

Group name: Development, Wiring and Function of Cerebellar Circuits

IP name: Juan Antonio Moreno Bravo

Group web:

<https://in.umh-csic.es/en/grupos/development-wiring-and-function-of-cerebellar-circuits/#info-general>

<https://morenobravoja.wixsite.com/website>

Title of the MRP/TFM:

Investigating the Impact of Early Cerebellar Disturbances on Cortical Maturation

Summary of the Project:

Clinical and experimental studies consistently report cerebellar abnormalities in individuals with ASD, including structural malformations and disruptions in cerebellar connectivity. However, the mechanisms by which early cerebellar dysfunction contributes to ASD-relevant phenotypes remain unresolved.

One emerging hypothesis is that cerebellar alterations do not act in isolation, but rather influence the development of distant brain regions, particularly the cerebral cortex, via long-range pathways. The cortex is central to many of the cognitive and behavioral deficits observed in ASD, suggesting that cerebellar-driven disruptions in cortical development could be a key contributing factor.

In this project, we aim to explore how early alterations in cerebellar development impact cortical maturation. The student will use transgenic mouse models with cerebellum-specific developmental perturbations and analyze the resulting structural and functional changes in the cortex. The ultimate goal is to provide insight into the cerebellar contribution to cortical circuit formation and how this might relate to the pathogenesis of ASD.

Specific Objectives:

1. To generate transgenic mouse models with targeted disruptions in cerebellar development.
2. To perform phenotypic validation of these models by characterizing the impact of cerebellar perturbations on cortical cytoarchitecture and the distribution of specific neuronal populations.
3. To participate in the preparation of tissue samples for transcriptomic sequencing and/or functional analysis.
4. To validate candidate molecular pathways identified through transcriptomic analyses using complementary anatomical and functional approaches.

Methods and technology involved in the MRP/TFM Project:

- Viral tracing techniques
- Mouse genetics and transgenic model handling
- Clearing methods (iDISCO+) and 3D reconstruction (e.g., light-sheet microscopy)
- Classic histology techniques (Immunohistochemistry, in situ hybridization)
- Molecular biology approaches

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

Member/s of the lab who will act as tutor/co-tutor of the project (if different from the group IP): Martina Riva, Juan Antonio Moreno Bravo

Contact: juan.moreno@umh.es