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) : ICM
Research Unit Director : Alexis Brice
Research Team Director : Alberto Bacci
Team name : Cellular physiology of cortical microcircuits

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2. Internship project title:

Synaptic and circuit mechanisms underlying area-specific plasticity in the visual cortex

3. Internship Description :

Postnatal periods of enhanced plasticity, known as critical periods (CPs), allow the brain to adapt to the environment and are essential for acquiring new skills during development. The closure of CPs is associated with the maturation of a specific class of inhibitory GABAergic interneurons that express parvalbumin (PV cell), and is accompanied by the accumulation of a dense extracellular matrix, called perineuronal nets (PNNs), specifically around PV cells. Removal of PNN in primary visual area V1 of adult mice recovers enhanced plasticity observed during the CP (Pizzorusso et al., Science 2002).

We have recently demonstrated that PNNs modulate visual plasticity by specifically affecting thalamic synapses onto PV cells (Faini et al., eLife 2018). However, the synaptic and circuit mechanisms underlying PNN-modulation of thalamic recruitment of PV cells remain obscure. Interestingly, we have also noticed that PNN do not enwrap adult PV cells in associative visual areas, such as V2. This prompts the questions whether the endogenous absence of PNNs in V2 i) results from a differential thalamocortical synaptic recruitment of those interneurons ii) is associated to a different degree of plasticity in different visual areas.

The goal of the M2 will be to determine whether the endogenous absence of PNNs in V2, underlies specific plasticity in this associative area. This project will bring novel insights on how different visual areas process visual information. This research will likely change the current view of how sensory plasticity is expressed in the adult brain and could provide new therapeutic avenues for neurodevelopmental and neurodegenerative disorders, characterized by dysfunctional expression of PNNs.

The project will benefit from a multi-disciplinary approach well established in the laboratory, combining state-of-the-art *in vivo* and *in vitro* electrophysiology with 2P imaging and optogenetics. Its first aim will be to evaluate the synaptic mechanisms underlying the PNN-dependent modulation of plasticity of thalamic-PV synapses in V1 and V2 using patch-clamp recording from acute brain slices following the optogenetic activation of thalamo-cortical inputs. The internship could lead to a PhD research project during which the candidate will pursue the question with *in vivo* recordings and imaging to assess whether i) PV cells are differently recruited between V1 and V2 and ii) adult visual plasticity is different the two areas.