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Articles Highlighted

Appetitive and Aversive Learning in *Spodoptera littoralis* Larvae

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Adult butterflies are capable of associative learning that serves foraging flowers or finding oviposition sites. In experimental paradigms, they learn to extend their proboscis in response to floral orders associated with a sugar reward or to avoid them if paired with bitter substances. Such settings have been used to elucidate the neuronal circuitry and mechanisms underlying the aforementioned behaviors. Butterfly larvae have been less well studied for their learning capabilities, possibly because for them to feed on a plant the mechanisms mediating adaptation, habituation, and specialization appear more relevant. However, larvae would profit from associative learning in numerous situations, including navigating back to their host plant, avoiding photosensitive toxins, finding less toxic plant tissues, or sampling different host plants. Salloum et al. now adapted a paradigm recently developed for *Drosophila* larvae to study if Egyptian cotton worm larvae can associate a taste with an odor. To this end, they exposed groups of larvae to a sugar or a bitter compound as unconditioned stimuli (US) paired with an odorant as a conditioned stimulus (CS) and subsequently tested their reaction to the CS at different time intervals. Depending on the US used larvae learned to avoid or prefer the CS. This learning was specific because trained larvae discriminate CS from another odorant present during the training that remained unrewarded. Moreover, the aversive bitter stimulus was much more efficient than the sugar reward as US. Thus, the butterfly larvae were able to quickly store and memorize information crucial for their survival that offers them a substantial ecological advantage over using habitual mechanisms solely.

Bimodal Preference Profile for Sucralose in Rats

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In order to reduce calorie intake, nonnutritive sweeteners have become popular alternatives to natural sugars. However, with increasing concentrations several artificial sweeteners evoke off-tastes that involve activation of bitter taste receptors and/or transient receptor potential channels. Also sucralose, a trichlorinated intensely sweet tasting derivative of sucrose appears to elicit a moderate bitter taste in human subjects. Mice display a concentration-dependent preference for the sugar surrogate, whereas rats reacted quite variable to sucralose with considerable individual and gender variability, but they could roughly classified as sucralose preferrers or avoiders. Loney et al. now expand on these studies by investigating whether the variability in sucralose consumption is influenced by sex or hormonal status, whether preference for sucralose is reliable across strains, and whether the bimodal behavioral response to sucralose is driven by taste. The authors demonstrate in a series of preference tests with water and ascending concentrations of sucralose that the variability in sucralose preference is robust across sex, stage of estrous cycle, and 2 strains of rats. Moreover, they found the ratio of sucralose preferrers and avoiders to be 35–65% and that this bimodal distribution is driven by taste. Sucralose avoidance is extremely robust and could not be overcome by the motivation to rehydrate. From their observation, the authors conclude that sucralose avoiders detect a negative taste quality of the sugar surrogate to which preferrers are insensitive.

Modality-Specific Neural Effects of Selective Attention to Taste and Odor

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Selective attention to a specific feature of a stimulus serves goal-directed behavior and, as a physiological correlate, results in increased neural activity in a restricted area of the sensory cortex coding that feature. Attentional modulation of the sensory cortex can also occur if stimuli are expected probably enhancing sensitivity to incoming signals. For example, "searching" for a taste in a taste-less solution increased activity in the middorsal and anterior insula, an area implicated in taste perception and general attention alike. By means of functional magnetic resonance imaging, Veldhuizen and Small now examined whether insular activity during "taste search" reflects general or taste selective attention. To this end, they compared brain responses of subjects who sampled taste and odor stimuli or performed a detection task. The authors observed that ''seeking'' a taste led to activation of the primary taste cortex in the anterior and middorsal insula but not of the piriform cortex, that is, the primary olfactory cortex. The same type of modality-specific brain activation was seen when subjects were trying to detect an odor. In this case, however, the piriform but not the primary taste cortex showed up. Moreover, a far anterior insula cortical region responded to both, ''taste-seeking'' and ''odor-seeking.'' Thus, it appears that the primary taste and olfactory cortexes are sensitive to modality-specific but not general attention, whereas an area of far anterior insula responds across modalities to directed attention to taste and smell.

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