We are looking for highly motivated mater's students with a strong interest in neuroscience, behavior, and genetics, to study processing of visual cues underlying female chase in *Drosophila melanogaster*.

Investigating neural circuits that mediate the female chase in Drosophila courtship

Courtship rituals are complex and stereotypical behaviors crucial for reproductive success. Courtship behaviors are innate, robust, and easily reproducible in laboratory conditions, making them ideal behavioral paradigms to link motor output to neural circuit function and gene regulation. In *Drosophila melanogaster*, courtship is sexually dimorphic, with the presence of female contact pheromones and absence of a male specific odor arousing the male to court. The male extends a single wing and vibrates it to produce a species-specific courtship song, while maintaining close proximity to the female he is courting, presumably to beat competition from other males. Drosophila males rely on vision to remain close to the female, conveyed by LC10a visual projection neurons to a large extent (Agrawal et al., 2014; Ribeiro et al., 2018). LC10a are sensitive to visual objects with angular sizes and speeds the male is exposed to when courting a female (Ribeiro et al., 2018). To remain close to the female, Drosophila males execute several maneuvers, like orienting towards, approaching and following a female (also known as chase), that involve diverse set of visual features. Object looming underlies an approach, whereas lateral object motion elicits orienting (Ribeiro et al., 2026). Female chase, or following, involves an atypical visual scenario, in which the female abdomen appears as a large object that occupies most of the male visual field. Whether the same neural circuits process these diverse visual cues, or dedicated neural circuits exist for each set of visual features and therefore each courtship step, remains incompletely understood.

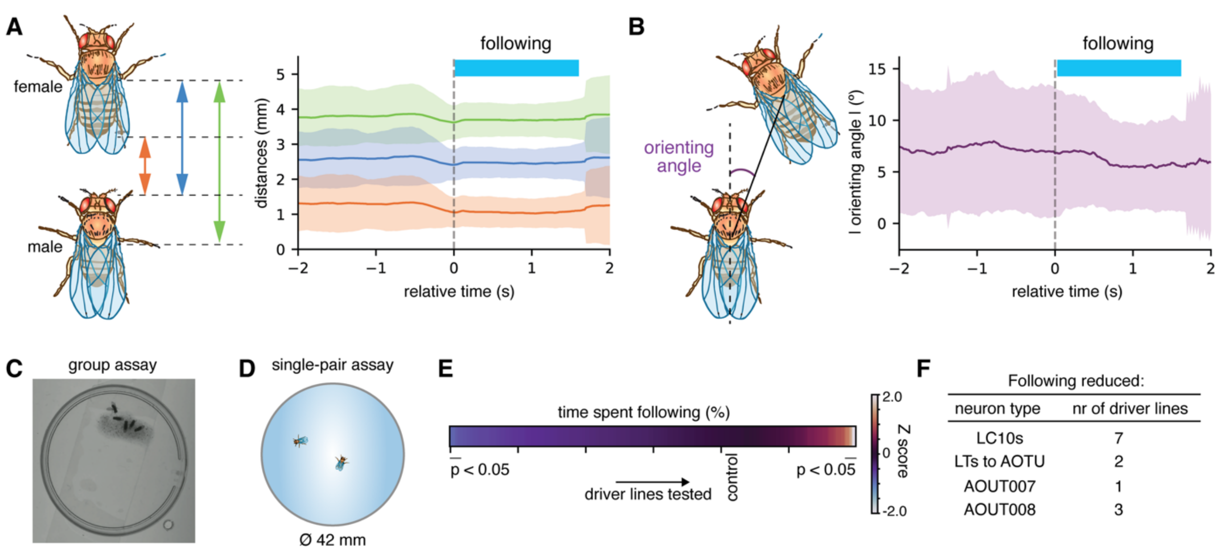

Figure 1: A. Following or chasing occurs with low variability in inter-fly distances. **B.** The variability in the orienting angle is less reduced during following. **C.** Snapshot of group assays with one naïve male and four virgin females. **D.** Schematic depicting the single pair assay in large assay arenas. **E.** Z scores for 300 tests compared to controls. **F.** The neuron types showing phenotypes in following.

The variation in inter-fly distances is reduced during following (Figure 1A), in contrast to variation in the orienting angle, which is less reduced (Figure 1B). This suggests that males might use object size in order to maintain short distance during a chase, so that the male must walk to maintain the angular size of the female abdomen constant (Figure 1A). Female chase is not an artefact of the single pair assay, since it was present in all courtship events that led to a copulation in group assays (Figure 1C, Gallego and Ribeiro, unpublished). To find the neurons regulating following behavior, we leveraged two large behavioral screens that used driver lines expressing a neurotransmission blocker to test courtship behavior in single pair assays, in search of neurons that specifically led to a reduction in following upon silencing. We found that blocking neurotransmission in the major downstream targets of LC10a neurons, the AOTU008 interneurons, led to a reduction in the percentage of time the male spends following (Figure 1D-F), without overtly affecting other behavioral actions during courtship (Chen and Ribeiro, unpublished data). The time spent singing and timing of courtship initiation were similar to controls, when AOTU008 neurons were silenced with three different driver lines. This suggests that following is regulated by a specific neuron type downstream of LC10a. The goal of this project is to test the neuron types downstream of AOTU008, and test whether AOTU008 neurons transform LC10a-information or simply relay the same signal-correlated information. This project will take place in collaboration with Wei-Qi Chen.

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https://www.med.lmu.de/bmc/de/forschung/forschungsbereiche/physiologische-chemie/physiolchemie/research-groups/ribeiro-lab/

Research papers related to this project:

Agrawal, S., Safarik, S., Dickinson, M., 2014. The relative roles of vision and chemosensation in mate recognition of Drosophila melanogaster. J Exp Biol 217, 2796–805. https://doi.org/10.1242/jeb.105817

Ribeiro, I.M.A., Chen, W., Sauter, M., Prech, S., Borst, A., 2026. A multi-input optic glomerulus mediates opposing behavioral responses to visual objects. Manuscript submitted.

Ribeiro, I.M.A., Drews, M., Bahl, A., Machacek, C., Borst, A., Dickson, B.J., 2018. Visual Projection Neurons Mediating Directed Courtship in Drosophila. Cell 174, 607-621.e18. https://doi.org/10.1016/j.cell.2018.06.020