Master de Sciences et Technologies
Mention Biologie Intégrative et Physiologie
Parcours : Neurosciences
Responsable : Professeur Régis Lambert

Internship Proposal
Academic Year 2018-2019

1. Host team:

Research Unit (e.g. Department or Institute): CNRS UMR 8246 Neuroscience Paris Seine
Research Unit Director: Hervé Chneiweiss
Research Team Director: Bertrand Lambolez & Bruno Cauli
Team name: Cortical networks & neurovascular coupling

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Supervisor of the Research Intern for this project: Ivan Cohen
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2. Internship project title:

Vascular dynamics in epileptic seizures

3. Internship Description:

In vivo brain activity recordings can help unravel the mechanisms underlying complex behaviors and pathologies. We have developed functional imaging based on ultrasound that reveals hemodynamics in superficial and deep brain areas with high sensitivity in freely moving rats, as EEG is being monitored [Sieu et al 2015]. This combined neuronal and vascular/metabolic experimental approach (fUS-EEG) could help address major issues of neurophysiology.

The aim of this project is to better understand the spatio-temporal dynamics of epileptic absence seizures and the relation between blood perfusion and epileptic spike-wave discharges, in order to better understand the underlying pathological mechanisms. Indeed, some publications have shown that vascular processes may contribute to initiation and suppression of these seizures.

Our preliminary results show that fUS-EEG robustly detects changes in perfusion in cortical and thalamic areas during a seizure. We will draw a complete map of hypo- and hyper-perfusion areas. We will use the high sensitivity of the technique to study the dynamics of blood adaptation to neuronal activity, in relation to initiation and termination of seizures. Through this approach we will address general questions regarding the relation between EEG signals and hemodynamics, neurovascular coupling in pathological condition, and we will contribute to develop a global understanding of the cognitive and metabolic processes in the brain.

Sieu LA, Bergel A, Tiran E, Deffieux T, Pernot M, Gennisson JL, Tanter M, Cohen I. (2015) EEG and functional ultrasound imaging in mobile rats. Nat Methods 12:831-834