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) : **Laboratoire de Physiologie Cérébrale CNRS UMR 8118, Université Paris Descartes**
Research Unit Director : **Isabel Llano**
Research Team Director : **Brandon Stell**
Team name : **GABAergic Synapses in the Cerebellum**
Address : **45 rue des Saints Pères, 75270 Paris Cedex 06, France**
Supervisor of the Research Intern for this project : **Brandon Stell**
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E-mail : **brandon.stell@parisdescartes.fr**

2. Internship project title: Tactile virtual reality to study sensorimotor mismatches in the cerebellum

3. Internship Description :

We are proposing an M2 intership project starting September 2018 in the Brain Physiology Lab (CNRS UMR 8118, Unviersité Paris Descartes, 45 rue des Saints-Pères, Paris, France) under the supervision of Brandon Stell (PhD) and Michael Graupner (PhD). The candidate will conduct a multifaceted project dedicated to studying **how the cerebelluar network of mice learns to interact with a virtual reality environment**. The experiments entail behavioral measurements, calcium imaging with advanced 2-photon microscopy, and electrophysiolocial recordings in awake, behaving animals.

A fundamental problem that has to be solved by the nervous systems of all organisms is how to discriminate self-generated sensory stimuli from sensory stimuli arising from the external world. This distinction allows the brain to focus on important stimuli without being overwhelmed with processing the constant barrage of uninteresting stimuli that it generates itself. For example, if you use the fingers of your right hand to tickle the palm of your left hand, you will remark a strikingly different sensation than if you ask someone else to tickle the palm of your left hand with their fingers (try it). This is because your cerebellum has learned how to predict what the sensory sensations that you cause to yourself should feel like and the circuitry in your cerebellum automatically ignores those sensations without you even thinking about it. Due to the difficulty in observing a mammalian brain while it moves and interacts with its environment, it is still unknown how this fundamental sensory discrimination task is solved by the brain.

To address this, we constructed a simple virtual reality environment to observe the brains of mice running through a virtual tube in the dark using their whiskers to inform them of their running speed. We control the speed of the virtual "walls" of the tube so that they move at the same speed at which the mouse is running (close-loop virtual reality) but are able to introduce "sensorimotor mismatches" by uncoupling the running speed from the speed of the walls to give the mouse the impression it is either running faster or slower than the speed at which its legs are carrying it.

The purpose of the project is to use 2-photon imaging techniques to observe individual cells in the cerebellum of mice while they are in the virtual environment. We will test how their brains adapt to

mismatches in their perceived and expected sensory experiences. **These experiments will help us to understand how specific neural circuits in the brain solve the fundamental problem of discriminating external vs self-generated stimuli.**

Applicants should pursue studies in/or related to neuroscience. The ideal candidate has practical skills for experimental work with animals, some background in neurophysiology, and a deep desire to understand the principles underlying the functioning of the nervous system. Good communication skills are a must.