Angela Schipanski, Biology

Year in School: Senior at the University of Wuerzburg, Germany
Faculty Mentor: Dr. Troy Zars, Biological Sciences
Funding Sources: MU Research Board and deutsche Forschungsgemeinschaft

Are the molecular mechanisms of and neural structures supporting learning conserved in the larval and adult development stages in *Drosophila*?

Learning describes the ability to change behavior based on experience. A memory is the stored form of those changes. Rather few molecules are known to be critical for memory formation. Even less is known about the relationship between those molecules and their temporal requirement through development. The rutabaga encoded type 1 adenylyl cyclase (rut-AC) is critical for both synaptic plasticity and memory formation in a number of species. Indeed, it has been proposed to be a molecular integratorí, responding synergistically to signals mediating the cue that is to be learned and the reinforcer. The rut-AC, thus, plays a central role in memory formation. In the Drosophila adult, the rut-AC has been found critical for every learning experiment in which it has been tested. And, the cellular site of action for the rut-AC has been determined for two learning paradigms. For learning olfactory cues, the rut-AC function is sufficient for memory formation in the Kenyon cells of the mushroom bodies.
Drosophila larvae are capable of olfactory learning. To train larvae, one group is rewarded with fructose in the presence of odor A and not reinforced in the presence of a second odor B (A+/B). A complementary group receives opposite training (A/B+). During a memory test, animals are given a choice between A and B. Animals that received A+/B training show a higher preference for A than reciprocally trained animals. As all other parameters are equal between these groups, the odor preference difference is exclusively due to associative learning. The role of the rut-AC in memory formation is conserved through development. Wild-type Drosophila larvae trained as above perform significantly better than rut-AC mutant larvae. Thus, at least one of the molecules critical for synaptic plasticity has a conserved role in memory formation at multiple stages of development. Whether the Kenyon cells of the mushroom bodies are also sufficient for odor learning in the larval stage is the focus of continued experimentation.