Effect of electrode morphology on the frequency spectrum of local field potentials in the rat ventral tegmental area
C. Delairesse¹, G. Becker¹, A. Plenevaux⁵, V. Seutin¹, S. Koulchitsky¹
¹ Laboratory of Neurophysiology GIGA Neurosciences, ² GIGA-CRC In vivo imaging, both at the University of Liège B4000 Liège, Belgium

Background
Chronic implantation is now widely used to study spike activity and local field potentials (LFP). In this work, LFPs of rat ventral tegmental area (VTA) were recorded with two different types of recording probes with different orientations.

Objective
To investigate whether the type/orientation of recording probes influences the LFP frequency spectrum

Methods
Male wistar rats were implanted either with microelectrode microwire arrays (Alpha Omega GmbH, Israel), or with silicon-based planar probes (Atlas, Neuroengineering, Belgium) at the following coordinates: 5mm posterior to bregma, 0.2mm lateral to midline, 7mm deep. In the case of the Atlas probes, some animals (n=3) were implanted with the recording side of the probe facing the lateral part of the brain and others (n=4) with the recording side oriented towards the midline. Telemetric recordings were performed using either the Multichannel® W8 or W16 system (Koulchitsky et al., 2016). Out of recordings lasting 30 minutes, we selected 10s epochs during which rats moved in a regular fashion (speed was 3.8 ± 0.26 mm/s). Care was taken not to include episodes during which type of behavior occurred (such as rearing, grooming, ...). For verification of the recording area the rats were anaesthetised and perfused with 4% paraformaldehyde containing 1% of Gadovist. The brains were removed from the skull and placed in Formalin for MRI scanning (9.4 Tesla MRI DirectDrive VNMRS, Agilent Technologies, Palo Alto, CA).

Results

Conclusion
In the VTA, LFP signals recorded with multielectrode arrays of different geometries yield qualitatively very different results. Whereas a theta peak is clearly observed with 360° sensing electrodes and laterally facing electrodes, it is much less present with midline facing electrodes.

We see 2 possible explanations for these differences:
1) The differential neurochemical nature of neurones in the medial versus the lateral VTA (with more DA neurones in the lateral VTA and more non-DA neurones in the medial VTA)
2) If the theta rhythm originates from elsewhere in the brain, its invasion of the VTA could be sensed differentially by electrode of opposite orientation

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