

## **Internship Proposal Academic Year 2018-2019**

### **1. Host team :**

Research Unit (e.g. Department or Institute) :  
CNRS UMR 8119, Centre de Neurophysique, Physiologie, Pathologies  
Research Unit Director : Claude Meunier  
Research Team Director : Mathieu Beraneck  
Team name : « Spatial orientation »

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### **2. Internship project title:**

***The thalamo-presubicular loop for signalling head-direction***

### **3. Internship Description :**

Spatial orientation in animals and in humans relies on networks of specialized neurons in extended brain regions. In this projet, we will focus on cells in the anterior thalamus and in the presubiculum, that are sensitive for head direction: these cells fire specifically when the head of the animal is oriented in their preferred direction, contributing as a sort of compass to navigation. Interestingly, while presubiculum signals the current head direction, the thalamic head direction cells anticipate the future direction of the head. How the head-directional signal is updated and coherently organized across different brain areas is unknown.

Our group has characterized the functional neuroanatomy of the principal neurons and interneurons in the presubiculum in the slice preparation (Nassar et al., 2015; Simonnet et al., 2013 ; Simonnet et al., 2017). For this M2 project, anatomical, electrophysiological and optogenetic techniques will be used to map the cell-type specific connectivity of the reciprocal thalamocortical loop. Do presubicular GABAergic neurons also contribute long-range projections to the thalamus ? To test this, the candidate will perform in vivo stereotaxic injections of retrograde tracers and viral constructs in the mouse brain. He or she will virally express ChR2 in

principal neurons or, in a cre dependent manner, in PV interneurons. Patch clamp recordings will be combined with photostimulation to study synaptic connectivity. To identify the nature of long-range neurons, the candidate will stimulate their axon terminals in the slice, while searching for excitatory or inhibitory postsynaptic events in patch clamp recordings of nearby thalamic neurons. The inhibitory action of presubicular PV neurons could be important for shifting the population of active thalamic head direction units, in relation to visual landmark information.