

SCHOOL OF BIOLOGICAL SCIENCES SEMINAR

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“There and Back Again: From *D. melanogaster* towards the Genus *Drosophila*”

For most *Drosophila* species we know far more about their genomes than their ecology, or how they navigate their world. Even given massive advances in *D. melanogaster* connectomics, most studies remain limited to this single species, leaving a substantial gap between genotype and phenotype. Here, single-species studies reveal mechanisms, and pairwise comparisons reveal differences, but neither can reliably identify recurring patterns or general rules of sensory evolution. My long-term career goal is to close this phenotype gap by establishing a genus-as-model system for a true comparative model of sensory brain evolution — shifting the field from isolated species comparisons toward a predictive framework for understanding freedoms and constraints on nervous system adaptation. A central hypothesis driving my research is that sensory evolution is concentrated within a limited number of evolutionarily flexible pathways, and that changes within these key pathways produce predictable shifts in behavioral preference and neural organization. By leveraging 35–40 different *Drosophila* species as independent evolutionary experiments — spanning rainforests, high-elevation deserts, and agricultural ecosystems — my laboratory provides the evolutionary replication needed to distinguish lineage-specific changes from recurrent targets of adaptation, and asks whether sensory evolution is predictable. For example, do similar ecological transitions repeatedly target the same receptors, behaviors, and brain regions, or does each lineage evolve unique solutions?

In this talk, I will present three interconnected research areas that address this question at different scales. I show how microbe-derived methanol drives pheromone efficacy and courtship success in *D. melanogaster*, revealing ecologically conditioned mating signals with implications for how host shifts may drive reproductive isolation across the genus. I then present high-throughput thermal behavioral assays across 36 species, where behavior is best described as a distributional phenotype rather than a static temperature. Finally, I discuss applied chemical ecology targeting soybean pests, including an emerging agricultural pest causing substantial crop losses across the Midwest, where the same sensory experiments address a critical integrated pest management problem. Together, these research areas build toward an ecological and evolutionary foundation for predicting how brains and behaviors evolve in response to sensing their environment from both a basic and applied science perspective.

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Hamilton Hall 112**

Zoom Link: <https://unl.zoom.us/j/94081044933>

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