

Group name: Neural circuits in vision for action

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Group web: <https://in.umh-csic.es/en/grupos/neural-circuits-in-vision-for-action/>

Title of the MRP/TFM:

Circuit control of visual attention and distraction

Summary of the Project:

How does the brain stay focused in a world full of distractions? This project investigates how **prefrontal cortex (PFC)** and **superior colliculus (SC)** circuits coordinate visual attention and how this balance can be altered by pharmacological agents like **psilocybin**.

Using a **closed-loop behavioral paradigm**, mice are trained to orient toward task-relevant visual cues while ignoring distractors. We combine **deep learning-based video tracking**, **optogenetic circuit manipulation**, and **high-density electrophysiological recordings or calcium recordings** to explore the neural basis of attention. We then will test how **psilocybin**, a compound known to affect attention and perception, modulates these neural dynamics and behavior.

This project aims to uncover **mechanisms of cognitive flexibility, distraction control**, and potential **therapeutic circuit targets** relevant to attention-deficit disorders.

Key Aims

- Measure distraction-resilient behavior and attention lapses
- Map the contribution of PFC-SC circuits to visual orienting
- Investigate how psilocybin alters attention and neural dynamics
- Identify circuit-level signatures of enhanced or disrupted focus

Methods and technology involved in the MRP/TFM Project:

Techniques You'll Learn

- Mouse handling and attention task training
- High-resolution behavioral tracking with DeepLabCut
- Optogenetics, fiber photometry, calcium imaging or Neuropixel recordings
- Behavioral and neural data analysis (Python/MATLAB)
- Drug administration protocols and psychopharmacological testing

Who Should Apply

Ideal for students passionate about brain-behavior relationships, neural circuit dynamics in attention-distractor networks and the neural effects of psychedelics. Programming skills and willingness to work with animals are essential.

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): Dr. Giovanni Usseglio

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