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 (e.g. Department or Institute): **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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Supervisor of the Research Intern for this project: **Luc Estebanez**
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2. Internship project title: Appropriation of a BMI prosthesis in the mouse model

3. Internship Description:

This M2 project aims to investigate how sensory feedback contributes to the embodiment of a prosthesis in a brain-machine interface (BMI) context.
BMIs are emerging as a clinical answer to many motor impairments. But until now, BMI use has been hindered by the lack of prosthesis embodiment. This means that for the subject, the prosthesis remains a remote object that is not part of its self. This issue is likely due to the lack of touch and proprioceptive feedback coming from the prosthesis to the user, as supported by the (Wada et al. 2016)
To test the impact of somatosensory input on embodiment, we will combine, in the mouse model, a closed-loop invasive BMI with a miniature mock prosthesis fitted with with touch sensors. These sensors will be relayed directly to the somatosensory cortex (S1) via our BMI.
Our team has recently built this closed-loop BMI tailored to the sensorimotor system of the mouse (Abbasi, et al., 2018, Journal of Neural Engineering). It combines a chronic readout of neuronal activity in the primary motor cortex with a tactile feedback in the form of rich, patterned mesoscopic photoactivation of Channerhodopsine-expressing pyramidal neurons in S1.

With the support of the permanent researchers of the laboratory, the Master student will use the in-house 3D printing facility to produce a mock mouse forearm, and fit this model with miniature touch sensors which will be relayed to the head-fixed mouse as direct cortical activations.

The Master student will then train the head-fixed mouse to detect touch stimulation to the prosthesis, in a context where visual information will be available to the mouse. If time allows, the student will then estimate the degree of prosthesis embodiment that results from this procedure and compare it with a « no-feedback » condition where only visual information will be available.