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

Internship Proposal

Academic Year 2019-2020

1. Host team :

Research Unit : Cognition Action Group, CNRS UMR 8257
Research Unit Director : Damien RICARD

Research Team Director : Eric KREJCI
Team name : Sensorial bases for behavior based on mice models

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2. Internship project title:

Neurophysiology of Visual Computation

3. Internship Description :

Our research in the mammalian visual system focuses on how the biophysical properties of neurons and their networks accomplish functional computations. We employ a symbiotic approach based on experimental and computational systems neuroscience, bridging the in vitro paradigm in cortical neurophysiology to complementary approaches in the in vivo, functional realm. In this way we aim to illuminate essential mechanisms that define what the brain computes, how it does it, and what code it speaks.

This project, based on whole-cell patch recordings of single mouse V1 neurons in vivo, will characterize visually-evoked synaptic conductances and the associated neuronal input-output (I/O) transfer function. Measurements will be made on neurons under normal conditions, as well as with the neuron's intrinsic properties modified, for example with the addition or the cancellation of specific membrane channels that underly neuron excitability. The experiments employ a novel closed-loop in vivo protocol based on a combination of the current, voltage and dynamic clamp recording modes. Taken together, these methods allow the characterization of the functional (visual) properties of a neuron, estimations of its synaptic input from the cortical network, and finally quantitative measurement of how synaptic excitation and inhibition interact with specific biophysics of the cell to produce the neural spiking code. Experiments will be closely tracked with the analysis of detailed computer models of single neurons and the cortical network, constrained by the electrophysiological data. The modeling will provide insight as to the essential dynamical mechanisms underlying the code, and as well produce hypothesis-driven variations on the next round of experimental protocols.