UFR de Chimie et de Biologie
UNIVERSITÉ Grenoble Alpes

Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2023-2024

Laboratory/Institute: Grenoble Institut Neurosciences - GIN **Director:** E. Barbier
Team: Brain, Behavior and Neuromodulation **Head of the team:** Julien Bastin

Name and status of the scientist in charge of the project: Brigitte Piallat **HDR: yes x no ☐**
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Program of the Master's degree in Biology:
☐ Microbiology, Infectious Diseases and Immunology ☐ Structural Biology of Pathogens
☐ Physiology, Epigenetics, Differentiation, Cancer x Neurosciences and Neurobiology

Title of the project: Effect of subthalamic nucleus stimulation on the macro and micro architecture of sleep in nonhuman primate.

Objectives (up to 3 lines): In this study, we aim to determine the effect of a new paradigm of nocturne subthalamic nucleus stimulation on sleep.

Abstract (up to 10 lines): Sleep, initially defined as a passive state, has in fact, a major role in a large number of biological phenomena such as the elimination of toxic substances and metabolic waste from the brain by the glymphatic system (Xie et al., 2013). The restorative function of sleep could be a consequence of the increased removal of these toxic substances that accumulate in the awake central nervous system. It is known that proteins linked to neurodegenerative diseases, such as α-synuclein, Abeta or Tau, are present in a toxic form in the brain and play a crucial role in the onset of Parkinson's or Alzheimer's diseases. Interestingly, it has been shown that these neurodegenerative diseases are strongly associated with a poor quality of sleep (Abbott & Videnovic, 2016) which can lead to a defect of the elimination of toxic waste from the brain. It has recently been shown that subthalamic nucleus (STN) stimulation treatment in parkinsonian patients improves sleep quality. Further study of which parameters of stimulation can act on the sleep quality and how this treatment improves sleep quality could provide crucial elements to improve the clearance of toxic substances from the brain and, in the next future, slow the progression of these diseases.
This project will be conducted in collaboration with a Clinatec Project. An innovative stimulation device provided by Medtronic will be used to allow an innovative STN stimulation in respect with sleep/wake behavior. New paradigms of stimulation will be applied during the night and the effect of this new stimulation will be assessed on the sleep/wake behavior.

Methods (up to 3 lines): This pilot study will be performed on one adult nonhuman primate, which will be chronically implanted with a deep brain stimulation electrode into the STN connected to a stimulator (Medtronic® RC+S), with epidural cortical grids at the surface of the frontal cortex (EEG) and with additional muscle electrodes (EMG). All these biological signals will be recorded and analyzed using a dedicated software.

Up to 3 relevant publications of the team:

Davin A, Chabardès S, Devergnas A, Benstaali C, Gutekunst CN, David O, Torres-Martinez N, **Piallat B.** Excessive daytime sleepiness in a model of Parkinson's disease improved by low-frequency stimulation of the pedunculopontine nucleus. NPJ Parkinsons Dis. 2023 Jan 25;9(1):9.

Davin A, Chabardès S, Belaid H, Fagret D, Djaileb L, Dauvilliers Y, David O, Torres-Martinez N, **Piallat B.** Early onset of sleep/wake disturbances in a progressive macaque model of Parkinson's disease. Sci Rep. 2022 Oct 19;12(1):17499.

Sherdil A, Coizet V, Pernet-Gallay K, David O, Chabardès S, **Piallat B**. Implication of Anterior Nucleus of the Thalamus in Mesial Temporal Lobe Seizures. Neuroscience. 2019 Jun 19.

Requested domains of expertise (up to 5 keywords): neurophysiology, nonhuman primate experiments, sleep physiology, electrophysiology