Biology Seminar

Western
UNIVERSITY · CANADA

12:30 - 1:30 pm
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BGS 0165

Pelin Volkan
Associate Professor
Department of Biology
Duke Institute for Brain Science
Duke University

The effect of social experience on gene expression, circuit function, and behaviors

Social experience has a profound impact on animal responses, yet the molecular and circuit-based mechanisms remain unclear. In *Drosophila melanogaster,* social isolation increases courtship vigor in wild-type males, whereas monosexual grouping suppresses it. Correspondingly, social isolation heightens the baseline and evoked neuronal activity in central courtship circuits, particularly elevating the evoked activity of P1 central courtship command neurons. We previously have shown that in peripheral pheromone sensing neurons social experience modulates the expression of *fruitless*, a critical courtship regulator expressed in 2000 interconnected neurons that constitute the majority of the courtship circuit. Single-cell RNA sequencing from *fru*-positive neurons in grouped and isolated male brains revealed that social isolation impacts *fru* expression in distinct neurons within the courtship circuit. Furthermore, numerous genes associated with neuromodulation, behavior regulation, learning and memory, and synaptic plasticity are differentially expressed in response to social experience. In the olfactory system, Or47b and Or67d receptors are expressed in *fru*-positive neurons tuned to fly pheromones. We found that the pheromone-sensing Or47b olfactory circuit contributes to the suppression of male-female courtship in males raised in monosexual groups, while Or67d pheromone circuits do not alter the impact of social experience on courtship. Intriguingly, Or47b and Or67d circuits exert opposite effects on the expression of certain genes, revealing that different social signals in the environment trigger distinct transcriptional responses in the brain. We also identified *Drosophila melanogaster* strains that show behavioral variation in response to social isolation. Transcriptional and SNP analysis at the genome level revealed strain-specific loci and gene expression patterns that are concordant with behavioral responses. These findings provide valuable insights into the fundamental mechanisms by which social experience drives behavioral adaptations through the modulation of genes critical for neural circuit structure and function.

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