



Thesis proposal n°2

Title: Effects of intracranial electrical brain stimulation on neuronal dynamics recorded by microelectrodes in epileptic patients

Lab: Centre de recherche Cerveau et Cognition (Brain & Cognition Research Center, CerCo – CNRS, UMR 5549), Toulouse, France (<https://cerco.cnrs.fr>)

Funding: ANR (DYNEUMICS Project)

Context: Intracranial electrical brain stimulations (EBS) are used to delineate the epileptogenic zone in pharmaco-resistant epilepsy. However, current EBS protocols are empirical and limited. EBS parameters are not optimal. The direct impact of EBS on neuronal activity, on local field potentials and on widespread networks has seldom been explored. Very little is known about the modification of electrical parameters. This is not limited to epilepsy, but to all the fields where EBS are used (Parkinson's, psychiatric diseases). The DYNEUMICS project aims at exploring the multiscale effects of EBS (clinical, oscillations, neuronal dynamics) thanks to a EBS protocol including new EBS frequencies (tailored to each brain location and seizure onset pattern) and to new intracranial hybrid electrodes equipped with tetrodes, which are more efficient to isolate single neuron activity. Understanding changes in neuronal dynamics after EBS will help to specify optimal parameters and improve the exploration of pharmaco-resistant epilepsy. The PhD student will work on this project which has started in 2021.

Location: The thesis will take place mainly at the CerCo and in the epilepsy department of the Toulouse University Hospital located in the immediate vicinity. The CerCo is a dynamic laboratory, with many students of all nationalities and profiles.

Skills required: Initial training in neuroscience with good experience in EEG signal processing. Coding in Matlab and Python. Basic math and physics. High level of rigor and organizational skills. Good social skills due to the different contexts of intervention and contact with patients in hospital. Good level of written and spoken English.

Thesis start date: Planned for early October 2022.

Application: Send CV, cover letter, academic transcripts and Master's thesis to the supervisors: Jonathan Curot (MD, PhD ; jonathan.curot@cnrs.fr) and Emmanuel Barbeau (emmanuel.barbeau@cnrs.fr).

References:

- Curot J, Barbeau EJ, Despouy E, Denuelle M, Sol JC, Lotterie, JA, ... & Peyrache, A. (2021). Local neuronal excitation and global inhibition during epileptic fast ripples in humans. *bioRxiv*.
- Despouy E, Curot J, Reddy L, Nowak LG, Deudon M, Sol JC, Lotterie JA, Denuelle M, Mazizh A, Bergaud C, Thorpe SJ, Valton L, Barbeau EJ. (2020). Recording local field potential and neuronal activity with tetrodes in epileptic patients. *Journal of Neuroscience Methods*, 341:108759.
- Curot J, Busigny T, Valton L, et al. (2017) Memory scrutinized through electrical brain stimulation: A review of 80 years of experiential phenomena. *Neurosci. Biobehav. Rev.* 78:161–177