SPECIAL SENSE: TASTE (GUSTATION)

OBJECTIVES.

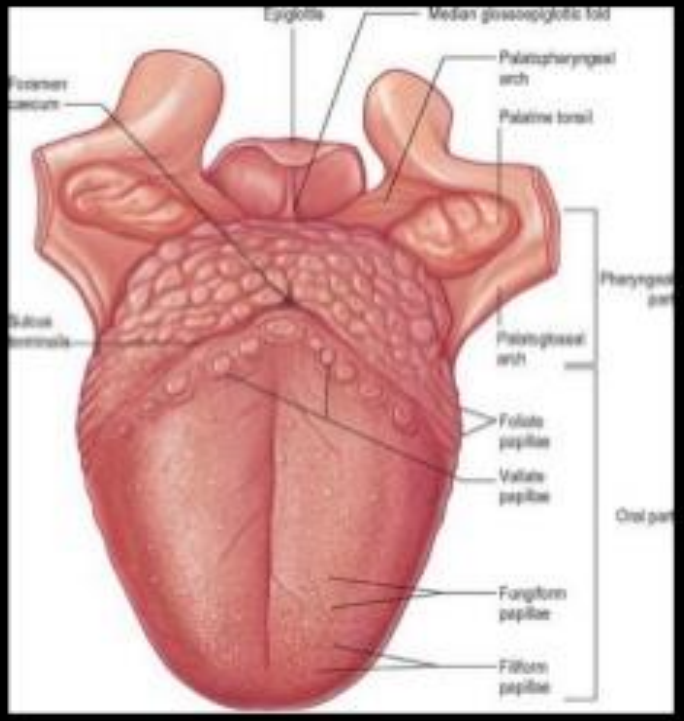
- Site of taste
- Taste pathway
- Physiology of taste

TASTE

- Chemical sense stimulated by food & drink.
- **Flavour** – olfactory, tactile & thermal attributes in addition to taste.

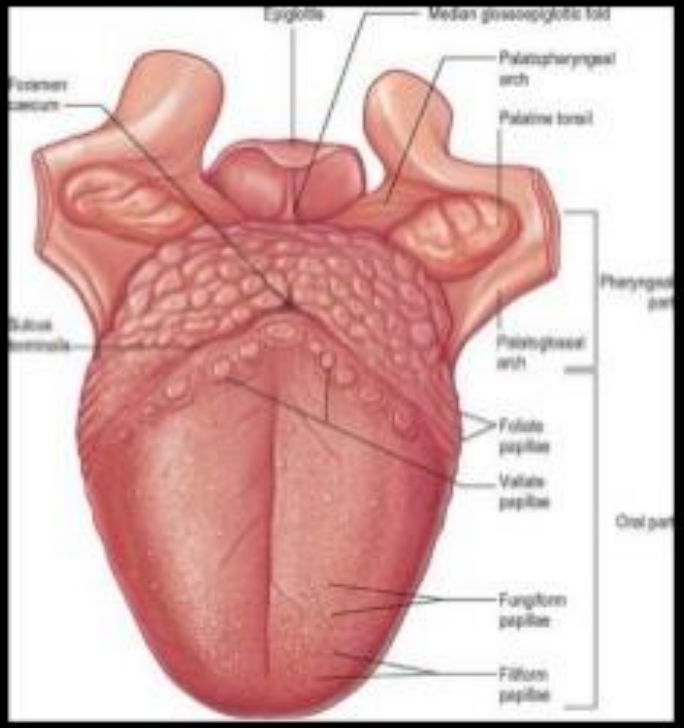
SITE OF TASTE

- Receptors are special chemoreceptors clustered in taste buds on tongue, palate, pharynx, epiglottis & upper 1/3rd of oesophagus.



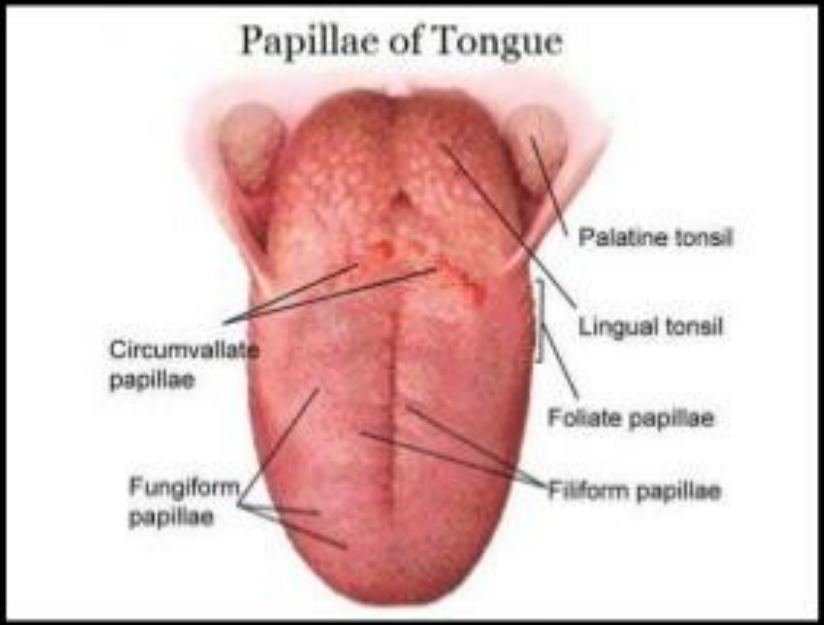
TONGUE

- Main site of taste sensation
- Mucous membrane contains numerous papillae which increases surface area of mucosa
- Taste buds located in wall of papillae.



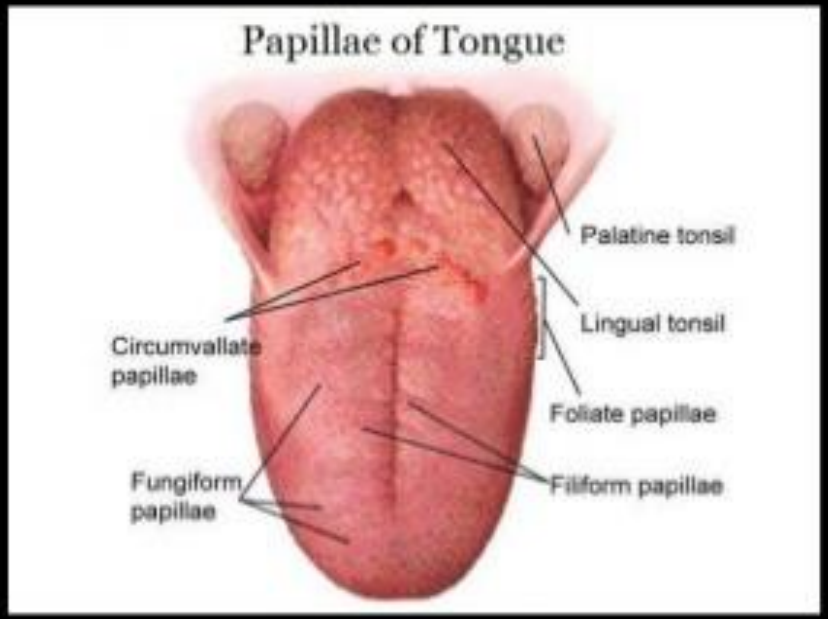
PAPILLAE

- Cicumvallate
- Fungiform
- Foliate
- Filiform



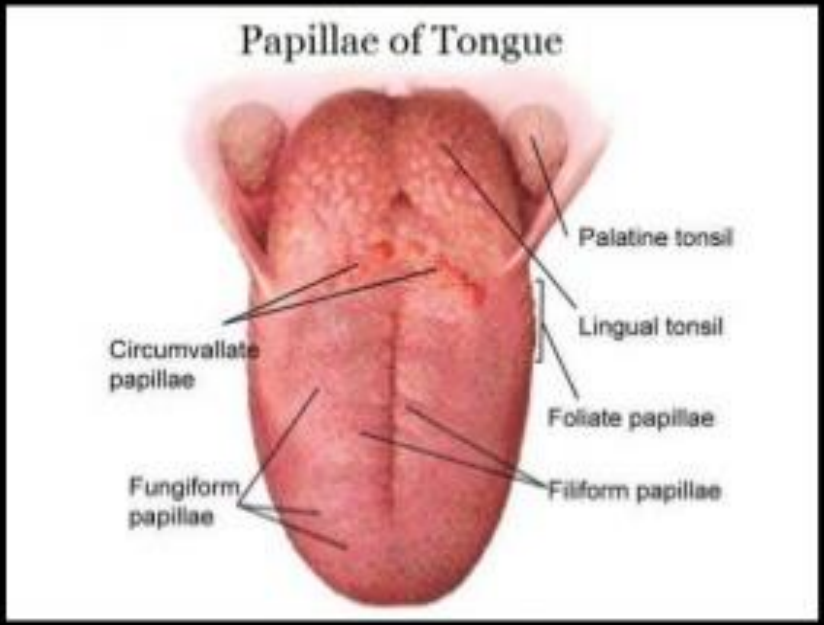
CIRCUMVALLATE

- Large 2-4 mm in diameter.
- **10-12 in numbers.**
- In a single row in front of sulcus terminalis.
- About 200 taste buds located around each papillae.



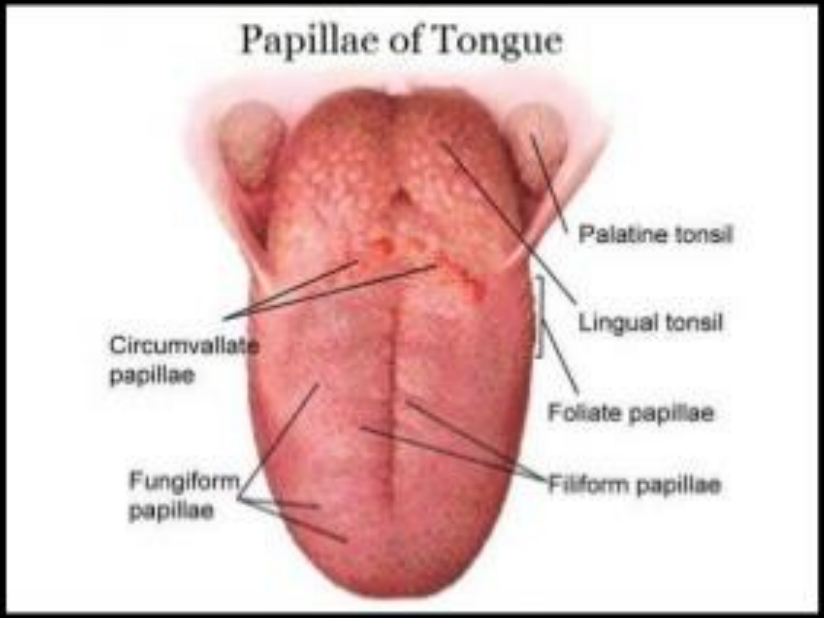
FUNGIFORM

- Bright red, flat dot like structure
- **Location** – ant 2/3rd, along the edges, dorsum & tip
- 1 mm in diameter
- about 8-10 taste buds around each papillae.



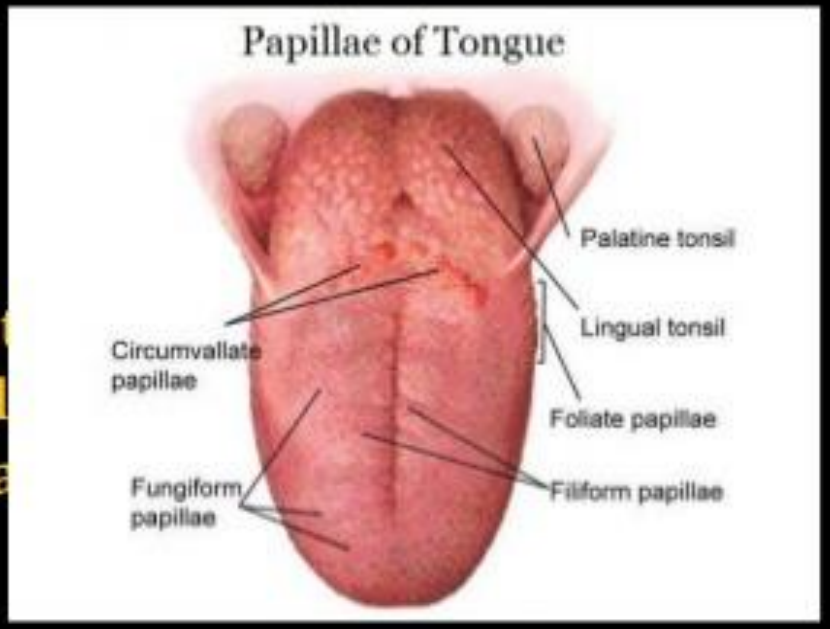
FOLIATE

- Transverse mucosal folds on posterolateral surface of tongue ant to circumvallet papillae
- Contains numerous taste buds.



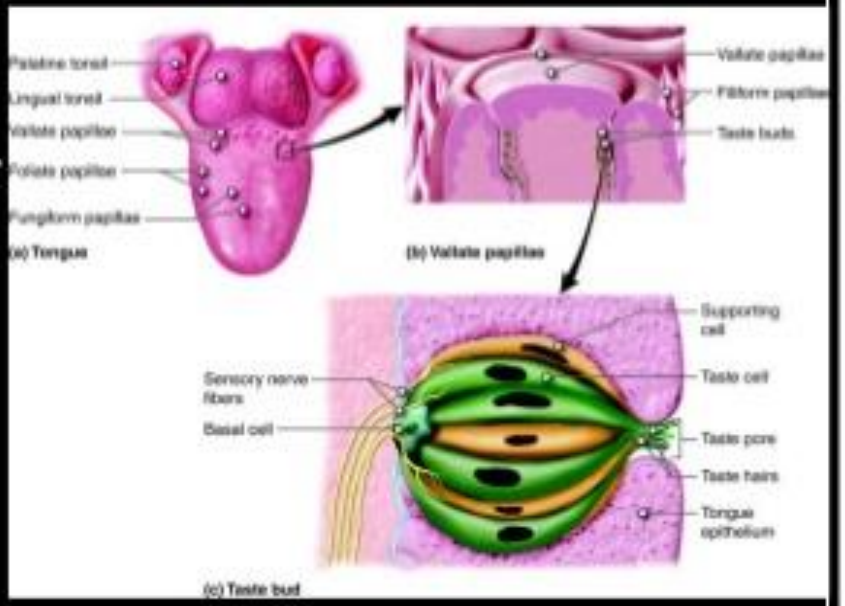
FILIFORM

- Small conical projections on dorsum of ant 2/3rd of tongue giving velvety appearance
- Arranged parallel to sulcus terminalis
- **Do not contain taste buds but play role in breaking up food particles so called mechanical papillae.**



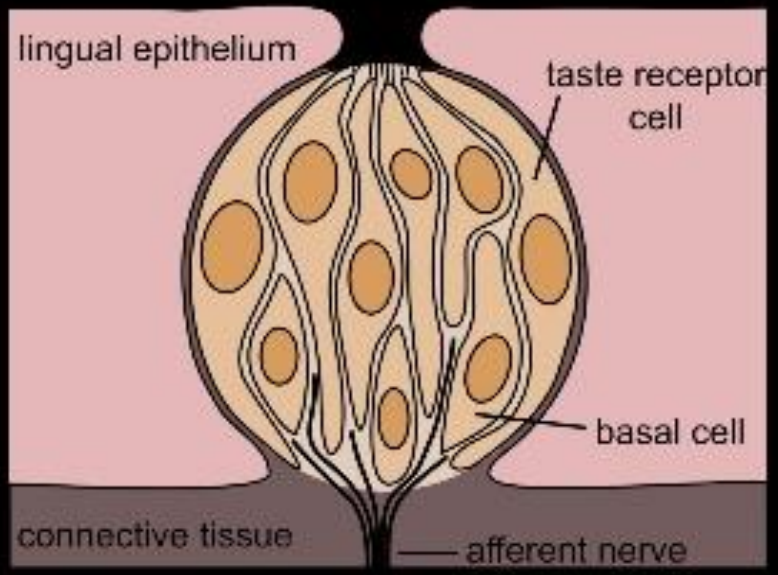
TASTE BUDS

- **STRUCTURE**
  - Barrel shaped
  - Contains small pore for substances to reach interior
  - Each about 50-70 µm in diameter.
- **Consists of**
  - Receptor cells
  - Basal replacement cells
  - Supporting cells



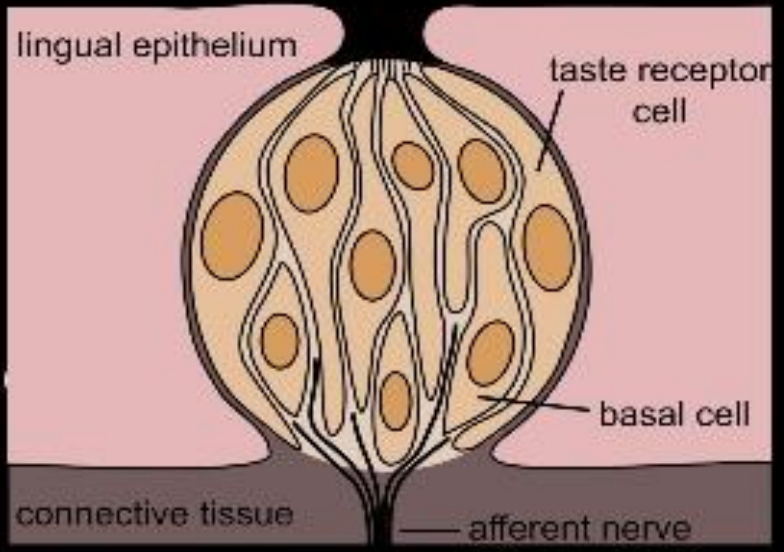
RECEPTOR CELLS

- **Each taste buds contains 100 receptors cells**



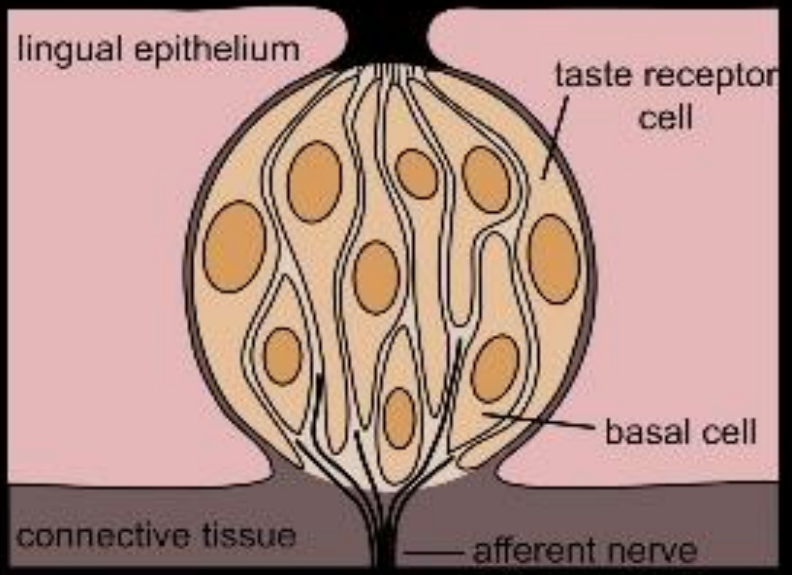
RECEPTOR CELLS

- **Characteristics**
  - Each cell elongate, bipolar shaped & extend from epithelial opening to base.
  - Short life span (10 days) & then replaced.
  - Their microvilli protrude int oral cavity & contact with saliva.
  - Innervated by sensory nerves.



BASAL REPLACEMENT CELLS

- Small round cell at the bottom of taste buds
- They are stem cells continuously differentiated into taste cells.

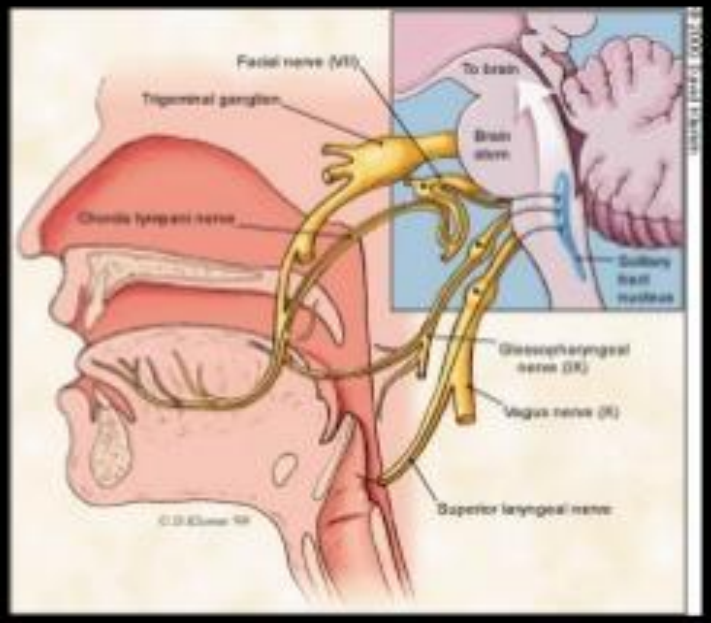


SUPPORTING CELLS

- Also called as **sustentacular** cells
- **Innervation –**
  - Sensory nerve fibre comes from branches of facial, glossopharyngeal & vagal nerve
  - Each taste buds innervated by 50 nerve fibres & each nerve fibre inturn receives inputs from all taste buds
  - Tactile & temperature receptors are innervated by trigeminal nerve.

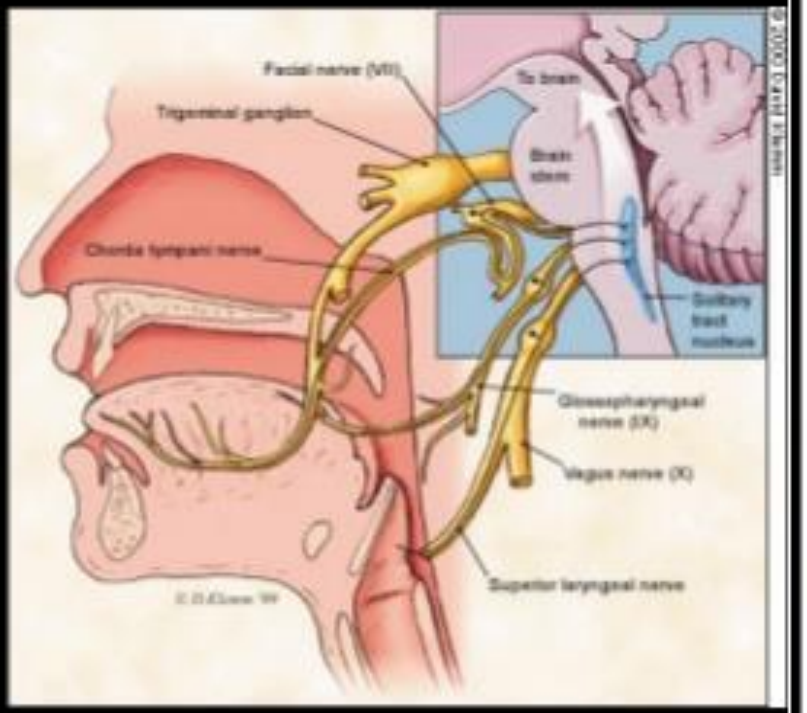
TASTE PATHWAY

- First order neurons
- Second order neurons
- Third order neurons



FIRST ORDER NEURONS

- Cell bodies are located in different ganglia of **7th, 9th & 10th cranial nerves.**
- From taste buds of ant **2/3rd** of tongue by branches of **chorda tympani nerve, branch of facial nerve** – cell bodies in **Geniculate ganglion.**

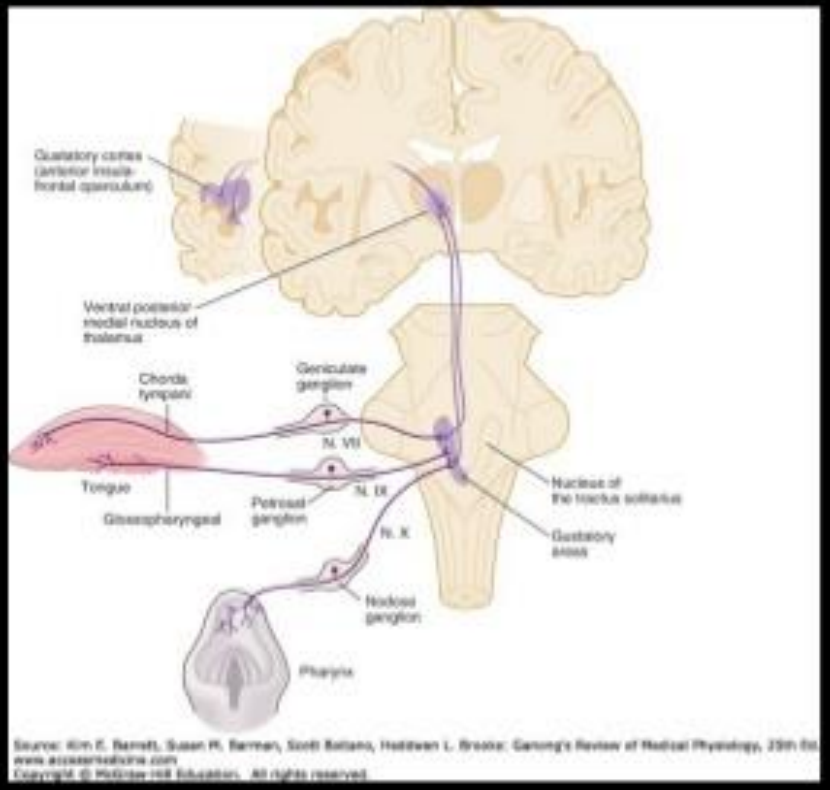


FIRST ORDER NEURONS

- From taste buds of **post 1/3rd of tongue** by Glossopharyngeal nerve – cell bodies in **Superior & inferior ganglion** of this nerve.
- From taste buds on **pharyngeal aspects of tongue, epiglottis, hard & soft palate** – Vagus nerve - cell bodies in Superior & **Inferior ganglion** of this nerve.
- All terminate in the **Nucleus of tractus solitarius.**

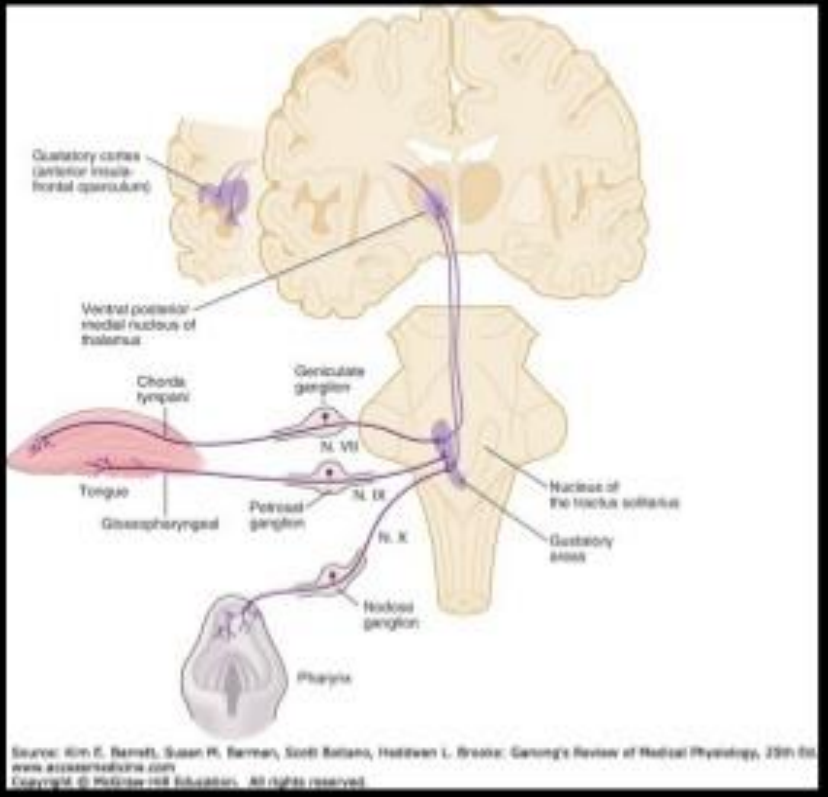
SECOND ORDER NEURONS

- Start from nucleus of tractus solitarius – cross midline join **Medial leminiscus**
- Terminate with 5th cranial nerve in **ventral posterior medial nucleus of thalamus.**



THIRD ORDER NEURONS

- From ventral posterior medial nucleus of thalamus
- Terminate in inferior part of post-central gyrus – **Taste cortex.**



PHYSIOLOGY OF TASTE

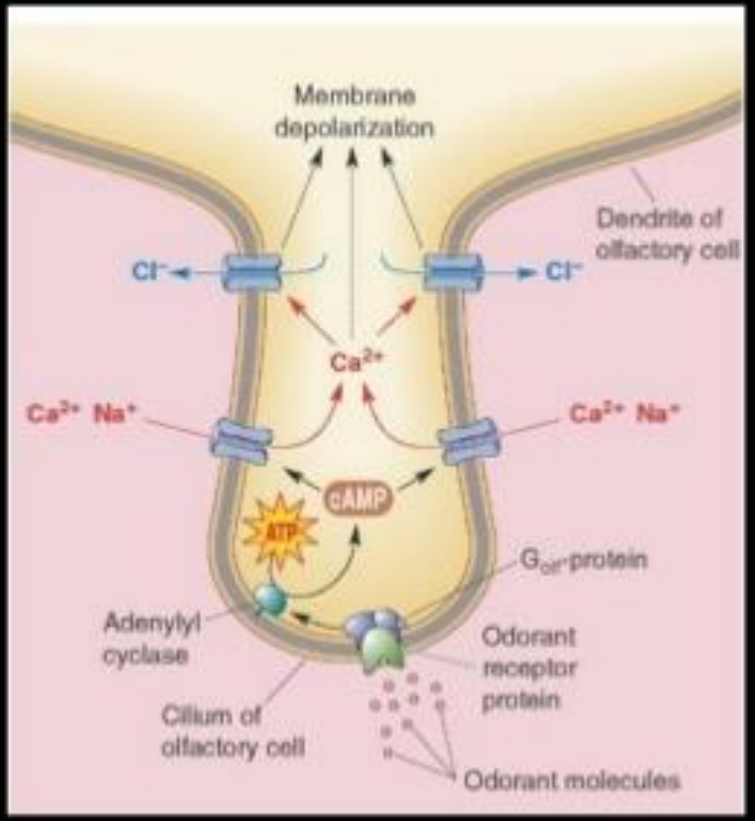
- Gustatory stimuli.
- Types of stimuli & Most sensitive areas of tongue.
- **10000** taste buds, after 45 years age decreases
- Sensations basically 4 – **sweat, sour, bitter & salty** & recently **Umami**.

SUBSTANCES PRODUCING PRIMARY TASTE SENSATIONS

- **Sweet** – by sugars, Glycols, alcohols, aldehydes, esters
- **Salty** – anions of iodized salts (Nacl)
- **Sour** – acids,
- **Bitter** – alkaloids, quinine, caffeine, nicotine, strychnine.
- **Umami** – glutamate in asian cooking.

TRANSDUCTION OF GUSTATORY STIMULI

- **Site** – receptors
- Dissolved substances acts on micro villi, depolarize the cells directly or via second messengers
- Develop receptor potential & generate action potential.

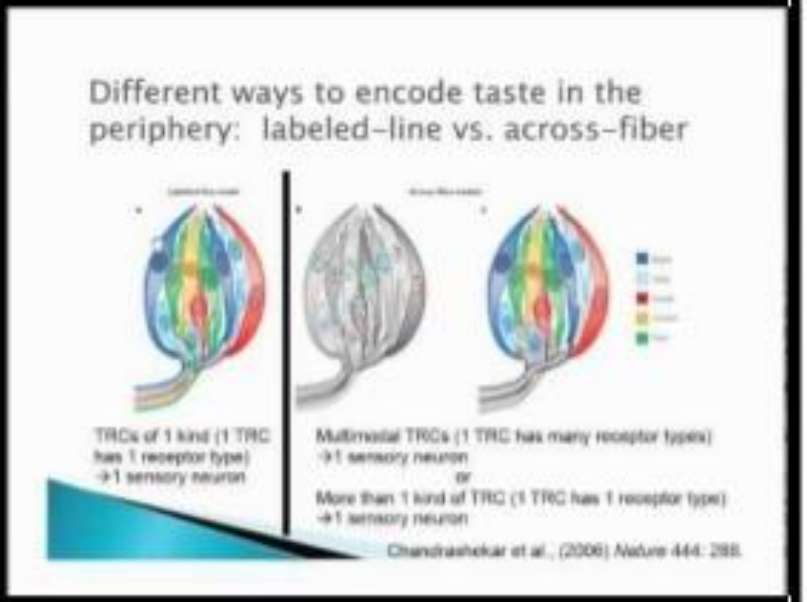


TRANSMISSION OF INFORMATION TO CORTEX.

- **Tastants** – Transduced into receptor potential – induces action potential – releases NT between taste cells & sensory nerve fibres – impulses to gustatory area of nucleus of tractus solitarius – to thalamus – to gustatory cortex.

ENCODING OF TASTE INFORMATION

- Its not simple, labeled line chemical system but by unique pattern of inputs from different cells .

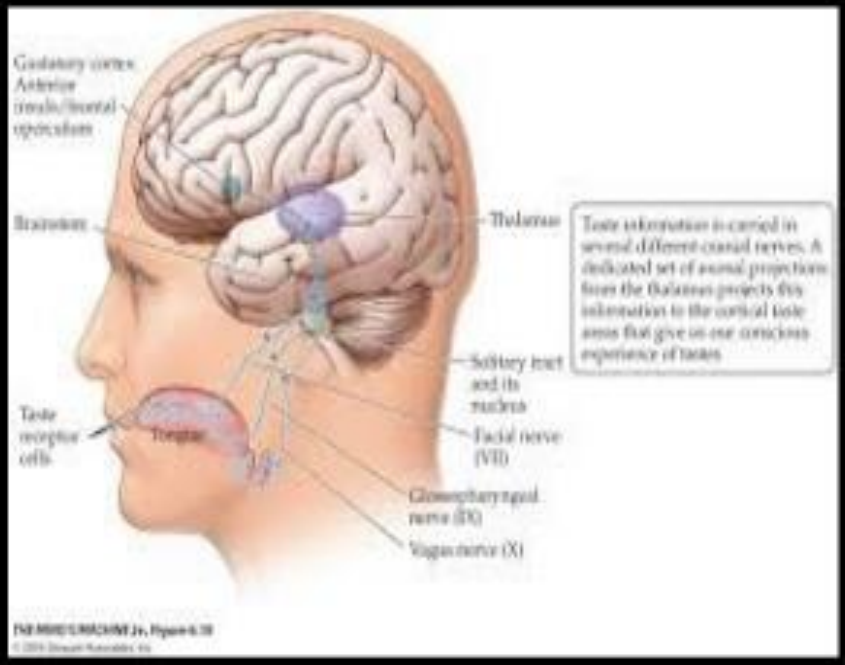


TASTE THREHOLDS AND INTENSITY DISCRIMINATION

- **Taste threshold** – salty needs 0.001 M, bitter 0.000008 M
  - Serves as protective function
- **Intensity discrimination** – its crude
  - 50% change is needed

SENSATION OF FLAVOURS

- **Gustatory inputs**
- **Olfactory inputs** – Volatile molecules released by food go to back of nasal cavity
- **Somatosensory inputs**
  - This includes texture & temperature as well as pain by spicy & minty foods.



PHENOMENON OF VARIATION AND AFTER EFFECTS IN TASTE SENSATION.

- Taste sensations exhibit after reactions & contrast phenomena
- Similar to visual after images & contrast.
- Some due to chemical tricks & others due to **true central phenomenon**.

FACTORS INFLUENCING TASTE SENSATION

- Area of stimulation.
- Temperature of Tastants
- Age of the person
- Sex – female more sensitive to sweet & salt.
- Adaptation
- Interaction between taste producing substances.
- Effect of taste modifying proteins – Miraculin in west african plant, it makes acid taste sweet.
- Abnormalities of taste sensations.

ABNORMALITIES OF TASTE SENSATIONS.

- **Ageusia** – absence of taste sensation
- **Causes**
  - Lesion of Mandibular division of trigeminal nerve.
  - Lesion of facial nerve
  - Lesion of glossopharyngeal nerve
  - Drugs – Penicillamine, captopril
  - Familial dysautonomia.

ABNORMALITIES OF TASTE SENSATIONS.

- **Hypogeusia** – Diminished taste sensitivity
- **Dysgeusia** – disturbed sense of taste, in temporal lobe syndrome
- **Selective taste blindness –**
  - Inherited autosomal recessive trait
  - Increased threshold for phenyl thiocarbamide (bitter taste)


THANKS!