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) :
CNRS UMR 8002, Integrative Neuroscience and Cognition Center
Research Unit Director : Florian Waszak
Research Team Director : Mathieu Beraneck & Desdemona Fricker
Team name : « Spatial orientation »

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## 2. Internship project title:

***The thalamo-cortical 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, including the thalamus, hippocampus and neocortex. The head direction (HD) signal is an internally generated compass signal, driven by vestibular information that is transmitted via the thalamus. Single HD neurons increase their firing rate when the head of an animal is oriented in a specific direction. Visual information helps to register the egocentric spatial information to landmarks in the environment, and the retrosplenial cortex is the major input pathway for visual related information. Previous studies suggest a close functional relationship between retrosplenial cortex and thalamic structures, but the underlying network connections for disambiguation of the head direction signal have not been deciphered on a single cell level.

The aim of this M2 project will be to record the electrical activity of single neurons in the cortical and thalamic regions of the head direction circuit, in the slice preparation. Optogenetic stimulation studies will be combined with anatomical tracing to map the cell-type specific connectivity of the reciprocal thalamocortical loop. We are particularly interested in synapse dynamics and plasticity : Hebbian coactivation of visual related inputs with different sets of HD inputs could underly the expression of bidirectional tuning of some retrosplenial HD neurons in vivo.

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 interneurons. Patch clamp recordings will be combined with photostimulation of axon terminals to identify the nature of long-range projections. Results from this project will be useful to understand the cellular und circuit underpinnings of landmark-based updating of the head direction signal.