Proposal of Master Research Project / Proyecto fin de Master for the academic year 2025-26

Group name: Development, Plasticity and Reprogramming of Sensory Circuits
IP name: Dra. Guillermina López-Bendito
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Title of the MRP/TFM: "**Thalamocortical loop dysfunction and recovery in a mouse model of developmental dyslexia"**

Summary of the Project:

This project is developed within the framework of the ERA-NET NEURON consortium, in collaboration with three international labs investigating the neural mechanisms underlying developmental dyslexia across species, ranging from mouse models and non-human primates to human studies.

Within this collaborative effort, our lab has focused on developing and characterizing a mouse model that mimics the thalamocortical dysfunction observed in dyslexic patients (Müller-Axt et al, 2017). To achieve this, we selectively downregulate neuronal activity in a specific higher-order visual cortex and assess how these alterations in corticothalamic connectivity impact visual perception and cognitive performance through behavioral, physiological and anatomical approaches.

An additional aim of the project is to explore the therapeutic potential of non-invasive neuromodulation. In the final stage of the study, we will apply high-definition transcranial direct current stimulation (HD-tDCS) to evaluate whether targeted stimulation can rescue altered network function and improve behavioral outcome.

The master's student will play an active role in:

- Establishing and optimizing behavioral paradigms in head-fixed mice for the study of visual processing,
- Contributing to the design and refinement of visual perceptual tasks (programming experience is not required, although basic knowledge will be considered a plus).
- Participating in the implementation and application of HD-tDCS in mice to test recovery of function.
- Assisting with behavioral data analysis and, depending on the student's interests, extending to the analysis of neural activity recordings and imaging datasets.

This project offers an opportunity to work at the intersection of neurodevelopmental disorders, systems neuroscience, behavior and neuromodulation, while receiving hands-on training with advanced experimental techniques in a dynamic and international research environment.

Methods and technology involved in the MRP/TFM Project:

- Behavioral testing and quantitative analysis of visual perception and cognitive performance in mice.
- Experimental task development and data processing using MATLAB and/or Python environments (basic experience is beneficial but not mandatory).
- Stereotaxic surgical procedures for targeted manipulations across developmental stages (from postnatal to adult).
- In vivo calcium imaging for monitoring cortical activity.
- Application of high-definition transcranial direct current stimulation (HD-tDCS) to explore functional recovery.
- Histological and anatomical validation of experimental interventions.

Member/s of the lab who will act as tutor/co-tutor of the project (if different from the group IP; PhD required to be tutor / co-tutor): **Elena Pérez-Montoyo, PhD.**

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