

**Group name:** Transcriptional and epigenetic mechanisms of neuronal plasticity

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**Group web:** <https://in.umh-csic.es/grupo3893>

**Title of the MRP/TFM:** Multi-omic analysis of activity-dependent gene expression in hippocampal neurons

**Summary of the MRP:**

Neuronal activity-dependent transcription (ADT) regulates many brain functions and is involved in key processes related to plasticity and neuropathology. ADT is controlled by hundreds of proteins, including transcription factors (TFs) and chromatin modifiers, which dynamically bind to specific regions of the genome. Our recent research has revealed thousands of transcriptional and epigenetic changes (accessibility, histone modifications, DNA methylation, 3D organization) associated with the physiological and pathological activation of hippocampal neurons. These advances have been possible thanks to the combination of epigenetic marking of the nuclei of specific neuronal populations in vivo with various massive sequencing techniques (Nat Neurosci 2019; Nat Comm 2020, 2024; and others). In this project, we propose to extend our multi-omics analysis to additional proteomic and next generation sequencing (NGS) techniques. The multi-omic analysis of the complexes that regulate ADT will clarify molecular mechanisms underlying neuronal plasticity and the etiology of cognitive disorders.

**Methods and technology involved in the MRP:**

The selected student will learn to independently perform the following techniques:

- Extracting nucleic acids and proteins from nervous tissue.
- Isolation of nervous tissue nuclei using the FANS (fluorescence activated nuclear sorting) technique.
- Collaboration in the extraction of mouse nervous tissue under the supervision of appropriately certified personnel.
- Preparation of protein samples for mass spectrometry analysis
- Protein detection using immunohistochemistry, Western blot, etc.
- Quantification of gene expression using RT-qPCR
- Multi-omics analysis and discussion of results.

In addition, the student will have the opportunity to participate in weekly laboratory meetings, meetings of the IN scientific programs in which the research group participates, general Institute seminars, and meetings and activities organized by the laboratory's network of collaborators.

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