Proposal of Master Research Project / Proyecto fin de Master for the academic year 2023-24

Group name: Neurogenetic basis of behavior
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Title of the MRP/TFM:
Integration of gustatory information in the central brain of *Drosophila melanogaster*.

Summary of the Project:

Animals, including the fly *Drosophila melanogaster*, continuously receive and process sensory information from the surrounding environment via different sensory systems, which ultimately direct appropriate behavioral responses. Among those behaviors, feeding is essential as it is how animals get all the needed nutrients to support their lives. In order to discriminate between nutritious and potentially toxic food, a set of specialized neurons, Gustatory Receptor Neurons (GRNs), housed in gustatory sensilla along the body, express a combination of chemosensory receptors responsible for the detection of food chemicals and project their axons to the subesophageal zone (SEZ), the primary taste center in the brain. While much is known regarding the gustatory receptors and the role of GRNs, it is not yet clear how the gustatory information conveyed by GRNs to the SEZ is processed. We have characterized molecularly by RNAseq the gustatory second-order neurons (GSONs) receiving direct input from sweet, bitter and mechanosensory (GRNs) in fed and starved conditions. The gene expression analysis shows that GSONs receiving input from sweet, bitter, and mechanosensory neurons segregate molecularly and that their molecular profile varies with the metabolic state of the fly (fed vs. starved). Furthermore, GSONs express a complex combination of neurotransmitters and neuropeptides, indicating that those neurons are not homogenous even when receiving information from the same taste quality.

Objectives:

- Analyze anatomically the neurons identified in the previous RNAseq to understand the input (from which GRN they are receiving information) and using trans-TANGO to which regions of the brain they send output.
- Using behavioral tests, study the role of those neurons in feeding behavior.
- Collaborate in *in vivo* calcium imaging experiments to characterize the type of sensory input received.

Methods and technology involved in the MRP/TFM Project:

- ***Drosophila* genetics. Crosses and management of transgenic stocks.**
- **Immunohistochemistry of whole brains**
- **GRASP (GFP Reconstruction Across Synpatic Partners) to test connectivity between neurons.**
- **Trans-synaptic tracing to understand the connectivity of the neurons analyzed.**
- **Confocal microscopy.**
- **Analysis of behavior experiments (R language).**

Member/s of the lab who will act as tutor/co-tutor of the project (if different from the group IP): Rubén Mollá Albaladejo and Manuel Jiménez Caballero

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