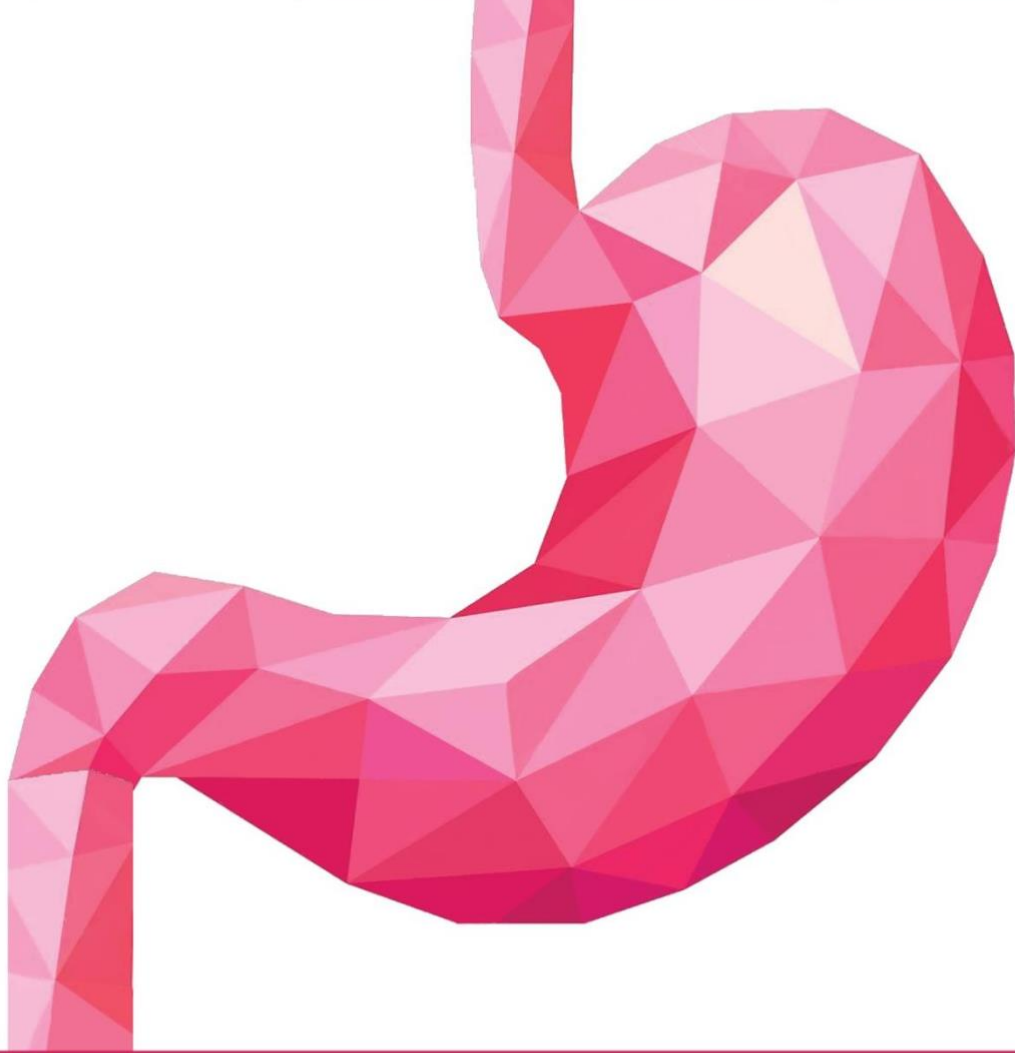




GIS

HISTOLOGY

1



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جعل الله حياتكم وردية جميلة نـ

Why we are even studying this?!

-To describe the cells of the **GI tract** then to know their function (for instance, we have four types of cells in the mucosa of the stomach: **Mucous cells** which obviously secrete mucus, **Parietal cells** that secrete HCl, **Chief cells** that secrete pepsinogen, and the **G cells** that secrete Gastrin hormone).

⇒ endocrine cells

-To describe the histological features of each part of the **GI tract**. (The lining epi. **from the oral cavity until the esophagus with the anal canal (alimentary tract)**: Stratified squamous NON keratinized. **The stomach**: Simple columnar epi. **without** goblet cells.

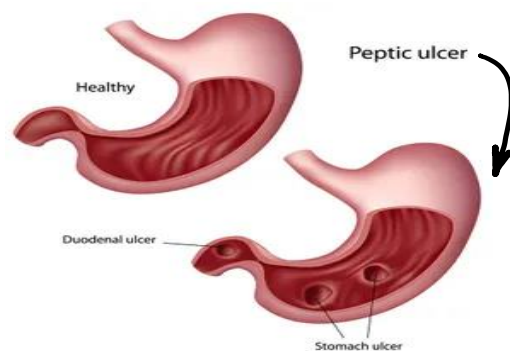
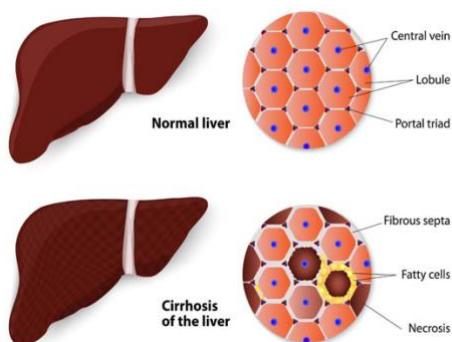
The small intestine: Simple columnar ciliated epi. with goblet cells. **The large intestine**: Simple columnar ciliated epi. with **numerous** goblet cells.

(There is a difference in the glands.)

Histology-Function Relation

-To differentiate between different parts of the GI tract.

-To be able to diagnose the pathology, if you don't know how the normal cells look like how would you know the abnormal ones!



As you can see in the pics above some clinical problems:

Gastric ulcer: occurs in stomach, and it is very rare.

Peptic ulcer: (duodenal ulcer) it is more common, why? Because the Chyme (digested bolus) that comes from the stomach is very acidic and usually it is being neutralized in the duodenum with alkaline secretions, but hyperacidity can lead to ulcer especially in the first inch of duodenum.

Liver cirrhosis: is a late stage of scarring (fibrosis) of the liver caused by many forms of liver diseases and conditions, such as hepatitis and chronic alcoholism and bilaharziasis, so that that the hexagonal shape of hepatocytes with lobes an lobules will be distributed, so the function will be distributed as well.

The digestive system consists of the digestive tract (Alimentary tract)—oral cavity, esophagus, stomach, small and large intestines, rectum, and anus—and its associated glands—salivary glands, liver, gall bladder and pancreas.

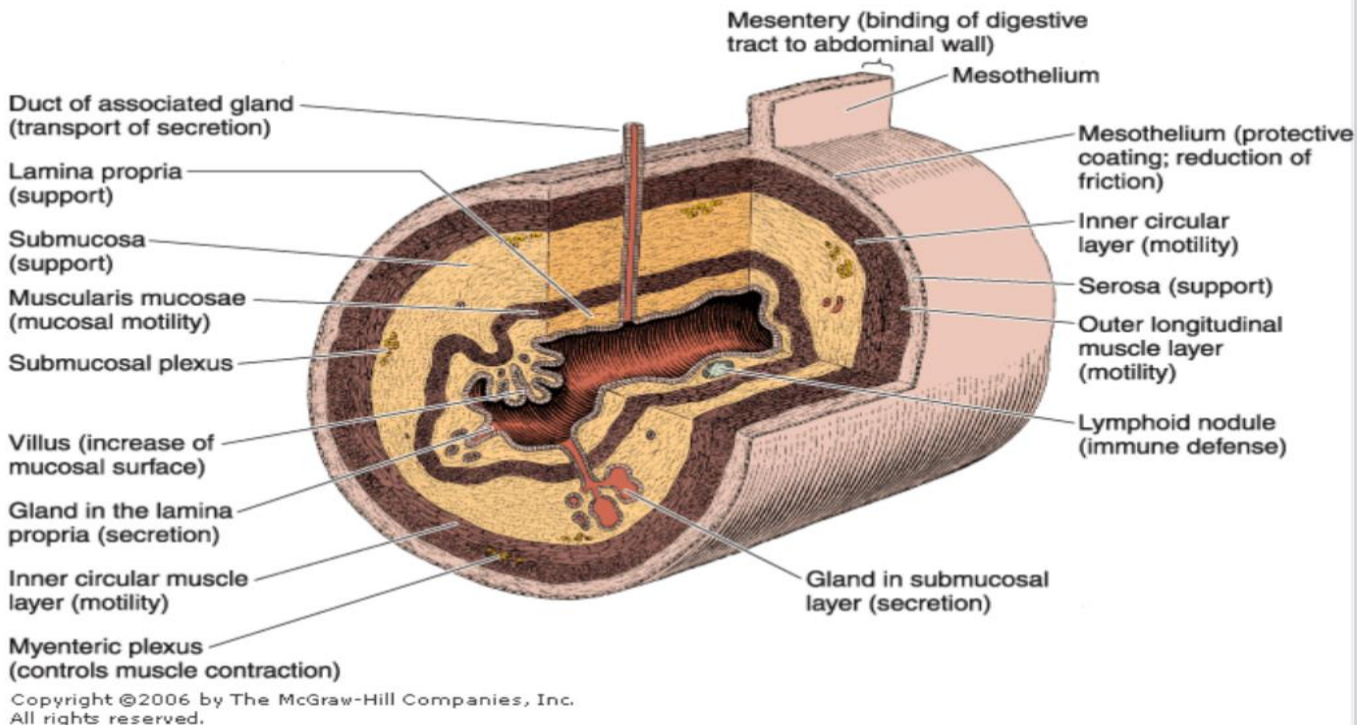
- **Its function is** to obtain the molecules necessary for the maintenance, growth, and energy needed by the body from ingested food.
- Large molecules such as proteins, fats, complex carbohydrates, and nucleic acids are **broken down into small molecules that are easily absorbed** through the lining of the digestive tract, mostly in the small intestine.
- Water, vitamins, and minerals are also absorbed from ingested food. In addition, the inner layer of the digestive tract is a protective barrier between the content of the tract's lumen and the internal milieu of the body.

Then through **portal vein**, these ^{البيضة الداخلية} molecules will leave the blood and go to the **liver**, for storage, formation of enzymes and hormones, detoxification, vitamins formation, metabolic pathway, so if the liver is damaged, that will be not functioning properly.

Upper GI such as the stomach has a function to make the chyme (semi fluid material).

Small intestines do secretion and absorption for the digested material.

Large intestines (colon) do absorption of material and formation of stool or feces.

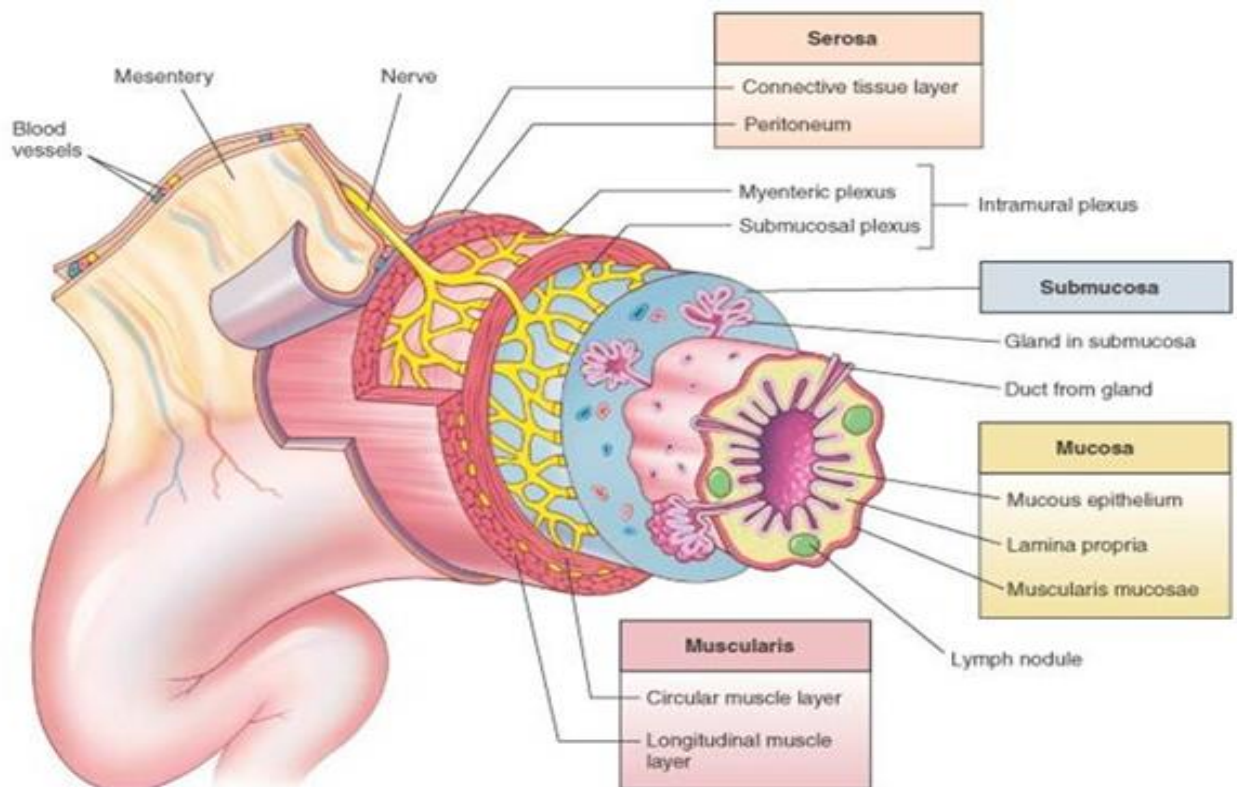


The **GIT** is a hollow tube with a lumen of variable diameter and a wall made up of four main layers: **mucosa**, **submucosa**, **muscularis** (externus), and **serosa or adventitia**.

1-Mucosa (mucous membrane): it's divided into 3 sublayers:

- A. **epithelial lining:** each part has its own type (ex: stomach has simple columnar epithelium without goblet cell, but from mouth to esophagus with the anal canal it's lined by stratified squamous non-keratinized...).
- B. **lamina propria:** loose areolar connective tissue rich in blood and lymph vessels, sometimes also it contains **glands** (important for secretion) and lymphoid tissue.
 - intestinal glands are called Lieberkühn Crypts.
 - chief cells secrete pepsinogen.
 - parietal cells secrete HCl.
- C. **muscularis mucosa:** usually made of a thin **inner circular layer** and an **outer longitudinal layer** of smooth muscle. It changes the shape of lumen (helps in peristaltic movement).

In the stomach the most inner layer is OBLIQUE.



2-Submucosa: it's composed of dense connective tissue with many blood and lymph vessels and a submucosal (**Meissner's**) nerve plexus (which is located between the submucosa and the external muscle). It may also contain glands and lymphoid tissue.

-There are glands in the submucosa of **esophagus** and **duodenum** (unlike the mucosa as it contains glands in **all the organs**), Meaning that **both the esophagus and duodenum** have glands in their submucosa as an **EXCEPTION**.

-The submucosal gland of **duodenum** is known as **Brunner's gland**, it secretes alkaline secretions to neutralize the acidic chyme of stomach when reaches duodenum (in addition to mucosal glands).

-Esophageal cardiac gland in submucosa (there are mucosal esophageal glands, too).

3-Muscularis (Muscularis externa): it is composed of smooth muscle cells organized as 2 sublayers:

- A. **The internal sublayer** (close to the lumen), the fiber orientation is generally circular.
- B. **The external sublayer** it is longitudinal.

-Also, it contains the **myenteric** or (**Auerbach's**) nervous plexus, which lies between the two muscle sublayers.

It's way **bigger** than the submucosal (**Meissner's**) nerve plexus.

The **vagus nerve** gives the biggest parasympathetic preganglionic here, it's responsible for the **secretion** and the **peristaltic movement**.

-Blood and lymph vessels in the connective tissue **between** the muscle sublayers.

4-Serosa and adventitia: It's a thin layer of loose connective tissue rich in blood and lymph vessels, adipose tissue.

If simple squamous covering epithelium (serosa or mesothelium), if the coverage is connective tissue, then it is (adventitia).

In the abdominal cavity, the serosa is continuous with the mesenteries (a double fold of peritoneum that attaches the intestine to the posterior abdominal wall) and with the peritoneum.

However, in places where the digestive organ is bound to other organs or structures the serosa is replaced by a **thick adventitia**, consisting of connective tissue containing vessels and nerves, **without** the mesothelium.

-For example: The oral cavity, thoracic esophagus, ascending colon, descending colon and rectum.



تنفسوا الصعداء احبائي وروحوا كلوا شوية قطايف تا نبدا بالموضوع الثاني..

و صهلوا
عائتي بجر

Basic mucosal forms in the GI tract:

(to connect the structure with the function)

-**Protective**: stratified squamous epithelium that is found in the oral cavity, pharynx, the esophagus and the anal canal.

Rapid and excessive mitosis for the fast healing of the damaged tissue.

خلال 6hr

-**Secretory**: the mucosa consists of a long closely packed tubular glands, found in the stomach.

In the **lamina propria** or the **submucosa**.

-**Absorptive**: the mucosa is arranged in a fingerlike projections called villi (to **increase the surface area**) with intervening short glands called crypts, that is typical for the small intestine.

In the duodenum some crypts extend from the muscularis mucosa to the submucosa (**Brunner's Glands**) (for the **neutralizing effect of stomach acidity to prevent peptic ulcers**).

-**Absorptive/protective**: the mucosa is arranged into closely packed tubular glands special for water absorption and mucus secreting goblet cells (to produce mucous that protects the intestines from feces which may be a hard object).

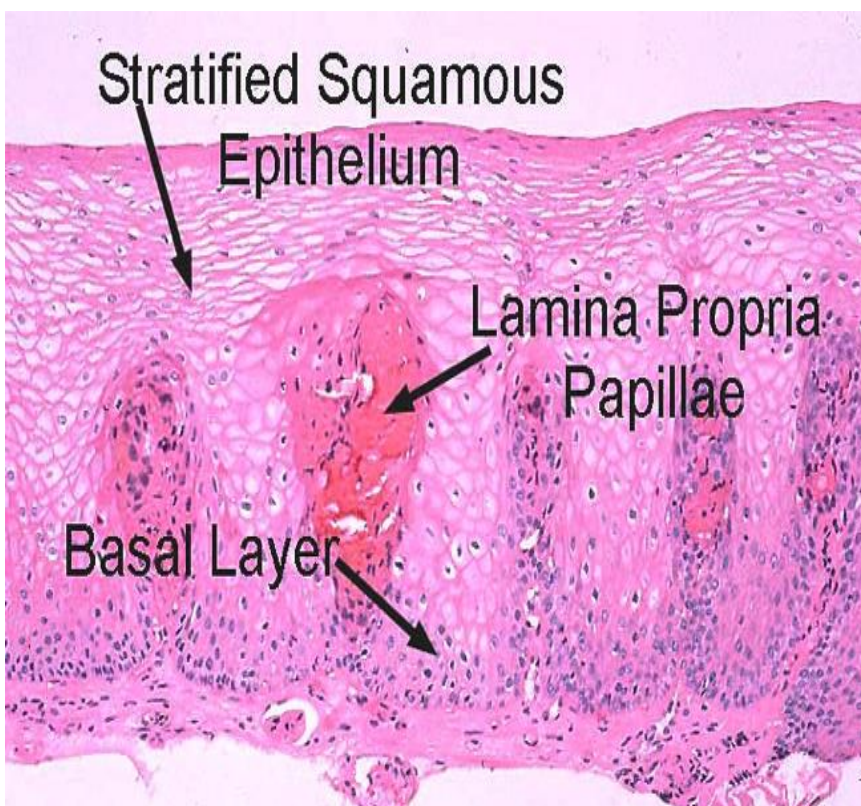
It lines the whole **large intestine**.

Now let's start talking about oral cavity:

- ❖ The oral cavity is lined with **stratified squamous epithelium**, keratinized or non-keratinized depending on the region.
- ❖ It has the same layers as the 4 lined layers of the GI tract because it is part of it, after the 4 layers there is a voluntary muscle which is the **buccinator** (**supplied by buccal branch from facial**).
- ❖ The keratin layer (**Parakeratinized**) protects the oral mucosa from damage during masticatory function and is present mostly in the gingiva (gum) and hard palate.

*it's a common place for injury...

- ❖ Lamina propria in these regions has several papillae and rests directly on **bony tissue**.
- ❖ The Non-keratinized squamous epithelium covers the **soft palate, lips, cheeks, the floor of the mouth** and the **cleft (groove)** of the papilla.
- ❖ The Lamina propria has papillae similar to those in the dermis of the skin and is continuous with a submucosa containing diffuse small salivary glands.
- ❖ The **soft palate** has a core of skeletal muscle, numerous mucous glands, and lymphoid nodules in its submucosa.



The papillae are projection of the submucosa through the mucosa to the surface

ال section وري تى

Now let's go to the lips, we can see:

- **Outer layer:** skin (with sebaceous glands, hair follicles...)
- **Internal mucous surface:** has lining mucosa with a thick, non-keratinized epithelium and many minor labial salivary gland.
- **Voluntary Orbicularis oris muscle.**
- **Red region (vermillion/ transitional zone):** modified skin with no hair follicles, no sebaceous glands, rich in blood vessels, and highly sensitive (**nerve terminals**), that is why it occupies large area in the brain, despite its small size.

* Tongue:

-It is a mass of striated muscle covered by a mucous membrane whose structure varies according to the region, the muscle fibers cross one another in three planes; they are grouped in bundles, usually separated by connective tissue.

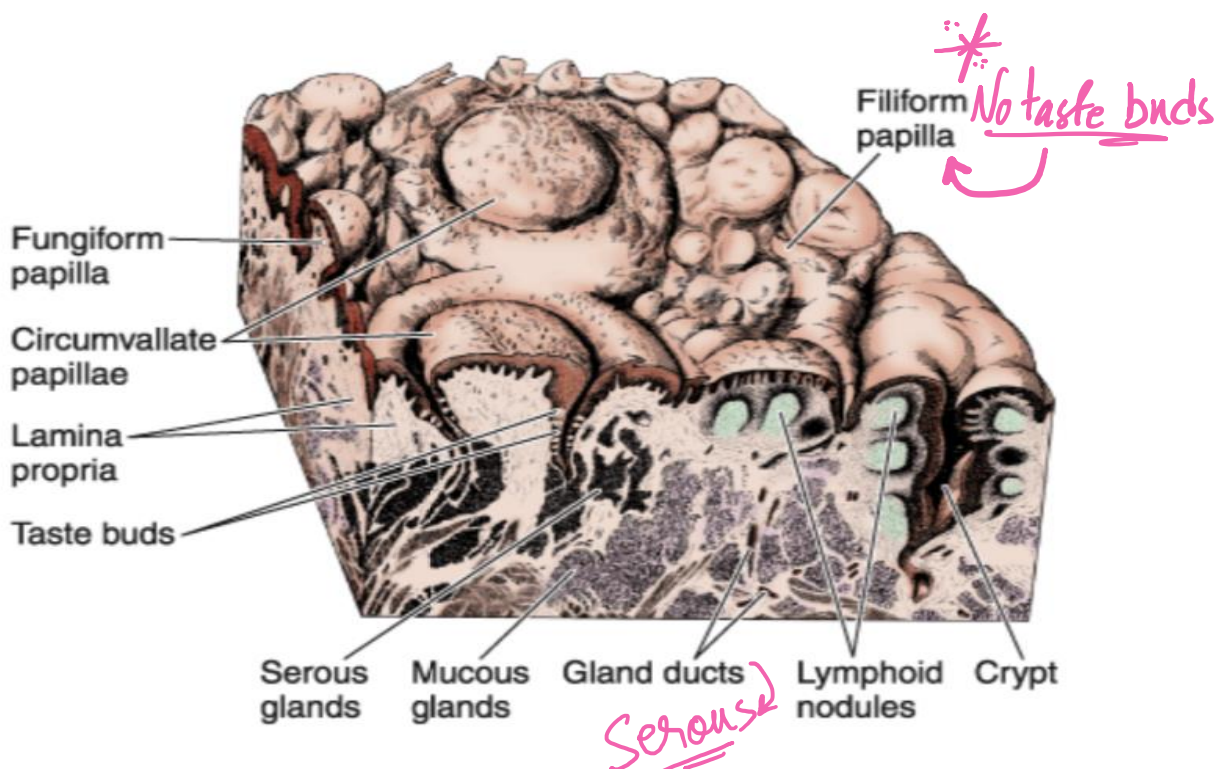
Because the connective tissue of the **lamina propria** penetrates the spaces **between** the **muscular bundles**, the mucous membrane is strongly adherent to the muscle.

-The mucous membrane is **smooth** on the lower (**ventral**) surface of the tongue.

-The **Lower** surface of the tongue (**mucosa, nonkeratinized**) and the **upper** dorsum (**parakeratinized: partially keratinized epithelium**).

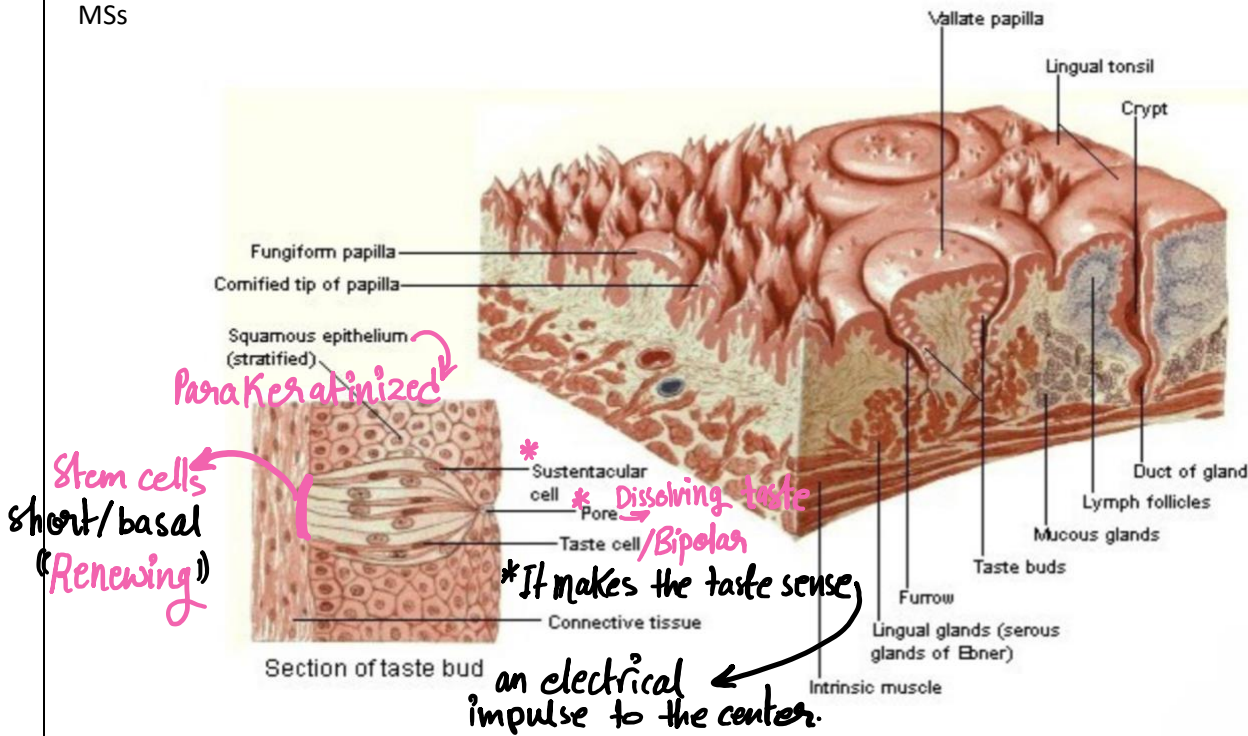
-The tongue's **dorsal** surface is **tough**, irregular, covered anteriorly by a great number of small eminences called **papillae** with the taste buds.

-The **posterior one-third** of the dorsal surface of the tongue is separated from the anterior two-thirds by a V-shaped boundary (**sulcus terminalis**).



* Behind this boundary, the surface of the tongue shows small bulges composed mainly of **two types of small lymphoid aggregations**:

- **small collections of lymphoid nodules.**
- **the lingual tonsils**, where lymphoid nodules aggregate around invaginations (**crypts**) of the mucous membrane. **in the posterior 1/3**



Now in the **anterior two thirds** we have **papillae**:

-Papillae are elevations of the oral epithelium and lamina propria that assume various forms and functions. **There are four types**:

1-Filiform papillae have an elongated conical shape, they are quite numerous and are present over the entire surface of the tongue.

- Their epithelium is keratinized which **DOESN'T** contain taste buds.

2- Fungiform papillae resemble mushrooms; they have a narrow stalk and a smooth-surfaced, dilated upper part, these papillae, which contain scattered taste buds on their upper surfaces, are irregularly interspersed among the filiform papillae.

3- Foliate Papillae: poorly developed in humans, consist of two or more parallel ridges and furrows on the dorsolateral surface of the tongue and contain many taste buds.

4- Circumvallate papillae: (surrounded by circular groove, they are where we find taste buds at medial side of papilla) Circumvallate is circular, but you can see two clefts/ grooves/sulcus in some sections, they have taste buds at both sides of papilla.

-It's for the **bitter taste** (طعم المر اللذي لا يدونه لحدن) ☹️

-A common mistake that a lot of people do that when they take a medicine they put the pill all the way in the back side of their tongues, which it makes them feel that **EWW** taste! (**Instead you can advise them to put it in the apex of their tongues which will make them feel nth at all because it's for the sweet taste**).

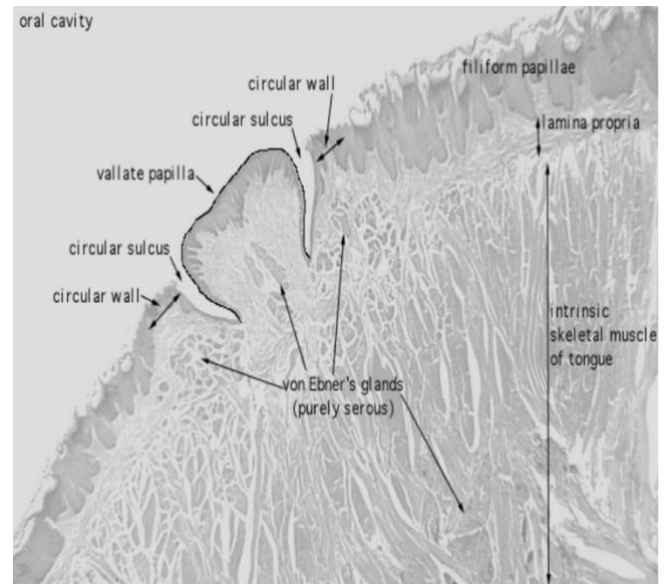
- All of them are innervated by **chorda tympani** except the **circumvallate**(by **glossopharyngeal**).
- They are distributed in the V region in the posterior portion of the tongue.
- Numerous serous (**von Ebner's**) glands drain their contents into the deep groove that encircles the periphery of each papilla.
- This moat like arrangement provides a continuous flow of fluid over the great number of taste buds present along the sides of these papillae.
- The glands also secrete a **lipase** that probably prevents the formation of a hydrophobic layer over the taste buds that would hinder their function.
- This flow of secretions is **important** in **removing food particles from the vicinity of the taste buds** so that they can **receive and process new gustatory stimuli**. Along with this local role, lingual lipase is active in the stomach and can digest up to **30%** of dietary triglycerides.
- Other small mucous salivary glands dispersed throughout the lining of the oral cavity act in **the same way** as the serous glands associated with this type of papillae **to prepare the taste buds in other parts of the oral cavity**, such as the **anterior portion of the tongue** to respond to taste stimuli.

* Appears clearly in animals



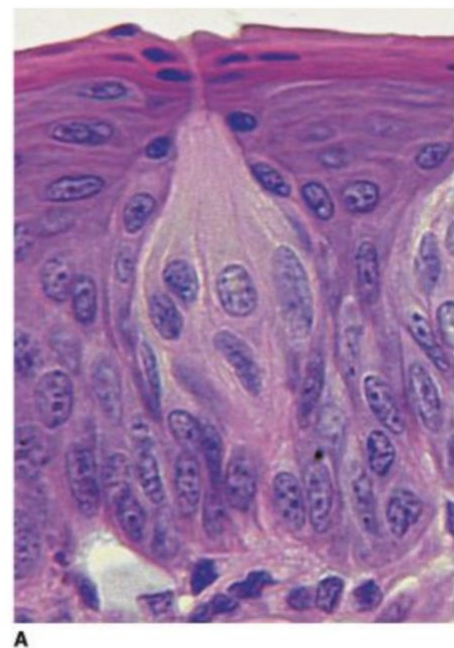
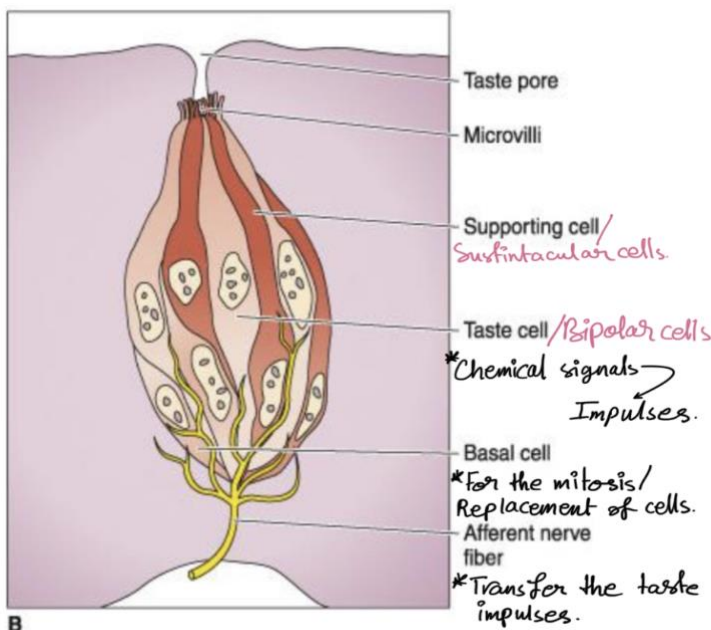
استغفر الله والعليم وأتوب إليه

-The arrow which says (**vallate papilla**) from both sides, you can find a **groove** (named here: **circular sulcus**), the part of the vallate which faces the groove is the medial wall of and it is made of **parakeratinized** **BUT** the lateral wall of circumvallate (the arrow which says the **circular wall**) is made of **nonkeratinized** epithelium because it is **deep**, and not likely to be injured.



*Types of Cells responsible for taste:

- **Bipolar cell/ Gustatory cell**: It is known as **gustatory microvillus**, it's found in the center microvilli from each taste cell projects into the taste pore and here starts **chorda tympani (branch of facial nerve)**.
- **Supporting cells (around the gustatory/ bipolar cells)**.
- **Basal cells (basal stem)**: active in mitosis to regenerate the two previous cells (**gustatory and supporting**).

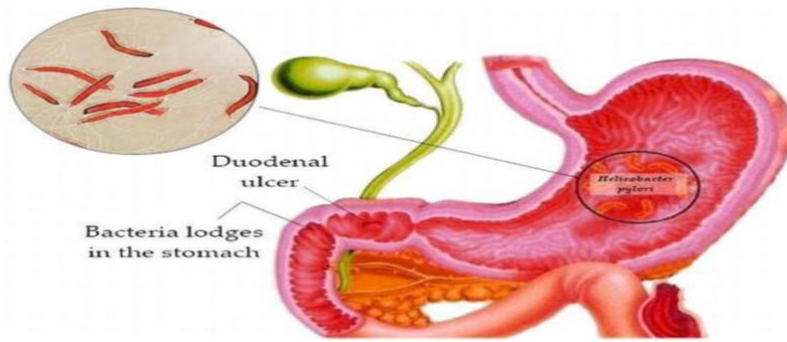


*Now let's talk about salivary glands:

- **Saliva** is a complex fluid that has digestive, lubricating, and protective functions.
- We produce about **8-10 liters** of saliva per day.
- **Parotid gland**: **serous** secretion, its duct opens at the vestibule of mouth (**at the level of upper second molar**).
- **Submandibular gland**: **mixed**, 70% serous and 30% mucous.
- **Sublingual gland**: **mucous** mainly, 10% serous.

In humans, the **minor salivary glands** secrete **10%** of the total volume of **saliva**, but they account for approximately **70%** of the **mucus** secreted.

Dehydration leads to dryness which leads to **growth of bacteria**, especially when immunity weakens, we have bacteria everywhere in our body, they are **opportunistic** waiting for your immunity to weaken (***Helicobacter pylori* in stomach is normally NON-pathogenic unless in cases of immunosuppression, they are activated and may cause gastritis**).



The striated ducts of each lobule converge and drain into **ducts** located in the **connective tissue septae** separating the lobules: **interlobular (between lobes)** and **intralobular (inside each lobe)**.

* General histology:

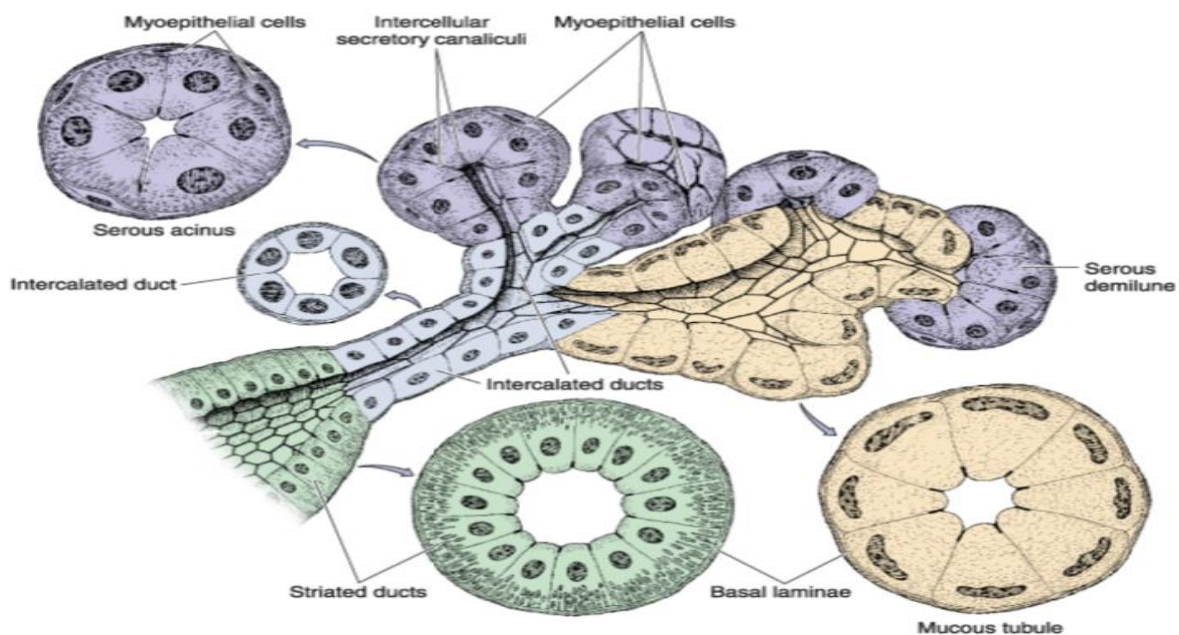
- They are initially lined with **pseudostratified** or **stratified cuboidal epithelium**, but the more **distal** parts of the excretory ducts are lined with **stratified columnar epithelium** containing a **few** mucus-secreting cells.
- The main duct of each major salivary gland ultimately empties into the **oral cavity** and is lined with **nonkeratinized-stratified squamous epithelium**. Vessels and nerves enter the large salivary glands at the **hilum** and gradually branch into the lobules.
- A rich vascular and nervous plexus surrounds the **secretory** and **ductal** components of **each lobule**.
- The **capillaries** surrounding the **secretory end pieces** are very important for the **secretion of saliva**, stimulated by the **autonomic nervous system**.
- **Parasympathetic** stimulation, usually through the **smell** or **taste** of food, **promotes vasodilation** and a **copious watery secretion** content.
- **Sympathetic** stimulation **produces small amounts of viscous saliva**, rich in organic material.

الكثير

Acinus (many acini) system: is a group of cells acting as one unit draining into ducts (directed into a lumen).

Salivary glands are all with **secretory acinus** which drain into **ducts** that drain into the oral cavity (**acini contains serous, mucous secretory cells or both**) as well as **myoepithelial cells** all surrounded by basement membrane.

This structure can be thought of as a grape attached to its stem; the stem corresponds to the duct.



-Serous cells: are usually **pyramidal** in shape, with a **broad base** resting on the **basal lamina** and a **narrow apical surface** with **short, irregular microvilli** facing the **lumen** with **rounded nuclei**.

-They exhibit characteristics of polarized **protein-secreting cells**.

-Mucous cells: are usually **cuboidal** to **columnar** in shape, their nuclei are **oval** and **pressed** toward the bases of the cells.

-They exhibit the characteristics of **mucus-secreting cells** containing **glycoproteins important for the moistening and lubricating functions of the saliva**.

-Most of these **glycoproteins** are called **mucins** and contain 70-80% carbohydrate moieties in their structure.

-Mucous cells are most often organized as **tubules** consisting of cylindrical arrays of secretory cells surrounding a lumen.

The mucous glands have a clear, vacuolated, foamy appearance compared to the much more dense, darkly-staining serous glands.

Myoepithelial cells:

- Are found between the **basal lamina** and the **basal plasma membrane** of the cells forming secretory end pieces and intercalated ducts (to a lesser extent), which form the initial portion of the duct system.
- Myoepithelial cells surrounding each secretory portion, usually **two to three cells per secretory unit**, are well developed and branched (**they are called basket cells**).
- Whereas those associated with **intercalated ducts** are **spindle** shaped and lie **parallel** to the length of the duct.
- These cells have the ability to divide and differentiate into **secretory** or **ductal cells**.
- **Intercalated and striated ducts** are also called **intralobular ducts** because of their location **within** the lobule.

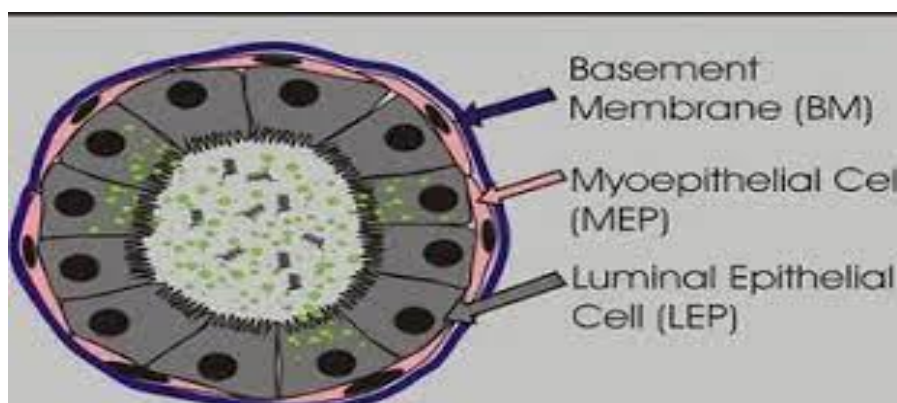
- These cells show several characteristics that resemble smooth muscle cells, including **contractility**.

Also, they establish **intercellular junctions** among them selves and with secretory cells, such as **desmosomes**.

The contraction of myoepithelial cells **accelerates the secretion of saliva**, their main function seems to be the **prevention of end piece distention during secretion** due to the increase in intraluminal pressure. **In the duct system, secretory end pieces empty into the intercalated ducts, lined by cuboidal epithelial cells.**

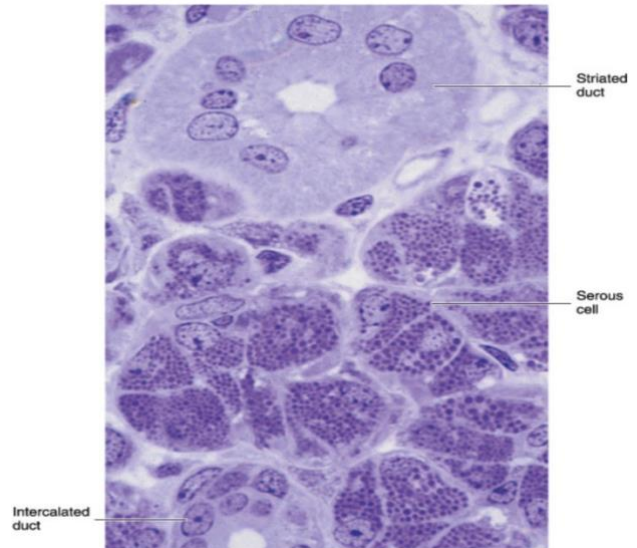
Several of these short intercalated ducts join to form **striated ducts** characterized by **radial striations** that **extend from the bases of the cells to the level of the central nuclei**.

When viewed in the electron microscope, the striations are seen to consist of in foldings of the basal plasma membrane with **numerous elongated mitochondria** that are aligned parallel to the in folded membranes; this structure is characteristic of **ion-transporting cells**.



*** Parotid gland:** It's a branched **acinar gland**; its secretory portion is composed exclusively of **serous cells**.

- Containing secretory granules that are rich in **proteins** and have a **high amylase activity** which is **responsible for most of the hydrolysis of ingested carbohydrates**.
- The digestion begins in the mouth and continues for a short time in the stomach, before the gastric juice acidifies the food and thus decreases amylase activity.
- Intercalated and striated ducts are easily observed within the lobules, due to their length.

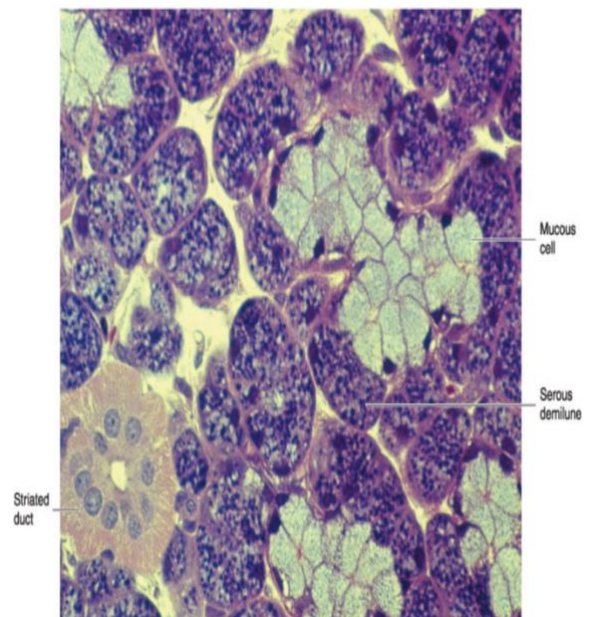


- As in other large salivary glands, the **connective tissue** contains many **plasma cells** and **lymphocytes**.
- The **plasma cells** secrete **IgA**, which forms a complex with a secretory component **synthesized by the serous acinar, intercalated duct, and striated duct cells**.
- The **IgA-rich secretory complex** released into the **saliva is resistant to enzymatic digestion and constitutes an immunological defense mechanism against pathogens in the oral cavity**.

*** Submandibular (Submaxillary) gland:**

The submandibular gland is a branched **tubuloacinar** gland, its secretory portion contains **both mucous and serous cells** which are the main component of this gland and are easily distinguished from mucous cells by their **rounded nuclei** and **basophilic cytoplasm**.

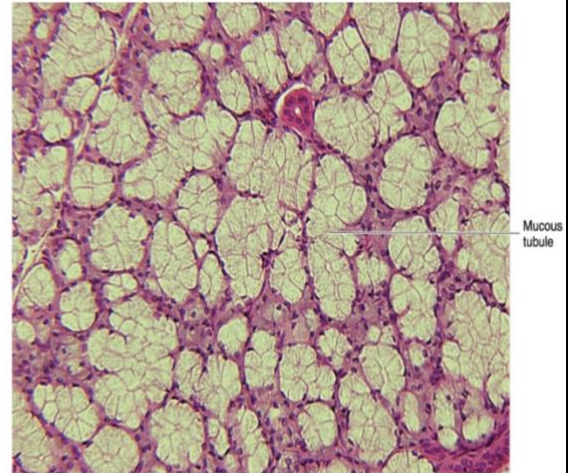
- **Serous cells** are responsible for the **weak amylolytic activity** present in this gland.
- In humans, **90%** of the **end pieces** of the submandibular gland are **serous acinar**, whereas **10%** consist of **mucous tubules** with serous demilunes.
- The cells that form the **demilunes** in the submandibular gland **secrete the enzyme lysozyme, whose main activity is to hydrolyze the walls of certain bacteria**.



- Some **acinar** and **intercalated duct** cells in large salivary glands also secrete **lactoferrin**, which **binds iron, a nutrient necessary for bacterial growth**.
- **Striated ducts** are **easily observed** in the human submandibular gland, but **intercalated ducts** are **very short**.

***Sublingual gland:** like the submandibular gland, is a branched **tubuloacinar** gland formed of **both serous and mucous cells**.

- **Mucous cells** predominate in this gland; **serous** cells are present almost exclusively on **demilunes** of mucous tubules.
- As in the submandibular gland, **cells that form the demilunes** in this gland **secrete lysozyme**.
- **Intralobular ducts** are **not** as well developed as in other major salivary glands.



Serous demilunes cannot be seen in the parotid gland, because it is purely serous.

***Minor Salivary Glands:** they are numerous, covering the whole oral cavity. They are **mucous**, and contributes **a lot** to the daily 8 salivary liters.

- **Labial glands** (related to lips).
- **Lingual glands** (related to tongue).
- **Minor salivary glands of palate.**

*** صوفين !**

- These **non-encapsulated** glands are distributed throughout the oral mucosa and submucosa.
- **Saliva** is produced by **small groups of secretory units** and is conducted to the **oral cavity** by **short ducts**, with little modification of its content.
- Minor salivary glands are usually **mucous**.
- The small **serous** glands present in the **posterior region of the tongue** (**von Ebner's glands**) are the **only** exception.
- **Lymphocyte aggregates** are commonly observed within minor salivary glands, associated with **IgA secretion**.

اللهم حبك اللهم عونك، اللهم رضاك ولطفك

اللهم كل الحاجه إليك

اللهم هُداك وذكرك وتيسيراً لا يتبعه عُسراً

اللهم ونفساً راضيه وخلوقه..

thikrallah



يُحِبُّكَ الْعَاقِبَةُ مَا كَانَ يَدِي هُوكَ نَ لِيَسَ وَعَد
كثير ربح بسهل والدراسة ♥

made with love

MSs