

# بسم الله الرحمن الرحيم

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## Warning!

This is the first lecture in the gastrointestinal system and the first lecture ever for **Doctor Mohammed Al-Muhtaseb**. As we know the doctor gives a lot of information during his lecture, so the sheets will be long & condensed ... so please be patient and may **Allah** be with us during this system & during the long journey of medicine 😊

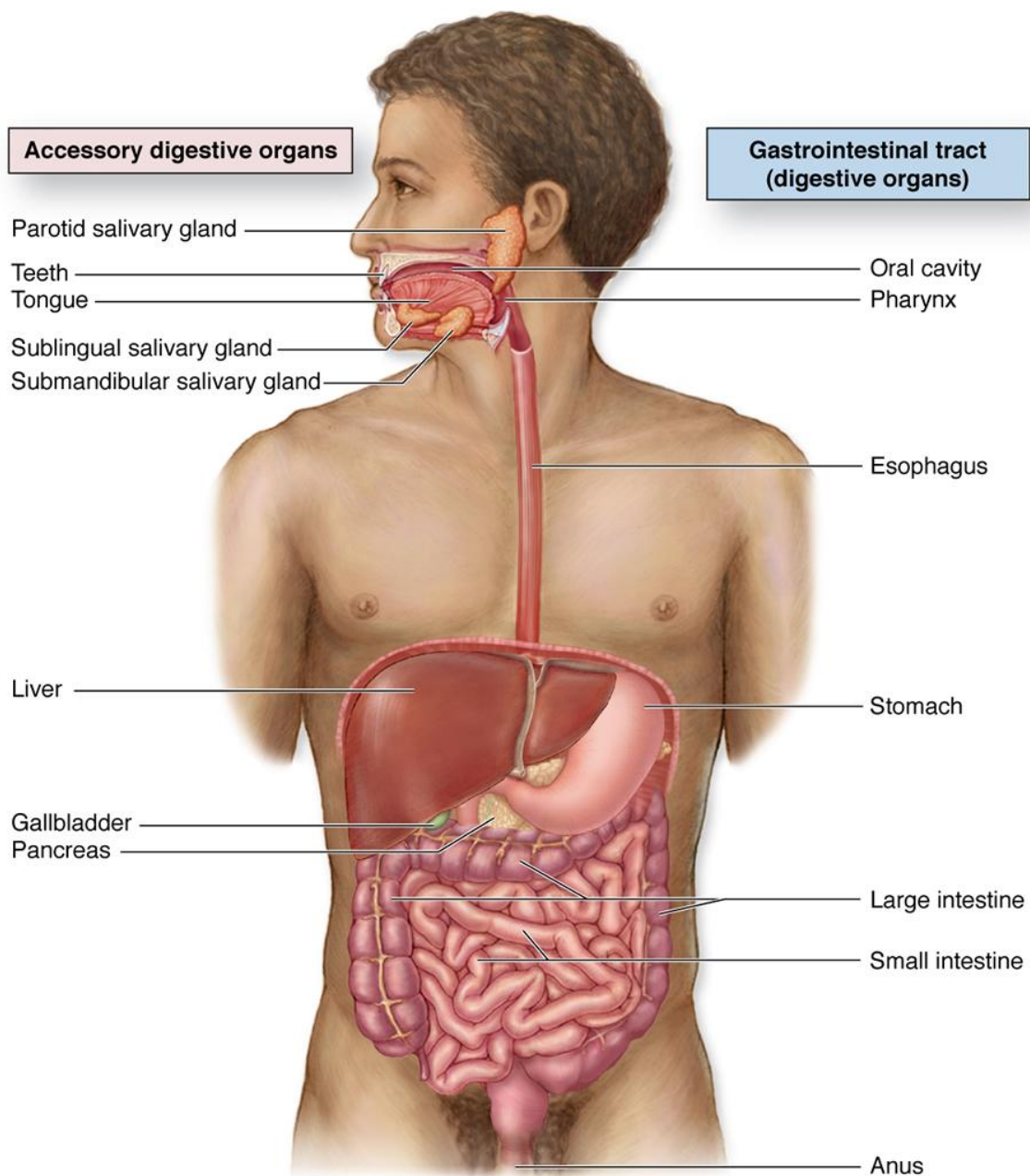
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**In this lecture we will cover the following subjects:**

- A) General introduction to the gastrointestinal tract.**
- B) General features of the gastrointestinal tract.**
- C) Layers of the gastrointestinal tract organs.**
- D) Histopathology (very brief point).**
- E) Clinical problem (Peptic ulcer – briefly–).**
- F) Gastrointestinal tract function (in general).**
- G) Basic mucosal forms in the gastrointestinal tract.**
- H) The Oral Cavity: (Tongue & Salivary glands)**

✓ **ملاحظة :** ترتيب المعلومات هنا يختلف عن ترتيبها أثناء المحاضرة ; وذلك تسهيلا للطالب أثناء قراءة الشيت. مع التأكيد على وجود جميع المعلومات التي وردت بالمحاضرة **إن شاء الله**.  
✓ أي كلمة بين { } تعود على الكلمة التي يعود إليها الضمير , وذلك منعا لـ اللبس .

## A) Introduction:



The Gastrointestinal tract consists of:

### 1) Gastrointestinal tube:

- Starts from **the oral cavity** (Mouth) then we have **the pharynx, esophagus, stomach, small intestine, large intestine**, and the anal canal.
- So it {the tube} starts from Oral cavity and ends with anal canal.

## 2) Association organs:

Examples on them:

- **1) Salivary glands**; which opens in the oral cavity; like the Parotid gland , Submandibular gland , and the Sublingual gland .
- **2) Liver & Gallbladder** found in the abdomen
- **3) Pancereas** .

:: these are called the association organs of the Gastrointestinal tract ::

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## B) General features of the Gastrointestinal tract :

### Shape-function relationship:

There is a relationship between the shape of the cells & their function (Always the anatomy is related to Physiology ) :

Examples:

- **Esophagus** → Have **Stratified Squamous non keratinized epithelium** cells → So it has **Protective** function.
- **Stomach** → Have Simple **columnar Epithelium**, and we'll find that it is **rich in Glands** (Tubular glands) → So its function is **Secretion & Digestion**.
- **Colon** → Its function is **Absorption & Formation of Feces** → So you'll find that Lining Epithelium is rich in **goblet cells** ; which { goblet cells } secrete **Mucous** for **lubrication** as a result of **absorption** of water, hard masses resulting in friction with **Mucosa** . Also it {colon} is rich in **tubular glands** for secretion.

**:: from that { the three mentioned points } we can see that there is a relation between the function & the type of cell :: .**

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### C) Layers of the GIT organs :

If we take any **cross section** from the GIT , we'll find that it consists of **4 layers** as following < starting from **inside** > :

- Layer#1 = **Mucosa**.
- Layer#2 = **Submucosa**.
- Layer#3 = **Muscular layer**.
- Layer#4 = **Serosa or Adventitia**

**\*Note:** these layers vary from organ to another.

### 1- Mucosa (the first layer ):

- Consists of **3 sub layers** :

#### **A) The Lining Epithelium:**

As we said we have simple **columnar epithelium** in the stomach & duodenum , **stratified squamous non keratinized** in esophagus and oral cavity , **goblet cells** in colon (large intestine) for **lubrication** because there will be absorption of water and formation of feces .

#### **B) Lamina propria :**

It is **loose connective tissue** , rich in **glands**(especially in **stomach** for digestion purposes) , **blood vessels** , **lymphatic's**( the more distally we go in the GIT , **lymphatic nodules** increases for **Immunity** purposes ; because the food we ingest may have bacteria( **contamination**) .

#### **C) Musclaris Mucosa :**

Which is a smooth muscle with; **Inner Circular (IC) layer**, **Outer Longitudinal (OL) layer** . It<Musclaris Mucosa> can be one or two very thin layers . It is responsible for **the changes in the shape of mucosa** or its motility.

***:: End of the first layer - MUCOSA- ::***

## **2-SubMucosa ( the second layer ) :**

Which is composed of **Dense connective tissue**; rich in **blood vessels** , **lymphatics** , and **glands** .

The glands of the Submucosa are found **in two organs only** in the GIT; **Esophagus & Duodenum !** . ( there is **no** gland in SubMucosa **Elsewhere** ) .

Also there is **Meissner's nerve plexus** in the submucosa , and it is **Autonomic** ( sympathetic & parasympathetic ) .

**:: end of the second layer –SubMucosa- ::**

## **3-Muscularis( the third layer ) :** consisting of **two layers** ; **Inner circular** & **Outer longitudinal** .

Between the two layers we have **plexus of nerves**; called **Myenteric** ( or **Auerbach's**) **nerve plexus** which is **autonomic nervous system** ( sympathetic & parasympathetic ) , it is responsible for **the Peristalsis movement of the GIT** .

The **intestines** are always in Peristaltic movement; the **parasympathetic Nervous System** is responsible for it through **the vagus nerve** , which **goes to the Myenteric nerve plexus** and finally to **the smooth muscle** , contracting it and eventually **Peristaltic movement** .

Notes:

- Always **the parasympathetic** is responsible for motility ( **secretomotor stimulation of the gland** ) , it will **stimulate** the gland ; **contracting** it .
- The **sympathetic** is always **vasomotor** for blood vessels; it will cause **vasoconstriction of the blood vessels** leading to **decrease in secretion indirectly**.

**:: End of the third layer –MUSCLARIS - ::**

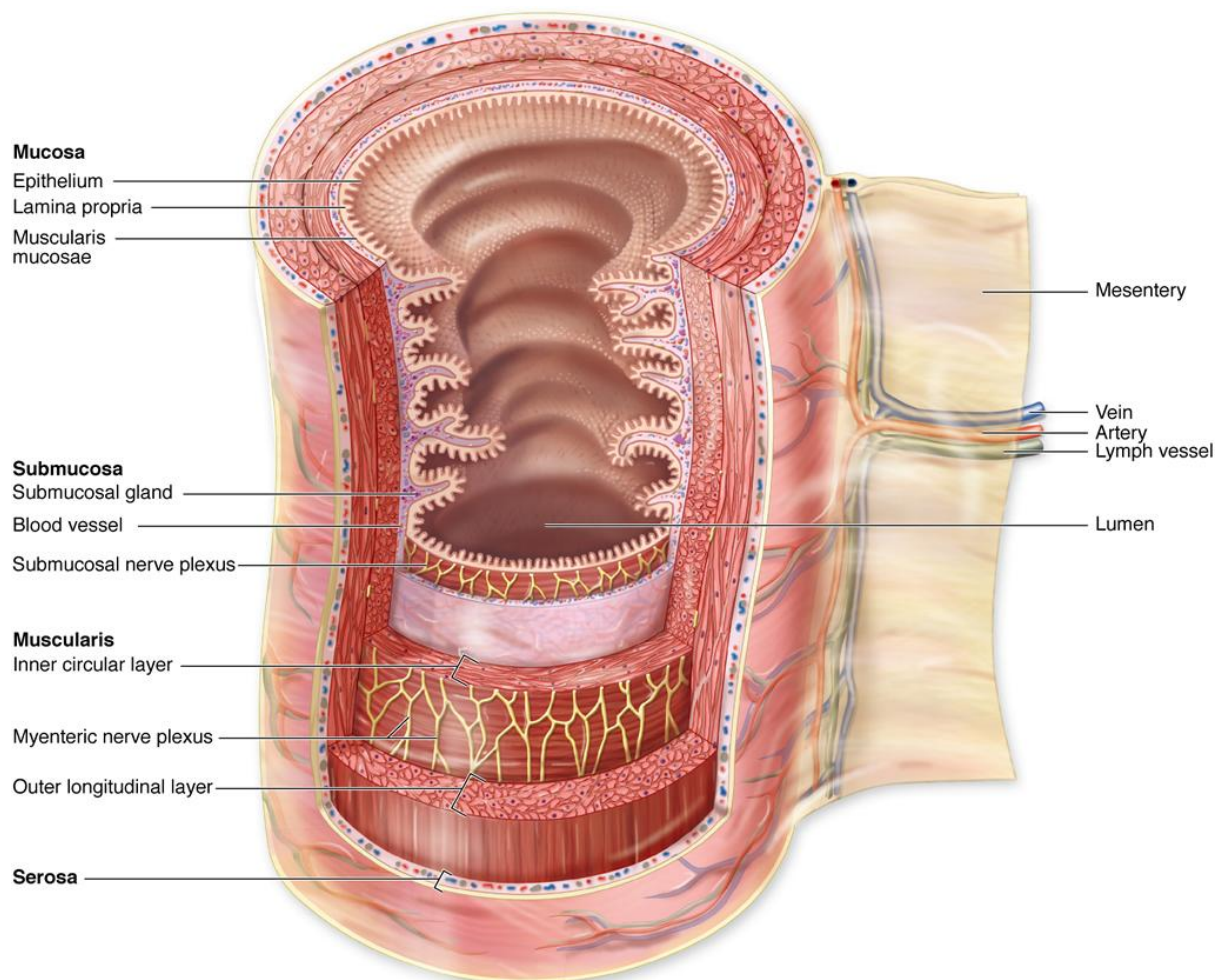
**4-Serosa ( the 4<sup>th</sup> layer ) :** If it's covered by **peritoneum** we name it mesothelium layer . Mesothelium is **simple squamous epithelium** covering the **outer layer** of the GI organs.

It is called **Adventitia** when the **mesothelium** is converted to **connective tissue**.

It < Adventitia > is found in **retroperitoneal** organs within **posterior abdominal wall** ( **Duodenum** , **Gallbladder with liver** ).

**:: End of the 4<sup>th</sup> layer – Serosa- ::**

**:: Check the figure below and notice the 4 mentioned layers::**



## D) Histopathology:

- You have to know the normal histology to recognize the pathology.
  - In order to make diagnosis you have to **compare** between the specimen (that is going to be tested) with **the normal histology** of that part (in which **the specimen is taken from** ) .
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## E) Clinical Problems :

**Peptic ulcer:** is the most important disease of the GIT; **Most common site is the duodenum** (more accurate = **first inch of duodenum**) and it's called **dudenaulcer** ) .

What causes peptic ulcer? The **chyme** of **the stomach** is **acidic** , and when it reaches **the first inch of the duodenum** it will cause **irritation** to **mucosa** .

Normally, **the duodenum** is responsible for alkalization of the **acidic chyme** , but sometimes **excess of acidic chyme** will cause **irritation** leading eventually to **duodenal ulcer** .

- **Again the GIT Starts from the oral cavity ( Mouth ) then we have the pharynx ,esophagus ,stomach, small intestine (Duodenum ,Geginum , ileum ) , large intestine( cecum . appendix ,ascending colon , transverse colon ,descending colon , sigmoid colon ,and rectum) , and the anal canal.**
  - **Association organs (Liver, gallbladder, pancreas) have different histology.** (To be discussed later Enshallah ) .
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## F) GIT function (in general):

### **Why we are blessed by the grace of GIT?**

Because whenever we eat there will be **digestion**, and after digestion; **absorption** will occur, and all the **absorptive material** will go by **portal vein** to **the liver**, then **feces will be formed** accumulating in **rectum** and then **Defecation** through **the anal canal**.

- Note: in Biochemical terms; **Digestion: is changing complicated materials into simple absorptive material.**

Examples on that < the note > :

- 1) **Carbohydrate** (complicated-\_-) will be digested to **Simple glucose** (simple absorptive material ^\_^).
- 2) **Proteins** (complicated-\_-) will be digested to **Amino Acids** (simple absorptive material ^\_^).
- 3) **Fats** (complicated -\_-) will be digested to **Fatty acids** (simple absorptive material ^\_^).

They < simple absorptive material > will be **absorbed and then go through portal vein to the liver.**

They go to the liver; because the function of the liver is **store Glycogen, Synthesis of enzymes, Forming coagulative material, the production of bile or bile salts** which are important for digestion, **synthesis of heparin.**

***:: you can clearly realize that the liver have many important function , that's why we will take it in details Enshallah :: .***

## **G) Basic mucosal forms in the GIT:**

We always relate function with structure. Examples:

- 1) If we look at **the mucosa** for example we may see that the function is **protection** ( as in Esophagus and oral mucosa ) and **the lining epithelium is stratified squamous non keratinized .**

As long as you're eating you **can bite your mucosa leading to bleeding**, but after **6 hours** there will be **complete healing** → because **stratified squamous** is characterized by **Mitosis of cells!** , so it will regenerate the cells continuously.



- 2) If we look at mucosa of stomach, we'll see **the tubular glands** that are designed for **secretory function**, so the function of the stomach is **digestion**, and the glands are responsible for **secretion**.
- 3) **Absorptive** : Small intestine ; especially **the duodenum** which contains **Brunners glands** found in **submucosa** ; it helps in **alkaline secretion** .
- 4) **Protective/Absorptive** : **first inch of deudenum** → **neutralizes the acidic chyme of stomach**. Also **the colon** may be **absorptive** for water, **protective** in formation of feces.

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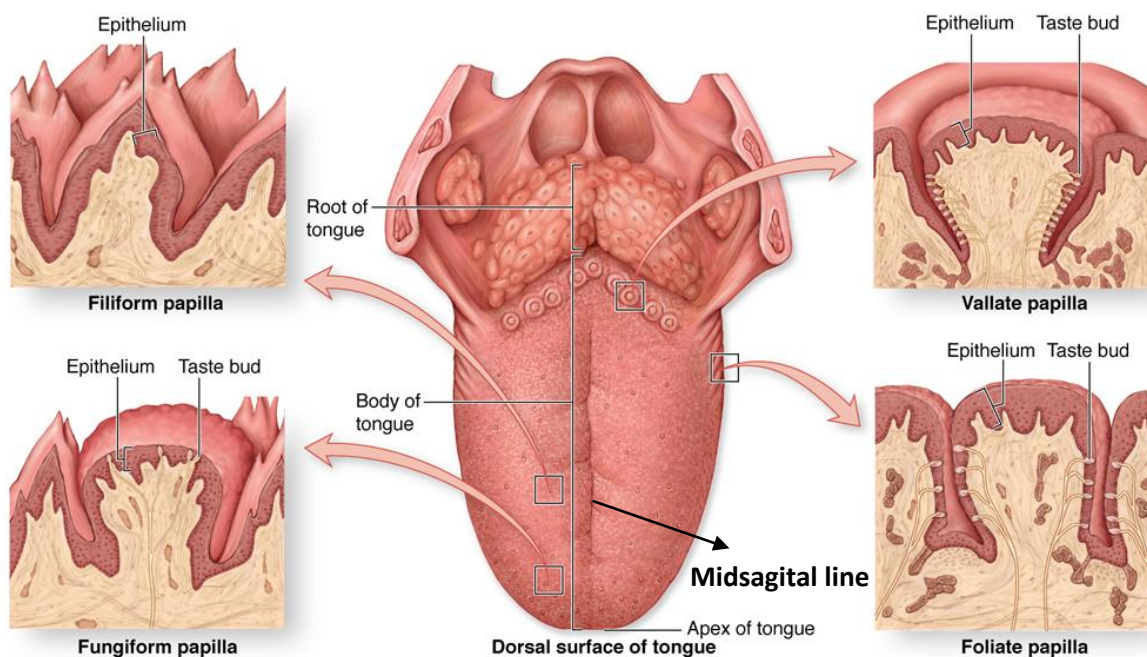
## H) The Oral Cavity:

- Consists of **Tongue** (for **glutination**) , **Gums**(Gingival) which contains the **sockets of teeth** , **Teeth** ( for **grinding** of food) .
- The oral cavity is rich in **minor salivary glands**; for moistestiring of the food making **the polus** which will be swallowed.
- Also there is **opening (ducts)** for **the large salivary glands**, which are important for **mucous** and **serous** secretion.
- As mentioned saliva is very important for; **moisistring** of food so we can **swallow it** , giving us **the ability to speak** and **making us happy** 😊 .
- **Dryness of the mouth** will lead to **inflammations (stomatitis)** because of bacteria in the oral cavity replicate in dry environment leading to making it pathogens 😞 , also **loss of the ability to swallow**.

Note: Large salivary gland are: **Parotid** , **Submandibular** , **Sublingual glands** , **1-1.5 liters** of saliva are secreted daily.

- Generally the lining epithelium in the oral cavity is **Stratified squamous non-keratinized epithelium**; but in **the floor** of the mouth it is connected with **loose connective tissue**.
- In **the gums** it < lining epithelium > is connected by **dense connective tissue**, the same goes for **the hard palate periosteum**.
- The type of **epithelium can be changed**; converting from non-keratinized to **para-keratinized**. So if friction occurred to it, it will not become keratinized but para-keratinized!
- **Para-Keratinized epithelium** → can be found in **Gingiva** , **hard palate** , and **dorsum of the tongue** .It is due to injury with **digestion** and it will not reverse to non-keratinized nor keratinized .

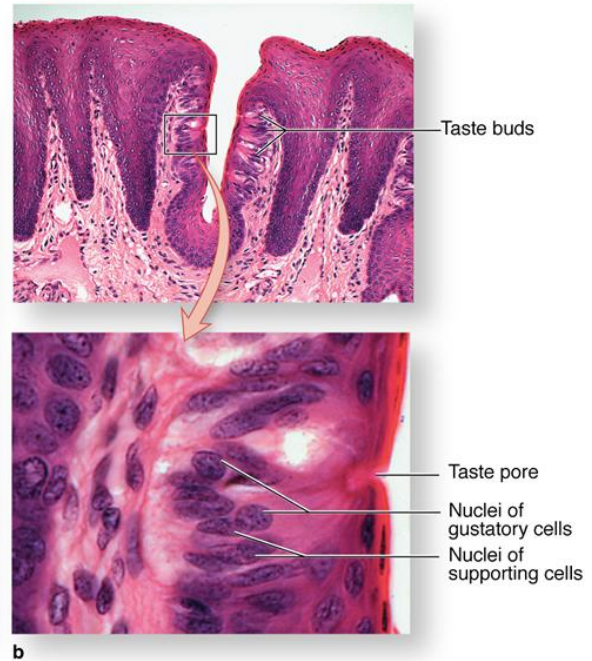
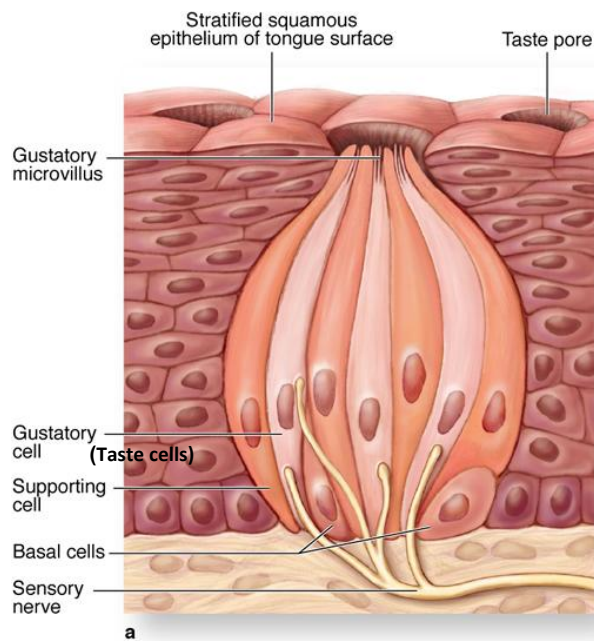
• **TONGUE:** ( check the figure below )



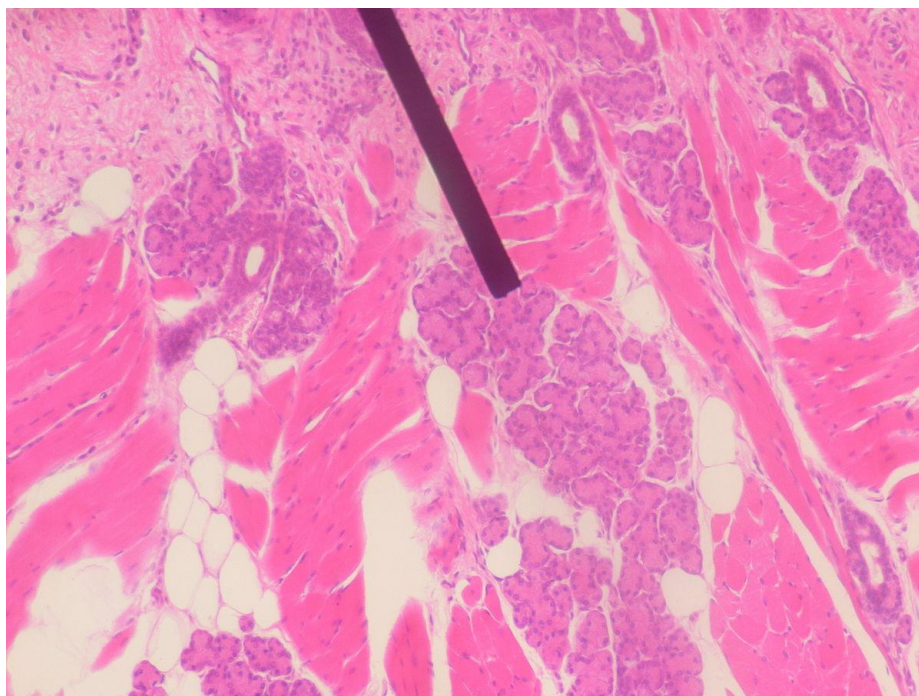
- Is composed of **two half's**; **right & left half**, separated by **midsagittal line**. Since it's two half's there will be two muscles groups (**one in each half**) that are the same.
- Also it is divided into: **Anterior 2/3 & Posterior 1/3**.

- **The posterior third is lymphatic structure** (consists of lymphatic tissue) & no taste buds.
- **Anterior two thirds** contain **taste buds** but no lymphatic nodules.  
Circumvallate papillae, fungiform papillae, filiform papillae: they are **lingual papillae** that **contain taste buds**, and they are found on the anterior aspect of the tongue . The cells responsible for sensation of taste (sweet , bitter , salt ,....) are found on **the dorsum surface** of the anterior two thirds of the tongue **which contain the taste buds** .
- **The dorsum surface** of the anterior two thirds of the tongue is lined by **Stratified squamous para-Keratinized** → because **the dorsum** is always at **risk of injury** .While the lower surface → is **stratified squamous non keratinized epithelium**.
- The tongue is muscular organ contains **skeletal striated muscles** in **different directions**.
- **Taste buds** : in the middle of it we have **Taste cells** ; which will take the **dissolving material** and convert it to **taste impulses** ( **special signals**(taste impulses) for tasting that will be transmitted through the nerve responsible for tasting ;which is **afferent nerve fiber** ; which is a part of corda tympani of the **facial nerve** , then it < special signals > will reach **the tasting centers in the brain** resulting in **taste recognition** ^\_^ ) .
- Around it < tasting cell > there is **supporting cells**, also we can see **lymphatic nodule** especially in **the posterior third of tongue**.

**:: check the figure below to see the taste cells ::**



- **Remember: Anterior 2/3 → stratified squamous para-keratinized epithelium.**
- There is a gland around the taste buds called **Von Ebner's gland**; which secrete serous on the groove around the lingual papillae, dissolving materials, to feel the **taste sensation**. ( the pointed at structure below)



**:: end of the tongue ::**

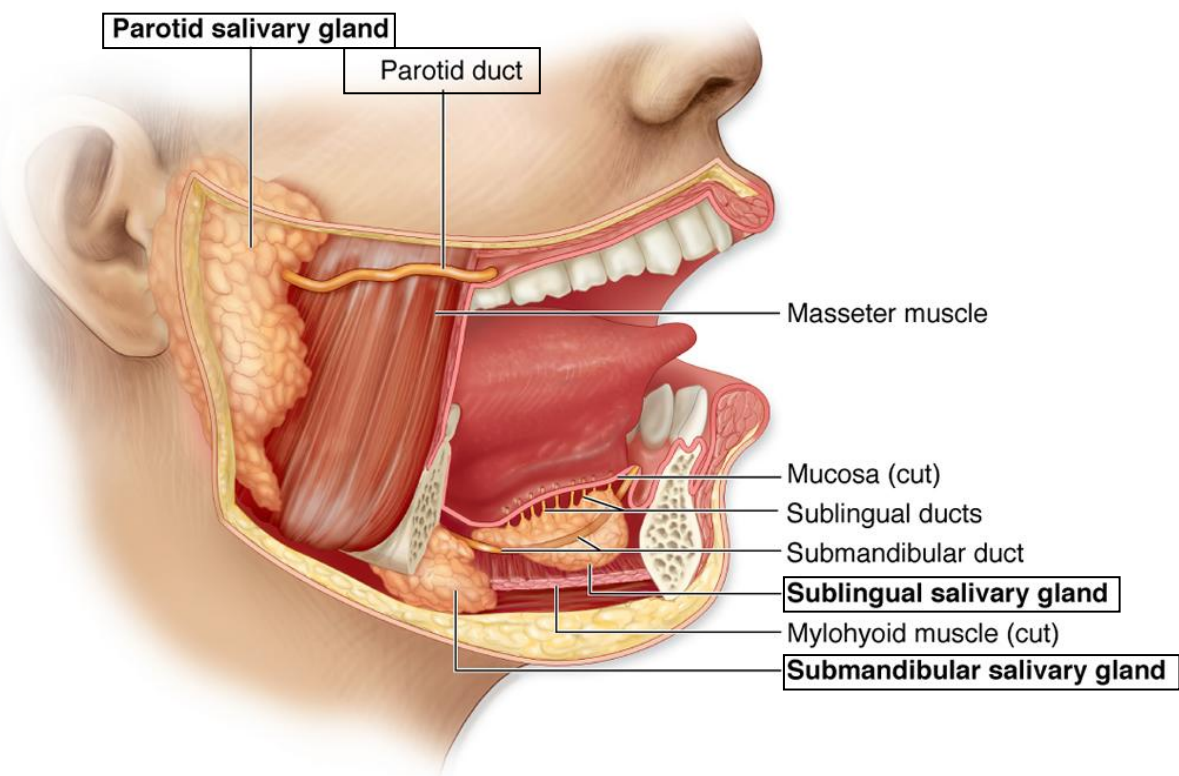


- **Salivary gland:**

- ❖ We have **minor glands** & **three large pairs of glands**. Minor salivary glands secrete mucous mostly , when it <minor SG> is found on the lip it's called Labial salivary gland , if it's found on palate it's called palatial salivary gland , if it's found on tongue it's called lingual salivary gland .

- ❖ The three pairs ; we have the Parotid ( related to **ramus of mandible from outside** ) , Submandibular (related to **sub mandibular fossa** of the mandible ) , Sublingual ( related **sublingual fossa** of the mandible ) .

- ❖ **Mylohyoid muscle** separates **Submandibular gland** from **Sublingual gland**.



- ❖ These glands < the large ones > some of **its secretions** is **mucous**, and some of it is **serous** secretion. Serous means; **amylase & Immunoglobulin** for **killing bacteria**. Some of them will secrete only one type of secretions, others are **mixed** glands (serous and mucous ) .

Note:

**Parotid gland → only serous secretion.**

**Submandibular gland → Mixed!**

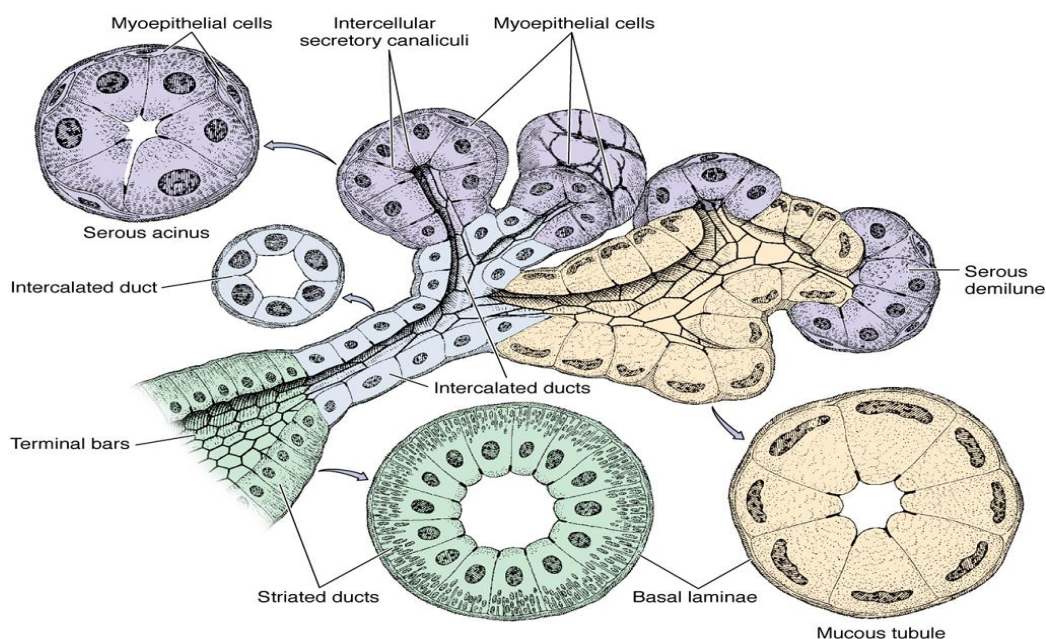
**Sublingual gland → mostly mucous secretion.**

- ❖ Each one of the large glands **has its own duct** ; which opens in **the oral cavity**. Example : Parotid duct open on the upper second molar tooth , so if it <the duct > was obstructed ; **Swelling** of parotid gland will occur , causing **severe pain** ( when the patient **see food** , his gland will be **stimulated** ,secretion will start , finally **swelling** ☹ ☹ ) .
- ❖ Any gland of the large ones ;is surrounded by a capsule of connective tissue ; except for the Parotid gland which has **two capsules** , and from here any swelling in it will cause severe pain ( because there will be **no enlargement** , but there will be **pressure on the structure of the gland** ).

- ❖ The capsule is **connective tissue**, usually sends **septa** between **the lobes & lobules** of the gland, so the gland is divided into lobes & lobules by connective tissue septa. The septa have two functions :
  - 1) Contains **blood vessels, lymphatics, Nerves**.
  - 2) Contains **Large ducts**; they act as **passageway** (for the secretions) to **oral cavity**.
- ❖ Accumulation of secretory cells is called **Acini**. (6-8 secretory cells) will form **Acinus**, **group of Acinus is called Acini**.
- ❖ Acini can be **serous acini** or **mucous acini** or **mixed** depending on the gland type.
- ❖ **Lumen** is where the secretions accumulate, and from it, **small duct will start**. After small duct appearance, it will become **intercalated ducts**, and when it **enlarges** it will be **Striated ducts**. When it reaches between the lobes it's called **interlobar duct**, and it is a large duct.
- ❖ **Myoepithelial cells**: between **the basement membrane** of the acini and **the acini cells**, called **myo**; because it contains **myofibrils**, its function is to squeeze the gland, push the secretion to the lumen, eventually to **the duct**.
- ❖ **Serous acini** is **smaller** than Mucous acini. **The nuclei** of the **Mucous acini** is **flattened** and **basal**, while in **serous acini** they are **rounded and below center** (near the base).

- ❖ **Zymogens granules** are found in **the apex of the serous acini** making it **acidophilic** & the base is **basophilic** , while the **mucous acini** is filled with **mucous secretion** so when doing laboratory preparation to it , it will give **foamy appearance** ( vacuole ) .
- ❖ Intercalated duct is **the smallest duct**, consisting of **5-8 simple cuboidal cells** .While **the striated duct** is a **larger duct**, named striated because there is **elongated fold of the basement membrane** , and the **presence of mitochondria there** (elongated fold) .
- ❖ **Interlobal duct** ; starts as **simple cuboidal** → then it become **startified cuboidal** → **startified columnar** → **stratified squamous** ( when it reaches **the opening** of the oral cavity ) , blood vessels & lymphatics **accompanies** the iterlobal duct .

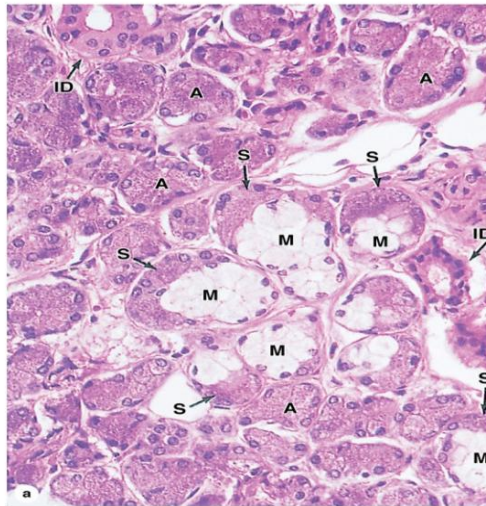
**:: all Previously mentioned stuff about the salivary glands & their cells are illustrated in the figure below ::**





- ❖ In the **submandibular gland**, the secretion is mixed therefore we can find the **Serous Demilunes** = capping of serous over mucous acini .

( check the figure below to see **Serous Demilunes**"S" ) .



- ❖ In **basket cells (myoepithelial duct)**, mucous is more than serous.
- ❖ **Submandibular duct** has **complicated** duct.
- ❖ **The Sublingual** duct is **very minimal** and its secretion is mostly mucous but serous demilune could be found.
- ❖ **Minor salivary** are **numerous** like **labial** , **palatal** . Most of its secretion is **mucous**. in the tongue we have von **ebner's gland** and it secretes **serous** only which contains enzymes, IG and aggregation of lymphocytes and opens into vallate papillae,

**:: End of Salivary glands ::**

**:: THE END::**

... بعذر عن أي خطأ لغوي أو علمي...

زميلكم | علاء الدين دحبور ☺