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 part of our collaboration within the ERA-NET NEURON consortium, where we work alongside three international labs to investigate the neural mechanisms underlying developmental dyslexia in different species, from mouse models and non-human primates to human studies.

Our lab is focused on developing and characterizing a mouse model that mimics the thalamocortical dysfunctions observed in individuals with dyslexia. To achieve this, we selectively downregulate the neuronal activity of a specific higher-order visual cortex, aiming to alter corticothalamic connectivity. We then assess the behavioral and functional consequences of this manipulation using visual-based tasks.

In the final phase of the project, we will test whether non-invasive neuromodulation (HD-tDCS) can restore function and improve behavioral performance, offering insights into possible therapeutic strategies.

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

- Setting up and optimizing a head-restrained behavioral system to run visual-based tasks in mice.
- Contributing to the design and refinement of visual perceptual tasks for behavioral testing (no programming skills required, but basic knowledge will be considered a plus)
- Participating in the application of HD-tDCS in mice to test recovery of function – a cutting-edge approach in translational neuroscience
- Assisting with data analysis, focusing on behavioral outcomes and, if interested, extending to neural recordings or imaging data.

This project offers an opportunity to work at the intersection of neurodevelopmental disorders, systems neuroscience, behavior and neuromodulation, offering hands-on training with cutting-edge tools and mentoring in a dynamic and international research environment.

Methods and technology involved in the MRP/TFM Project:

- Behavioral assays and analysis tools for assessing visual perception and cognitive performance in mice.
- Programming (MATLAB or similar languages) for task design and data analysis (basic experience is helpful but not mandatory).
- Stereotaxic surgeries across developmental stages (from postnatal to adult), allowing targeted neuronal manipulation.
- Calcium imaging to monitor neural activity in vivo.
- High-definition transcranial direct current stimulation (HD-tDCS) applied in animal models to explore functional recovery.
- Histological processing to validate anatomical and cellular effects of experimental manipulations.

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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