μ-Raman spectroscopy and infrared spectroscopy. The lecture includes not only the analysis of the samples secured from controversial pictures, but also comments on some significant cases of forgeries of paintings that are investigated in the Institute of Criminalistics Prague in cooperation with the National Gallery. This work has been financially supported by the project of the Ministry of the Interior of the Czech Republic: Comprehensive Instrumental Methods for the Assessment of an Artwork's Authenticity, a Material Database of the 20th century (VI20172020050).

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IDENTIFICATION AND ANALYTICAL CHARACTERIZATION OF U-47700-ET AND 4-F-PENTEDRONE

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A large number of new psychoactive substances (NPS) have gained much distribution and popularity on the global market in the last few years. These NPS largely fall within the following groups: synthetic cannabinoids, synthetic cathinones, phenethylamines, tryptamines, and piperazines. Other classes also include benzodiazepines, arylalkylamines, aminoindane, arylcyclohexylamines, piperidines/pyrrolinde, diarylethylamines, thienotriazolodiazepines, fentanyls, and other synthetic opioid derivatives, etc. Clinical and forensic toxicology laboratories are continuously confronted by analytical challenges when dealing with the new psychoactive substances. Governments worldwide have taken action in an attempt to control these compounds. By October 2016, over 730 NPSs were reported to the United Nations Office on Drugs and Crime (UNODC) Early Warning Advisory (EWA), far exceeding the 244 substances currently controlled under the International Drug Conventions. In China, in addition to the first regulation of 12 substances in 2013, 116 narcotic drugs and psychotropic substances and 4 fentanyl derivatives for non-medical use were placed under control on 1 October 2015 and 1 March 2017, respectively. Police officials seized some powdered samples which were transported via the express. Among the seized samples, we identified two new psychoactive substances, one opioid analgesic of U-47700 derivative: 3,4-dichloro-*N*-(2-(diethylamino)cyclohexyl)-*N*-methylbenzamide (U-47700-Et) and one synthetic cathinone derivative: 1-(4-fluorophenyl)-2-(methylamino)pentan-1-one (4-F-Pentedrone). This paper reports on the analytical properties of these two compounds. These identifications were based on by liquid chromatography-quadrupole-time-of-flight-mass spectrometry (LC-QTOF-MS), gas chromatography-mass spectrometry (GC-MS), and nuclear magnetic resonance (NMR) spectroscopy, and Fourier Transform infrared spectroscopy (FT-IR), which would be useful for forensic chemists involved in the identification of related compounds. The synthetic methods of U-47700-Et have been reported in 1980, but to our knowledge, the analytical data was not available. There have been no synthetic, chemical, or biological information about 4-F-pentedrone until now, making this the first report on the compound.

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IDENTIFICATION OF VICTIMS IN TERRORIST BOMBING OF HILLAH, IRAQ

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Introduction: One of the important aspects of managing the aftermath of terroristic events is dead body management. The present article is a brief description of managing a terroristic event that occurred in a gas station in Hillah, Iraq, in November 24, 2016. During the event, two buses transporting Iranian pilgrims were exploded. The bodies were retrieved without supervision of forensic medicine experts and put in dead body covers to be delivered to the Iranian Legal Medicine Organization. **Materials and Methods:** The delivered covers contained either complete bodies or destroyed incomplete bodies or body parts (85 pieces). All corpses were examined by forensic medicine experts and in some cases autopsy and radiographic imaging were performed. Dental profiles of all corpses were developed and a sample for genetic identification was taken from each corpse. Blood samples were taken from relatives of those declared as missing persons in the event to prepare genetic profiles for comparison. **Results:** Genetic profile matching was performed for all body pieces and the relatives of the missing persons. Finally, 58 corpses were identified within a week and the bodies were delivered to their families. **Discussion and suggestions:** Considering the fact that, in addition to Iranian victims, there were victims from other countries such as Iraq and Afghanistan in this event racial characteristics of the victims were of utmost importance in distinguishing the identity of each corpse. On the other hand, lack of supervision by forensic medicine experts when the bodies of the victims were being retrieved, made the task of the Iranian forensic medicine staff more difficult and time consuming. Coordination between legal medicine organizations of neighboring countries in this regard can be helpful in managing such kinds of disastrous events.

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MAXIMISING FORENSIC DNA UTILITY: ETHICAL, SOCIAL AND LEGISLATIVE CHALLENGES.

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Since the emergence of forensic DNA profiling and the corollary creation of DNA databases, efforts to maximise the efficiency and utility of DNA technology have intensified. Such efforts are expedient given the imperative that expenditure on DNA should be cost-effective and the benefits demonstrable. To this end, regimes governing forensic DNA have often been adjusted to better target those from whom DNA will prove most 'profitable', and to expand the uses of retained DNA. Yet the European Court of Human Rights in 2008 clearly articulated the need for a 'balance' between police powers to retain the DNA of citizens, and privacy concerns, human rights and public interest. The Court left unsaid what this balance should be, leaving such calibrations to domestic legislators. The Court was likewise silent on whether there ought to be limitations on the uses of retained DNA. In delivering a unanimous but terse ruling, the Court left States wide discretion, and while scientific and technological advances continue to attract the eye of ethicists and sociologists, (particularly around developments such as phenotyping and familial searching), the governance and legal regimes of DNA databases garner far less critical attention. In some instances, a 'balance' originally struck may have been destabilised by subsequent legal reforms, or changes in practice, and regimes are in need of re-calibration. Thus forensic DNA databases continue to raise questions of legitimacy and acceptability, particularly when accounting for ongoing efforts to maximise DNA efficiency and utility.

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ANALYSIS OF NAME WRITINGS & SIGNATURES/ INITIALS OF THE PERSONS AND THEIR SIGNIFICANCE

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There are some peculiar cases pending in various courts where document expert is required to compare the writings with the signatures/initials in order to ascertain their common authorship beyond the basic principle of handwriting science which states that "Only likes can be compared with likes". Writings are to be compared with writings and signatures/initials are to be compared with signatures/initials of similar script. In such cases the body writings on documents are admitted and signatures/initials of

the executants are disputed or denied and sometimes body writings on documents are disputed or denied and signatures/initials of the executants are admitted. These cases may involve documents relating to Pronotes, Receipts, letters, Wills, Agreements or deeds, Cheques, Suicide notes, Anonymous or threatening letters etc. For the present study 200 persons including 100 males and 100 females were chosen as subjects in the age group of 22-65 and were either graduates or post graduates. They were provided with some common text of their introduction as samples to write in English including their name writings with their accustomed hand and after it they were required to sign in their own style i.e. full signatures or initials. The writings and signatures/initials of all the subjects were obtained on the executive bond white paper with similar blue gel pen. After the critical and exhaustive examination of the general and individual writing characteristics of name writings and signatures/initials of all the subjects, the results revealed that the subjects who write their signatures like writing their full name writings an opinion with regard to their common authorship can be formed subject to the natural variations, similarly the subjects who write some visible letters in their signatures can also be compared with their counterparts in the name writings and the subjects who sign their names in a peculiar manner with complicated and scribbling strokes without any decipherable letter cannot be compared with their name writings and thus no opinion can be formed with regard to their common authorship. Dr. Vikram Raj Singh Chauhan

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3D DOCUMENTATION OF CRIME SCENE AND IDENTIFICATION OF PERPETRATORS BASED ON BPA

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The presented system is able to preserve the crime scene and generate a 3D model from the digital data that can be used for further analysis with the dedicated software provided with the system. The specialized analytic module for bloodstains provides forensic experts with an opportunity to perform precise, quick and objective assessment. In addition, the implemented bloodstain database supports the expert in determining the mechanism for generation of the bloodstains at the scene. This solution will be capable of presenting the distribution and layout of stains in an unambiguous, trustworthy and objective way. These are crucial factors to draw the right conclusions about the origin mechanisms of bloodstains and help in identification of the perpetrator and the victim (esp. when combined with DNA analysis), in reconstruction of the course of the event as well. The goal of the system is to assist law enforcement administration in investigative proceedings and facilitate subsequent legal proceedings that rely on forensic evidence. Selected innovative features of the system: - Reconstruction of the crime scene in 3D virtual reality that retains highly accurate modeling of relevant details, the people present as well; - Opportunity for experts to draw conclusions based on object–oriented data, even without appearing personally at the crime scene; - Complex nature of the technological idea starting from hardware to software solutions through database design, to conclude with prototype tests and training in instruction of the end users. Nevertheless it depends on a system adopted there is no substantial differences as to the methods of conducting crime scene examination in various countries. The software developed in the program incorporates a number of ways of documentation including written reports, photographs, videographs, scene sketching, mapping as well. Therefore it can be very helpful not only to the law enforcement officers, prosecutors, expert-witnesses, but also to private attorneys for demonstration the potential course of events, characteristics of the people present as well, at the crime scene.

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SIMULTANEOUS QUANTIFICATION OF Δ9-THCA, Δ9-THC, CBN AND CBD IN SEIZED DRUGS USING UPLC-PDA/QDA

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An analytical method using ultra-high performance liquid chromatography-tandem mass spectrometry (UPLC-PDA/QDa) for the qualitative and quantitative analysis of Δ9-tetrahydrocannabinolic acid-A (THCA-A), Δ9-tetrahydrocannabinol (Δ9-THC), cannabidiol (CBD), and cannabinol (CBN) in confiscated cannabis products has been developed. The seized cannabis products were extracted in methanol by sonication. After centrifugation, the supernatants were separated on a Waters UPLC BEH C18 column (100 mm×2.1 mm, 1.7 μm) with isocratic elution at a flow rate of 0.2 mL/min, coupling with PDA at 220 nm. The binary mobile phase was methanol (containing 0.1% formic acid) and water. The correlation coefficient of standard curve for the three cannabinoids in linearity range was not less than 0.999, as well as the recoveries of the three cannabinoids in cannabis products were 82%-102% with the relative standard deviations (RSDs) of 0.36%-4.12% at three spiked levels. The method is specific, easy, quick and suitable for confirmation of the cannabinoids in seized cannabis products. Cannabis plants in different areas were classified by their chemical phenotype as drug-type or fiber-type plants, taking into account either the phenotypic index (%Δ9-THC+%CBN)/%CBD, or the THC/CBD and the (THC+CBN)/CBD ratios. The analysis of the original composition of plant material is necessary for the detection and analysis of cannabis products and the quality control of cannabis plants. The study shows that the usefulness of the principal component analysis (PCA) method for chemotaxonomic classification of Cannabis varieties in different regions of China.

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DELIVERY OF FORENSIC ASSISTANCE IN INTERNATIONAL SETTINGS

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The goal of this presentation is to highlight the role of forensic science in meeting larger international development goals. In particular, forensic science promotes a fair and effective criminal justice system, supports transnational criminal investigations, identifies the missing and aids human rights investigations. This presentation will review ICITAP's experience in delivering forensic assistance and highlight the challenges encountered in international settings as well as provide examples of technical assistance meeting immediate host country needs. ICITAP's forensic assistance programs take a holistic approach to development and aims to improve all aspects along the forensic continuum from crime scene to courtroom testimony. In line with the National Academy of Science's recommendation, an overarching goal of ICITAP forensic assistance programs is international accreditation and adoption of recognized best practices. Accreditation institutionalizes quality practices and therefore supports sustainability of U.S government investments. Laboratory accreditation requires a significant investment of time and resources in Western countries. A laboratory attempting to be the first in their country or region to become accredited faces an even more difficult endeavor. Achieving international accreditation is a long process that requires solid management skills such as strategic planning, budgeting, and administration of a rigorous quality assurance program. Additionally, scientists must understand the capabilities and limitations of their discipline to validate processes, develop reliable standard operating procedures and effectively testify in court proceedings. Similar to Western countries, continuing education is often needed to address technological advancements that have been made after a scientist's formal education has been completed. The presentation will highlight ICITAP's approach to forensic development. To highlight the

aspects of a successful program, the presentation will feature a review of ICITAP's current efforts in Mexico under the Merida Initiative, a security cooperation agreement between the United States and Mexico. ICITAP has already assisted some Mexican forensic laboratories and crime scene units in Mexico become accredited under the ISO 17025 and 17020 standards. ICITAP and the Department of State share a common goal of assisting all Mexican State laboratories meet the accreditation standards over the next several years. Additionally, The Mexican Government has recently transitioned to an accusatory criminal justice system and ICITAP is providing expert witness training to help facilitate the effective and reliable testimony of Mexican forensic scientists.

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STRYCHNINE POISONING: A RARE CASE REPORT

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Death due to strychnine poisoning has been described in the literature since the 19th century. Strychnine poisoning is a rare and fatal event, requiring rapid medical intervention. Most of the case reports associate strychnine poisoning with suicide deaths. However there are also reported cases of homicides and accidental deaths. According to data provided by the Forensic Chemistry and Toxicology Laboratory, only 4 cases of strychnine poisoning were recorded between 2009 and 2016 in the northern region of Portugal. This is a case report of a 56 year old man with a history of chronic alcoholism, high blood pressure and unspecified lung disease. One night he complained of nausea during dinner, then added chills and thirst. He went into cardio-respiratory arrest soon after. No traumatic injuries were found in the external examination. In the internal examination, regarding the cause of death, there was blood infiltration of the tongue and signs of blood aspiration, compatible with *antemortem* convulsive episode, which is a common physiopathological feature produced by strychnine poisoning. The presence of strychnine on peripheral blood at a concentration of 1084 ng/mL was found, being its lethal concentration of 500 ng/mL. In the anatomopathological examination important observations weren't made for the cause of death. In conclusion, this is a case with violent cause of death due to strychnine poisoning. It was not possible to determine the underlying etiology with the provided circumstantial information. This case demonstrate, in the first place, that strychnine death, although uncommon, still exists - and should be taken into consideration in the differential medical diagnosis. Although strychnine poisoning most commonly occurs with muscle spasm and seizures, the presentation may be atypical, as in this case. On the other hand, the absence of traumatic injuries in the external examination does not exclude violent death, and a toxicological study must always be done even in the absence of suspicion of crime.

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COMPARISON OF AUTHENTIC AND SYNTHETIC TRAINING AIDS FOR DRUG-DETECTION DOGS

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Drug-detection dogs are deployed to detect illicit drugs worldwide. They are typically trained to detect the odour of the drug, not specifically the parent compound. Due to the limitations and restrictions of using authentic illicit drugs for training drug-detection dogs, synthetic training aids have been developed to overcome these issues. Law enforcement agencies and private companies in Australia use synthetic training aids as a complementary tool to seized illicit drugs. To date, there has been no research conducted to determine if the odour of the synthetic training aids are an accurate representation of the authentic illicit drug. This study focuses on the synthetic training aids, ScentLogix™ and SOKK®, and the corresponding seized illicit drugs used by police dog units in Australia. Volatile organic compounds (VOCs) were collected from a range of seized illicit drug training aids with varying weights and purity levels. Each training aid (authentic and synthetic) was placed in a sealed container and a method was optimised for solid-phase microextraction (SPME) of the VOCs. The VOCs were subsequently desorbed from the SPME fibres and analysed using comprehensive two dimensional gas chromatography-time of flight mass spectrometry (GC×GC-TOFMS). The results of this study determined the VOCs that were present in the authentic training aids and compared these to the VOC profile of the corresponding synthetic training aid. It was determined that the odour comprising the ScentLogix training aids contained the most abundant VOCs present in the headspace of the authentic training aids, which were predominantly solvents. Less abundant key VOCs were also present such as methyl benzoate which represents the primary compound canines alert to in cocaine. However, the abundance of methyl benzoate was low in the VOC profiles of both the authentic and synthetic training aids. Further, recommendations will be provided for law enforcement agencies and private companies that utilise drug-detection dogs.

Disclosure: All authors have declared no conflicts of interest.

GC-MS EXAMINATION OF DIFFERENT KINDS OF COPY PAPER

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Paper plays an important role in our daily life, and paper evidence becomes common physical one in forensic sciences. The rubber, filler, pigment, fluorescent whitening agent, spice may be mixed with pulp during paper-making, so different paper can be distinguished. Recently, many methods have been developed to analyze the difference between all kinds of paper, such as GC, LC, LCMS *et.al.*. In this paper, 19 kinds of A4 copy paper were analyzed by GC-MS, the results showed that the method is feasible. 19 kinds of A4 copy paper (70g/m2) were purchased in Chinese market. 1/4 sheet of each paper were extracted by solvent (methanol/ ethyl acetate/ ethanol/acetone 10mL)for 4 hours with room temperature, then analysis was performed by GCMS(Thermo Fisher Trace GC Ultra and DSQ II mass spectrometer). The extraction method was optimized with methanol as extraction solvent, and by the optimization of experimental conditions, the best extraction condition is temperature 40°C and time 2 hours. 19 kinds of A4 copy paper from different manufacturers were extracted with the experimental condition that was optimized, then the chemical constituents of 19 extracts were analyzed by GC-MS method. The relative retain time and peak area were calculated to distinguish different paper. It is obvious that the 19 kinds of A4 paper owned different chromatography, the kinds and content of chemical composition of 19 kinds of A4 copy paper were different.

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THE CONTRIBUTION OF FORENSIC PATHOLOGY TO FAMILY HEALTH

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Forensic pathologists through their privilieged access to post-mortem information can make a significant contribution to familial health and wellbeing. Consultations with families about causes and circumstances of death aid in understanding, dispel misconceptions and help with grieving. Engagement with clinical colleagues and faciliation of appropriate referrals where issues of potential genetic significance for surviving next of kin are present can also save lives. This presentation will describe

the work of the Family Liaison Service at the Victorian Institute of Forensic Medicine in Melbourne Australia. It will specifically reference the VIFM's cardiac referral service and present examples of cases where interventions which had their origins in the autopsy suite have resulted in vital contributions to family health. The practice of forensic pathology is often seen as remote from the concerns of clinical medicine, but the establishment of strong and collaborative links with clinical medicine means that we can be more than the what happened specialism, we can be the specialism which helps stop it happening again.

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TISSUE DONATION AND CORONIAL DEATH INVESTIGATION

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Organ donation is a well-established life-saving undertaking in many countries, however post-mortem tissue donation attracts comparatively scant attention from clinicians and the public. Heart valves, tendons, split-skin grafts and bone removed with the consent of next of kin from deceased individuals within 24 hours of circulatory arrest may also be used in life-saving and life-improving surgeries. In Australia, individuals whose deaths are the subject of medico-legal death investigation are a major source of tissue for transplantation, recognising that the donors less likely to transmit disease to recipients are more likely to be found amongst sudden unexpected deaths in previously healthy people. However the needs of the death investigation system can sometimes come into conflict with those of the healthcare system with tensions as to what would best serve the needs of the community. Additionally, increasingly burdensome regulatory, safety, and manufacturing requirements make this particularly difficult terrain to traverse. This presentation will highlight the work of the Donor Tissue Bank of Victoria, Australia's first multi-tissue tissue bank and a division of the Victorian Institute of Forensic Medicine. It will cover the history of tissue banking in the state of Victoria, how the challenges inherent in the situation of a healthcare operation within a medicolegal death investigation facility are addressed, and finally provide an overview of what the future of tissue banking in this setting might look like.

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EPICARDIAL FAT ASSOCIATION WITH OTHER BODY FAT DEPOSITS AND CORONARY ARTERY STENOSIS

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Background and aims: Former studies indicate that epicardial fat tissue may be a contributor to the progression of coronary artery disease and that epicardial fat mass is increased with generalized increases in body adiposity. Autopsy combined with computed tomography (CT) allows us to quantify organ sizes and perform tissue segmentation. CT of eviscerated hearts makes volume estimation of epicardial fat and myocardium possible, using semi-automatic segmentation techniques. The aim of this study was to investigate the association of epicardial fat with other fat deposits in the body. Furthermore, we wanted to test the association between different fat parameters, including epicardial fat, and the degree of coronary artery stenosis. **Materials and methods:** We included 144 individuals who underwent a medicolegal autopsy, and did an ex vivo computed tomography of the eviscerated hearts. Using the semi-automatic computer software program Mimics® we determined the epicardial fat and myocardium volumes. During autopsy body height and weight, waist and hip circumference as well as omental and kidney fat weight were measured, and the degree of coronary artery stenosis was evaluated. We tested the association between the measured fat parameters and a categorical degree of stenosis, using ordinal logistic regression. Furthermore, we tested the association between epicardial fat and other fat measurements using linear regression. 12 (8%) subjects were excluded due to inadequate CT-scan. Of the remaining 132 subjects included in the results, 74 (56%) were males, and the mean age was 53 years (range: 22-94 years). **Results:** We found that weight, body mass index (BMI), waist circumference, hip circumference, omental fat weight and kidney fat weight significantly and positively associated with epicardial fat volume (p-values<0.05). The best correlation was found with kidney fat weight (coefficient of determination=32%, p<0.0001). We found no association between any parameters of fat (weight, BMI, waist or hip circumference, epicardial-, omental- or kidney fat) and the degree of coronary artery stenosis. **Conclusions:** Epicardial fat was positively associated with all body fat measurements included in the study and the strongest correlation was found to kidney fat. We found no association between any fat measurements, including epicardial fat, and the degree of coronary artery stenosis.

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IDENTIFICATION OF 12G SHOTGUN PISTOL THROUGH PRIMED SHOT SHELL CASES

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Firearm identification is a significant field of forensic science and is one of the ways to provide justice to both victim and accused. There are significant points in firearm identification that can be used to identify firearms, for example extractor marks, ejector marks, breech face marks, barrel marks etc. 12G shotgun pistols are widely used in crimes in developing countries like Pakistan, India etc. The identification of 12G shotgun pistols is usually difficult using un-primed shot shells when they are brought under examination by firearm examiners. During a case study (specific details can't be shared for confidential reasons) it is observed, after repeated careful examinations, that identification of firearm is possible by using primed shot shell/cartridge cases. During 12G shotgun pistol identification procedure, test fires are produced using primed shot shell cases. A shot shell is made primed by removing all pallets from its inside. Many primed shot shell cases are fired using 12G shotgun pistols and collected for examination under comparison microscope for side by side inspection. Photographs are also taken for future record. When the questioned shot shell cases are compared with primed test shot shell cases, there are significant matching features, particularly shape of firing pin is exactly same in all shot shell cases. In this way questioned shot shell cases are identified as having been fired in particular shotgun pistol. The safety of firearm examiner is always paramount during firearm identification process. Therefore based on the results of primed shot shell, the test fires can be produced using primed shot shell cases. This technique is further verified in multitude cases and very good firing pin impressions are produced on primed shot shell cases. Therefore, this technique can be used by firearm examiners in the examination of lethal firearms such as 12G shotgun pistols and blow back pistols. This technique will ensure the safety of firearm examiner and identification of the lethal weapon, which may not be otherwise possible using un-primed shot shells.

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DNA IDENTIFICATION OF DIFFERENTIALLY PRESERVED HUMAN REMAINS: AN EFFICIENT SAMPLING METHOD

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DNA profiling is a reliable and efficient way to identify bodies or separated

body parts. For this, DNA-samples of the deceased are required. To enable identification the DNA profiles of the deceased must be compared with ante mortem DNA samples of the missing individuals (presumed victims) and/or DNA reference samples from their blood relatives. Usually, the collection of adequate ante mortem DNA is technically simple. The acquisition of a suitable post mortem sample may however be complicated, for instance due to the variable degree of preservation of the human remains and the associated degradation of DNA, and the risk of (cross) contamination from either other human remains or from members of the investigating team. These challenges are especially encountered during Disaster Victim Identification operations, but can also be met in cases with only one or few casualties. We introduce an efficient method for the collection of post mortem samples of muscle and bone tissue, bone marrow and teeth for DNA analysis. The method is not only applicable for intact bodies, but also for decomposed, damaged, skeletonized and/or intermingled body parts. Using this method we obtained highly informative genotyping results with a minimal chance of contamination. The method is straightforward, easy to learn, inexpensive and fast. The performance of the method is illustrated by discussing its application in the identification process of the victims of the MH17 airplane crash in Ukraine in 2014. Also the selection of the tissue to be sampled and the site of sample excision will be discussed.

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THE MULTI-INDIVIDUALITY OF HANDWRITING

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The multi-individuality of handwriting is a rare phenomenon, resulting in the development of two or more wholly or largely different habits of writing. These heterogeneous skills of writing are used in a spontaneous way, but also by conscious choice of one of them, depending on the circumstances of writing, e.g. taking notes, preparing official documents, emotional state or the speed of writing. Different varieties of writing of the same person can lead experts to issue erroneous opinions, especially if the reference material does not reflect the type of the handwriting appearing in the questioned document. There can be a problem with the assessment of the homogeneity of the reference material in the case of the multi-individuality of handwriting. There is also the ability to manipulate the reference material. The example of the multi-individuality of handwriting will be presented.

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ADVANTAGEOUS AND LIMITATIONS OF ALTERNATIVE SPECIMENS IN FORENSIC TOXICOLOGY ANALYSIS

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Since the first use of hair as an alternative specimen for determination of heavy metals, the analytical instruments showed great advancements. These advances permit the toxicologists to determine the very low concentration of drugs in such samples. The typical alternative specimens are included; hair, nail, sweat, saliva and meconium. Each of these samples represents advantageous and drawbacks which could impact the toxicological results. The collection of alternative specimens is easy, non-invasive and could be performed under the controlled situation without privacy beseech. Although the advantageous of alternative specimens are identical each of them represents its own limitation which restricts its application. For example hair could be contaminated by environmental contaminations or some of the drugs cause inhibition of saliva secretion and cause dry mouth. Moreover, the concentration of drugs in these samples is very low which necessitate the application of sensitive analytical instruments for analysis. The aim of this review is to describe the advantageous and drawbacks of alternative specimens regarding their collection, pre-treatment and analytical interpretation. Although the use of alternative specimens brings back into the 1960s this review will focus on recent 7 years.

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COMPARISON OF TRAUMATIC AND NATURAL DISEASE OF THE INTESTINAL TRACT IN THE PEDIATRIC POPULATION

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Hemorrhage within the wall of the intestinal tract may be due to trauma or natural causes. This dichotomy of a natural disease entity vs. non-natural etiology has a significant implication to the medicolegal system as an organic disease process may be misinterpreted and ruled as homicide, leading to a miscarriage of justice. We compare the macroscopic and histological features of infectious colitis in an 8-month old infant with intestinal serosal injuries in a 30-month old child with child abuse. In the infectious colitis case, there were three hemorrhagic strictures involving the ascending, transverse and descending colon with intervening normal areas of bowel. Cross-sections of the large bowel show foci of mucosal ulceration and areas of thickening by a fibrotic deposition and transmural hemorrhage. Microscopic sections of the bowel showed an acute and subacute process: There were invasive bacteria associated with ulceration and pseudomembranes. The strictures were composed of mural edema and early fibrosis. In the cases of child abuse, trauma was not limited to the abdominal cavity. In addition, there was predominant involvement of the small intestine with secondary involvement of the large intestine. Microscopic evaluation of the involved small bowel showed injuries of varying ages. More recent areas showed submucosal hemorrhage and an acute inflammatory reaction. Older areas showed granulation tissue, scarring and seromuscular injury. These cases are compared as a means to inform isolated findings of the bowel and distinguish the etiology.

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Y CHROMOSOME AND MTDNA DIVERSITY IN A FRENCH-CANADIAN POPULATION AND LESSONS FOR FORENSIC GENETICS

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Knowledge of the dynamic of sex-linked markers (on the Y chromosome and mitochondrial DNA [mtDNA]) is necessary for multiple areas of genetics including forensics. However, fine-scale estimation of frequencies, i.e. relevant to a specific population of interest, remains a challenge, as these markers are sensitive to genetic drift and founder effects. This limitation impacts on the interpretation of DNA evidence. Typically, one assumes that 1) reference samples used to calculate match probabilities are representative of the populations of interest and 2) the genetic diversity is stable over time and space, but these assumptions may not be true. Our objective is to test this empirically using the French-Canadian population from Québec. Models combining genealogical and molecular data can overcome limitations associated to limited samples in order to obtain a reliable estimation of frequencies, making it possible to test above assumptions underlying DNA interpretation. Those models allow to obtain a much larger coverage of the population from a small genetic sample. By linking long-term genealogical data from the French-Canadian population of Québec to Y chromosome data from 429 men connected to this genealogy, we were able to impute a haplotype for up to 400,000 men who lived between 1608 (i.e. the foundation of the population) and 1960.

Likewise, we imputed a mtDNA haplotype to 2 million individuals from 875 genotyped individuals. We then determined how haplotype frequencies have changed through time and space in the population. Analysis of mtDNA showed that haplotype frequencies were relatively stable through time, but that they weren't distributed homogeneously on the territory. Differences between sub-populations were sometime more important when looking at a much finer scale. Results from ongoing spatio-temporal analysis of Y haplotype frequencies will also be presented. Those results are determining for forensic genetics because they challenge the application of haplotype frequencies from national or international databases to specific caseworks.

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RECENT LEGAL MEASURES AGAINST STALKING IN INDIA

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Stalking refers to a constellation of repeated and persistent behaviors to impose unwanted communication or contact on another person. Communication can be via e-mails, graffiti writings, letters, paper notes, telephone calls or text. Unwanted contact can be by appearing in places the victim is expected, approaching the victim, following the victim, maintaining surveillance and visiting the victim's home, family, or friends. Additional behaviors may include ordering goods or canceling appointments on the victim's behalf or initiating bogus legal actions. Physical assaults, property damage and threats may accompany stalking. About 80% of stalking is done by men. Lately there has been a rise in the incidence of crimes against women, including stalking around the world. India is no exception. Thus in 2013, Indian government amended the Indian Penal Code (IPC), by adding some sections. For the first time stalking was defined in IPC. Now s354 D of IPC states that "Any man who • follows a woman and contacts, or attempts to contact such woman to foster personal interaction repeatedly despite a clear indication of disinterest by such woman; or • monitors the use by a woman of the internet, email or any other form of electronic communication commits the offence of stalking. Such conduct does not amount to stalking if the man who pursued it proves that • it was pursued for the purpose of preventing or detecting crime and the man accused of stalking had been entrusted with the responsibility of prevention and detection of crime by the State or • it was pursued under any law or to comply with any condition or requirement imposed by any person under any law or • in the particular circumstances such conduct was reasonable and justified In India, the punishment is now quite severe for stalking. On first conviction, there is imprisonment [simple or rigorous] up to 3 y and also fine [any amount]. On second or subsequent conviction - Imprisonment [simple or rigorous] up to 5 y, and also fine [any amount] The presenter will discuss the law against stalking in India, and some recent case studies.

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SEX DETERMINATION BY DISCRIMINANT ANALYSIS OF 3D CT MEASUREMENTS OF FORAMEN MAGNUM

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Objective: The aim of this study is to assess the degree of sexual dimorphism of the foramen magnum (FM) in the Egyptian population by using three dimensions computed tomography (3D CT), to evaluate its accuracy in sex determination and to develop discriminant functions for sex determination for this cranial sample. **Subjects & Methods:** Three dimensions computed tomography films on the foramen magnum were done for every case. The metric parameters were as follows: length of right condyle (LRC), width of the right condyle (WRC), length of left condyle (LLC), width of the left condyle (WLC), length of foramen magnum (LFM), width of foramen magnum (WFM), maximum intercondylar distance (MID), minimum intercondylar distance (MnID), maximum bicondylar distance (MBD). **Results:** There was a statistically significant difference in five measurements (LRC, LLC, LFM, WFM, and MID) between male and female with accuracy rate 93.3% regarding sex discrimination. If an individual person score on the DF is above 56.25 then the individual is considered male and if the DF score is below 56.25 the individual is considered female. **Conclusion:** This study shows that the means that the male skull is significantly larger than the female. If an individual person score on the DF is above 56.25 then the individual is considered male and if the DF score is below 56.25 the individual is considered female..

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INVESTIGATING THE USE OF 5-MTN, GENIPIN AND LAWSONE TO IDENTIFY AREAS OF "TOUCH" DNA DEPOSITION

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Small amounts of DNA may be transferred from an individual to an item during periods of brief and passing contact. These deposits are invisible and typically are not associated with a body fluid. Currently there is no method forensic practitioners can employ to localize these deposits for sampling. In an attempt to develop a method to visualize such deposits, three amino acid reagents (5-Methylthioninhydrin (5-MTN), Genipin, and Lawsone), traditionally used to detect latent fingerprints on paper by producing a colour development or fluorescence, were tested. 5-MTN proved to be the most effective reagent for localizing deposited DNA in preliminary studies where these chemicals were applied to dilutions of saliva on filter paper, swabs and white cloth. Through further optimization it was determined that 5-MTN could be applied directly to an item and a colour change was observed corresponding to touched areas with an optimal development time of 4 hours. Subsequent application of zinc chloride solution produced fluorescence at 530nm. The application of 5-MTN does not significantly decrease the quantity of DNA extracted from a sample (n=36) nor does it inhibit DNA profiling. To demonstrate potential applicability to forensic casework a mock case scenario was created in which an individual was grabbed on several areas of a worn t-shirt. Treatment with 5-MTN facilitated detection of DNA deposits from both the individual who wore the T-shirt and the person who grabbed it. This technique has the potential to be used for identification of low level deposits of DNA from non-bodily fluid sources in forensic examinations.

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DETECTION OF NICOTINE IN ORAL FLUIDS AND ASSOCIATED E-LIQUIDS BY DSA-TOFMS, GC-MS AND LC-MS/MS

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Introduction: As the popularity of electronic cigarettes continues to rise, the variety of electronic cigarette liquids (e-liquids) continues to increase. Regulations on manufacturing standards of e-liquids are still in their infancy in the United States. This has resulted in inconsistencies of e-liquid matrices and nicotine content due to manufacturer variability. This study sought to analyze e-liquids that according to the manufacturer contained 0% and 0.6 % nicotine using Direct Sample Analysis-Time-Of-Flight-Mass Spectrometry (DSA-TOFMS), Gas Chromatography-Mass Spectrometry (GC-MS) and Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/

MS) in order to evaluate the reported nicotine concentrations. Further, oral fluid samples were collected after vaping the e-liquids. **Materials and Methods:** E-liquid samples labeled as containing 0% and 0.6% nicotine were purchased from V2® (Miami, FL, USA), MigVapor© (Pompano Beach, FL, USA) and halocigs© (Trinity, FL, USA) in flavor categories "Sahara", "Vanilla", and "Columbian Coffee". Analytical standard of nicotine, cotinine, nornicotine, norcotinine and anabasine were obtained from Cerilliant (Round Rock, TX, USA). Oral fluid samples were collected from human subject volunteers in accordance with IRB protocol. Samples were collected using Quantisal© (Immunalysis, Pomona, CA, USA) at set time points (e.g. 10 mins prior to-, 5, 15, 30, 45 and 60 mins after-vaping) and analyzed using a Altus A30 UPLC with QSight 220 Laminar Flow Triple Quadrupole Mass Spectrometer (PerkinElmer, Shelton, CT, USA). E-liquid samples were prepared by diluting 15 uL with 1985 µL of methanol (Fisher Scientific Inc., Pittsburgh, PA, USA) was pipetted into a disposable glass tube. Samples were vortexed for ten seconds and 95 µL was pipetted into an auto sampler vial with 5 µL of nicotine-d_4 internal standard (Cerilliant Corporation, Round Rock, TX, USA). E-liquid samples were analyzed by DSA-TOFMS and GC-MS (PerkinElmer, Shelton, CT, USA). **Results:** Of the commercially obtained e-liquids, the 0% nicotine "columbian coffee" flavor had a detectable level of nicotine by DSA-TOFMS in pulse mode and confirmed by GC-MS. Of the oral fluid samples, nicotine was detected at 5, 10, and 20 mins and reached trace levels at 30 mins post collection. Cotinine was detectable throughout all time points, however it remained at a stable concentration at each time point. **Conclusions:** An orthogonal workflow for the detection of nicotine and related metabolites in oral fluid after vaping nicotine free labeled e-liquids by DSA-TOFMS, GC-MS and LC-MS/MS was evaluated. Further, an examination of the e-liquids by DSA-TOFMS and GC/MS was conducted in parallel.

Disclosure: All authors have declared no conflicts of interest.

MULTIPLE FATALITY RESPONSE TO NINE INDIGENOUS DEATHS IN A BURNED HOUSE IN PIKANGIKUM, ONTARIO

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Nine family members were recovered from a heavily damaged home following a fire on the Pikangikum Reserve, a remote Northern Ontario. A team of three forensic pathologists, two forensic anthropologists, six pathology assistants, two radiology technicians and one forensic science technician worked alongside three forensic identification officers and three fire investigators to undertake the task of performing the post-mortem examinations of this family in a single day. Pre-planning for this multiple fatality allowed for regular morgue business continue uninterrupted. The morgue was designed to handle multiple fatalities and contributed to a successful day. The purpose of the post-mortem examinations was to collect information to aid in identification and determine the cause of death. The day began with a presentation from the scene forensic anthropologist. Postmortems were assigned so that any bodies with unresolved commingling would be autopsied concurrently. During the autopsies there was ongoing communication amongst all team members. The postmortems were divided amongst three teams with each forensic pathologist performing three autopsies and the forensic anthropologists circulating amongst cases. All of the decedents had fire related injuries and were in variable states of completeness. In particular, one of the children had extensive destruction to the pelvic organs that interfered with recognition of the internal sex organs. Confirmation of the organ as a bladder was made by frozen histological section. One adult had antemortem trauma that was interpreted with the assistance of the forensic anthropologist. Samples for ancillary investigations included: toxicological analysis, histology and samples for DNA. All nine individuals died from smoke inhalation. Biological information such as approximate age and sex, were communicated to the identification committee. All of the autopsy reports were audited by another forensic pathologist on the team to ensure completeness and similar content. Two of the adult individuals were diagnosed with hypertrophic cardiomyopathy and referred to a cardiovascular pathologist. Genetic testing did not detect a mutation. Hypertrophic cardiomyopathy is typically an autosomal dominant condition and can affect surviving family members. The finding of this disease allows for family members to be screened for this condition. This presentation will impact the forensic community by showing how a well-coordinated post-mortem response with appropriate experts working systematically and as part of an inter-disciplinary team in the morgue results in a successful and expedient multiple fatality investigation of a significantly burned group of human remains, as well as providing important information which may impact the health of surviving family members.

Disclosure: All authors have declared no conflicts of interest.

STUDY ON MYOCARDIUM OF SUDDEN TRAUMATIC DEATHS TO SUGGEST DIAGNOSTIC CRITERIA FOR MYOCARDITIS

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Introduction: Myocarditis is defined as inflammation of the heart muscle that is frequently accompanied by myocellular necrosis. Due to high inter-observer and sampling variability, controversies exist over the diagnosis of myocarditis. Post-mortem studies have shown active myocarditis may result in small focal areas of myocardial necrosis leading to false negative result. On the other hand, Dallas criteria were never intended for post-mortem work and thus, application of Dallas criteria alone to the diagnosis of myocarditis in autopsy specimens may be inaccurate. Over-diagnosis of myocarditis has taken place in autopsy cases where presence of scant / negligible inflammatory foci is interpreted as active myocarditis resulting in problems of administration of justice. The significance of scant or negligible foci of inflammation in the heart muscle as a cause of death has not studied up to now. **Objective:** To study the presence of inflammatory foci in myocardium of normal population who died suddenly of trauma in the view of developing an autopsy diagnostic criteria for myocarditis by routine histopathology. **Methodology:** A prospective descriptive study on microscopy of the hearts of previously healthy asymptomatic young (Less than 40 years) people who died of trauma and observed the frequency and severity of inflammatory foci. The severity of myocarditis was graded qualitatively and quantitatively according to the pre formed grading. **Results:** Out of the 24 hearts examined during this preliminary study, the cause of death in 7 (29.2%) individuals was road accident followed by hanging in 5 (20.8%). The period of survival in a majority 17 (70.8%) was less than 1 hour. There were 19 males and 5 females. There were 10 (41.7%) individuals having no inflammatory foci **(none)** among any of the 10 sections observed. 11 (45.8%) were having few inflammatory foci in few slides **(scant)** and 02 (8.3%) with many foci over few slides **(mild)** and none with numerous foci over many slides **(moderate).** However, there was 1(4.2%) with many foci in each slide **(Marked)**. Type of inflammatory cells in all who had foci was lymphocytes. Presence of inflammatory foci did not show any significant association with the age ($p=0.19$) or gross changes of the heart. **Conclusions** Presence of scant inflammation with lymphocytes in the myocardium of young asymptomatic adults is a common observation and thus conclusion of myocarditis as a cause of death based on scant inflammation at microscopy is erroneous and can lead to miscarriage of justice.

Disclosure: All authors have declared no conflicts of interest.

ANOMALOUS ORIGIN OF LEFT MAIN CORONARY ARTERY FROM PULMONARY ARTERY

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Anomalous origin of left coronary artery from the pulmonary artery syndrome,is a rare congenital cardiac anomaly. The majority of patients die within first year of life if left untreated. However,a few patients can be asymptomatic and survive into adulthood due to well-developed collateral between left coronary artery and dilated right coronary artery. We reported a case of a 18 years old male who has been collapsed suddenly while he taking his breakfast with his workmates at his work place at the quarry where he started to work since 2 years. He was immediately transported to the nearest hospital, At the ER resuscitation efforts were made but unfortunately all had been unsuccessful and his death was confirmed, his autopsy revealed ALCAPA syndrome with dilated right coronary artery. Introduction: Anomalous origin of the left coronary artery (LCA) from the pulmonary artery (ALCAPA) is a rare congenital anomaly that commonly presents in infancy occurring in approximately 1/ 300,000 live births, which if untreated has up to 85% mortality, most deaths occurring before 1 year of age from complications related to heart failure, Some patients remain asymptomatic likely secondary to an extensive network of collateral vessels between the right and left coronary system. The small minority of patients who survive to adulthood with ALCAPA will ultimately develop symptoms, or present with arrhythmia, syncope or sudden death

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DEMONIC POSSESSION & EXORCISM: INVESTIGATIVE AND AUTOPSY FINDINGS IN 3 DEATHS FROM CANADA

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Exorcism is described in various cultures and religions and is intended to expel a possessing spirit from the inhabited person or place. The scientific literature is limited to psychiatric perspectives, with little written on the findings of death investigations when a person dies as the result of 'exorcism'. We present the findings of 3 deaths that involved the belief that the victim was possessed. Case 1 was a 3 year old girl discovered dead in her home with her mother. At the scene, an open bible, bay leaves in the child's mouth and nose, and a looped and knotted extension cord were noted. At autopsy, injury types included thermal, sharp force, and blunt force, with ocular and genital injury and some post-mortem injuries. The cause of death was pressure on the neck and chest and the mother admitted to causing the injuries. Case 2 was an 81 year old woman discovered dead in her home where she lived with her son. No religious text was identified at the scene. At autopsy, injury types included sharp and blunt force, with ocular injury, partial incision of the tongue and at least one human bite mark. Some injuries were post-mortem. A tip of a knife was embedded in the skull. The cause of death was stab wounds of chest and her son admitted to the lethal acts. Case 3 was a 19 year old man discovered dead at his family home. An open bible and oral rehydration drinks were noted at the scene and a diaper was on the body. At autopsy, there were signs of dehydration and restraint injuries on the extremities. Vitreous biochemistry showed a dehydration pattern and death was ascribed to dehydration. His father and mother admitted to the acts that caused his death. In cases 1 & 2 the perpetrators suffered mental disorders resulting in findings of not criminally responsible, whereas case 3 resulted in criminal convictions. These cases illustrate some common themes: 1. All occurred in the victim's home, 2. Religious texts may be found open at the scene, 3. Perpetrators were well known to victims, 4. Perpetrators readily admitted to spiritual motivations for their acts, 5. Multiple forms of injury may be seen; when deaths involve perpetrators with mental health disorders, the injuries often exceed those required to cause death, are mutilating, involve special sites (eyes, mouth, genitals), and include post-mortem injuries.

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EVALUATING THE EFFECTIVENESS OF RECOVERY METHODS FOR GUNSHOT RESIDUE ON VEHICLE MATERIALS

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Gunshot Residue (GSR), also known as Firearms Discharge Residues (FDR) or Cartridge Discharge Residue (CDR), is one of the most forensically significant pieces of evidence in relation to a firearms incident, frequently employed in casework to link weapons, and ammunition to suspects and victims. It is therefore essential that the collection and analysis of GSR is precise, robust and reliable. A number of comprehensive reviews have been undertaken in relation to firearms examination and identification, outlining four main GSR collection techniques; tape lifts, swabs, carbon coated stubs and vacuuming. Although these techniques have been thoroughly tested in relation to retrieval from the hands and hair of a shooter, the same cannot be said for recovery from materials in vehicles. The purpose of this research was to conduct an empirical study, using an experimental research methodology, in order to ascertain the most effective collection method for the recovery of GSR from vehicles. Previous studies have also stated that the aforementioned collection methods can be used up to 50 times on a surface before becoming overloaded with material. Taking this into consideration, procedures for the effective use of each method on material were determined. Reviews, have shown that the most efficient and reliable method of GSR examination once it has been collected, is through the use of scanning electron microscopy and energy dispersive x-ray analysis with the assistance of automated software. Based on previous research, the American Society for Testing and Materials (ASTM) and the European Network of Forensic Science Institutes (ENFSI) have produced universally accepted guides in relation to international industry standards for the analysis and determination of GSR in criminal investigations, which was adopted for this research, with the load factor of GSR for each recovery method being calculated. External agencies, such as Key Forensic Services, Hampshire Constabulary, The Metropolitan Police Service and Kent Police, were consulted during this period to discuss the operational needs, viability and success of each recovery method in live case work. This information was then be used, in conjunction with the results from the SEM-EDX analysis, to determine the most effective method of GSR recovery from material in vehicles.

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THE USE OF TANDEM MASS SPECTROMETRY IN SCREENING AND CONFIRMATION OF DRUGS OF ABUSE TESTING

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Introduction: Testing urine for drugs of abuse (DAT) is applied in Nova Scotia (NS) under the Children and Family Services Act. The procedure previously employed based on SAMHSA Guidelines included screening by immunoassay and confirmation of positive results by gas chromatography-mass spectrometry (GC-MS) or thin layer chromatography (benzodiazepines). Being costly, labour intensive with a lengthy turn-around time, we opted for alternative technologies, using liquid chromatography mass spectrometry-mass spectrometry (LC-MS/MS) for screening for DAT and confirmation in two separate settings for 24 drugs and their metabolites in total. **Methods:** Targeted screening and confirmation analyses (benzodiazepines, benzoylecgonine, methadone, opioids/opiates, amphetamines and phencyclidine) were performed on two separate API 3200 QTRAP LC-MS/MS systems (AB Sciex).

Each instrument was dedicated to one type of analysis (screening or confirmation). Samples were received through chain of custody procedures and were analyzed in a secure laboratory. Samples, controls and working standards were mixed with internal standard, acetate buffer and β-Glucuronidase and incubated at 65°C for 1 hour (screening procedure) and if positive for DAT, they underwent a confirmation procedure using a different aliquot extracted in a modified procedure (incubation at 60°C for 2 hours). Following incubation, proteins were precipitated with methanol/zinc sulfate and the samples were centrifuged. Supernatants (200 µL) were injected on the respective LC-MS/MS. During screening, drugs were identified by comparing their retention times (RT) with those of calibrators and by detection of one multiple reaction monitoring (MRM) transition involving two diagnostic ions. Drug concentrations at or above cutoffs underwent confirmation using RT and one MRM ratio with three diagnostic ions. **Results and Conclusion:** Screening and confirmation by LC-MS/MS allowed accurate and precise quantitative detection of 24 individual drugs and metabolites in both definitive steps of testing and with every analysis. For benzodiazepines, specific identification of each of 11 benzodiazepines and metabolites individually was available with each analysis, an advantage not previously available by TLC especially for illicitly acquired diazepam. Similarly, methadone and its metabolite EDDP were also tested for on every sample thus providing regular monitoring for the methadone treatment program. In conclusion, screening and confirmation testing for DAT in two separate steps by LC-MS/MS provides quantitative information that eliminates the presumptive testing provided by immunoassay and avoids possible false positive results. Additionally, it improves turn-around time, and apart from upfront equipment cost, is a cost effective approach for forensic DAT.

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DENTAL AGE ESTIMATION IN ADULTS: EAST-CENTRAL EUROPE REGION

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The main objective of this study is to create method for the age estimation from ground sectioned teeth, which is supposed to underpin contemporary population of East-Central Europe better than currently widely used ones, predominantly based on modifications of Gustafson´s aging method. Additional objective is elimination of subjective evaluation. **Methods**: One hundred twenty five mono-radicular teeth, unaffected by pathological processes or dental treatments, were analysed. The samples were taken from 70 subjects, whose age at death was between 18 and 89 years. Extracted and cleaned teeth were mounted in epoxy resin, and subsequently ground by Grinder-Polisher in the bucco-lingual plane. The ground sections were evaluated using the reflected light microscope. Length measurements were performed in a medial plane, width measurements were perpendicular to this plane. All the statistical analyses were performed using Statistica 12 program. **Summary of Results**: The Pearson correlation coefficient between length of root transparency (T) and age was 0.81, and between that of secondary dentin deposit (SD) and age 0.75. Other dimensions or their different combinations were correlated rather weakly. Two equations for age estimation were derived using linear and nonlinear regression. The mean absolute error of estimation was 4.12, and 3.99. In cases where more than one tooth was evaluated, the mean absolute intra-individual difference was 3.62 y. **Conclusions**: The teeth used for this study were collected from dead persons coming from East-Central Europe. The strongest correlation with age shows length of root transparency and length of secondary dentin deposit. For this reason, these marks were utilized for regression equations calculations. As compared with methods based on modifications of Gustafson´s method, subjective evaluation is reduced and new calculated equations should reflect the current population more precisely.

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A MORE COMPREHENSIVE APPROACH TO ALCOHOL EXTRAPOLATION

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Forensic science laboratories are often faced with DUID and DFSC cases involving alcohol. The key issue in several of these cases involve the blood alcohol concentration (BAC) of the individual at the time the incident occurred. Many experts attest to BAC extrapolations following manual calculations using the original Widmark factor (1932) for estimating volume distribution without consideration for successive improvements to the formulae by Watson (1981), Forrest (1986), Ulrich et al. (1987) and Seidl et al. (2000). This is likely due to perceptions of the complexity to employ the more complicated algorithms which account for gender, age, weight, height, water content, and body mass index (BMI) compared to a single coefficient by Widmark. The complexity increases when combined with various combinations of plausible absorption and elimination rates. The single point BAC result derived by limiting the calculation to a single method does not reflect the entire range of possible values at the time of the incident. By limiting the calculation to an average of the physiological ranges without consideration of a bounded interval of possible BAC values does not address individual differences and therefore could present incomplete information to a fact-finder when evaluating whether an specific individual's BAC was greater than a statutory level at a particular time prior to the direct measurements. This presentation will include several case scenarios where various extrapolation formulae are considered to highlight the variations experts may obtain when selecting one method over another.

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THE CHARACTERISTICS OF HUMAN TRAFFICKING CASES AND THE INVESTIGATION STRATEGIES

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Trafficking in women and children not only is an ancient crime, but also a kind of international crime. In recent years, Because of the influence of the traditional concept of family and gender imbalance and other factors in some poverty-stricken areas, there is a big buyer's market of human trafficking. and this crime has become the fastest growing and one of the most profitable crimes. With the police crackdown, these cases gradually have the following characteristics: this crime is becoming more and more professional. The mean of crime is more abundant and the violence in these cases is escalated. The suspects aim to profit and their transaction process is obvious. The positive contact with the suspects and the victim has a long time; the whereabouts of the sale is complex and the crime area is expanded. Cracked the case, it's important to verify the clues and do the filing work. and according to different cases, targeted collecting case information, especially the stolen time, place, route and transportation, so as to analyze the transit transport routes and sell. In general, such cases of suspects choose trafficking objects are often relatively poor in rural and remote areas. These suspects often transfer the victim to the northern and eastern coastal towns or rural areas to sell by car, train and other vehicles. Because of such cases always are serial crimes, and the suspects are vagabond to commit crimes. The police analyze cases through the information of suspect's traffic, accommodation and bank transaction information, so as to search evidence for case investigation from target of crime and crime means. In line with the conditions, the police could found that suspects through the case investigation. Therefore, it is necessary to make full use of video surveillance, publish the reward notice and investigation visits and other means to collect case information. and what police should do is to obtain evidence for crime through the identification, questioning, interrogation and other investigative measures.

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QUANTITATION OF THC AND METABOLITES IN WHOLE BLOOD BY LC-MS/MS FOR PER SE LAW TESTING

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Introduction: As legalization of marijuana becomes increasingly popular, the need for marijuana drug-impaired driving laws is also increased. Current applications monitor (–)-*trans*-Δ^9-tetrahydrocannabinol (THC) and its two major metabolites (THC-OH and THC-COOH).The determination of impaired driving from marijuana usage differs according to individual state laws, but five states currently have a cut-off limit of THC or metabolites. One of the major analytical challenges is an unknown interference inflating measured concentrations using current LC-MSMS methods to be 20-30% higher than reported by traditionally longer chromatographic gradients of GC-MS. In order to accurately quantitate THC and metabolites in whole blood, a robust method is presented using a reagent kit. We also investigated CBD, CBN and other THC metabolite to rule out potential cross-interference. **Methods:** The sample preparation methodology is a whole blood protein precipitation followed by solid phase extraction and chromatography is achieved by a Phenomenex reverse phase column. Data is acquired using a positive and negative polarity switching in Multiple Reaction Monitoring (MRM) mode to optimize sensitivity of the analytes to achieve a limit of quantitation (LOQ) of 1 ng/mL for THC, THC-OH and THC-COOH respectively. A longer 8.5-minute LC gradient is provided in addition to a 4.25-minute method to separate an isobaric interference observed in all positive cannabinoid users, all samples were analyzed on SCIEX QTRAP® 4500 coupled to a Shimadzu HPLC. **Preliminary Data:** The LOQ of THC, THC-OH and THC-COOH is 1 ng/mL. The %CV at the LOQ is 3.95%, 7.61% and 2.09% for THC, THC-OH and THC-COOH, respectively. The %Recovery for LOQ analysis is 83-105% for all three analytes. Inter-assay analysis is done by analyzing a total of six biological replicates of low and high quality control. Three biological replicates were analyzed by two different analysts over two different days and the %CV for THC, THC-OH and THC-COOH at both concentrations were ≤15%, complying with SWGTOX guidelines.

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DIAGNOSIS OF CORONARY ARTERY DISEASE USING TARGETED PMCT CORONARY ANGIOGRAPHY

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Targeted post-mortem computed tomography (PMCT) combined with coronary angiography could play a role in the investigation of sudden natural death. We introduce a targeted PMCT coronary angiography technique and its application in the case of a man who died of coronary artery disease. A 53-year-old man collapsed suddenly at work and died soon after arrival at the hospital. The body was examined by PMCT and targeted PMCT with coronary angiography. The left anterior descending coronary artery had 75%–100% stenosis in the middle segment, and the distal segment could not be clearly displayed. In addition, the left circumflex coronary artery and right coronary artery exhibited calcification, expansion, atherosclerosis, and an area of 50% stenosis. There was also a pulmonary ground-glass opacity and small amount of fluid in the subglottic trachea and main bronchi. The imaging results suggested that the victim had died of coronary artery disease, which was confirmed by the autopsy. In summary, targeted PMCT with coronary angiography can demonstrate the arteries and principal pathology that account for most natural deaths. This method is a simple, reliable, sensitive technique for identifying the presence coronary artery disease. This method is a valuable adjunct to the radiological post-mortem examination and is applicable in routine diagnosis services.

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MIR-19B INHIBITS GJA1 AND SYNERGIZES MIR-1 IN VMC

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Background: Viral myocarditis (VMC) is a life-threatening disease that lead to cardiac arrhythmia. It is a frequent cause of sudden death without prior structural heart disease. However, the mechanisms remain unknown. This study aimed to explore the role and potential mechanisms of miR-19b in VMC. It may contribute to diagnose VMC and help forensic experts to seek the cause of sudden death. **Methods**: The microarray analysis and quantitative polymerase chain reaction were used to detect miR-19b in VMC model. Western blot analysis, Immunohistochemistry and luciferase reporter assay were used to examine the relationship of GJA1 and miR-19b in HL-1 cells and human cardiomyocytes derived from the induced pluripotent stem cells (hiPSCs-CMs). **Results**: miR-19b was significantly upregulated in VMC model, and caused irregular beating in hiPSCs-CMs. The upregulation of miR-19b was associated with decreased GJA1 in vivo. In contrary, while the miR-19b inhibitor increased, its mimics suppressed the expression of GJA1 in HL-1 cells. Besides that, overexpressed GJA1 could reverse the miR-19b-mediated irregular beating in hiPSCs-CMs. In addition, miR-19b could synergizes with miR-1 to improve the inhibit effect for GJA1 by a dose-dependent manner. **Conclusions**: Our research suggests that miR-19b cooperates with miR-1 to downregulate the expression of GJA1 which lead to irregular beating. **Key words**: viral myocarditis, microRNA, gap junction, miR-19b, miR-1

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MASSIVELY PARALLEL SEQUENCING OF 34 FORENSIC AUTOSOMAL STRS

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Short tandem repeats (STR) sequences not only vary in the length of the repeat unit and the number of repeats but also in the region where they conform to an incremental repeat pattern. Size-based separation by PCR amplification and capillary electrophoresis (CE) technology has been the standard method for STR genotyping; however, it can only identify STRs by length, not by sequence. Sanger sequencing, which has been used to further characterize STR loci, is impractical for routine forensic use due to the laborious nature of the procedure and the additional steps required to separate heterozygous alleles prior to sequencing. Massively parallel sequencing (MPS), which is an interesting alternative to universal PCR-CE methods and Sanger sequencing, may revolutionize the field of forensic STR genotyping. MPS technology produces sequence data that provide a precise description of the repeat allele structure of STRs and variants that may reside within the amplified fragment or in nearby flanking areas. In this study, we sequenced 34 frequently used forensic STRs included in popular commercial STR-CE kits of Powerplex 21 (Promega, Wisconsin, USA), Goldeneye™ 25A (Goldeneye, co, Ltd, China) and AGCU 21+1 (AGCU, co, Ltd, China) in parallel with Ion Torrent PGM platform. STR nomenclature followed the newest International Society for Forensic Genetics (ISFG) requirements. Except inconsistent results caused by either the insertions/deletions present in the STR motif and flanking regions or the different adopted analysis method, fully consistent results were obtained through PCR-CE and MPS, demonstrating the reliability of the custom-designed panel and the MPS technology. High coverage sequencing data were used to determine the allele/stutter/noise ratio and the ACR values for the heterozygous genotypes. Full concordance was seen with the DNA input down to 0.25 ng with the exception of a single allele drop-out. However, an increased percentage in heterozygous imbalance was observed when the input DNA amount was lower than 5 ng. The allelic sequences obtained with the MPS technology reveal true variations in the STR loci and identify previously unknown alleles. This custom-designed MPS-STR panel and Ion Torrent PGM offer an integrated solution from library-preparation of STRs

and sequencing to data analysis.

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DRIVING UNDER INFLUENCE OF PSYCHOACTIVE SUBSTANCES-RELATED CASUALTIES IN TAIWAN (2003-2015)

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Driving under influence (DUI) of psychoactive substances including alcohol and other illicit drugs has become a major issue of public safety. The traffic casualties of traffic accidents have increased annually with a trend of involving diversities of DUI including New Psychoactive Substances (NPS) that raise public attention. Thus, traffic accidents have seriously endangered public safety and imperiled national productivity. Publicizing enforcement of drunk driving laws, reinforced enforcement of these laws, and restricting alcohol availability can reduce alcohol-related traffic deaths and injuries, which is important in tackling college and underage drinking problems. However, DUI of illicit psychoactive substance has been recognized as an essential contributing factor to the traffic accidents worldwide. From 2003 to 2015, the total 3008 (12.4%) traffic accident's forensic fatalities out of 24284 forensic autopsy fatalities from the Institute of Forensic Medicine, Ministry of Justice (Taiwan) were collected. All traffic-related fatality information were collected and analyzed according to epidemiological investigation. The cause of traffic accident-related death includes natural cause, driving under the influence of illicit drugs, or other extrinsic factors. These results demonstrated that the total 3008 traffic fatalities include 2791 (92.8%) accidental cause, suicide 25 (0.8%), homicide 31 (1.0%), natural cause 120 (4.0%) and unknown 41 (1.4%). In addition, male (2349, 78.1%) occurrence of traffic accident death rate was about 3.6 times the amount of women's (656, 21.9%) and the average age was 52.6 ± 13.9 years old. From the analysis of alcohol and illicit drug abuse, there were 74.7% absent of alcohol and drug, 21.8% alcohol abuse (with blood alcohol concentration above 50 mg/dL), 5.4% of illicit drug abuse, 1.9% for combined alcohol and illicit drug use. In spite of declining traffic fatalities involving alcohol abuse from 33.2% (2006) to 11.5% (2015), the percentage of traffic accidents involving illicit drug abuse remains between 2.2 and 9.5% during 2003-2015. The study demonstrated that despite the steady decline of drunk driving, DUI of drug and alcohol still represent the major causes of traffic accidents. The result can be referenced for the establishment of traffic accident prevention strategies. *This work was supported by Ministry of Justice, project no. 106-1301-05-04-02.*

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FAST FORENSIC TOXICOLOGICAL SCREENING AND QUANTITATION UNDER 3 MINUTES WITH A QTOF LC-MS/MS SYSTEM

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Introduction: Quadrupole Time-of-flight (QTOF) mass spectrometer provides the full-scan information of the precursors ions and the product ions in high resolution and the capability of fast switching between MS and MS/MS scans for obtaining sufficient structural information. Two main approaches exist to acquire MS/MS information for screening purpose: Information-dependent-acquisition (IDA) or Data-dependent-acquisition (DDA). For IDA-MS/MS, a survey scan is performed to collect the information on the precursor ions, followed by multiple dependent MS/MS scans for the most abundant precursor/candidate ions. MS/MS^{All} with SWATH® acquisition is a novel MS/MS^{All} technique. In every data cycle, the instrument acquires TOF-MS information first, and then it sequentially acquires MS/MS information of all precursor ions across a specified mass range in multiple pre-divided mass windows. Both IDA and SWATH are compatible with retrospective data interrogation. In this study, we aimed to develop an ultra-fast screening method in a forensic toxicological setting using the SCIEX X500R QTOF system and compare IDA-MS/MS and MS/MS^{All} with SWATH acquisition for this fast screening method. **Methods:** Sample preparation *Dilute and shoot*. Blank urine samples were spiked with multiple drugs commonly found in forensics setting at different concentration levels. Typically, samples were diluted 10-fold in 10% methanol and centrifuged. The clear supernatants were transferred to autosampler vials and 10 mL samples were injected. LC condition HPLC separation was on a 20 × 2 mm cartridge-type column with cartridge holder. Mobile phase A was 10 mM ammonium formate in water and mobile phase B was 0.1% formic acid in methanol. LC runtime was 2.5 minutes. **Results:** Two sets of urine samples were tested with two different target lists (~ 100 compounds each with some variations). The true positive rates were consistently better with SWATH® acquisition compared to IDA-MS/MS using fast LC method. This also applied to unknown urine samples due to better MS/MS coverage with SWATH. However, with longer LC method, the true positive rates between IDA-MS/MS and SWATH were nearly identical. **Conclusion:** In this study, we have developed a super-fast screening/quantitation method in forensic setting under 3 minutes using the SCIEX X500R QTOF system. Two non-targeted data acquisition methods: IDA-MS/MS and MS/MS^{All} with SWATH acquisition were both tested and compared. When throughput is the priority, and a short LC method is used, the preferred data acquisition approach would be SWATH acquisition due to the complete MS/MS coverage.

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CADAVER DOG DETECTION (UK); THE PAST, PRESENT AND FUTURE

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The breakdown of biological tissue during mammalian decomposition results in the production of a variety of inorganic gases e.g. CO_2 and NH_3. Alongside these compounds are a diverse range of volatile organic compounds (VOCs). These volatile substances are intermediate products of decomposition produced when large molecules such as proteins are broken down. Victim recovery dogs, also known as cadaver dogs are trained to indicate to this unique mixture of volatiles, allowing them to search and detect decomposing remains. The first application of detector dogs in the UK dates back to the 19th century where their purpose was focused on the detection of blood, in the hope to find fallen soldiers in World War II. Presently, the UK has several task forces routinely working on the detection of both blood and decomposed remains. However, there is yet to be a standardised training method for victim recovery dogs within the UK, with police forces implementing diverse training techniques using a variety of sample types. This lack of standardisation is absent internationally, an issue that is an ever growing research topic. The University of Leicester is currently collaborating with a multitude of UK police forces, to investigate the variability of these training methods. By applying a variety of analytical techniques, including cutting edge techniques such as multidimensional gas chromatography mass spectrometry (GCxGC-MS) we are able to provide a comprehensive analysis of the volatiles being released through the decomposition process. With this knowledge we are able to produce an alternative training system that replicates decomposition more accurately and efficiently.

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A GEOGRAPHICAL ANALYSIS OF TRAFFICKING ON EVOLUTION, A POPULAR DARKNET MARKETPLACE

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The Internet continues to play an important role in illegal trafficking. Cryptomarkets are online marketplaces, located on the darknet, that facilitate the trading of a variety of illegal goods, mostly drugs. While the literature focuses on drugs, various other goods and products related to financial or identity fraud, firearms or counterfeit goods, as well as doping products are also offered on these marketplaces. This research provides an analysis of the structure of trafficking (types and proportions of products, number of vendors, shipping countries) through the analysis of relevant data collected on a popular marketplace in 2014-2015, *Evolution*. It also aims at highlighting geographical patterns in the trafficking of these products (e.g. trafficking flows, specialisation of vendors, role in the distribution chain). The analysis of the flow of goods between countries emphasises the role of specific countries in the international (e.g. the Netherlands, Germany) and domestic (e.g. Australia) trafficking, potentially informing law enforcement agencies to target domestic mails or international posts from specific countries. Spatial analysis also showed the specialisation of vendors from certain countries (e.g. China, the Netherlands) in the distribution of specific products (e.g. New Psychoactive Substances (NPS)/Luxury goods and Ecstasy, respectively). The research also highlights the large proportion of licit and illicit drug listings and vendors on *Evolution*, followed by various fraud issues (in particular, financial fraud), the sharing of knowledge (tutorials) and finally goods, currencies and precious metals (principally luxury goods). Looking at the shipping country, there seems to be a clear division between digital (e.g. hacking services or financial fraud material) and physical (e.g. illicit drugs or luxury goods) products, with more specific information given for physical goods. This reveals that the spatial analysis of trafficking is particularly meaningful in the case of physical products and to a lesser extent for digital products. Finally, the geographical analysis reveals that spatial patterns on *Evolution* tend to reflect the structure of the traditional illicit market. The analysis of cryptomarkets should be integrated in a more global approach that aims to improve the knowledge of illicit market structures and trafficking, which is in line with a forensic intelligence approach. Developing strategies to monitor Internet activities on cryptomarkets and on dedicated forums are powerful means to observe and detect global and specific trends for different categories of products on the illicit market.

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FORENSIC GAIT ANALYSIS: MORPHOMETRIC BODY ASSESSMENT WITH ASSOCIATED CCTV IMAGE QUANTIFICATION

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Closed Circuit Television (CCTV) cameras are often referred to as 'the silent witness' and have rapidly become a universal presence. Their use can provide useful information about an incident and about a "person of interest" (POI) in many policing scenarios. In the context of photo-comparative analysis, a limitation of CCTV images arises however, from the distortions present within the camera specification and environmental influences. Consequently, optimum identification of a POI would entail quantifying the wide range of image distortions present. Additional challenges exist when facial features are concealed or otherwise obscured, thus preventing facial analysis. One solution to overcome this, is the morphometric assessment of the body; one aspect of 'body mapping'. Further, as POIs are frequently recorded in motion, implementing gait analysis could add significant information relating to individuality. The aim of this study was to identify *distinct* features of the body during gait (stance, walk, and run) to provide additional identification information of a POI from surveillance footage. The method comprised of a morphometric assessment of 18 anthropometric measurements (static, dynamic and angle), 25 morphological features for stance and 52 morphological features for gait assessed, of both male and female volunteers. As a result, a standardised protocol was developed, and population databases established from which frequency statistics were obtained, thus concluding whether the combination of variables observed differ between individuals. Furthermore to ascertain which features exactly were common or distinct once compared to all age, race and sex categories for correlation determination. Body mapping as a forensic tool is often poorly validated or subjective. However, this does not mean it is not of value. The broader purpose of this research is therefore to establish a method of evaluating gait analysis that offers valuable identification information to the criminal justice system whilst being scientifically robust, and importantly adhering to legal admissibility standards.

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THE IMPACT OF ONE-STEP LUMINESCENT CYANOACRYLATES ON SUBSEQUENT DNA ANALYSIS

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Cyanoacrylate (CA) fuming is the most commonly used laboratory technique to enhance fingermarks on non-porous surfaces such as glass. Conventional CA techniques, which often require post-stain treatment, have been found to be compatible with DNA analysis. However, in recent years, one-step luminescent CA fuming techniques, such as PolyCyano UV (Foster+Freeman) and Lumikit™ (Lumicyano™; Crime Science Technology (CST)) have been introduced as an alternative to conventional CA fuming. One-step luminescent CAs allow for simultaneous fuming and staining, eliminating the need for the application of a poststain for visualisation. This reduces processing times and limits exposure to hazardous chemicals and solvents. Studies have reported that one-step luminescent CAs typically give similar results to conventional CA on a number of substrates, however, their impact on DNA analysis is yet to be reported. As DNA analysis techniques, including commercial quantitation and profiling kits, often use systems involving fluorescent molecules, the potential for interference with DNA analysis needs to be assessed. This study investigated the impact that common one-step luminescent CAs have on DNA analysis techniques and how this compares to conventional CA techniques. Two week aged fingermarks collected from four donors on glass microscope slides were treated with a conventional or a one-step CA technique in a MVC1000 (Foster+Freeman) CA fuming chamber. Following routine imaging, each fingermark specimen was double swabbed and DNA was extracted using a standard silicabased protocol. The recovered DNA was quantitated with the Plexor HY® Kit (Promega) and profiled with PowerPlex® 21 (Promega). The impact these CA techniques have on DNA analyses will be discussed.

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UNRAVELLING THE MYSTERIES BEHIND SUDDEN DEATH

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Aims and Objectives: To determine the age and gender distribution of the deceased individuals and to find out the cause of death and to detect the incidental or co-existing pathology in deceased individuals. **Materials and Methods:** 304 autopsy specimens received in histopathology lab for a period of 2 years from January 2015 to December 2016 were reviewed. The autopsy records, clinical case notes, gross specimens and

histopathological slides were retrieved, wherever available. The results were analyzed based on gross findings and histological examination. Histopathological findings of the organs submitted were studied. Pathological findings which contributed to cause of death were noted. Histopathological findings which were diagnosed incidentally or co-existing pathology which may or may not have been the cause of death were specifically noted. **Statistical Analysis:** All the data were analysed using the SPSS software. Age and gender distribution, frequencies of histological findings, causes of deaths and number of histological findings according to body systems were tabulated **Results:** The present study showed that 221 cases were males and 83 cases were females. In maximum cases pathology was detected in cardiovascular system (41.4%) followed by respiratory system (17.4%). Myocardial infarction was seen in 7.2 % cases, pneumonia in 10.5 % cases, cirrhosis liver in 5.9 % cases, coronary artery occlusion/narrowing in 11.8 % cases, myocarditis in 11.5 % cases and pericarditis in 5.6 % cases. Some of the other pathological findings noted were tuberculosis, burns, pancreatitis, meningitis, encephalitis, cardiomyopathy, gastric ulcer, gangrene intestine and sacrococcygeal teratoma. There was one case each of meningioma, wolman's disease, high grade rhabdoid tumor, soft tissue sarcoma of liver,mucormycosis, aspergillosis and anomalous origin of left coronary artery from coronary sinus all of which were incidental findings. **Conclusion:** Whenever there is sudden death in healthy asymptomatic individuals, a careful and thorough search of findings at autopsy as well as histopathological study should be made to ascertain the cause of death

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AN UNEXPECTED DEATH RELATED TO ACCIDENTAL BTX INHALATION

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BTX is an acronym for Benzene, Toluene and Xylene. These aromatic hydrocarbons are some of the volatile organic compounds (VOCs) found in the oil and gas industry. Each of the chemicals is well absorbed, extensively metabolited and does not persist in the body for long periods of time. All of the BTX chemicals can produce neurological impairment and exposure to benzene can additionally cause hematological effects. Many of the BTX chemicals are listed as a potential carcinogen in man with harmful effects on the central nervous system. BTX inhalation may occur accidentally or intentionally in various situations which could result in acute non-lethal or lethal intoxication. We reported here a case of unexpected death related to BTX inhalation in the chemical plant. He was taken to hospital after his collapse while cleaning the BTX tank. He died under medical treatment for 2 days. Simultaneously benzene, toluene and xylene have been measured in blood from hospital and autopsy specimens (blood, lung and brain tissue) by gas chromatography-mass spectrometry and SPME sampling. and investigation of the environment at the accident scene was performed by our team. Some of the air in the scene was collected for analysis. This case shows the importance of taking special precautions when working near a chemical tank, or in any situation of potential BTX exposure.

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CLIENT PARTNERSHIPS TO FACILITATE INTRODUCTION OF NEW FORENSIC DNA TECHNOLOGY TO THE JUSTICE SYSTEM

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Since the introduction of Short Tandem Repeat (STR) forensic DNA analysis over twenty years ago and subsequent acceptance by the courts worldwide, many incremental, procedural improvements have been made with few or no resulting legal challenges. These have included an increase in the number of STR loci, increased sensitivity and the use of automation to assist in the production of DNA profiles. What has not significantly changed over this timeframe is the inherent human element in DNA interpretation. Given the limits of an individual's ability to systematically consider all variables and perform all calculations necessary to resolve complex DNA mixtures in a timely fashion without error, such DNA profiles have historically been deemed 'not suitable for comparison' at the Centre of Forensic Sciences (CFS). The advent of probabilistic genotyping systems has provided tools for DNA scientists to perform the thousands, if not millions, of calculations necessary to reliably resolve the component genotypes from complex DNA mixtures. Such systems are widely thought to surpass classical methods as they can be applied to a broader range of DNA mixtures, including highly complex or low level mixtures. The CFS has implemented the STRmix™ software application. It was recognized that this would likely be considered, by clients, to be a substantive change to the way in which DNA results are analyzed and reported. A considered, proactive approach was therefore undertaken to achieve general understanding and acceptance of the technology within the judicial system prior to its introduction in court. All relevant stakeholders, including lawyers (both Crown and defence), police officers and judges were engaged at an early stage. The approach, spanning months and beginning well in advance of implementation, included workshops and training events covering DNA basics, mixture analysis fundamentals, technical aspects of the software, including how its performance and reliability was assessed, as well as resulting changes to CFS reports. This was augmented by the production and dissemination of various external client documents. In addition to presentations for broader client audiences, intensive and advanced training was provided to a select, core group of Crown attorneys that could assist in ushering the technology through the legal process in early litigations. Feedback has been positive, the strategy has been successful in laying a strong foundation for the introduction of this technology in Ontario court rooms, and may serve as a model going forward in this and other jurisdictions.

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SUDDEN INFANT DEATH OF MONOZYGOTIC TWIN ON THE SAME DAY: A CASE REPORT

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Sudden Infant Death Syndrome(SIDS) represents a major leading cause of death among all racial and ethnic groups of infants between one month to one year of age. The exact cause of such death is unfortunately unknown, but there are multiple possibilities for that: cardiovascular abnormalities, suffocation and infectious causes. The occurrence of sudden unexpected death in twins is extremely rare event. For the first time in Palestine, we report an 8-week-old female twins who found dead while sleeping on their backs, their death occurred concurrently within 24 hours. Extensive investigations were done, all approved that their death was completely a natural one.

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THE LATIN AMERICAN ASSOCIATION OF FORENSIC ANTHROPOLOGY (ALAF)

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Progress of the practice and quality of Forensic Anthropology in Latin America: the network of the Latin American Association of Forensic Anthropology. In 2003, the Latin American Association of Forensic Anthropology (ALAF, for its signals in Spanish) was founded by the Equipo Argentino de Antropologia Forense, the Fundacion de Antropologia Forense de Guatemala, the Equipo Peruano de Antropologia Forense and other Latin American forensic experts. Since then, with the mentorship of Dr. Clyde Snow, ALAF currently has 120 members and has organized 13 meetings, the first one done in Guatemala (2004) and the last meeting on October 2016 in Mexico. F The ALAF, a non-profit association, emphasizes as its main objectives: 1.) To promote the use of Forensic Anthropology and Archaeology in judicial and humanitarian investigations in Latin America and collaborate with judicial branches on the improvement of criminal procedures and investigations. 2.) To establish ethical and professional criteria for the practice of Forensic Anthropology. 3.) To ensure the quality and scientific independence of the practice. 4.) To support the application of forensic standards to the Latin American context. 5.) To promote further training for forensic anthropologists and archaeologists in Latin America and abroad. 6.) To create an independent accreditation board that will certify qualified practitioners. 7.) To promote mechanisms for the families of the deceased to access the forensic investigations (in accordance with international conventions protocols and recommendations). and 8.) To protect the ALAF members and their families, considering the risks that accompany work in Forensic Anthropology in some Latin American countries. As part of implementing and guarding the best practice of the Forensic Anthropology, this presentation has as main goal to show the progress of the ALAF since its foundation, and three are the relevant issues presented: 1.) In 2016, the ALAF created a "Latin American Guide of best practices for the application of Forensic Anthropology" (GLAAF – for its signals in Spanish). This guide provides a detailed description of good practices, basic guidelines for preliminary investigations, interviews, archaeological recoveries, laboratory analysis, identification and final reports. 2.) We highlight advances such as the certification of procedures and standardization of criteria of forensic anthropologists in the region, which has been done annually since 2012 until the present. 3.) The creation of the Latin American Board of forensic experts, to this day consisting of 11 members.

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SUPER-RESOLUTION ON PIXEL VALUES SELECTION FOR DEGRADED IMAGE RECOGNITION BY SUPPORT VECTOR MACHINE

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Numerical information of the vehicle license plates on the images taken by security cameras can be useful for criminal investigation, and that information is required to be sufficiently accurate and reliable because the information can serve as evidence in trial. However, in many cases, the images of the security cameras are degraded remarkably, and it is difficult to recognize the license plate numbers accurately. Among various degradation factors of security camera images, insufficiency of the pixels is one of the main factors that makes recognition of license plate numbers difficult. Therefore, we propose super-resolution method which is suitable for the accurate image recognition of degraded license plate numbers. Example-based super-resolution approaches using single-image generates information other than the information contained in the original images, so that there are some opinions that the reliability of example-based approaches is not enough for judgment use. Therefore, we propose a multi-frame super-resolution approach which selectively uses reliable pixel values from the original low resolution images with reference to the template figure images. In this method, after the high resolution template images and original low resolution images are registered, the reliable pixel values are selected from the corresponding pixel values of the original low resolution images so that the degradation of the super-resolution image is suppressed and high frequency components near the edges are held. In order to perform pixel value selection appropriately, high-precision registration and an appropriate selection of the template images are required. We realized high-precision registration and an appropriate selection of the template images using support vector machine. In order to compare the performance of our method with that of the conventional multi-frame super-resolution, we measured the correct rate of recognizing characters by normalized cross correlation. As a result, the correct rate of the proposed method has increased by about 32.4% in comparison with the correct rate of the conventional multi-frame super-resolution.

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A SYSTEM FOR TESTING AND ANALYZING THREE-DIMENSIONAL FOOTPRINTS

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Since the footprints which found in crime scene are very difficult to be used to narrow the scope of the suspect or clarify the direction of investigation. 3D scanning (microscopic) which could be more effective than 2D imaging in reflecting the detailed features of footprints, still it involves high hardware costs and an exponential increase in calculation capacity owing to the large size of 3D files. In order to solve the above problem, a single point laser 3D footprint detecting system was designed and developed. The key technologies of this system, such as feature extraction and similarity comparison were all introduced in detail. Finally, the experiment result of 3D footprint inspection demonstrated the accuracy and reliability of this system.

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CHRONIC ALLOSTASIS AS A CANDIDATE MEDIATOR OF HIPPOCAMPAL VOLUME CHANGE IN SEVERE MENTAL ILLNESS

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Introduction: Previous studies indicate that severe mental illness, such as schizophrenia and major depressive disorder, is associated with smaller hippocampal volume based on MRI-segmentation in both living and deceased patients. The hippocampal formation has multiple functions in the human brain, including memory and spatial navigation, cognitive abilities which may be affected in individuals with severe mental illness. There is evidence of chronic stress affecting the hippocampal formation by inhibiting neuronal regeneration in the dentate gyrus. We hypothesize that chronic stress may function as a mediator between severe mental illness and reduced hippocampal volume. **Method:** We performed a T2-weighted post-mortem cranial MRI-scanning on a population of 130 deceased individuals with suspected or known mental illness (schizophrenia and major depressive disorder) and at the subsequent autopsy removed each adrenal gland. The glands were measured and weighed, and a section was embedded in paraffin for microscopic evaluation of cortical thickness as a proxy estimate for endogenous cortisol production levels. The size of the hippocampal formation is estimated using manual segmentation on the PM-MRI images, based on a landmark-based segmentation algorithm developed and validated at our department. We will use linear regression to correlate the hippocampal volume with adrenal cortical

thickness and psychiatric diagnosis. **Preliminary results:** Our preliminary findings on a subsample of the study population show a trend towards smaller hippocampal volume, adjusted for total brain weight, in the left hemisphere of males, but so far we have detected no significant difference among diagnosis groups or gender. **Perspectives**: The results from this project will in a future study be correlated with cortisol measurements from hair samples and additional registry data variables to control for stressful life events. More knowledge of the role of chronic stress as a possible mediator of the increased morbidity and mortality is important for identifying future areas of prophylaxis and treatment.

Disclosure: All authors have declared no conflicts of interest.

AGGREGATION-INDUCED EMISSION (AIE)-ACTIVE FLUOROPHORES FOR LATENT FINGERPRINT ANALYSIS

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Fingerprints have been widely used in many fields, including forensic investigations and personal identification. And, it was considered one of the most valuable physical evidence for identification at crime scenes. Numerous efforts have been made in recent years to improve the existing techniques for better visualization of the LFPs, especially the use of quantum dots (QDs), electrochemistry (ECL), immunological multimetal deposition (iMMD) and mass spectrometry. However, some of these methods require heavy instrumentation, complex procedures, environmental unfriendly or expensive materials, and materials with less sensitivity. Therefore, to develop a simple and sensitive new techniques for better LFP imaging is of great importance. Fluorescent probes are powerful tools which are important to analytical sensing, and the sensing sensitivity and accuracy of a probe is determined by the brightness and contrast of its fluorescence before and after analyte binding. However, many conventional fluorophores are usually faced with a challenge that they will be quenched at high concentrations or in aggregate state. This leads us to what is called the concentration quenching or aggregation caused quenching (ACQ) phenomenon. Evidently, it seems adverse to sense analytes including the latent fingerprints (LFPs), ions, and others. To our delight, the development of the fluorescent materials with high solid-state quantum yield in aggregated state or even in solid state which is known as the aggregation induced emission (AIE) effect of the dyes can solve the problem well. So far, a variety of functional materials based on AIE fluorophores have been extensively reported, however, only a limited number of AIE dyes have been applied by visualizing the LFPs. The new method to identify the LFPs may protect policemen from the harmful effects of dust and can effective avoid the ACQ phenomenon to some extent. As a part of our on-going research on the visualization of the LFPs, we herein describe the design and synthesis of simple fluorescent probes based on the AIE-active organic dyes for the recognition of LFPs. What's more, we hope that the resolution of the fingerprints which would be visualized by the probe can be able to offer a positive match with those fingerprints present in databases to satisfy the police or other security agencies demand.

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FORENSIC USE OF REMOTELY PILOTED AIRCRAFT AT THE BRAZILIAN FEDERAL POLICE

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The first forensic reports using RPAs in the Brazilian Federal Police were registered in 2013. The reports examined were classified into eight categories, according to the subject treated: Irregular Use of Soil (48), Mineral Extraction (15), Engineering (4), Aeronautical Accidents (3), Pollution (2), Fire (2), Crime Scene (2), Marijuana Crop (1). The most frequent application of RPAs in forensic examinations at the Brazilian Federal Police is in environmental issues. The main objective of this research was to understand the fast evolution of the adoption of airborne imaging devices to improve the quality of forensic reports made by the Brazilian Federal Police. We used the national forensic database (SISCRIM), which contains more than 20 million records and over 720 thousand electronic documents produced by the Brazilian Federal Police's forensic scientists since 2006 in the different areas of the forensic knowledge. We conducted a full survey of the Federal Police forensic reports using RPAs produced in Brazil, until late February 2017. 77 documents were found (66 full forensic reports and 11 technical documents), produced in 12 of the 51 existing forensic units. A single local unit (UTEC of Uberlândia/Minas Gerais) was responsible for the production of 37 documents (48% of the total). The forensic unit of the State of Minas Gerais, based in Belo Horizonte, produced 14 documents (18% of the total). The forensic unit of the State of Pernambuco, based in Recife, produced 12 RPA related forensic documents (16% of the total). The National Institute of Criminalistics produced four documents (5% of the total). Most of the reports (40/77) were produced with data acquired by fixed wing RPAs. 27 reports used multirotor RPAs, and the remaining eight did not specify the device. It is worth mentioning that two reports were found that used R/C Boats to collect the data. The forensic scientists collect and analyze evidence from crime scenes and other sources to provide official reports for investigation and prosecution. The objective is determining whether a crime has occurred and, if so, who was responsible for it and his/her *modus operandi*. The interest shown in this technology and equipment suggests a common trend in the Forensic Sciences. RPAs offer images with superior resolution, ease of operation and low cost. Fast dissemination of their use is expected.

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THE APPLICATION OF LASER DETECTION LINE TRACE TRACEABILITY SYSTEM

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In order to overcome the abuse that images and 3D scanning method is difficult to track cutting tools efficiently and rapidly through trace, a set of laser detection signal tracing system for cutting line traces is designed and implemented. The system consists of motion control subsystem, laser detection subsystem and microscopic imaging subsystem. By holding breakage of the cable, firstly, using single-point laser displacement sensors to pick up linear surface features signal linear cut marks, then wavelet decomposition is used to reduce the noise, and the signal after noise reduction is obtained. After that, the size difference between the signal variance is used to achieve matches of similar coincidence for trace features, and then using a gradient descent method to have machine learning of parameters to construct the corresponding cost function. Getting the minimum cost of cost function value through continuous iterative, and finally realizing the fast traceability of corresponding cutting tool. The experiment of line trace sample data tracing is put forward to test the effectiveness of the system: 25 groups of test data was tested on matching based on 1000 groups of samples in bulk. It took nearly 1.5 seconds to do the operation, with the correct tracing rate of 98%. The experiment proved the accuracy and effectiveness for cutting trace detection signal traceability by this system.

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EU POLICIES RELATED TO UNACCOMPANIED MINOR ASYLUM SEEKERS' AGE ESTIMATION PROCEDURES: NEW ISSUES

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Immigration and asylum seeking has never been such an important phenomenon as it is currently evident from the daily chronicles and Europe is in the front line since many years. In 2015 as many as 1.006.551 asylum seekers arrived at the EU borders, many of them were unaccompanied minors. Therefore immigration must be considered a core issue in the European Union (EU) countries policy and a major concern for the EU as a whole. In the case in which the asylum seekers' (AS) age is unknown or is questioned by the authorities and considered not valid or unreliable, age estimation procedures are necessary to determine if that individual is accountable for his actions in criminal law, shall undergo specific obligations (educational, for instance) or should receive specific aides or other providences from the state administration. The age of the asylum seeker is the first and most important parameter to obtain the permission or the refusal to enter the EU. Moreover, the Schengen Act (2006) enables the free movement of individuals within the Schengen Area countries. Despite the importance of the issue, no standardization exist among the EU countries about the procedures for age estimation and a proper EU common regulation in the matter of age estimation procedures still lacks. This matter rises ethical problems related to the immigrants right to be correctly informed about the procedures to follow, properly assessed with a ratified homogenous and shared protocol, issued according to the most recent and accepted scientific evidence. Despite the recall of Art. 25-sub 5 of the recast EU Asylum Procedures Directive (2013), stipulating to opt for the least invasive (and ethically sustainable) age estimation examination, only very few EU member states (Ireland, United Kingdom; and Greece and Hungary, as a first step) rely on an interview basis, consider the documentary evidence, and the physical appearance and demeanour of the applicant. Most EU member states use also medical methods to observe dental and/or skeletal age related parameters, even implying the use of x-rays. Moreover, many other ethical and technical problems must be faced and solved and will be discussed.

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HYPERSPECTRAL IMAGING: A TECHNIQUE FOR AGING BLOWFLY PUPAE

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This research for the first time engaged *hyperspectral imaging* (HSI) to age blowfly pupae. HSI consists of the acquisition of imaging data in which each pixel is associated with a detailed reflectance profile. Under controlled experimental conditions it is assumed that different target objects, such as blowfly pupae of different age or species, will reflect light differently based on their difference in physical structure and possibly the biochemical composition of the cuticle. Blowflies (Diptera: Calliphoridae) are the predominant taxa used to indicate time since death (minPMI) as they are typically the first insects colonising remains after death. The growth or developmental duration of blowflies is driven by temperature and specimen age is determined using reference data detailing developmental timeframes which are temperature-dependent for specific life stages. Following the larval stage when the duration between stages is the longest between pupal formation and adult fly eclosion, error can be introduced to the minPMI estimate. At present optimal estimation of age between life stages, particularly between pupal formation and adult fly eclosion generally involves destructive and/or invasive techniques or sometimes an average guestimate. Ultimately non-destructive and non-invasive techniques are needed that allow for the specimen to remain intact and be used for later re-analysis. Such invasive techniques include morphological examination of developmental changes using a conventional light microscope, histological staining, scanning electron microscopy (SEM), micro-computed and optical coherence tomography and gene expression analysis. However, these techniques are labour intensive, require expensive equipment and involve a high degree of specialist expertise to interpret results This work developed a predictive model for determining pupal age for two blowfly species, *Calliphora dubia* Maquart and *Chrysomya rufifacies* Maquart at two temperatures (24°C and 30°C), correlated with the morphological changes occurring during pupal metamorphosis. HSI is a promising technology in forensic entomology being non-destructive, non-invasive, suitable for both live and preserved specimens, portable (field or laboratory based), rapid and cheap and requires little expertise other than how the HSI camera operates.

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ATYPICAL NON-BALLISTIC PENETRATING MISSILE INJURY IN AN INDUSTRIAL SETUP: RARE CASE REPORTS

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Low-velocity non-ballistic missiles resulting in penetrating fatal wounds that also in an industrial working setup are rare cases seen by forensic pathologists. We present two cases wherein an industrial worker sustained fatal penetrating wound, while working in a steel sheet pressing factory. A metallic piece of 5 grams, 6.5 cm x 1.8 cm in dimensions, detached from the steel sheet resulted in penetrating injury to the left lung. In an another case from the same factory zone showed a penetrating wound of 1.1 x 0.3 cm over the left side back of abdomen with 4 x 0.5 cm metallic piece found lodged in the caudate lobe of liver. These cases were brought to PGIMER, a tertiary care institute for the specialized care, but succumbed to the injuries. Since injuries on the chest and abdomen were clean cut incised penetrating wounds, homicidal nature of the injury was kept in mind when the cases were subjected to forensic autopsy. It is observed that such bizarre injuries are easily preventable if torso armour is made mandatory by the authorities for the workers in such factories.

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AXUD1 ACCELERATES STRESS-INDUCED CARDIOMYOCYTES APOPTOSIS THROUGH ACTIVATING WNT SIGNALING PATHWAY

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Background: Restraint stress is not an uncommon case in forensic pathology. Stress-induced cardiomyocyte apoptosis contributes to the pathogenesis of a variety of cardiovascular diseases, but how stress induces cardiomyocyte apoptosis remains unclear. AXUD1 is a novel pro-apoptotic protein that mediates cell apoptosis in multiple processes. Whether AXUD1 mediates stress-induced apoptosis is unclear. **Objectives:** The aim of this study was to investigate whether restraint stress has any effect on AXUD1 expression and cardiomyocyte apoptosis in heart tissue of rats, and to detect the potential interaction of AXUD1 with the Wnt pathway-mediated cardiomyocyte apoptosis. **Methods:** Restraint stress model was established by placing rats in restraint tubes for 6h/day. We randomly divided 24 Sprague Dawley rats into four groups: control group and three restraint-stress groups with restraint times of 1, 3, and 7days. *In vitro,* cultured myocytes were treated with norepinephrine (NE)/ corticosterone (CORT) in different concentration to establish cell model of stress. Total protein and RNAs were extracted and subject to western blot and quantitative real-time PCR analysis, respectively. The cell apoptosis was detected using TUNEL staining. **Results:** Data showed that after

exposure to restraint stress, the plasma levels of NE and CORT were significantly elevated in the stressed rats. The cardiomyocytes exhibited increased expression of AXUD1, accompanied with decreased Bcl-2 and increased Bax, cleaved-caspase3 expression in a time-dependent manner. Interestingly, the expression of Wnt signaling (Dvl-1, β-catenin, c-Myc) were consistently higher in cardiomyocytes undergoing restraint stress which suggested the activation of Wnt signaling pathway after restraint stress. In addition, the treatment of NE/CORT to myocytes well mimicked restraint stress *in vitro*. Compared with control myocytes, it was observed that AXUD1 level and cardiomyocytes apoptosis were markedly promoted under NE/CORT treatment in a time/dose-dependent manner. Wnt signaling pathway was also activated. Knockdown of AXUD1 using a siRNA approach blunted NE/CORT-induced cardiomyocytes apoptosis and also inactivated the Wnt signaling pathway. **Conclusions:** AXUD1 accelerated restraint-induced cardiomyocytes apoptosis through activation of Wnt signaling pathway, which might be a potential diagnostic marker of restraint stress-induced myocardial injury.

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STRUCTURE IDENTIFICATION OF NOVEL METABOLITES FOR AMB-FUBINACA, MARKERS OF ITS ABUSE

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Recently the use of synthetic cannabinoids has increased around the world. It has become necessary for forensic laboratories to rapidly screen and confirm new synthetic cannabinoids and their metabolites in biological matrixes due to the continuous modification of their chemical structure. A suspect was arrested on the charge of illegal possessing and taking herbal blend, whose urine was presented to our forensic lab. The seized herbal blend was confirmed a synthetic cannabinoids mixture of two compounds of XLR-11 and AMB-FUBINACA by GC-MS analysis. The following LC-MS/MS experiment with urine sample indicated the presence of XLR-11 metabolites, according to the comparison with standard and published data. Therefore, the urine sample was suspected to be positive for the metabolites of AMB-FUBINACA. To our knowledge, the chemical structures of AMB-FUBINACA metabolites have not yet been elucidate and no certified reference materials for them were commercially available. Therefore, identity confirmation of those metabolites was achieved by MS technique using liquid chromatography quadrupole tandem time of flight (LC-Q-TOF) mass and automated identification and confirmation of metabolites software. AMB-FUBINACA was investigated for the first case in our country. and its four principal metabolites were found in urine specimen obtained from suspected user, thus verifying the abuse of AMB-FUBINACA. The main metabolite was O-desmethyl AMB-FUBINACA formed by O-demethylation of the methoxy group. The hydroxylation and hydrogenation mainly accured on the methyl-3-methylbutanoate moiety, that is similar to AB-FUBINACA and ADB-FUBINACA. Four metabolites including further hydrogenated metabolites of the defluorinated metabolite were successfully structurally characterized. It was able to identify novel metabolites rapidly without reference materials by using Q-TOF MS/MS and a software which could predict and find possible metabolites automatically based on the peak finding strategy including biotransformation parameters and multiple mass defect filtering.

Disclosure: All authors have declared no conflicts of interest.

METHODOLOGIES USING DRONES IN THE CHARACTERIZATION OF ENVIRONMENTAL CRIMES IN THE BRAZILIAN AMAZON

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In the last 5 years the use of RPA (multirotor and fixed wing drones) had a substantial increase in Federal Police of Brazil, changing some methodologies in the field, resulting in major quality of the forensic reports. However, there is still no standardized methodology for using this new tool. Very often, criminal activities consists in extracting natural resources from protected areas and sell the goods as they were from authorized sources. Hence, the police job is to register the environment damage. The resources may be wood, minerals or biological. The most common method of performing forensic analysis in the environment is the use of satellite images and field measurements. However, in the Brazilian Amazon region, the satellite images are not of good quality, both because of the large territory as the constant cloud cover. Such limitations, implies in the need of further analysis in place, like measurements using precision GPS, walk or drive to survey the perimeter and use of tape for lifting depth of mining areas. Through a project of cooperation between the Federal Police and the Ministry of Science and Technology, FINEP (Financier of Studies and Projects) has provided funds to purchase equipment, books and development of systems for the study of new methodologies. The use of RPA as imaging transport platform assists in obtaining Orthomosaic high resolution images and Digital Elevation Models, allowing experts can perform the measurements (such as perimeter, area and volume) with better quality, in a shorter time. Sometimes this are the only way to achieve the goal, as in several locations is very difficult to physically get to the site. We observed high productivity gains in the exam with the RPA, as, for example, with 30 minutes flight was possible to obtain images of a sand extraction area while the team in the field took 3 hours to get measurements by the traditional method. The images obtained using the RPA must be processed for the generation of orthomosaics to be used in the measurements, whereas in the traditional method many of the measurements are obtained directly in the field. The conclusion is that there is a gain in the time required for the exams, higher measurement accuracy and easier to get to certain places within the area, plus the ability to virtually revisit the site. However, it is necessary to correctly specify height and flight path, image overlap, model resolution, among other features.

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EVALUATION AND IMPLEMENTATION OF THE RAPIDHIT™ INSTRUMENT FOR RAPID HUMAN DNA IDENTIFICATION

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The Centre of Forensic Sciences evaluated a RapidHIT™ instrument with the GlobalFiler® express chemistry for its ability to generate DNA profiles from standard comparison and crime scene-type samples in an automated manner. Various sample types, including buccal, blood and saliva were used to evaluate the instrument's suitability. Results of this validation indicate that this rapid DNA system is capable of generating high quality DNA profiles from most reference-type samples. Full DNA profiles were generated at 15 or 5 ng of initial input DNA from blood (depending on the instrument protocol used), and ½ of a buccal swab touched once to the inner cheek. Swabs of drink containers and samples from cigarette butts also generated full DNA profiles. Cigarette butts were one of the most variable sample types, with results at an average of 17/24 loci. Drink container swabs generally produced better profiles, with an average of 21 loci. To determine whether it was possible to re-analyse samples using standard DNA methods, samples were removed from the RapidHIT™ cartridges several days following the initial extraction. Through a combination of autosomal and Y-STR testing it was determined that amplified DNA product from the original GlobalFiler® Express amplification was transferred to the swabs prior to their removal from the cartridge. However, if the samples are removed from the cartridge prior to its removal from the RapidHIT™ instrument no transfer of amplified DNA occurred. The RapidHIT™ instrument was implemented for modified Rapid DNA analysis in the Biology Section in 2015 for the analysis of known reference samples, with the goal of decreasing overall analysis times for these sample types. During this implementation period the ultimate goal was achieved in many cases, while various technical and process flow challenges were

also encountered. This experience has demonstrated that the RapidHIT™ instrument can be used for the analysis of known reference samples with varied success, but the challenges encountered underscore the early state of this technology.

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NEW PROCEDURES FOR COLLECTING DIGITAL EVIDENCES IN SOLVING CYBERCRIMES

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As technology has penetrated in each and every aspect of our lives, it is no wonder that cybercrime is in its advance stage and has been escalating in its intricacy. With the pace in innovation of modern technology, solving cybercrimes has become almost ultramodern. In the present study, we have adopted a general procedure for collecting digital evidences through emails, computer printouts, smart phones, etc. These vital digital evidences with the help of modern forensic technologies will be helpful in linking the crime with the criminal and in turn will help in the administration of justice. Various types of cybercrime and case studies on it have also been discussed thoroughly.

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IS HUMAN DECOMPOSITION FLUID A VALID TRAINING AID FOR CADAVER-DETECTION DOGS?

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Cadaver-detection dogs are used by police and volunteer services to locate human remains in cases of missing persons, suspected homicides, and mass disasters. Due to ethical restrictions, these dogs cannot be trained using human cadavers; rather, they are trained using pseudo-scents or human tissues such as blood, bone or decomposition fluid. However, the chemical profiles of these training aids have not been comprehensively investigated, and their accuracy as substitutes for decomposing remains has not yet been determined. This study investigated the validity of human decomposition fluid as a training aid for cadaver-detection dogs. The study examined the odour profile of decomposition fluid, including the changes in the profile over time (aged for one year), when diluted (serial dilutions to 10^{-12}), and under different storage conditions (room temperature, refrigerator and freezer) using Solid-Phase Micro-Extraction (SPME) and Comprehensive Two-Dimensional Gas Chromatography—Time of Flight Mass Spectrometry (GC×GC-TOFMS). The volatile organic compounds (VOCs) identified in decomposition fluid were compared to the VOCs reported in the literature for human cadaver decomposition odour. A wide range of characteristic decomposition VOCs were identified in the decomposition fluid, though the abundances decreased in lower dilutions. While individual VOCs were not always comparable to human remains, the compound class proportions of the odour profiles were deemed similar. Variable odour profiles were observed under different storage conditions; room temperature and refrigeration were suitable, but freezing was not recommended for sample storage. The results of this study suggest that decomposition fluid closely mimics the odour profile of a decomposing cadaver and is a suitable training aid for cadaver-detection dogs when stored appropriately.

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SUBARACHNOID HEMORRHAGE DUE TO DISSECTION OF PICA

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Information supplied by the Coroner indicates that the decedent, a 55 year old man, was essentially well until three days prior to death when he developed sudden onset of vertigo, nausea and vomiting. His past medical history includes hyperlipidemia for which he was prescribed Crestor. No further significant history is noted. There was no significant family history of cardiac or related issues. He was admitted to hospital on March 4, 2016. He was treated with Ondansetron, Serc and Zofran. A CT scan of the head was interpreted as unremarkable. He seemed to have been settling and appeared well at 11 p.m. on March 6, 2016 when noted by nursing staff. At approximately 1 a.m. on March 7, 2016, he was found without vital signs and could not be resuscitated. His death was sudden and unexpected. The Coroner attended and ordered a post-mortem examination to determine the cause and manner of death. Prior to the autopsy, a CT scan of the body showed a massive subarachnoid hemorrhage. A targeted autopsy limited to the head was performed. Postmortem CT scan showed cerebellar infarction and subarachnoid hemorrhage. A review of the hospital admission CT shows cerebellar infarction. See attached Radiology Report by Dr. D. Little. Segmental mediolytic arteriopathy (SMA) is an uncommon, non-atherosclerotic and non-vasculitic arteriopathy. The disease is characterized by lytic degeneration of the arterial media and may be associated with intramural dissection, thrombosis or aneurysm. Only rare cases of isolated SMA dissection of the posterior inferior cerebellar artery (PICA) have been reported [1]. This case presents inferior cerebellar artery dissection, aneurysmal dilatation of the arterial wall, infarction of the cerebellum and ultimately rupture with subarachnoid hemorrhage. DNA sequencing has been performed in this case. The results reveal an altercation of the COL541 gene. The decedent is heterozygous for this alteration. Ehlers-Danlos syndrome, for example, caused by COL541 is an autosomal dominant disorder; therefore, the recurrence risk is 50% for offspring of an individual with a COL541 mutation. No other findings suggestive of Ehlers-Danlos Syndrome were identified, although the post-mortem was limited. DNA sequencing also reveals four further changes. Genetic counseling is recommended for interpretation of the results. Given the potential heritability of this condition (segmental mediolytic arteriopathy), assessment of surviving first degree family members (parents, siblings, children) by a professional with expertise in medical genetics should be considered to help exclude a primary inherited vascular disorder in other family members.

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FOOT TORTURES AND THE IMPLICATION OF FORENSIC PODIATRY IN CASES OF HUMAN RIGHTS VIOLATIONS

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The aim of this presentation is to give an overview of the history of foot torture from Middle Ages to the present times, demonstrating its forensic importance on current criminal investigations, mainly the ones related to war crimes and crimes against humanity. Feet are unique structures in human body because they present the highest number of sensory nerve terminations per square centimeter. Just in one foot we can find 200 nociceptors, 25 baroreceptors, 12 terminations sensitivity to cold, 2 terminations sensitivity to heat, 1 metre of blood vessels, 4 meters motor nerve fibers, 15 sebaceous glands and 100 sweat glands. Foot places one quarter bones of the body. Thus, injuries in the foot are extremely painful. As the Bible describes, Jesus was condemned to death nailing his

alive body to a wooden cross, one of them on his both feet. The Spanish Inquisition or the Holy Office was an institution created by the Catholic monarchs Fernando II and Isabel I to maintain Catholicism in the Kingdom of Spain in 1478. This was abolished during the regency of María Cristina de Borbón and Fernando VII in 1.834. During the Inquisition times, different tortures were performed in the feet of the non-believers. Several torture instruments were developed just for that purpose: feet burnt at bonfire, shackled ankles like the torture of Cuauhtémoc, the breaker wheel "Catherine Wheel" or breaking limbs, the shin, dismemberment by horses, Strappardo or "*Garrucha*", the iron boot, the hiker, the "*Turca*", and more gadgets to hurt. Many of them have been conserved in museums and castles, as part of historical exhibitions. From ancient to current times, different asiatic cultures have adopted the habit of wearing shoes that inhibit the normal development of the foot, "lotus feet" or "feet crescent" being another kind of long-term form of torture. Modern times introduce new forms of torture, such as the application of dry cement to the feet and throwing the person to the water by mafias and terrorist groups. More sophisticated ways of torture are applied in war crimes, like the use of electrocution or chemical acids on the foot, leading to get a confession from the tortured. Nowadays Arab countries apply traditional punishments methods towards the same objective. Therefore, the identification and study of this kind of tortures on feet by forensic podiatrists can play an important role towards the prosecution of criminals, helping to pursue justice for the victims.

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SPECTRUM OF CEREBRAL PATHOLOGY AS A FUNCTION OF SURVIVAL TIME IN ABUSIVE HEAD TRAUMA

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Background: Mechanisms of parenchymal brain injury with abusive head trauma are poorly understood. Perhaps least studied is the spectrum of cerebral pathology as a function of survival time. **Materials and methods**: We retrospectively reviewed 19 cases of fatal abusive head trauma, all associated with acute collapse, with post-trauma survival times ranging from acute death to 20 years. Data on subdural collections and ocular pathology were also examined. **Results:** Brain changes of decedents who were found dead or in full arrest and not resuscitated ranged from no pathology (excluding ocular and subdural pathology) to obvious cerebral edema. Survival for a period of days or longer invariably showed widespread ischemic brain injury. Asymmetry in swelling and acute necrosis favoring the side of the subdural hemorrhage was noted in some cases. In all cases with criminal proceedings and survival of days or less, defense experts invoked "healing" and a "lucid interval", in spite of absence of both. Long term survivors showed marked ischemic brain injury, which also tended to be more pronounced on the side of more pronounced subdural hemorrhage. There was no relationship between the presence of neomembrane and the acuteness of the presentation or survival time. Neurologic collapse with preserved vital signs was noted in a subset of cases. Retinal hemorrhages were common with days or less survival. Microscopic examination provided no additional information as regards cause and manner of death or timing of the acute collapse. **Conclusions:** 1) Outcome in abusive head trauma is determined by brain injury per se. 2) Asymmetry in brain injury favoring the side of the subdural hemorrhage, and presence of neurologic collapse with preserved vital signs in some cases, suggest acute traumatic injury to parenchymal brain tissue as the limiting factor, with ischemia, from trauma-induced edema/swelling and/or cardiovascular collapse, occurring secondarily. 3) Neomembranes were common but were unrelated to the acute collapse. 4) The pattern of injury in long term survivors was inconsistent with remote diffuse axonal injury. 5) The conclusion of homicide required examination of the clinical context and/or medical records at the time of collapse in addition to gross autopsy observations. On the other hand, microscopic observations had no clear role in cause and manner interpretation and tended to be misused by secondary reviewers. 6. Research into the admissibility of opinions on "lucid intervals", pathological dating of intracranial injuries, and microscopic observations is needed.

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INFRA-RED PHOTOGRAPHY: A PRACTICAL METHOD FOR THE DETECTION AND IDENTIFICATION OF GUNSHOT RESIDUE

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During the investigation of firearms incidents Gunshot Residue (GSR) is often the only forensic evidence that can provide a link between the scene, the shooter and the firearm. Forensic ballistics, however remains relatively under-researched in relation to forensic practice. Packaging and transportation of samples often causes damage to fragile GSR deposits, reducing the probative and evidential value. However, a key limitation of GSR analysis is that traditionally few visualization and / or screening techniques can be conducted at the crime scene. There has been some research looking at presumptive testing, but there is further requirement to evaluate remote testing methods as an early screening tool for the presence of GSR. Digital Infrared (IR) photography could help address these issues; as its portability allows it to be easily transported to scenes for in-situ examinations and its unobtrusive nature leaves the despots' physical structures undisturbed, thus demonstrating advantages over other techniques, such as chemical tests. This research aimed to evaluate the effectiveness of IR photography as a rapid and efficient technique for GSR visualisation on different fabric types and skin. Utilising the collaborative efforts of industry practitioners, equipment manufacturers, academic staff and students; the Attestor Forensics Scene View BV800 viewing system was used to visualise GSR deposits, from a variety of weapons, across seven surfaces. The first experiment focused on the victim and employed a Glock 17 and 9mm Luger ammunition, on four different fabric types and at three firing distances of 50mm, 200mm and 1000mm on an indoor police range. The second and third experiments focused on suspect detection and identification; employing military personnel using Glock 17 handguns and SA80 semi-automatic rifles on an outdoor range. The outcomes demonstrate that IR photography can produce comparable results to other GSR visualisation techniques, without the limitations of disturbing the sample's structure or being obstructed by certain material types. IR photography therefore has the potential to provide an early assessment tool for samples suspected of containing GSR deposits. A crucial advantage, as only the most beneficial samples will be referred for more advanced and costly examinations. Despite IR photography producing comparable results to other techniques, such as XRF, ALS and chemical tests, its portable and non-destructive nature offers greater practicality than these methods; making IR photography a suitable technique when considering budgetary and capability limitations.

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DEVELOPMENT AND APPLICATION OF A HIGHLY EFFICIENT COCAINE CLASSIFICATION METHOD

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Drug trafficking is one of the main concerns in national/international criminal investigations. In order to unravel these illegal drug distribution networks, comparative analysis of chemical profiles is a strong tool. For cocaine, many different groups of chemical compounds can be used for profiling, and the information obtained from the profiling can be handled in numerous ways. Selecting the right method using a balanced combination of the compound groups is highly important in order to deliver accurate

statements to the investigator. Our aim in this study was to establish a highly discriminative method using cocaine alkaloid and residual solvent profiling, and subsequently put the method into context by predicting the linked or non-linked nature of numerous cocaine seizures seized during 2016 and 2017.

Alkaloid and residual solvent impurity profiles were analysed using gas chromatography–mass spectrometry (GC–MS) and headspace GC–MS, respectively. Logistic regression and discriminant analysis (linear and quadratic) were used to evaluate different classification models that combined the use of both cocaine alkaloid and residual solvent distances. Different data transformations and distance methods were examined, and the different models were ranked using cross validation.

Residual solvent profiles exhibit considerable higher discrimination power than cocaine alkaloid profiles. Thus, a residual-solvent-weighted model (log10 transformation and cosine distance) was found superior at distinguishing correctly between linked and unlinked seizures compared to models using alkaloid distance alone. In this model, residual solvent profiles are only weighted when cocaine alkaloid profiles are very similar. The established model is continuously being used to predict the linkage status of numerous seizures and results hereof will be presented.

The finding of present study demonstrates the possibility to combine information from two different groups of chemical compounds for statistical comparative analysis of cocaine seizures in a highly discriminative and easy-to-implement way.

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3D DOCUMENTATION OF PATTERNED INJURY: DIFFERENT MEASURING TECHNIQUES AND A CASE EXAMPLE

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In forensic medicine the precise three-dimensional (3D) documentation of patterned injuries is important, especially in cases of blunt force. Patterned injuries on skin and bones can give clues to the injury causing instrument. Therefore patterned injuries on deceased as well as on living persons should be carefully documented. The geometric information of the injury is necessary for further reconstructive work. Cases of blunt force with shoes against the head of living people occur quite often. In many of these cases patterned injuries remain visible on the skin, sometimes even after days. This case report presents a young man who was involved in a physical conflict during a street hockey game. After the end of the game, there was an impressive patterned injury visible on his forehead. His face was 3D documented a week after the application of the blunt force and the patterned injury was still visible. For the 3D documentation the hand-held scanner Go!SCAN 50 (Creaform/Amatek, Québec, Canada) was used and photogrammetric photos were taken with a DSLR camera Nikon D600 (Nikon, Inc., Tokyo, Japan) and evaluated using PhotoScan software (Agisoft, St. Petersburg, Russia). The presumed injury-inflicting instruments were a pair of shoes and gloves. Both were documented using the stripe light scanner ATOS III (GOM, Braunschweig, Germany). The morphometric match analysis between the patterned injury and the presumed injury-inflicting instruments was performed using the visualization and animation software 3ds Max (Autodesk Inc., San Rafael, California, USA). Based on this practical forensic case, the results of the different measuring systems are demonstrated and the advantages and disadvantages of the systems are discussed, especial in the context of injury documentation on living persons. The method, results and possibilities of the morphometric match analysis are elaborated and the way the case was solved is explained. The case example shows that, thanks to the technological advances, the 3D measurement technology will have more and more impact on the routine of the forensic medical examination of living persons as well.

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3D ACCIDENT RECONSTRUCTION: NEW MEASURING TECHNIQUES FOR 3D DOCUMENTATION OF CRASHED CARS

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The morphometric 3D reconstruction of traffic accidents is a multi-disciplinary field of work. Different institutions, for example police, forensic medicine and accident analysts, are responsible for the answering of questions regarding the cause and course of accidents. The use of imaging methods in forensic medicine and of modern 3D measuring methods in forensic medicine and police, as well as the morphometric 3D reconstruction enable a multi-disciplinary analysis of traces and findings, thus opening up new horizons and perspectives. For securing traces and findings at the accident scene, on involved vehicles and on deceased or injured persons easy-to-use and time-saving 3D documentation methods are important. The documentation of an accident scene can be performed very accurately and quickly using photogrammetry and 3D laser scanning. For the documentation of persons photogrammetry, hand-held scanners and radiological imaging are suitable methods. However, the detailed and accurate 3D measurement of accident vehicles was still a time-consuming factor, especially because of the dark and shiny surfaces of the cars and the complex shape of bicycles. This study has the objective to validate and evaluate 3D measuring techniques for the 3D documentation of accident vehicles. The advantages and disadvantages of the different methods are worked out particularly with regard to resolution and accuracy, user-friendliness, expenditure of time, mobility and limitations. The results of the morphometric 3D reconstruction are demonstrated on a real case where a car collided in result of a self-accident with the crash barriers on the highway und came to a halt on the carriageway. Shortly after, a second car crashed into the first car. The driver of the car from the initial accident immediately died on-site. It was questioned which of the accidents caused the fatal injuries. Such reconstructions are only possible if the traces on the scene, deformations and traces on the vehicles and the medical findings of the persons involved are documented thoroughly.

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FLESHING OUT OUR METHODS: HOW FAT TISSUE AFFECTS SKELETAL AGE ESTIMATION

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Forensic anthropologists rely on skeletal age estimations to assist in the identification of individuals recovered from crime scenes, mass graves, terrorist attacks, and natural disasters. However, numerous validation studies have established that our commonly used standards have limited application across populations, time periods, and socio-economic differences. Reliability for adult skeletal age estimations is especially low for individuals over the age of 40 years. Recent research has shown that body mass significantly affects skeletal aging. Obese individuals are consistently over-aged, while underweight individuals are under-aged. These studies were conducted on dry bone, using body mass measurements from autopsy records with no information on soft tissue available. The current study builds on this work, examining how fat tissue contributes to skeletal aging. CT scans were used to measure fat and assess age on 420 individuals from the Victorian Institute of Forensic Medicine (Melbourne, Australia). The individuals ranged in mass from 44 to 183kg and in age from 20 to 79 years. 3D volume rendered images of the pubic symphysis, auricular surface, and 4th rib were created and the Suchey-Brooks pubic symphysis, Lovejoy et al. auricular surface, and Işcan et al. fourth rib methods were used to assess age. Preliminary findings show that as fat tissue increases, there is an increase in the estimated skeletal age at death with all three methods. When separated by age, there are no significant differences in the age estimates of high- and low-fat individuals under the age of 30 years. These findings suggest

that individuals over the age of 30 years with high amounts of fat tissue are over-aged using our current methods. This research has significant implications for forensic skeletal analyses, particularly given the rising rates of obesity worldwide.

Disclosure: All authors have declared no conflicts of interest.

VALIDATION OF APPLIED BIOSYSTEMS PRECISION ID ANCESTRY PANEL FOR USE IN FORENSIC CASEWORK

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The Centre of Forensic Sciences (CFS) is validating the Applied Biosystems Precision ID Ancestry Panel with the goal of providing investigators with investigative information regarding the bio-geographic ancestry of DNA sources. A ThermoFisher Scientific (TS) Ion Chef Instrument was used to prepare libraries, template and load chips, while sequencing was performed using the TS Ion S5 Next Generation Sequencer. HID SNP Genotyper Software was used to make genotype calls from aligned reads and to make admixture predictions. The validation procedure includes the testing of 30 samples collected from CFS staff of various bio-geographic ancestries. These same samples had previously been provided to Applied Biosystems for testing as part of the open, competitive procurement of the NGS technology. The admixture prediction provides the proportional contribution from seven continental groups - Americas, Africa, Europe, E Asia, Oceania, S Asia, and SW Asia - that best describe the genotype. As was the case with test results previously provided to the CFS by Applied Biosystems, the sample donor's self-declared ancestry concurred with the major component of the admixture prediction – Africa (n=8), Europe (n=6), E Asia (n=8), S Asia (n=5), SW Asia (n=1), admixed (Europe/S Asia, n=1) – for all but one sample. In this instance, the donor self-declared his ancestry as 50% Irish and 50% Egyptian. The admixture prediction for this individual was 65% European and 35% SW Asian. These results are not unexpected because the populations used to define the African continental group are all Sub-Saharan; no North African populations are included. Additionally, individuals that declared SW Asian or S Asian descent had higher levels of admixture predicted than other continental groups that were tested. The following studies have also been performed in an ongoing validation: contamination, sensitivity, non-probative casework and mixtures. The validation will be discussed with special focus on how results will be used to carefully select samples to be processed together on the NGS platform and to inform the general criteria for test acceptance (e.g. DNA quantity thresholds, mixture ratio thresholds, etc) in casework at the CFS.

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THE TIME OF DEATH IN COURT

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Knowing the time of death is crucial to resolve criminal cases. For determining the time of death several methods are used, for example livor, rigor, temperature and decomposition. Because of the great importance of the time of death the methods used have to meet the Daubert criteria. A case study was performed within the Dutch jurisprudence in criminal cases in which the time of death was disclosed as a crucial topic. Method: For this study all published Dutch adjucations in criminal law suits of the district courts, the high court's and the Supreme Court in the period of 2010-2015, in which the term 'time of death' occurred, were selected (N=66).In the research the following question was stated: How does the expert witness, and subsequently the Dutch judge, determine the time of death? Do the methods which were used meet the Daubert criteria? Results: Out of 66 cases in 40 cases the method of determining the time of death was not described in the adjucation or the decision was made by a judge on testimonies or facts (like telephone records). Of the 26 cases in which the method in which the time of death was determined was clear, in 38% the Henssge nomogram, in 15% Hennsge and rigor and livor mortis, in 4% potassium vitreous humor, in 4% Cooling down ergo sim, in 4% solely rigor/livor, in 12% postmortal changes and in 19% entomology and postmortal changes were used. Discussions in court were in 26% (N=66) about the inability to determine the time of death, 7% the time of death was unclear, 5% the conclusions did not add up to other evidence, 3% method was contested. The precision of determining the time of death was between 0,25 hours up to several days. Conclusion: In most cases the Henssge Nomogram, which is validated, was used. A limitation of this method is that it can only be used in the first 24 hours. For the use of vitreous humor, the cooling down ergo sim method is no scientific evidence available. Researches on entomology in the Netherlands are not available. Decomposition to determine the post mortem interval is not sufficiently researched in the Netherlands. Nevertheless, these methods are used in court by experts and convictions are based on the expert witness report and statement.

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FORENSIC IN SILICO: THEORETICAL STUDY OF FITC AND CB[6] TO DETECT AMPHETAMINE AND CATHINONE

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Forensic *in silico* is a powerful tool to study forensic problems in chemistry and toxicology. Although there are many reliable experimental methods, they may be expensive and sometimes time-consuming. Besides, good standards and specialized knowledge are required for an accurate empirical measure. Considering that is an increasing search to improve drugs identification, new substances have been tested. The main issue of this work is to study two substances according to their ability to link (fluorescein isothiocyanate, FITC) or host (Cucurbit[6]uril, CB[6]) amphetamine (amph) and cathinone (cath). Quantum chemistry calculations were used to evaluate the energies of each process. The computational procedure followed the steps: a) structures were constructed by Avogadro software individually[1,2]; b) energy optimization was performed with Orca®[3]software. Density Functional Theory (DFT, B3LYP) method with a Def2-TZVPP basis set was used to optimize these structures. c) Calculation of the complexes: (1) FITC-amph, (2) FITC-cath, (3) CB[6]-amph, and (4) CB[6]-cath. In cases (3) and (4), the geometries containing the hosted molecule fitted in the center of CB[6] cavity was tested. Table 1 summarizes the results, which show that for both amphetamine and cathinone the energy for the complexes formation (bolded) is lower than those regarding the sum of the molecules individually. However, for the cathinone, the process is highly favorable, since its energy is lower than the amphetamine one. The only difference between the molecules is a carbonyl group, which probably accounts for stabilizing the complexes. The authors thank CENAPAD-SP for providing the computational environment.

Table 1. B3LYP results for energies calculated

Structure	Energy/hartress
amph	-405.2144129
cath	-479,5704975
FITC	-1636.056835
CB[6]	-3607.790453
amph + FITC (sum of individual energies)	-2041.271248
amph + CB[6] (sum of individual energies)	-4013.004866
FITC-amph complex	**-2041.294757**

CB[6]-amph complex	**-4013.053573**
cath + FITC (sum of individual energies)	-2112.234262
cath + CB[6] (sum of individual energies)	-4083.967881
FITC-cath complex	**-2552.608105**
CB[6]-cath complex	**-4085.122309**

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FORENSIC BODY FLUID IDENTIFICATION USING PROTEOMICS ON LC-QTOF

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Most body fluid tests utilized in forensic laboratories are presumptive in nature. This limitation can be problematic in situations where the identity of the body fluid is of significant importance in a criminal investigation. To address this issue a proteomic analysis of body fluid-specific proteins by liquid chromatography-quadrupole time-of-flight mass spectrometry (LC-QTOF) was assessed to determine whether it could be used to specifically identify blood, semen, saliva and vaginal fluid. A brief protein extraction step was added prior to DNA extraction to allow for the simultaneous isolation of proteins for body fluid identification and DNA for human identification. The protein extract was digested with trypsin to generate tryptic peptide precursors for detection on a Waters Xevo G2-S QTOF. Four to 6 peptides, considered characteristic of each body fluid type (21 peptides in total), were targeted in a multiplex data-dependent acquisition. In limited testing thus far, successful identification was achieved for single source blood (n=12) and saliva (n=6) samples. Two post-coital vaginal swabs resulted in positive identification of both semen and vaginal fluid and one menstrual vaginal swab was analyzed, positively identifying both blood and vaginal fluid proteins. Protein detection was specific to the body fluid targeted, resulting in no false-positive identifications. Further testing demonstrated a minimal loss (<3%) of DNA in the protein fraction of blood and saliva samples. Swabs preserved following proteomic extractions and subsequently processed through DNA analysis generated complete PowerPlex® 16HS DNA profiles. This protocol, given further assessment, may provide an effective approach to specifically attribute body fluids to corresponding DNA profiles in a manner that minimizes sample consumption in the forensic laboratory.

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FORENSIC SCIENCE PERCEPTION FROM DECISION-MAKERS IN QUEBEC POLICE ORGANIZATIONS

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Forensic science faces several challenges regarding its ability to provide accurate and relevant evidence in the courtroom. Besides, it is also recognized that forensic data is only poorly integrated into crime investigations and analyses (Ribaux, 2014). In the Province of Quebec, Brodeur (2007) supported that forensic science even plays a minimal role in the resolution of homicides and seldom contributes to the identification of suspects. Human sources (i.e. witnesses, informants) and police sources (i.e. patrols, monitoring) are the most important factors in clarifying cases, particularly in murder cases (Brodeur, 2007). Hence, it could become relevant to question whether forensic science could be optimized at the level of police investigations in Quebec. Few papers address forensic resources management by law enforcement decision-makers. Indeed, a forensic science conception based unilaterally on laboratory analysis ignores all the steps upstream and downstream of trace management in a security concept that goes beyond merely presenting evidence to the court, from data collection to the development of assumptions and the management of police organizations (Ribaux, 2014). The efficiency of traces processing in laboratories cannot be isolated from the whole process, which is defined and managed by the law enforcement organizations. Police departments, and particularly operational and financial decision-makers, could therefore be relevant factors in the development of forensic science. Indeed, they represent an integral part of a group of actors directly concerned with the optimization of forensic science, along with detectives, crime scene investigators, forensic examiners, judges, lawyers and intelligence analysts (Rossy & Ribaux, 2014). The understanding of this discipline and its concepts by police chiefs is therefore at the heart of strategic, operational and financial decision-making. It may impact the resources and missions that are given to Crime Scene Units. The aim of this research is then to understand how law enforcement decision-makers perceive the forensic science and how they manage the resources given to crime scene investigators. To do so, fifteen semi-directive interviews were conducted with police decision-makers (i.e. managers) of level 2 and higher law enforcement agencies. Those organizations were selected because of their obligation to run a Crime Scene Unit according to the *Loi concernant l'organisation des services policiers*. We also conducted a qualitative analysis of the *Manual of policing practices* from the *Ministère de la Sécurité publique du Québec*. This document provides the legal frame of all law enforcement activities.

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EXTRACTION BY DISPERSIVE LIQUID MICROEXTRACTION FOR DRUGS DETECTION BY HPLC AND GC-MS

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Among the different microextraction techniques which are introduced during the recent years dispersive liquid-liquid microextraction (DLLME) gained much attention because of its simplicity, short extraction time, less organic solvent consumption and low sample volume which required for extraction. Despite of these advantageous, the major drawback of DLLME is that its application is restricted to the liquid samples such as urine. Therefore extraction of drugs from complex matrices such as blood or tissue samples required a primary liquid-liquid extraction (LLE) in order to bring these samples into the liquid form. One of the most appropriate solvents which is used for LLE process is 1-chlorobutane. By use of this solvent different classes of drugs could be extracted from biological samples more efficiently. In this work the advantageous of using of 1-chlorobutane as a suitable LLE solvent and DLME as a microextraction technique are combined in order to enhance the extraction recovery of different drugs from biological samples including blood, bile, liver and gastric content. For LLE process, the pH of all the biological samples were adjusted at 9.20 using saturated borate buffer, then 10 mL of 1-chlorobutane was added and solution was shaken for five minute. After centrifugation for 5 minute at 3000 rpm the 1-chlorobutane layer was collected and back extracted using 5 mL of 1M of HCl. The aqueous layer was collected after 5 minute centrifuge at 3000 rpm and was basified with concentrated ammonia to pH 10. The DLLME was performed using a mixture of methanol: chloroform (2:0.3 v/v) as disperser and extracting

solvents respectively. The obtained solution was centrifuged for 5 minute at 3000 rpm and sedimented chloroform was collected and evaporated to dryness under a stream of nitrogen. The residue was reconstituted in 30 µl of methanol and injected into the HPLC and/or GC-MS. The extraction recoveries were between 0 and 90% and obtained chromatograms were clean.

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DEVELOPMENT OF A NEW METHOD FOR SIMULTANEOUS QUANTITATIVE BHB AND GHB ANALYSIS BY GC-MS

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Beta-hydroxybutyric acid (BHB) and gamma-hydroxybutyric acid (GHB) are two analogs of endogenous or exogenous nature found in biological matrices. BHB is analyzed as a biomarker for diabetic or alcoholic ketoacidosis. GHB, on the other hand, is targeted as a xenobiotic. In Canada, it can be taken as a medication for the treatment of narcolepsy (Xyrem®), but is more often consumed as a drug of abuse. GHB is a central nervous system depressor, with euphoric effects similar to those of alcohol. Last year, (2016) it was detected in 21.2% of drug impaired driving cases in Québec. The development of a GC-MS method combining the quantitative analysis of BHB and GHB is presented here with preliminary results of the ongoing validation. Pairing the analysis of the two analogs will standardize and improve the analytical analyses process. Protein precipitation of the biological matrix analyzed is performed, followed by a derivatization step. The extract is then injected on an Agilent® GC-MS, using Mass Hunter® to perform data analysis. This method was developed for a wide array of forensic matrices: ante and postmortem blood, vitreous humour, urine, and other liquids. Method development highlighted that solvent (ethyl acetate or acetonitrile), temperature and time used for the derivatization process can influence the final outcome. Even though the two target analytes are structurally very similar, they are both influenced differently by the various factors. Additionally, GHB and BHB behave differently depending on the type of evaporator used prior derivatization. BHB and GHB have their own deuterated internal standard (BHB-D_4 and GHB-D_6, respectively) to compensate these effects. Method validation is performed following ISO 17025, CAN-P-1578 and SWGTOX validation guidelines. High linearity is observed in the dynamic range 10 to 500 µg/mL for both BHB and GHB. Accuracy and precision were both below the 20% threshold for standards and QCs. This new, robust and improved method will replace the separate BHB and GHB GC-MS confirmation methods, improving the efficiency of the toxicological workflow.

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