Chemical sensation-taste

•Taste buds are present in tongue, helping in taste function

•13 chemical receptors are present

•2 Sodium, 2 potassium, 1 chloride, 1 adenosine, 2 sweet, 2 bitter, 1glutamate, and 1 hydrogen receptor

Primary sensation of taste are

- 1. Sour
- 2. Salty
- 3. Sweet
- 4. Bitter

Sour taste: caused by acids, hydrogen ion concentration

<u>Salty taste:</u> elicited by sodium ion concentration

- <u>Sweeet taste</u>: is not caused by single class of chemicals
- Sugars, glycols. Alcohols, aldehydes, ketones, amides, esters, amino acids, small proteins, sulfonic acid, halogented acids, lead and beryllium.
- <u>Bitter taste</u>: caused by
- 1. Long chain organic substances containing nitrogen
- 2. Alkanoids (drugs, quinine, caffeine, strychnine, and nicotine,

Threshold of taste

- Threshold stimulation of sour taste by hydrochloric acid averages -0.0009 N
- Salty taste by sodium chloride -0.01M
- Sweet taste by sucrose- 0.01 M
- Bitter taste by quinine- 0.000008 M

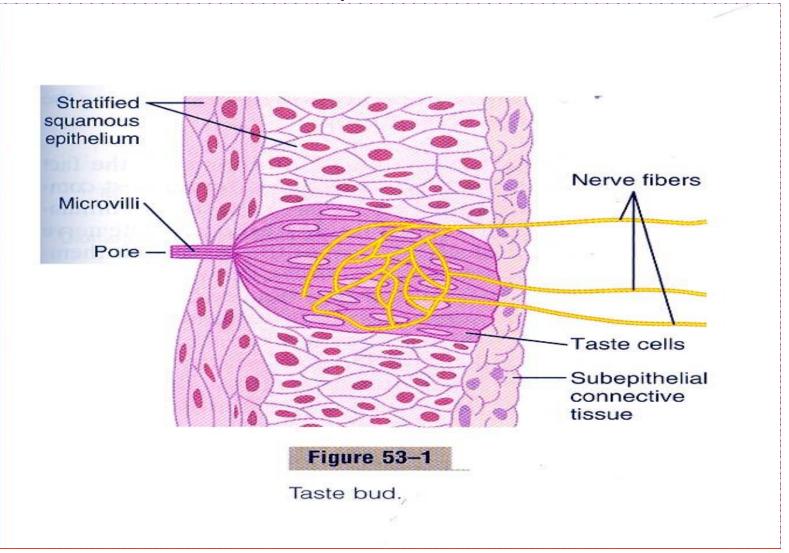
Taste blindness

- Some people are taste blind for some Thiourea compounds
- Phenylthiocarbamide is used for demonstrating taste blindness

Taste buds and its function

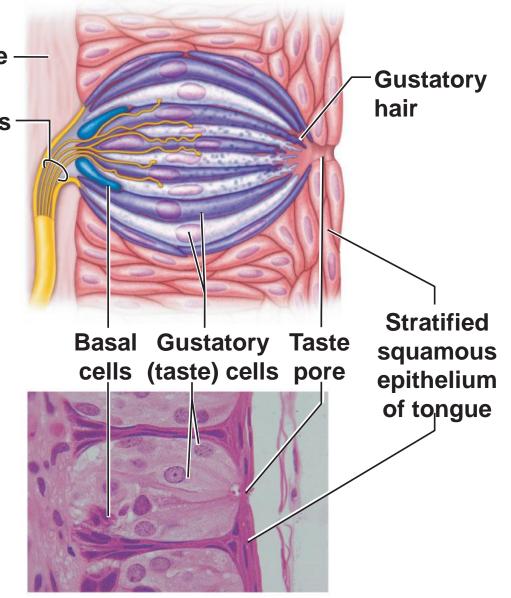
- Taste have
- Diameter- 1/30 millimeter
- Length- 1/16 millimeter
- Composed of 50 modified epithelial cells, mainly supporting cells called <u>Subtentacular</u> <u>cells</u>, and other are the taste cells.
- Mitotic division replace taste cells, mature taste cells lie towards the center of the bud.

- Taste Buds (Sustentacular cells and Taste cells)



- Lowers mammals taste cells have a life span of 10 days, and unknown for humans
- Outer tips of taste cell arranged around taste pore.
- Microvilli or taste hairs protrude out from each cell tip. It forms receptor surface.
- Taste nerve fibers are stimulated by taste cell receptors.

Connective – tissue Taste fibers – of cranial nerve



(c) Enlarged view of a taste bud.

Location of taste buds – found on three types of papillae in the tongue

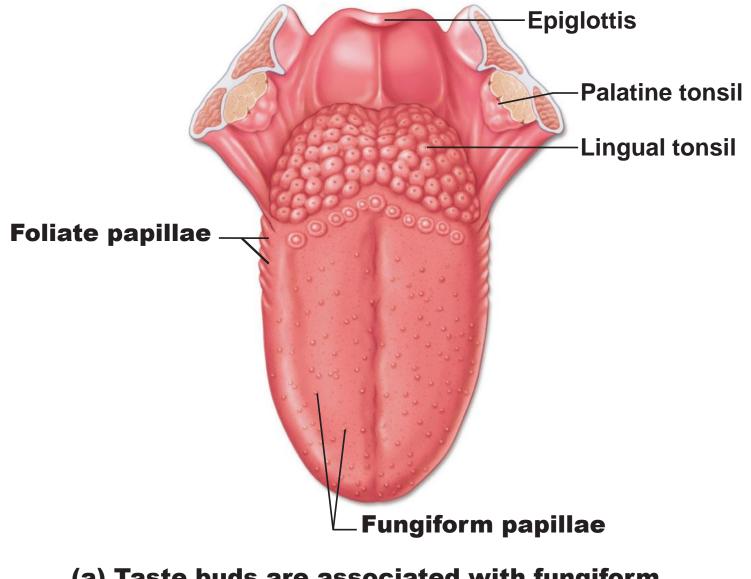
. Walls of the troughs that surrounds the *Circumvallate papilla* which form V line on the posterior tongue

. Fungiform papillae over the flat anterior surface of the tongue (moderate number)

Foliate papillae located in the folds along the lateral surfaces of the tongue (moderate number)

Additional taste buds are located on the palate, tonsillar pillars, epiglottis and proximal esophagus

Adults have 3000 to 10,000 taste buds



(a) Taste buds are associated with fungiform, foliate, and circumvallate (vallate) papillae.

Physiology of Taste

- In order to be tasted, a chemical:
 - Must be dissolved in saliva
 - Must contact gustatory hairs
- Binding of the food chemical (tastant)
 - Depolarizes the taste cell membrane, causing release of neurotransmitter
 - Initiates a generator potential that elicits an action potential

- Sweet and salty tastes are located on the tips of the tongue.
- Sour taste- on lateral sides
- Bitter taste- on the posterior side of the tongue and soft palate

Mechanism of taste bud stimulation

- Membrane of taste bud is negatively charged inside.
- Application of taste causes loss in negative charge- depolarization
- Change in electrical potential in taste cells is called receptor potential.
- Receptor potential initiate the binding of taste and receptor protein- opening channels, allowing positive charge to enter the cell.

 For sweet and salty taste – receptor proteins activates second messenger transmitter substance, causing intracellular chemical changes eliciting taste signals.

* Transmission of taste signals into the CNS

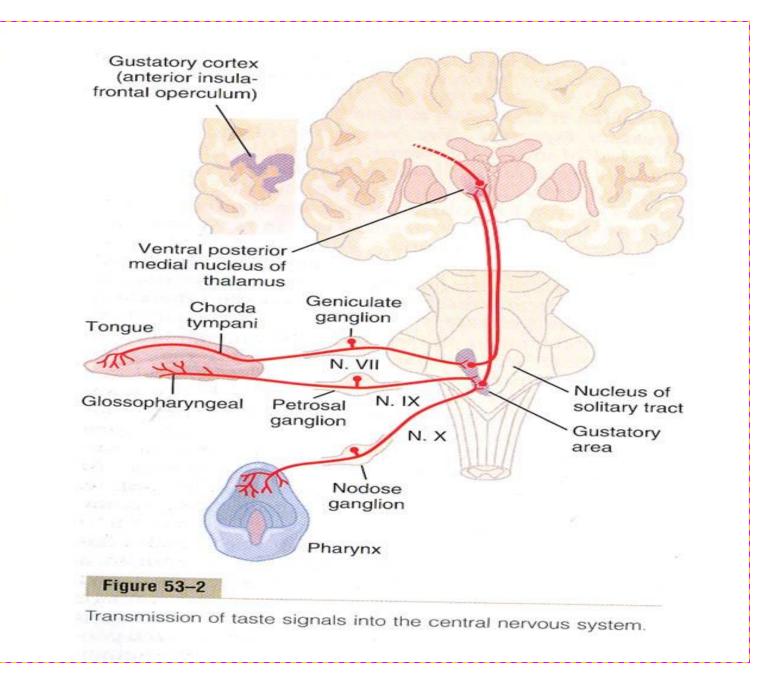
Taste buds from the anterior 2/3 of the tongue > Chorda tympani branch of *Facial Nerve*.

- * From posterior third of the tongue > Glossopharyngeal nerve
- * From tonsillar areas and back of the tongue > Vagus Nerve

Tractus Solitarius (medulla oblongata) > Medial Lemniscus > Thalamus

Center – Postcentral Gyrus

Adaptation of Taste – Extreme degree of adaptation that occurs in the sensation of taste almost certainly occurs in the *central nervous system*



Gustatory Pathway

- Cranial nerves VII and IX carry impulses from taste buds to the solitary nucleus of the medulla
- Impulses then travel to the thalamus and from there fibers branch to the:
 - Gustatory cortex in the insula
 - Hypothalamus and limbic system (appreciation of taste)

Influence of Other Sensations on Taste

- Taste is 80% smell
- Thermoreceptors, mechanoreceptors, nociceptors in the mouth also influence tastes
- Temperature and texture enhance or detract from taste