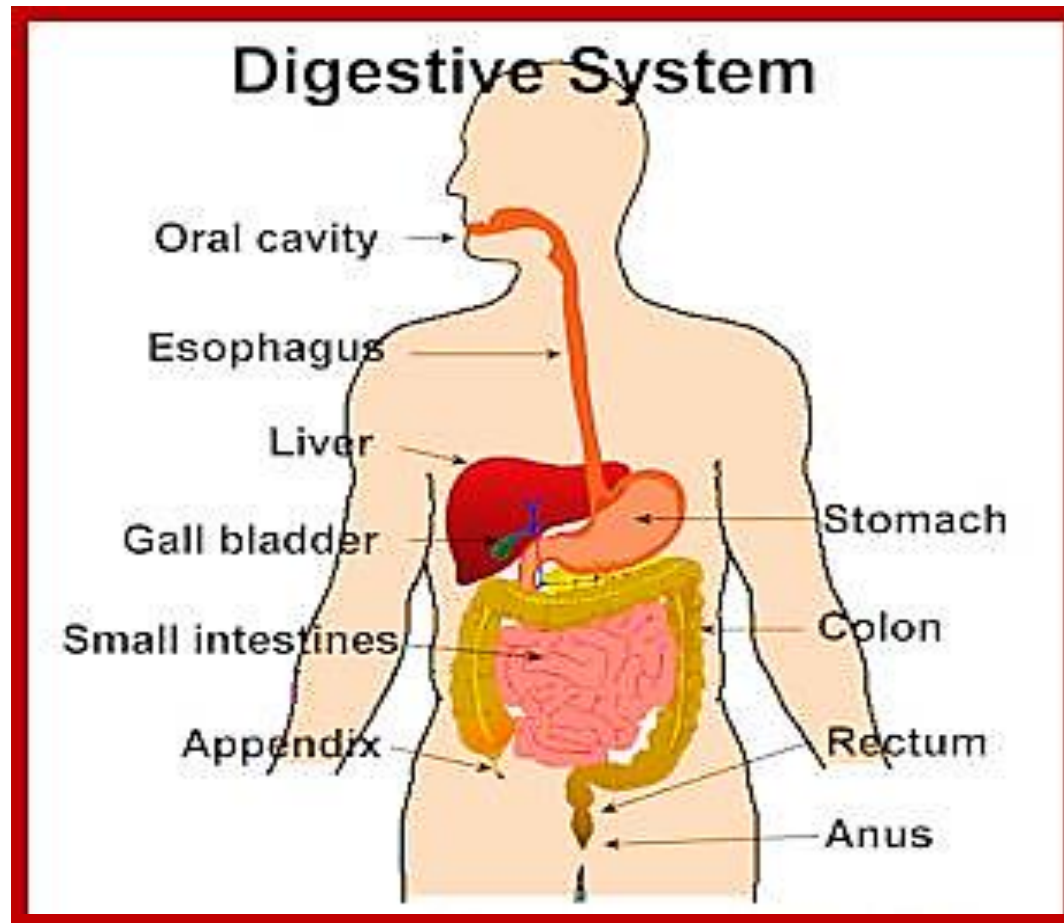


Introduction to The Digestive system

Professor Dr. Hala El-mazar



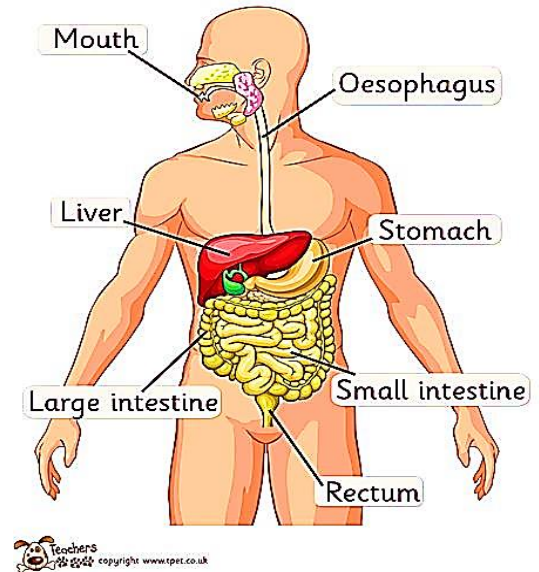
Digestive system

1. Oral cavity

2. Digestive tract

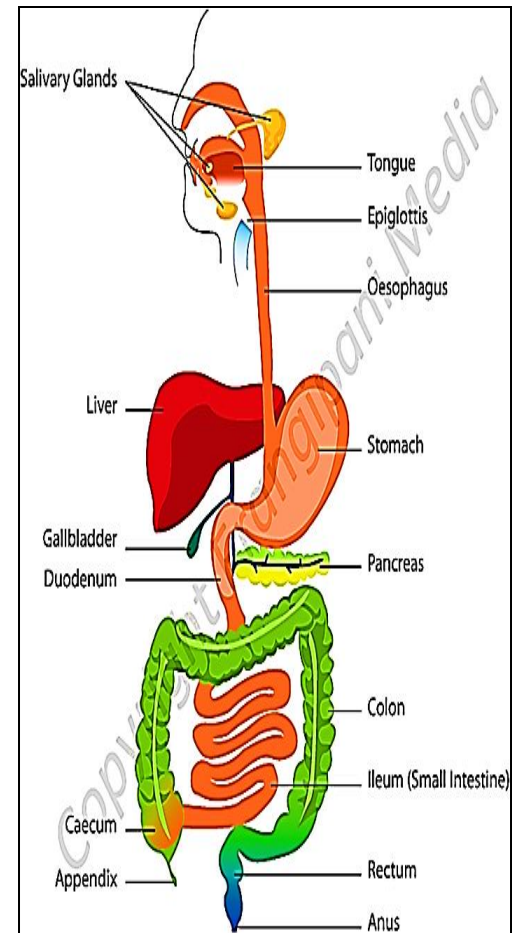
3. glands

The digestive system



The digestive system includes the following parts:

- **The oral cavity** (lips, tongue, teeth & salivary glands)
- **The alimentary canal** (9- 10 meter)
(esophagus, stomach, small/ large intestine & anal canal)
- **The associated glands** (liver, pancreas)



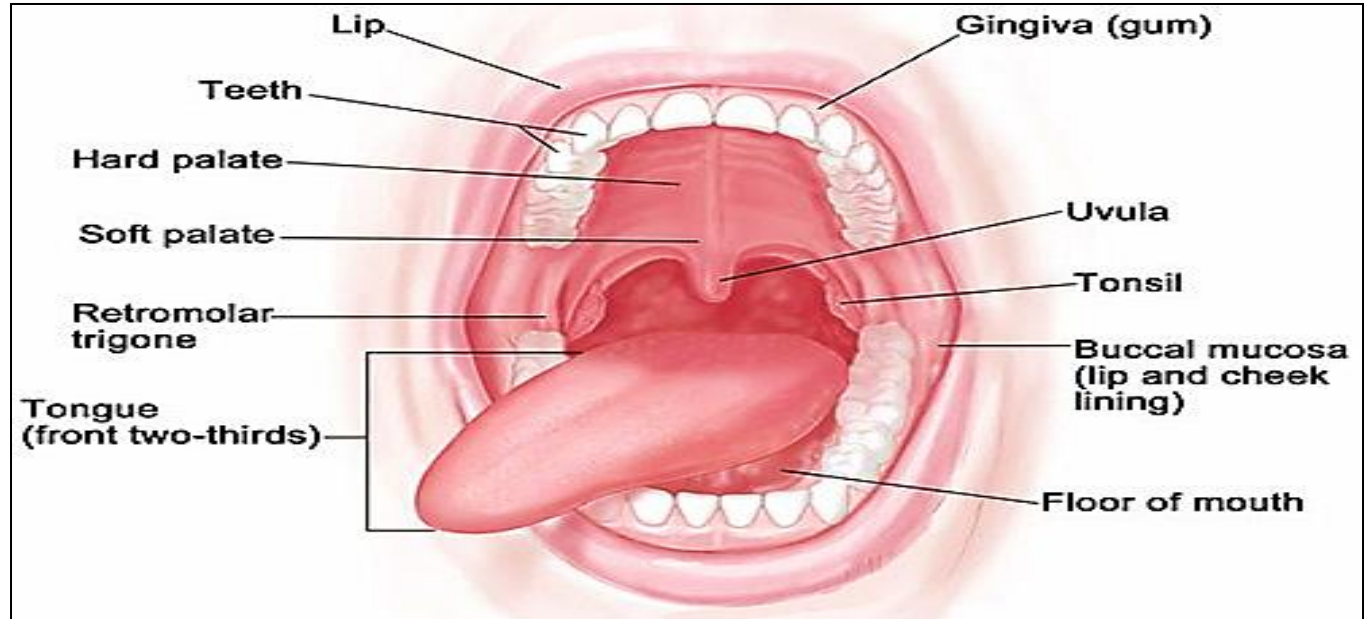
Function of digestive system:

- 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, buccal) cavity

contains:

- Lips
- Tongue
- Gingiva
- The teeth

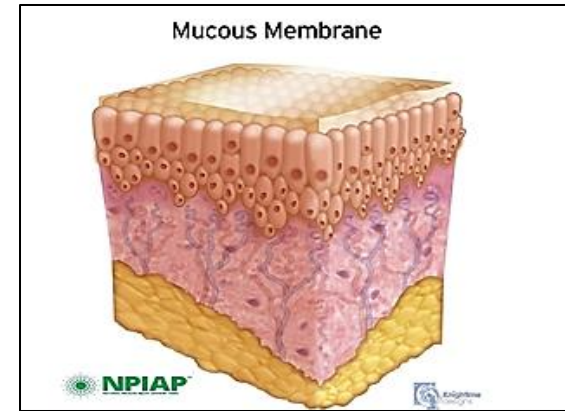


- Hard and soft palates - form roof of mouth.
- Salivary glands (3 pairs) & their ducts
- Ends by pharynx

The lining of The oral cavity is called **mucous membrane** which is formed of 2 layers:

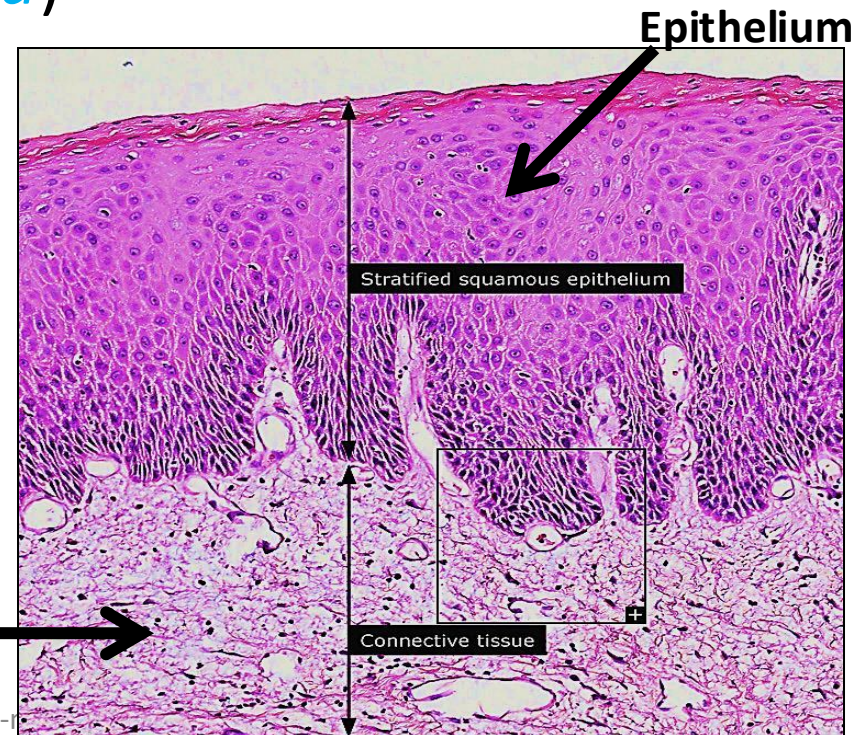
A- Epithelium:

- Stratified squamous
(*Keratinized or non-keratinized*)



B- Lamina propria:

formed of dense C.T. &
contains **minor salivary glands**
B.V. & lymphatics , nerves



The lips

Labial.....

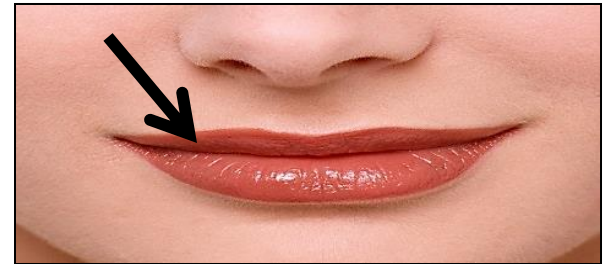
A- outer surface covered by **skin**



B- inner surface covered by **mucus membrane**

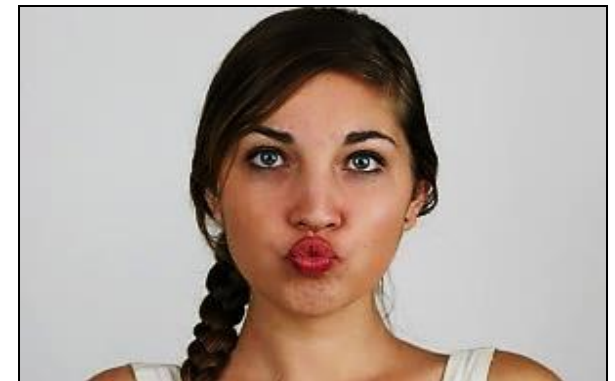


C- Lip margin (**red margin**)



D- The inside of the lips contains bundles of striated voluntary muscle **orbicularis oris** + dense fibro-elastic

C.T.



Structure of lip:

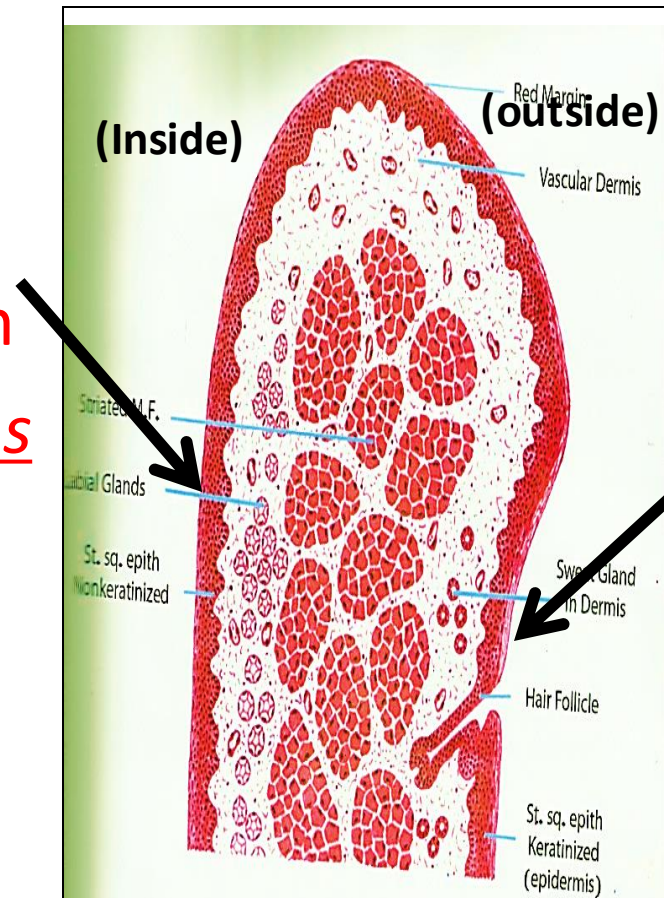
1- Outer surface: covered with **thin skin**
keratinized stratified squamous epithelium

contains hair follicles, sebaceous,
& sweat glands

2- Inner surface: covered by **mucous m**

A) Non- keratinized stratified squamous

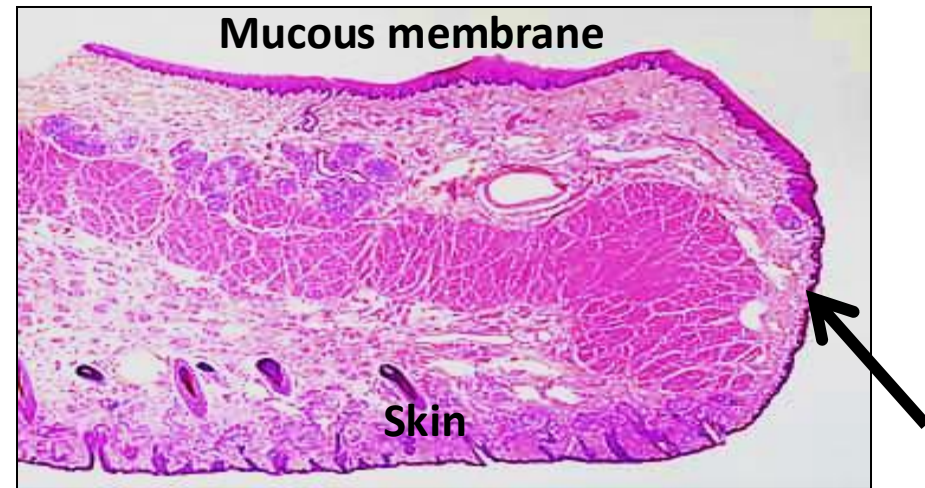
B) Lamina propria: loose C.T.,
contains **B.V.**, lymphatic's, nerves
labial glands *



C- Red margin of lip :
covered with *modified skin*:

1- Thin

less keratinized, *No hair follicles, No sebaceous or sweat glands.*

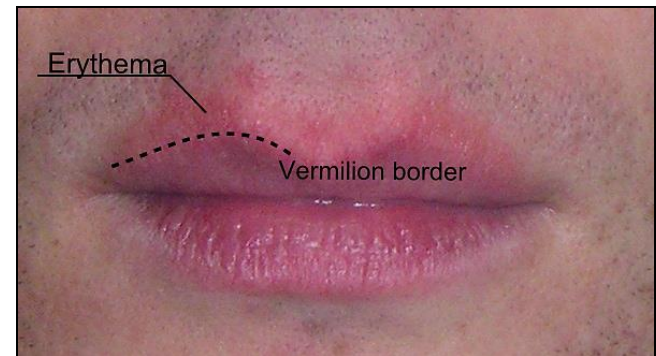


2- Transparent: Red due to the reflection of the underlying *B.V.*



3- Highly sensitive :richly supplied e free nerve endings.

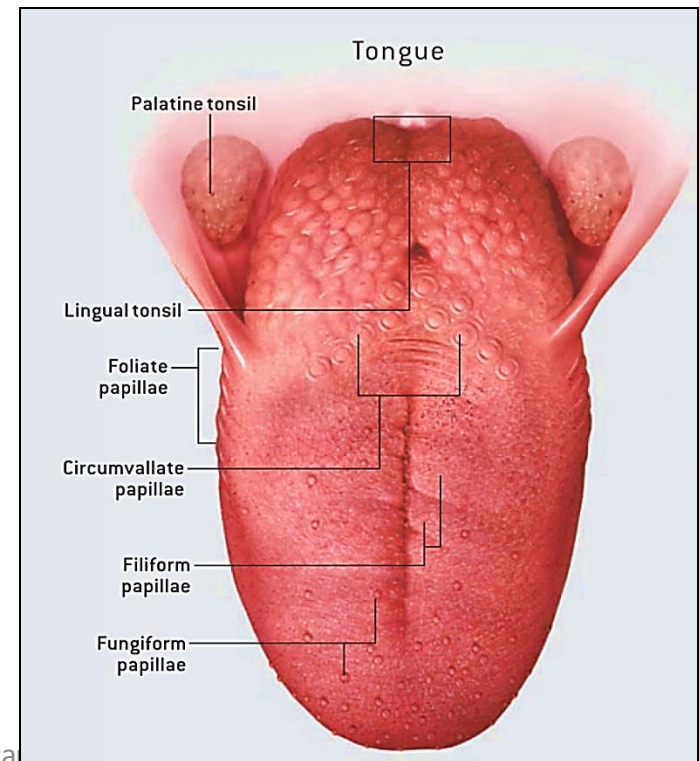
The lip margin (**vermillion**) represent the change in the epidermis from highly keratinized facial skin to less Keratinized labial skin. richly supplied with free nerve endings. So it is *highly sensitive*.



The tongue

Function of tongue:

- Taste: contains taste receptors
- Mastication
- Formation of Bolus
- Swallowing
- Speech
- Suckling in babies

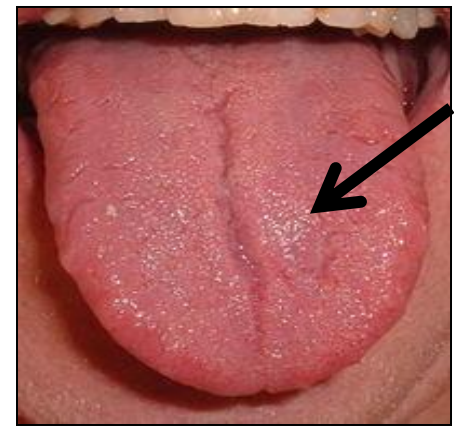


The tongue lingual.....

It has:

1- dorsal (upper) surface:

- Rough, has **lingual (tongue) papillae**
- Covered e **partially keratinized stratified squamous epith.**



(Dorsal surface)

2- ventral surface:

- Smooth, vascular
- Covered e **non- keratinized st. squ. Epith**

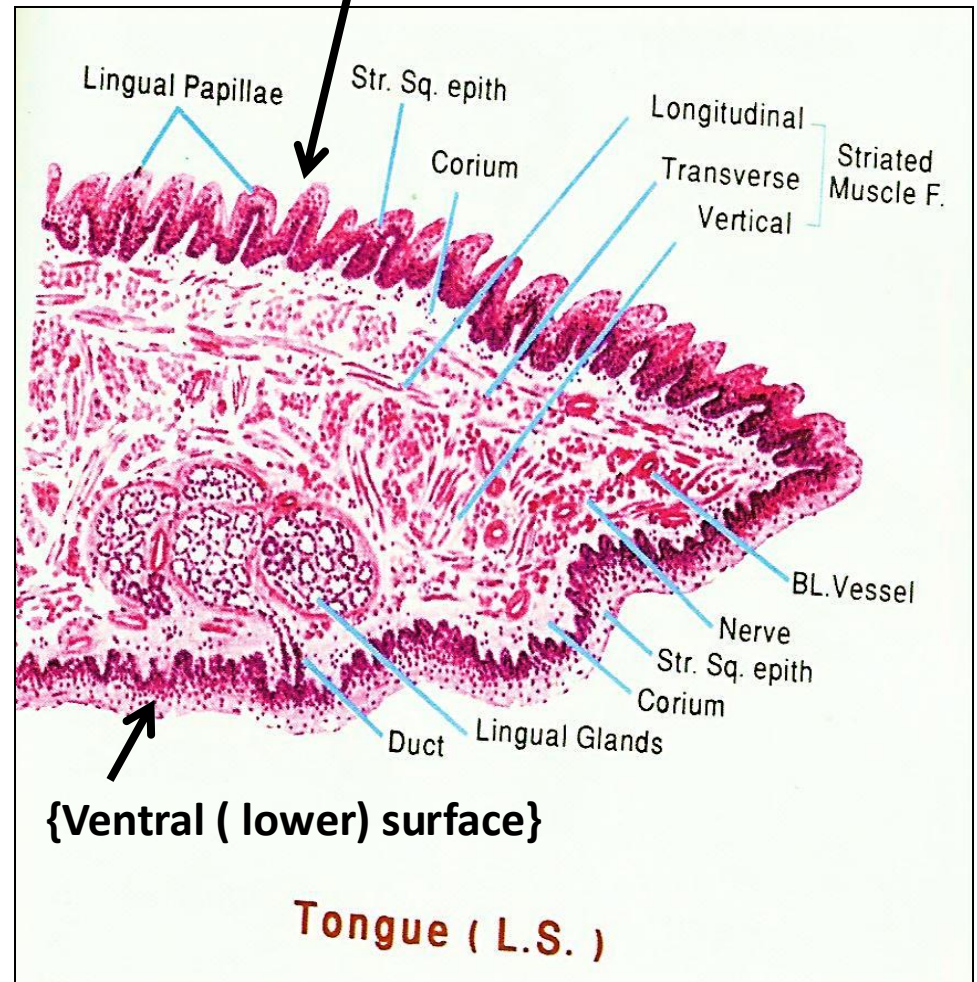
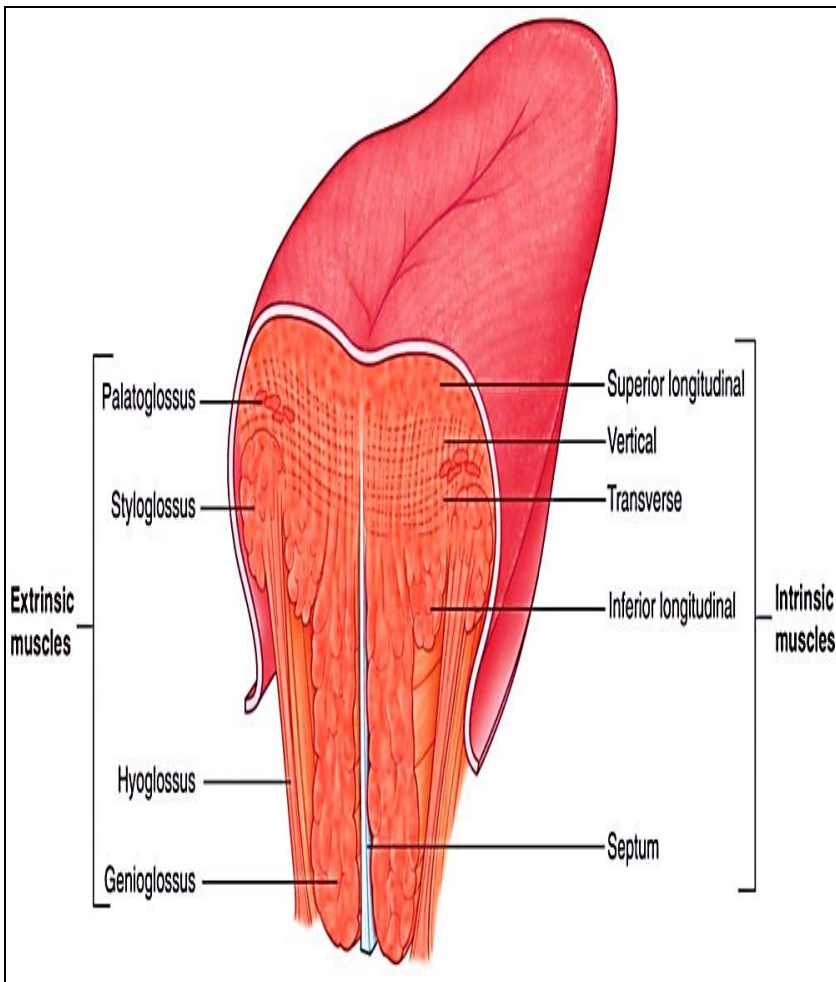


(Ventral surface)

3- Inside of tongue :

Contain bundles of **striated voluntary muscles** running in different directions & CT containing small **salivary glands.**

{Dorsal (upper) surface}



Structure of the tongue

- The dorsum of the tongue is divided by a V- shaped groove called **Sulcus terminalis**

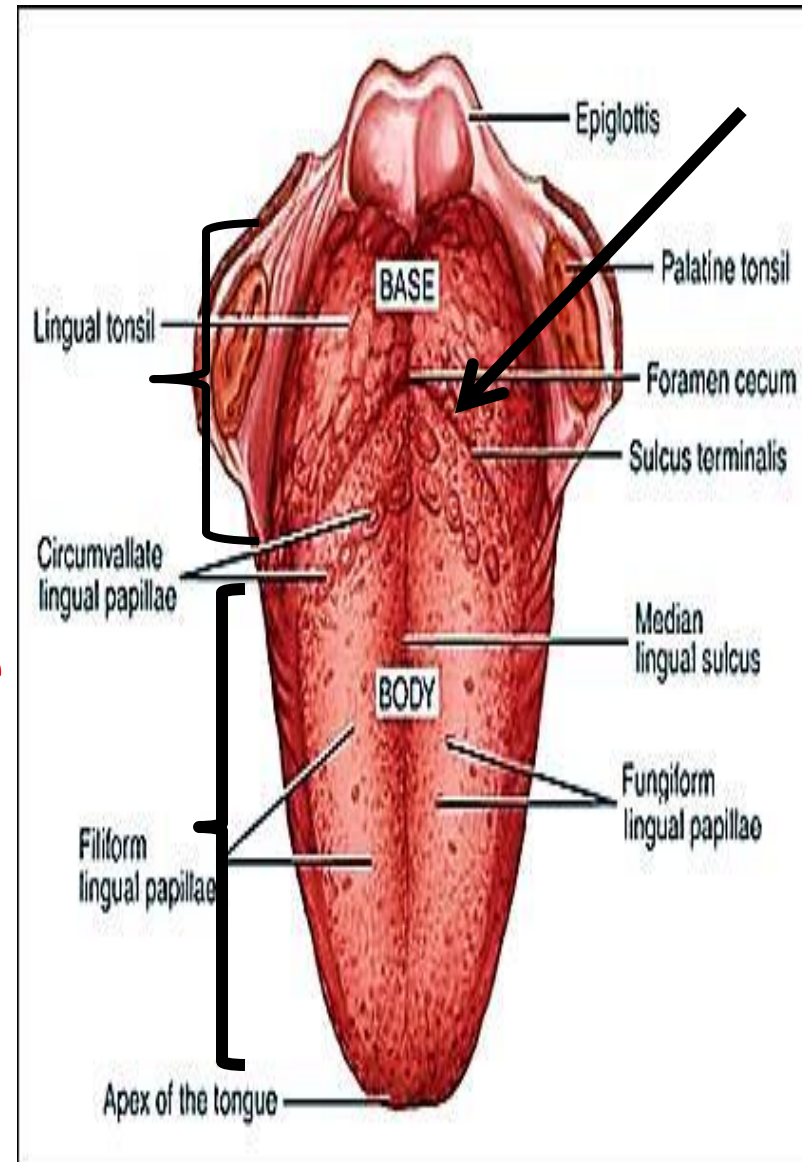
- It divides the tongue into:

- **body** (anterior **2/3**)

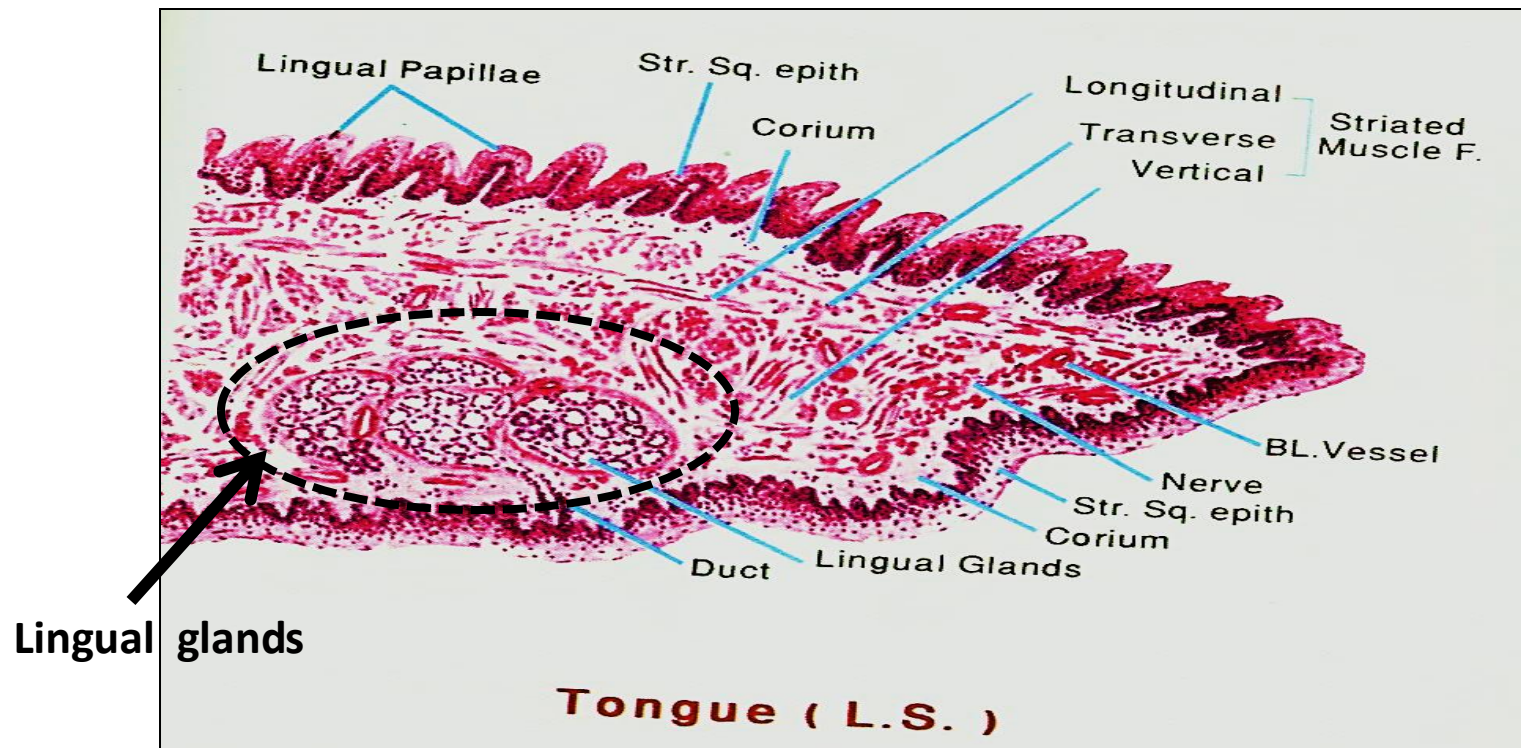
- **base** (posterior **1/3**)

- Ant 2/3 contains **lingual papillae**

- Post 1/3 contains **lingual tonsil**



- The ventral surface of tongue is covered e mucous membrane loosely attached to underlying C.T.
- Contains **NO papillae**,
- **Lingual glands** are embedded in muscles of ventral surface



Tongue (lingual) papillae

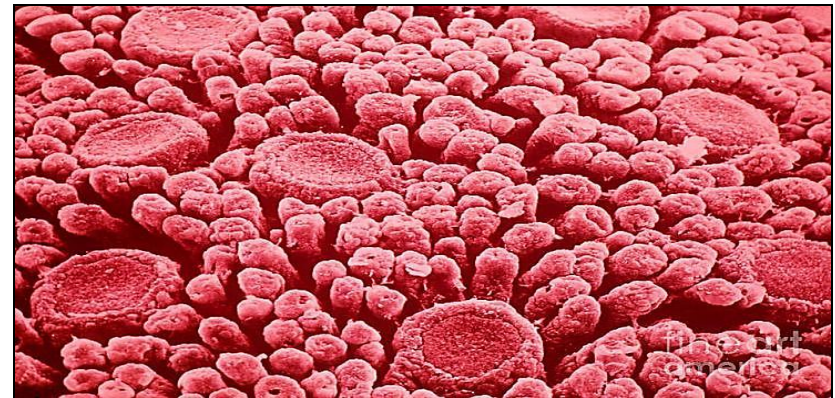
- Little projections on dorsal surface & sides of the tongue
- Formed of C.T. Core covered by **partially keratinized stratified squamous epithelium**

- Lingual papillae are 4 types:

1. Filiform papillae
2. Fungiform papillae
3. Circumvallates papillae
4. Foliate papillae



(Dorsal surface of tongue showing lingual papillae)



Lingual papillae:

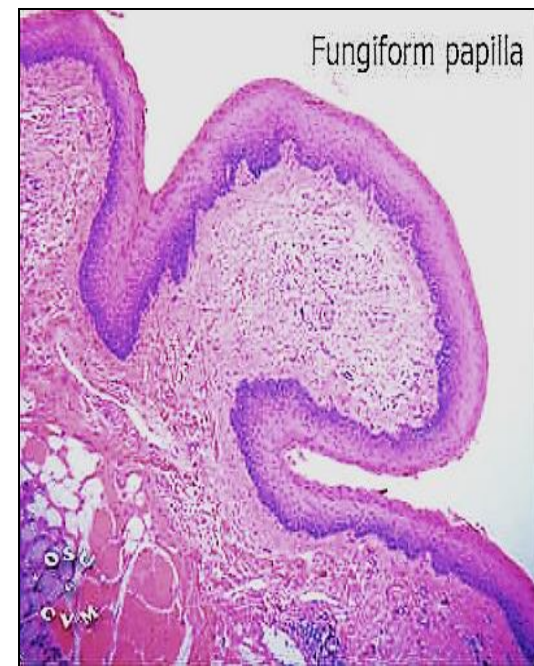
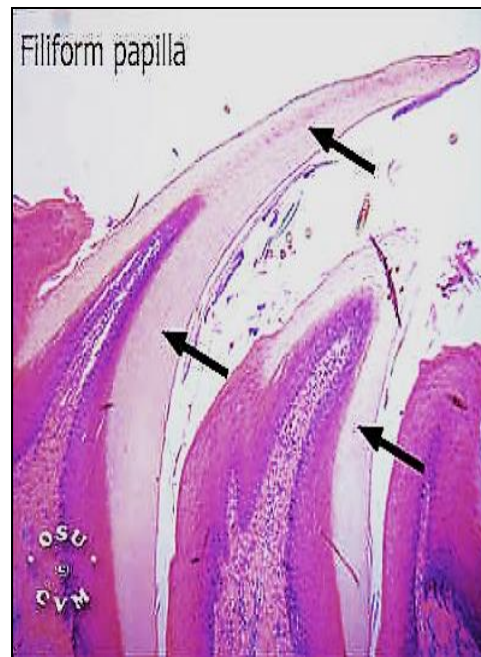
- There are 4 Types:

1. Filiform papillae

2. Fungiform papillae

3. Circumvallate papillae

4. Foliate Papillae



Filiform papillae:

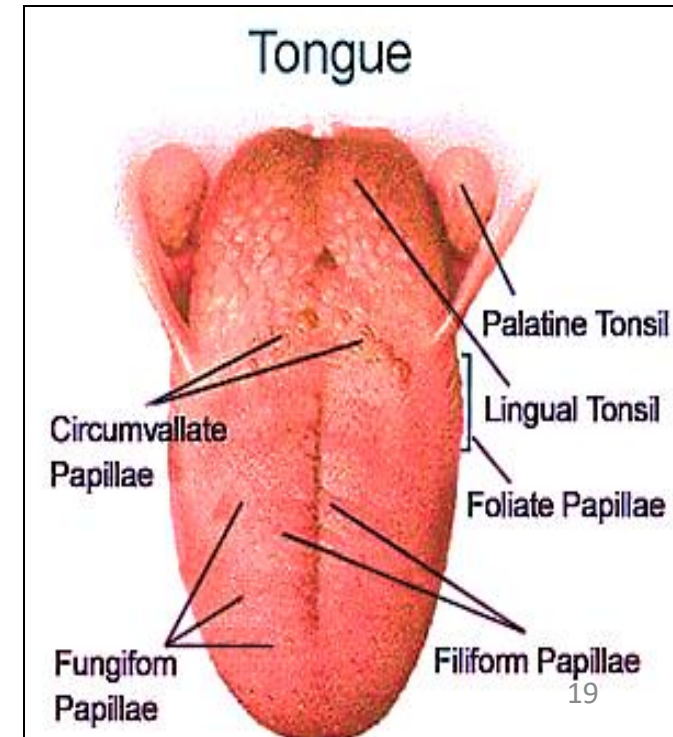
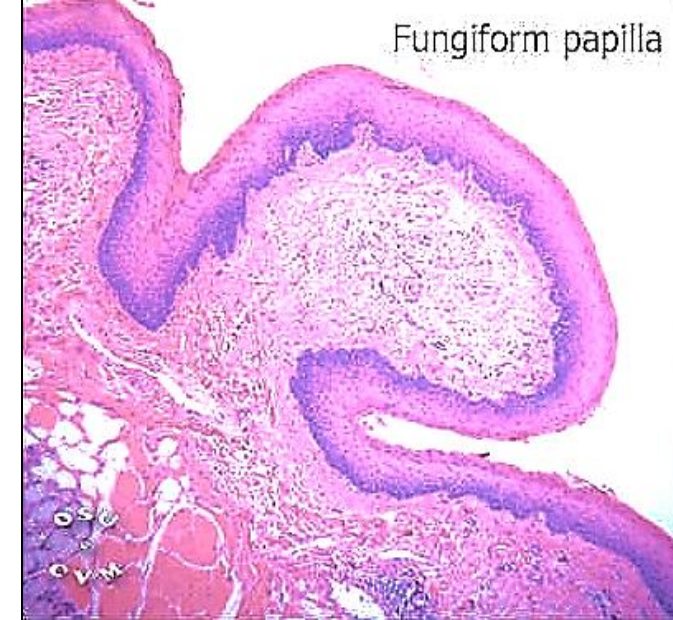
- Conical shape
- contain **NO** taste buds
- Formed of C.T. core covered e
keratinized stratified squ. epithelium

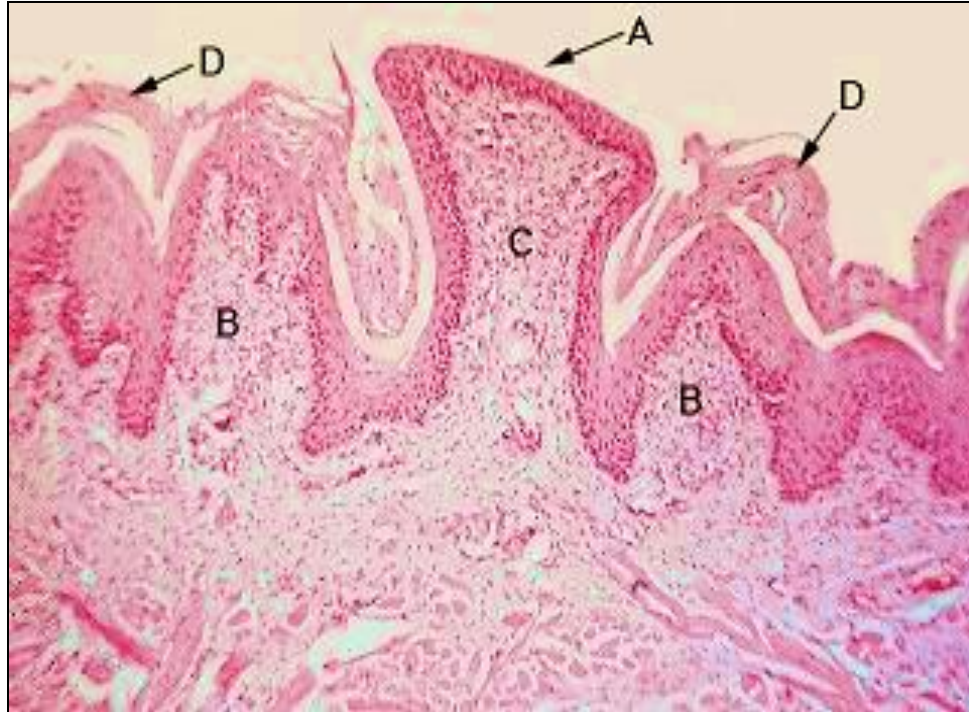


- Numerous in # found on ant. 2/3 of tongue
- give the tongue surface a roughness that aids in manipulating foods in the mouth(mechanical papillae)

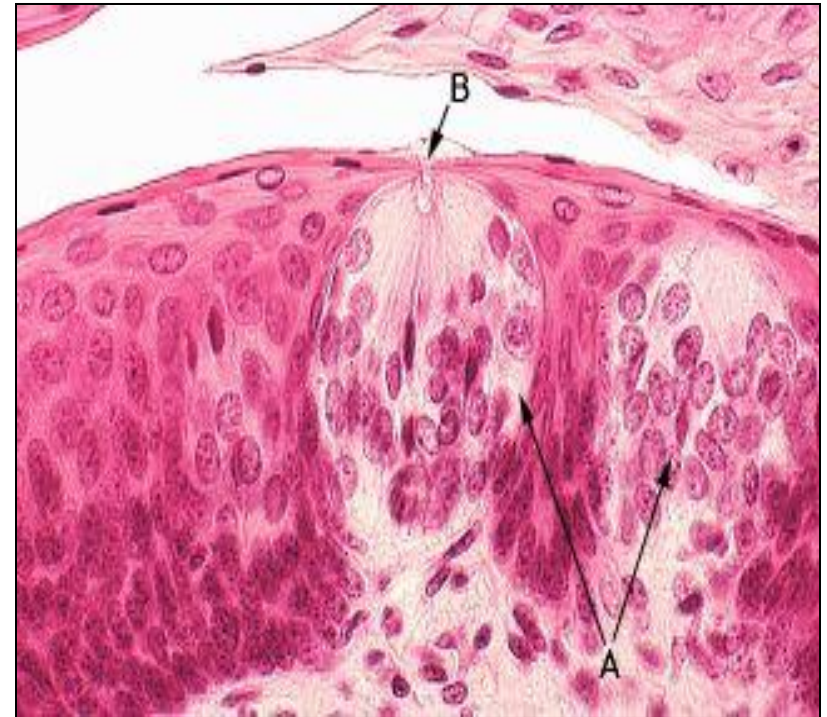
Fungiform papillae:

- Short , broad , very vascular
- Few in number, found on ant 2/3 of tongue among Filiform papillae
- Taste buds found on the surface of papillae
- Covered with Non- keratinized stratified squamous epithelium
- Red due to presence of many B.V. in underlying C.T.





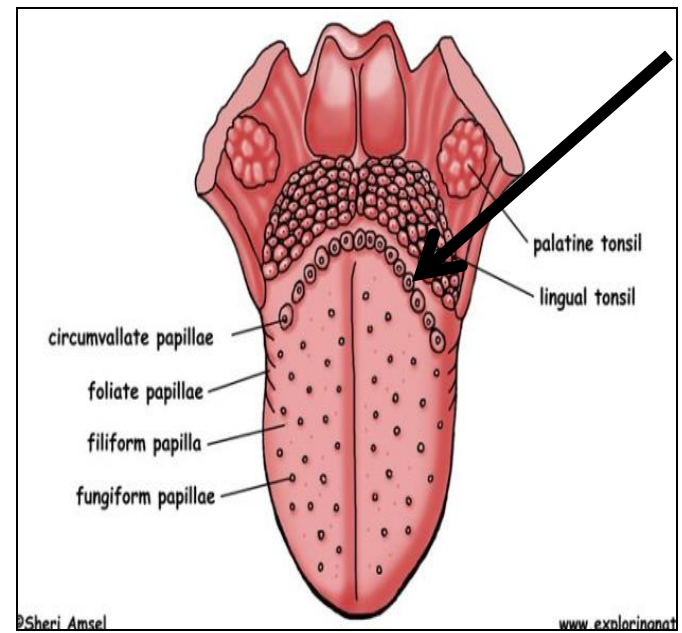
A: fungiform papillae
D: keratinized filiform papillae
B: connective tissue



Taste buds are intraepithelial structure

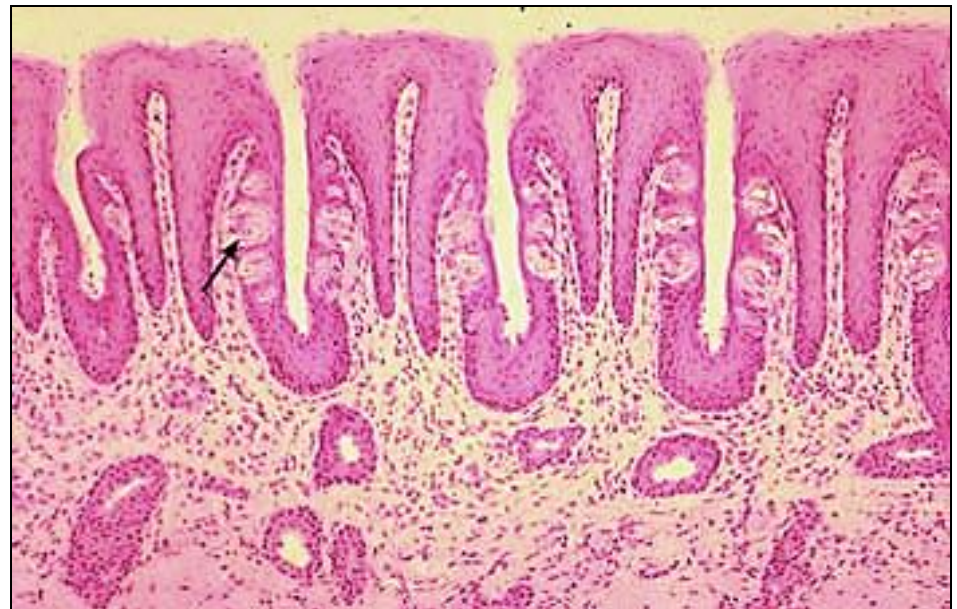
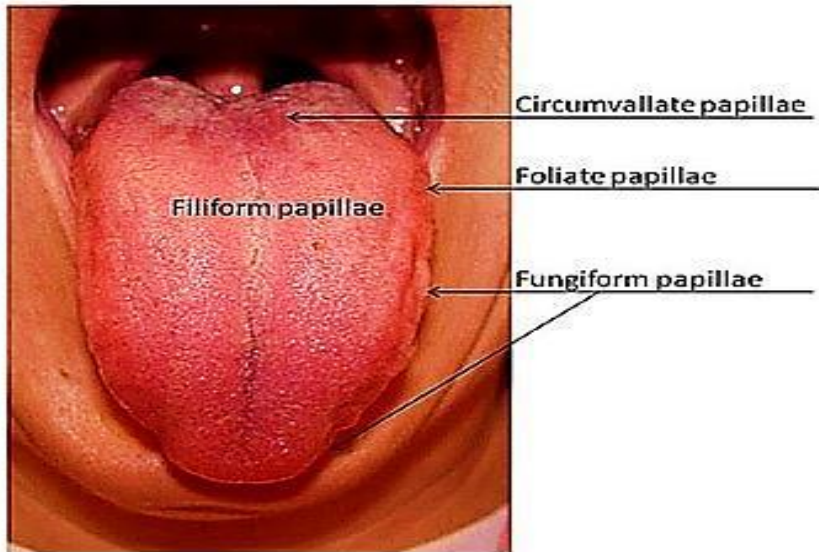
Circumvallate papillae:

- largest papillae, 8- 12 in number
- Found in front of sulcus terminalis
- They don't project on the surface
- Each one is surrounded e groove (trench)
- Von Ebner's glands (serous salivary)
Open by duct at base of papillae
- covered e Non- keratinized st.squ.epith
- Taste buds present on the lateral sides of these papillae

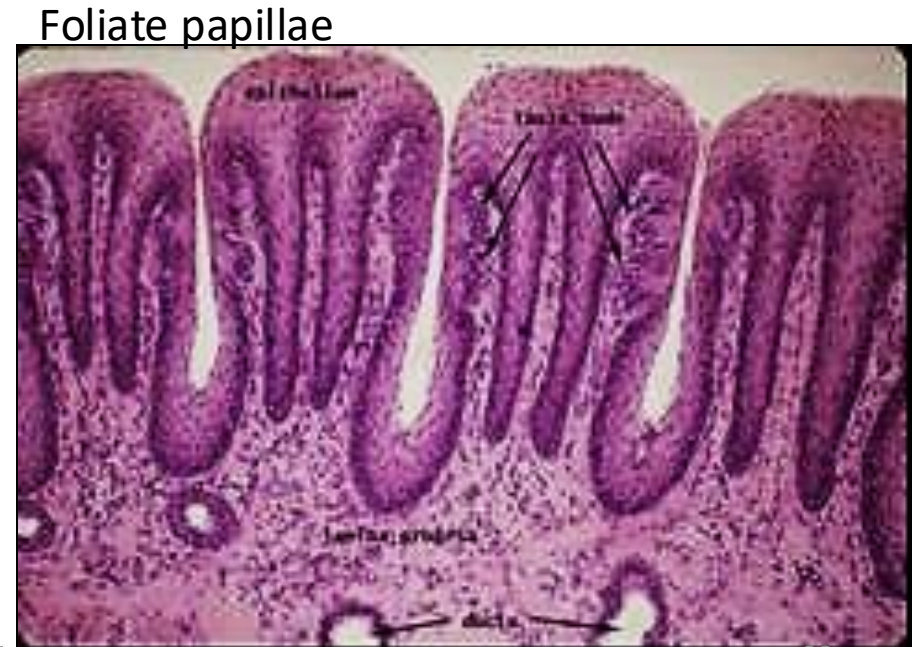
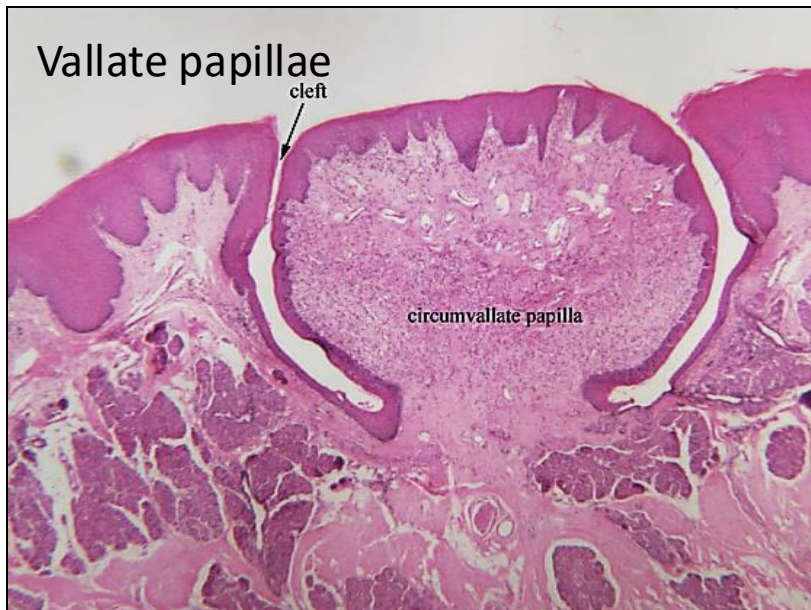
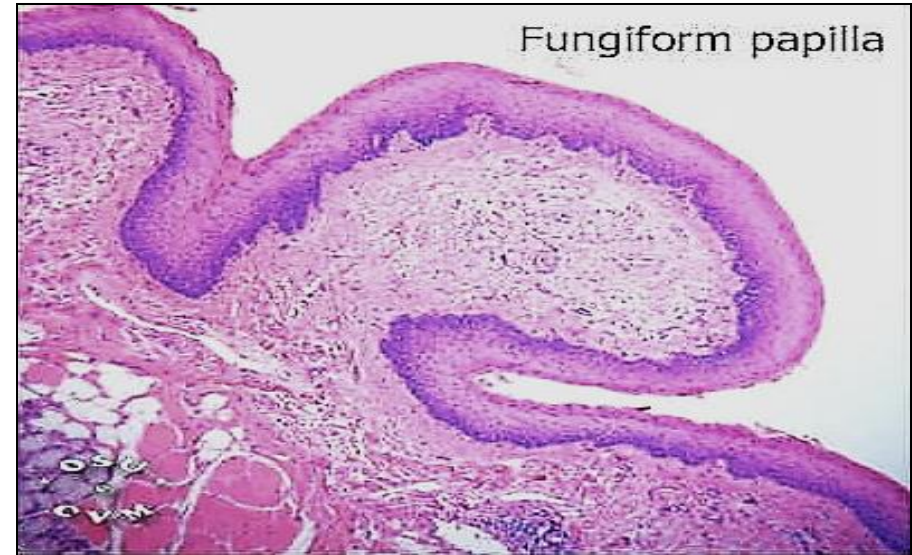
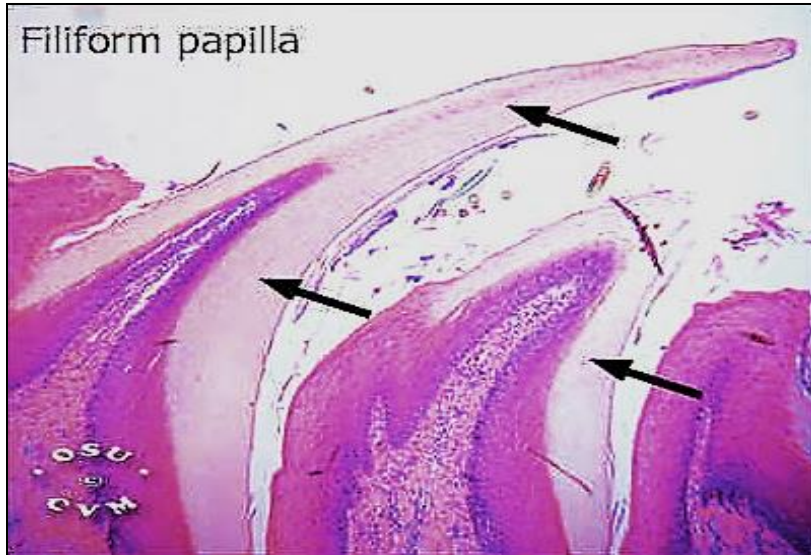


Foliate Papillae :

- Each papillae is formed of 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

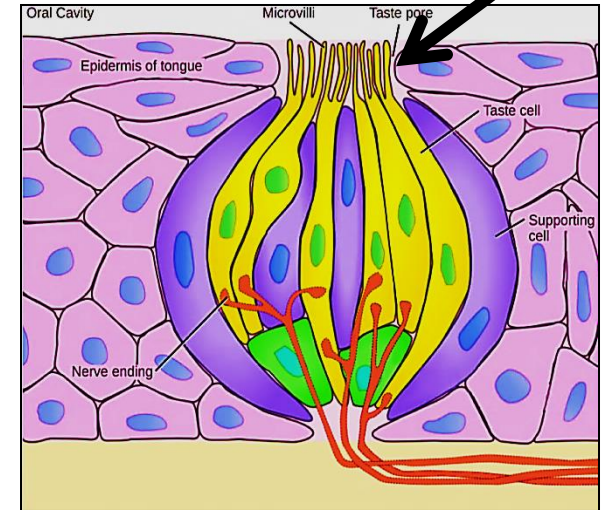
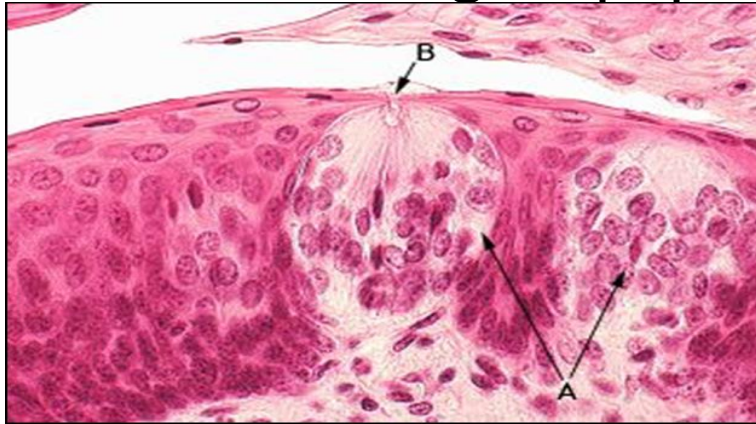


(Different shapes of lingual papillae)



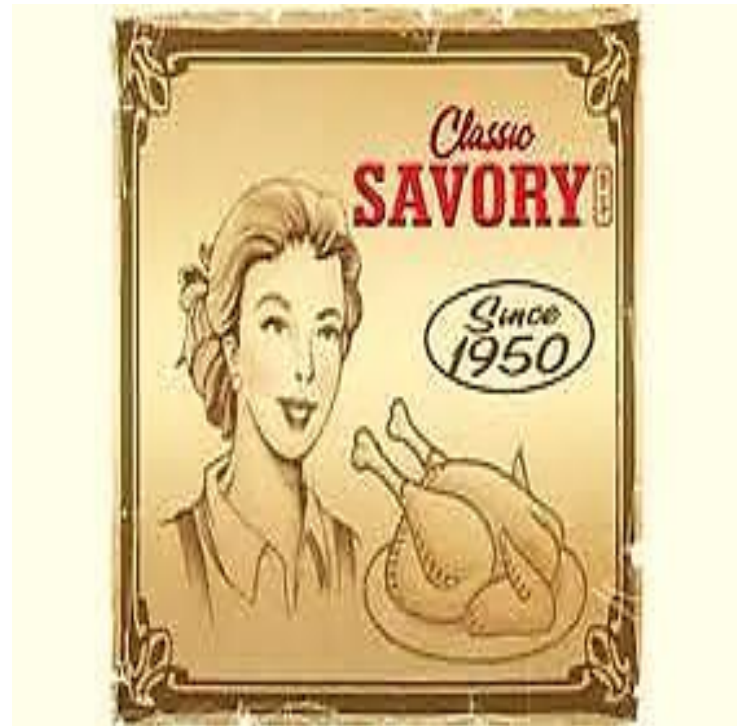
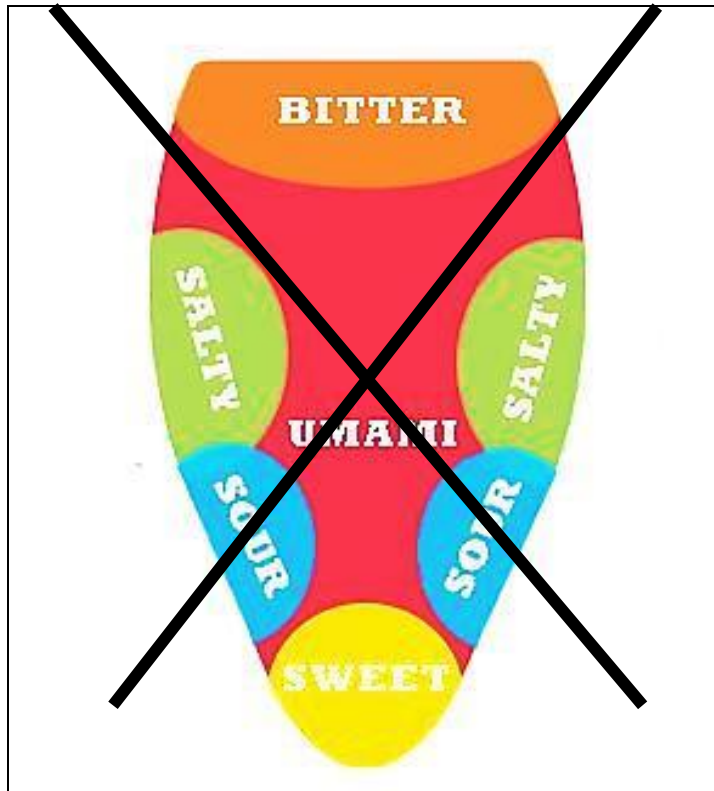
Taste buds (neuro-epithelium)

- Oval structures present on dorsal surface of tongue, in the epithelium of the lingual papillae



- Each taste bud formed of 3 types of cells & taste pore for contact of saliva
- 1- **Sensory (taste) cells**: tall columnar cells , Central in position, with microvilli (taste hairs) to receive tastants
 - 2- **Supporting cells**
 - 3- **Basal cells (stem cells)**: for regeneration

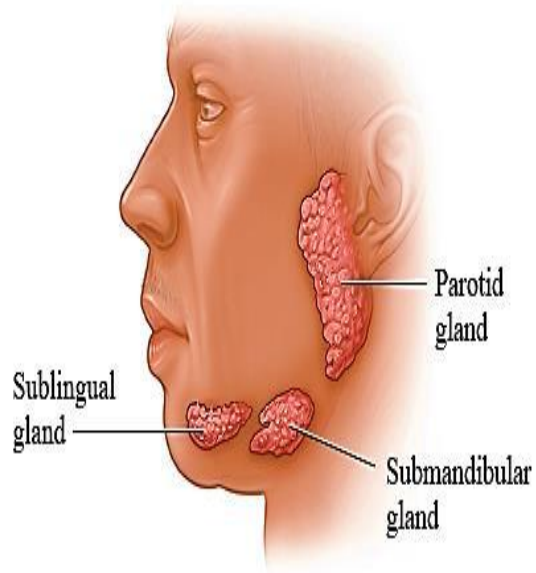
The sensation of taste can be categorized into five basic tastes: sweet, sour, salt, bitter, and umami.



- **is spicy a taste ?**
- **Spiciness is not a taste**



- **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 receptor 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 **endorphins** which make us enjoy eating spicy food



Salivary glands (3 pairs)

© Healthwise, Incorporated

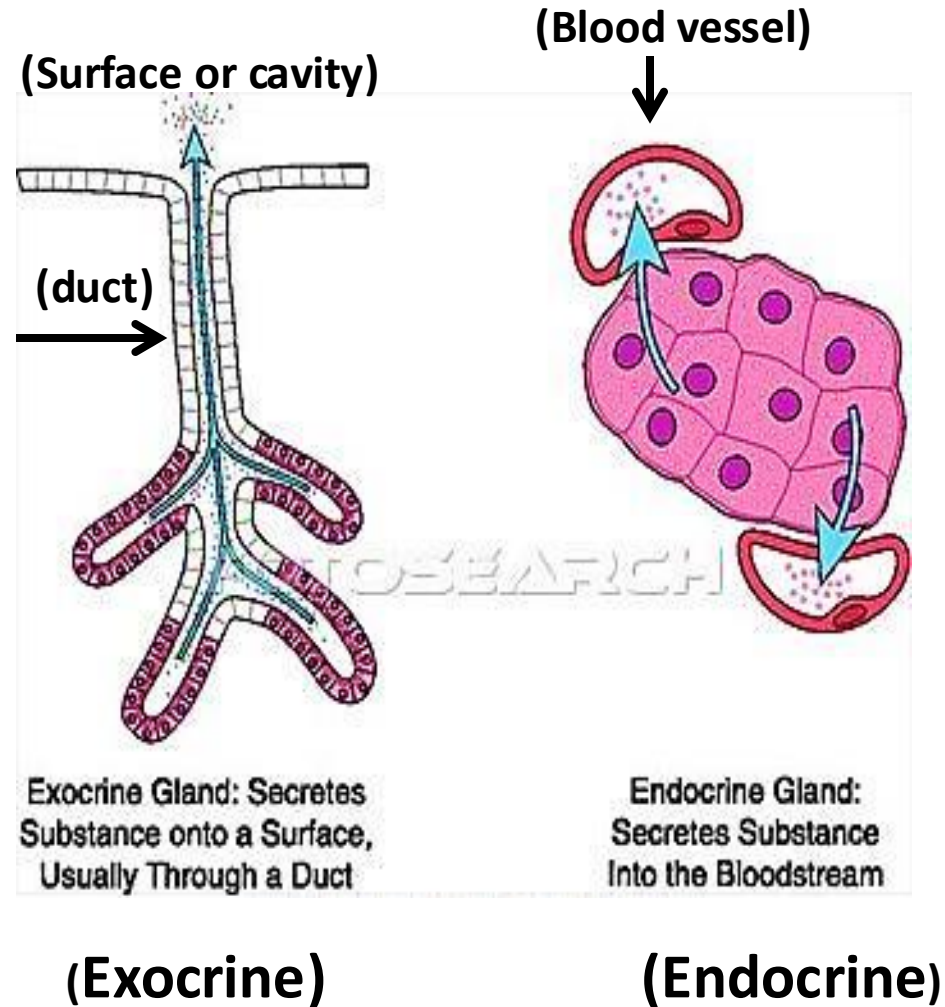
Parotid

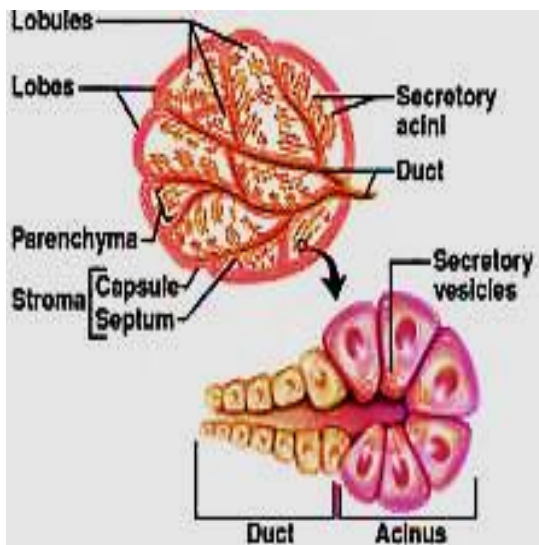
submandibular

sublingual

Salivary glands

- 3 pairs: parotid, sublingual, submandibular
- They are exocrine glands
- Multicellular glands
- They secrete **Saliva**
- Saliva may be:
 1. serous : parotid
 2. mucous : sublingual
 3. both: submandibular





Gland structure

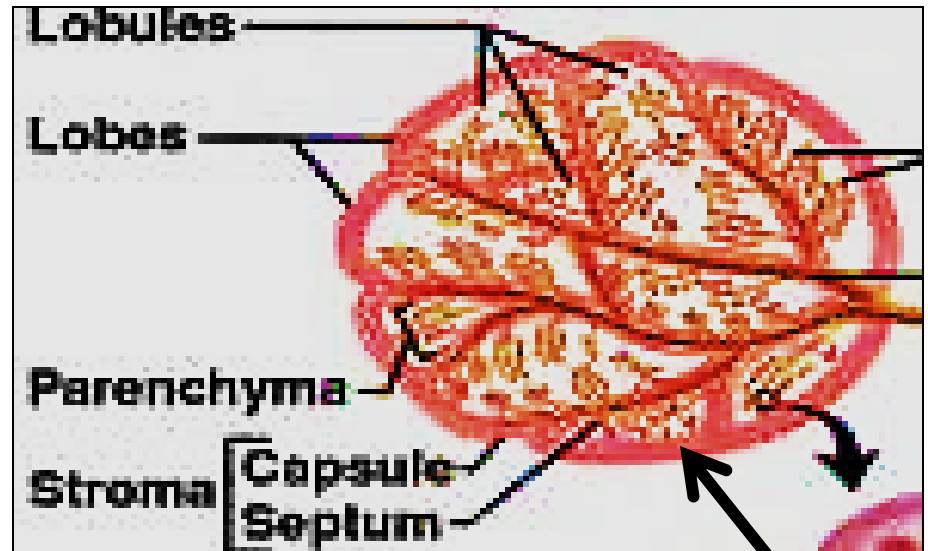
1- stroma
(C.T. frame)

2- Parenchyma
(secretory cells)

Structure of the salivary glands

A- Stroma

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



➤ It consists of:

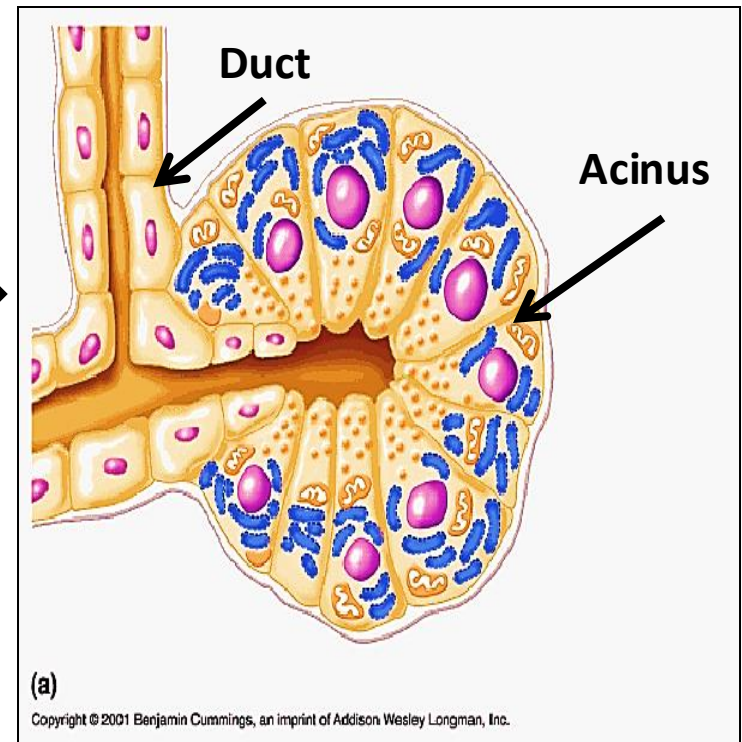
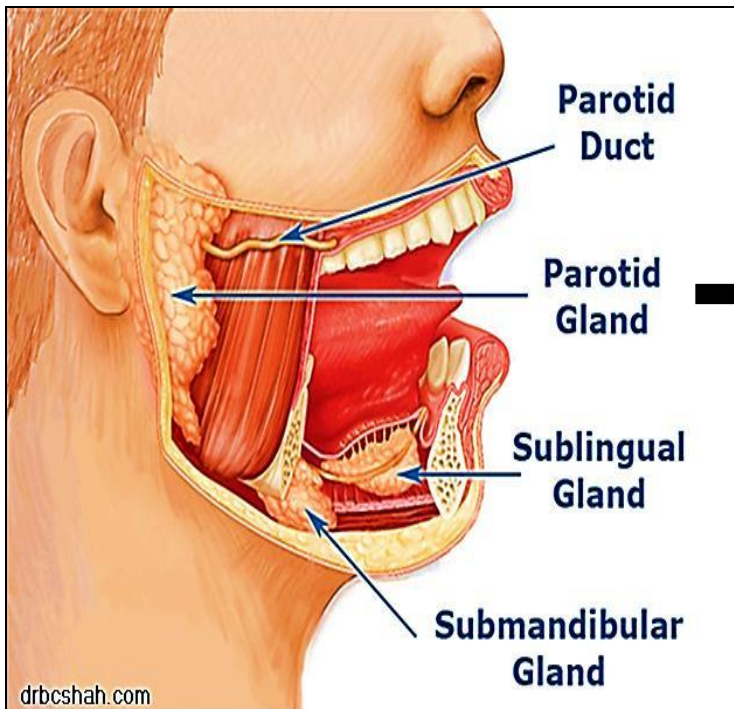
- **Capsule**: covers the gland from outside
- **Septa** : divide the glands into lobes & lobules
- **Reticular network**: present in the background of the gland (stained e Ag)

B- Parenchyma

Includes:

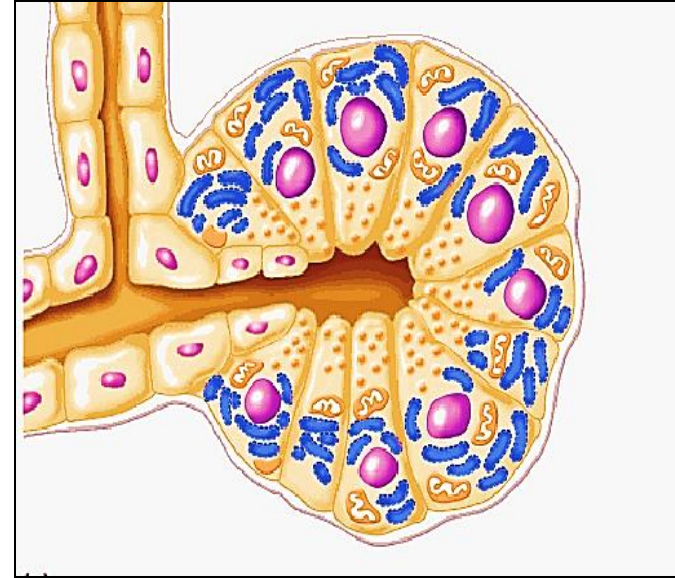
A- Secretory units (salivary acini) → secrete saliva

B- Duct system → conduct saliva to the mouth cavity



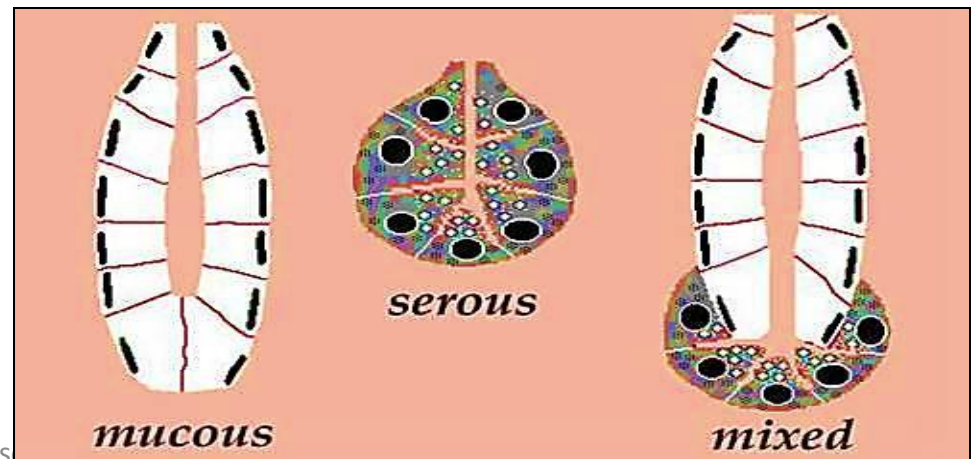
A- Secretory acini

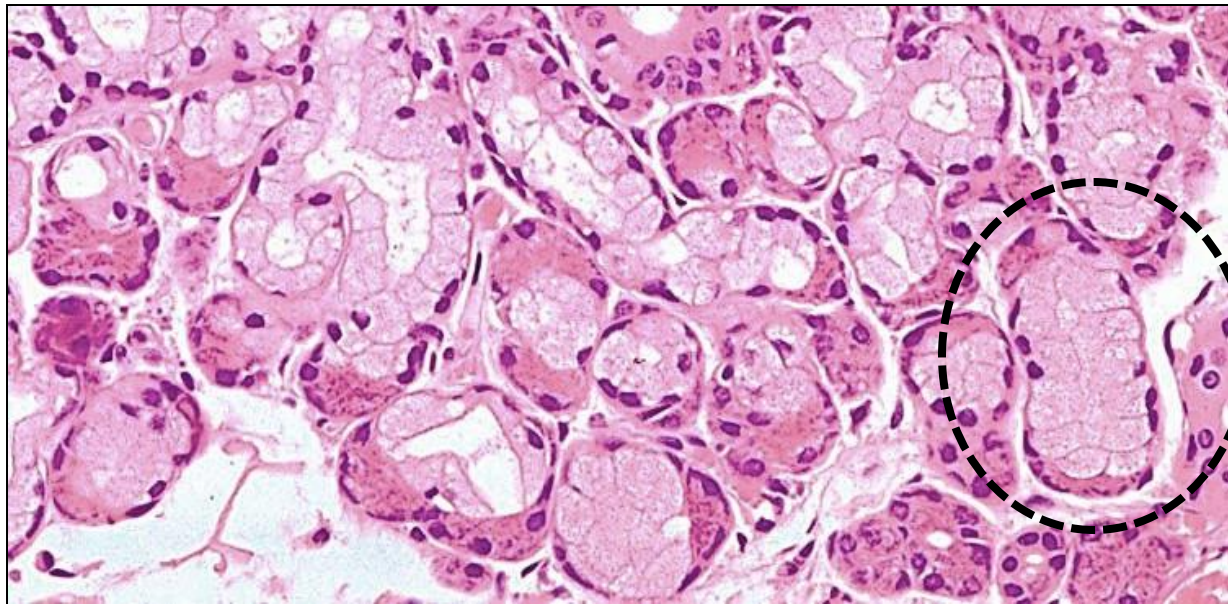
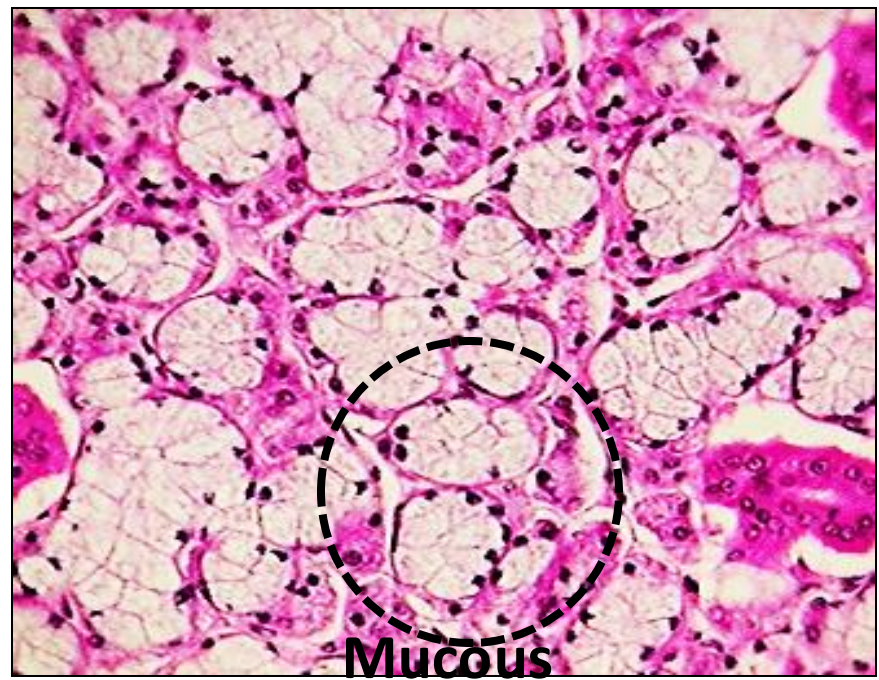
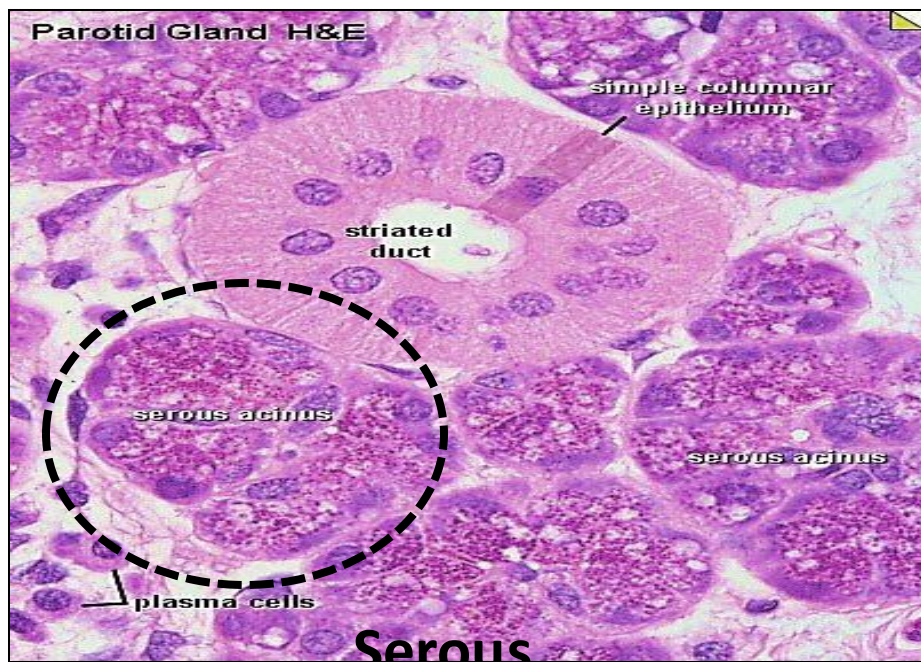
- Group of cells encircling a lumen
- The cells are either:
 - a- secretory cells (serous or mucus)
 - b- non- secretory cells (Myoepithelia)



- The acini are classified according to the type of secretion into:

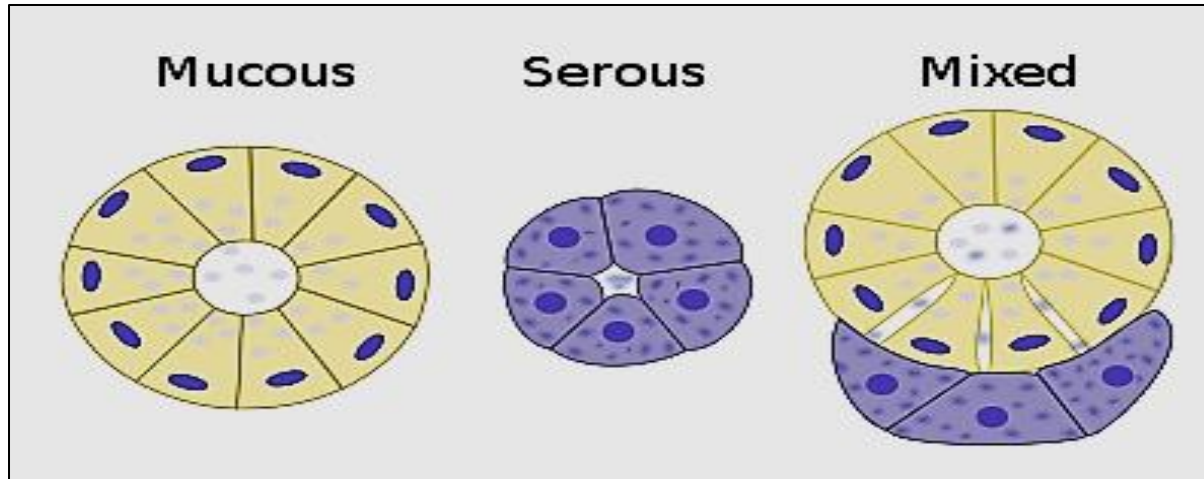
1. serous
2. mucous
3. mixed (muco-serous)





Mixed

Serous vs. Mucous acinus



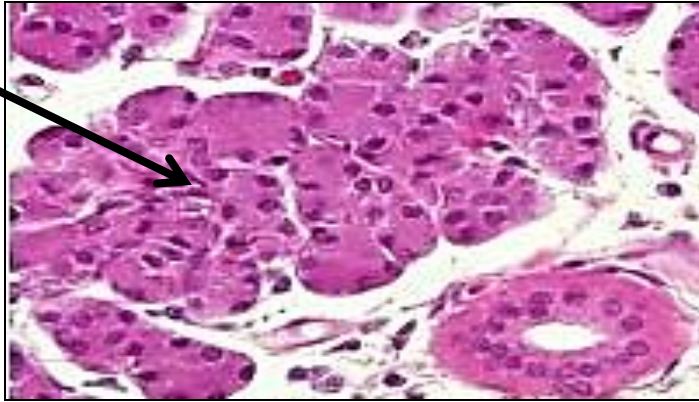
Serous (**Parotid**)

- 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



Serous

Mucous



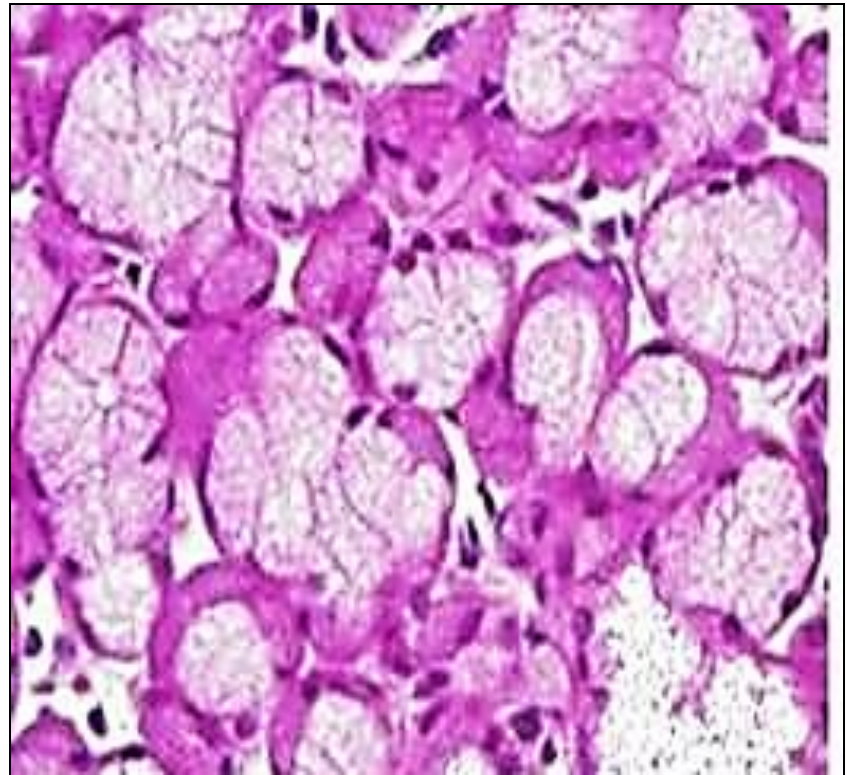
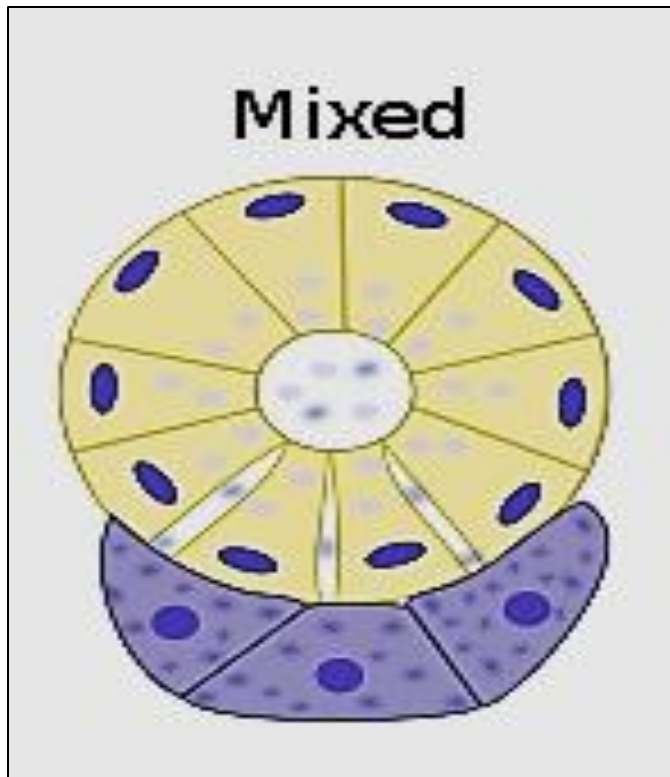
Mucous

- 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

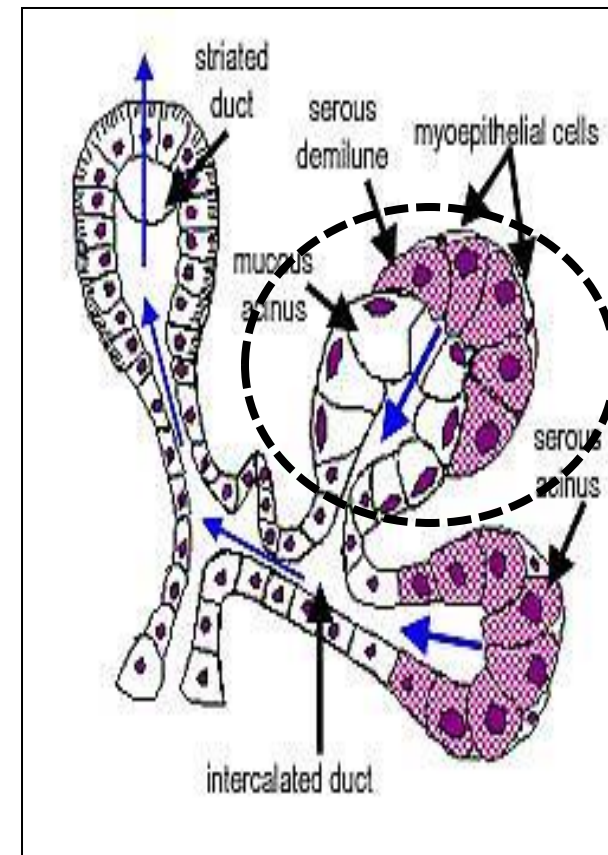
Mixed (muco-serous) acinus

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



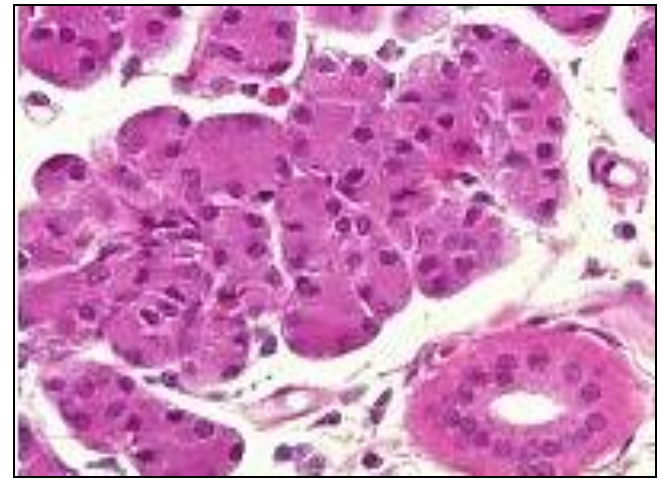
Crescent of Gianuzzi (serous demilune):

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



○ Parotid gland:

- Acini: are pure serous

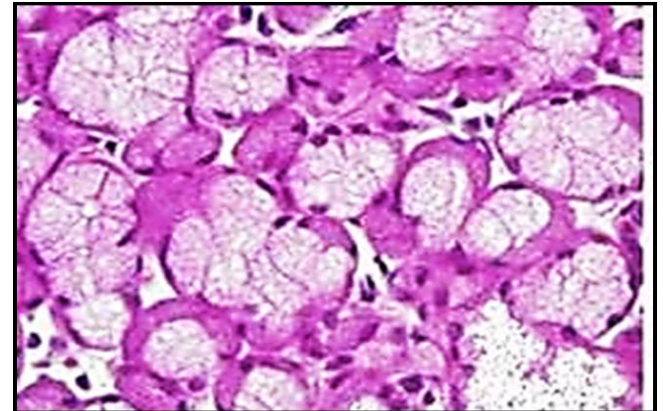


○ Sublingual gland:

The smallest & the only unencapsulated

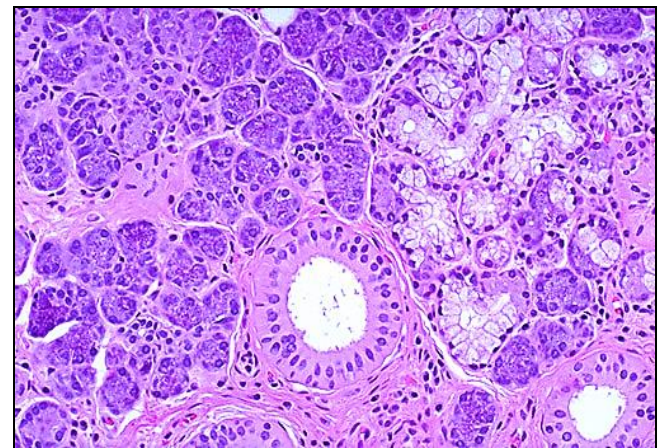
Acini : mostly mucous capped
with serous demilunes

Produce mainly mucous



○ Submandibular gland:

- Acini: mixed serous & mucous



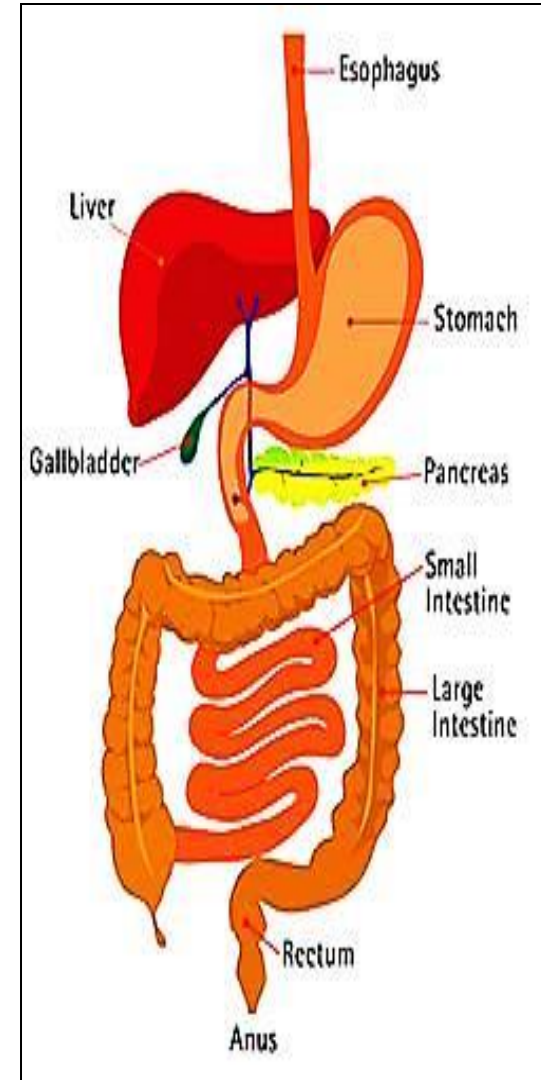
2- The Gastro- intestinal tract

Composed of:

- Esophagus
- Stomach
- Small intestine
- Large intestine
- Anal canal

GIT is a tube, its wall made of 4 layers

Some modifications occur along its length



General features of the wall of the GIT

its wall is composed of 4 layers:

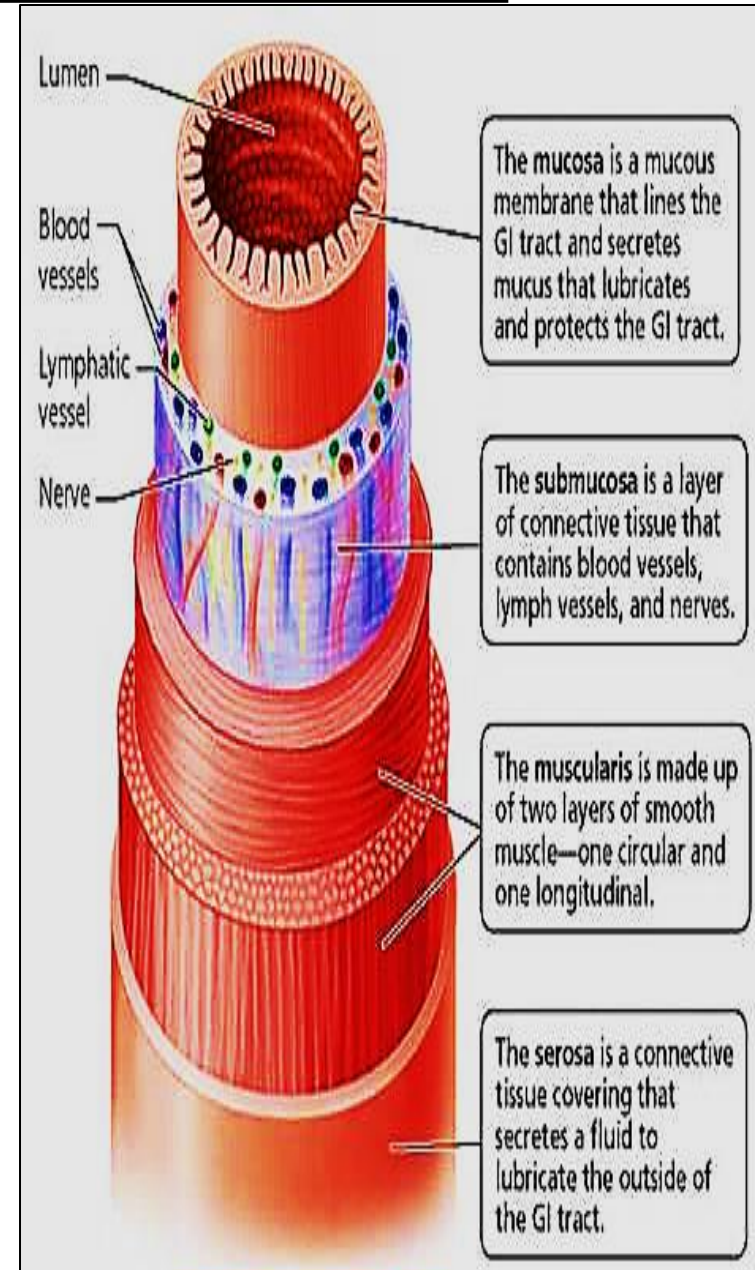
❑ Mucosa:

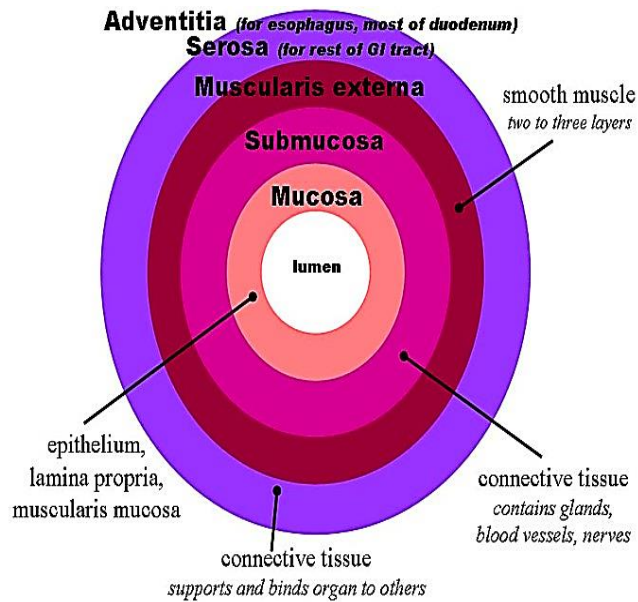
- Epithelium
- CT (Lamina propria, corium)
- Muscularis mucosa (s. ms.)

❑ Submucosa: C.T.

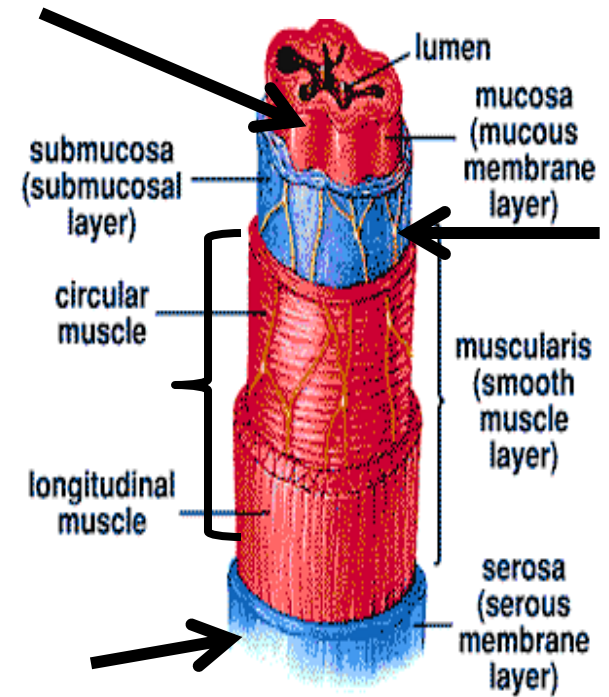
❑ Musculosa : 2 layers of smooth muscles (IC & OL)

❑ Adventitia or serosa





GIT Layers



1.

Mucosa

2.

Submucosa

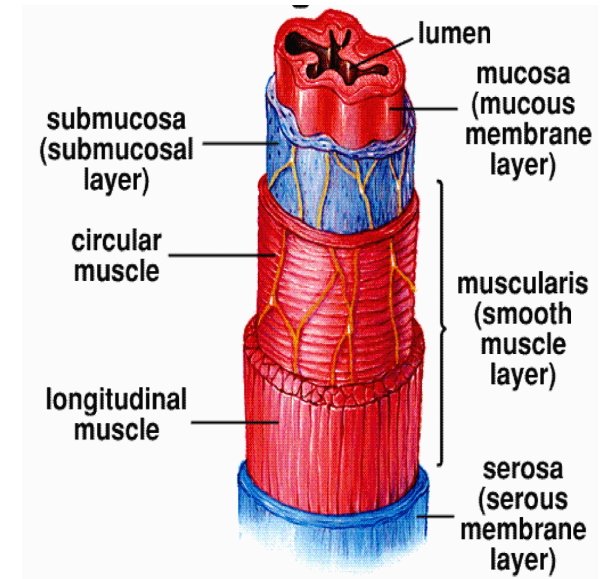
3.

**Musculosa
(muscularis
externa)**

4.

**Serosa
Or
Adventitia**

1. GIT Mucosa



1.Epithelium

Simple columnar

Except esophagus &
anal canal..?

2.Lamina propria

Loose CT

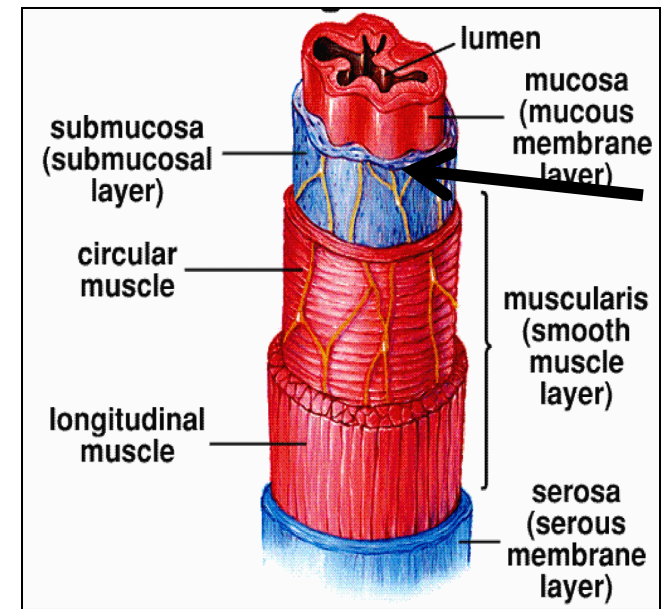
Mucous glands
Lymphatic nodules

3.Muscularis mucosa

Layer of smooth ms.
produce
folds of mucosa



2. GIT Sub-Mucosa



**Dense irregular
CT**

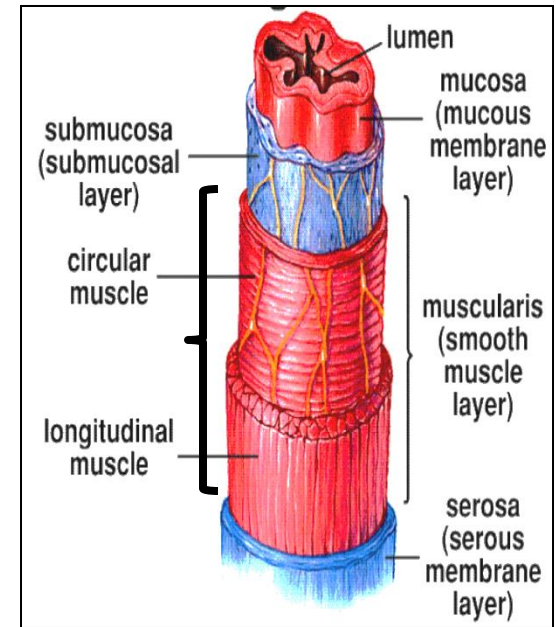
**May contain
Mucous glands
Lymphatic nodules**

**Meissner's
plexus
(autonomic ganglia)**

3.GIT

Musculosa

(muscularis externa)

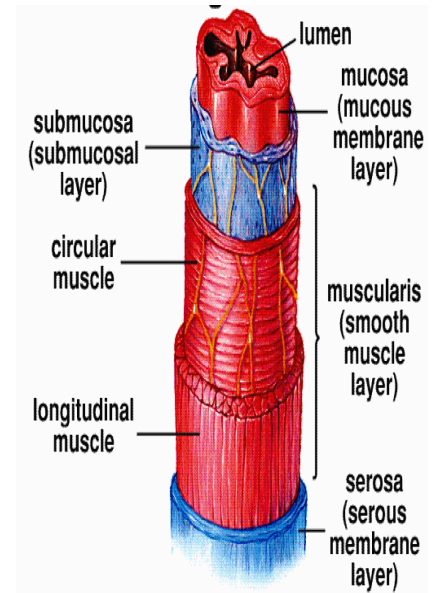


**Inner
Circular
(IC)**

**Auerbach's or
Myenteric plexus
(Between two layers)**

**Outer
longitudinal
(OL)**

4. Serosa or Adventitia



Serosa
Covered by
Peritoneum

Adventitia
Not covered
by peritoneum

Adventitia vs. serosa

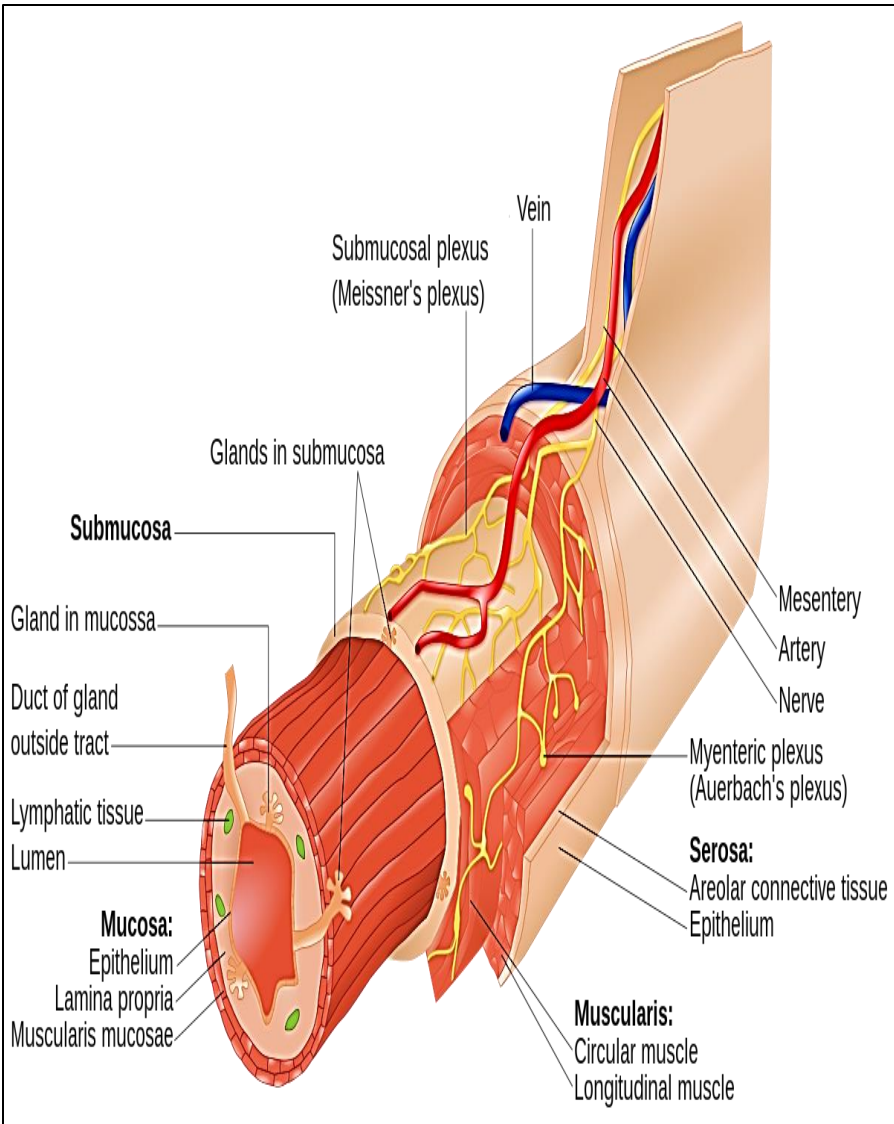
Serosa: double layer membrane made of epithelium (mesothelium)

One layer is attached to the organ called **visceral layer**, the other layer will be close to the body cavity & called **parietal layer**. In between these two epithelial layer is fluid called **serous** for lubrication (reduce friction)

Serosa will wrap organs that set in a body cavity i.e abdominal cavity like GIT organs within the peritoneum i.e intraperitoneal organs (**liver, stomach, spleen, 1st part pf duodenum, ileum, jejunum, transverse & sigmoid colon**)

Adventitia: is not epithelial is loose CT that wraps organs that set outside the peritoneal cavity i.e. retroperitoneal and attach them to the abdominal cavity

pancreas, esophagus, ascending & descending Colcon



Serosa

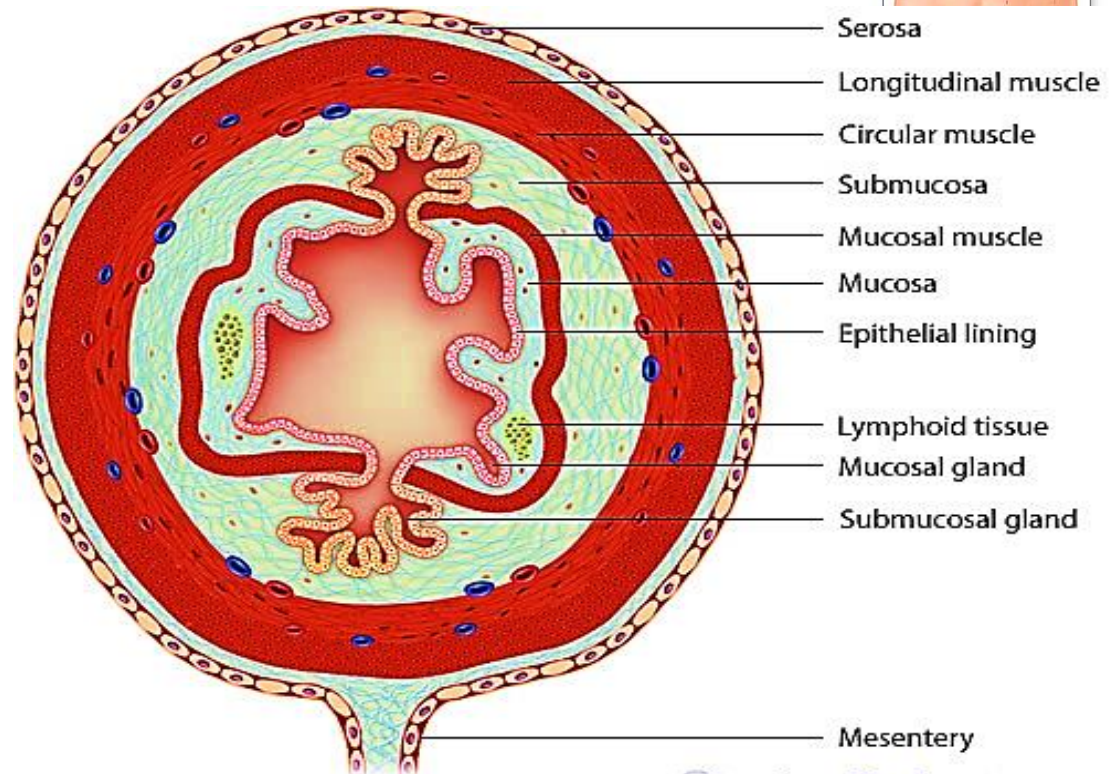
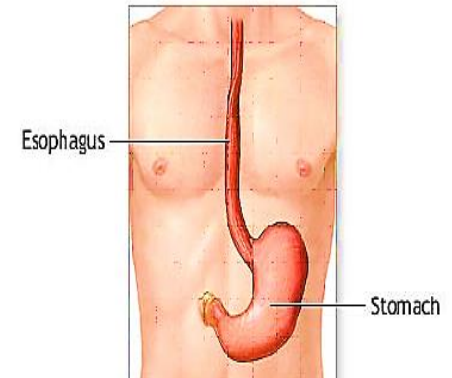


Adventitia

The esophagus

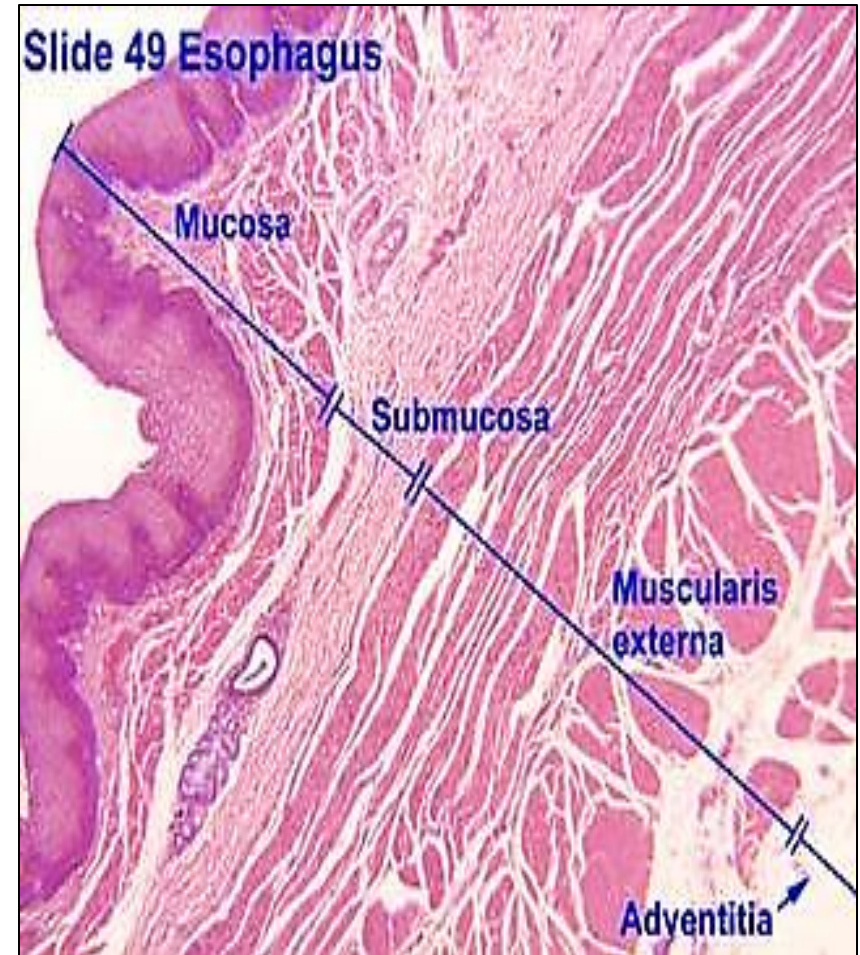
- Muscular tube connects the pharynx with stomach, transport food
- Its wall consists of 4 layers:

- Mucosa
- Submucosa:
- Muscularosa
- Adventitia

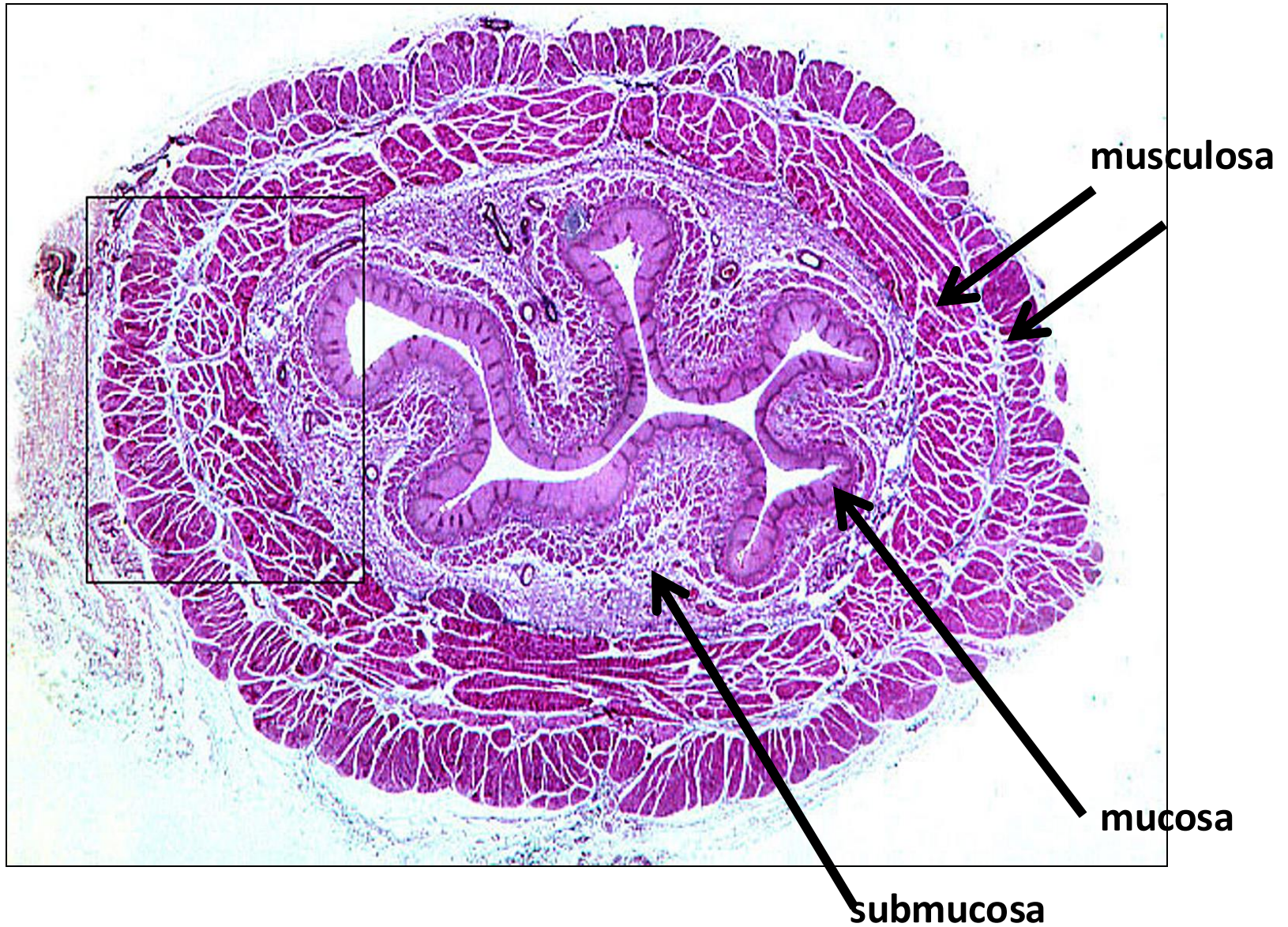


Esophagus

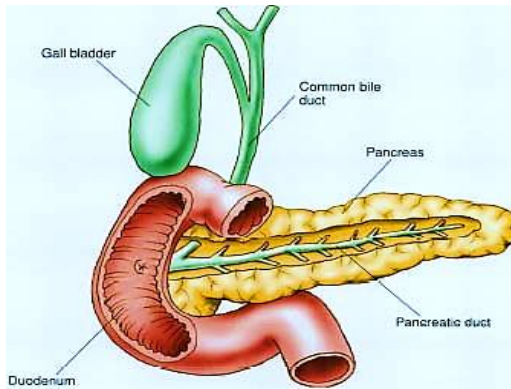
- **Mucosa**
Epithelium: thick layer of **non-keratinized stratified Squamous epithelium**
- **Submucosa**: C.T. contains BV, & esophageal mucous glands
- **Musculosa** : upper 1/3 striated, lower 1/3 smooth ms. middle 1/3 mixture of both
- **Adventitia**: C.T. layer with NO peritoneum



Cross section in the Esophagus



Pancreas

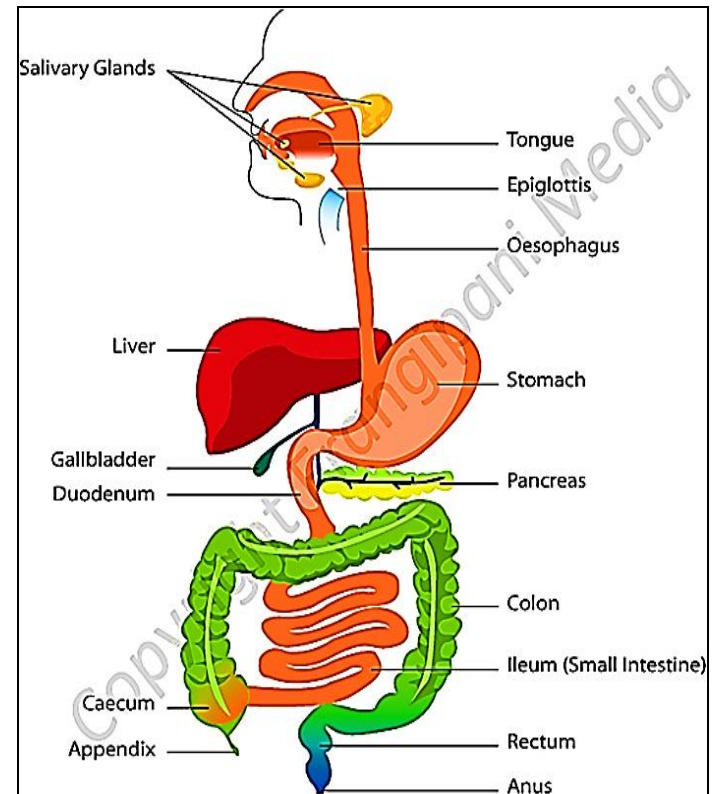


Exocrine
(Acini+ ducts)

Endocrine
Islets of Langerhans
(Cells+ blood vessels)

3- Organs associated with digestive tract

- Liver
- Pancreas
- Gall bladder



Pancreas

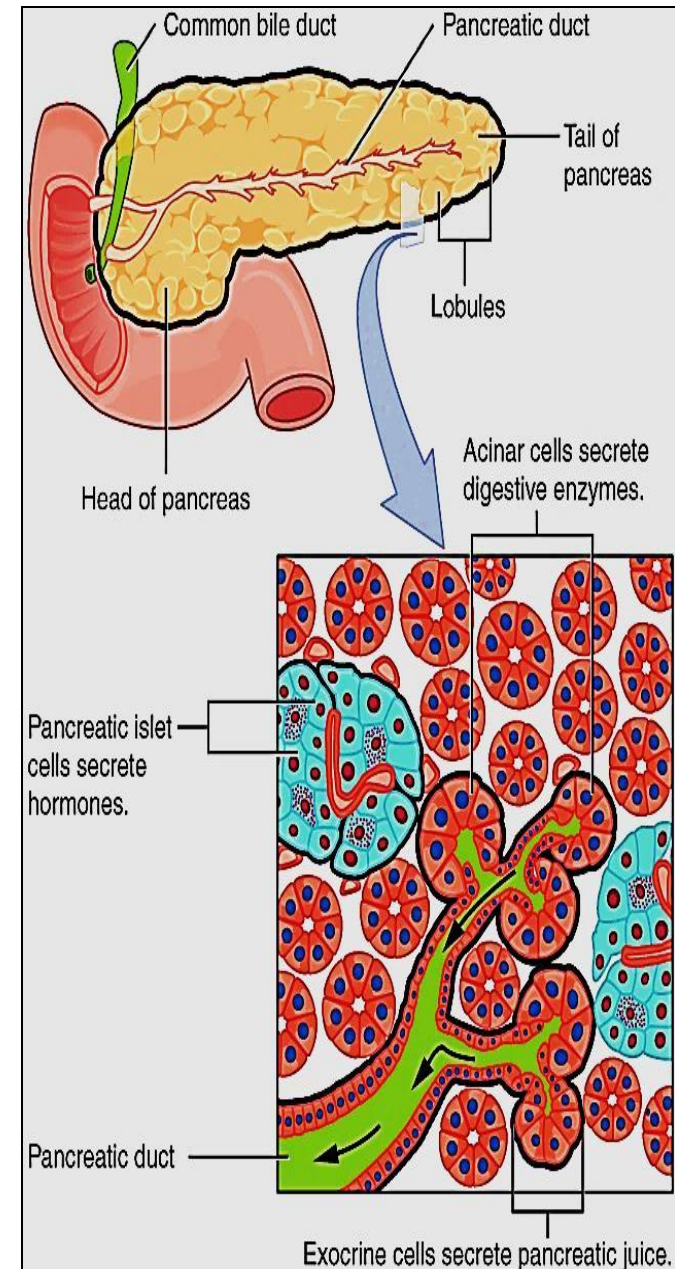
Is a gland with **mixed gland**

Exocrine part:

- Secretory acini secrete enzymes that pass through pancreatic duct → small intestine

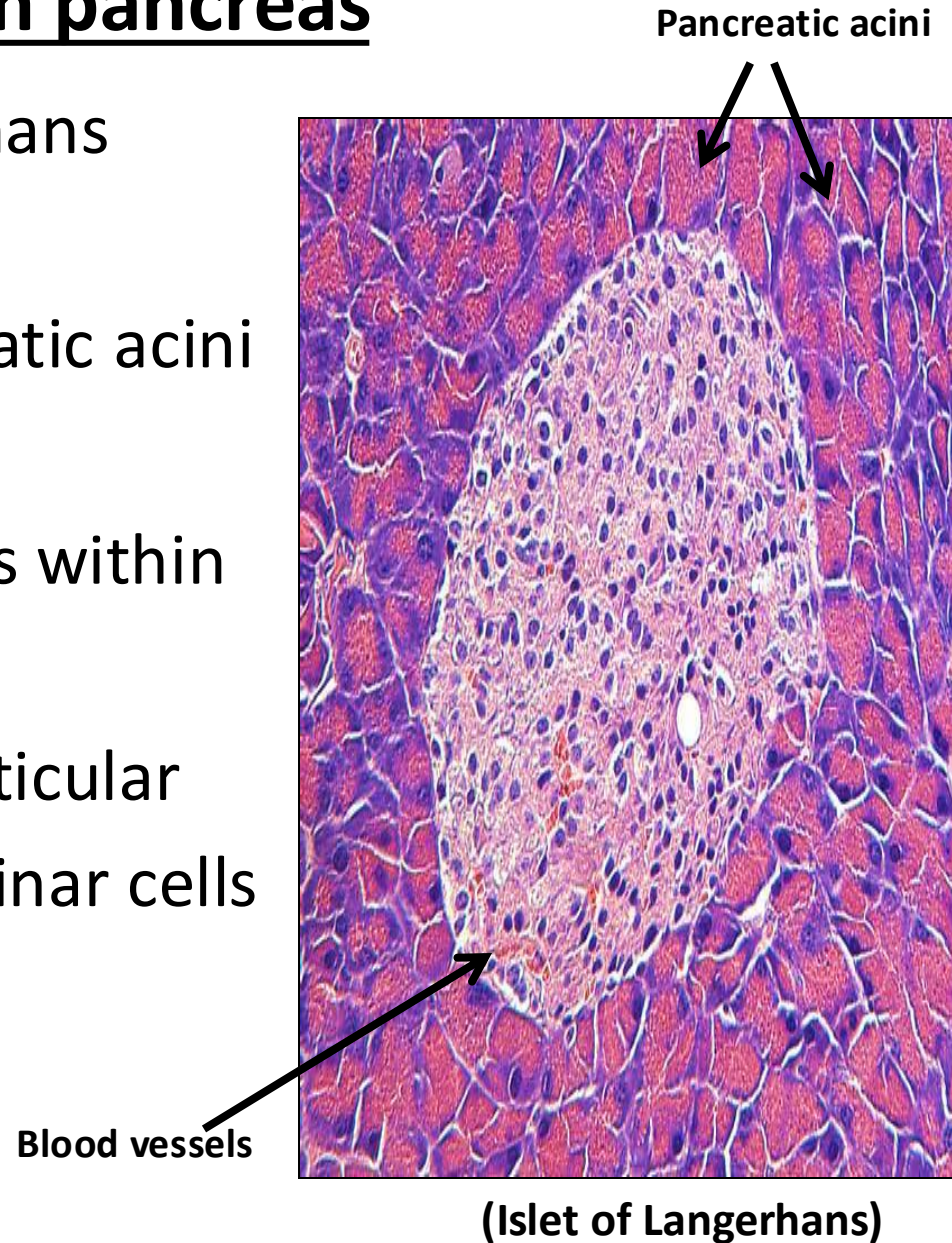
Endocrine part (*Islets of Langerhans*):

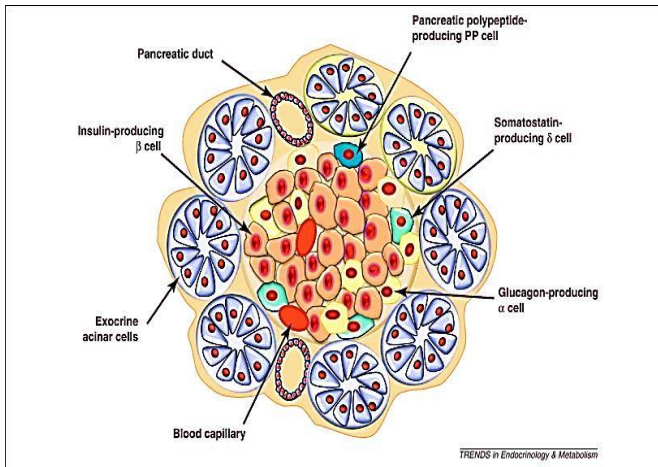
- More at tail of pancreas
- Lie between exocrine acini
- Secrete hormones **directly to blood**



Section in pancreas

- Showing an islet of Langerhans
- Islet surrounded by pancreatic acini
- Islet cells enclose bl. vessels within
- Islet cells surrounded by reticular fibers to separate it from acinar cells





Cells of islet of Langerhans

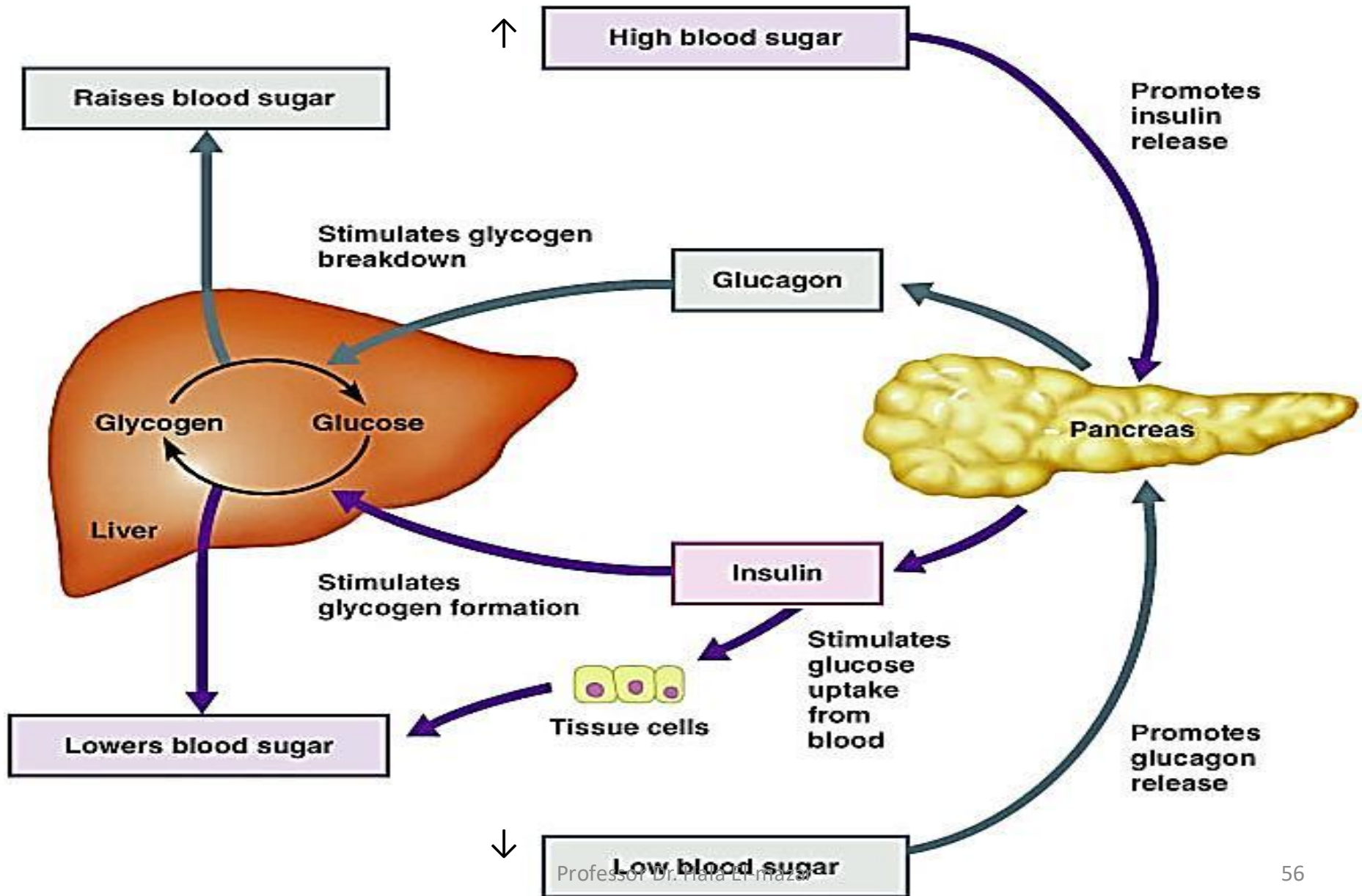
Alpha cells
20%
Glucagon
↑
bl. glucose

Beta cells
70%
Insulin
↓
bl. glucose

Delta cells
Somatostatin
Control other
Hormone
levels

F - cells
Pancreatic
Polypeptide
hormone
Controls
Pancreatic
acini

Regulation of blood glucose level



Thank you

