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## The effects of sensitization on habituation using the olfactory jump reflex in *Drosophila*

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Memories can arise from simpler habituation and sensitization training as well as associative classical conditioning. However, in a complex environment, animals receive sensory cues in a fashion that can be more accurately described as having some habituation, sensitization and associative components. The relation between these types of memories at the molecular, systems and behavioral level remain largely unexplored. We can alter the timing of odor and electric shock presentation to induce all three types of memory in a defensive olfactory jump reflex. Habituation is a short-term change in behavior as a response to a repetitive stimulus. Using seven odors, we showed flies habituate their jump reflex to background levels of jump probabilities with ten odor presentations. Interestingly, the seven odors tested can be categorized into three groups based on their habituation rates: a high jump probability, a low jump probability, or a no-jump probability. Also, odors show some specificity as habituation of one odor does not lead to a total loss of jump response (complete cross-habituation) although it is reduced (partial cross-habituation). We chose to use six odors for further analysis. Sensitization is defined as an interference with habituation because of a dishabituating stimulus. Using electric shock as a potential sensitization cue, we presented shock and immediately tested jump probability. Interestingly, we found unpaired electric shock increased the jump probability with all odors tested, even those that do not induce a naïve jump. Classical (Pavlovian) conditioning arises when an animal associates a neutral stimulus with one that induces a reflex. Preliminary tests suggest that the paired presentation of electric shock and odor does not increase the jump probability of subsequent odor presentation. With the establishment of these three behavioral paradigms, the stage is set to investigate the interaction of habituation and sensitization on associate classical conditioning. Future experimentation should determine the relationship of the molecular and neural systems underlying these different forms of memory.