Sensory preconditioning in the cricket *Gryllus bimaculatus*: Associations between neutral sensory stimuli

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Sensory preconditioning is a variation of high-order conditioning, which forms an association between two neutral stimuli without an apparent reinforcement. The purpose of this study is to establish the sensory preconditioning paradigm in crickets and to investigate the mechanism of learning between neutral stimuli. In the first phase of training, crickets received pairing trials of odor and visual pattern, and in the second phase, they received pairing trials of the visual pattern and water reward (or saline punishment). As a result, crickets showed conditioned response to the odor used in the training over another odor which was only used in the odor preference tests, suggesting that crickets are capable of the sensory preconditioning.

In our recent study, we demonstrated that appetitive reinforcement requires octopaminergic transmission and aversive reinforcement requires dopaminergic transmission in classical conditioning of crickets. Therefore we investigated whether the association between neutral stimuli in the first phase of sensory preconditioning is octopaminergic or dopaminergic transmission-dependent. As a result, blockade of neither octopaminergic nor dopaminergic signaling impaired association between neutral stimuli. We conclude that the mechanisms for association between neutral stimuli differ from those for reward or punishment learning.