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Factors Affecting Identification of Components of Odor Mixtures

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In everyday situations, most components of an ambient complex mixture of olfactory stimuli that can change in composition over time dynamically are undetected by humans. In experimental settings, the ability of subjects to identify an odor component in a binary mixture depends on the relative salience of the 2 compounds. Components of mixtures of higher complexity are, as a rule, not recognized, a phenomenon referred to as ''mixture suppression'' that may explain why characteristic odors can be approximated by dominant single compounds. Adaptation, even if incomplete, can unbalance the mutual suppression of odorous compounds. Small intensity changes of odorous compounds in mixtures can therefore make odors appear or disappear. In their report, Frank et al. investigate the effect of stimulus intensity and adapting time on the identification of components in mixtures in human. They demonstrate that 1 and 5 mM concentrations of vanillin and phenylethyl alcohol elicited rapidly adapting independent odors that were not confused with each other. Moreover, these stimuli were easily identified as single stimuli, but phenylethyl alcohol was more effective than vanillin when tested in mixtures. Interestingly, the stimuli proved more effective at the higher concentration only when in the context of 1-mM stimuli. Finally, the authors found that after adapting to one component, the new extra mixture component became more effective, whereas the adapted ambient component became less effective. This effect appeared more pronounced during longer exposure times. Frank et al. conclude that the olfactory system codes characteristic odors of critical compounds by adjusting the perceptual intensity of the many potential odor stimuli in dynamic natural settings.

Alcohol Dehydrogenase and Ethanol Preference in Fruit Flies

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Food choice depends on preferences. Ethanol is a well-known chemical that affects preference and guides insects including fruit flies to fermenting food sources. At high concentrations, however, ethanol becomes toxic causing flies to become hyperactive and later uncoordinated and sedated. Like other animals, fruit flies demonstrate prominent alcohol dehydrogenase (Adh) activity as well as tolerance to counteract the adverse effects of ethanol. However, the importance of Adh, in this process is not well understood. Ogueta et al. now show that adult fruit flies of both genders prefer food with up to 5% ethanol over food lacking the alcohol, whereas they avoid food with high ethanol content.

Intriguingly, impaired Adh function reduced both, preference to low and aversion to high concentrations of ethanol in adult flies. The Adh-impaired flies also showed diminished ethanol tolerance. Thus, the data indicate a strong linkage between ethanol metabolism and ethanol-evoked behavior. The negative correlation of aversion to high ethanol concentrations with Adh function would reduce offspring survival by enabling egg laying of Adh-impaired flies on high ethanol-containing substrates and could account for the low abundance of Adh-null alleles in natural fly populations.

Representation of Sweet and Salty Taste Intensities in the Brain

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The interplay between taste and intake behavior has attracted remarkable attention recently due to the obesity epidemic. Sensory properties of food including taste intensity affect liking and disliking. Pleasant food has optimal taste intensity and deviation from optimum decreases pleasantness. The most common seasonings of sweet or savory foods are sucrose and sodium chloride, respectively. Spetter et al. aimed at determining the brain regions where taste activation covaries with sweet and salty taste intensity. They did so by functional magnetic resonance imaging of brains of human subjects who tasted simple solutions containing various concentrations of sucrose or sodium chloride. Although sweet and salty stimuli led to neuronal activation in several areas including the anterior insula, amygdala, striatum, and hippocampus, only middle insula activation increased bilaterally and similarly with increasing concentrations of both stimuli suggesting that sweet and salty taste intensity is represented in this region.

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