MASTER 2 Neurosciences Fondamentales et Cliniques
UCB Lyon 1, Lyon, France

Internship proposal 2020-2021
(internship from January to end of May 2021)

Host laboratory:

Institut NeuroMyoGène (INMG), CNRS UMR5310, Inserm U1217
Faculté de Médecine – 8 avenue Rockefeller – 69008 LYON
www.inmg.fr

Host team :

Energy Metabolism and Neuronal Development
http://courchetlab.eu/

Internship supervisors :

Dr Julien Courchet : Chargé de Recherche (julien.courchet@univ-lyon1.fr)

Project title :

A metabolic pathway controlling cortical circuits formation in the mouse

Project summary :

Our group in interested in the cellular and molecular mechanisms involved in axon morphogenesis and neural circuits formation in the mouse cerebral cortex. Our main focus is a protein kinase named NUAK1, which we characterized as a autism-candidate gene. NUAK1 regulates cortical circuits development through a novel cellular mechanism involving the control of mitochondria trafficking and metabolic activity in the axon.

The goal of the Master 2 projet is to identify some of the molecular links between NUAK1 and mitochondrial activity through the characterization of novel substrates of NUAK1. The team has performed unbiased proteomics, RNAseq and metabolomic analyses and identified candidate metabolic pathways.
The Master2 project will consist in the functional validation of these metabolic pathways. To do so the selected candidate will adopt a combination of *in vitro* and *in vivo* methods involving real-time measurement of metabolic biosensors using time-lapse microscopy, primary neuronal cultures and immunocytochemistry, and methods devised to manipulate metabolic activity or positioning of mitochondria in correlation with axon development.

Our team belongs to Institut NeuroMyoGene, a novel institute dedicated to the study of the nervous and muscular systems. Candidates will join a vibrant and collaborative work environment, with access to all technical platforms (microscopy etc…) for their project. Our work is supported by funds from ERC and AFM-telethon.

Methods: confocal microscopy, time-lapse microscopy, neurobiology, metabolism

Please send your proposal to emiliano.macaluso@univ-lyon1.fr and marion.richard@univ-lyon1.fr for publication on the website.

3-5 recent publications :

Lanfranchi M, Meyer-Dilhet G, Dos Reis R, Garcia A, Blondet C, Javin L, Amar A, Courchet J. (2020). *The AMPK-related kinase NUAK1 controls cortical axons branching though a local modulation of mitochondrial metabolic functions.* **bioRxiv** https://doi.org/10.1101/2020.05.18.102582

Rangaraju V, Lewis TL, Hirabayashi Y, Bergami M, Motori E, Cartoni R, Kwon SK, Courchet J. (2019). *Pleiotropic Mitochondria: The Influence of Mitochondria on Neuronal Development and Disease*. **The Journal Of Neuroscience** 39 (42) 8200-8208

Courchet V, Roberts AJ, Meyer-Dilhet G, Del Carmine P, Lewis TL, Polleux F, Courchet J. (2018). *Haploinsufficiency of autism candidate gene NUAK1 impairs cortical development and behavior*. **Nature communications** 4289. https://doi.org/10.1038/s41467-018-06584-5

Courchet J, Lewis TL, Lee S, Courchet V, Liou DL, Aizawa S, Polleux F. (2013). *LKB1-NUAK1 kinase pathway regulates terminal axon branching through mitochondrial trafficking*. **Cell** 153(7):1510-25.