Title: The evolutionary neurobiology of social and symbiotic behavior

Author: David Miller

Abstract: Dalotia coriaria, the greenhouse rove beetle, belongs to the family Staphylinidae, the most diverse family on the planet with over 70,000 species. Beetles in this family have repeatedly evolved to live symbiotically inside the colonies of social insects such as ants and termites. This widespread convergent evolution of a complex and behaviorally intimate symbiosis is unique in the animal kingdom. Studying the neural circuits involved in interspecies interactions has been impossible until now, given the lack of symbiotic relationships in traditional modern organisms. Establishing rove beetles as a new model organisms will allow us to answer questions such as: How does one species evolve the means to recognize and interact effectively with another species? Are there dedicated neural circuits for perception of other organisms? Does evolution co-opt pre-existing circuits to foster interspecies recognition and behavioral interaction, or are new structures or circuits involved? Our lab has established protocols for mass rearing and mass collecting syncytial embryos. Candidate immediate early genes, used for identification neuronal populations relevant to interspecies interactions, have been identified. CRISPR knockouts and piggyBac transposon insertions of the Q binary system are also being developed. Knockouts of specific olfactory receptors and expression of GCaMP and channelrhodopsins in distinct neuronal populations will allow for the dissection of the neural circuits involved in recognition of other species and execution of complex symbiotic behaviors.