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PATHWAY INVOLVED IN TASTE

The gustatory system or sense of taste is the sensory system that is partially responsible for the perception of taste (flavour). Taste is the perception produced or stimulated when a substance in the mouth reacts chemically with taste receptor cells located on taste buds in the oral cavity, mostly on the tongue. Taste, along with smell (olfaction) and trigeminal nerve stimulation (registering texture, pain, and temperature), determines flavours of food and other substances. Humans have taste receptors on taste buds and other areas including the upper surface of the tongue and epiglottis. The gustatory cortex is responsible for the perception of taste. The tongue is covered with thousands of small bumps called papillae, which are visible to the naked eyes. Within each papilla are hundreds of taste buds. The exception to this is the filiform papillae that do not contain taste buds. There are between 2000 and 5000 taste buds that are located on the back and front of the tongue. Others are located on the roof, sides and back of the mouth, and in the throat. Each taste bud contains 50 to 100 taste receptor cells.

Taste receptors in the mouth sense the five taste modalities: sweetness, sourness, saltiness, bitterness and savouriness (also known as savoury or umami). These five tastes exist and are distinct from one another. Taste buds are able to distinguish between different tastes through detection interaction with different molecules or ions. Sweet, savouriness and bitter tastes are triggered by the binding of molecules to G protein-coupled receptors on the cell membranes of taste buds. Saltiness and sourness are perceived when alkali metal or hydrogen ions enter taste buds, respectively. The basic taste modalities contribute only partially to the sensation and flavour of food in the mouth. Other factors include: Smell, detected by the olfactory epithelium of the nose, texture which is detected through a variety of mechanoreceptors, muscle nerves, etc., temperature which is detected by thermoreceptors , and coolness (such as of menthol) and hotness (pungency), through chemesthesis. As the gustatory system senses both harmful and beneficial things, all basic taste modalities are classified as either aversive or appetitive, depending upon the effect the things they sense have on our bodies. Sweetness helps to identify energy-rich foods, while bitterness serves as a warning sign of poisons. Among humans, taste perception begins to fade around 50 years of age because of loss of tongue papillae and a general decrease in saliva production. Humans also have distortion of taste through dysgeusia.

Salt and sour taste mechanisms detect, in different ways, the presence of sodium chloride (salt) in the mouth. However, acids are also detected and perceived as sour. The detection of salt is important to many organisms, but specifically mammals, as it serves as a critical role in ion and water homeostasis in the body. It is specifically needed in the kidney as an osmotically active compound which facilitates the passive re-uptake of water into the blood. Because of this, salt elicits a pleasant taste in most humans.

Sour and salt tastes can be pleasant in small quantities, but in larger quantities become more and more unpleasant to taste. For sour taste this is presumably because the sour taste can signal under-ripe fruit, rotten meat, and other spoiled foods, which can be dangerous to the body because of bacteria which are growing. Sour taste signals acids, which can cause serious tissue damage. Bitter is a generally negative flavour, though its method of action is unknown.

Sweet taste signals the presence of carbohydrates in solution. Since carbohydrate have a very high calorie count (saccharides have many bonds, therefore much energy and they are desirable to the human body, which evolved to seek out the highest calorie intake foods. They are used as direct energy (sugars) and storage of energy (glycogen). However, they are many non-carbohydrate molecules that trigger a sweet response, leading to the development of many artificial sweetners.

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 anteriaor third of the tongue. The glossopharyngeal nerve connects to taste buds in the posterior two thirds of the tongue. The vagus nerve connects to the 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.