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 :

Institut des Neurosciences Paris-Saclay, UMR9197 CNRS/Univ.Paris-Sud, dir. Philippe Vernier

Group : Génétique Moléculaire des Rythmes Circadiens, leader François Rouyer

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2. Internship project title: Synchronization of sleep-wake rhythms by the visual system in Drosophila

3. Internship description :

Brain circadian clocks control sleep-wake cycles. In Drosophila, the brain clock relies on a network of about 150 neurons that show oscillations of clock gene expression. Different subsets of clock neurons contribute to specific behavioral components and use sensory inputs such as light and temperature to synchronize with day-night cycles (Dubowy, C. & Sehgal, 2017, *Genetics* **205**, 1373-139). The clock perceive light through either the intrinsic photoreceptive molecule cryptochrome or six rhodopsins that are distributed in three photoreceptive structures: compound eye, Hofbauer-Buchner eyelet, and ocelli (Yoshii, T., et al., 2016, *Commun Integr Biol* **9**, e1102805). One major goal of the lab is to identify and define the properties of the neuronal circuits that connect photoreceptors to the clock network. Histamine is the neurotransmitter of insect photoreceptors and our results show that each of the two histamine-gated chloride channels (ORT and HISCL1) is used by first-order interneurons, as well as cells recently identified in the lab, to collect light information from the photoreceptors. The project will aim at characterizing the specific function of each of the two histamine receptors in the different circuits that bring light information to the different groups of clock neurons. Drosophila neurogenetic tools will be used to study combinations of specific rhodopsins, histamine receptors and clock neurons in order to understand how specific light input circuits allows the adaptation of the sleep-wake behavior to the daily changes of the environment. Anatomical (characterization of interneurons and their associations with upstream photoreceptors and downstream clock neurons) as well as functional (connectivity assays based on calcium imaging in the neurons) analyses will be performed to probe the relevant circuits. Different types of genetics, molecular biology and microscopy techniques for anatomy/connectiviy (immunolabeling and fluorescence/confocal microscopy, GRASP) and function (GCaMP Ca2+ imaging) will be used, in addition to behavioral (sleep-wake) analysis.

Recent publications of the group:

Saint-Charles, A. et al. Four of the six Drosophila rhodopsin-expressing photoreceptors can mediate circadian entrainment in low light. *J Comp Neurol* 524, 2828-2844 (2016).

Chatterjee, A. & Rouyer, F. Control of sleep-wake cycles in Drosophilain in *A time for metabolism and hormones* (eds Sassone-Corsi, P. & Christen, Y.) 71-78 (Springer, 2016).

Arganda-Carreras, I. et al. A statistically representative atlas for mapping neuronal circuits in the Drosophila adult brain. *Front Neuroinform,* in press (2018).

Szabo, A. et al. Ubiquitylation dynamics of the clock cell proteome and TIMELESS during a circadian cycle. *Cell Rep,* Accepted (2018).

Chatterjee, A. et al. Reconfiguration of a multi-oscillator network by light in the Drosophila circadian clock. *Curr Biol,* Accepted (2018).