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: **Department of Integrative and Computational Neuroscience (ICN), Neuro-PSI, CNRS Gif-sur-Yvette**
Research Unit Director: **Philippe Vernier**
Research Team Director: **Daniel Shulz**
Team name: **Sensorimotor processing and plasticity**

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## 2. Internship project title:

**Encoding of complex tactile stimulus patterns in the somatosensory cortex of awake mice.**

## 3. Internship Description:

This M2 project aims to investigate how complex spatio-temporal sensory stimulus are encoded in awake behaving mice.
Rodents are nocturnal animals which can recognize objects, navigate the environment and also socialize by using tactile information gathered with their whiskers. The whisker system is composed by a precise arrangement of whiskers in the snout of the animal that provides information from multiple contacts to the brain. The way that this multi-whisker information is encoded in the somatosensory cortex of an awake behaving animal has not been fully described yet. Specifically, the encoding of higher order features as edges and objects of different sizes and shapes was not been explored due to the difficulty in shaping complex whisker stimulations. In addition to this, the animals actively 'whisk' by moving their whiskers back and forth in order to gather the tactile information, making the controlled stimulation a big challenge.

Our team has worked in the recent years on the detailed characterizations of the neuronal activity arising when complex stimulations where delivered in anesthetized animals. These efforts have been done in the primary somatosensory cortex (S1, Estebanez et al. 2012, Estebanez et al. 2016, Vilarchao et al. 2018) and more recently in the secondary somatosensory cortex (Goldin et al. 2018). To deliver the stimulus, we use a specialized tool built by our team that allows the micrometrically controlled and simultaneous displacement of 24 whiskers ('*The Matrix*', Jacob et al. 2010). We discovered that single neurons in S1 can encode local and global features of whisker movements and that S2 integrates more across time and space compared to S1. However, we do not yet know what is the impact of the activity of one of the regions on the precise tactile feature encoding of the other, or how the neuronal activation changes during the presence of a relevant stimulation in an awake state.

In the framework of this project, the student will work in the adaptation of a matrix of stimulation in order to be used with an awake behaving mouse. The student will have to develop a training protocol to

habituate the animal to be head fixed and to prevent it from whisking during the passive delivery of the stimulus. If the first part is successfully achieved, we will study the impact of global patterns of general object shape stimulation in the single neuron and in the population activity of cells recorded with muti-site electrodes in S1 and S2. We will also explore the possibility to manipulate optogenetically the activity of one region to test the changes on the encoding of a shape on the other region.