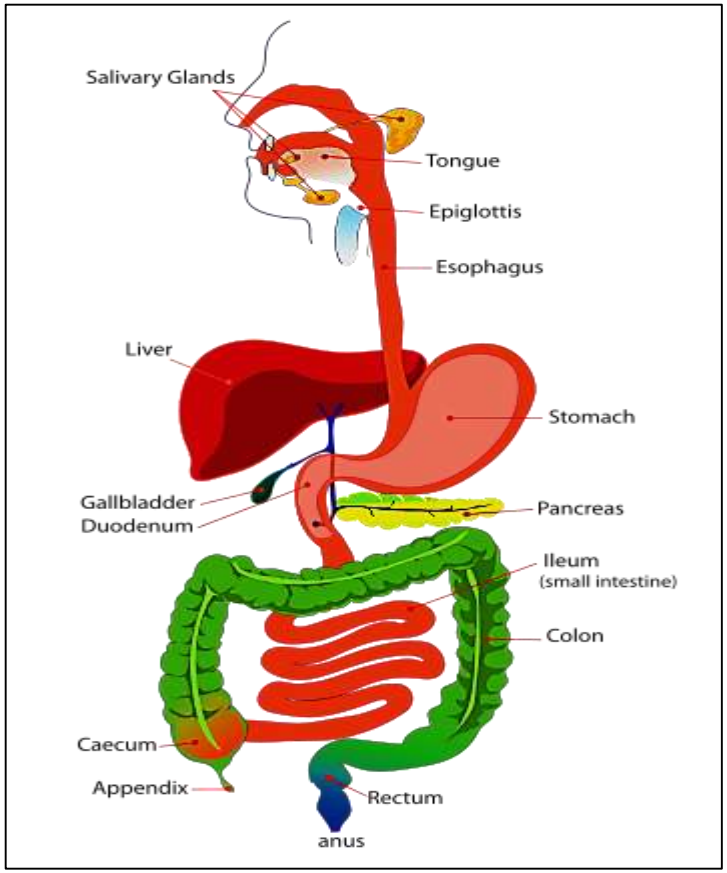
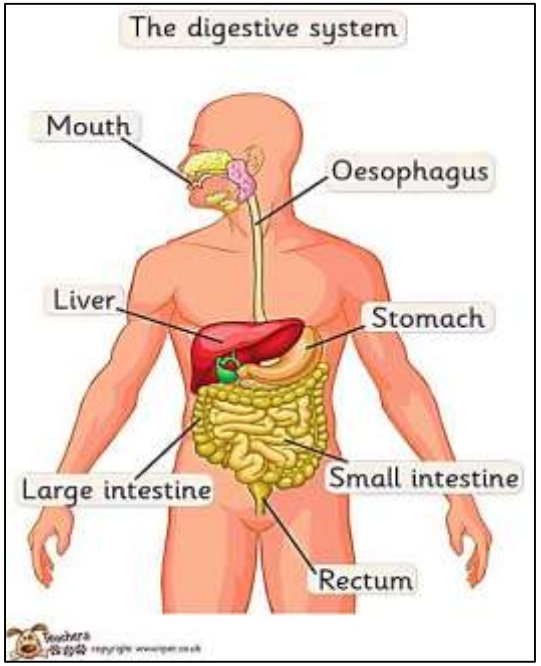
The digestive system



Digestive system



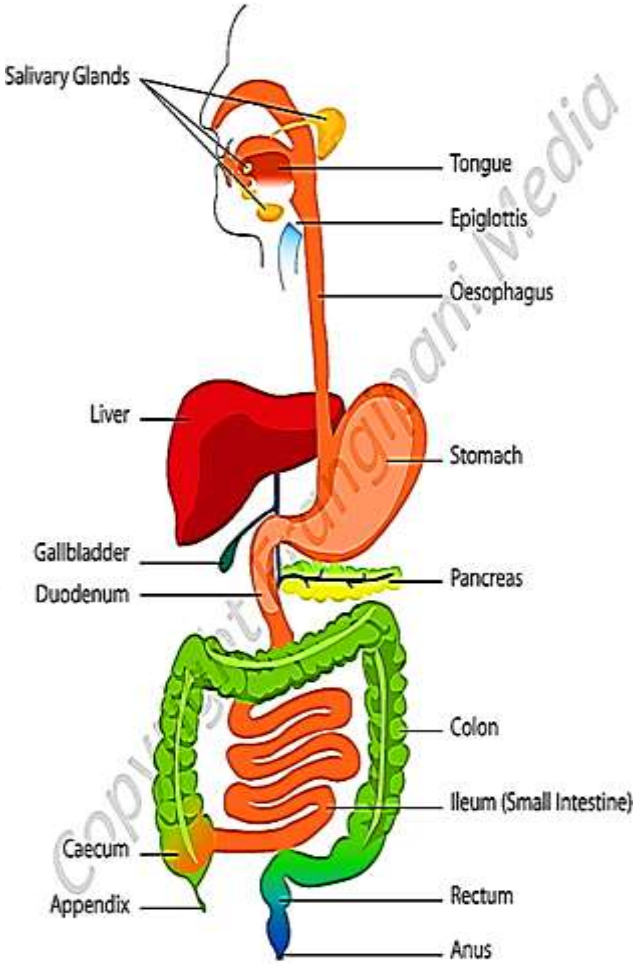
1. Oral cavity

2. Digestive tract

3- glands

Parts of the digestive system:

- **The oral cavity** (lips, tongue, teeth & salivary glands)
- **The alimentary canal** (esophagus stomach, small/ large intestine, & anal canal)
- **The associated glands** (liver, pancreas)

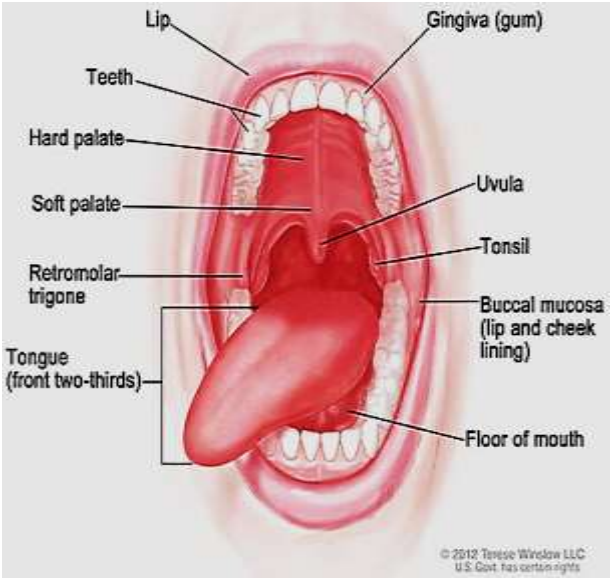


Function of digestive system:

- Ingestion & fragmentation of food……..oral cavity
- Digestion…… oral cavity, salivary glands, stomach, small intestine, liver & pancreas
- Absorption…… small intestine (food) & large intestine (water)
- Elimination of waste products…… anal canal

The mouth (oral) cavity

- contains the lips, tongue, gingiva , the teeth



- The ducts of **major** & **minor** salivary glands open into the oral cavity

- The oral cavity is lined by *mucous membrane* → formed of 2 layers:

a- **Epith** : stratified squamous. its cells rich in glycogen
(Keratinized or non- keratinized)

b- **Lamina propria**: loose C.T. under the epith. contains minor salivary glands , B.V. & lymphatics , nerves

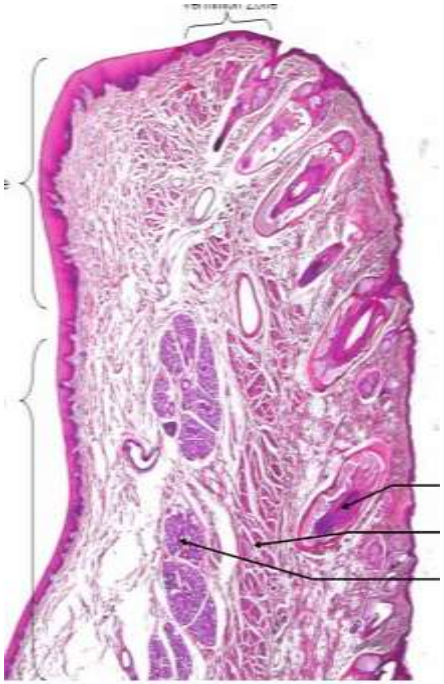
- Gum (gingiva): is the mucous membrane (m.m.) which adherent to the periosteum of the alveolar bone of the teeth. Covered with keratinized stratified squamous epithelium

- The lip: has

  a- **External surface** covered by skin

  b- **Internal surface** covered by m.m.

  c- **The inside** of the lip contains bundles of skeletal ms (orbicularis oris) & fibro-elastic C.T.



(Inside)

(outside)

Structure of lip:

A- Internal surface: covered by m. m.

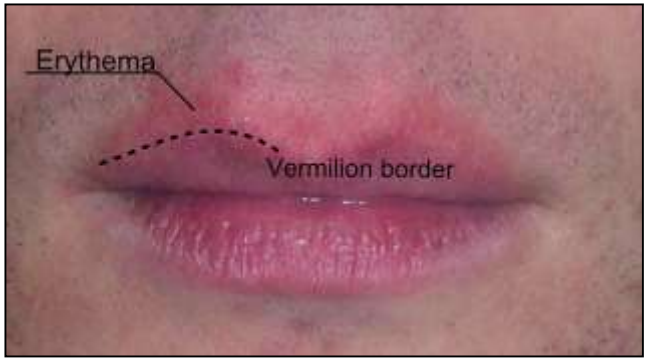
- Epith: Non- keratinized stratified squamous
- Lamina propria: loose C.T., contains B.V., lymphatics, nerves, labial glands *

B- External surface: covered with thin skin (keratinized stratified squamous epith.) contains hair follicles, sebaceous, & sweat glands

C- Red margin of lip : covered with modified skin, *thin* (less keratinized, No hair follicles, No sebaceous or sweet gland. *Transparent*. *Red* due to the reflection of the underlying B.V.

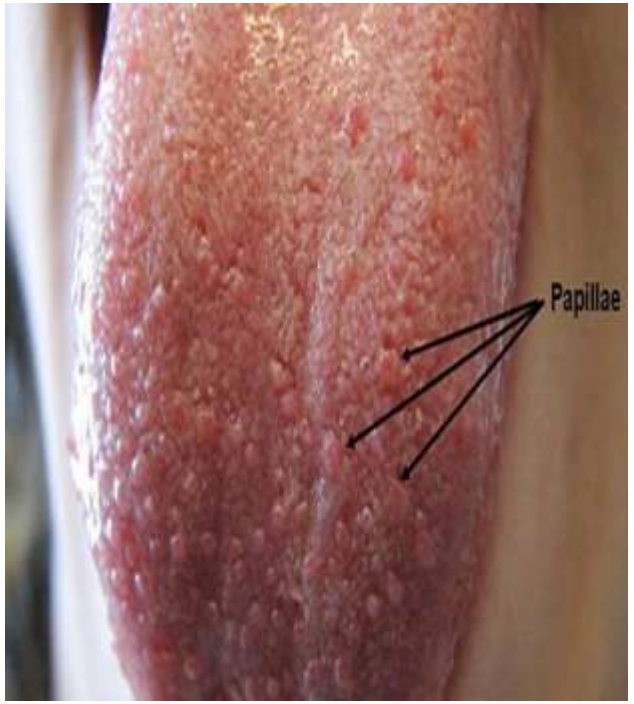
The lip margin (vermilion) represent the change in the epidermis from highly keratinized face skin to less Keratinized lip skin. richly supplied e free nerve endings. So it is *highly sensitive*.

(herpetic stomatitis : HSV type I)



The tongue: **(highly mobile muscular organ)**

- Made of interlacing bundles of **skeletal ms**. (4 intrinsic & 4 extrinsic) covered on both surfaces with m.m.



1- The dorsum of the tongue

is covered e parakeratinized stratified squamous epithelium firmly attached to underlying C.T. that contains B.V., nerves, lymphatics (**minor Salivary gland**)

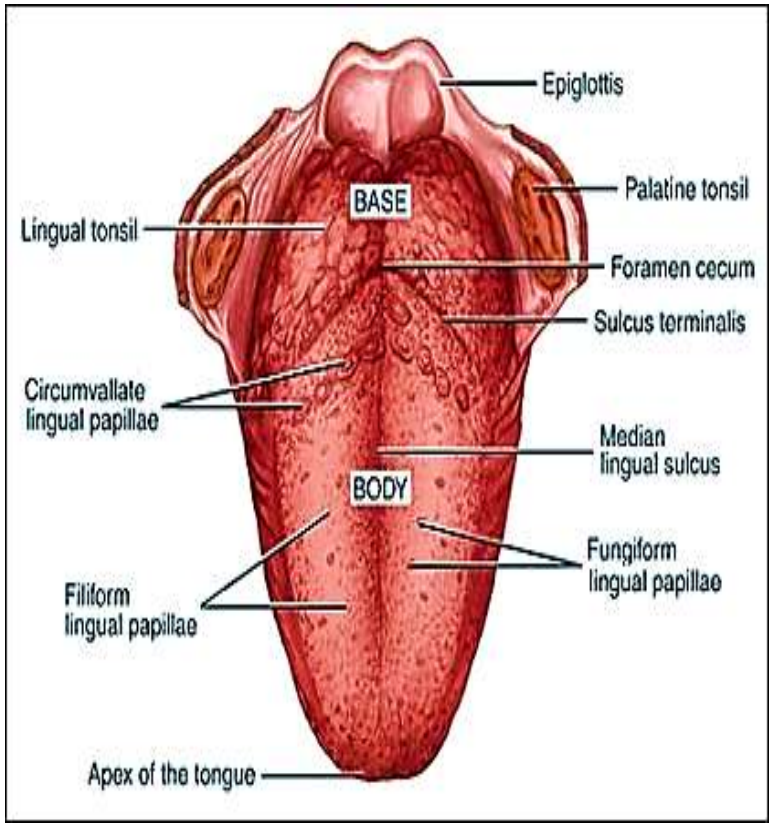
- The ant 2/3 of dorsum of the tongue contains projections called papillae & post 1/3 contains lingual tonsil

Sulcus terminalis : V- shaped groove on the dorsal surface of tongue

- It divides the tongue into:

  body (oral): ant. 2/3

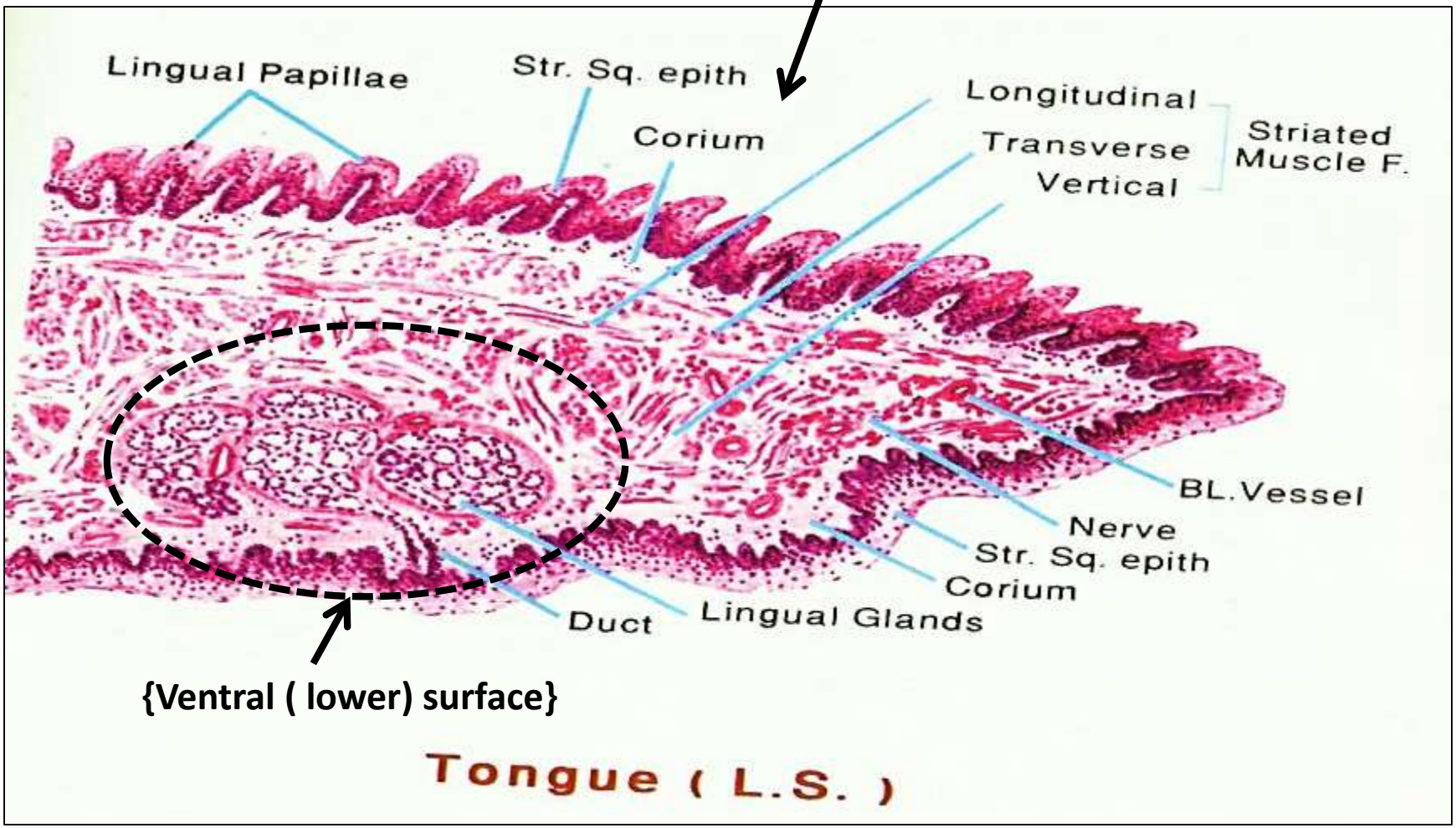
  base (pharyngeal): post. 1/3



2- The ventral surface of tongue is covered e m.m. loosely attached to underlying C.T. e NO papillae & is covered with non- keratinized stratified squamous epithelium

- **Lingual glands** are embedded in C.T. of ventral portion

{Dorsal (upper) surface}



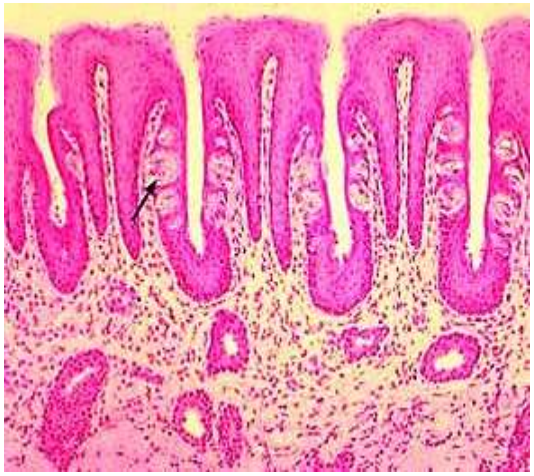
Structure of the tongue

Lingual papillae:

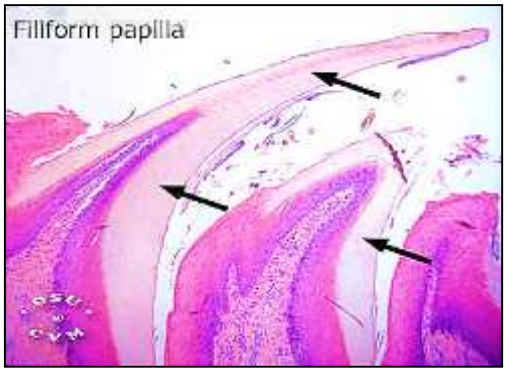
- Little projections of the m.m. of the dorsal surface of the tongue
- Each is formed of central core of C.T. covered with stratified squamous epithelium

- There are 4 Types:

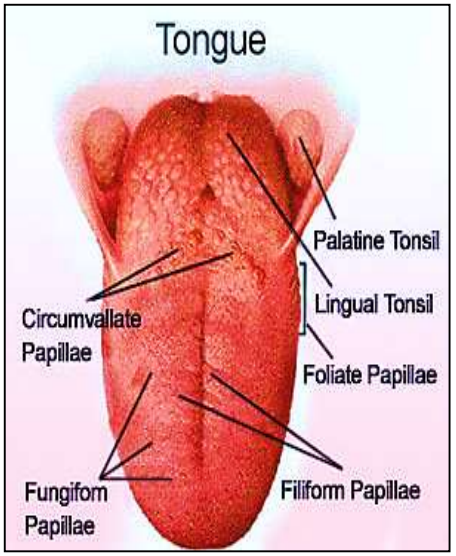
1. Filiform papillae
2. Fungiform papillae
3. Circumvallate papillae
4. Foliate Papillae



○ Filiform papillae:

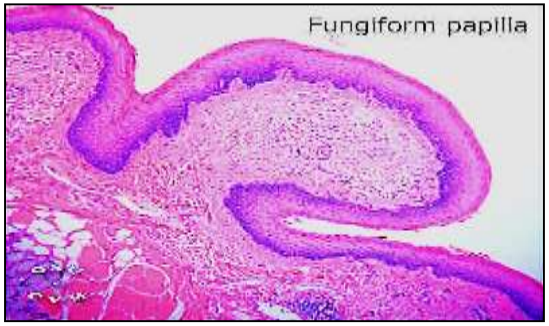


- Conical shape, contain NO taste buds
- Formed of C.T. core covered e keratinized stratified squ. epithelium
- Numerous in number found on ant. 2/3 of tongue

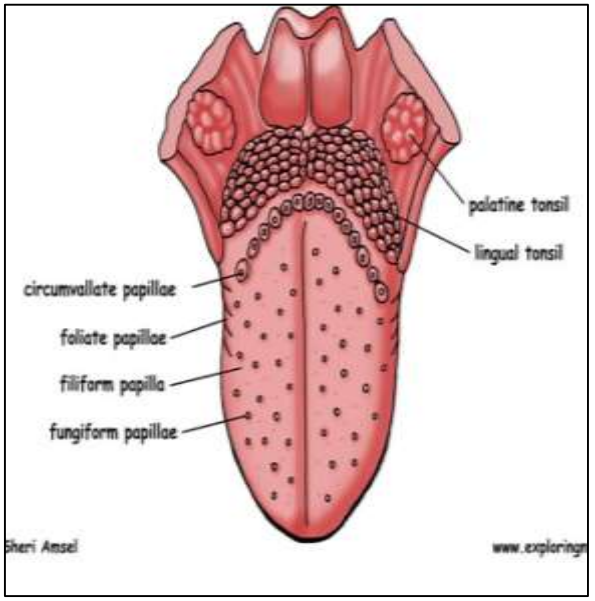


○ Fungiform papillae:

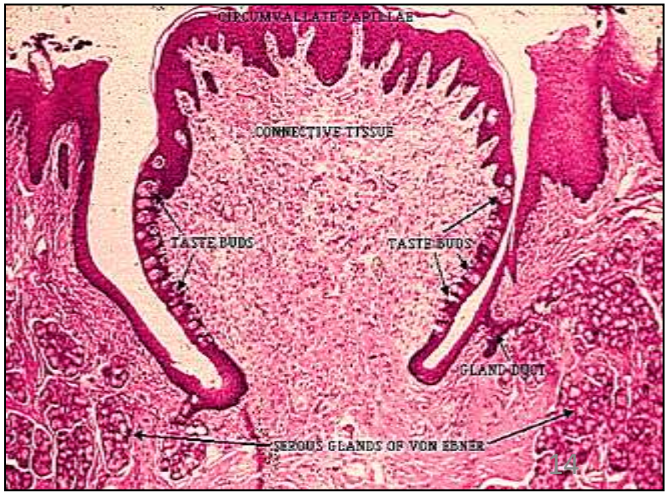
- Mushroom- shaped, very vascular found on ant 2/3 of tongue among Filiform papillae
- Their covering epith is Non- k.st.squ. red due to presence of many B.V. in underlying C.T.
- Contain taste buds on superior surface



○Circumvallate papillae:

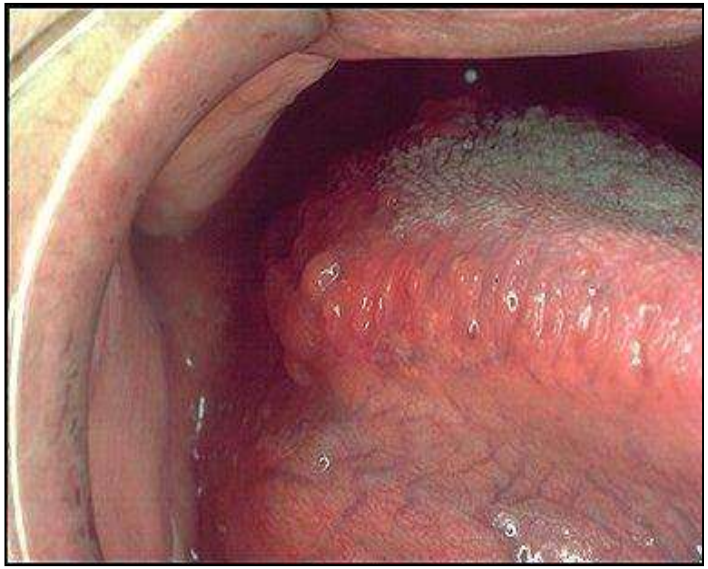


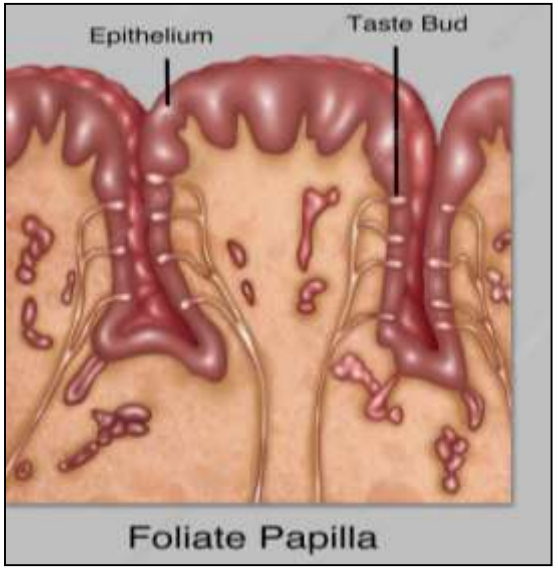
- Largest, circular papillae, 10- 15 in # ,
  Found in front of the sulcus terminals
- They don't project on the surface
- deep in their C.T.
- Each one is surrounded e groove (trench = furrow)
- They contain Von Ebner glands (serous, begin lipid hydrolysis)
- They covered e Non- k.st.squ.epith
- Taste buds present on the lateral sides of these papillae



○ **Foliate papillae**:

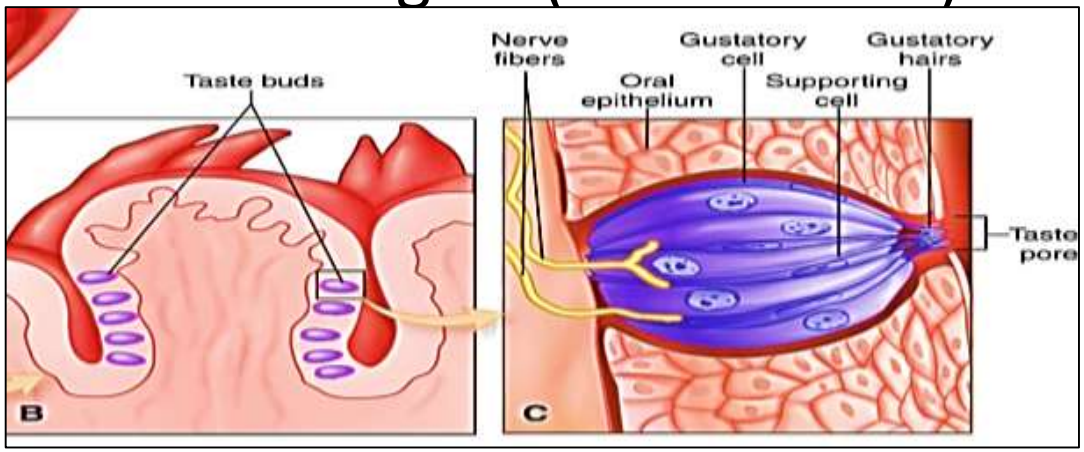
- Formed of short vertical folds, found on sides of tongue
- covered e non- k. stratified squamous epithelium
- Each papillae is separated by groove and contains many taste buds
- This type is at high risk for oral cancer

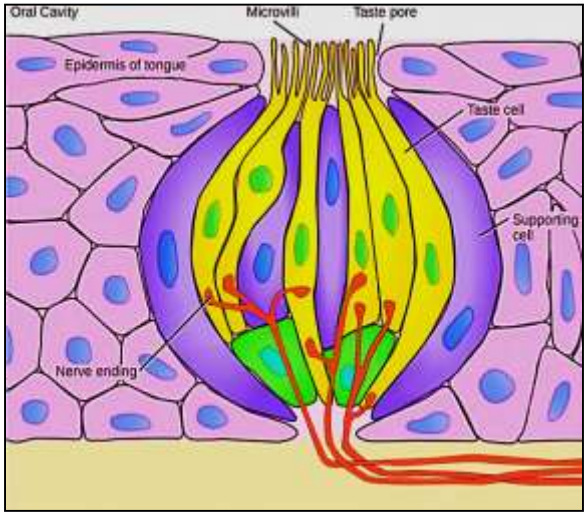




Taste buds (neuroepithelium)

- Oval structures present in the lingual papillae on dorsal surface of tongue (2000 – 8000)





- Each taste bud formed of **3 types of cells** & **taste pore** for passage of saliva:

1- **Sensory (taste, gustatory) cells: 50- 100 cells / bud**

2- **Supporting cells**

3- **Basal cells (stem cells)**

- Neuro-epithelial (taste, chemoreceptors) cells:

a. Tall columnar cells, central in position, 3 types I, II, III
b. Their apical surface terminate e fine filaments called gustatory hairlets which project into the gustatory pore
c. The base of the cells has vesicles that contain neurotransmitter & synapse with afferent nerve fibers

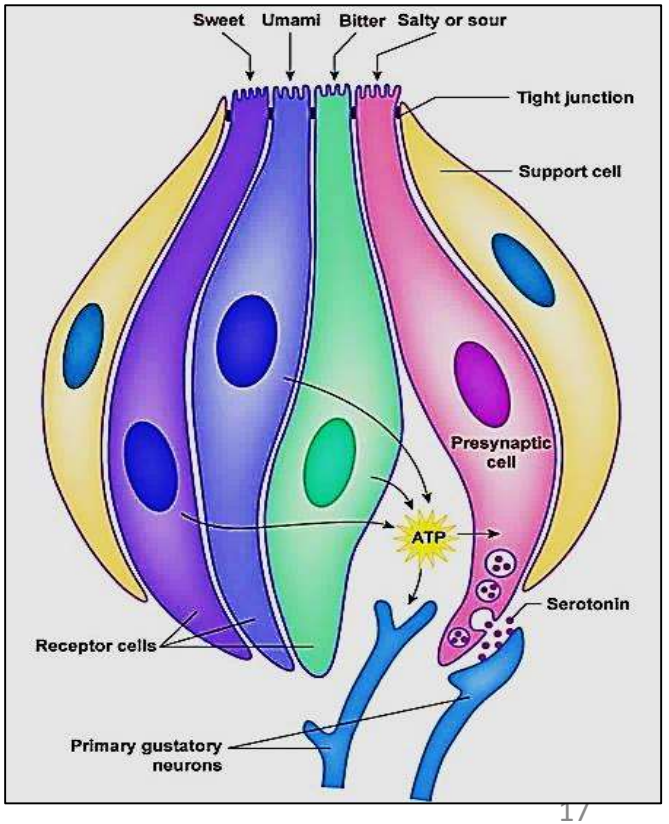
- The supporting cells

Tall columnar cells form the outer wall of the taste buds

- Basal cells:

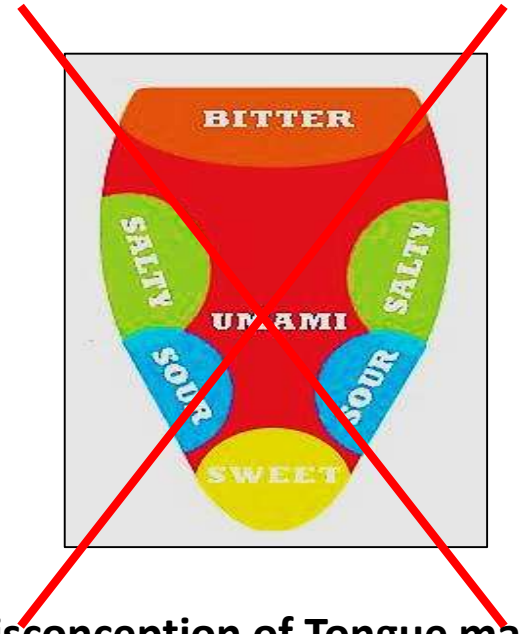
found at the base of taste bud act as a stem cells for regeneration

The average life of a taste bud is 10 days

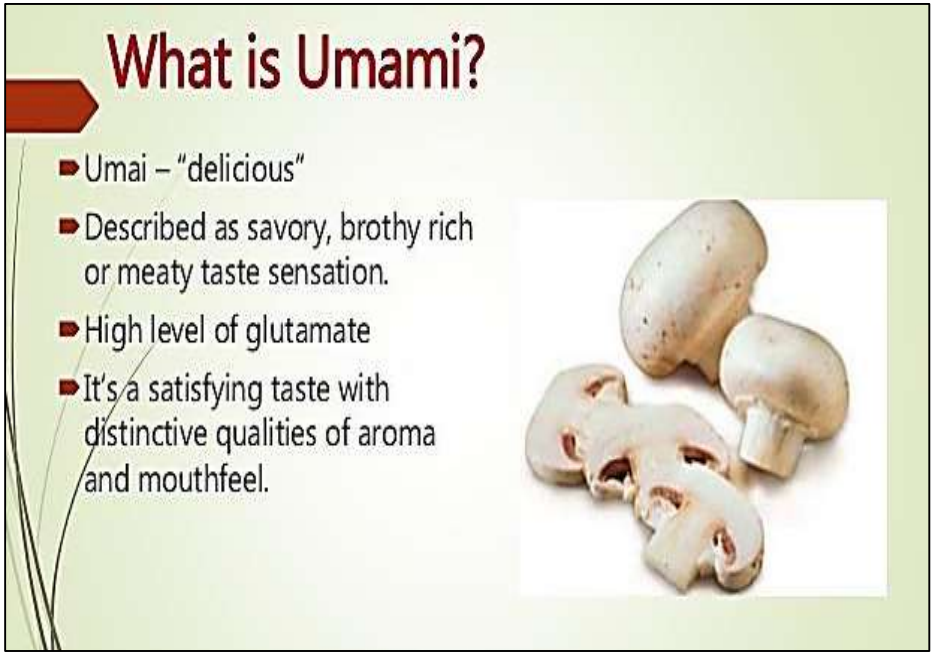


The sensation of taste can be categorized into five basic tastes: sweet, sour, salt, bitter, and umami.

Each taste bud contains a variety of chemoreceptors that recognize all tastants, but each taste cell appear to be specialized to respond to only one or two of the tastants.



Misconception of Tongue map



- **is spicy a taste ?**
- **Spiciness is <u>not a taste</u>**

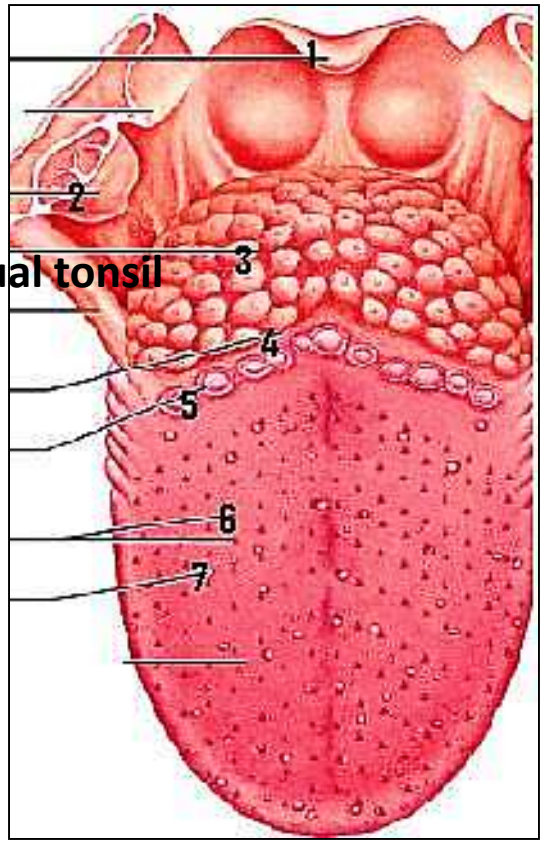
- **The spicy taste is a combination of hot and pain sensations**
- **The active ingredient in chilli peppers** (spicy food) is called **Capsaicin**
- This substance binds to <u>receptor</u> on the tongue called **vanilloid receptors** .. these receptors detect **pain and heat** and send signals to the brain... the brain send signals to numb the tongue
- Sometimes you may notice after you have eaten a lot of spicy food that the spiciness doesn't affect you as much because the receptor stop responding .. the phenomena is called **Capsaicin desensitization .. Spicy food does not damage the taste buds**

- Eating spicy food read by the body as a pain sensation your pituitary gland to release **<u>endorphins</u>** which make us enjoy eating spicy food

Lingual tonsil:

- The post 1/3 of tongue has No tongue papillae

- Under its non-keratinized stratified squamous epithelial covering there is lingual tonsil



- It is formed of groups of lymphoid follicles

- Assist the immune system in the production of antibodies in response to invading bacteria or viruses

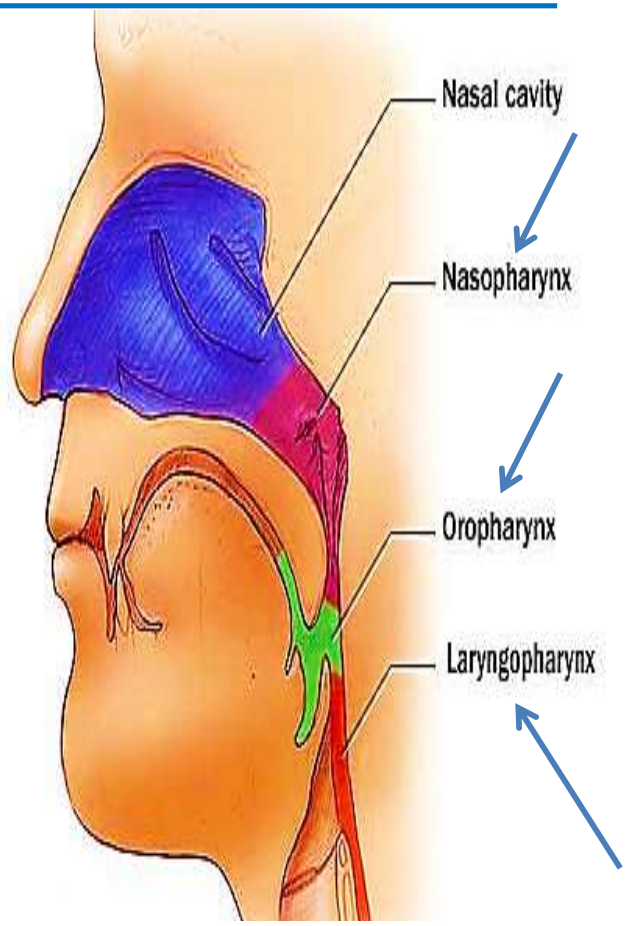
Pharynx:

- Divided into 3 parts:

1- Nasopharynx: lined e pseudo- stratified columnar ciliated epith.

2- Oropharynx : lined e non- keratinized Stratified squamous epith.

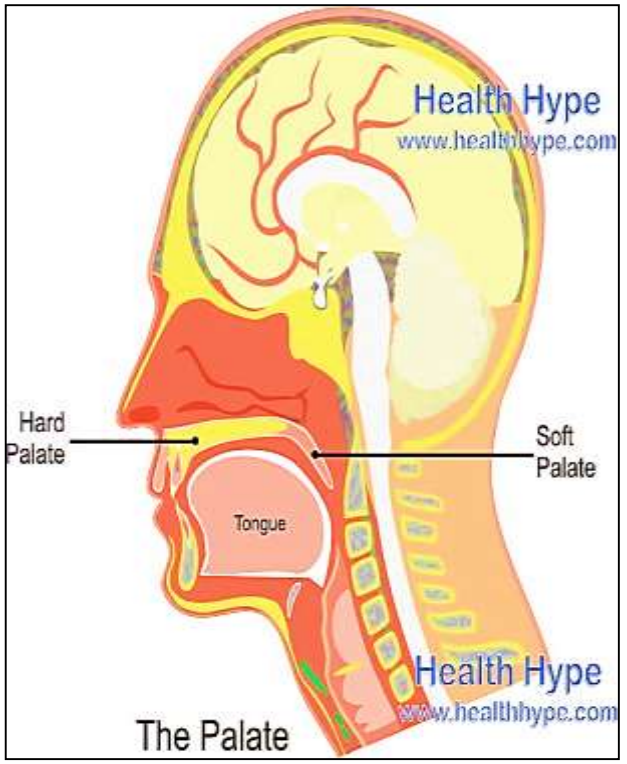
3- Laryngo-pharynx: as oropharynx



The palate:

The roof of the oral cavity composed of:

- Ant part → hard palate
- Post part → soft palate



Hard palate:

- Formed of bone lined e keratinized stratified squamous epith.

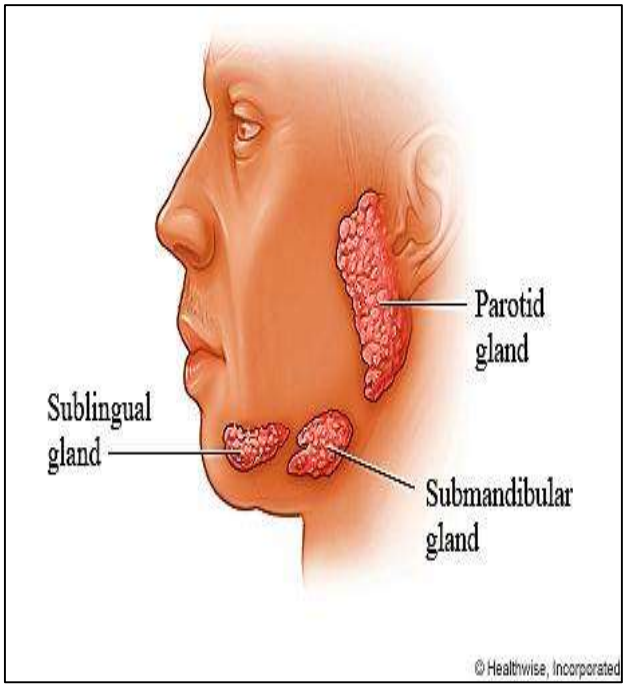
Soft palate:

- Covered e non – keratinized stratified squamous epith

The salivary glands

Types of salivary gland:

A. The main = large = extrinsic
B. The accessory = small = Intrinsic



A- The main salivary glands

- 2 Parotid glands in front of both ears
- 2 Submandibular gland: lie against the inner aspect of the mandible
- 2 Sublingual glands: lie below the tongue in the mucous membrane of the floor of the mouth

B- Accessory salivary gland

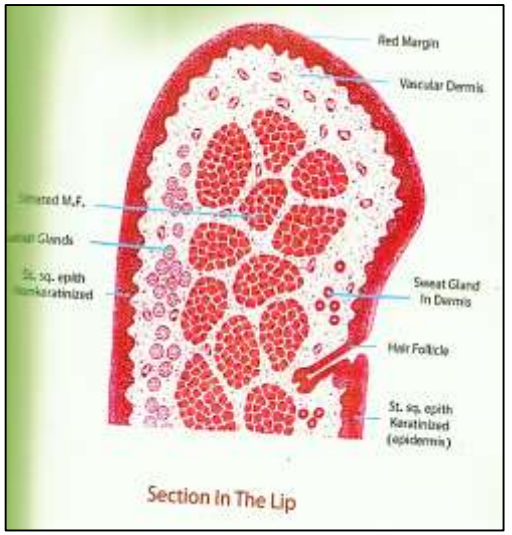
- Small, microscopic glands scattered in the C.T. of the oral mucous membrane:

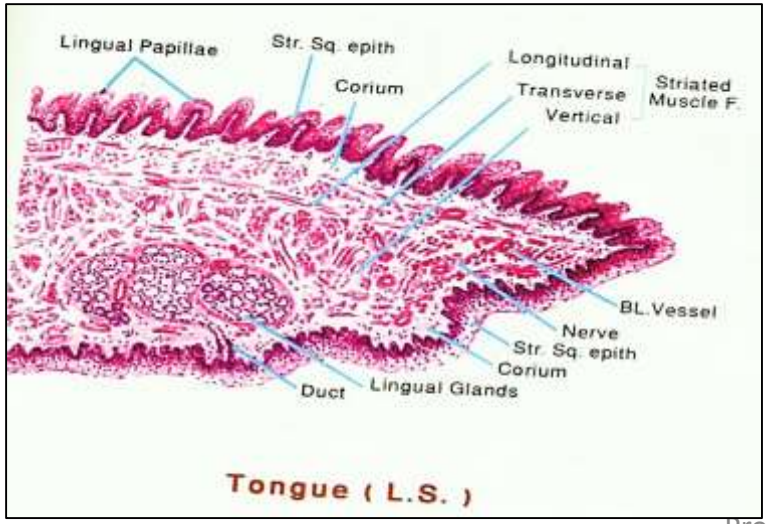
I. The lips → labial glands

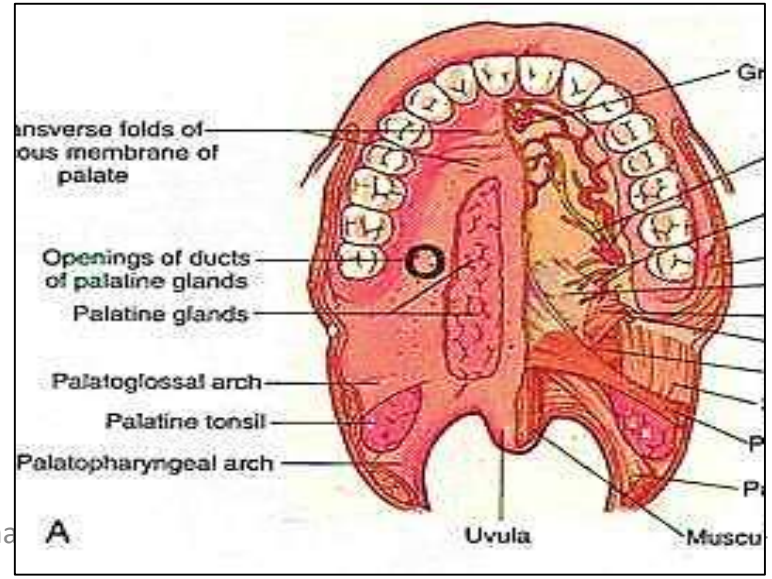
II. Tongue → lingual glands

III. The palate → palatine glands

- They secret saliva (10%) constant rate
- Their secretion is mainly mucous



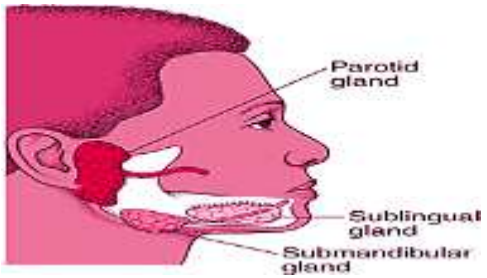




Salivary glands

- Exocrine glands, produce the saliva (90%) (pH 6.5 – 7.5)

(99.5% :water & 0.5% : electrolytes, mucus, enzymes & Ab)



- Saliva has the following functions:

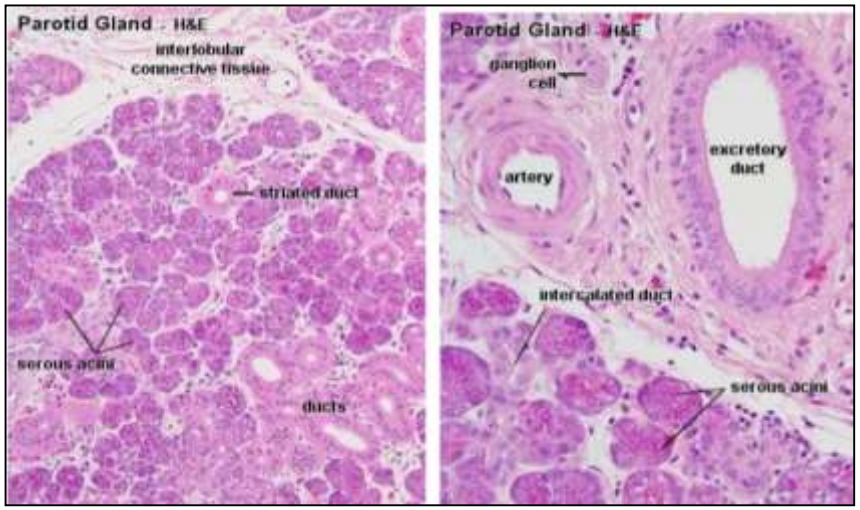
1. Lubricates & cleans the oral mucosa & the lips
2. Initiate digestion of carbohydrate & lipids (amylase & lipase)
3. Contains antimicrobial agents IgA, lysozyme, Lactoferrin that control the bacterial flora of the oral cavity
4. Act as solvent substance that stimulate taste buds
5. Assist in swallowing

Structure of the salivary glands

Stroma & Parenchyma

A- Stroma

C.T. framework supports the gland and transmit the blood vessels ,nerves, lymphatics, & ducts



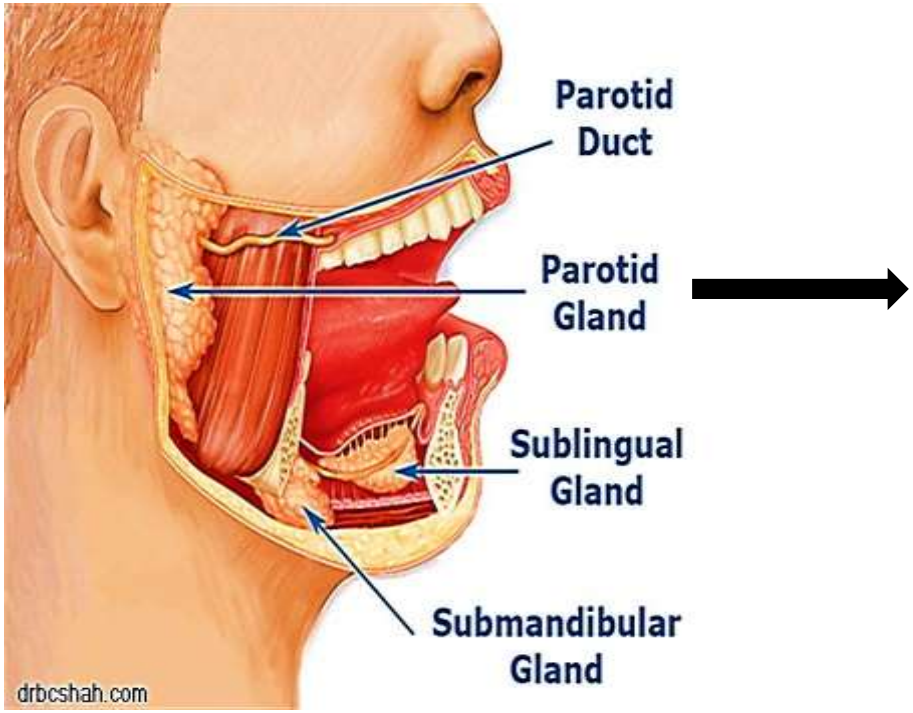
- It consists of:
  - Capsule: covers the gland from outside
  - Septa : divide the glands into lobes &lobules
  - Reticular network: present in the background of the gland (stained e Ag)

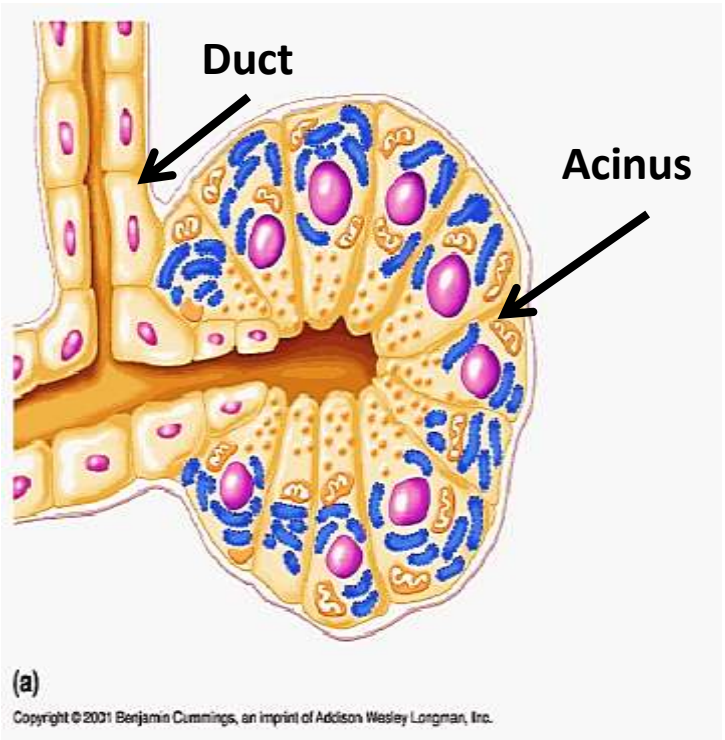
B- Parenchyma

Includes:

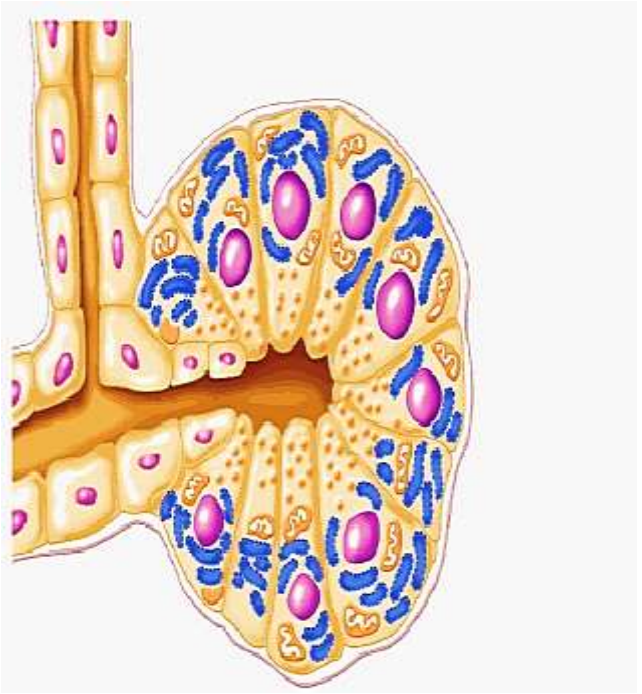
A- Secretory units (salivary acini) → secrete saliva

B- Duct system → conduct saliva to the oral cavity





A- Secretory acini



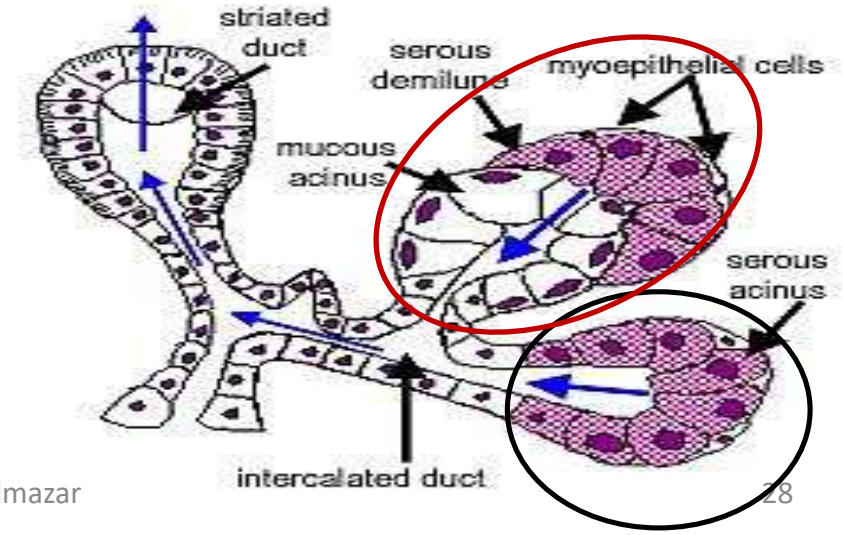
- Group of cells encircling a lumen
- 2 types of cells:

  a- Secretory cells (serous or mucus)

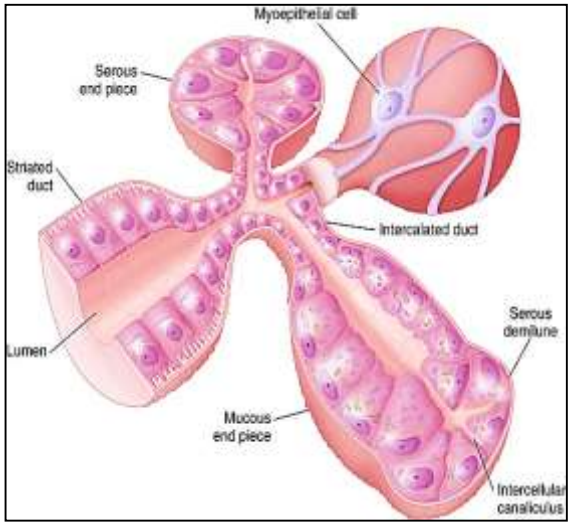
  b- Non- secretory cells (Myoepithelia)

- According to the **type** of secretion the acini divide into:

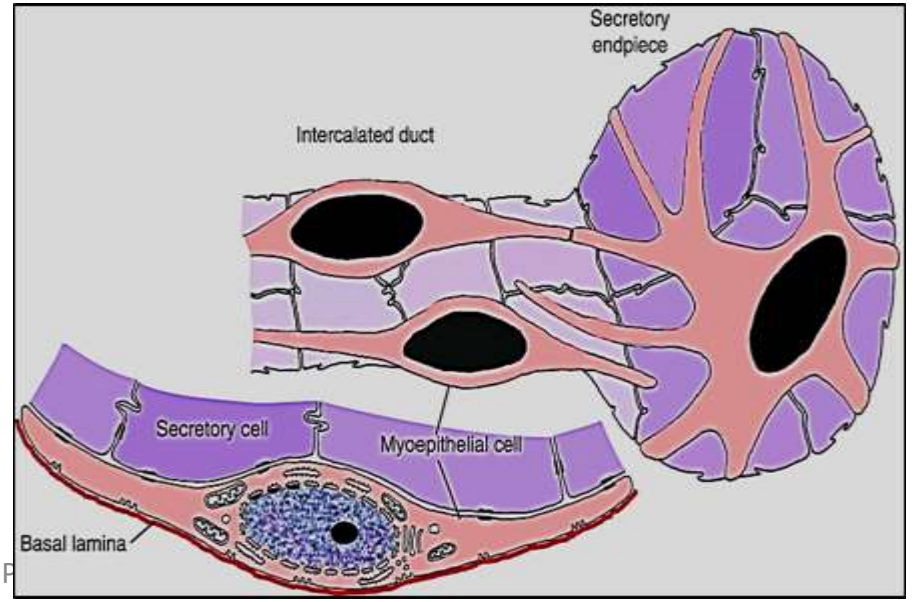
1. serous
2. mucous
3. mixed (muco-serous)



Myoepithelial cells (Basket cells)



- Star –shaped cells present between the base of the secretory cells & their basement membrane **
- They are branched cells, their cytoplasm contain actin & myosin filaments
- When contract → release secretion



Myoepithelial cells of salivary glands

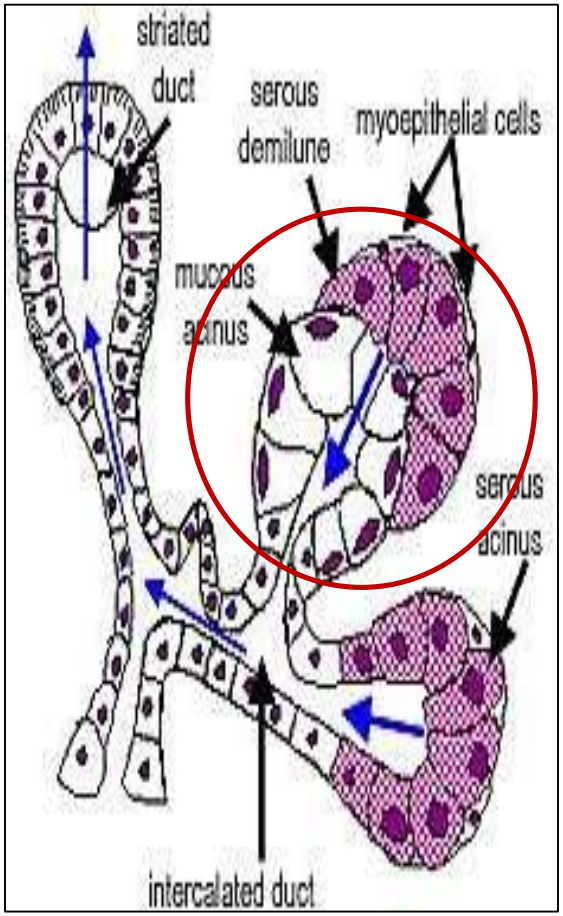
Immunohistochemical staining for the myofibrils within the myoepithelial cells

Crescent of Gianuzzi (serous demilune):

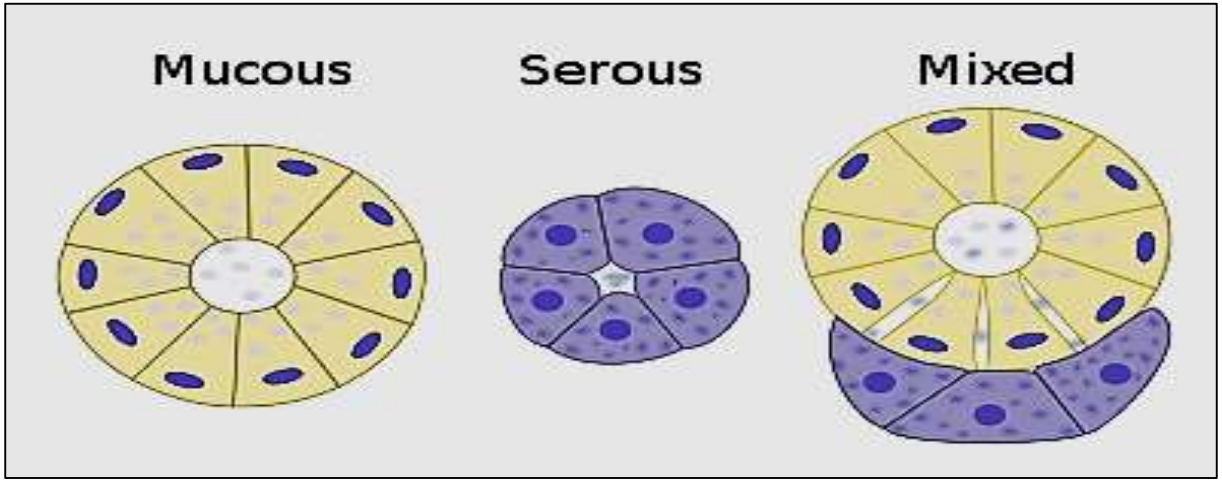
- group of serous cells form a crescent at one side of a mucous acinus.

- The serous secretion of these cells reach the lumen of the mucous acinus by passing through intercelluar canlicauli.

- demilune cells secrete the proteins that contain the lysozyme → add antimicrobial activity to mucus.



Serous vs. Mucous acinus

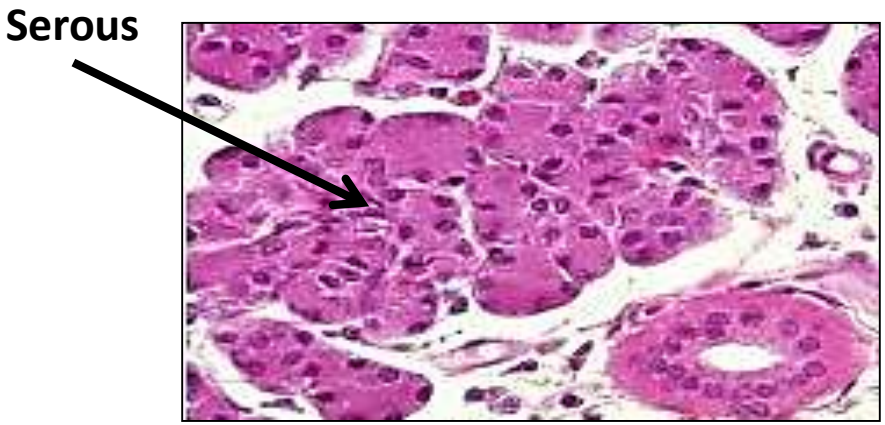


Serous (Parotid)

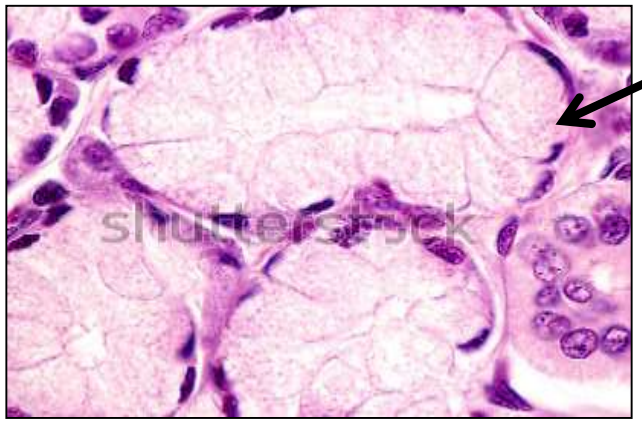
- Small diameter
- Narrow lumen
- Lined e short pyramidal cells
- Nuclei are rounded & central

Mucous (sublingual)

- Larger in diameter
- Wide lumen
- Lined with tall cells
- Nuclei are flat & peripheral



Serous



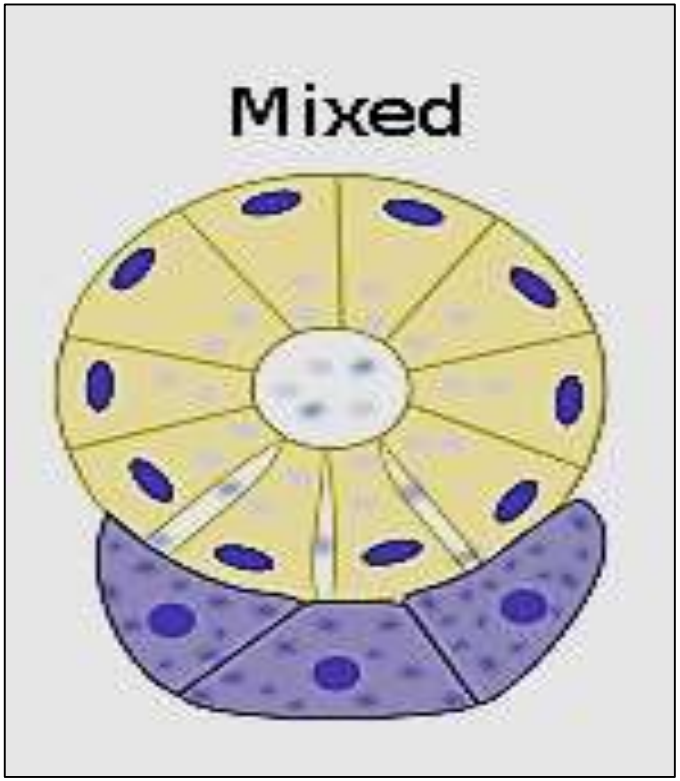
Mucous

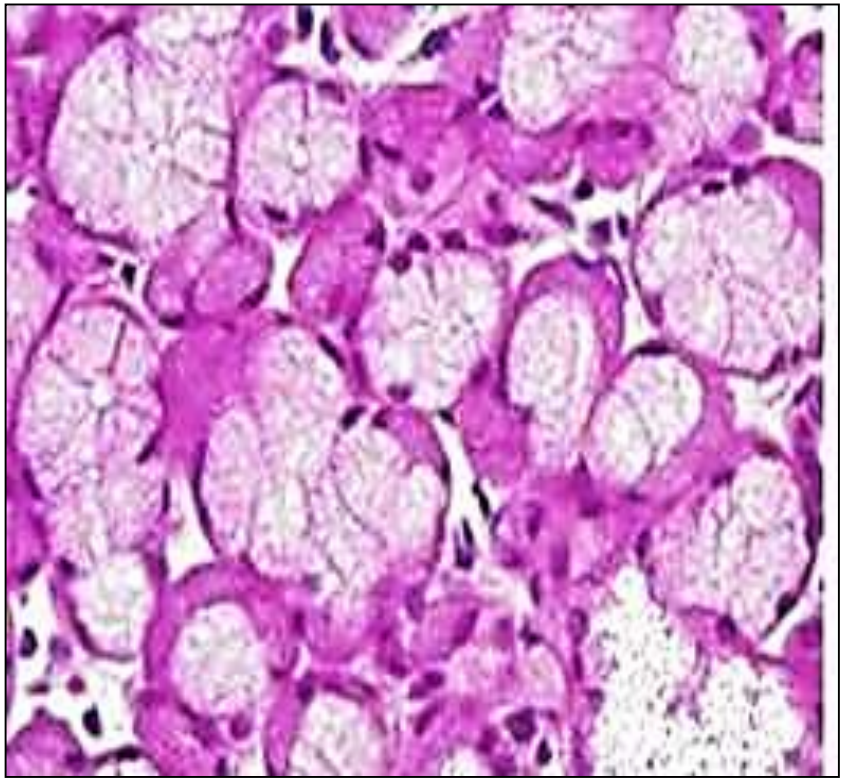
- Basal cytoplasm is basophilic (↑ in rER)
- Basket cells are less
- Secrete fluid **serous**
- Secrete **amylase aid in digestion of starch**

- Cytoplasm is pale, foamy & vacuolated (dissolved mucus)
- Basket cell are more
- Secrete viscid **mucous**
- Secrete **mucous for lubrication**

Mixed (muco-serous) acinus

Is essentially a mucous acinus which is capped by a group of serous cells forming → Crescent of Gianuzzi (serous demilune)

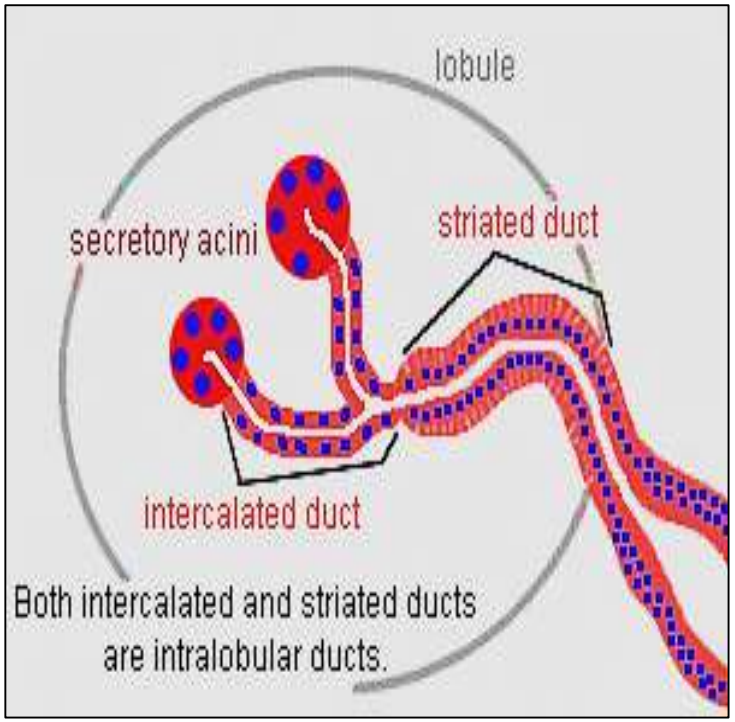




B- the duct system (branching system)

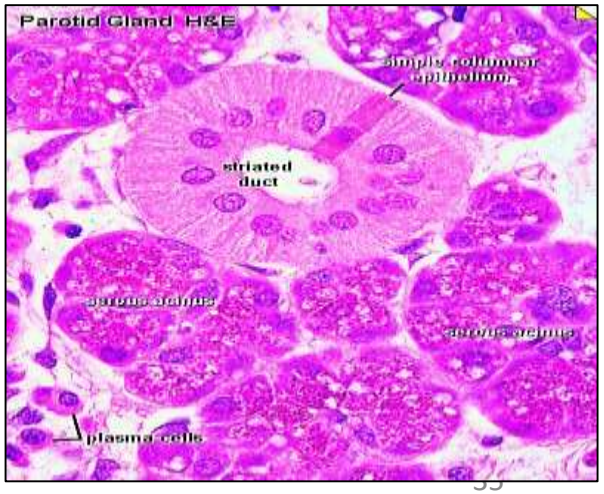
- **Intercalated ducts**:

thin ducts ,
drain the secretory unit, lined with flat or cuboidal cells.



- **Striated (secretory)ducts:**

1. present inside the lobule
2. *take part in the secretion of saliva*
3. lined with low columnar cells
4. Their apical and basolateral membranes contain ion channels to transport ions as Na^+,& K^+ (ion transporting cells)



Has acidophilic cytoplasm e basal acidophilic striations
(infolded basal lamina e ↑ mitochondria)

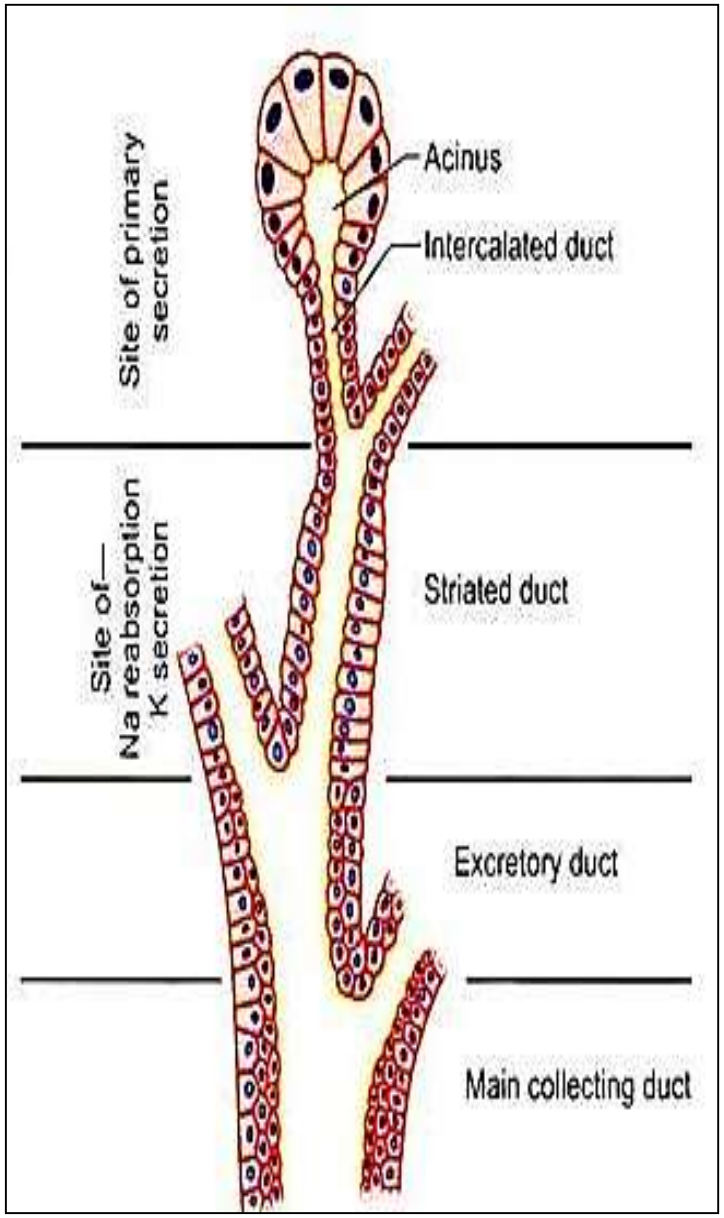
- **Inter-lobular ducts (excretory)**: in the septa between lobules lined e columnar cells → drain into

↓

- **Inter-lobar ducts (excretory)**: in septa between lobes, lined e pseudo-stratified columnar epithelium →

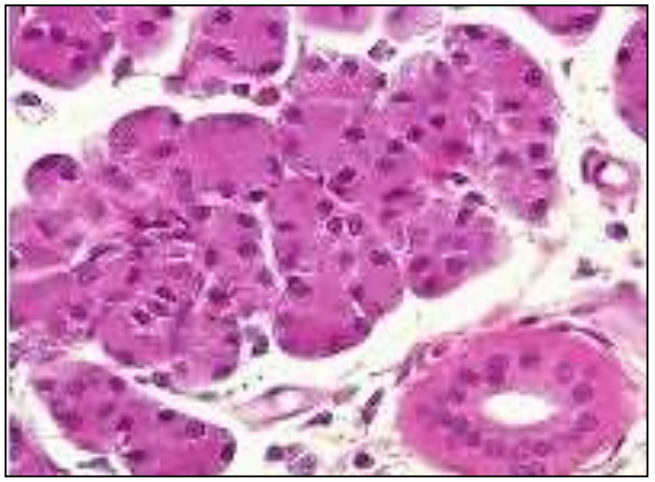
↓

- **the main duct:** drains secretion in oral cavity, lined 1st with stratified columnar → stratified squamous near its opining in mouth cavity



○ Parotid gland:

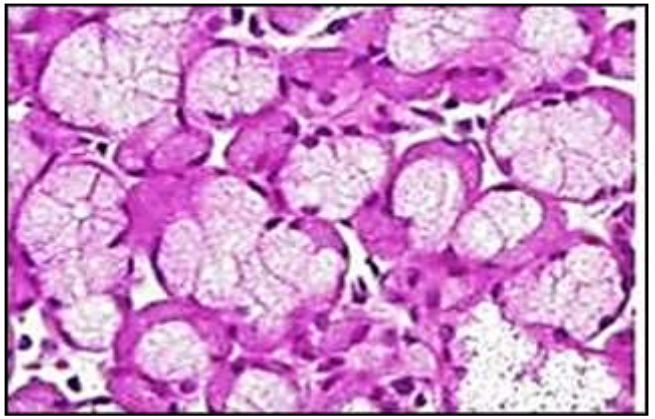
- Acini: are **pure serous**
- Opens by parotid duct



○ Sublingual gland:

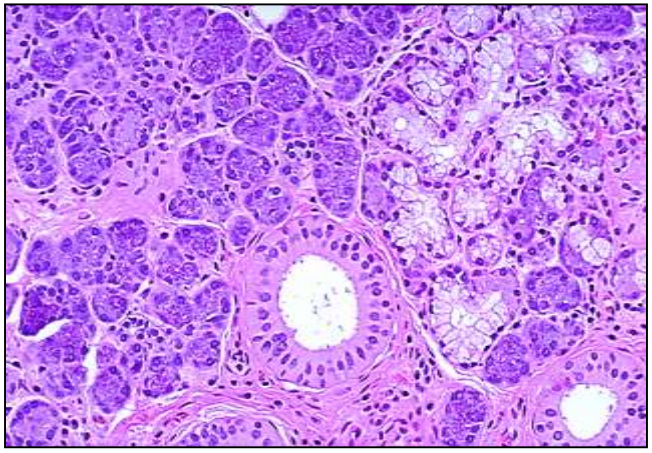
The smallest & the only unecapsulated

- Acini : **mainly mucous** cells capped with serous demilunes **(mixed)**
- Opens by 10-12 mini ducts



○ Submandibular gland:

- Acini: **mixed serous** & **mucous** acini
- Opens by Wharton's duct



Thank you