Modelling human corticogenesis, neuronal maturation and integration from pluripotent stem cells

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The generation of *in vitro* and *in vivo* models to study human cortical development is essential to address the molecular and cellular mechanisms involved in brain evolution as well as to elucidate major pathways affected in developmental and degenerative cortical diseases. Here we found that human pluripotent stem cells (PSC) cultured without added morphogens, recapitulate corticogenesis *in vitro* leading to the sequential generation of functional pyramidal neurons of all six layers identities. Human cortical neurons matured slowly in culture, and presented an increase in spontaneous synaptic activity upon co-culture with astrocytes. Following transplantation into the mouse neonatal and adult brain, human PSC-derived cortical neurons integrated robustly and established specific axonal projections corresponding to native cortical neurons of diverse cortical layers and areas. Neuronal differentiation and connectivity complexified progressively over several months *in vivo,* culminating with the development of elaborate dendritic patterns, the presence of dendritic spines, and the establishment of reciprocal synapses with the host in a time dependent fashion highly reminiscent of the human species. Our data demonstrate that human cortical neurons generated from PSC can establish synapses *in vitro* and develop complex neuronal features characteristic of the cerebral cortex *in vivo*, thereby offering unprecedented opportunities for the modelling of human cortex diseases, and brain repair.

1st Meeting of the
Belgian Society for Stem Cell Research (BeSSCR)
Stem cells: ready for the transition from bench to bedside?

More info: www.BeSSCR.be

Friday September 12th 2014, Ghent, Belgium

8:00 - 8:30 **Registration + coffee**

8:30 - 8:40 **Welcome and Introduction: Prof. Petra DE SUTTER,** *Department for Reproductive Medicine, Ghent University Hospital, Belgium*

Keynote session: Different stem cell horses in the stable
Chair: Karen Sermon, Björn Heindryckx

8:40 – 9:20 **Prof. Jacob HANNA,** *Weizmann Institute of Science, Israel*
Production of naive pluripotent human stem cells

9:20 –10:00 **Prof Catherine VERFAILLIE**, *Leuven Stem Cell Institute, Belgium*
Uses of Reprogrammed Cells in Medicine

10:00–10:40 **Prof Cédric BLANPAIN**, *Université Libre de Bruxelles, Belgium*
Stem cells during cancer initiation and growth

10:40–11:15 **Coffee Break**

Session II: Legal aspects of Stem Cells: are they ethical?
Chair: Guido Pennings, Lieve Nuytinck

11:15-11:45 **Prof Guido DE WERT**, *Maastricht University, The Netherlands*
Ethical implications of stem cell research

11:45-12:15 **Dr. Philippe JACOBS**, *European Patent Attorney of Tech Transfer, UGent*
Legal aspects: patent possibilities for industry of stem cells and derivates

12:15-12:30 **Poster teasers**

12:30-13:30 **Lunch: walking dinner buffet + Poster session**

Session III: Production of functional cells from stem cells in a dish?

Chair: Ellen Goossens, Petra De Sutter

13:30–14:00 **Prof Susana CHUVA DE SOUSA LOPES**, *Leiden University, The Netherlands*
From pluripotent stem cells towards germ cells

14:00–14:30 **Prof. Pierre VANDERHAEGHEN,** *Université Libre de Bruxelles, Belgium*
From stem cells to cortical networks

14:30–15:00 **Prof. Harry HEIMBERG,** *Vrije Universiteit Brussel, Belgium*
Differentiation or transdifferentiation towards functional beta cells

15:00-15:30 **Refreshment Break**

Session IV: Stability of stem cells: should we ever use them clinically?

Chair: Filip Van Nieuwerburgh, Mieke Geens

15:30 - 16:00 **Dr. Bart VAES,** *Regenesys, Belgium*
Characterization of the properties of the cells from an epigenetic perspective

16:00–16:30 **Prof. Claudia SPITS,** *Vrije Universiteit Brussel, Belgium*
(Epi-)genomic stability of pluripotent stem cells

16:30-17h00 **Prof. Yves BEGUIN,** ***Université de Liège, Belgium***
Use of mesenchymal stem cell derived cells for clinical applications

17:00-17:30 **Discussion + concluding remarks: Prof. Karen SERMON,** *Research Group Reproduction and Genetics, Vrije Universiteit Brussel, Belgium*

17:00–19:00 **Refreshment Break**