Neurophysiology of visual cognitive processes in Non-Human Primates

Guilhem Ibos (https://www.iboslab.com/, Institut de Neurosciences de la Timone, Marseille) proposes 3 years long, fully funded, Phd position. This position is part of a global project supported by the Aix-Marseille University IDEX (AMIDEX).

As a group, we study cortical mechanisms of cognitive control in non-human primates (NHP, macaque and marmoset monkeys). We specialize in training NHP to perform sets of cognitive tasks and recording/analyzing extra cellular neuronal activity in large populations of distributed cortical networks. Adapting our behavior to ever changing environment requires to constantly compare sensory representation and internally generated, goal-directed representations of our needs and expectations. For example, when looking for a friend in a crowd, we compare visual representation of each objects (extracted within the hierarchy of visual areas) to internally generated representation of our friend. Such behavior engages a large set of cortical and sub cortical areas, and involves several cognitive processes such as working memory and decision-making. Our research group aims at understanding how different sources of information are integrated and compared in order to facilitate decision-making processes. We recently proposed that a network of cortical areas, including parietal and prefrontal cortices, interact with sensory visual cortex when comparing what we are looking at (sensory information), to what we are looking for (working memory information)(1–4). We routinely record simultaneously the activity of populations of PFC, V4 and LIP neurons in macaque monkeys. This project aims at testing the causal role of the parietal cortex in the above mentioned mechanisms and its influence on the rest of the network. The experimental aspect of the project will consist in reversibly inactivating the parietal cortex, simultaneously recording the activity of prefrontal and visual cortex while monkeys perform delayed match to sample task. Animals are already trained and implanted.

During this Phd, selected student must (i) get familiar with the relevant scientific literature; (ii) finalize data acquisition of the ongoing project. She/he will fully participate to experiments which consist of recording extracellular neuronal activity simultaneously in three cortical areas (Parietal, visual and prefrontal cortices) of one macaque monkey. She/he will learn state-of-the-art methods for training/manipulating NHP and for recording and analyzing extracellular activity related to cognitive mechanisms.

Candidates should:

(a) have notions of cognitive neurosciences and show record of highest grades. Experience in animal research in general and with NHP in particular will be a plus but is not mandatory.
(b) have a solid experience in programming (Matlab, Python), statistics and data analysis.
(c) be able to collaborate with other students/post docs.

Candidates must contact Guilhem Ibos (guilhem.ibos@univ-amu.fr) who will supervise the project.

Reference list:

1. *G. Ibos, D. J. Freedman, Sequential sensory and decision processing in posterior parietal cortex. Elife. 6 (2017), doi:10.7554/eLife.23743.*
2. *G. Ibos, D. J. Freedman, Interaction between Spatial and Feature Attention in Posterior Parietal Cortex. Neuron. 91, 931–943 (2016).*
3. *G. Ibos, D. J. Freedman, Dynamic Integration of Task-Relevant Visual Features in Posterior Parietal Cortex. Neuron. 83, 1468–80 (2014).*
4. *D. J. Freedman, G. Ibos, An Integrative Framework for Sensory, Motor, and Cognitive Functions of the Posterior Parietal Cortex. Neuron. 97, 1219–1234 (2018).*