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QUESTION:

Elucidate the pathway involved in Taste.

ANSWER:

The gustatory system or sense of taste is the sensory system that is partially responsible for the perception of taste (flavor). 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 flavors of food and other substances. Humans have taste receptors on taste buds and other areas including the upper surface of the tongue and the 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 eye. 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 savoriness (also known as savory or umami). Scientific experiments have demonstrated that these five tastes exist and are distinct from one another. Taste buds are able to distinguish between different tastes through detecting interaction with different molecules or ions. Sweet, savoriness, 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 flavor of food in the mouth—other factors include smell, detected by the olfactory epithelium of the nose; texture, detected through a variety of mechanoreceptors, muscle nerves, etc. temperature, detected by thermoreceptors; and "coolness" (such as of menthol) and "hotness" (pungency), through chemesthesis.

The tongue can also feel other sensations not generally included in the basic tastes. These are largely detected by the somatosensory system. In humans, the sense of taste is conveyed via three of the twelve cranial nerves. The facial nerve (VII) carries taste sensations from the anterior two thirds of the tongue, the glossopharyngeal nerve (IX) carries taste sensations from the posterior one third of the tongue while a branch of the vagus nerve (X) carries some taste sensations from the back of the oral cavity. The trigeminal nerve (cranial nerve V) provides information concerning the general texture of food as well as the taste-related sensations of peppery or hot (from spices).

THE TASTE PATHWAY

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.

Three nerves carry taste signals to the brain stem: the chorda tympani nerve (from the front of the tongue), the glossopharyngeal nerve (from the back of the tongue) and the vagus nerve (from the throat area and palate). In addition, the trigeminal nerve carries signals from the touch / temperature / pain system. Taste signals combine in the brain stem areas involved in arousal (i.e. from sleep) then with smell signals in the brain to produce the sensation of flavour.