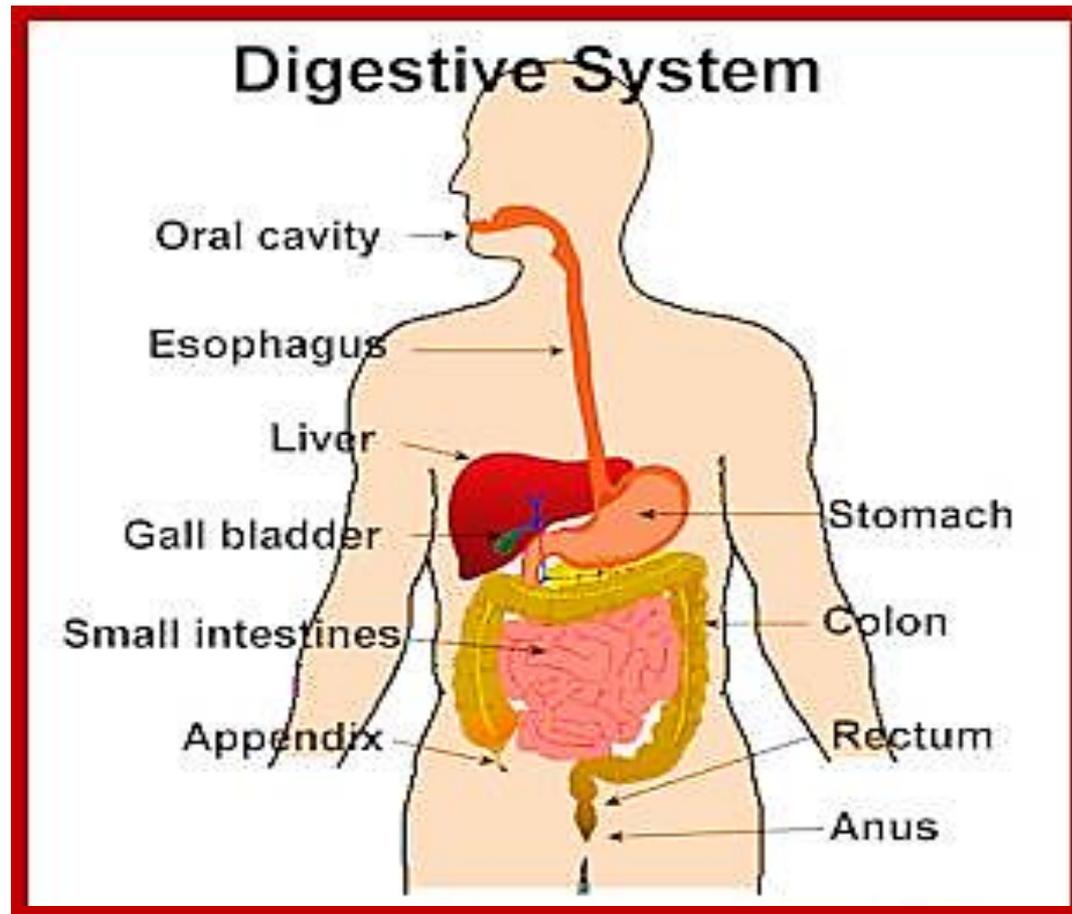


Introduction to The Digestive system

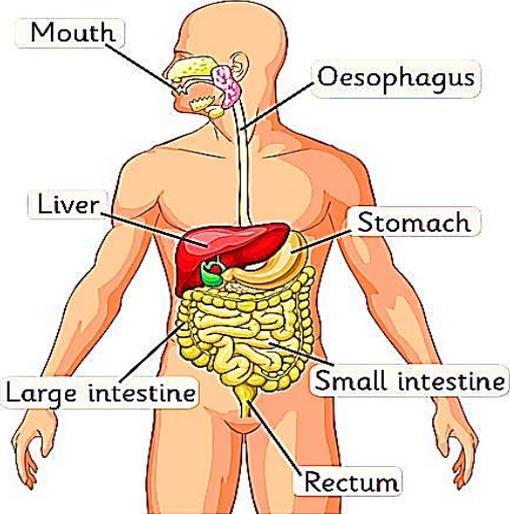


Professor Dr. Hala El-mazar



Digestive system

The digestive system



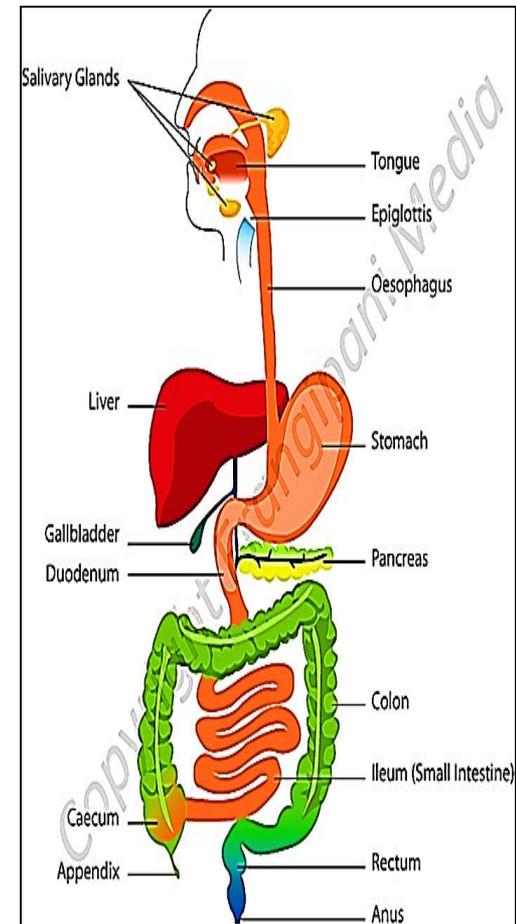
1. Oral cavity

2. Digestive tract

3. glands

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)



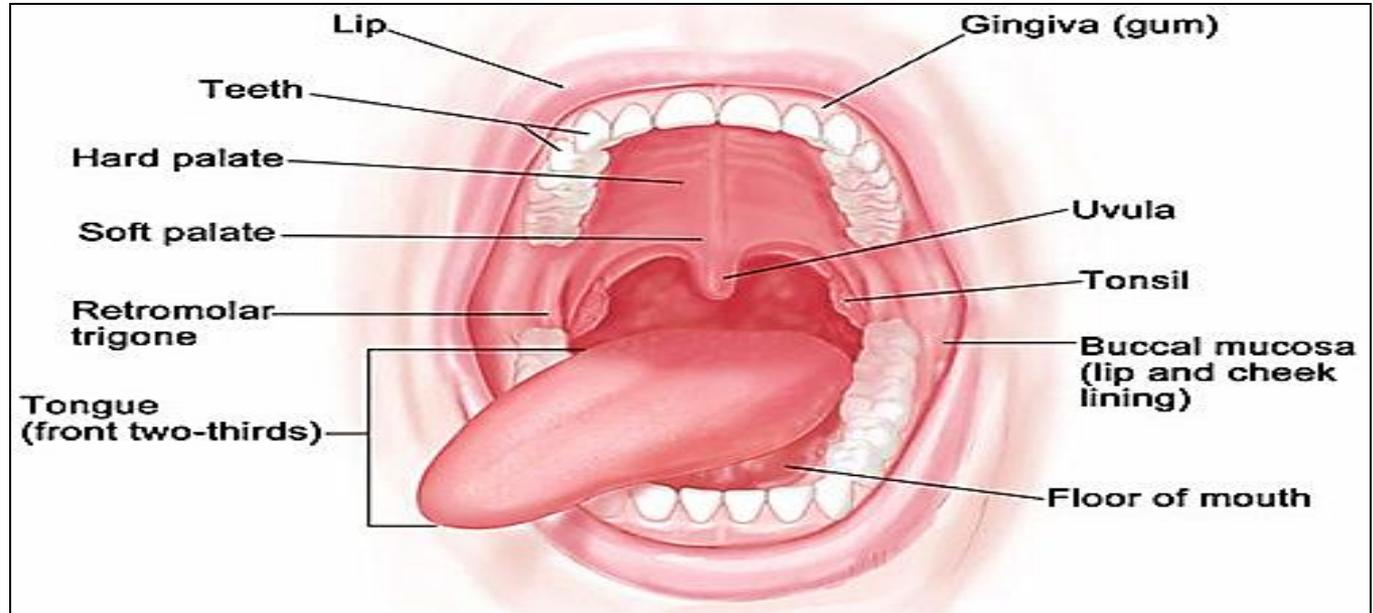
Function of digestive system:

- **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

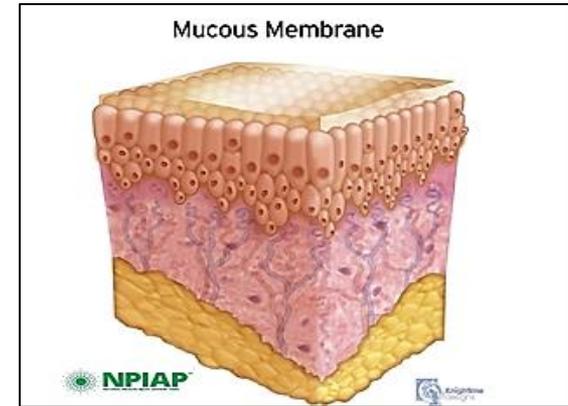


- Hard and soft palates - form roof of mouth.
- Salivary glands (3 pairs) & their ducts
- Ends by pharynx

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

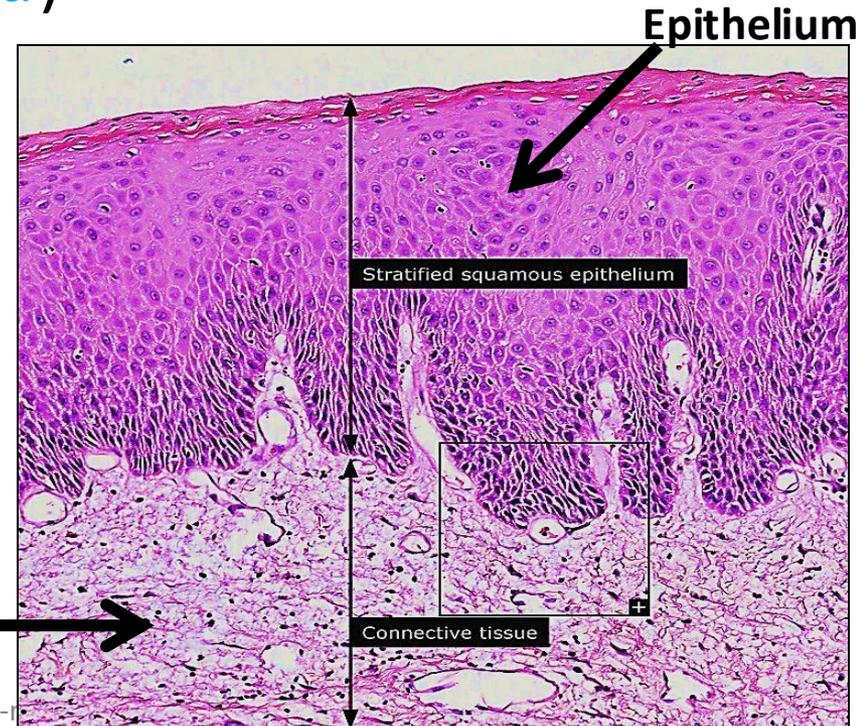
A- Epithelium:

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



B- Lamina propria:

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



Lamina propria

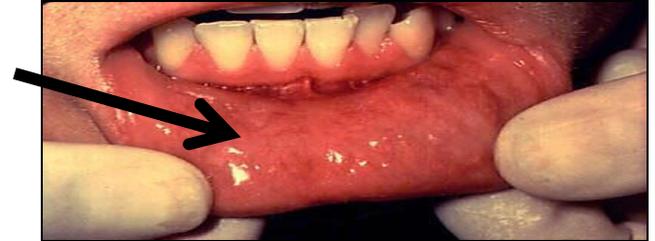
The lips

Labial.....

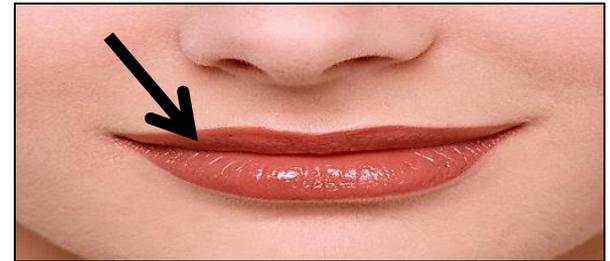
A- outer surface covered by **skin**



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

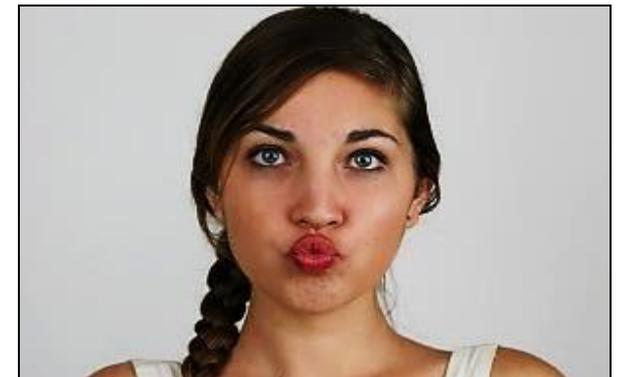


C- Lip margin (**red margin**)



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

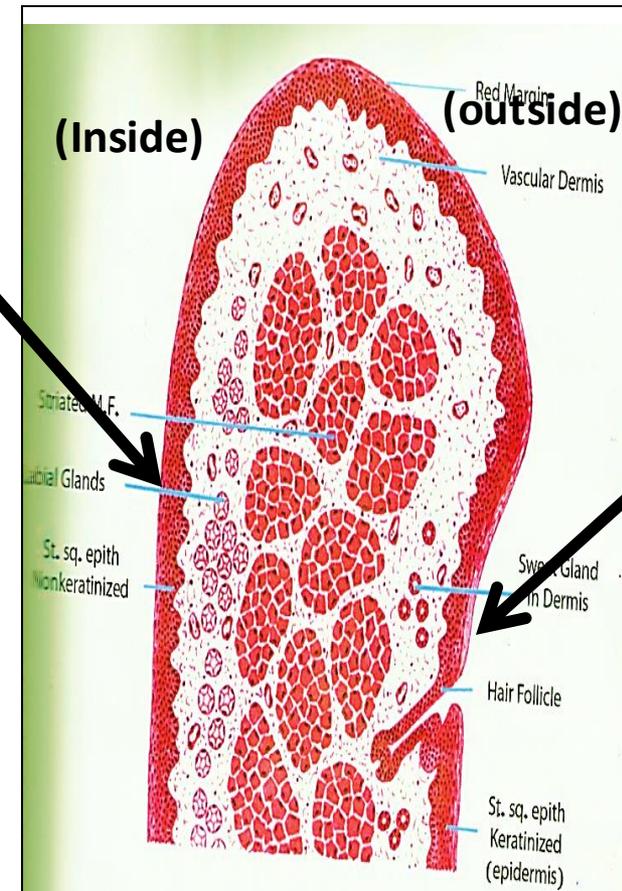
2- Inner surface: covered by **mucous m**

A) Non-keratinized stratified squamous

B) Lamina propria: loose C.T.,

contains **B.V.**, lymphatic's, nerves

labial glands *



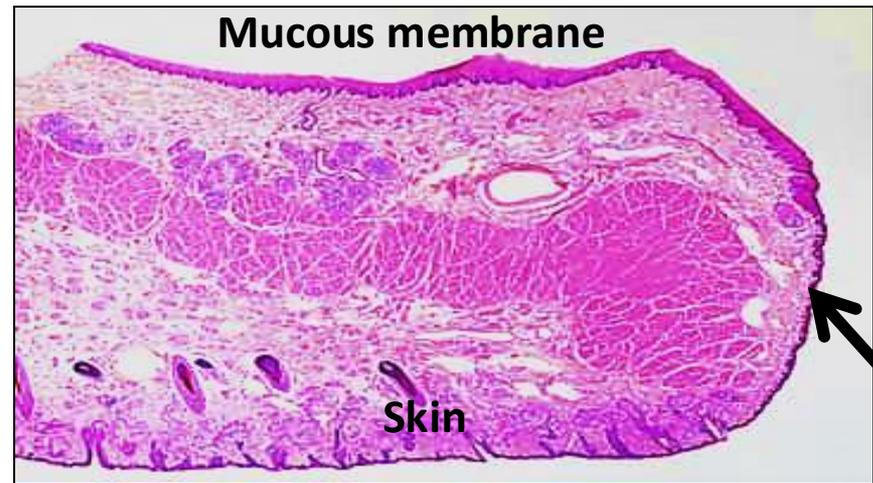
C- Red margin of lip :
covered with *modified skin*:

1- Thin

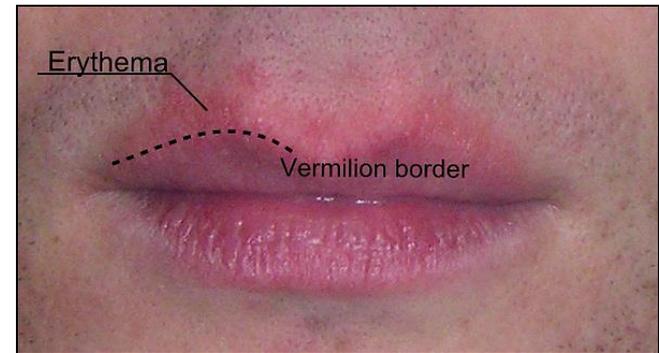
less keratinized, *No hair follicles, No sebaceous or sweat glands.*

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

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



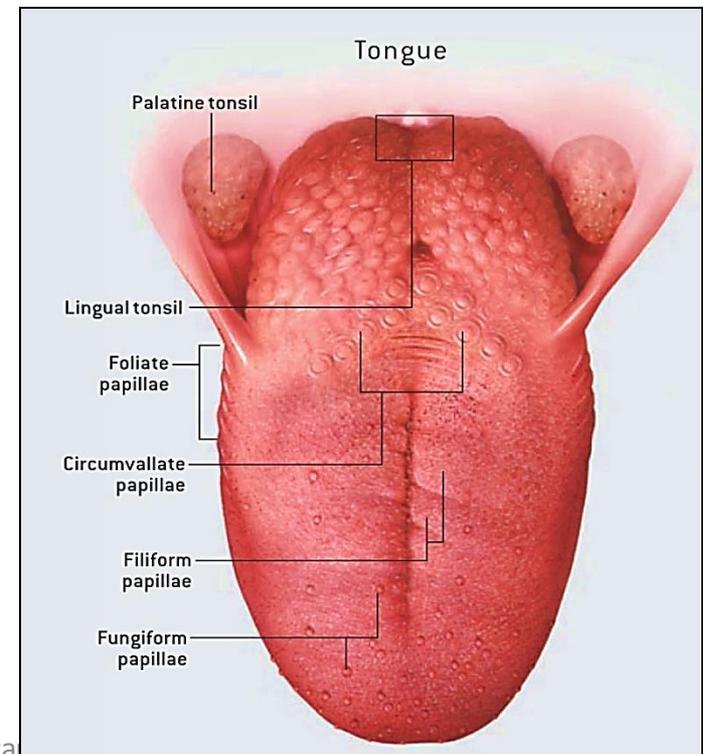
The lip margin (**vermillion**) represent the change in the epidermis from highly keratinized facial skin to less Keratinized labial skin. richly supplied with free nerve endings. So it is *highly sensitive*.



The tongue

Function of tongue:

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

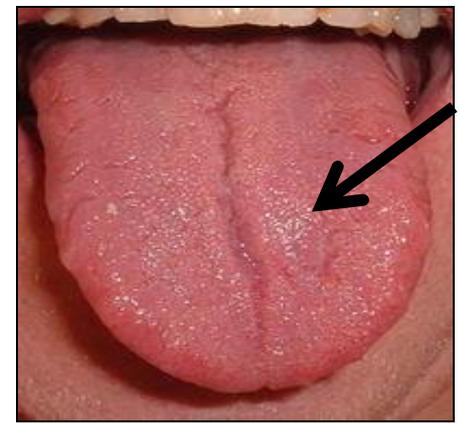


The tongue lingual.....

It has:

1- dorsal (upper) surface:

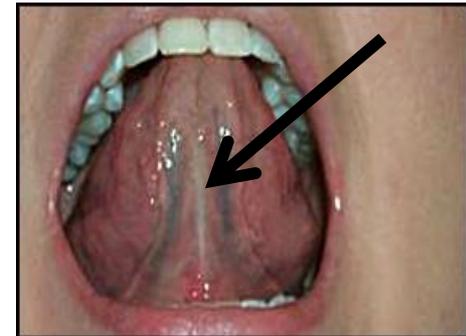
- Rough, has **lingual (tongue) papillae**
- Covered e **partially keratinized stratified squamous epith.**



(Dorsal surface)

2- ventral surface:

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

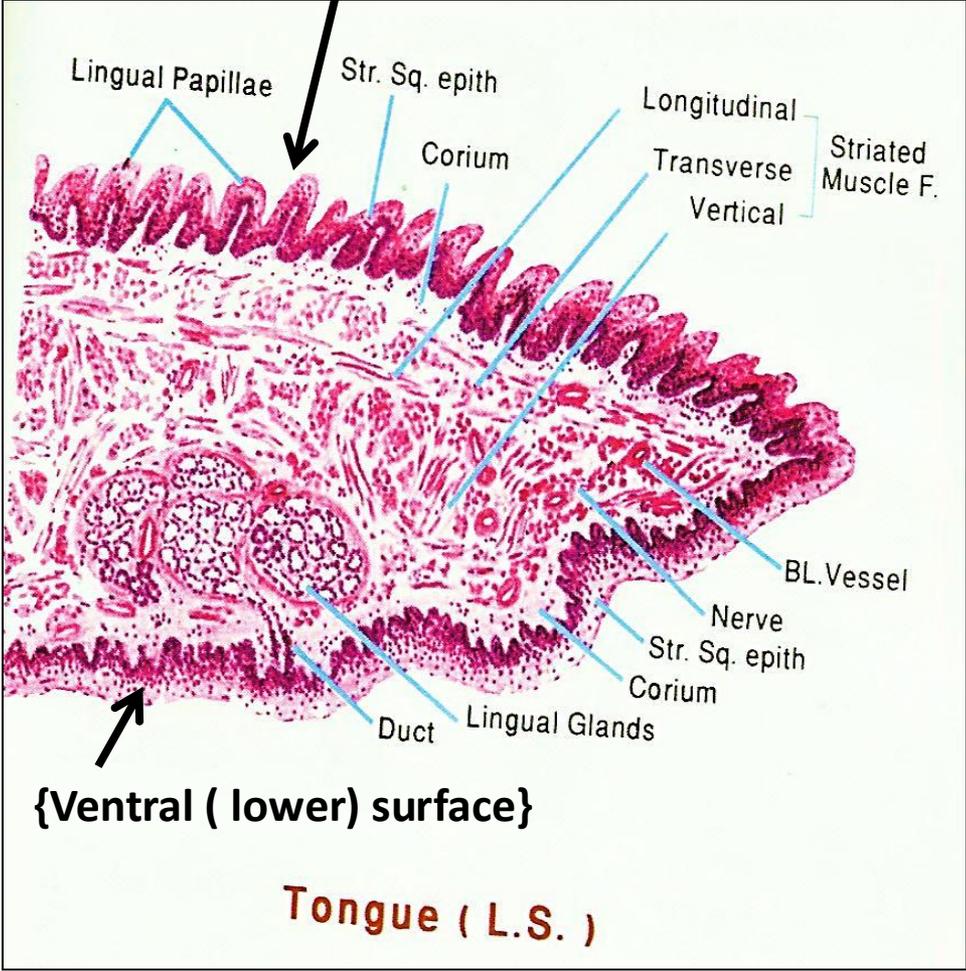
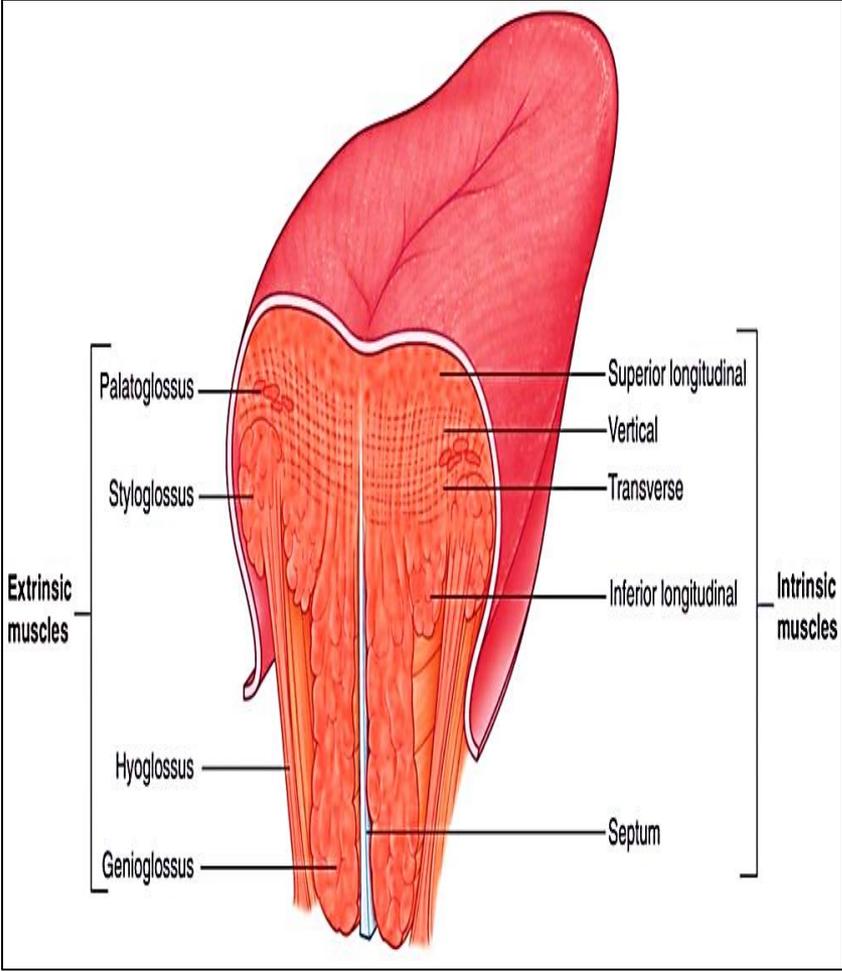


(Ventral surface)

3- Inside of tongue :

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

{Dorsal (upper) surface}



{Ventral (lower) surface}

Tongue (L.S.)

Structure of the tongue

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

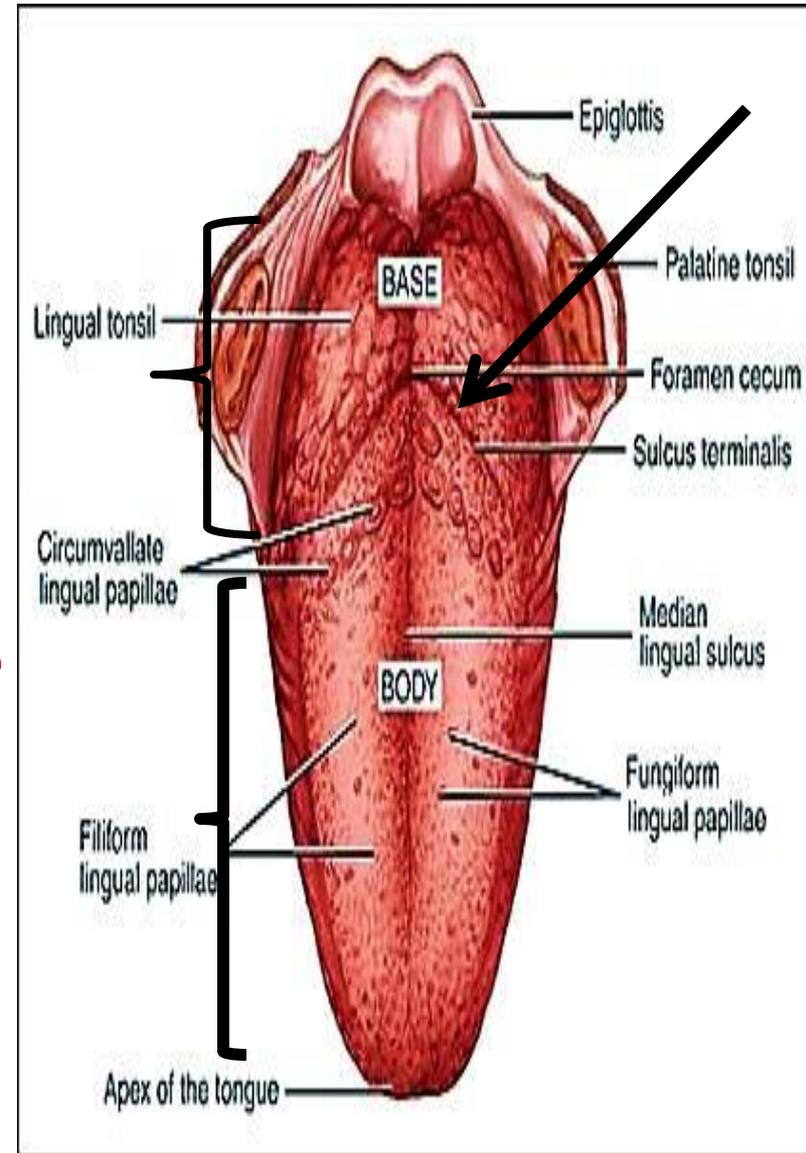
- It divides the tongue into:

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

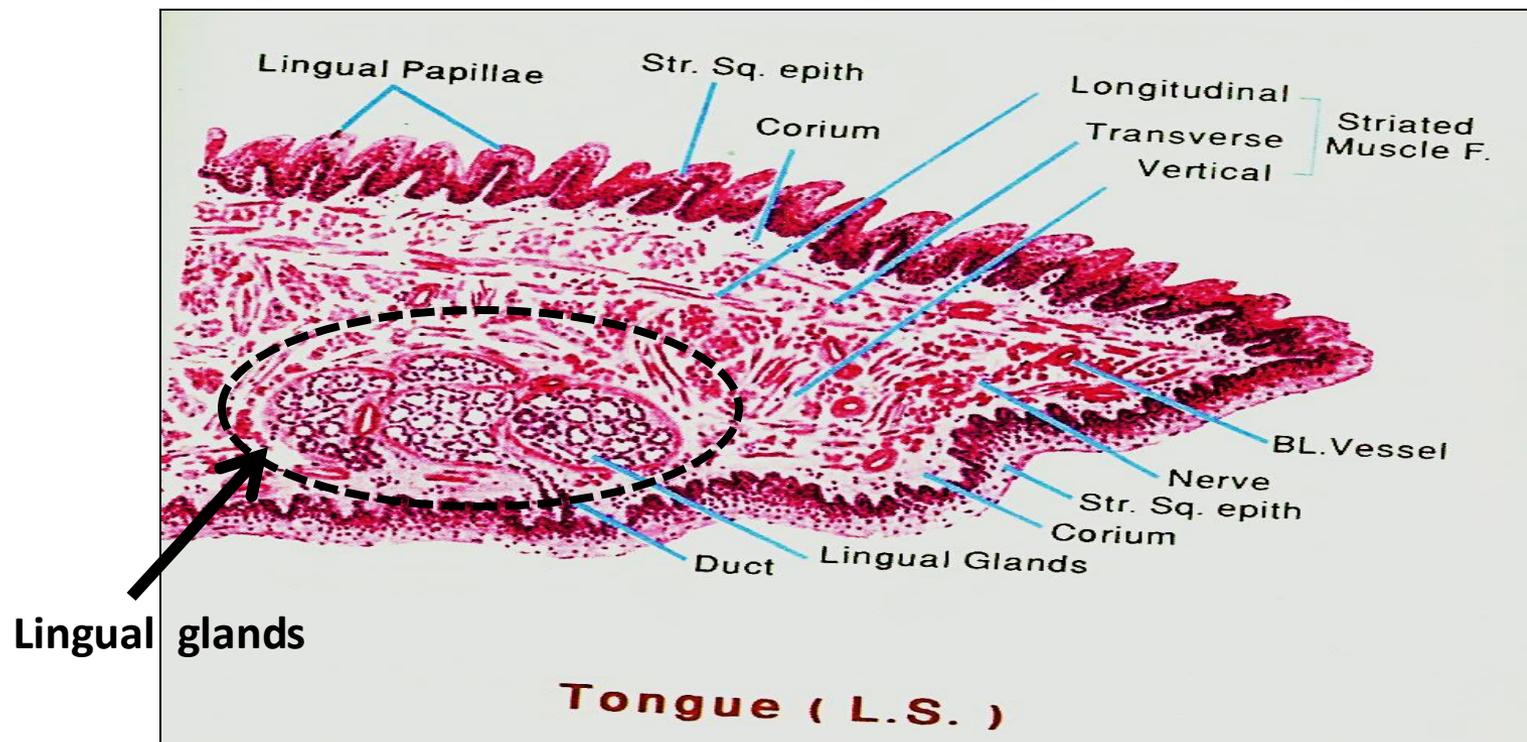
- **base** (posterior **1/3**)

- 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

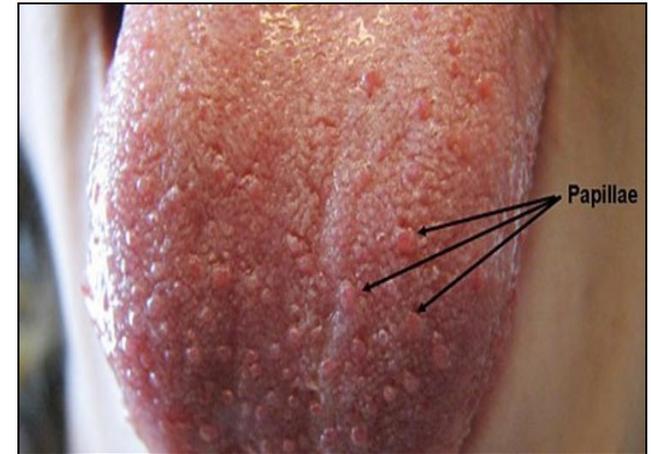


Tongue (lingual) papillae

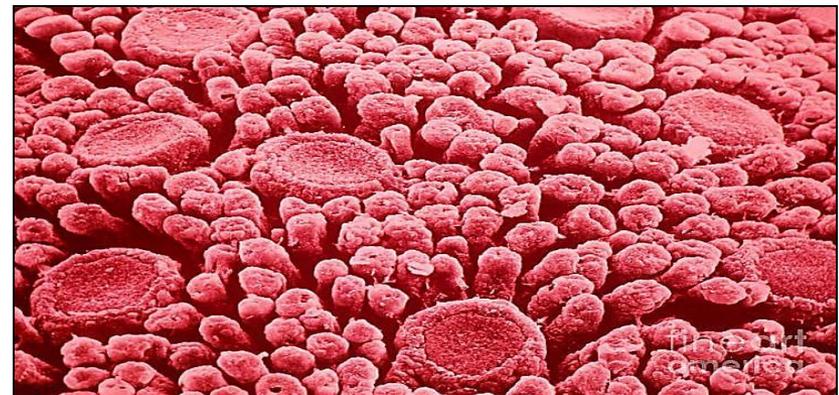
- Little projections on dorsal surface & sides of the tongue
- Formed of C.T. Core covered by **partially keratinized stratified squamous epithelium**

➤ Lingual papillae are 4 types:

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



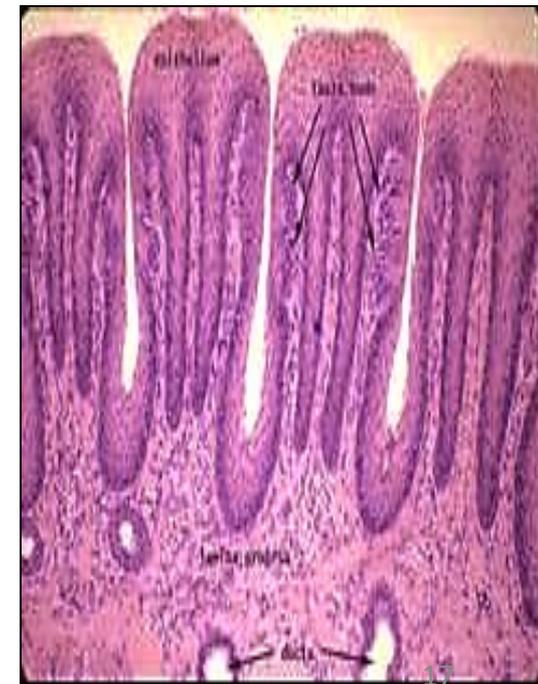
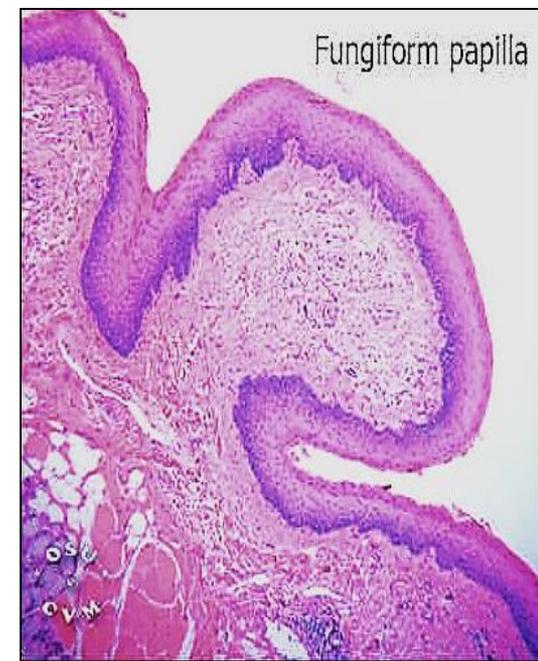
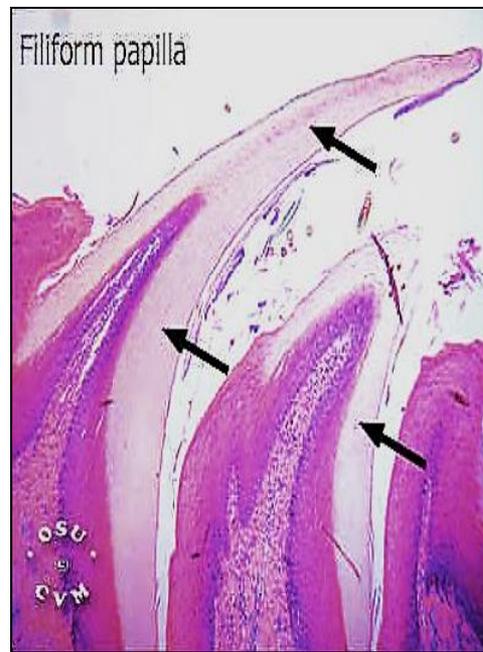
(Dorsal surface of tongue showing lingual papillae)



Lingual papillae:

• There are 4 Types:

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



Filiform papillae:

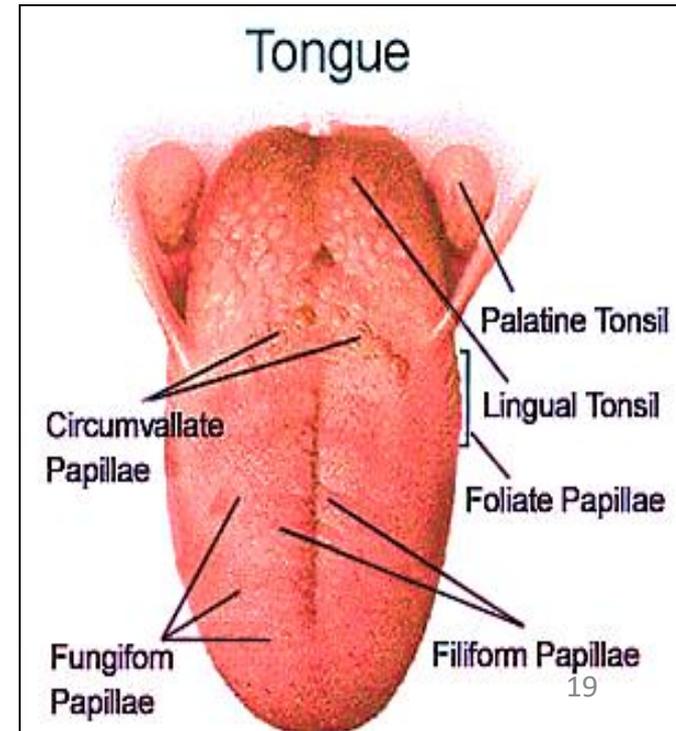
- Conical shape
 - contain **NO** taste buds
 - Formed of C.T. core covered e
- keratinized stratified squ. epithelium

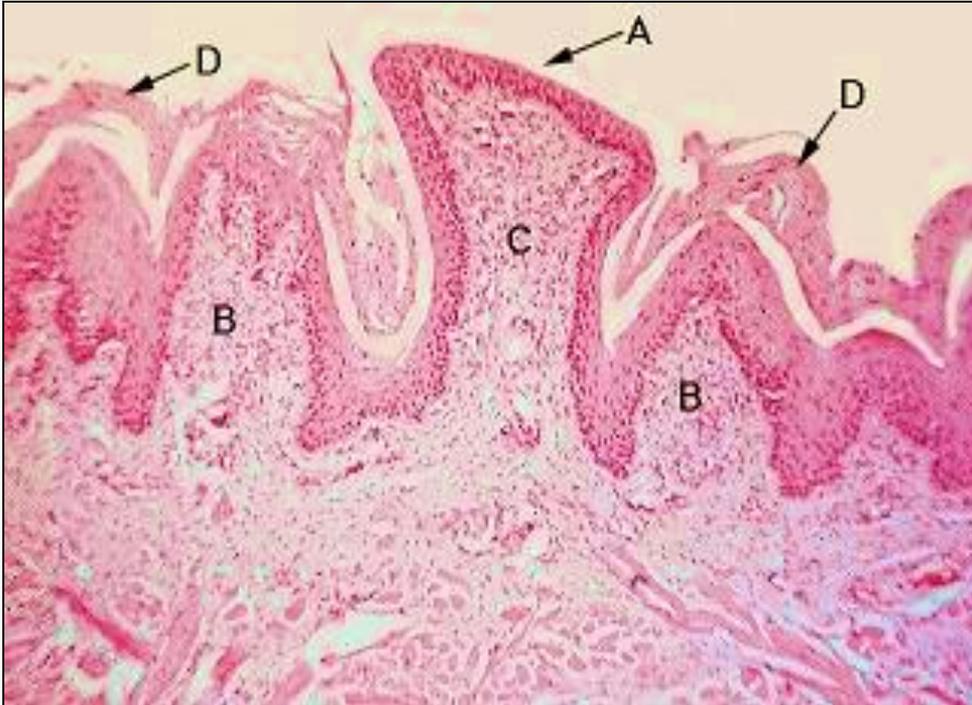


- Numerous in # found on ant. 2/3 of tongue
- give the tongue surface a roughness that aids in manipulating foods in the mouth(mechanical papillae)

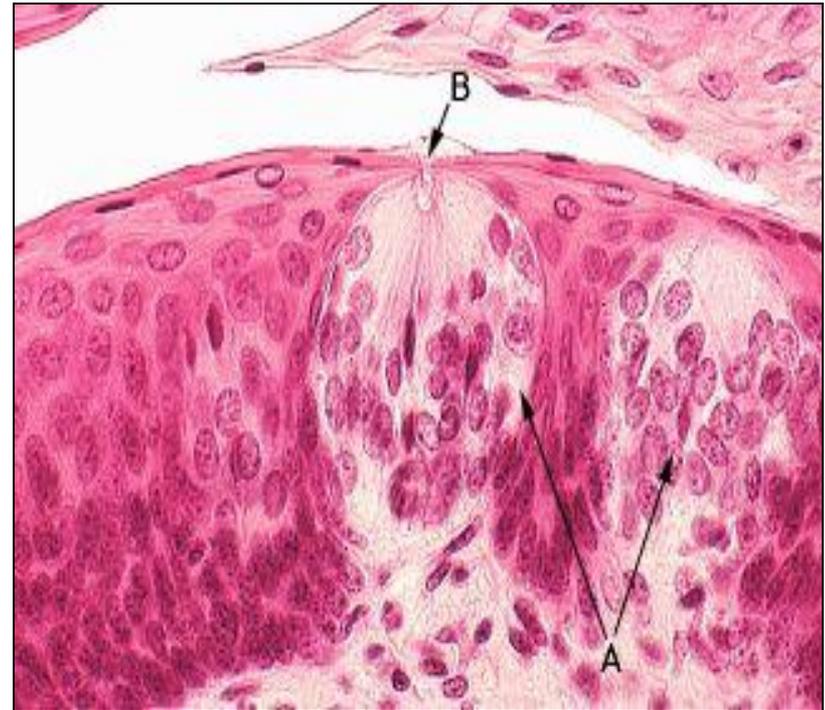
Fungiform papillae:

- 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.





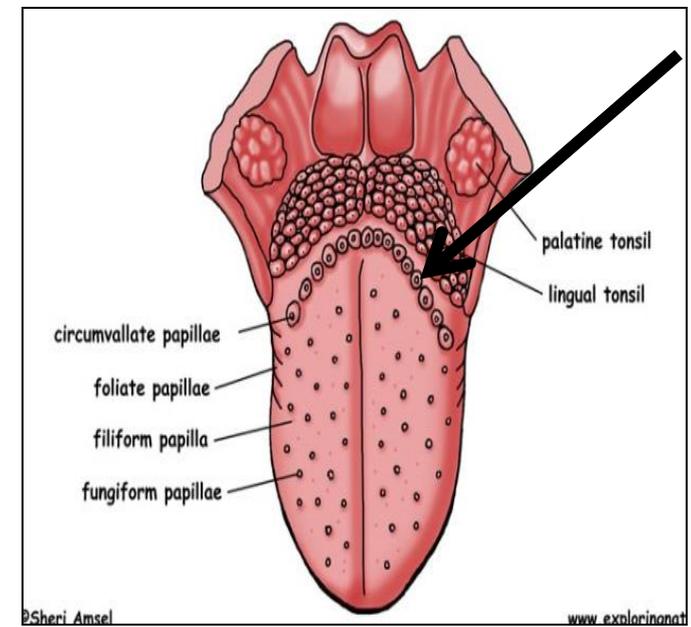
A: fungiform papillae
D: keratinized filiform papillae
B: connective tissue



Taste buds are intraepithelial structure

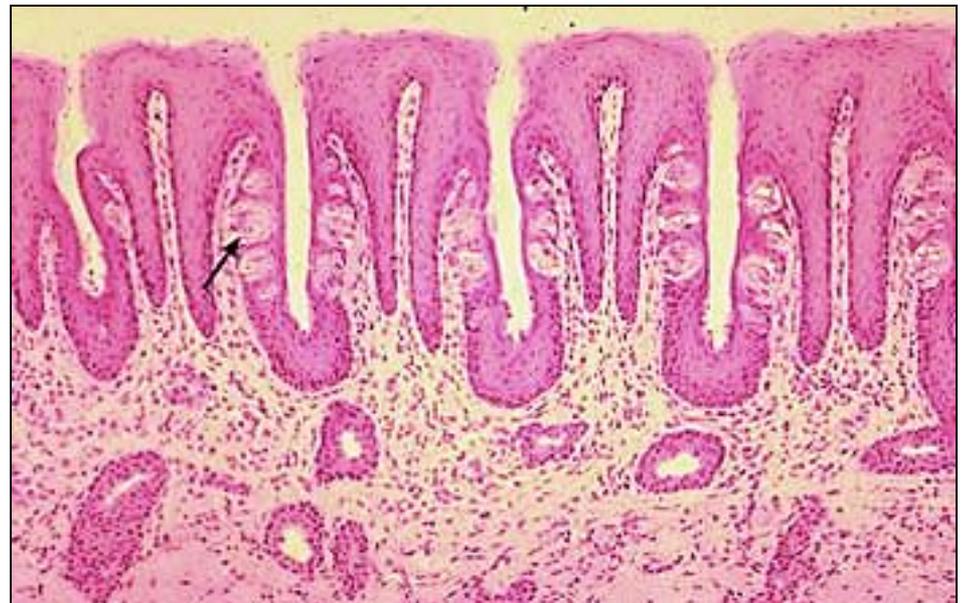
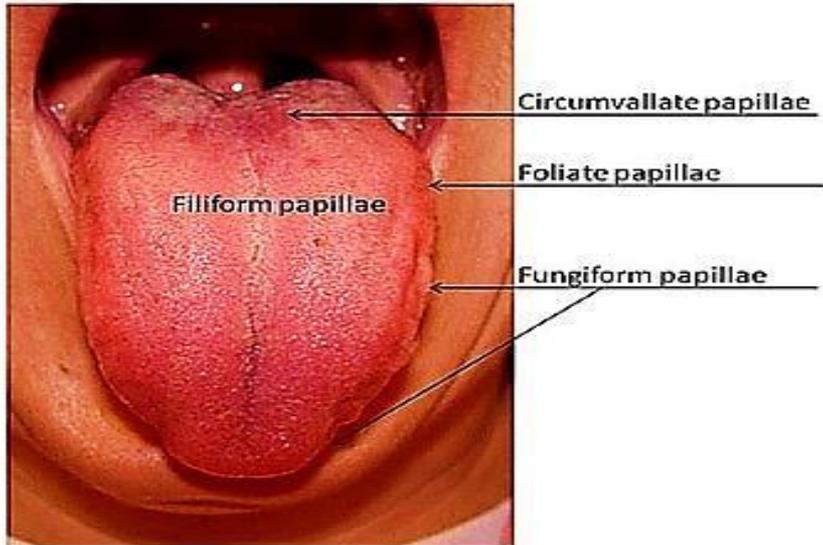
Circumvallate papillae:

- 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

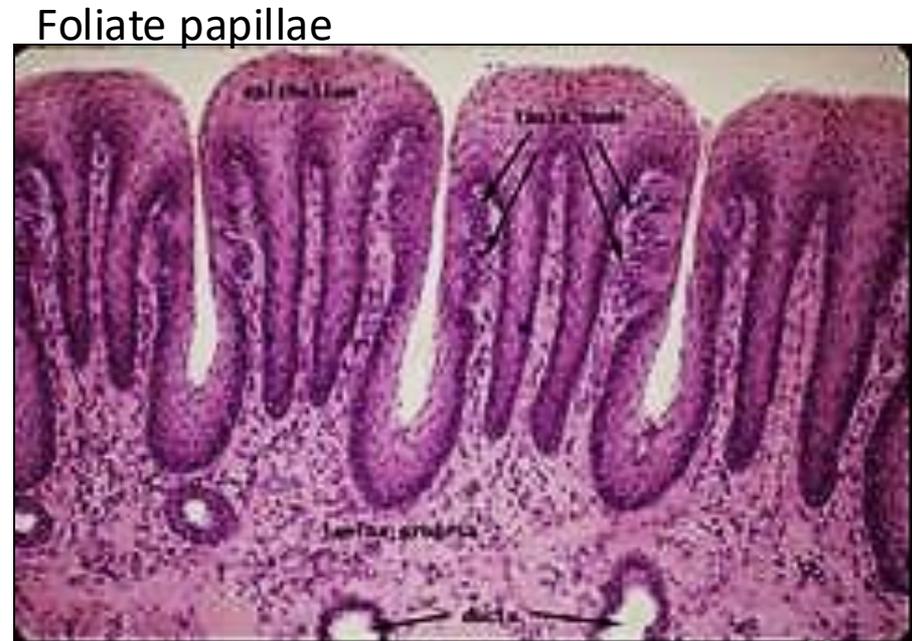
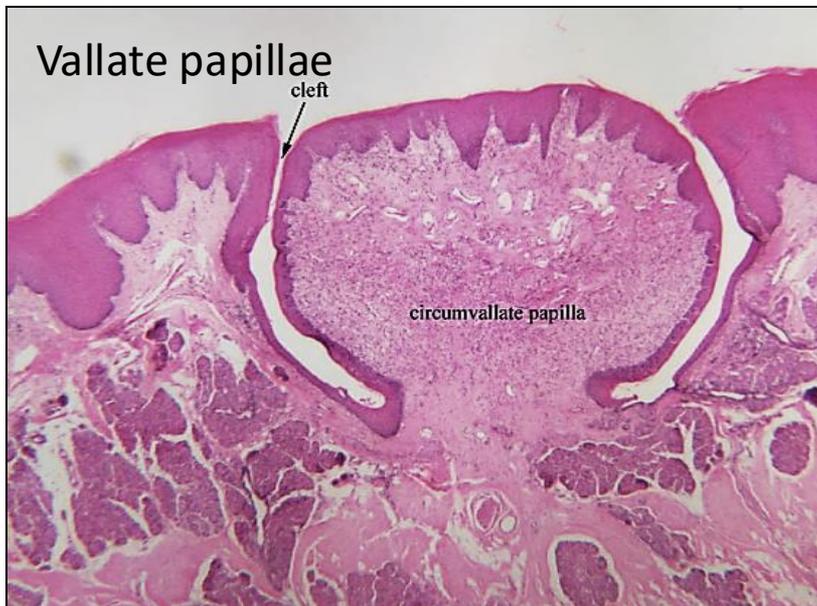
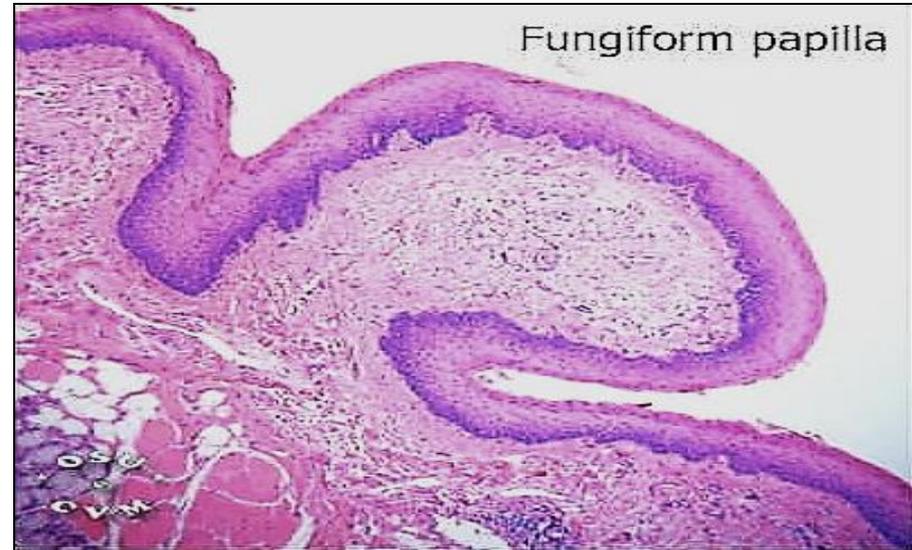
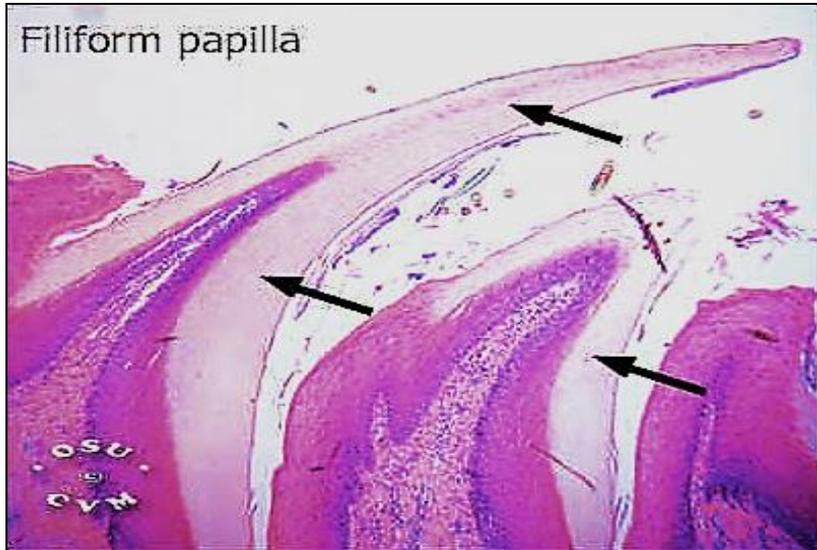


Foliate Papillae :

- 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

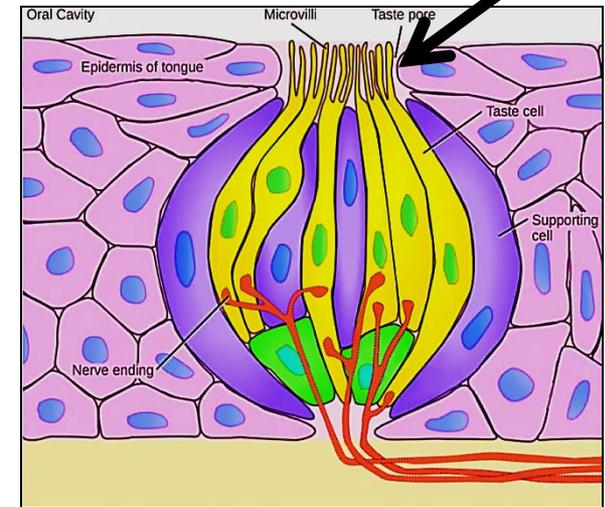
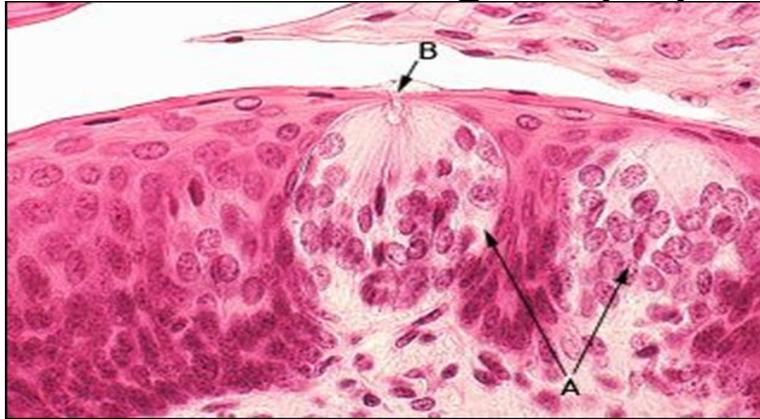


(Different shapes of lingual papillae)



Taste buds (neuro-epithelium)

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



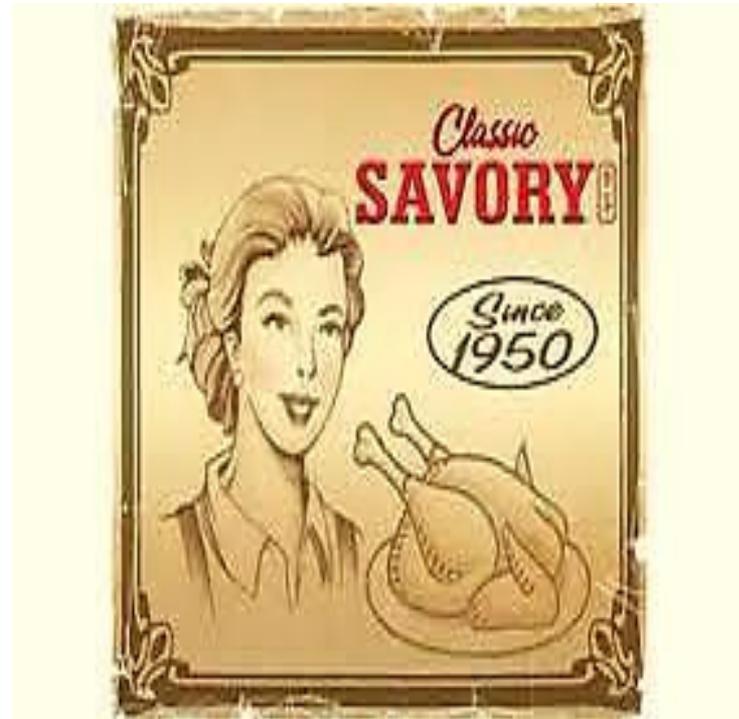
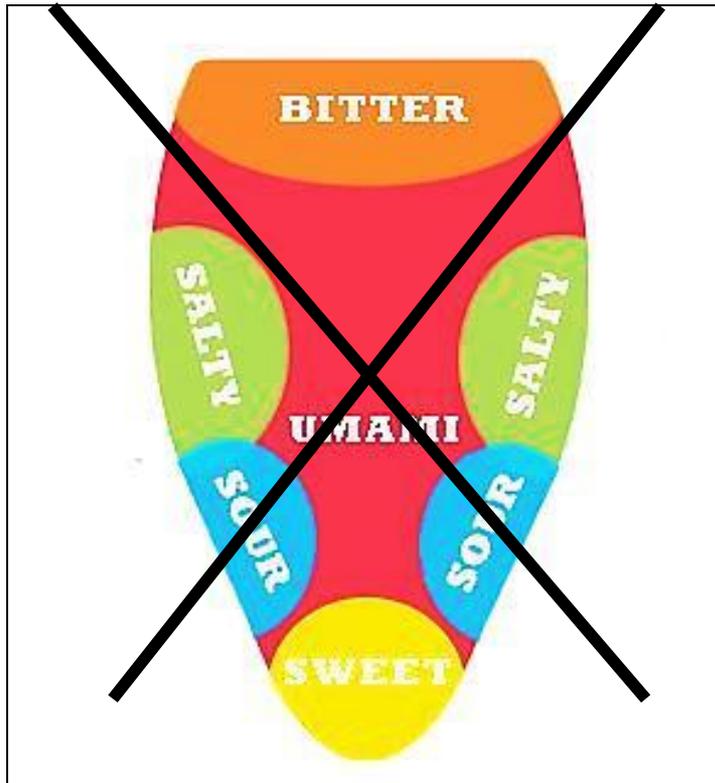
- Each taste bud formed of **3 types of cells & taste pore** for contact of saliva

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

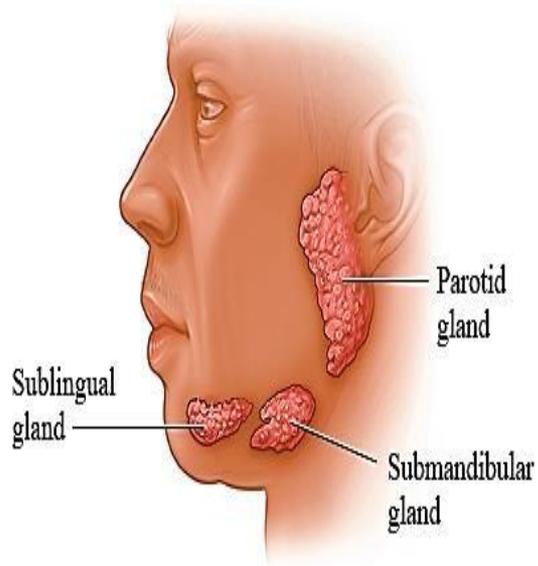
The sensation of taste can be categorized into five basic tastes: sweet, sour, salt, bitter, and umami.



- **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



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Salivary glands (3 pairs)

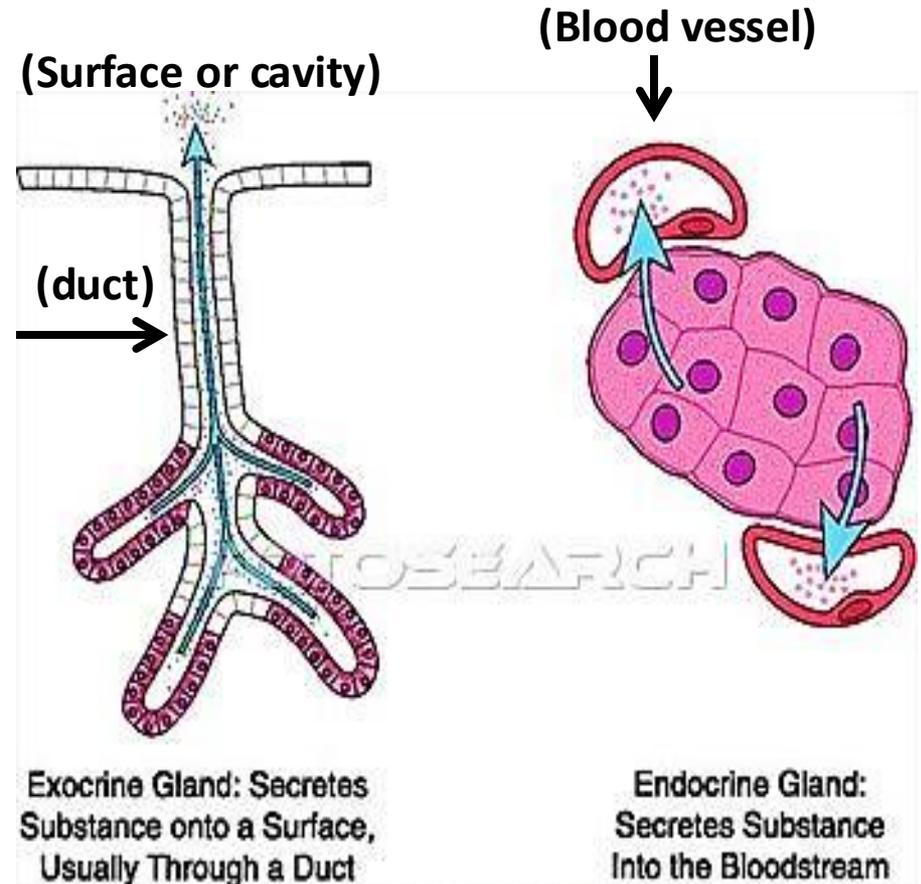
Parotid

submandibular

sublingual

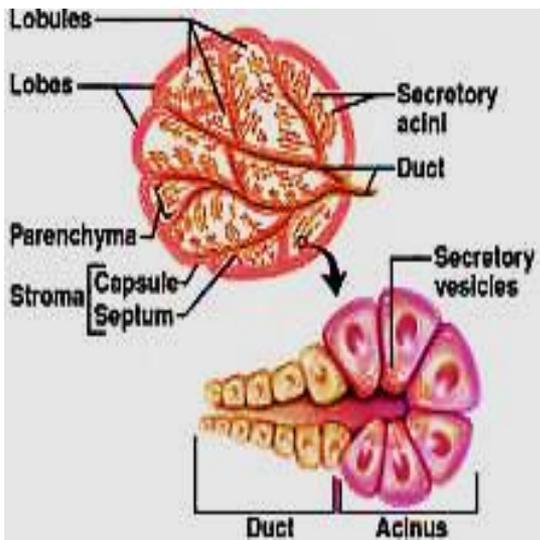
Salivary glands

- 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



(Exocrine)

(Endocrine)



Gland structure

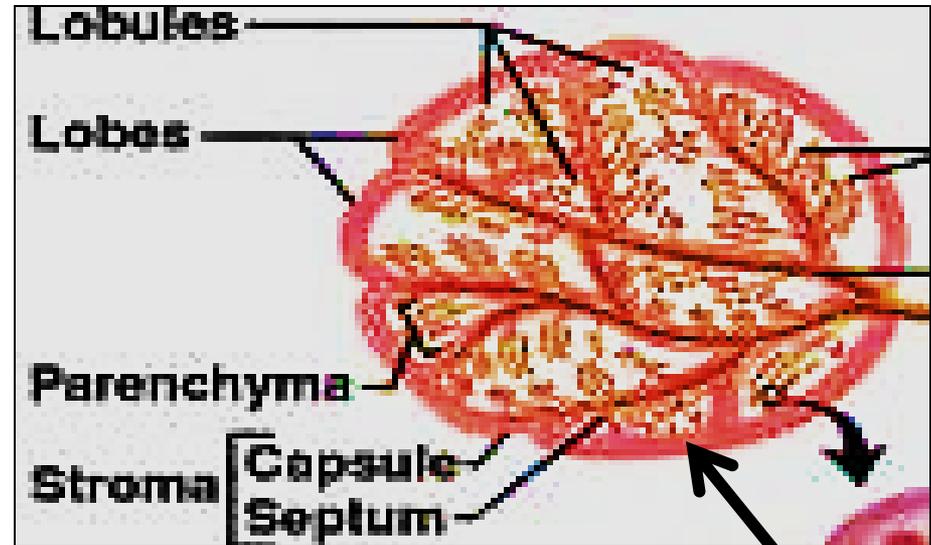
1- stroma
(C.T. frame)

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:

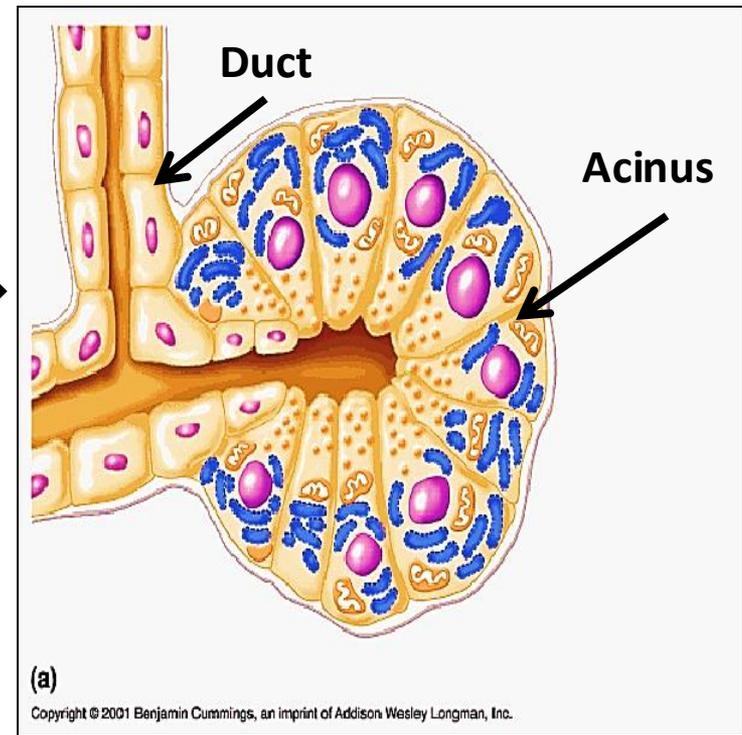
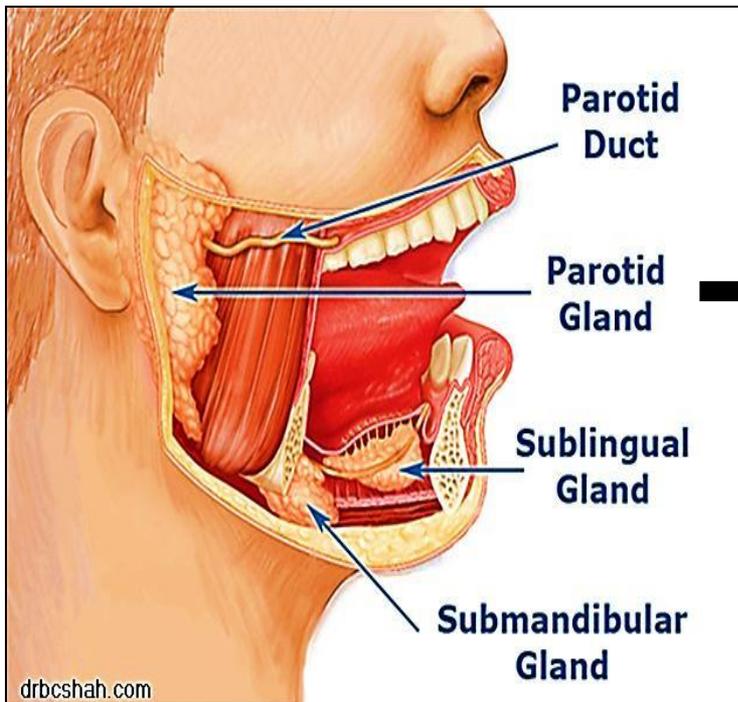
- **Capsule**: covers the gland from outside
- **Septa** : divide the glands into lobes & lobules
- **Reticular network**: present in the background of the gland (stained e Ag)

B- Parenchyma

Includes:

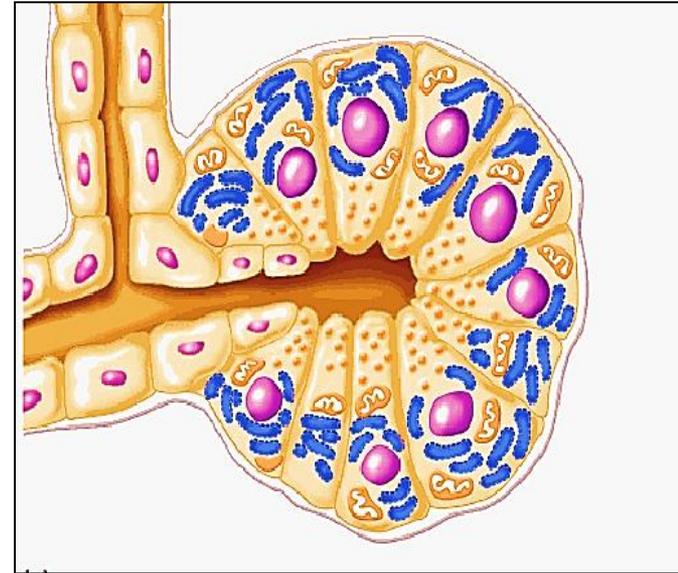
A- **Secretory units** (salivary acini) → secrete saliva

B- **Duct system** → conduct saliva to the mouth cavity



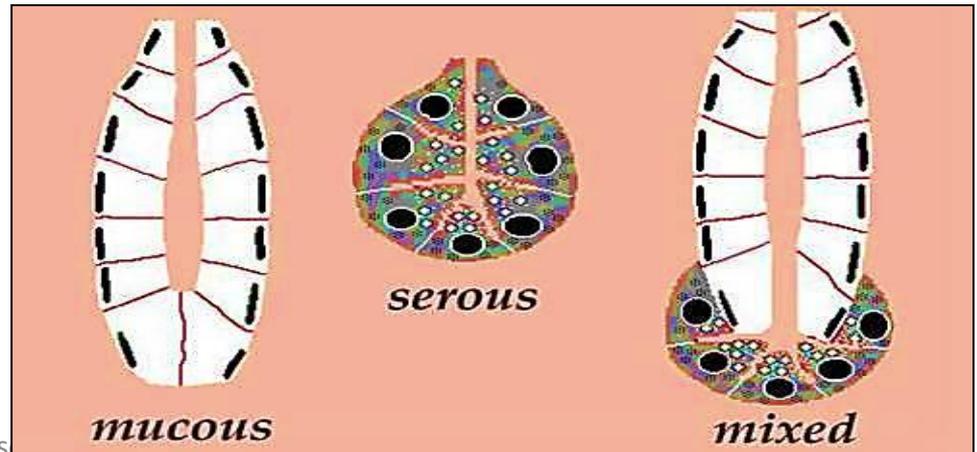
A- Secretory acini

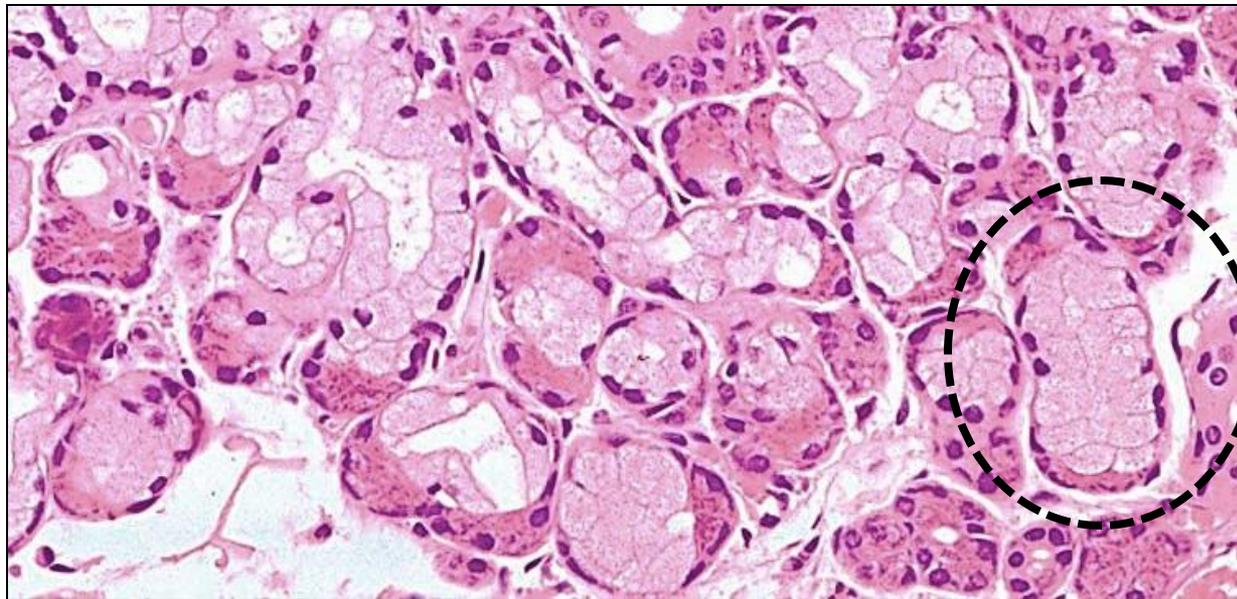
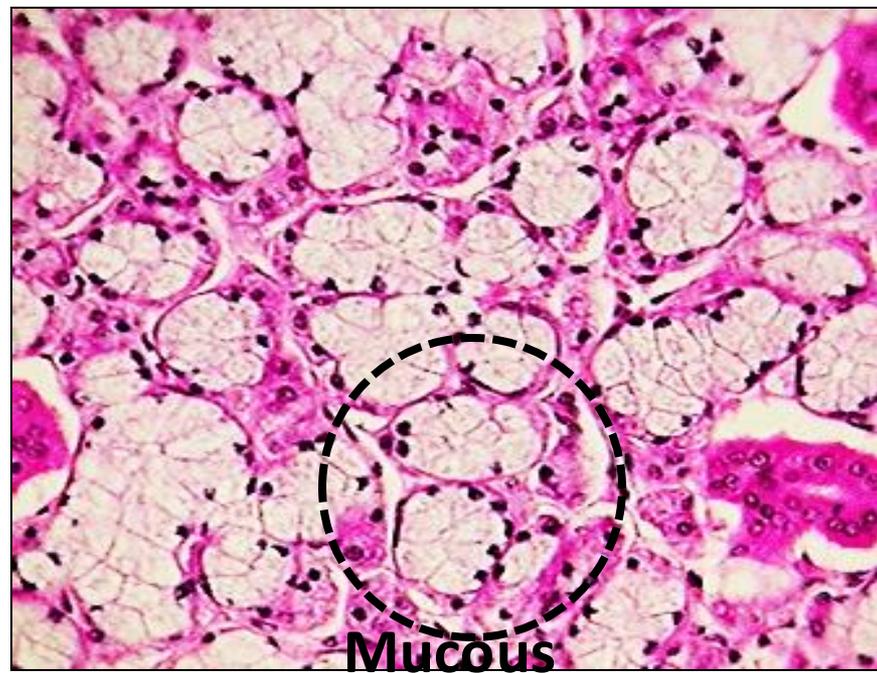
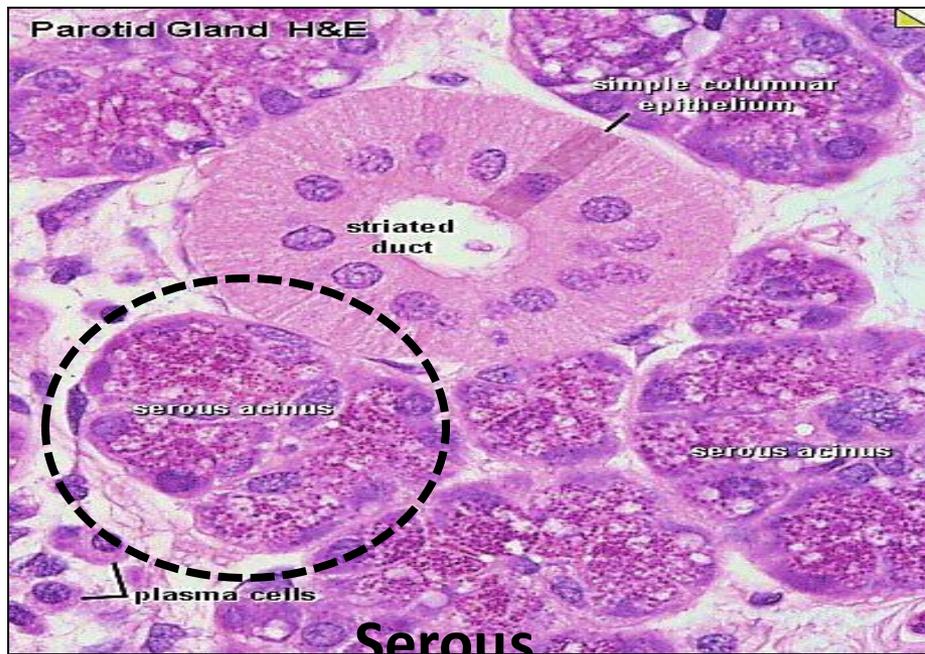
- Group of cells encircling a lumen
- The cells are either:
 - a- secretory cells (serous or mucus)
 - b- non-secretory cells (Myoepithelia)



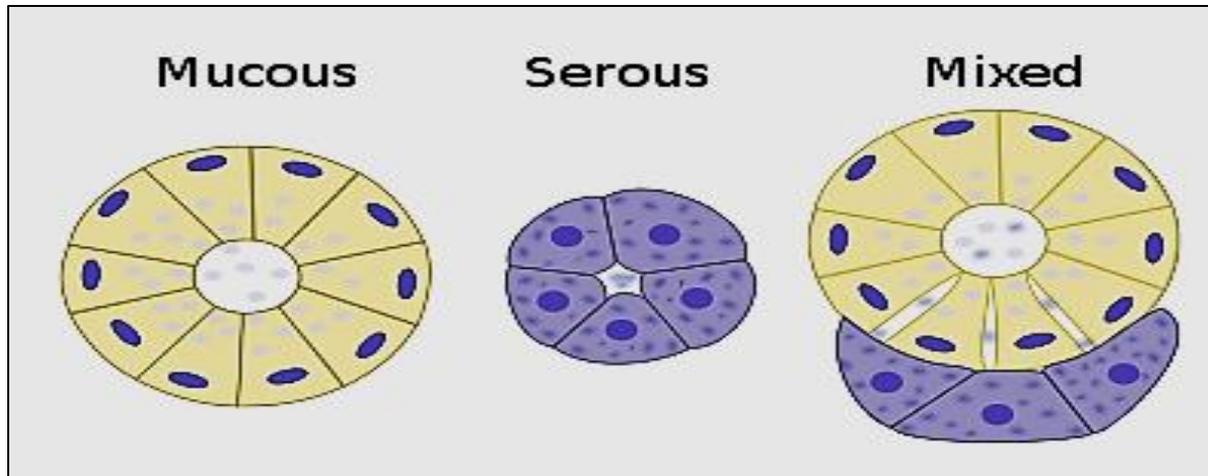
- The acini are classified according to the type of secretion into:

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





Serous vs. Mucous acinus



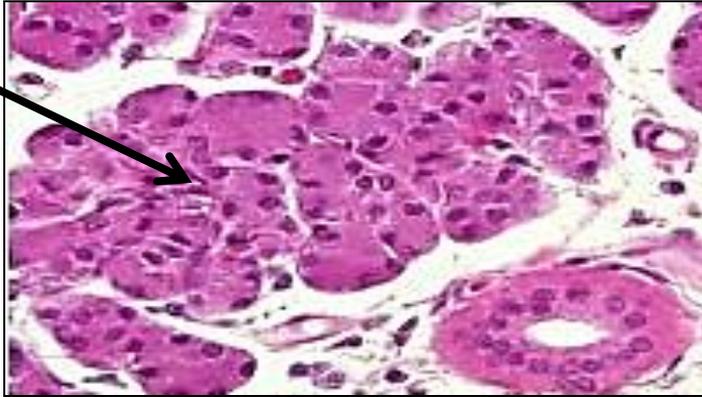
Serous (**Parotid**)

- 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



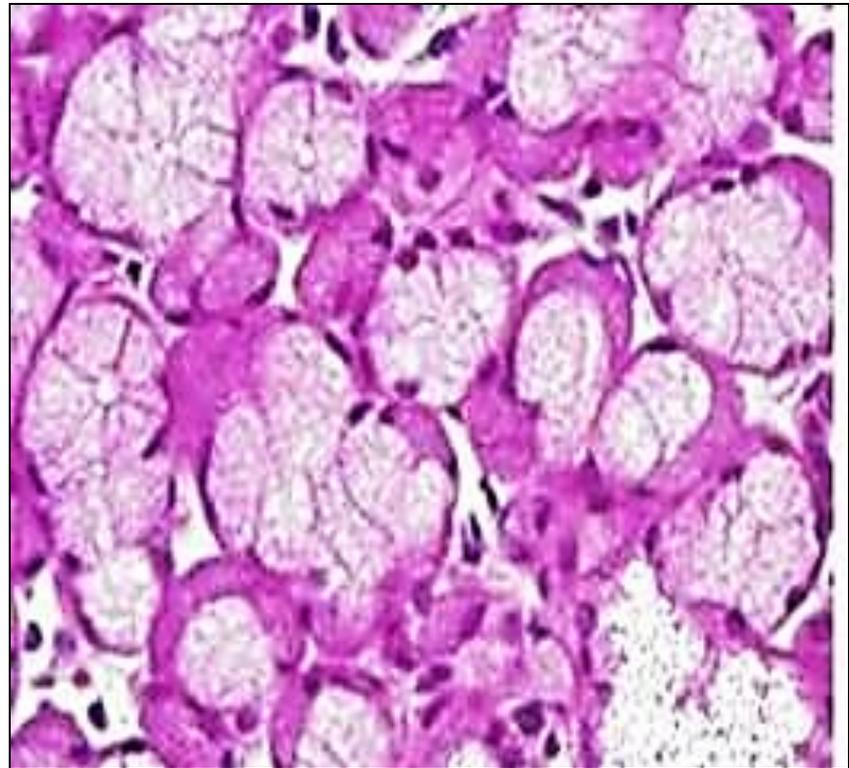
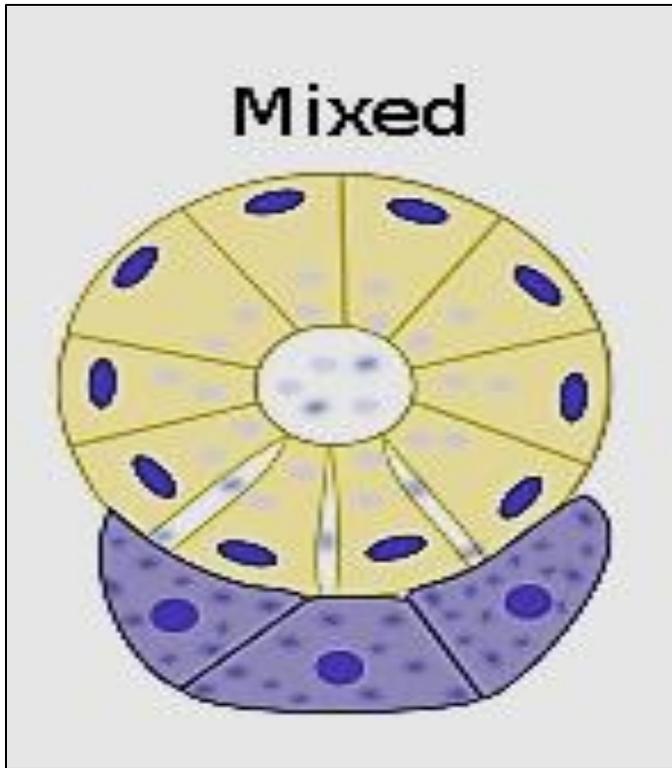
Mucous

- 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

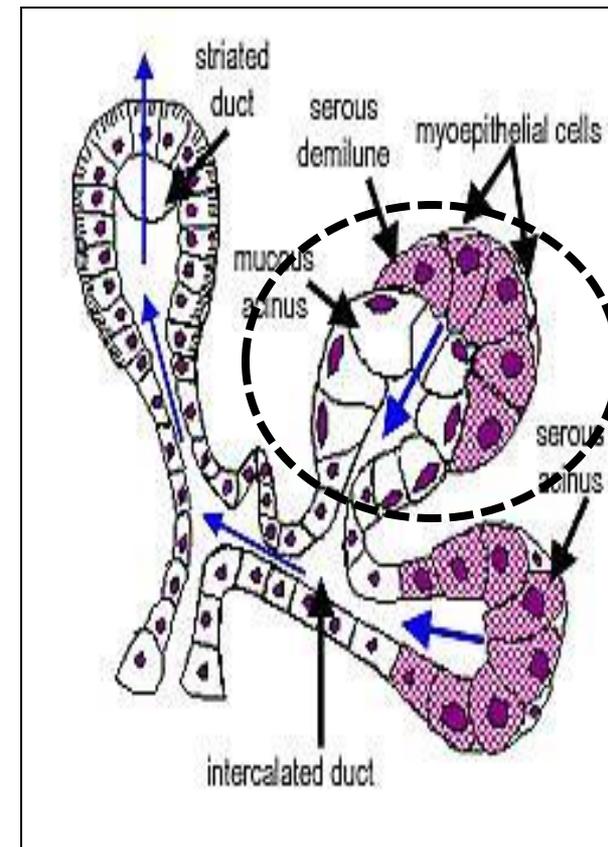
Mixed (muco-serous) acinus

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



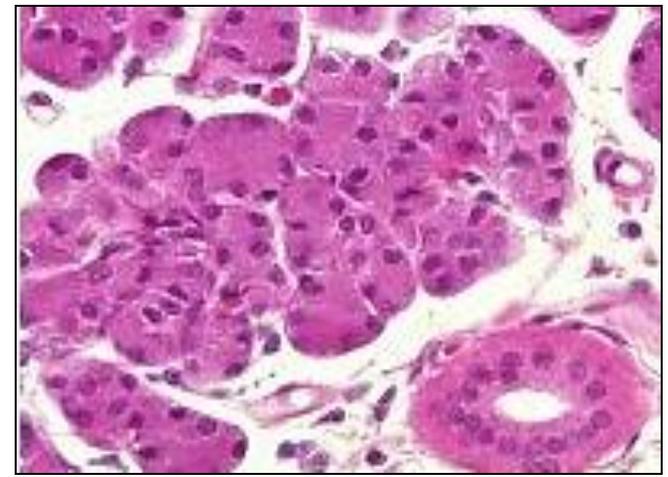
Crescent of Gianuzzi (serous demilune):

- 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

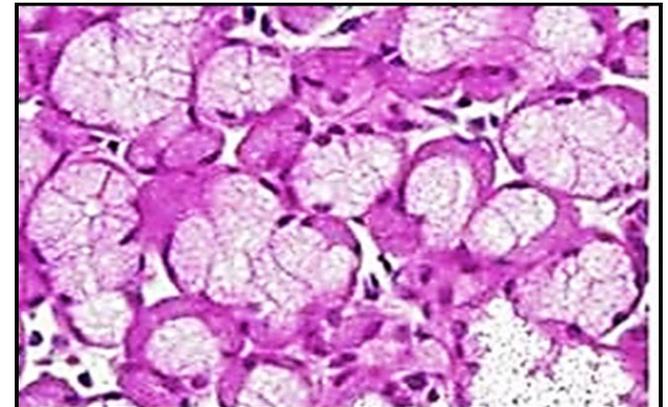


○ Sublingual gland:

The smallest & the only unencapsulated

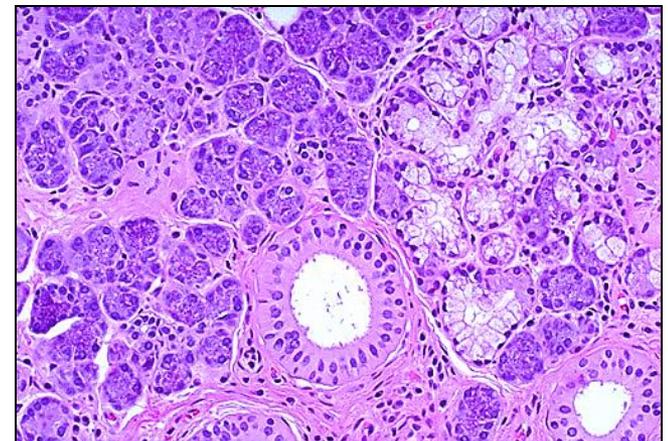
Acini : mostly mucous capped
with serous demilunes

Produce mainly mucous



○ Submandibular gland:

- Acini: mixed serous & mucous



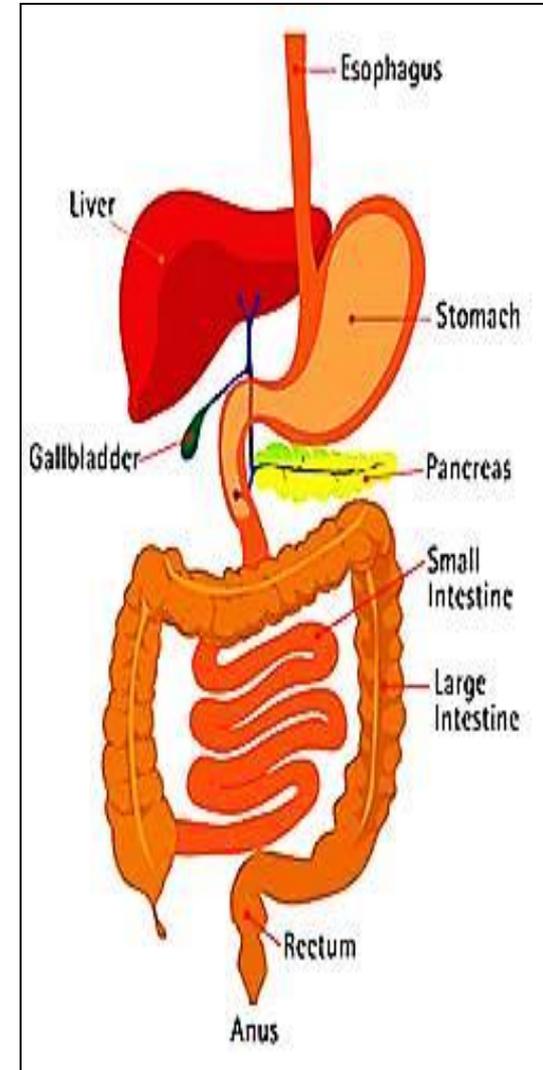
2- The Gastro- intestinal tract

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:

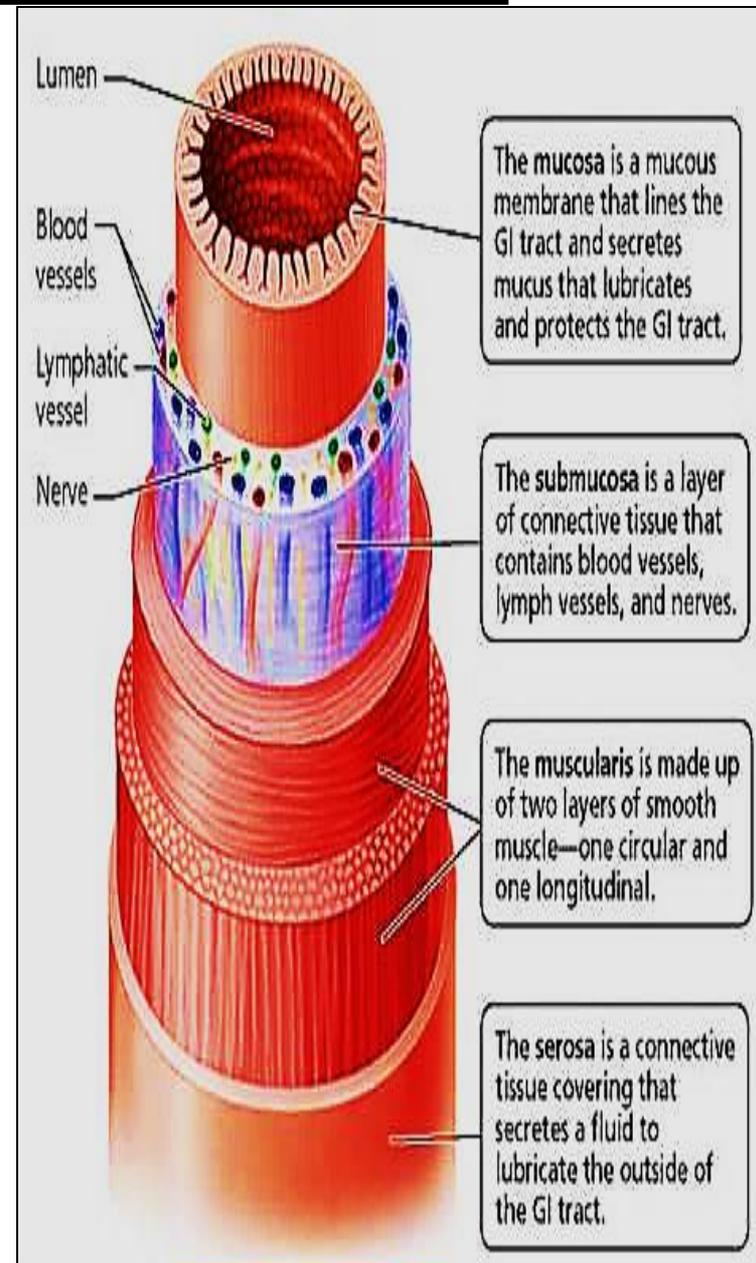
□ Mucosa:

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

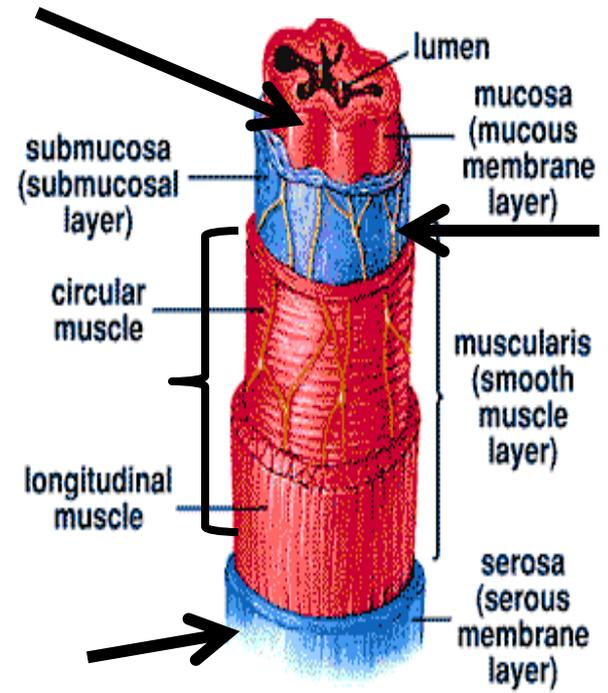
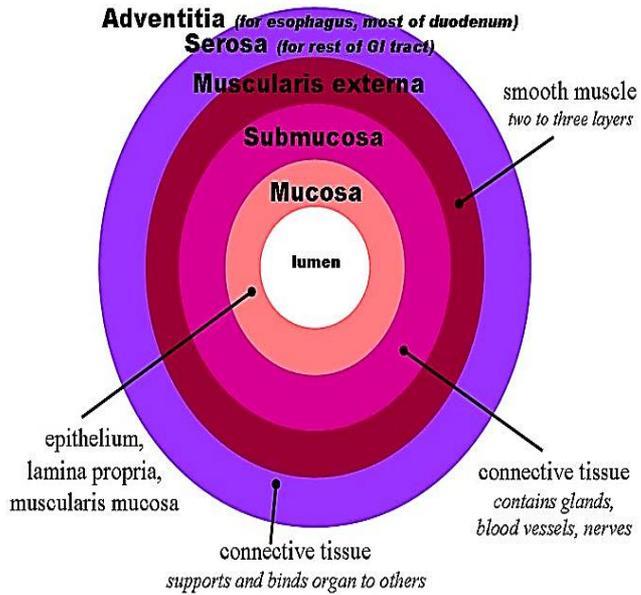
□ Submucosa: C.T.

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

□ Adventitia or serosa

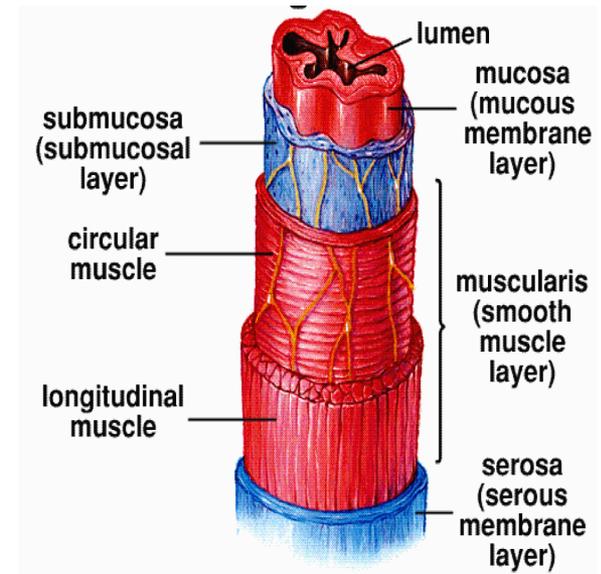


GIT Layers



1. **Mucosa**
2. **Submucosa**
3. **Musculosa (muscularis externa)**
4. **Serosa Or Adventitia**

1. GIT Mucosa



1. Epithelium

Simple columnar

Except esophagus &
anal canal..?

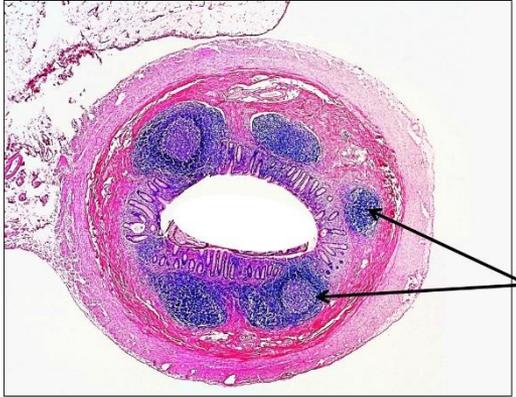
2. Lamina propria

Loose CT

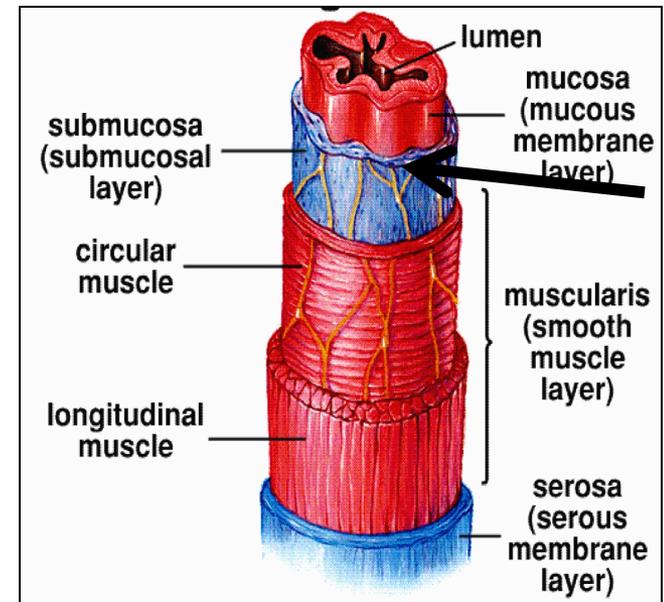
Mucous glands
Lymphatic nodules

3. Muscularis mucosa

Layer of smooth ms.
produce
folds of mucosa



2. GIT Sub-Mucosa

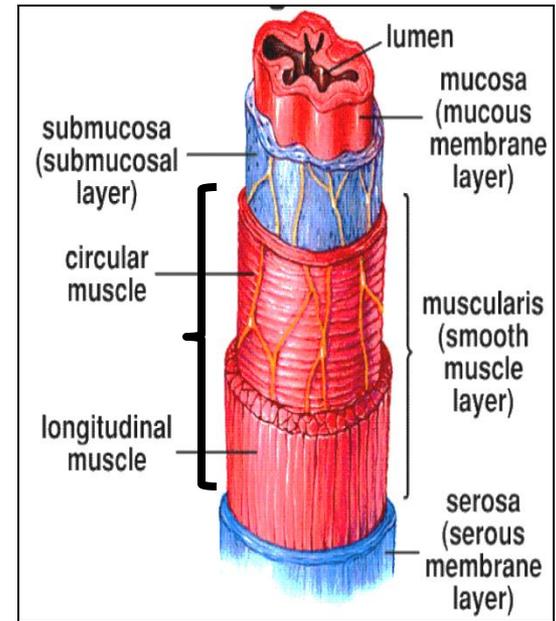


**Dense irregular
CT**

**May contain
Mucous glands
Lymphatic nodules**

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

3.GIT Musculosa (muscularis externa)

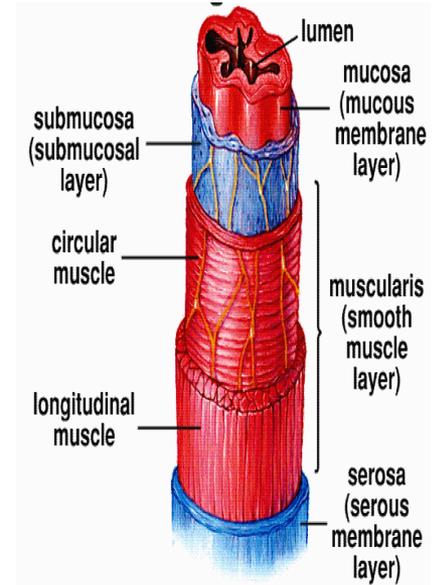


Inner
Circular
(IC)

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

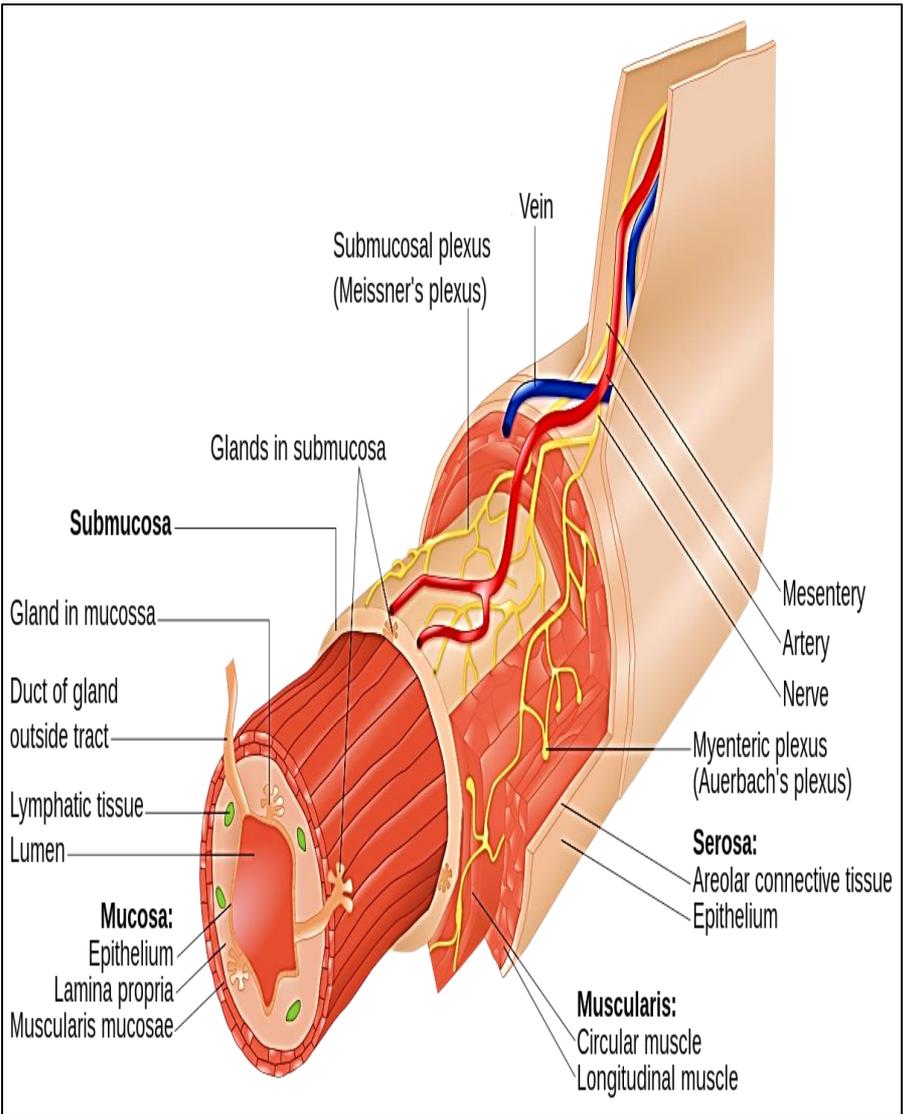
Serosa: double layer membrane made of epithelium (mesothelium)

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)

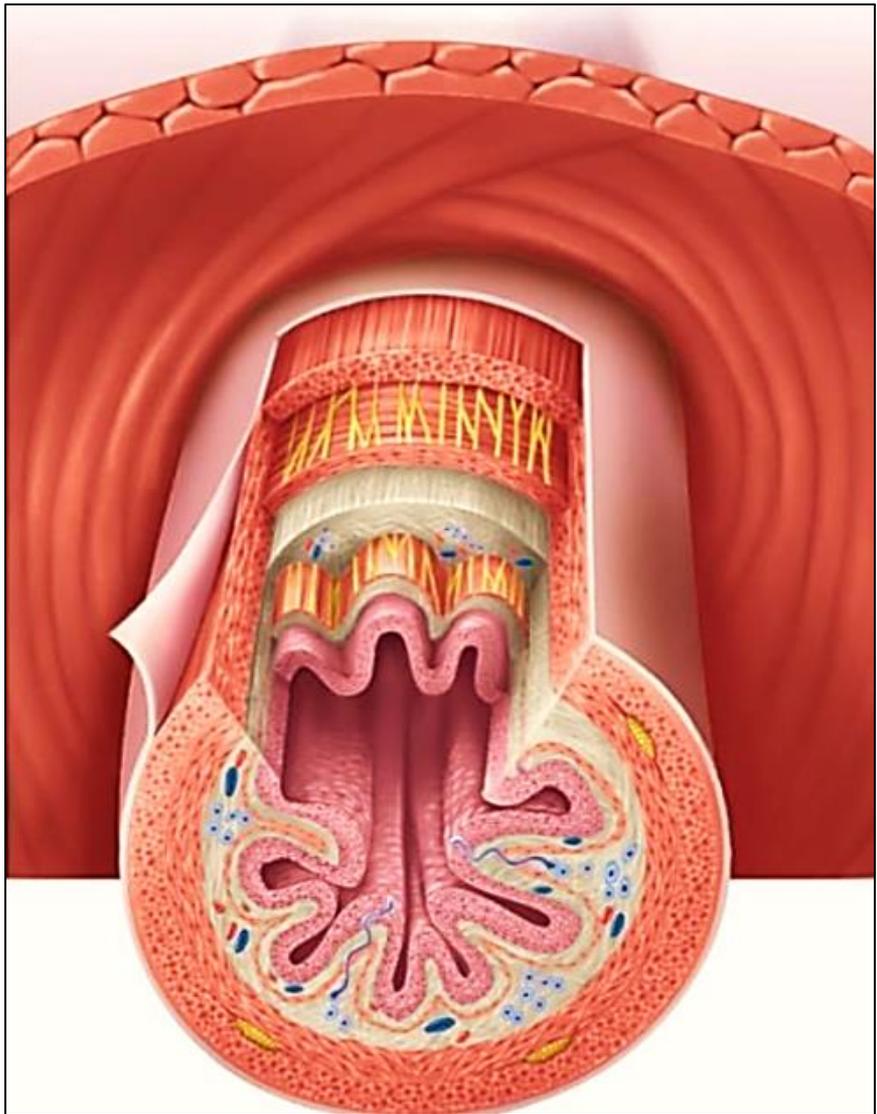
Serosa will wrap organs that set in a body cavity i.e abdominal cavity like GIT organs within the peritoneum i.e intraperitoneal organs (**liver, stomach, spleen, 1st part pf duodenum, ileum, jejunum, transverse & sigmoid colon**)

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

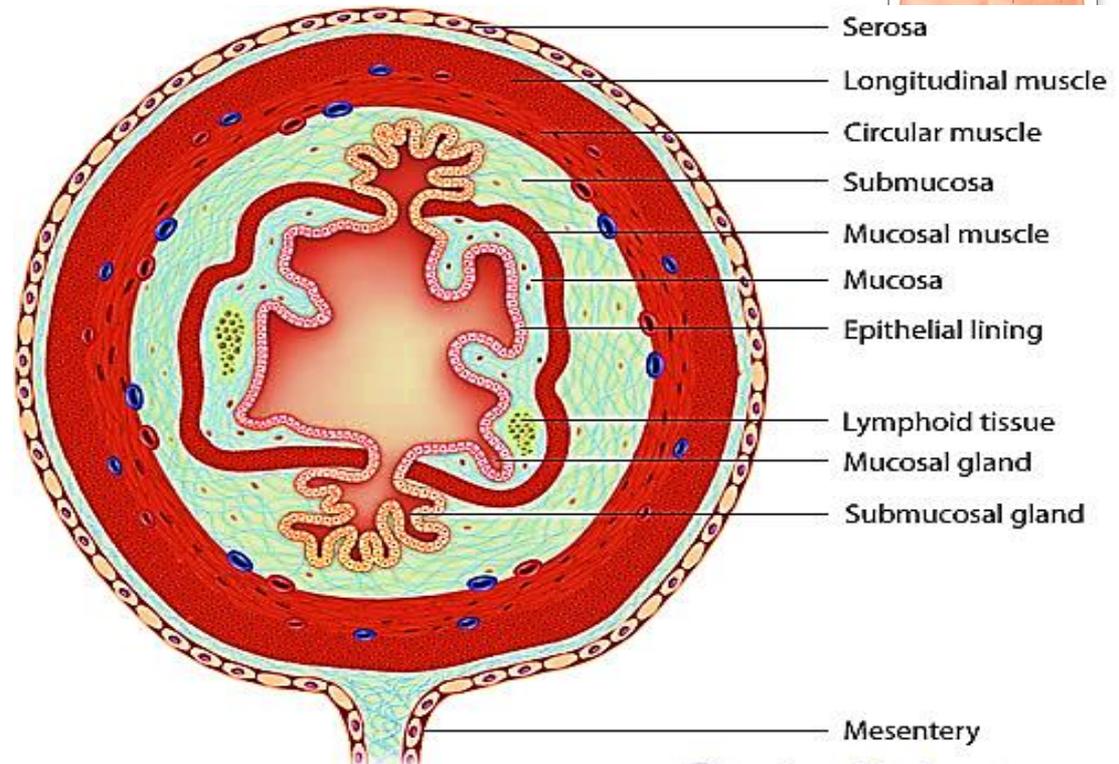
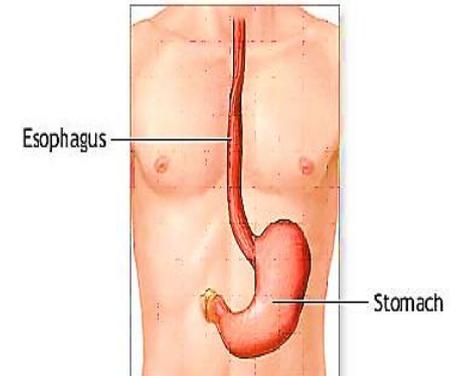


Adventitia

The esophagus

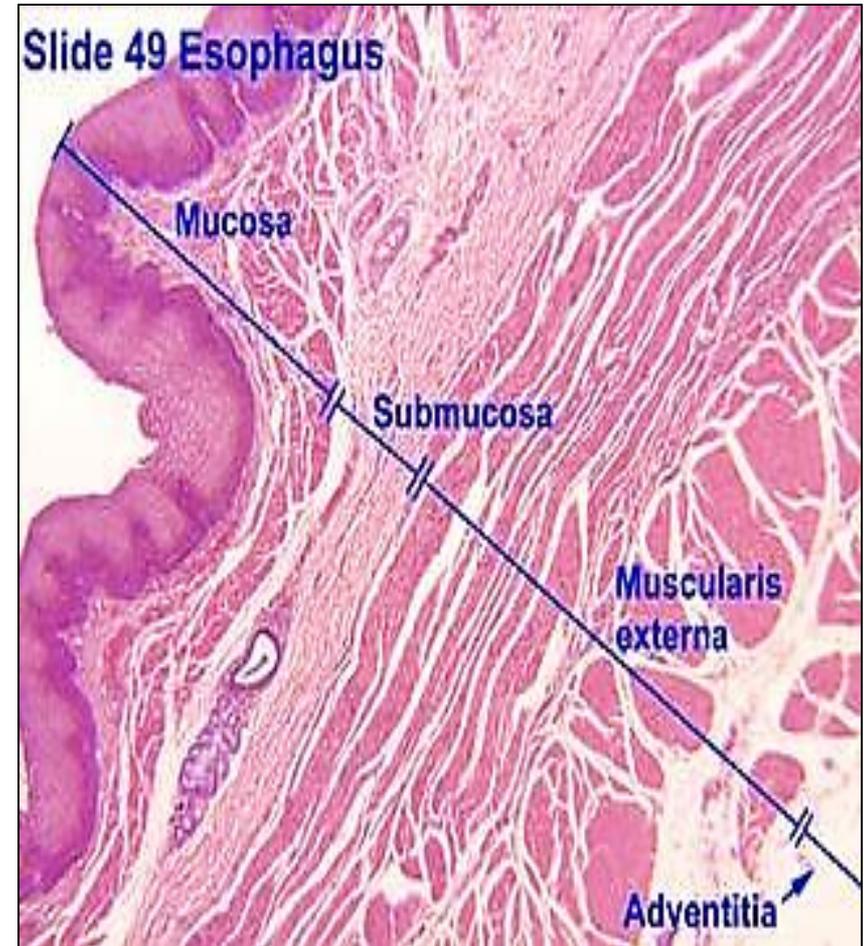
- Muscular tube connects the pharynx with stomach, transport food
- Its wall consists of 4 layers:

- Mucosa
- Submucosa:
- Muscularosa
- Adventitia

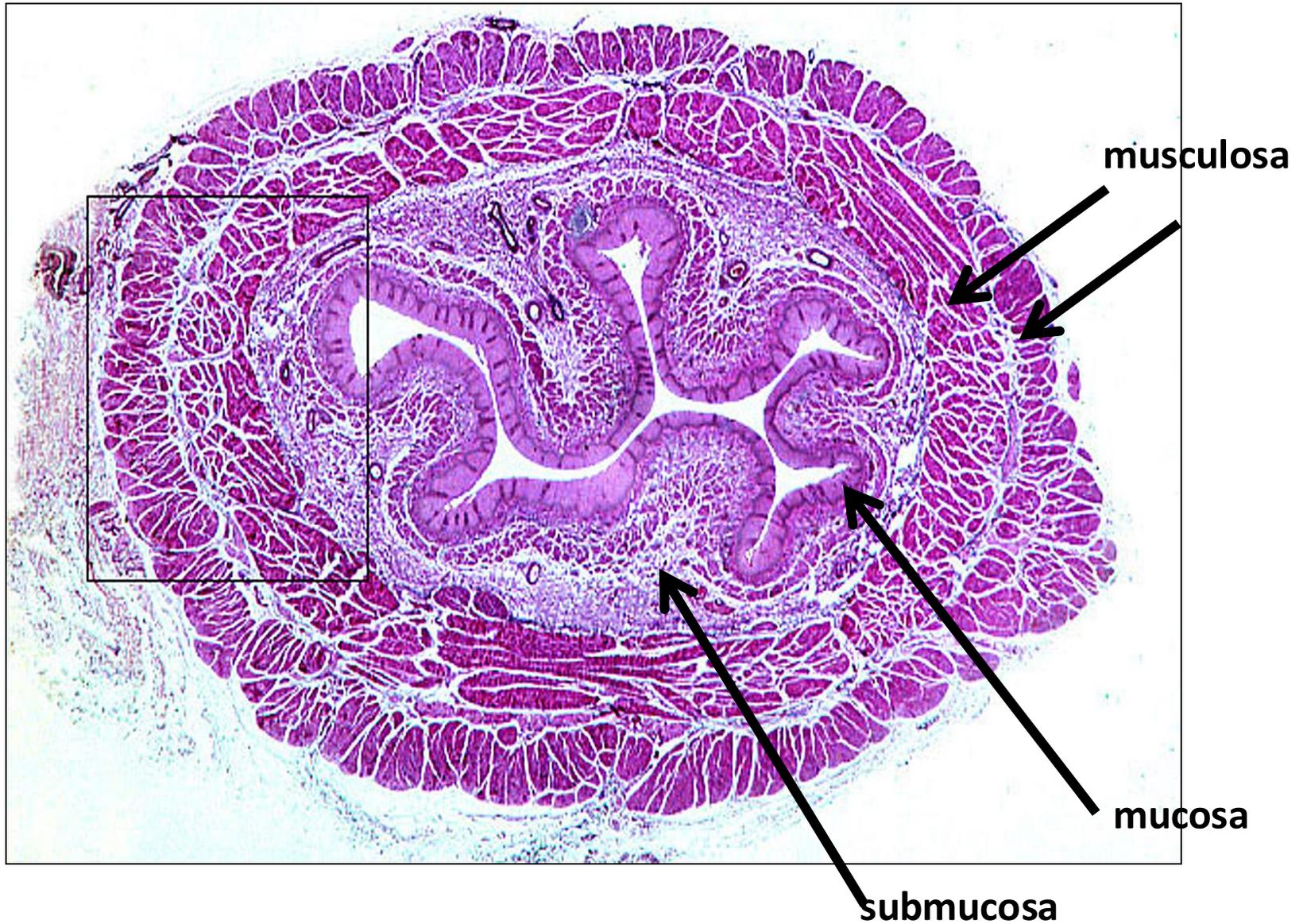


Esophagus

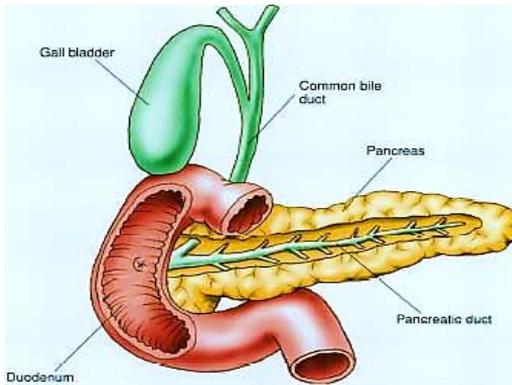
- **Mucosa**
Epithelium: thick layer of **non-keratinized stratified Squamous epithelium**
- **Submucosa**: C.T. contains BV, & esophageal mucous glands
- **Musculosa** : upper 1/3 striated, lower 1/3 smooth ms. middle 1/3 mixture of both
- **Adventitia**: C.T. layer with NO peritoneum



Cross section in the Esophagus



Pancreas

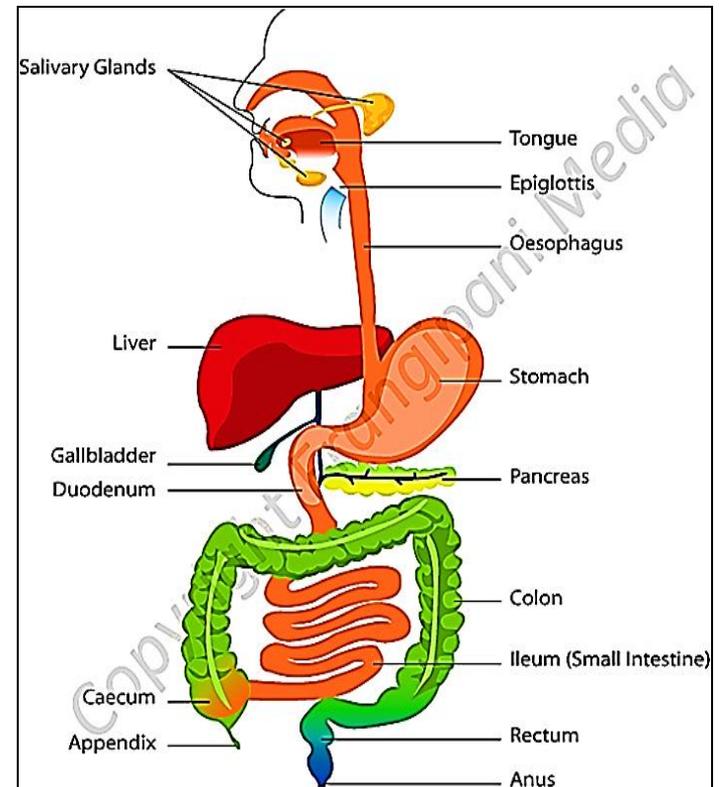


Exocrine
(Acini+ ducts)

Endocrine
Islets of Langerhans
(Cells+ blood vessels)

3- Organs associated with digestive tract

- Liver
- Pancreas
- Gall bladder



Pancreas

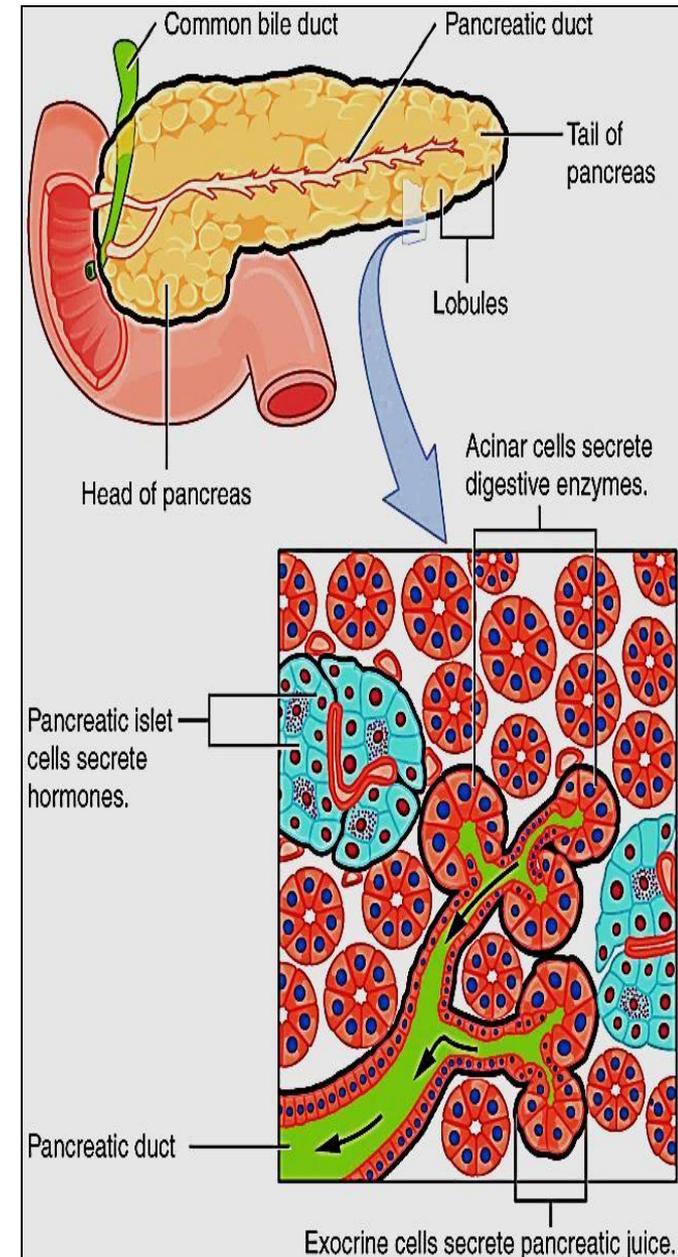
Is a gland with **mixed gland**

Exocrine part:

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

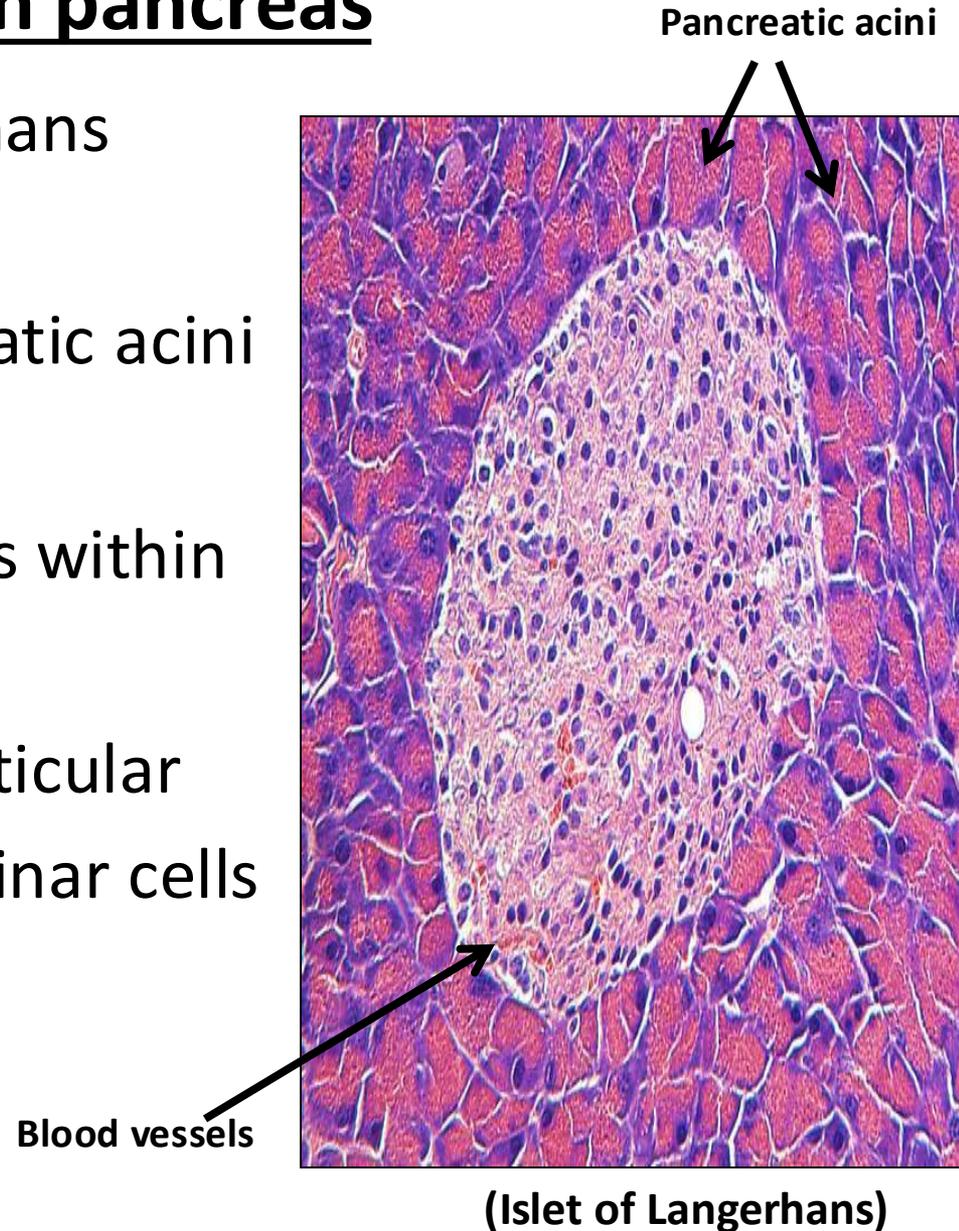
Endocrine part (*Islets of Langerhans*):

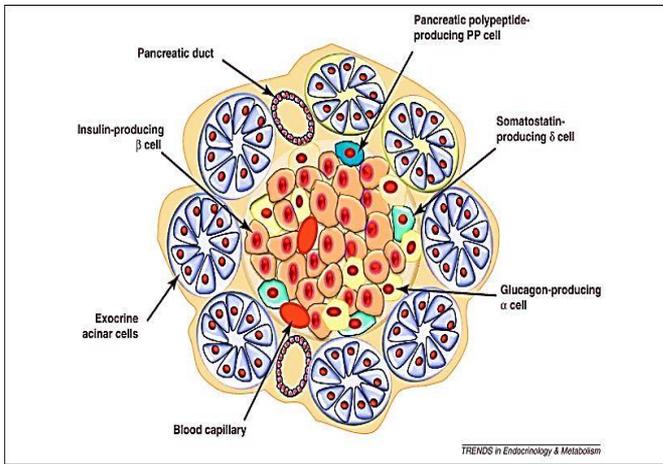
- More at tail of pancreas
- Lie between exocrine acini
- Secrete hormones **directly to blood**



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

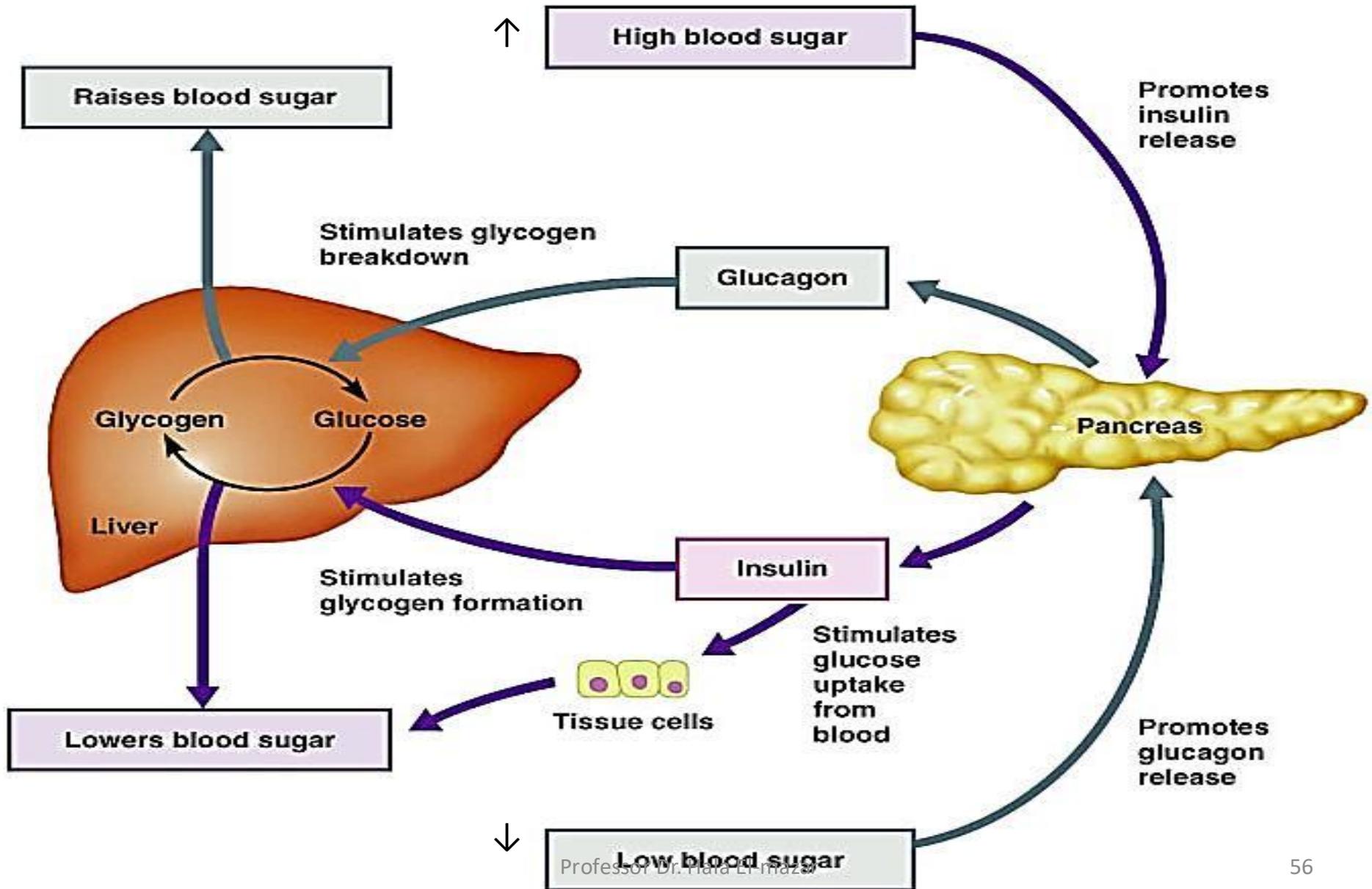
Alpha cells
20%
Glucagon
↑
bl. glucose

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

