MASTER 2 Fundamental and Clinical Neurosciences

Internship proposal 2023-2024

(internship from January to June 2024)

Host laboratory: Lyon Neuroscience Research Centre, Centre Hospitalier Le Vinatier, 95 Boulevard Pinel, 69500 Bron

Host team : PsyR2 https://www.crnl.fr/en/equipe/psyr2 , Centre Hospitalier Le Vinatier, 95 Boulevard Pinel, 69500 Bron

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Project title : Emotion-behaviour interplay – neural correlates and meditation intervention

Project summary : *approx 10 lines*

Our emotions fluctuate as we go through our day, in response to what we encounter – for example, seeing someone cough might make us feel worried or stressed about getting ill. These emotions in turn can help us to act appropriately in the situation – for example we might try to avoid the person or wash our hands. The overall goal of my work is to understand the rich interplay between emotions and behaviour, neurally and cognitively, in healthy humans and how this can be modified through meditation. In this larger framework, I can offer different projects depending on the student's interest. They all have in common that they will provide the student with a strong training in computational methods. Please get in touch for more specific information for each possible project.

Project 1: Emotion regulation and meditation

Recently, meditation, particularly in the form of mindfulness 'packages' involving many different meditation techniques, have become widely available as training programs. One common reason people meditate is to improve their emotional experience. However, relatively little is known about the cognitive moment-to-moment processes during meditation that lead to these outcomes. Here, we will test how people regulate emotional experiences moment-do-moment during meditation and creatively generate novel strategies when old strategies fail. A complementary project will be looking at the impact of meditation on how meditation changes creative real-life emotion regulation. Both of these projects will involve the student learning to

code computerized tasks, test participants over the internet and analyse data with computational models. Prior coding experience (e.g. R) highly desirable.

Project 2: The relationship between naturalistic behaviour and basic cognitive processes

In research on how people learn and make decisions, a very widely used and fruitful design is the n-alternatives forced choice task, an experiment structured into trials in which participants choose between several options. However, this framework cannot capture all important aspects of decision-making. Of relevance here, this approach does not capture how people prioritize behaviour in a self-determined way, deciding what to do when for how long. This has been addressed in cognitive neuroscience in a new approach over the last decade, the 'neuro-ecological framework'. Here, tasks are designed inspired by evolutionary considerations of 'naturalistic' behaviours the brain has evolved to solve. I have used this framework to address how people plan, see through their plans in a self-determined way and how this is affect by individual differences in apathy (Scholl et al. 2022) (people with apathy were less flexible in stopping a course of action that was no longer fruitful). We have also used this framework to understand how threat and stress affects self-determined behaviour and how this is affected by clinical dimensions like anxiety, anhedonia or compulsivity (Trier et al. 2023).

However, what is still unclear how these more naturalistic behaviours relate to behaviours measured in more 'classic' cognitive tasks, like attention or working memory. To address this, this project proposes to collect behaviour in the 'naturalistic tasks' in the same participants as 'classic' tasks (participants will be easily collected online). This project would provide a student with a good hands-on overview of different types of cognitive tasks, as well as data analytical skills (computational modelling). Prior coding experience would be a bonus, but not strictly required.

Project 3: Understanding brain dynamics underlying emotion-behaviour interplay

In this project, we will measure the interplay between behaviour, physiologically measured emotions and brain in the threat task described above (Trier et al., 2023). To understand brain dynamics on a millisecond timescale, I will use MEG, which offers the required temporal resolution, while at the same time allowing some spatial localization. With MEG we can test whether processing under threat shifts to more 'high frequency', i.e. faster flickering between brain states, analogously to the psychological experience of 'racing thoughts'. Data for this project has already been acquired. The student would learn to analyse physiological and MEG data with computational methods. Prior coding experience required.

3-5 recent publications :

Palmer, T., Kadri, K., Fakra, E., **Scholl, J.***, & Fouragnan, E.* (2023). Differential Relationship Between Meditation Methods and Psychotic-Like and Mystical Experiences. 10.31234/osf.io/7cwhv

Trier, H., O'Reilly, J., Spiering, L., Ma, S., Kolling, N., & Rushworth, M.* **Scholl, J.,** * (2023). Emotions and individual differences shape foraging under threat. https://doi.org/10.31234/osf.io/v6u3y

Scholl J, Trier HA, Rushworth MFS, Kolling N (2022) The effect of apathy and compulsivity on planning and stopping in sequential decision-making. PLOS Biology 20(3): e3001566. https://doi.org/10.1371/journal.pbio.3001566

Scholl J, Klein-Flügge M (2018) Understanding psychiatric disorder by capturing ecologically relevant features of learning and decision-making,
Behavioural Brain Research

Kolling N*, **SchollJ*,** Chekroud A, Trier HA, Rushworth MFS (2018)
Prospection, Perseverance, and Insight in Sequential Behavior; Neuron
(* indicates equal contribution)