

Chemical Senses II Taste

The receptors for taste are the taste buds or gustatory cells located on the tongue, palate, palatoglossal arch, posterior wall of the pharynx and posterior wall of the larynx. As the taste cells just as the receptive neurons in the olfactory system are in a very hostile environment they are constantly being replaced by new cells, and yet their functions continue unabated.

Lingual Taste Buds.

The tongue is a very mobile muscular organ that is located in the oral cavity and pharynx. It is divided into a root, a body, apex, dorsal surface and an inferior surface. The body and apex of the tongue are very mobile. The tongue has at least three main functions: forming words, moving food from the oral cavity into the pharynx by passing the bolus along the palate, and taste.

The mucous membrane that covers the dorsal surface of the body and apex of the tongue is rough due to the presence of lingual papillae.

- Circumvallate are large and flat, lie in the terminal sulcus, and consist of a wall with a deep central depression, the walls containing taste buds (See Figure One)
- Foliate, small lateral folds of the lingual mucosa
- Filiform are long and numerous and contain sensory nerve endings from cranial nerve V3 (ant 2/3 dorsum and apex of tongue) and CN IX (post 1/3 of tongue), and
- fungiform mushroom shaped and pink in color located among the Filiform papillae and are most numerous at the apex and sides of the body of the tongue.

Taste buds are associated only with the circumvallate, foliate and fungiform papillae. There are also a few taste buds in the oral surface of the soft palate, posterior wall of oral pharynx and the epiglottis.

Classically there are four groups of subjective taste qualities each localized to a zone of the tongue:

Sweet and salt at the tip of tongue,

Sour at the sides, and

Bitter at the pharyngeal end.

But in addition there is other taste

In reality all parts of the tongue respond to the four kinds of taste.

The transduction of the 4 taste response include:

Sodium chloride and is involves a Na^+ channel in the taste receptor cells with a resultant depolarization,

Acids (sour) produce an increase in H^+ effects the Na^+ channel directly or blocks K^+ channel.

Sweet compounds bind to G-protein-receptor molecules that decrease K^+ else where in the cell.

Bitter compounds, that are especially protective as they make the individual aware of toxic substances. And use both ligand-gated channels and G-protein couple receptors. That permits them to be activated by many compounds.

Information carried in by the chorda tympani of cranial nerve VII is more sensitive to sweet or salty while glossopharyngeal fibers are more sensitive to sour or bitter. The

gustatory nerve endings usually end in many taste buds with there being one predominate response in each nerve that matches the function of that region (e.g. sweet from the apex and bitter from the pharyngeal border)

Second Order Neurons.

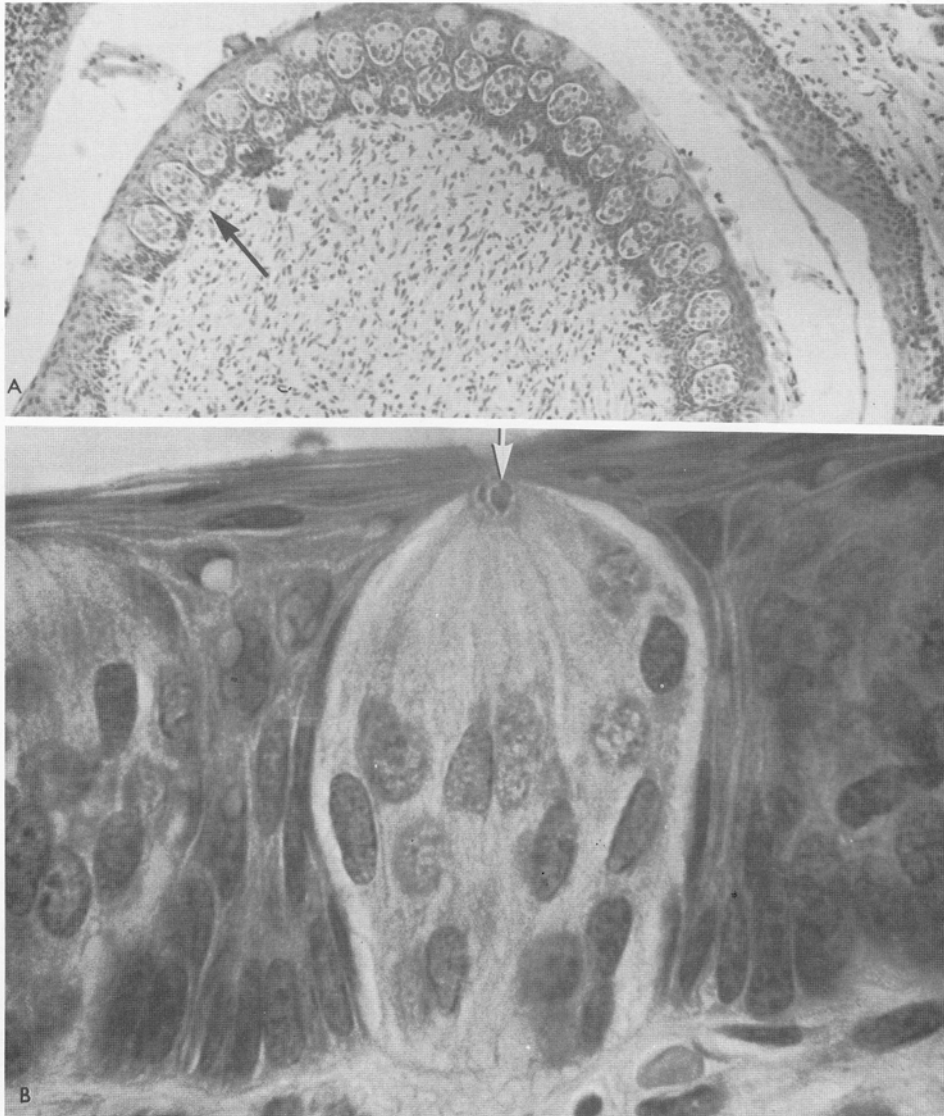
The information from the taste buds is brought centrally via cranial nerve VII, IX and X to the nucleus of the solitary tract in the medulla (figs 11-3 to 11-7). The 2nd order neurons also participate in reflexes including swallowing, or coughing.

The 2nd order axons ascend uncrossed in the central tegmental tract to the medial part of the ventral posterior medial nucleus of the thalamus (see Chapter 15) that then projects onto the gustatory cortex in the insula and parietal operculum. Gustatory information projects from these areas onto orbital cortex where there is a overlap of olfactory, gustatory and hypothalamic sensations that produce a strong response to many gustatory stimuli.

Gustatory information also reaches the Parabrachial nucleus in the pontine reticular formation and is then distributed with nociceptive and visceral information onto hypothalamus, amygdale and septum.

Cortical Neurons.

As one ascends in the gustatory system the neurons are more sensitive to particular chemical sensations. Cells in the brainstem and thalamus respond to more than one taste. While cells that are analyzed in the cortical regions show a selectivity that is not seen subcortically. Recent evidence has shown that taste plays a critical role in determining what an infant eats. In most animals gustatory sensations from each foodstuff greatly influence the animals intake, but in humans this is not necessarily the case. We are affected by environmental pressure that produce bizarre eating habits that may lead to obesity or anorexia.



Taste buds. *A*, Circumvallate papillae of a rhesus monkey showing numerous taste buds. *B*, Taste bud; arrows identify gustatory pore into which the neuroepithelial cilia project. H & E stain.