

MASTER 2 Fundamental and Clinical Neurosciences

Internship proposal 2026-2027

(internship from January to June 2027)

Host laboratory:

Lyon Neuroscience Research Center CRNL. Inserm U1028 - CNRS UMR5292 - Université Claude Bernard Lyon 1.

Host team :

Tiger Team <https://www.crnl.fr/en/equipe/tiger>

Internship supervisors :

- Paul MARCHAL, Postdoctoral Researcher, paul.marchal@inserm.fr
- Vincent MAGLOIRE, Researcher Inserm, vincent.magloire@inserm.fr

Project title :

Simultaneous recording of adenosine and acetylcholine fluctuations in the hippocampus of a mouse model of epilepsy using freely behaving multiplex fiber photometry.

Project summary :

Despite decades of effort, seizures cannot be predicted with good accuracy. Patients' propensity to experiencing seizures not only depends on predictable circadian rhythms, but also on stochastic brain states. Key regulators of neuronal excitability, namely neurotransmitters (NTs) and neuromodulators (NMs), are also strongly modulated by circadian rhythms and brain states and so by tracking their fluctuations we should be able to better understand and predict seizure occurrences. In this context, adenosinergic and cholinergic systems are of particular interest as they are strongly involved in brain state regulation, in particular in the regulation of sleep-wake cycle and the modulation of seizure activity.

This project will be conducted in a rodent model of temporal lobe epilepsy (involving the hippocampus) using fiber photometry in combination with polysomnography (EEG, EMG) and video monitoring. We will take advantage of newly developed genetically-encoded neurotransmitter indicators for adenosine (GRAB-Ado) and acetylcholine (GRAB-Ach) to monitor fluctuations of both neuromodulators in the hippocampus of control, and if time permit, in epileptic animals. We will study the correlations between these two signals and to additional multimodal measurements (e.g. hypnograms, locomotion, behavior, interictal activity...).

In this context, the student will have the opportunity to observe the surgical procedures, participate in the behavioral and photometry experiments (depending on animal handling accreditations), perform histochemistry assays and take part in designing and performing data analysis.

3-5 recent publications :

- Shimoda, Y., Leite, M., Graham, R. T., Marvin, J. S., Hasseman, J., Kolb, I., Looger, L. L., Magloire, V., & Kullmann, D. M. (2024). **Extracellular glutamate and GABA transients at the transition from interictal spiking to seizures.** *Brain*
- Magloire, V., Mercier, M. S., Kullmann, D. M., & Pavlov, I. (2019). **GABAergic Interneurons in Seizures: Investigating Causality With Optogenetics.** *Neuroscientist*
- Peng, W., Wu, Z., Song, K., Zhang, S., Li, Y., & Xu, M. (2020). **Regulation of sleep homeostasis mediator adenosine by basal forebrain glutamatergic neurons.** *Science*