

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: Centre de Recherche en Neurosciences de Lyon, CRNL, INSERM U1028, CNRS UMR5292, Université de Lyon, Neurocampus M Jouvet, Hôpital Vinatier, Bron

Host team : Forgetting processes and cortical dynamics, <https://crnl.univ-lyon1.fr/index.php/fr/Recherche/Equipes/23>

Internship supervisor:

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Project title: Targeting REM sleep as a treatment of post-traumatic stress disorders: a rat behavioral study.

Project summary:

Reactions to traumatic events are extremely diverse. Some people exposed to an extreme traumatic event remember it without an excessive emotional response. Others, exposed to the same event, re-experience it continuously throughout their lives. This pathological reaction to trauma called post-traumatic stress disorder (PTSD) is generally accompanied by distress symptoms and hyperarousal associated with sleep and memory alterations. PTSD is often characterized by an excessive conditioned fear, an increase in functional connectivity between amygdala and the medial prefrontal cortex (mPFC) and a decrease in connectivity between the hippocampus and mPFC. Our team recently showed that rapid eye movement sleep (REMS) plays a critical role in regulating these pathways after contextual fear conditioning (CFC). We have also shown that REMS is required for CFC learning and consolidation. During CFC, rats emit vocalizations in the ultrasonic frequency band (22kHz). Ultrasonic vocalizations (USV) at 22kHz constitute an ethological marker of negative emotions such as anxiety. Recently, for the first time, we have discovered that rats emit USV at 22kHz during REMS after CFC. We propose that REMS-USV correspond to a “behavioral replay” of the animal's memory or dream-like experiences of traumatic events. Using an experimental model of PTSD, we will characterize the link between REMS-USV and anxiety induced by the traumatic event. We speculate that replaying during REMS, the animal's own USV emitted during PTSD can down-regulate anxiety. We will also determine whether REMS-USV can restore functional connectivity between the hippocampus, amygdala, and mPFC after PTSD.

3-5 recent publications:

Brudzynski, S. M. Ethotransmission: communication of emotional states through ultrasonic vocalization in rats. **Current Opinion in Neurobiology** 23, 310–317 (2013).

De Rossi P et al. A critical role for VEGF and VEGFR2 in NMDA receptor synaptic function and

fear-related behavior. **Molecular Psychiatry** 21:1768-1780 (2016).

Le Merre, P. et al. Reward-Based Learning Drives Rapid Sensory Signals in Medial Prefrontal Cortex and Dorsal Hippocampus Necessary for Goal-Directed Behavior. **Neuron**, 97:83-91 (2018).

Ravassard, P. et al. REM Sleep-Dependent Bidirectional Regulation of Hippocampal-Based Emotional Memory and LTP. **Cerebral Cortex** 26, 1488–1500 (2016).

Rosier M, Le Barillier L, Meunier D, El Yacoubi M, Malleret G, Salin PA. Post-learning paradoxical sleep deprivation impairs reorganization of limbic and cortical networks associated with consolidation of remote contextual fear memory in mice. **Sleep**. 41(12). doi: 10.1093/sleep/zsy188. (2018)