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NURSING SCIENCE

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Elucidate the pathway involved in taste

Taste, or gustation, is a sense that develops through the interaction of dissolved molecules with taste buds. Currently five sub-modalities (tastes) are recognized, including sweet, salty, bitter, sour, and umami (savory taste or the taste of protein). Umami is the most recent taste sensation described, gaining acceptance in the 1980s. Further research has the potential to discover more sub-modalities in this area, with some scientists suggesting that a taste receptor for fats is likely.

Taste is associated mainly with the tongue, although there are taste (gustatory) receptors on the palate and epiglottis as well. The surface of the tongue, along with the rest of the oral cavity, is lined by a stratified squamous epithelium. In the surface of the tongue are raised bumps, called papilla, that contain the taste buds. There are three different types of taste papilla, based on their appearance: *papilla vallate

* papilla foliate

* papilla fungiform.

13 possible chemical receptors in the taste cells

- 2 sodium receptors

- 2 potassium receptors

- 1 chloride receptor

- 1 adenosine receptor

- 1 inosine receptor

- 2 sweet receptors

- 2 bitter receptors

- 1 glutamate receptor

- 1 hydrogen ion receptor - sour, salty, sweet, bitter and “umami”

PRIMARY TASTE SENSATIONS

five different taste sensations are currently recognized. The first, salty, is simply the sense of Na+ concentration in the saliva. As the Na+ concentration becomes high outside the taste cells, a strong concentration gradient drives their diffusion into the cells. This depolarizes the cells, leading them to release neurotransmitter.

The sour taste is transduced similar to that of salty, except that it is a response to the H+ concentration released from acidic substances (those with low pH), instead of a response to Na+. For example, orange juice, which contains citric acid, will taste sour because it has a pH value of about 3. Of course, it is often sweetened so that the sour taste is masked. As the concentration of the hydrogen ions increases because of ingesting acidic compounds, the depolarization of specific taste cells increases.

The other three tastes; sweet, bitter and umami are transduced through G-protein coupled cell surface receptors instead of the direct diffusion of ions like we discussed with salty and sour. The sweet taste is the sensitivity of taste cells to the presence of glucose dissolved in the saliva. Molecules that are similar in structure to glucose will have a similar effect on the sensation of sweetness. Other monosaccharides such as fructose or artificial sweeteners like aspartame (Nutrasweet™), saccharine, or sucralose (Splenda™) will activate the sweet receptors as well. The affinity for each of these molecules varies, and some will taste “sweeter” than glucose because they bind to the G-protein coupled receptor differently.

TASTE PATHWAYS

Gustatory pathways in humans have three orders of neurons. The first order neurons i.e. the relatively slowly conducting taste fibres from each side unite in the nucleus of tractus solitarius in the medulla oblongata. There they synapse on second order neurons, the axons of which will cross to opposite side and join the medial lemniscus, ending with the fibres for touch, pain and temperature sensibility in the specific sensory relay nucleus of thalamus  There they synapse on second order neurons, the axons of which will cross to opposite side and join the medial lemniscus, ending with the fibres for touch, pain and temperature sensibility in the specific sensory relay nucleus of thalamus .Third order neurons arise from there and relay in the taste projection area in the cerebral cortex at the foot of the post central gyrus. Hence it was concluded that taste does not have a separate projection area but is represented in the portion of the post central gyrus that sub serves cutaneous sensation from face.

Gustatory Nerve Impulses

Once the taste cells are activated by molecules liberated from the things we ingest, they release neurotransmitters onto the dendrites of sensory neurons. These neurons are part of the facial and glossopharyngeal cranial nerves, as well as a component within the vagus nerve dedicated to the gag reflex. The facial nerve connects to taste buds in the anterior third of the tongue. The glossopharyngeal nerve connects to taste buds in the posterior two thirds of the tongue. The vagus nerve connects to taste buds in the extreme posterior of the tongue, verging on the pharynx, which are more sensitive to noxious stimuli like bitterness.

Axons from the three cranial nerves carrying taste information travel to the medulla. From there much of the information is carried to the thalamus and then routed to the primary gustatory cortex, located near the inferior margin of the post-central gyrus. It is the primary gustatory cortex that is responsible for our sensations of taste. And, although this region receives significant input from taste buds, it is likely that it also receives information about the smell and texture of food, all contributing to our overall taste experience. The nuclei in the medulla also send projections to the hypothalamus and amygdalae, which are involved in autonomic reflexes such as gagging and salivation.