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Articles Highlighted

Single Taste Fiber Responses From Calf ''Chorda Tympani'' Nerve

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Much of our knowledge about mammalian gustation is based on experiments carried out in a very limited number of species, primarily rodents. Single fiber recordings from the chorda tympani nerve in these animals have commonly revealed 4 groups of fibers. S fibers respond best to sucrose and other sweeteners, N fibers best to sodium, Q fibers best to bitter compounds, and H fibers best to acids. These response profiles correspond well to the human basic tastes suggesting, together with data from behavioral experiments, that rodents and humans have similar taste categories. The work by Hellekant et al. now teaches us that these taste categories do not necessarily apply to other mammals. These authors recorded activity in single chorda tympani fibers in response to a set of ~30 different taste compounds. By hierarchical cluster analysis, they identified also responding 4 fiber clusters. The 4 identified clusters were best responsive to various monovalant cations and monosodium glutamate, short chain fatty acids, citric and ascorbic acid, and denatonium benzoate. The latter cluster, however, showed only weak responses to quinine. None of the clusters correspond to any of the human taste qualities. Instead, salts, acids, bitter chemicals, and sweeteners elicited responses in all 4 clusters. Moreover, stimuli of the same human basic taste excited different fibers in cattle. No designated group of fibers responded to sweet compounds and only very few fibers to high-potency sweeteners. The data suggest that the taste world of cattle differs profoundly from that of humans or rodents. The authors argue that the fiber clusters in cattle adapted during evolution to the strict vegetable diet of herbivores even though they rather resemble those of omnivorous pig, which, like cattle, is a member of the order of Artiodactyla.

Bitter Taste Receptor Oligomers

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An important question in taste research is how humans and other mammals detect the thousands of bitter compounds with a comparatively small number of receptors. The mammalian genome contains only ~30 genes encoding G protein–coupled receptors expressed in dedicated oral taste receptor cells and known to detect bitter chemicals. Recent evidence suggests that many of these so called taste 2 receptors (TAS2Rs) possess broad spectra of cognate bitter compounds, giving at least a partial answer to above question. Nevertheless, the fact that numerous G protein–coupled receptors function as homo- or heterooligomers and the finding that several or many TAS2Rs are coexpressed in the same bitter taste receptor cells prompted Kuhn et al. to investigate if TAS2 bitter taste receptors oligomerize and if oligomerization increases the number of functionally distinct bitter taste receptors. Coimmunoprecipitation experiments for quite a number of selected TAS2R pairs clearly demonstrated that TAS2Rs can physically interact in transfected cells. Subsequent bioluminescence resonance energy transfer analyses of all 325 possible binary combinations of human TAS2Rs established that the vast majority, if not all, of TAS2R pairs form homo- and heterooligomers. However, screening experiments in transfected cells with functionally coexpressed TAS2Rs and 104 bitter substances did not reveal any heteromer-specific bitter compound. Moreover, no other functional consequences of TAS2R oligomerization were obvious. Thus, the data of Kuhn et al. support the hypothesis that detection of so many bitter chemicals by humans depends primarily on the broad agonist profiles of the TAS2 bitter taste receptors.

P2 Odorant Receptor Projections During Aging

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In the olfactory system, odorant receptors project to discrete glomeruli creating a spatial map in the olfactory bulb that relates to odor quality and discrimination. During ontogenetic development, the targeting of olfactory receptors to glomeruli proceeds from a relatively scattered and diffuse pattern to precisely fixed positions. Constanzo and Kobayashi examined if changes in odorant receptor mapping occur also during aging. For their study, they used genetically engineered mice in the age of 2 weeks to 2.5 years. In these mice, the axons and terminal endings of all olfactory sensory neurons that express the P2 odorant receptor can be histologically visualized by means of β-galactosidase-mediated staining techniques. The authors measured the number and position of P2 glomeruli, the amount of axons targeting each glomerulus, and the lengths of the olfactory bulbs. They found that more than 70% of olfactory bulbs contained

multiple P2 glomeruli, a 42% increase in bulb length from 2 to 13 weeks, and a concomitant shift of the position of P2 glomeruli. In most cases, targeted glomeruli were filled with P2 axons, even though diffuse targeting was observed in rare cases in adult mice. However, diffuse targeting increased during aging reaching 20% of the cases in the age of 2 years. The authors conclude that odorant receptor mapping becomes disrupted in old age and could account for olfactory impairment in elderly adults.

Wolfgang Meyerhof