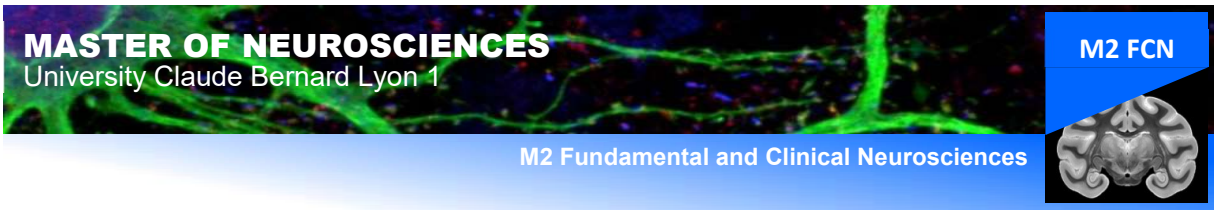

MASTER 2 Fundamental and Clinical Neurosciences

Internship proposal 2022-2023

Host laboratory: *Name + address*
Institut des Sciences Cognitives MARC JEANNEROD, UMR 5229 CNRS/UCBL, 67 Bd Pinel, 69675 Bron, France
Site web
Website: http://isc.rivetweb.org/index.rvt?display=umr5229

Host team : *team name + website*
Research team Neuroeconomics, reward and decision making

Website: https://dreherteam.wixsite.com/neuroeconomics

Internship supervisors : *name + position + email*
Jean-Claude Dreher, Directeur de recherches CNRS, HDR
Institution: CNRS/ University Lyon 1
E-mail adress: dreher@isc.cnrs.fr

Project title : Encoding of social hierarchy learning signals at the single cell level in humans

Lab Language: english

Project summary :

Humans and other primates have evolved the ability to represent their status in the group's social hierarchy, which is essential for avoiding harm and accessing resources. Yet it remains unclear how the human brain learns dominance status and adjusts behavior accordingly during dynamic social interactions. We have recently demonstrated that BOLD activity in the rostro medial prefrontal cortex (rmPFC) represents social dominance relationships as learned from competitive interactions, whereas the ventral striatum encode social victories and defeats, respectively (Ligneul et al., 2016; Qu et al., 2017; Ligneul et al., 2017; Ligneul and Dreher, 2016; Janet et al., 2022). The rmPFC is necessary to compute both the dominance value of an interacting opponent and a social prediction error, which is an update signal required for learning social ranks. Thus, dominance relationships emerge and are learned incrementally by Reinforcement Learning mechanisms, by accumulating positive and negative competitive feedback associated with specific individuals and other members of the social group.

We have now recorded neuronal activity from patients with epilepsy, implanted with microelectrodes in the medial PFC, anterior cingulate cortex, amygdala and temporal pole to investigate the neural computations engaged while learning social ranks. Patients played a similar social hierarchy learning task as developed in our previous fMRI/tDCS study (Ligneul et al., 2016). Participants were led to believe that they were playing with these 3 opponents in a network. The goal of this master is to continue these recordings and to analyze the current single cells and LFPs data. We will investigate the neural coding of the social prediction error signals at the level of neuronal populations. This will enable us to characterize the neural computations underlying learning of social ranks and to relate neuronal population coding to computational signals. We will test whether neuronal activity from the rmPFC and/or gamma-band power increases with learning from the time of the social outcome (victory vs defeat) to the time of the cue presentation (presentation of the opponent). We expect that neural responses to social defeats when facing higher ranked individuals will play a particular role for learning social hierarchy.

3-5 recent publications :

Ligneul, R., Obeso, I., Ruff, C. C. & Dreher, J.-C. Dynamical Representation of Dominance Relationships in the Human Rostromedial Prefrontal Cortex. *Curr. Biol.* 26, 3107–3115 (2016).

Qu, C., Ligneul, R., Van der Henst, J.-B. & Dreher, J.-C. An Integrative Interdisciplinary Perspective on Social Dominance Hierarchies. *Trends Cogn. Sci.* (2017). doi:10.1016/j.tics.2017.08.004

Ligneul, R. & Dreher, J.-C. in *Decision Neuroscience,* Academic Press, Elsevier, Eds. Dreher and Tremblay, 2016. https://www.elsevier.com/books/decision-neuroscience/dreher/978-0-12-805308-9

Ligneul, R., Girard, R. & Dreher, J.-C. Social brains and divides: the interplay between social dominance orientation and the neural sensitivity to hierarchical ranks. *Sci. Rep.* 7, (2017).

Janet R, .. Dreher J-C, Regulation of social hierarchy learning by serotonin transporter availability, *Neuropsychopharmacology*, in press