Master de Sciences et Technologies
Mention Biologie Intégrative et Physiologie
Parcours : Neurosciences
Responsable : Professeur Régis Lambert

Internship Proposal
Academic Year 2018-2019

1. Host team :

Research Unit (e.g. Department or Institute) : IBENS
Research Unit Director : Triller Antoine
Research Team Director : Dieudonné Stéphane
Team name : Inhibitory transmission

Address : ENS, 46 rue d'Ulm, 75005 Paris

Supervisor of the Research Intern for this project : Supplisson Stéphane
Telephone : 01 44 32 37 51
E-mail : stephane.supplisson@biologie.ens.fr

2. Internship project title:

Optogenetic imaging of synaptic vesicle recycling at inhibitory synapses

3. Internship Description :

The brain activity relies on the rate of transfer of information at chemical synapses and most evidence suggests that the amount of neurotransmitter release per synaptic vesicle conditions the quantal size, i.e., the amplitude of the postsynaptic response. Nevertheless, maintaining a constant supply of transmitter-filled vesicles remains challenging for most central synapses that contain only few hundred vesicles, a subset of which being competent for release. Therefore, efficient recycling mechanisms must operate near the active zone for the fast retrieval and the sorting of their specific components. Then newly vesicles are reshaped, reacidified and refilled de novo with a specific transmitter. Since the experimental readout lies on the activation of postsynaptic receptors, it has been difficult to isolate the kinetic and limitation of individual steps of the vesicle cycle. Nevertheless, the accumulation and the storage of thousands of transmitters molecule in exchange for proton is considered generally as the limiting step for fast recycling. When synapses run out of neurotransmitters, we have shown previously that GABA depletion impairs vesicle filling inhibitory neurons and, unexpectedly, reduces the pool size of recycling vesicles (Wang et al. (2013) Neuron 8:143-158). This inhibition is reversible upon reinstating GABA or its precursors in the external solution. These results suggested a metabolic control of the vesicle cycle that adjust the pool size of releasable vesicles with available metabolic resources.
The current project aims at providing a direct evidence for a metabolic control of the synaptic transmission at inhibitory synapses. Using optogenetic tools, electrophysiology and transgenic mice we will monitor vesicle recycling and synapses activity under different metabolic conditions. The project will involve culture neurons derived from the hippocampus to achieve better control of the neuronal metabolic environment. The project will explore the consequence induce by amino acids starvation for synapse functions and neuron short and long term survival.