Proposal of Master Research Project (MRP) for the Academic Year 2026-27

Group Name: Desarrollo, Plasticidad y Reprogramación de Circuitos Sensoriales
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Title of the MRP:
Activity-dependent plasticity in sensory segregation

Summary of the MRP:

During early development, stimulation of the whisker pad of the mouse evokes a bilateral response in the visual cortex, in addition to the expected somatosensory response. Around birth, this multi-modal activation disappears so that whisker pad stimulation elicits an exclusive response in the somatosensory cortex. This specific segregation is driven by the spontaneous stage I retinal activity acting at the level of the superior colliculus. Disrupting this spontaneous retinal activity prolongs the multimodality postnatally, but the system can eventually compensate and restrict the whisker pad stimulus from evoking responses in the visual cortex.
The primary aim of this project is to dissect the underlying mechanisms and circuit rearrangements that drive the segregation of visual and somatosensory pathways during the perinatal period.

Methods and technology involved in the MRP:

The student will be involved in the ongoing project and will perform:

- Calcium Imaging on acute brain slices to monitor multi-structure network activity, to identify how manipulated circuits functionally adapt to restrict multi-modal responses.
- Post-hoc tissue processing and characterization using immunohistochemistry and fluorescence imaging to map cellular identity, structure and synaptic markers following *ex vivo* electrophysiology (not performed by the student).
- Statistical analysis on the functional and structural data, ideally integrating the readouts into a model to simulate how these compensated circuits process sensory information compared to controls.

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