

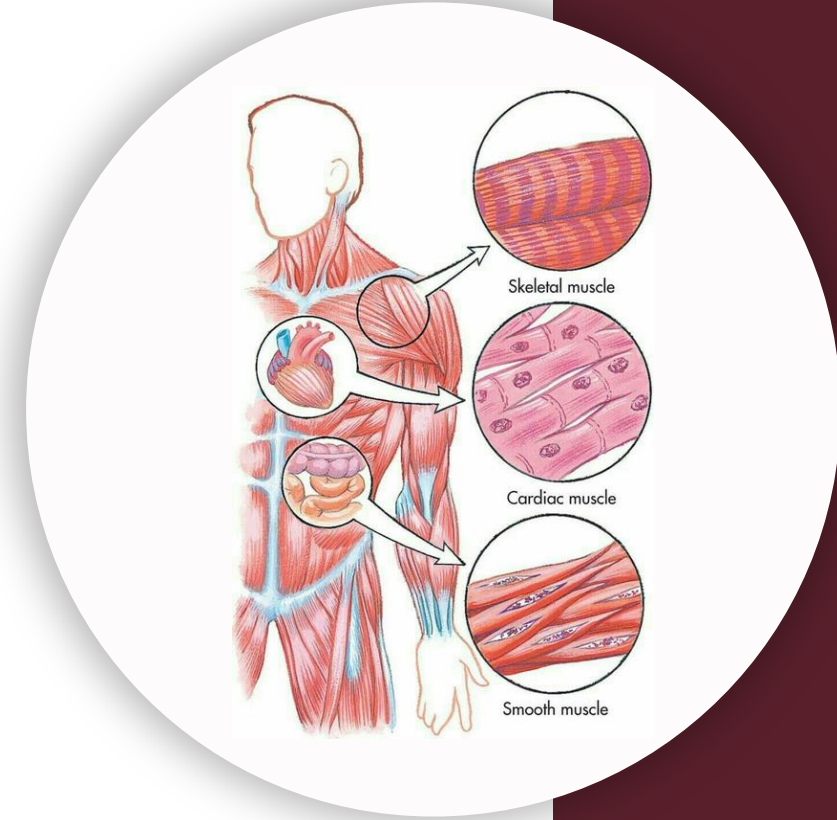
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جانب

GI Histology | MID 1

# Histology Of The GIT



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Reviewed by : NST Members

# HISTOLOGY OF THE GIT

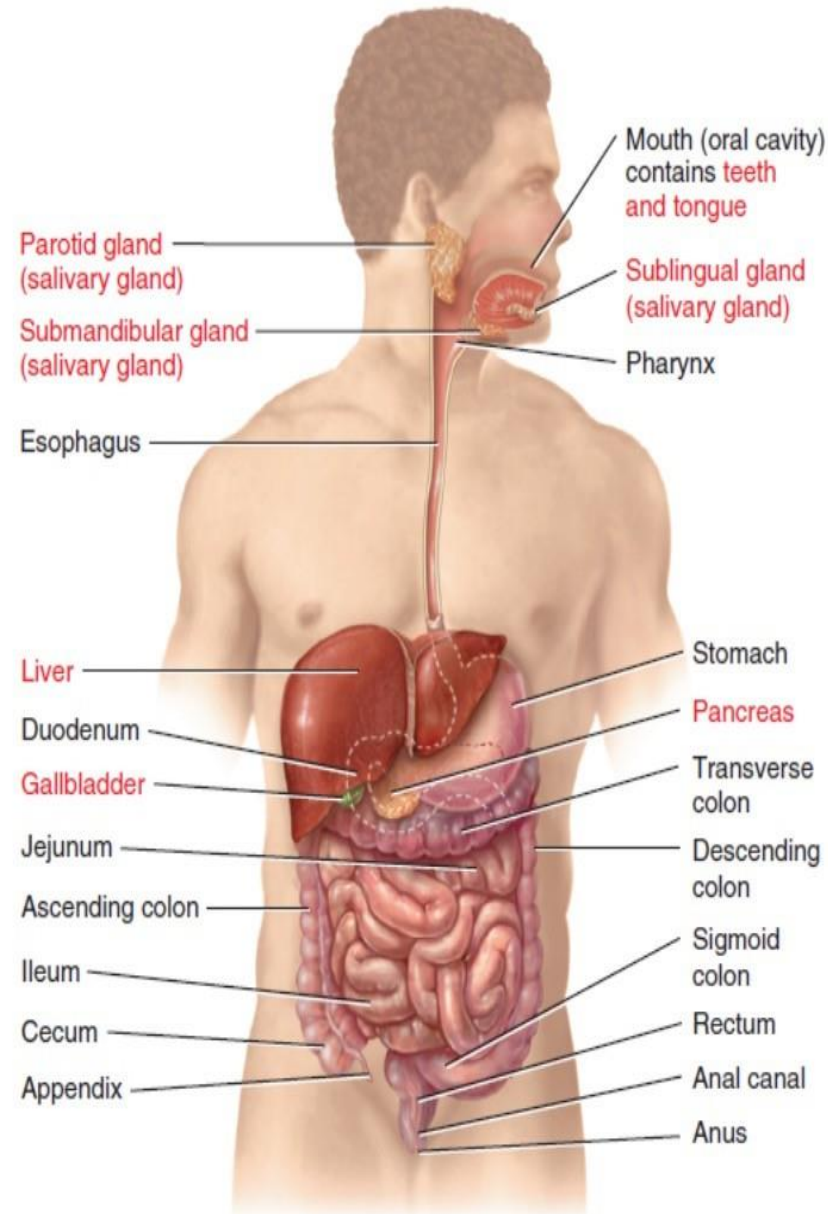
## Outline

- General features of the GIT histology
- Histology of the of the oral cavity including salivary glands.
- Histology of the esophagus and stomach
- Histology of the small and large intestine
- Histology of the associated glands; liver, gallbladder, and pancreas.

# Gastrointestinal Tract (GIT)

# The Gastrointestinal Tract (GIT)

- Consists of a group of organs that break down the food.
- Two groups of organs: the gastrointestinal (GI) tract and the accessory digestive organs.
- Is a continuous tube that extends from the mouth to the anus.
- Include the mouth, most of the pharynx, esophagus, stomach, small intestine, and large intestine.



- The length of the git is about 5–7 meters
- The **accessory digestive organs** include the teeth, tongue, salivary glands, liver, gallbladder, and pancreas.
- Teeth aid in the physical breakdown of food, and the tongue assists in chewing and swallowing.

# Layers of The GIT

- We say “layers” when we have lumen like: B.V, respiratory and GI tract.
- We have to have an **epithelium lining the lumen with underlying C.T**

## □ The layers go like this :

- 1) Lumen.
- 2) Mucosa.
- 3) Submucosa.
- 4) Muscularis.
- 5) If esophagus → adventitia.  
If stomach, small or larger intestine → serosa.

## 1. Mucosa

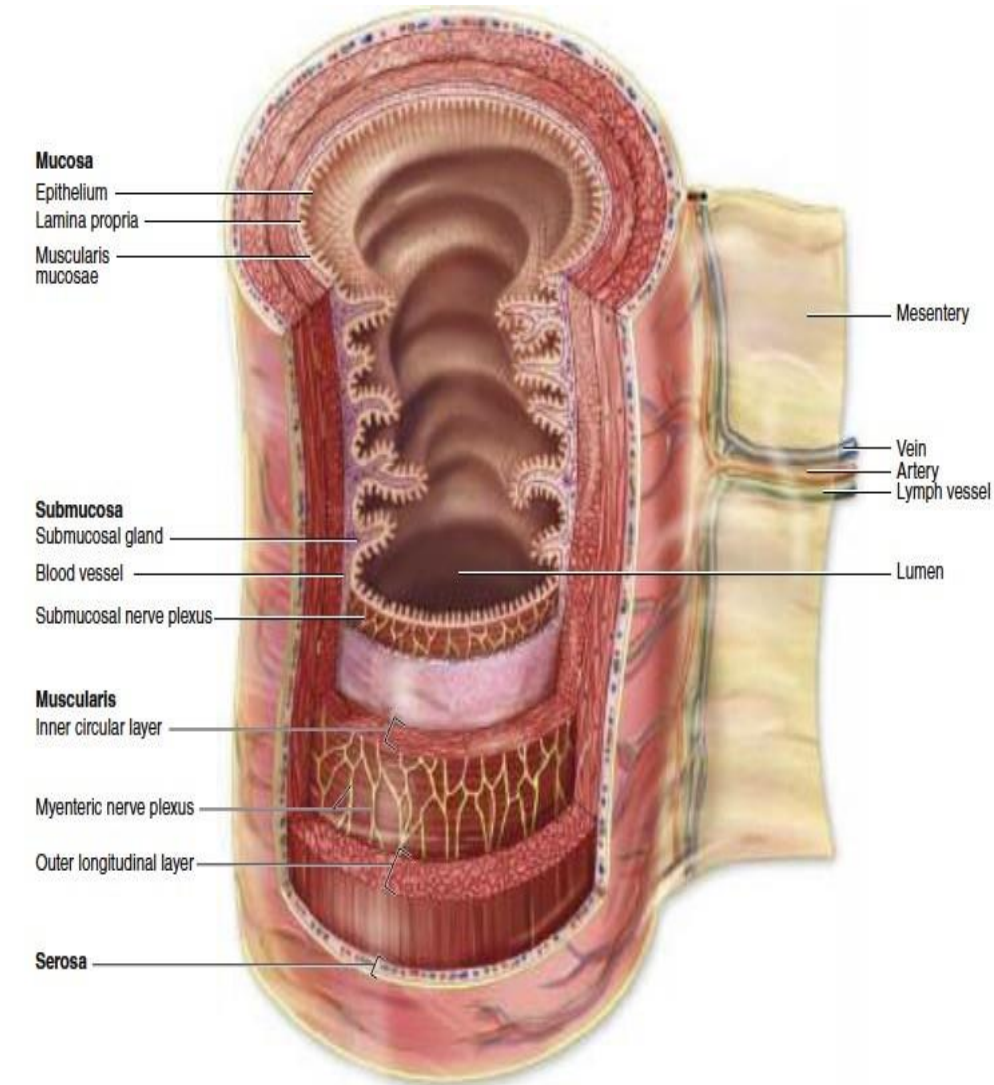
The wall of GIT has its own unique features, an **extra layer with smooth layer of smooth muscle + epithelium and supporting C.T.** These three together is what we call “mucosa”.

## 2. Submucosa

The mucosa is further **supported by another layer of C.T.** which is **big and very important (submucosa)**

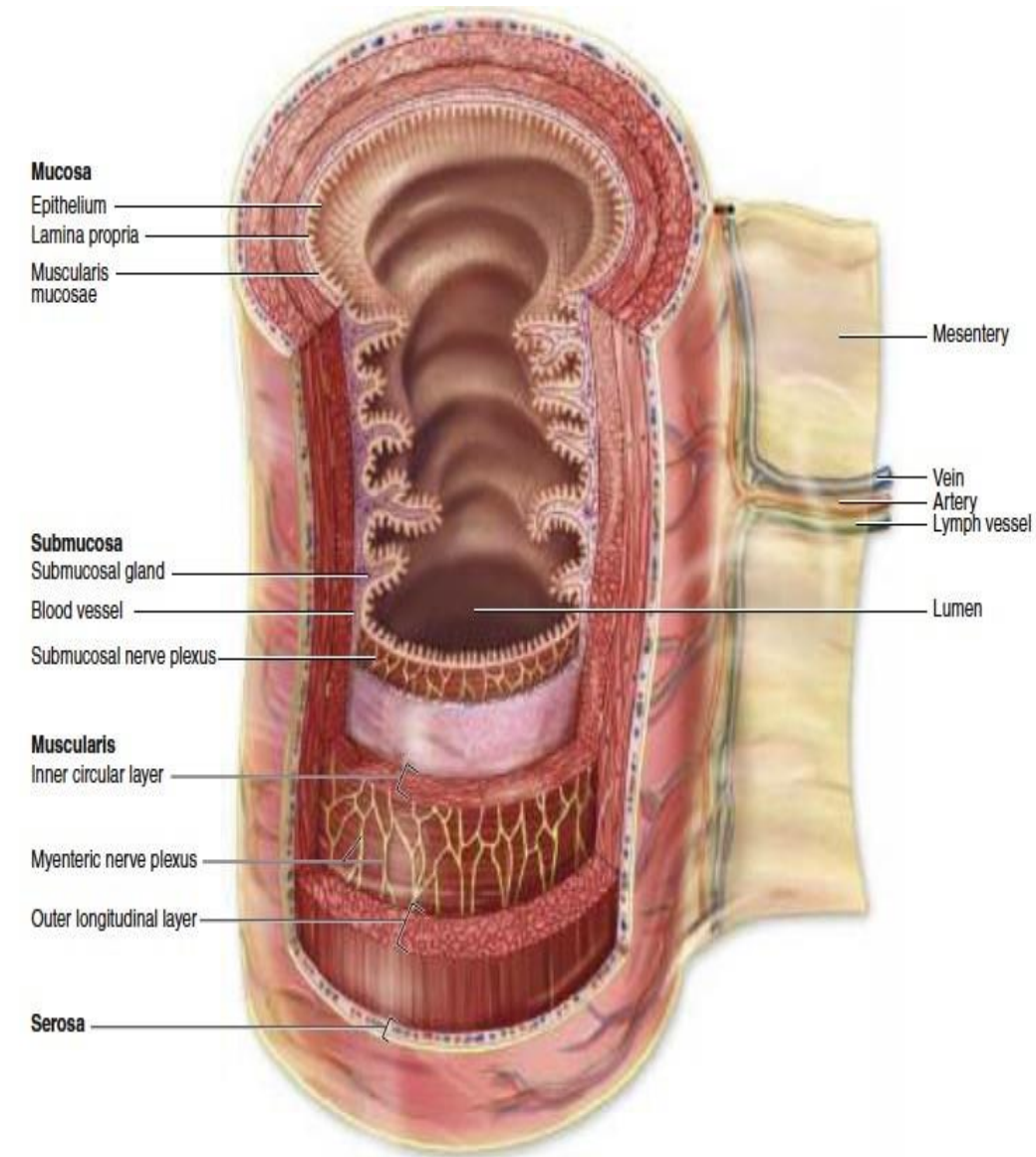
## 3. Muscularis

## 4. Serosa / adventitia



# Layers of The GIT

- There are substance passing through so we need motor cell (smooth muscles) and the layers are very thick and are the thickest in stomach and they differ from beginning of oral cavity (skeletal) , **esophagus (transitional organ, different regions, different compositions), stomach, small and large intestines (all smooth), and finally sphincter (skeletal muscle)**, So the GI it Starts as voluntary and end as voluntary, and any thing in between is involuntary (by smooth muscle).
- As a general rule : ***we don't have tissues that are exposed, everything has a covering (like epithelium (which has its own C.T covering) and C.T) so everything is covered with C.T.***
- The C.T will express itself as **adventitia** if we talk about **esophagus**, but in **abdomen** its different cause we have **peritoneum**.



# Layers of The GIT

- Lumen has to be lined with **epithelium supported by C.T (laminate propria, loose)**.
- You can generally know the type of lining by function of that organ ;)

## 1. Mucosa

Or mucus membrane,  
This if the first layer.

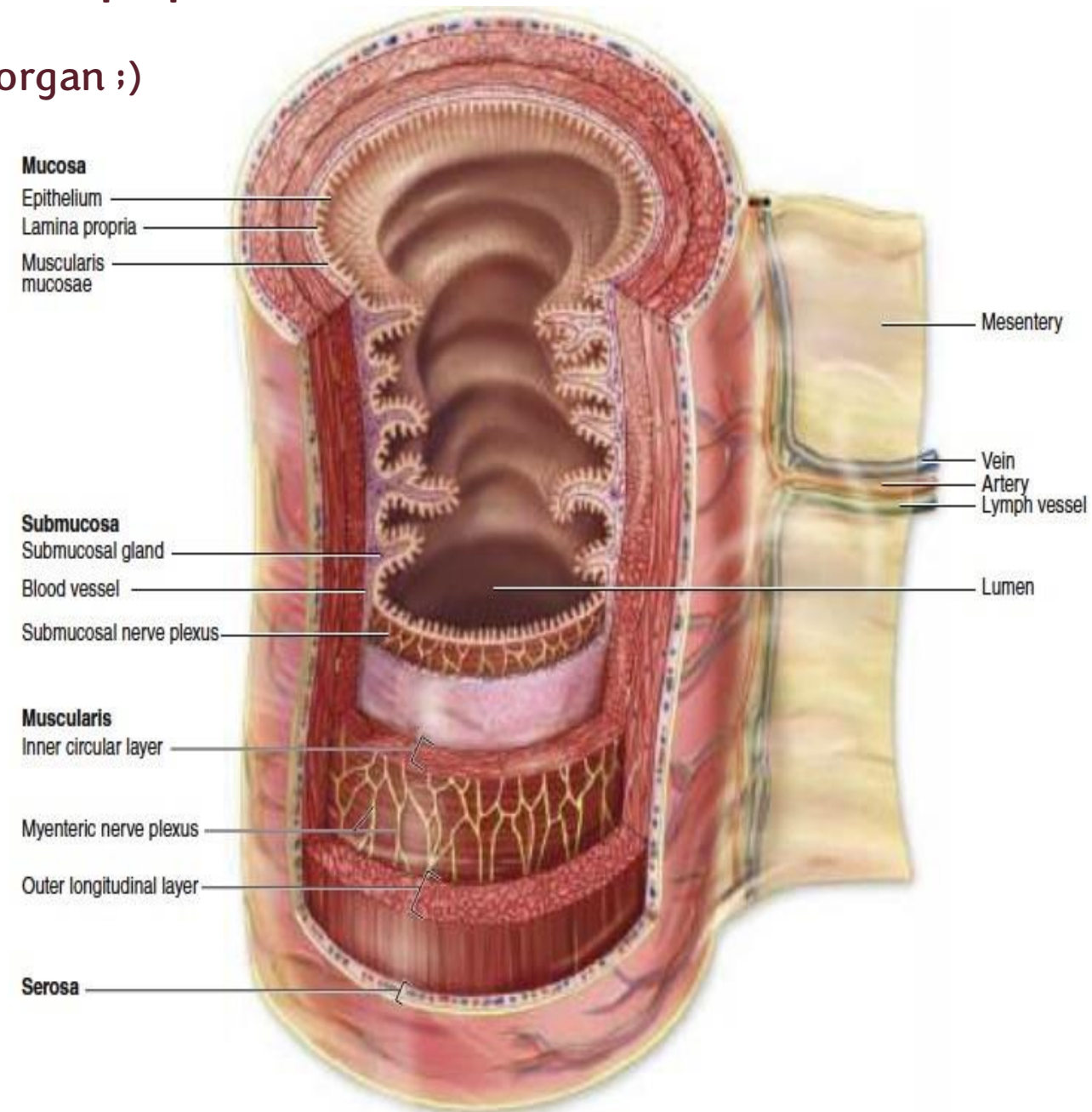
### • Composed of:

(1) a layer of epithelium in direct contact with the contents of the GI tract

(2) a layer of connective tissue called the lamina propria

(3) a thin layer of smooth muscle (muscularis mucosae). **Unique layer ;)**

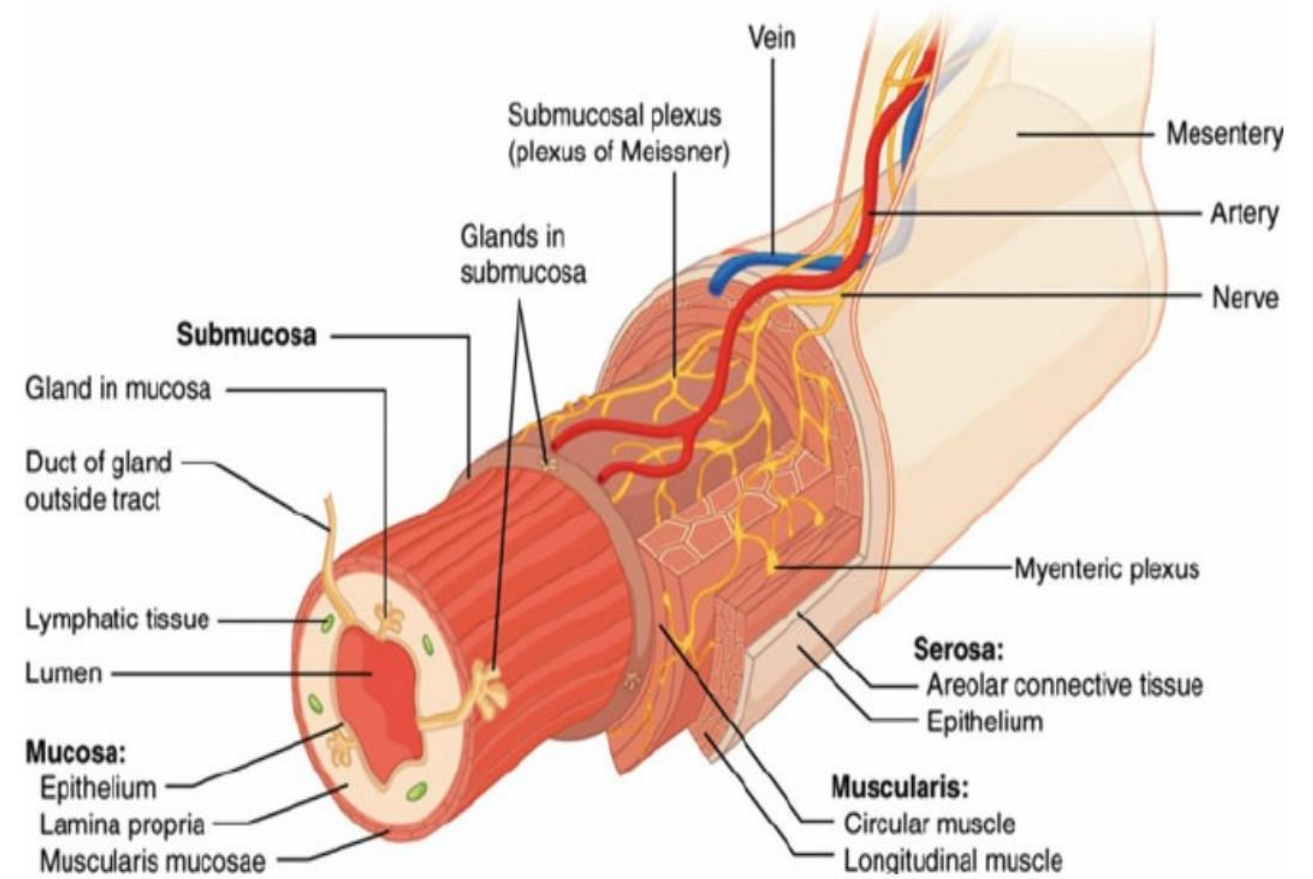
We named it **Muscularis mucosa** to differentiate that this is Muscularis of mucosa .



# Layers Of The GI Tract

## ➤ Epithelium :

- In the mouth, pharynx, esophagus, and anal canal is mainly nonkeratinized stratified squamous epithelium (protection) some regions in the oral cavity are keratinized.
- Simple columnar epithelium lines the stomach and intestines (secretion and absorption).



Layers of the gastrointestinal tract ( Source : OpenStax College, Rice University, USA (

- The rate of renewal every 5 to 7 days.  
**GIT is working 24/7 so we need lots of regeneration.**
- Located among the epithelial cells are exocrine cells that secrete mucus and fluid into the lumen of the tract, and several types of endocrine cells, collectively called **enteroendocrine cells** (hormones).  
**We also have endocrine cells that synthesize and release hormone that go with blood and circulates and function somewhere else.**

# Layers Of The GI Tract

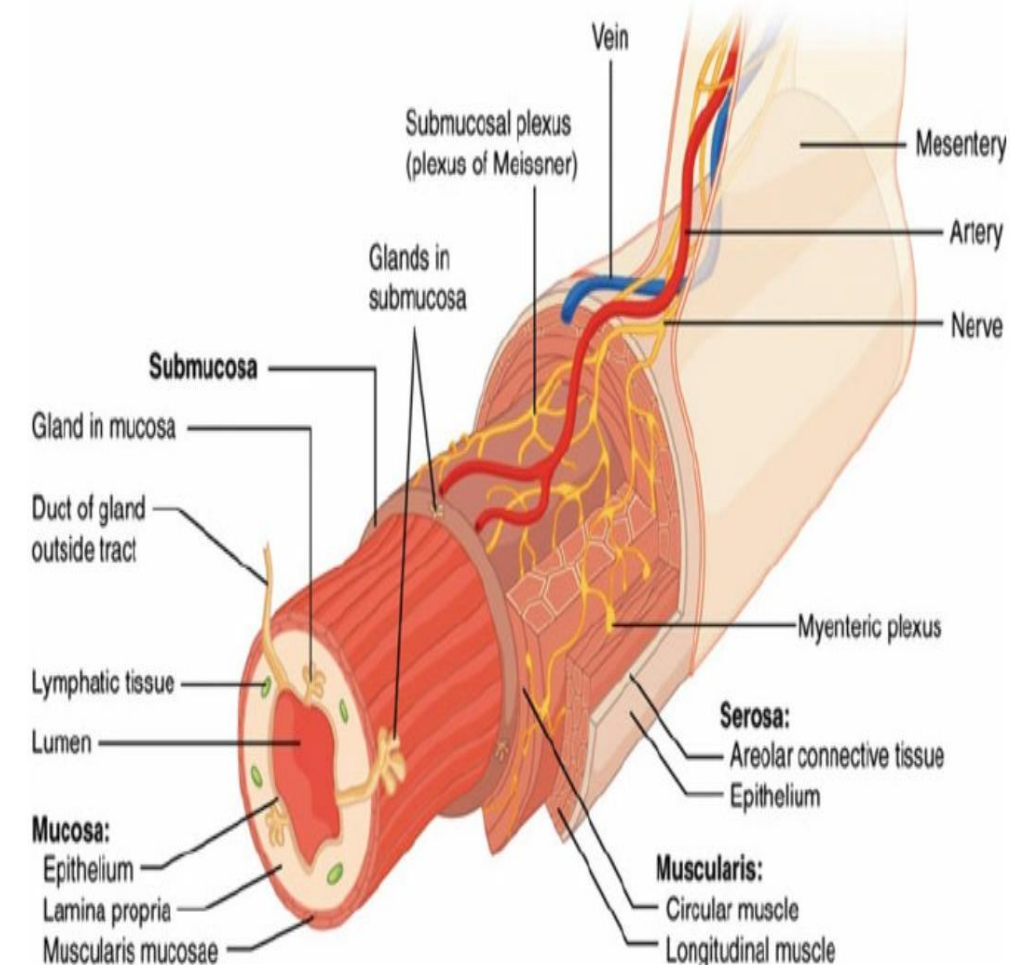
- Beginning of GIT and end is **stratified squamous (for protection)** then we have two **subtypes: keratinized and non-keratinized**.
- In **oral cavity** (we see areas **keratinized** and areas **non-keratinized**), **pharynx** and **esophagus** we have **stratified squamous**.
- In **stomach** where we do contraction and release of gastric juices (secretion) we have **simple columnar**, **Small intestine** we have absorption (also little bit digestion) so we find **simple columnar**, **In large intestine** we still have absorption so also **simple columnar**.
- After that we need to get rid of leftover, as the food passes through large intestine its being hardened so we go down to lower areas to finally reach outside so food is back to hard state so we go back to being **stratified squamous** in anal canal.
- All this is supported by **laminate propria** and further support by **Muscularis mucosa**.

# Layers of The GIT

- The **enteric innervation** or the **autonomic nervous system** is in the **submucosa**.
- The **blood supply** that comes in the different layer is gonna run or course through the **submucosa**.

## 2. Submucosa

- **Supports and wraps mucosa.**
- Considered more of **dense C.T** but not as dense as you'd imagine but it is way **denser than loose C.T** and has lots of fibers which is important for protection.
- Consists of denser CT that binds the mucosa to the muscularis.
- Contains many blood/lymphatic vessels, and that receive absorbed food molecules.
- Contains an extensive network of neurons (submucosal (**Meissner**) plexus of autonomic nerves and glands.
- We have part of **nervous system** that is found in **submucosa** and it's continuation is found in the **layer of muscularis**.
- Significant lymphoid tissue (MALT)

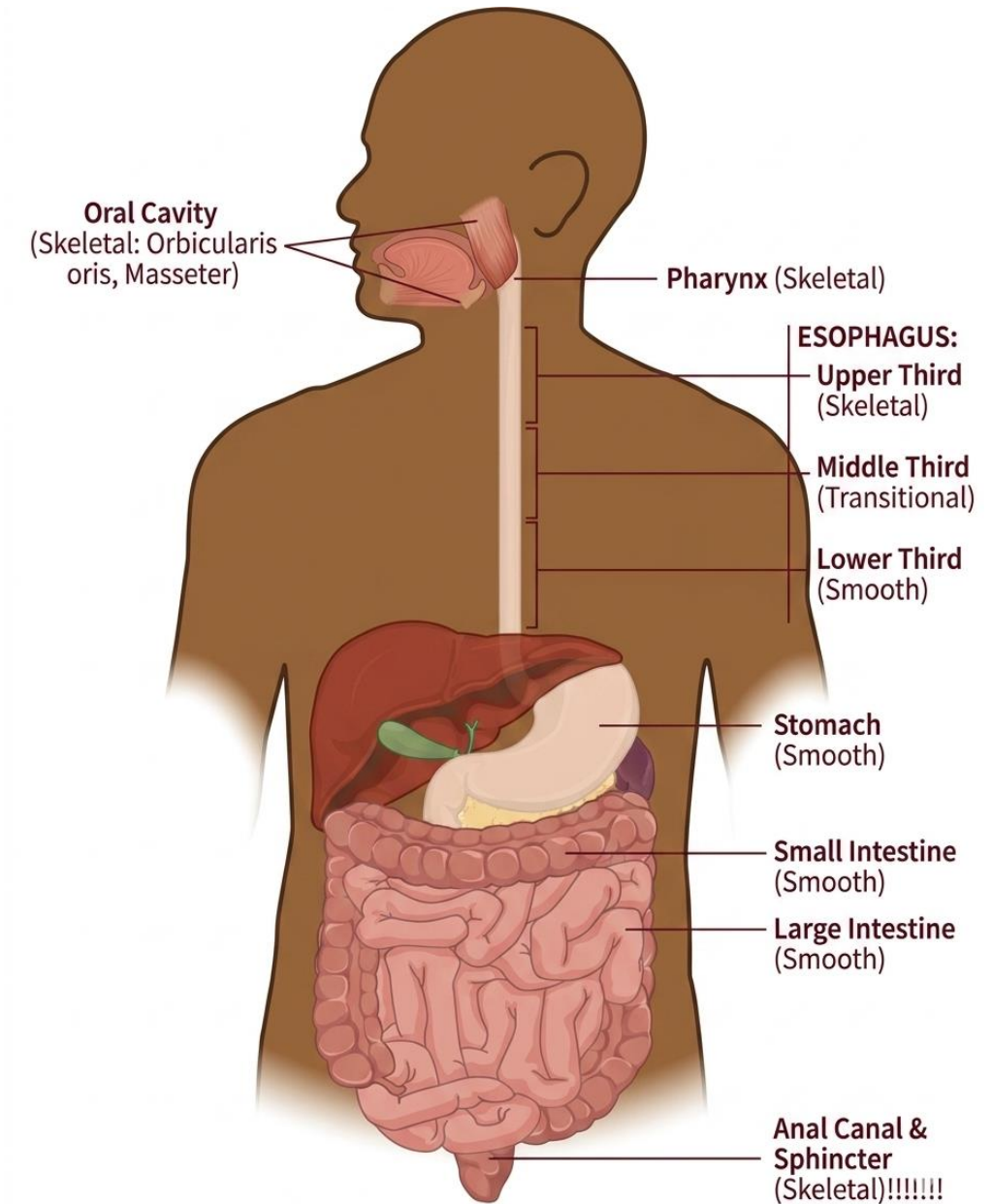


Layers of the gastrointestinal tract ( Source : OpenStax College, Rice University, USA )

- The **MALT (mucosa associated lymphoid tissue)** (both in mucosa and submucosa), they are a group of **WBC** mainly **lymphocytes** scattered throughout the **GIT**.
- We need it for **immune defense** cause **not everything we eat is sterile** and we also have our own **microbiome** so we need them to **protect us**.

# Layers of The GIT

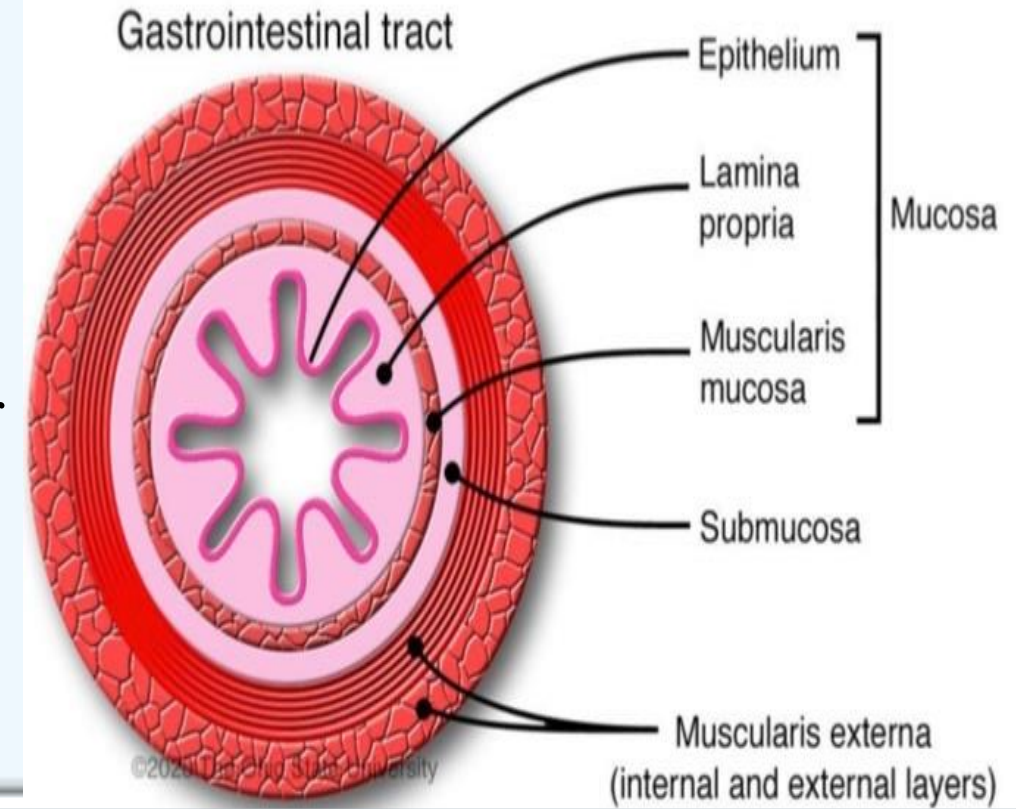
- ❖ It starts **voluntary** and ends **voluntary** (involuntary in between).
- ❖ In oral cavity (orbicularis oris) skeletal.
- ❖ **MASSETER** muscles (skeletal).
- ❖ **Pharynx** (skeletal).
- ❖ **Esophagus** (divided into three thirds, first one is skeletal(close to pharynx), the last one is close to stomach so smooth, in middle is transitional).
- ❖ **Stomach, small and large intestines** (smooth).
- ❖ Then we have 2 sphincters :
  - 1) **External anal Sphincter** which is **SKELETAL**
  - 2) **Internal anal Sphincter** which is smooth.



# Layers of The GIT

## 3. Muscularis

- The mouth, pharynx, and superior/middle parts of the esophagus, and external anal sphincter contains *skeletal muscle*.
- Throughout the rest of the tract, it is *smooth muscle*: inner circular fibers and an outer longitudinal fibers.
- We care for **pushing effect** → **inner layer is circular**.
- And the for **contraction** → **outer is longitudinal**.



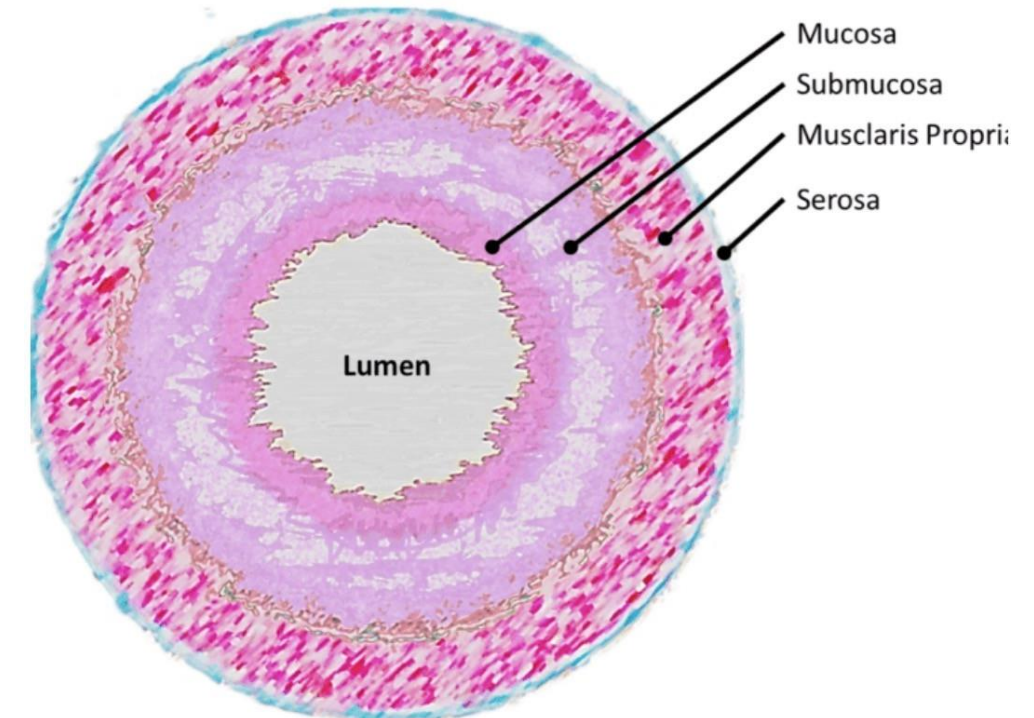
- The connective tissue between the muscle sublayers contains blood and lymph vessels, as well as the myenteric (**Auerbach**) nerve plexus of many autonomic neurons aggregated into small ganglia.
- **Together with messiner we consider as enteric system which is part of autonomic that controls GIT.**
- Contractions of the smooth muscle break down food, mix it with digestive secretions, and propel it along the tract.

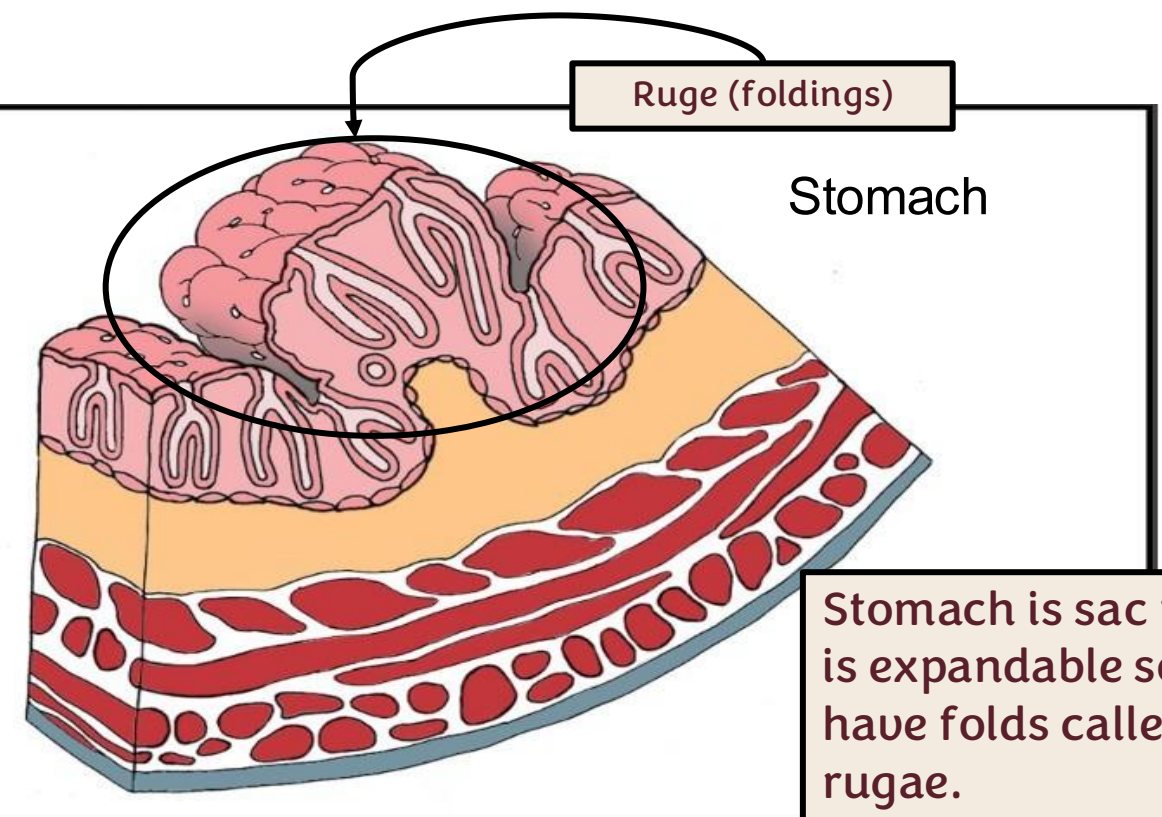
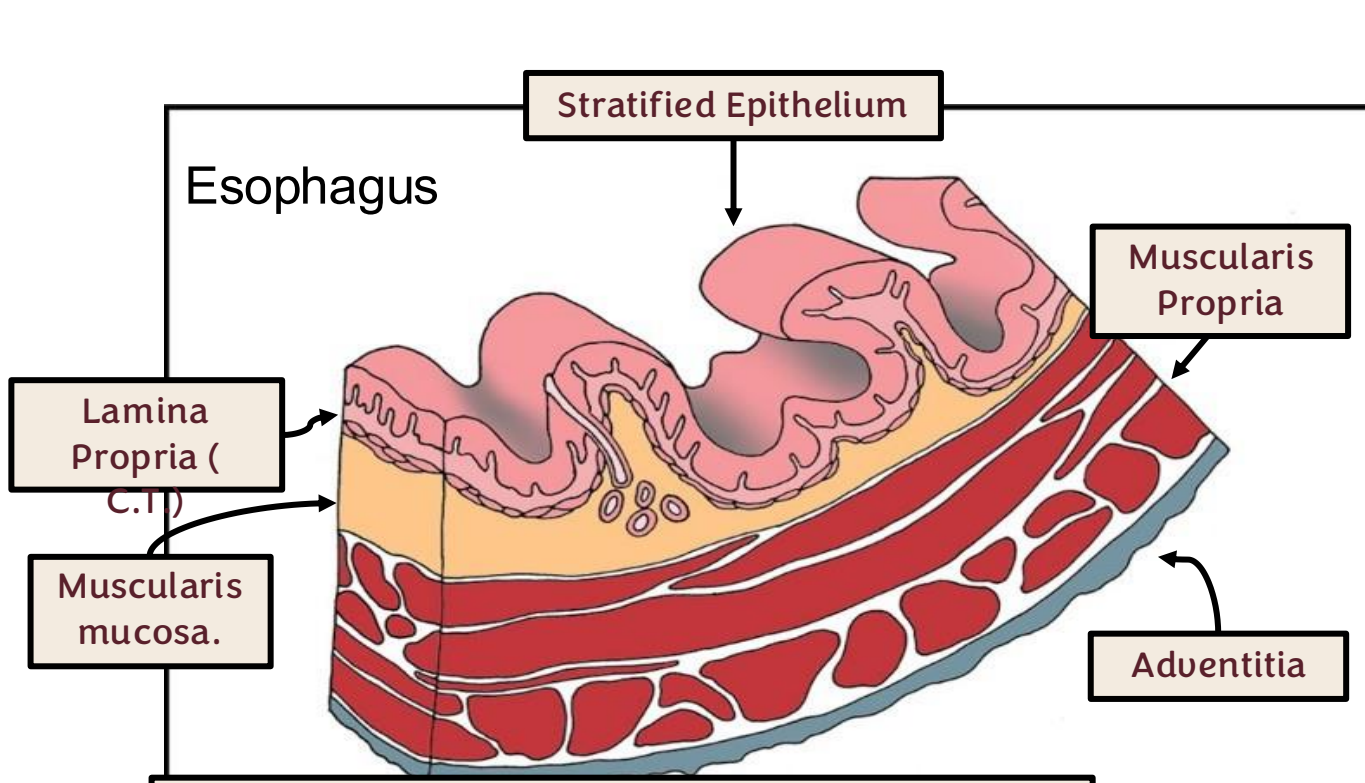
# Layers of The GIT

- In stomach and small and large intestine has outside covering (peritoneum) called **serosa** or **visceral peritoneum**.
- What lines abdomine is **parietal peritoneum**.

## 4. Serosa

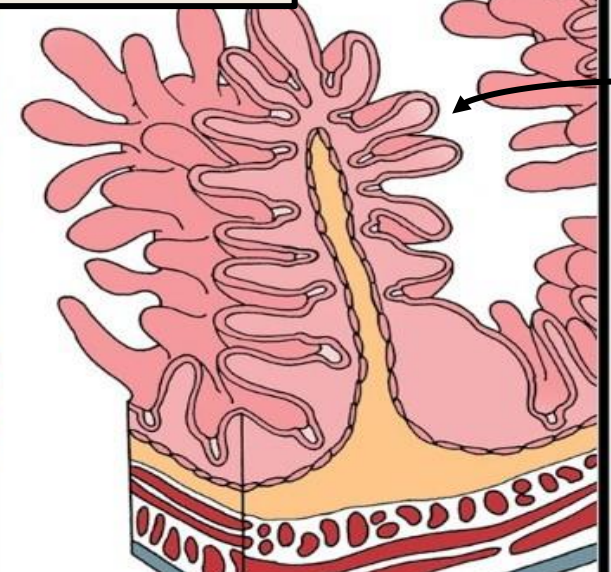
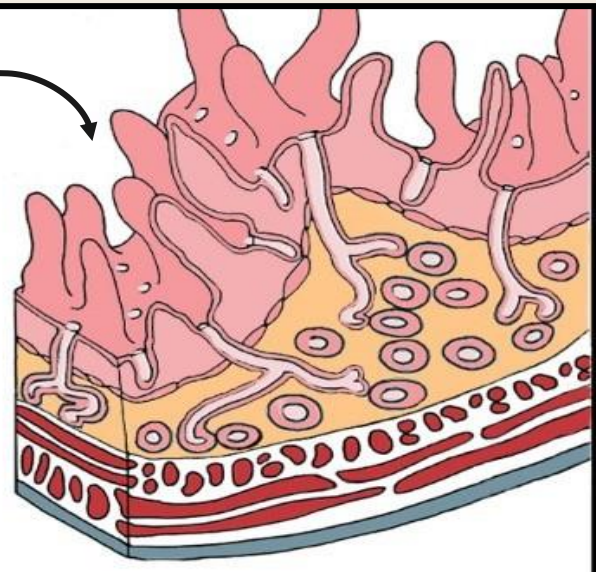
- Those portions of the GI tract that are suspended in the abdominal cavity have a superficial layer called the **serosa**.
- Is a serous membrane composed of areolar connective tissue and simple squamous epithelium (mesothelium).
- The esophagus lacks a serosa; *adventitia* forms the superficial layer of this organ.
- Is connective tissue **rich with fibers that is relatively thick**





Stomach is sac that is expandable so we have folds called rugae.

Since it is Small intestine, where most absorption is so we need pilcae circularis , vili and also microvilli.



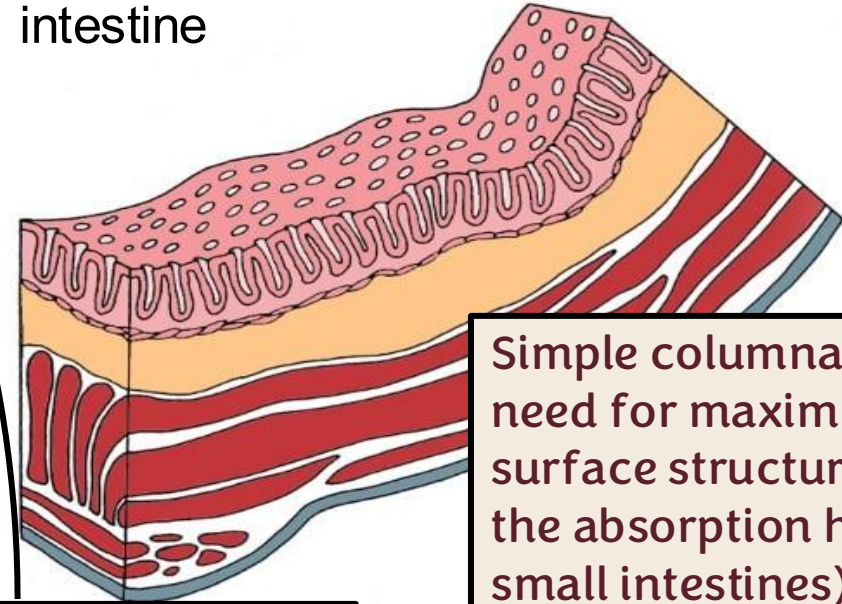
Small intestine

Lower magnification

Higher magnification

Villi & also there is microvilli at cell surface (not seen in this pic since they are very small (micro ;hence the name).

Large intestine

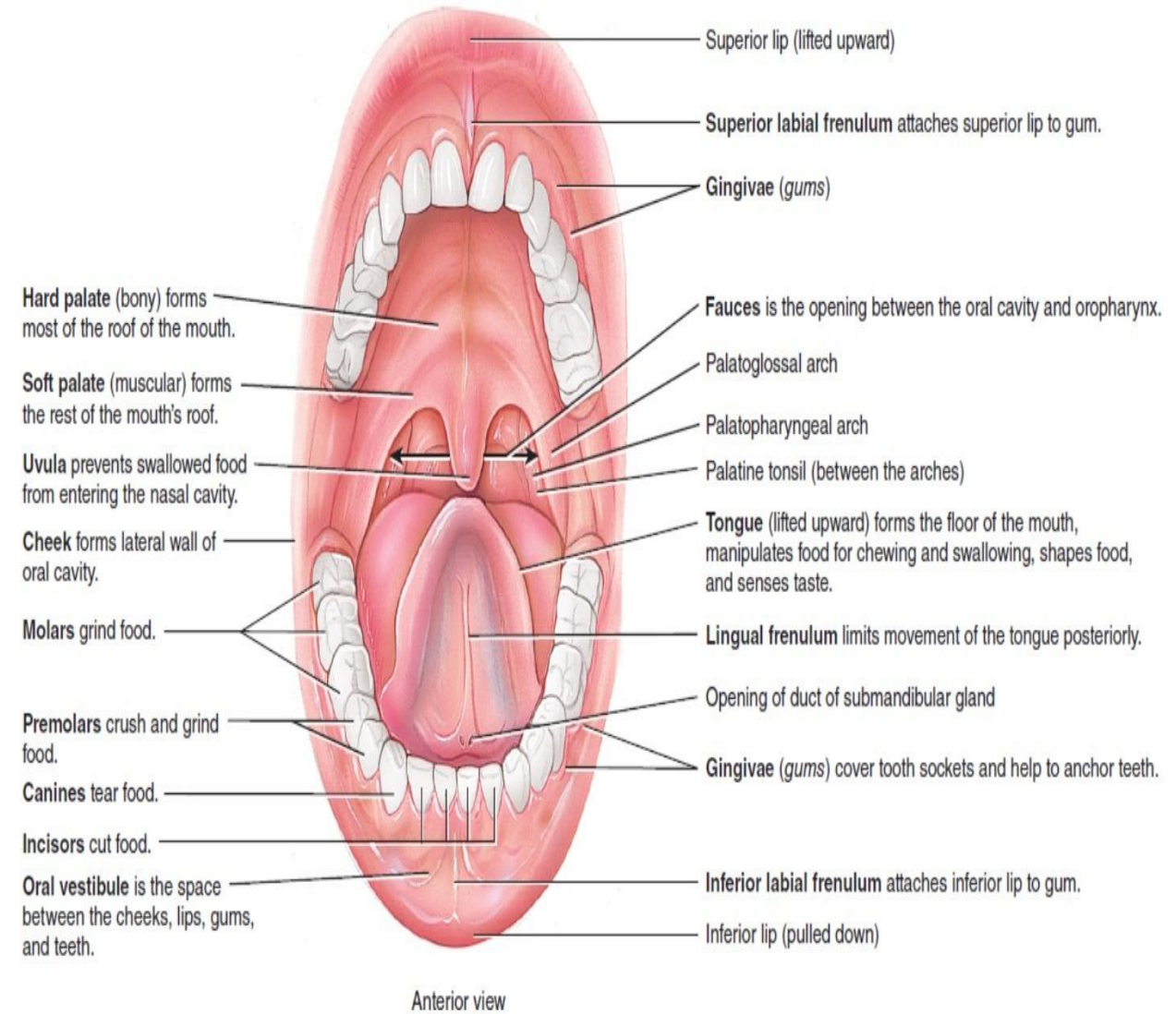


Simple columnar epithelium no need for maximum absorption surface structures (since most of the absorption has done in the small intestines)

# The Mouth

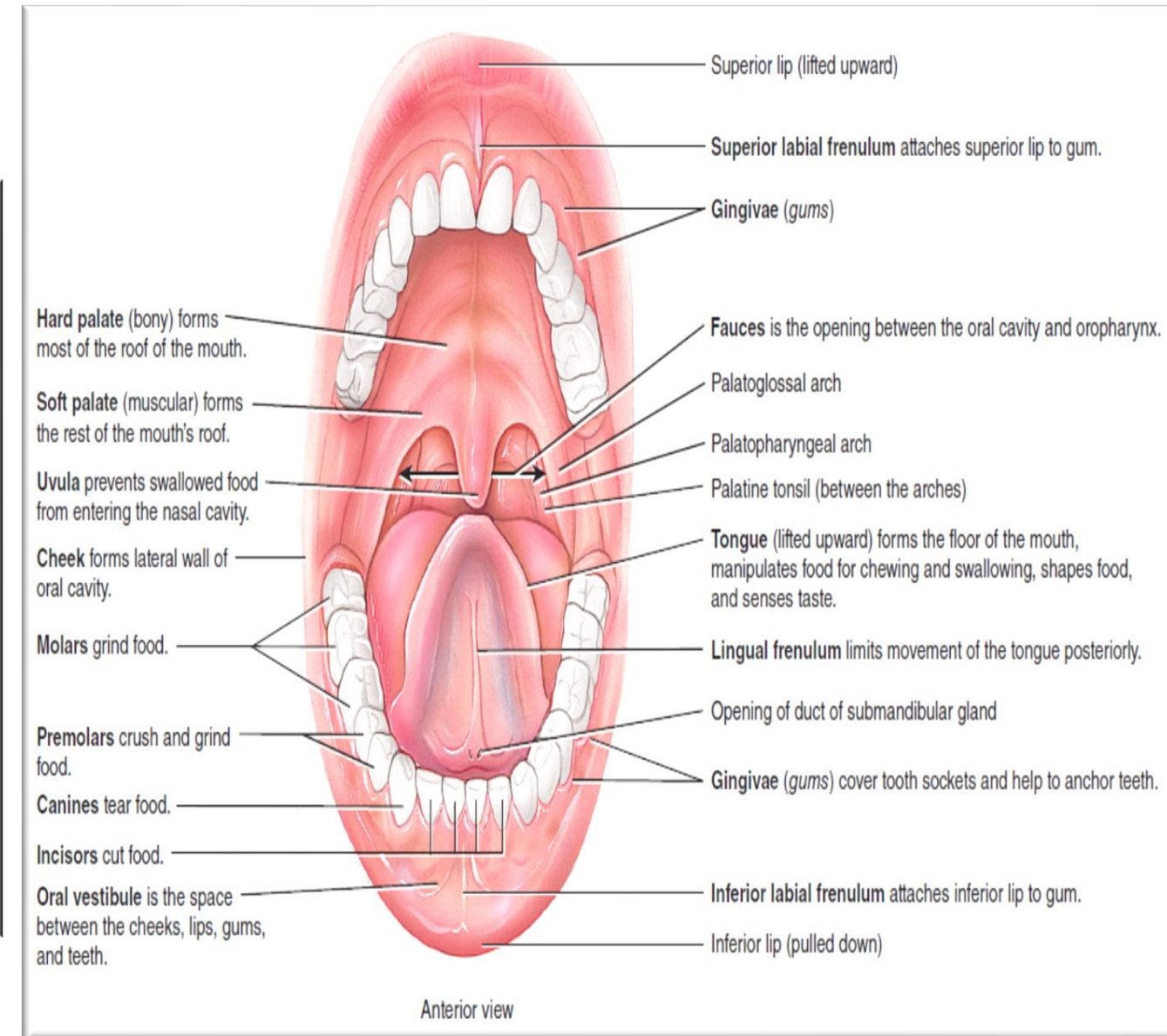
READ ONLY

- Also called the **oral** or **buccal cavity**.
- The **cheeks** form the lateral walls of the oral cavity; covered externally by skin and internally by a mucous membrane (nonkeratinized stratified squamous epithelium).
- The anterior portions of the cheeks end at the lips.



# The Mouth

- **Lips:** fleshy folds surrounding the opening of the mouth.
- They contain the orbicularis oris muscle and are covered externally by skin and internally by a mucous membrane.
- The **oral vestibule** is the space bounded externally by the cheeks and lips and internally by the gums and teeth.
- The **oral cavity proper** is the space that extends from the gums and teeth to the **fauces** (the opening between the oral cavity and the oropharynx)



# Oral cavity:

**The load is high here**

1. **Thin** Keratinized stratified squamous (SS)--- masticatory mucosa.

- Gums and hard palate.

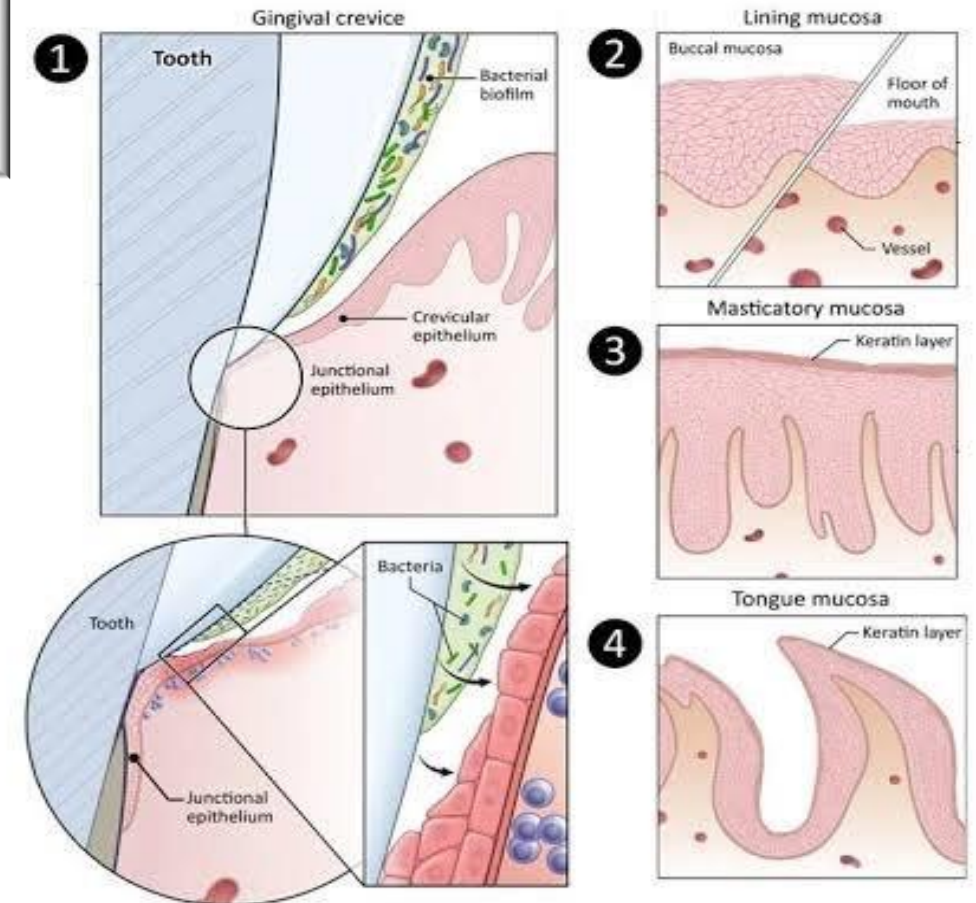
- Lamina propria rest on periosteum.

*Alveolar bone covered by periosteum, we need gum to be tightly adherent.*

2. Partially keratinized ss

3. Nonkeratinized ss—lining mucosa **Movable.**

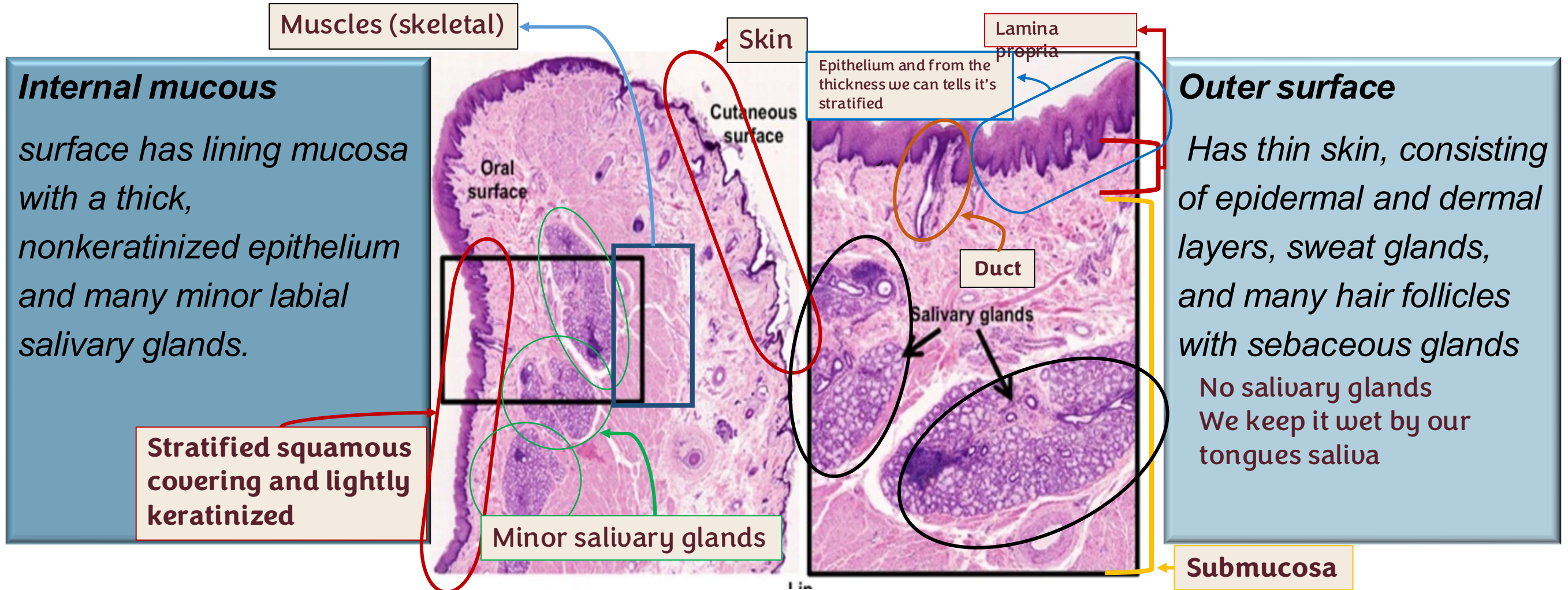
- Thick submucosa containing minor salivary glands and lymphoid tissue. **Thick Submucosa to accommodate minor salivary gland.**
- Soft palate, cheeks, floor of the mouth, and pharynx
- Contains antigen presenting cells
- Rich sensory innervation



**Canker sores Very important!!!**

- Has to do death of epithelia cells **cause of viral infection and exposes underlying C.T.**
- *Viral infections with herpes simplex 1 cause death of infected epithelial cells that can lead to vesicular or ulcerating lesions of the oral mucosa or skin near the mouth.*
- *Occur when the immune defenses are weakened by emotional stress, fever, illness, or local skin damage, allowing the virus, present in the local nerves, to move into the epithelial cells.*

# LIPS



**Internal mucous surface**  
*surface has lining mucosa with a thick, nonkeratinized epithelium and many minor labial salivary glands.*

**Stratified squamous covering and lightly keratinized**

**Outer surface**  
*Has thin skin, consisting of epidermal and dermal layers, sweat glands, and many hair follicles with sebaceous glands*

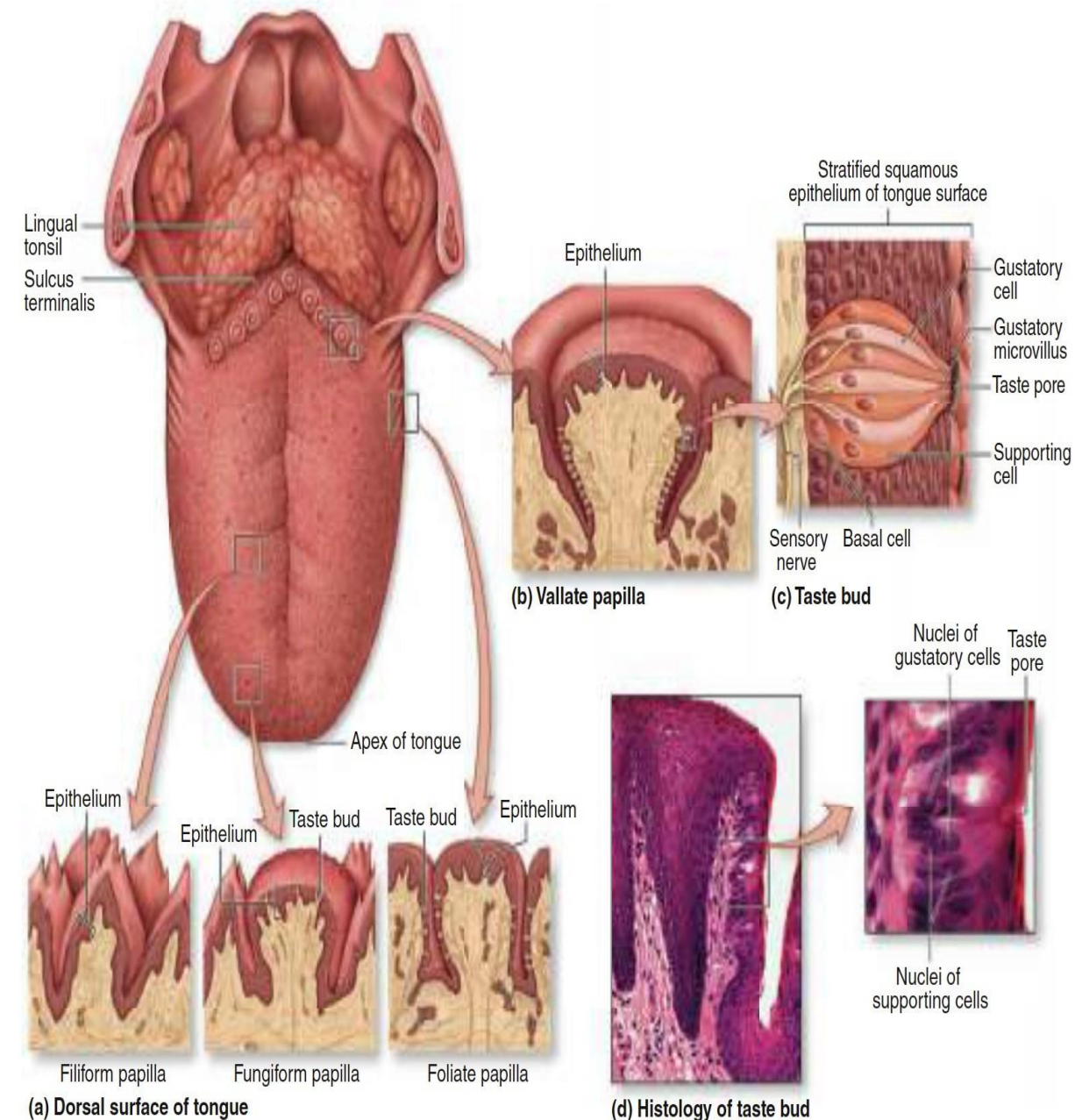
*No salivary glands  
 We keep it wet by our tongues saliva*

**Red vermilion zone, What distinguishes lips?** High innervation and blood supply that's why our lips are **more sensitive and more red.**

- *Covered by very thin keratinized stratified squamous epithelium.*
- *Lacks salivary or sweat glands and is kept moist with saliva.*
- *Connective tissue is very rich in both sensory innervation and capillaries---pink color to this region.*

# Tongue

- An accessory digestive organ composed of skeletal muscle covered with mucous membrane.
- Connective tissue between the small fascicles of muscle is penetrated by the lamina propria, which makes the mucous membrane strongly adherent to the muscular core

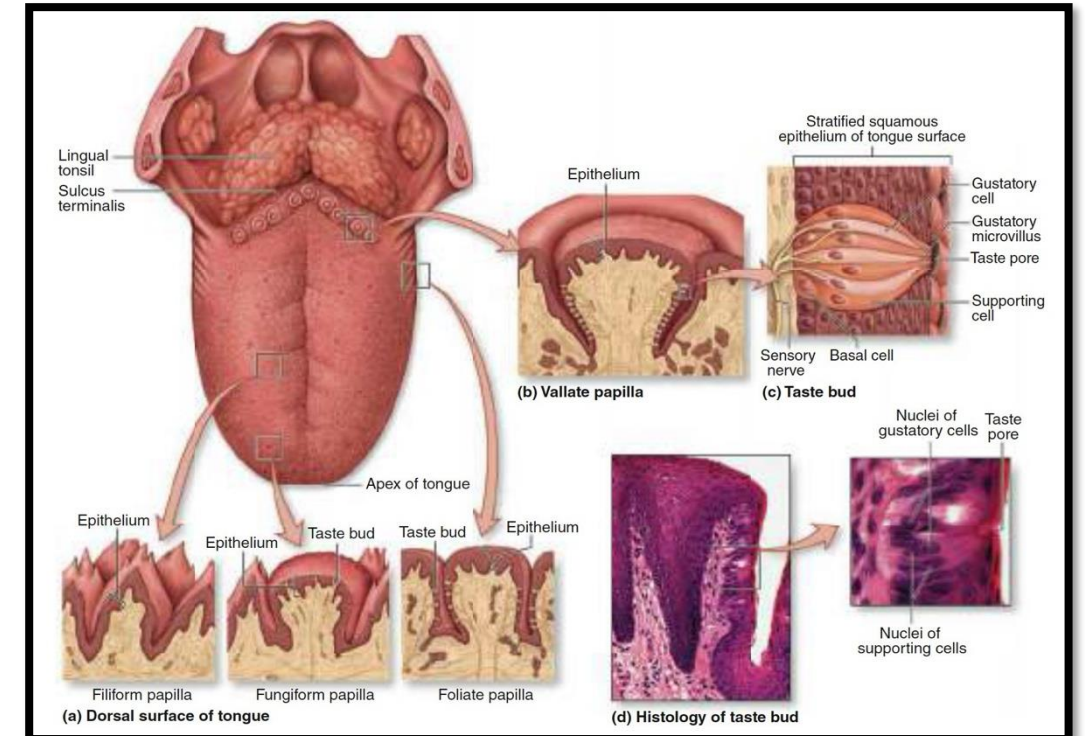


# Muscle (skeletal)

## □ Extrinsic and intrinsic (go back to anatomy lol).

- **Intrinsic Muscles** : originate and insert into C.T of tongue (changing the shape of tongue).
- **Extrinsic Muscles** : originates OUTSIDE tongue and Insert into tongue (PROTRUDE OR RETRACT IT OR MOVE IT SIDEWAYS).

- The tongue is covered by mucosa and C.T.
- Also, if you examine the tongue you won't find it smooth dorsally, it's actually full of taste buds
- Not smooth mucosa dorsally but ventral its smooth mucosa.
- The tongue has areas keratinized, non keratinized or lightly keratinized in relation to papillae.



- The C.T of muscles (muscles are usually arranged into fascicles) and fascicles are wrapped with C.T.
- Now, lamina propria supports epithelium, blends in and reaches fascicles so the tongue becomes ONE COMPLETE STRUCTURE.

# Tongue

## READ

### The extrinsic muscles of the tongue:

- Originate outside the tongue and insert into connective tissues in the tongue.
- Move the tongue from side to side and in and out to maneuver food for chewing,
- Force the food to the back of the mouth for swallowing.

### The intrinsic muscles of the tongue

- Originate in and insert into connective tissue within the tongue.
- They alter the shape and size of the tongue for speech and swallowing
- The dorsum (upper surface) and lateral surfaces of the tongue are covered with **papillae** (projections of the lamina propria covered with stratified squamous epithelium).
- Many papillae contain taste buds.
- Some papillae lack taste buds, but they contain receptors for touch.

# Tongue

**Filiform is the largest in number, but the smallest.**

**Filiform papillae:** very numerous, an elongated conical shape, and are heavily keratinized (gray or whitish) appearance.

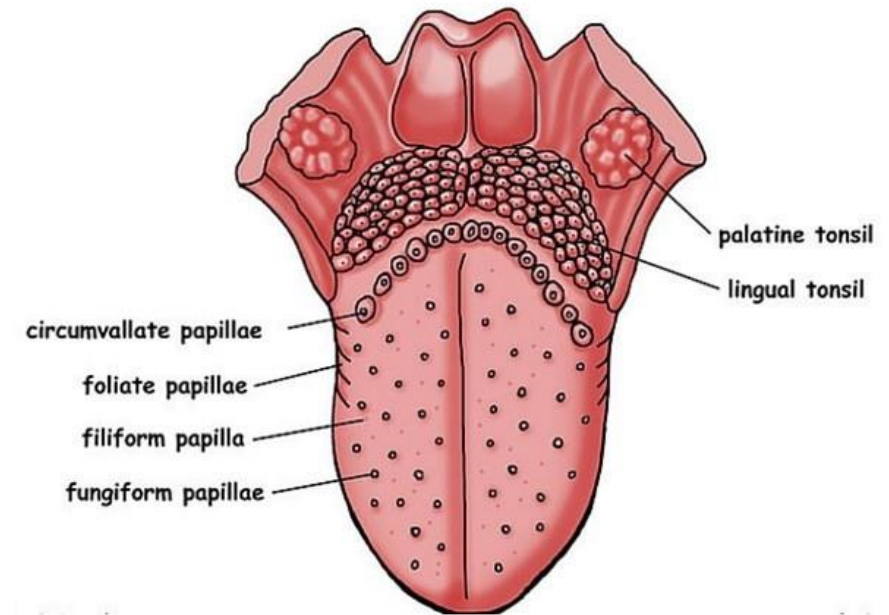
**Fungiform papillae:** much less numerous, lightly keratinized, and interspersed among the filiform papillae. Mushroom-shaped with well-vascularized and innervated cores of lamina propria.

➤ **Scattered.**

➤ **Large, which means that they have large core and large lamina propria.**

➤ **Lightly keratinized compared to filiform.**

• **Vallate (or circumvallate) papillae:** the largest papillae, 8-12, are aligned in front of the terminal sulcus. Ducts of several small, serous salivary (Von Ebner) glands empty into the deep groove surrounding each vallate papilla

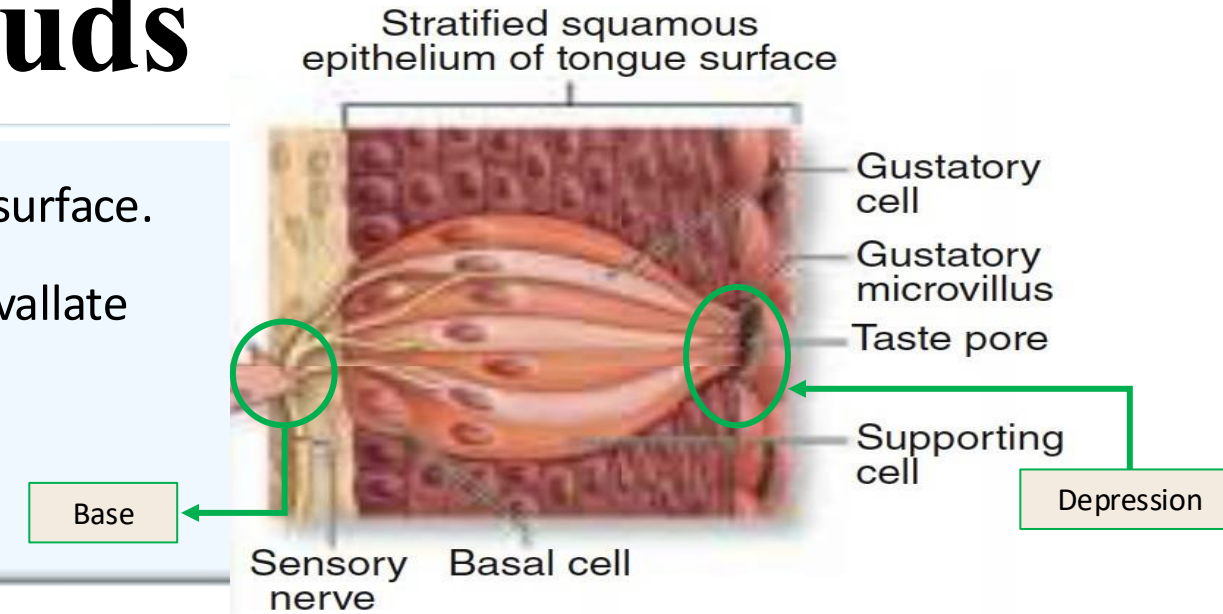


• **Foliate papillae:** several parallel ridges on each side of the tongue, anterior to the sulcus terminalis, but are rudimentary in humans, especially older individuals. **Mostly found in cats and dogs.**

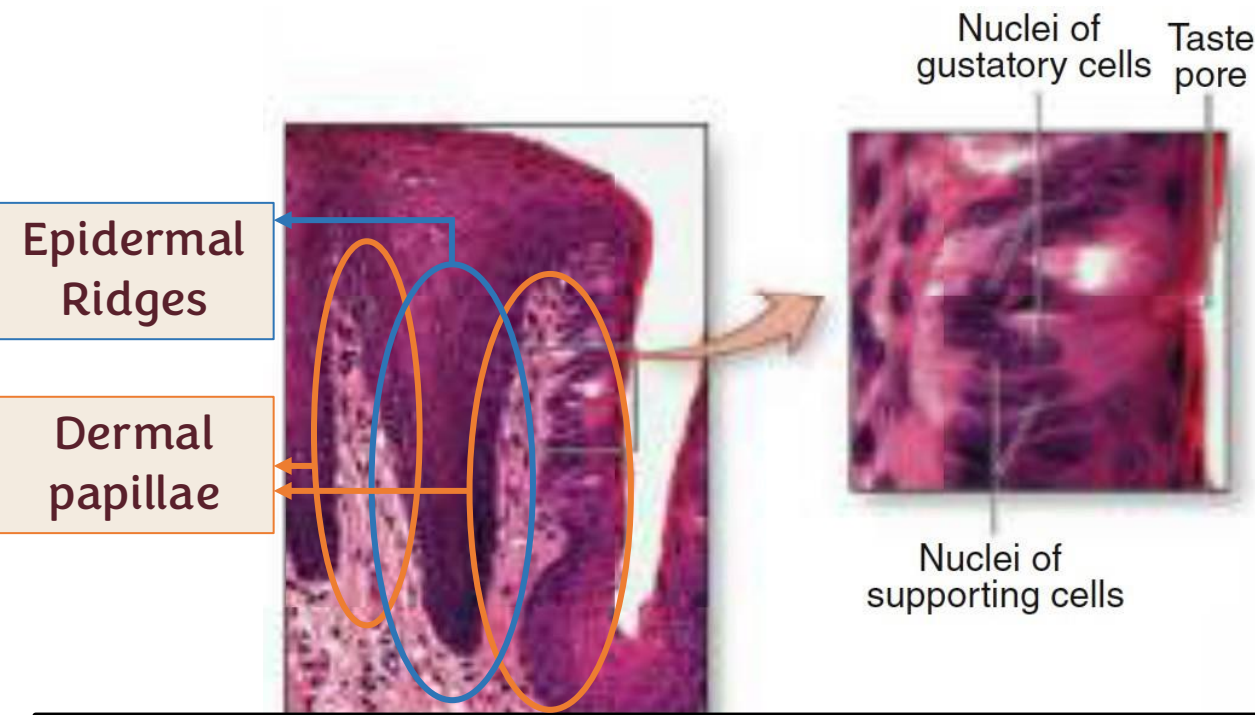
➔ **Anterior to sulcus terminalis, unique in its limited amount, looks and amount of taste buds on it (250 approximately).**

# Tongue-Taste Buds

- Ovoid structures within the stratified epithelium on the tongue's surface.
- Around 250 taste buds are present on the lateral surface of each vallate papilla.
- Many present on fungiform and foliate but NOT the filiform.



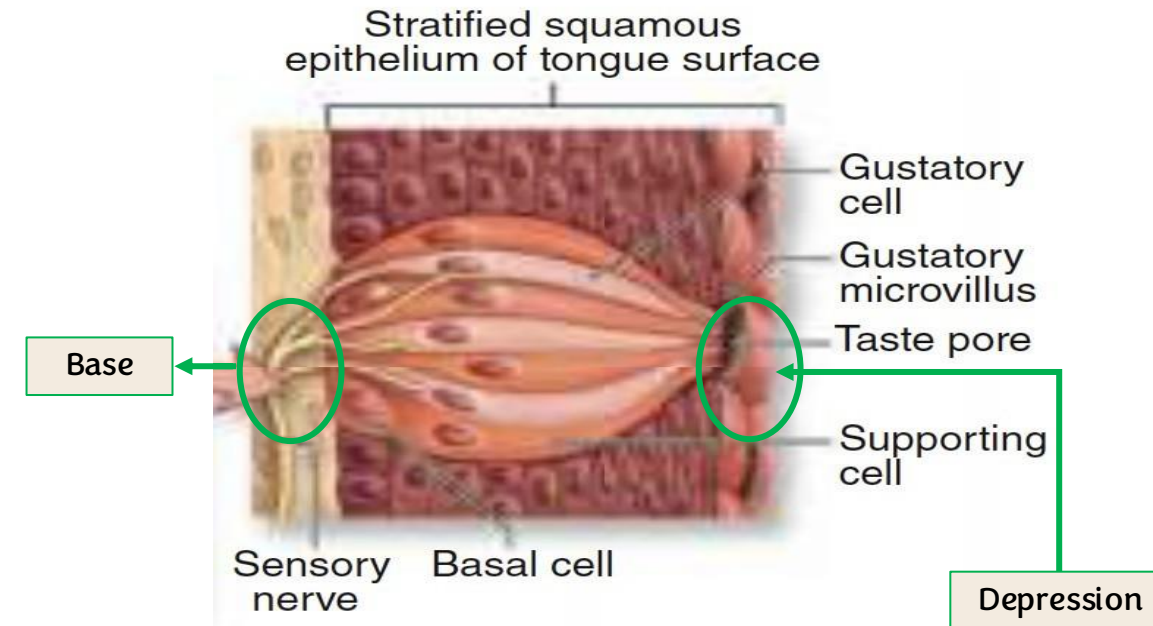
- They are not restricted to papillae and are scattered on the dorsal and lateral surfaces of the tongue.
- A taste bud has 50-100 cells, about half of which are gustatory (taste) cells.
- Is entered by afferent sensory axons--- synapses with the gustatory cells.
- Apically, gustatory cells have microvilli project toward a 2-um-wide opening— taste pore— molecules— dissolve in saliva—



We can distinguish **epithelium, epidermal ridges and dermal papillae**, also seen in oral cavity is same as one in skin.

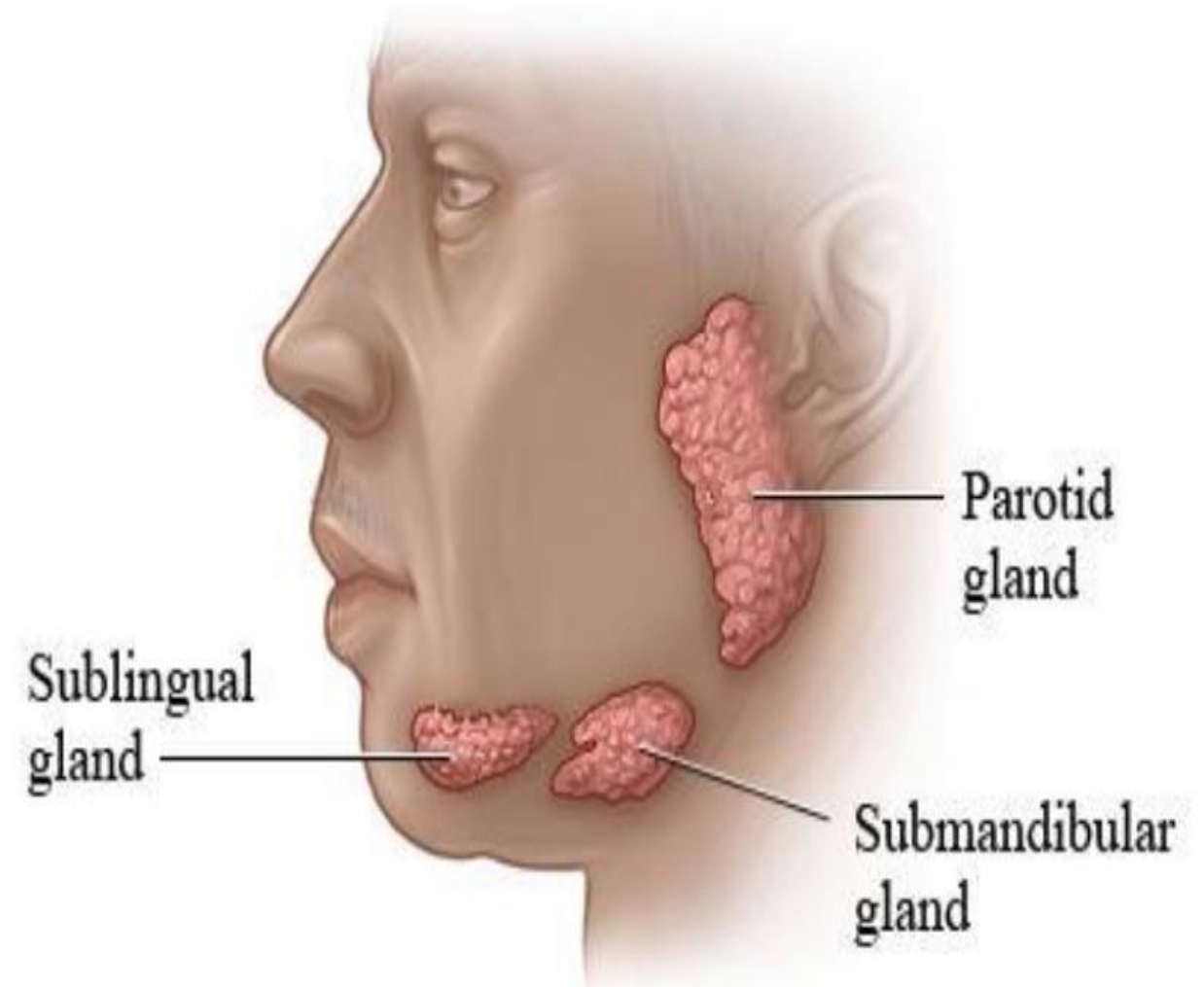
# Tongue-Taste Buds

- Taste buds are **scattered** on tongue with **highest concentration on circumvallate**.
- It has **supporting cells and specialized gustatory cells** (epithelia cells that **differentiated to be chemo receptors** (when food melts on **depression** it will **excite ion channels** so we have **action poteinal** so on **base of taste buds** we have to have something that is going to transfer the chemical signal into action potential, which are afferent (sensory)).



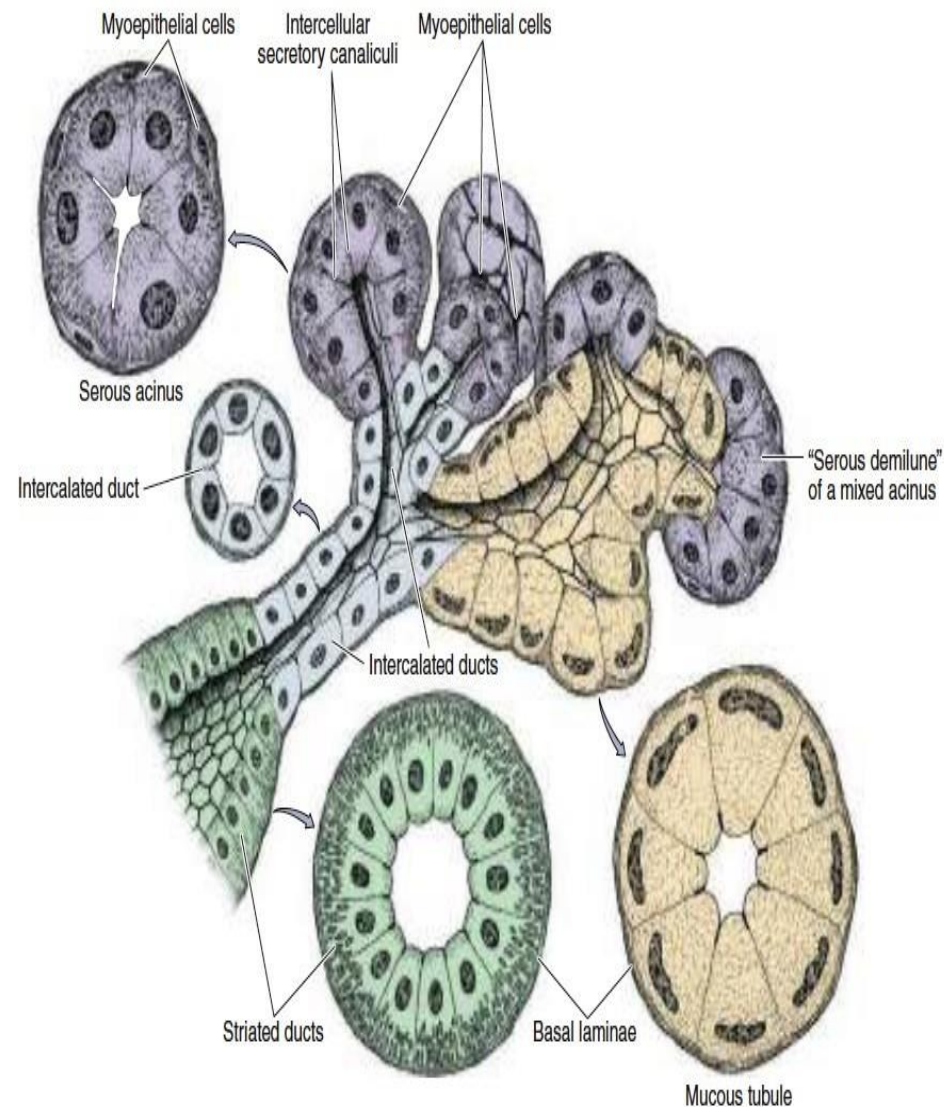
# Salivary Glands

- A gland that releases a saliva into the oral cavity.
- The mucous membrane of the mouth and tongue contains many small (**minor**) salivary glands that open to the oral cavity.
- Most saliva is secreted by the **major salivary glands**.



**Acinus** is where cells **synthesize and release the component of cell that's leaves and goes to duct which will modify the secretion**

- **Serous cells:** are polarized protein-secreting cells, pyramidal in shape, with round nuclei, well-stained RER, and apical secretory granules. Form a somewhat spherical unit called an acinus -- very small central lumen. Secrete enzymes and other proteins.



- **Mucous cells:** columnar in shape, compressed basal nuclei. Contain apical granules with hydrophilic mucins. Poor cell staining. Organized as cylindrical tubules rather than acini.

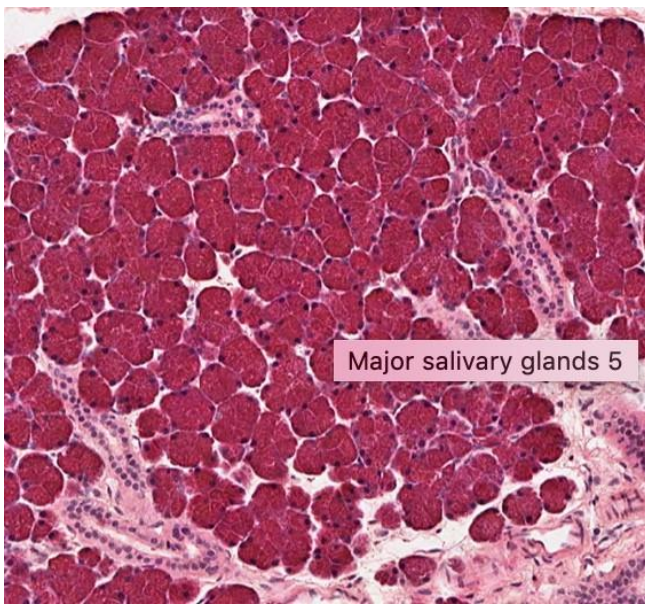
**Thick and viscous, sticky**  
**Lightly stained cause mucous is highly hydrated, nucleus is basally flattened, Grayish, is capped with serous acini.**

- **Myoepithelial cells:** Small, flattened cells extend several contractile processes around the associated secretory or duct and their activity is important for moving Secretory products into and through the ducts.
- Mixed salivary glands have tubuloacinar secretory units with both serous and mucous secretion.  
**Thin and thick filaments so they aid in expulsion of excretion**

# Serous cells

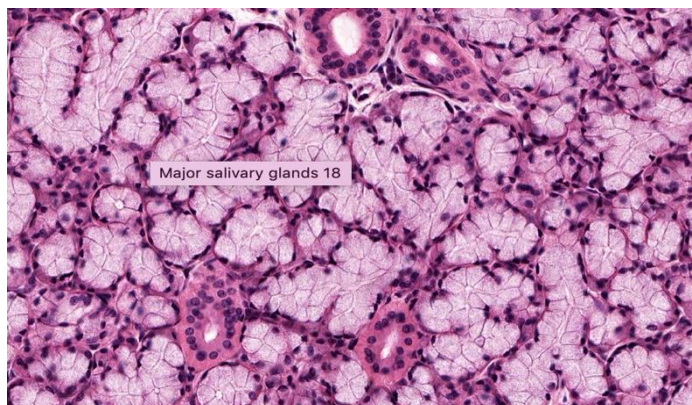
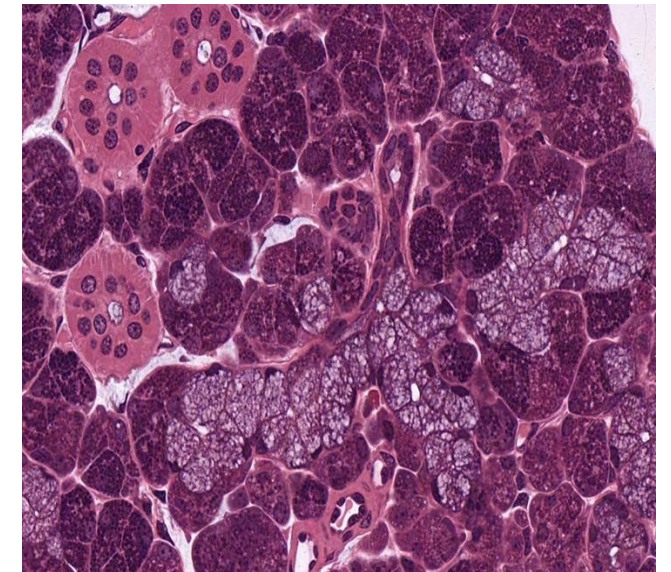
- ❑ Produce **thin, watery secretions** rich in proteins and enzymes.
- ❑ **Polarized cells** with:
  - **Basal region:** contains **nucleus and well-developed rough endoplasmic reticulum (RER)**.
  - **Apical region:** contains **secretory granules facing the lumen**.
- ❑ Appear **basophilic** due to **high amount of granules**.
- ❑ Cells are typically **pyramidal in shape** with **round nuclei**.
- ❑ Organized into **spherical units called acini**, each with a **small central lumen**.
- ❑ Secrete enzymes and proteins (e.g., amylase in salivary glands).
- ❑ Contribute to **secretion of IgA (Immunoglobulin A)**, which plays an important role in oral immunity.

- **Serous cells:** are polarized protein-secreting cells, pyramidal in shape, with round nuclei, well-stained RER, and apical secretory granules. Form a somewhat spherical unit called an acinus -- very small central lumen. Secrete enzymes and other proteins.



- **Parotid glands:** branched acinar glands with exclusively serous acini. Serous cells of parotid glands secrete abundant  $\alpha$ -amylase that initiates hydrolysis of carbohydrates and proline-rich proteins with antimicrobial and other protective properties.

- **Submandibular glands:** are branched tubuloacinar glands, primarily serous acini with many mixed tubuloacinar secretory units. Secretes  $\alpha$ -amylase lysozyme.
- **Serous demilune:** serous cells occur distally on short mucous tubules and often assume a crescent-shaped.



- **Sublingual glands:** smallest, branched tubuloacinar glands, but tubules of mucous cells predominate. Few serous cells add amylase and lysozyme.

LIP

Epithelium, non-keratinized (lining)

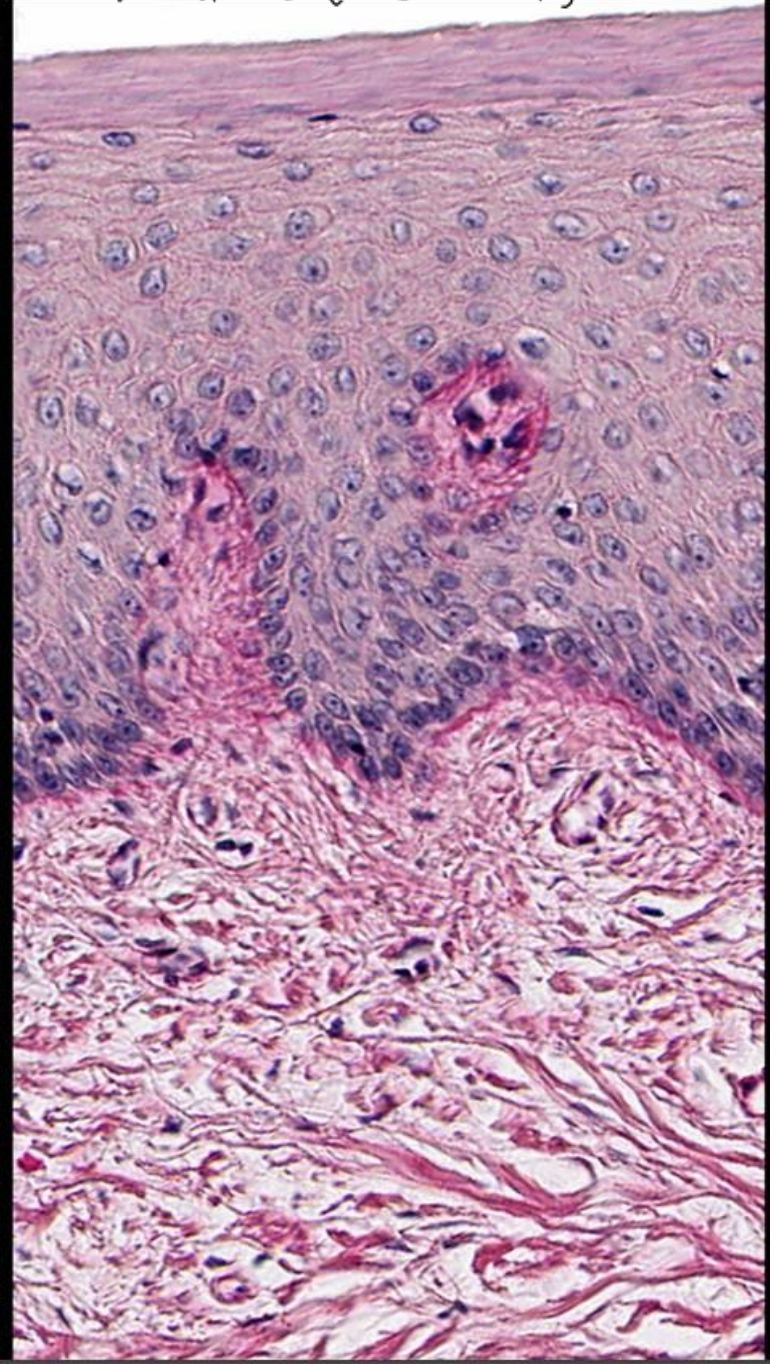


epithelia ridges

lamina propria

Fiber collagen

no nuclei on surface  
keratinized (masticatory)  
hard palate  
gums

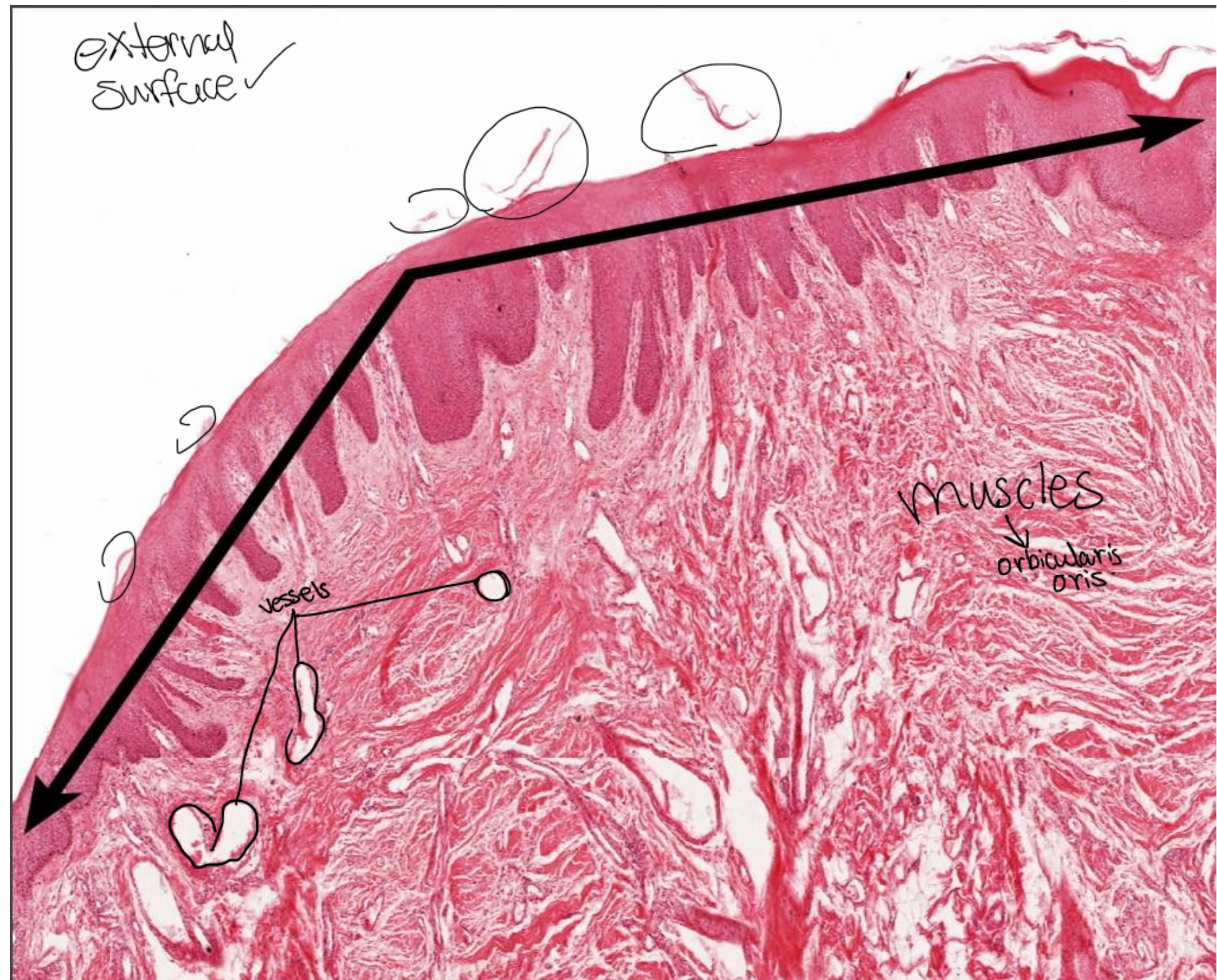


Partially



Filiform!

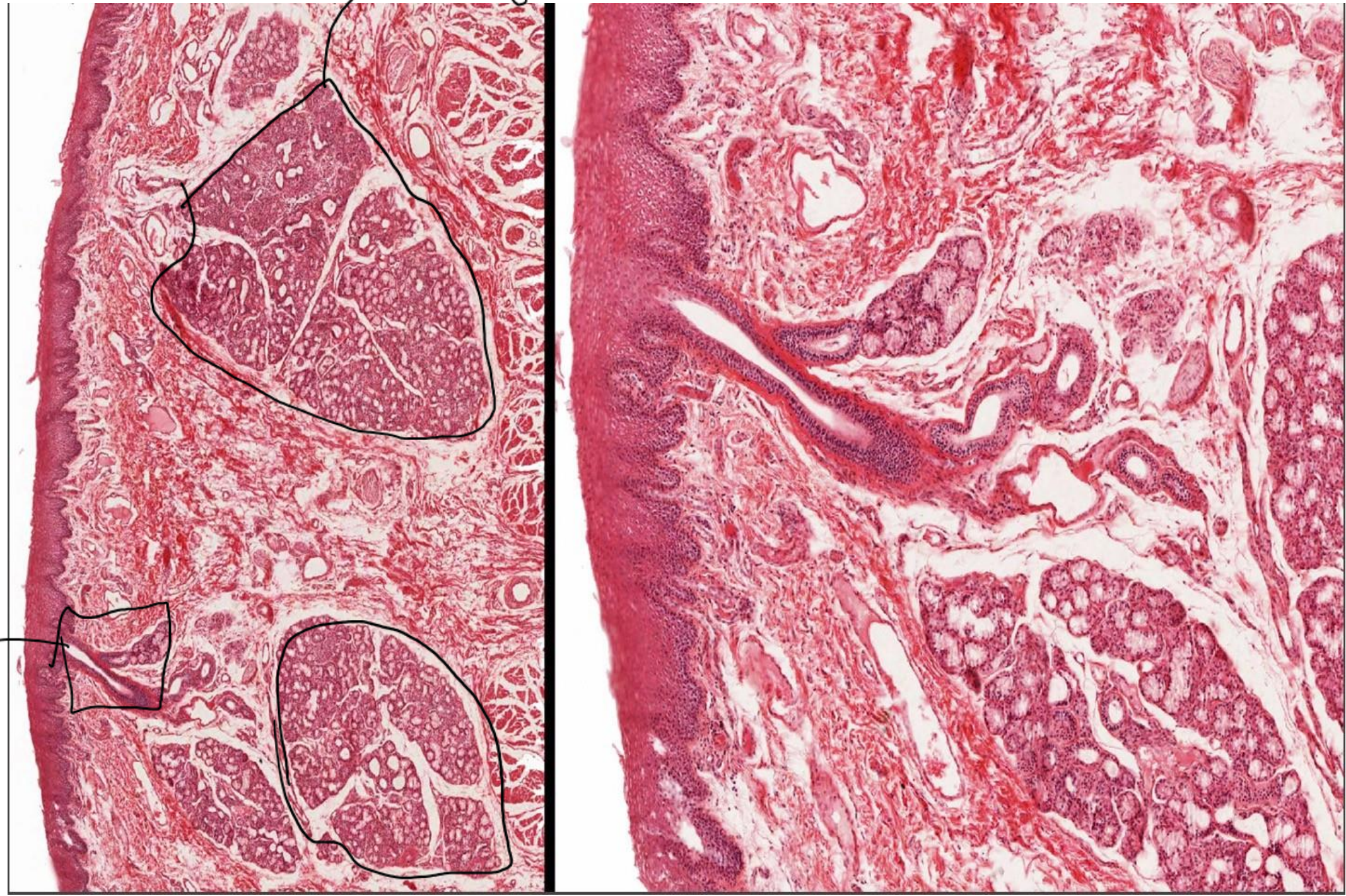
- \* low magnification, H and E stain
- \* lightly keratinized



lining

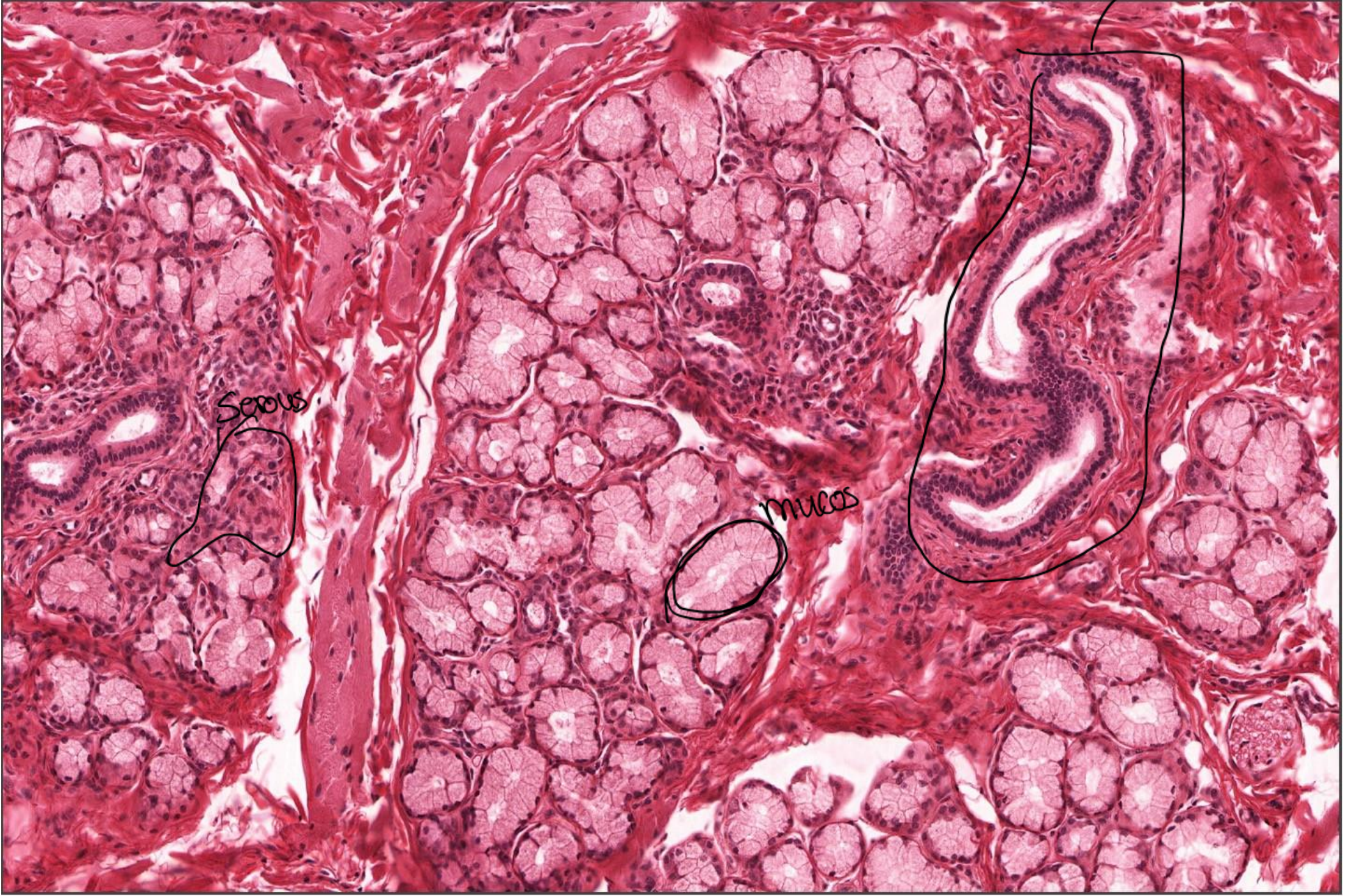
minor salivary glands

Ducts



\*Mixed !!!

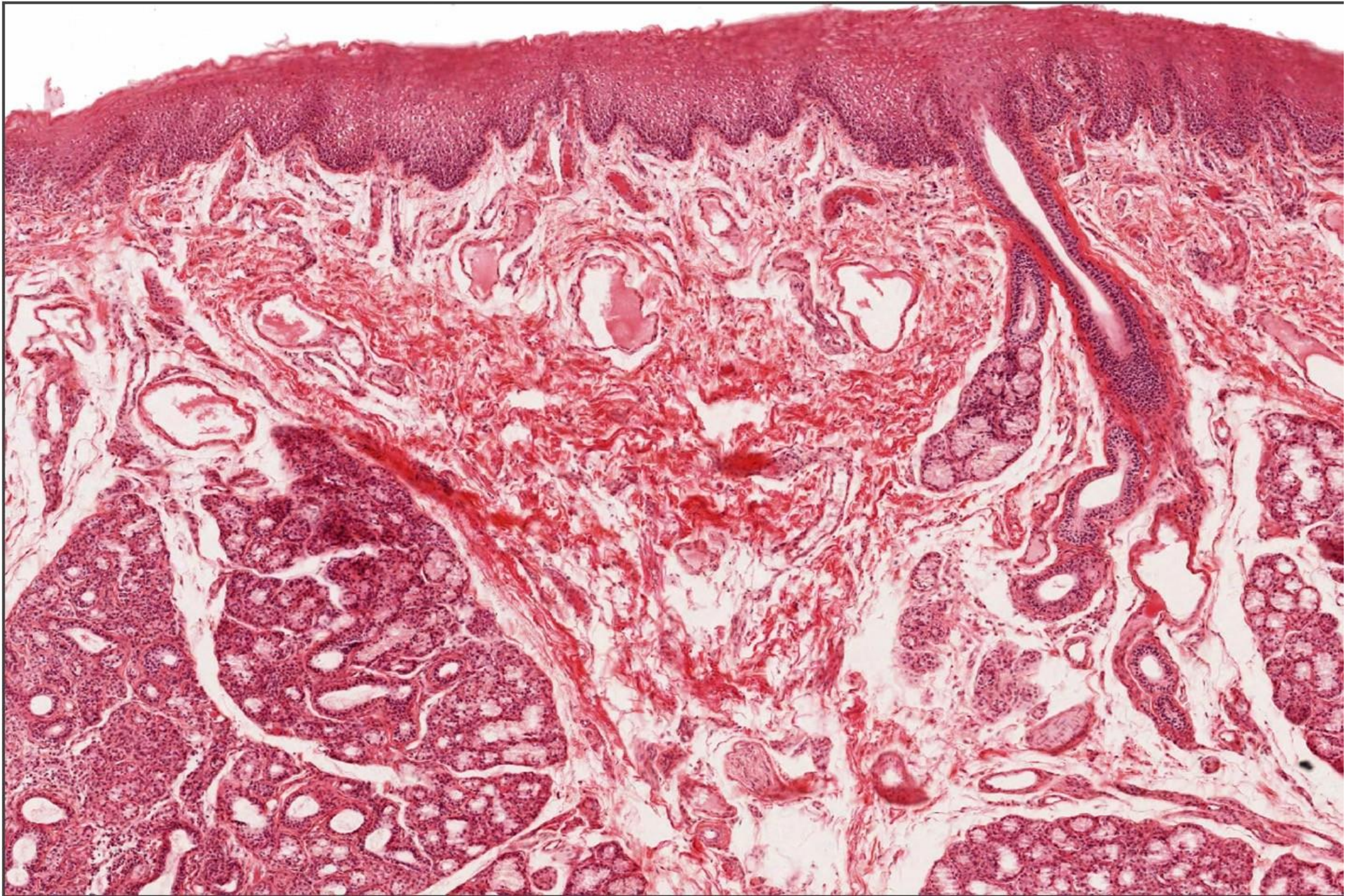
Duct



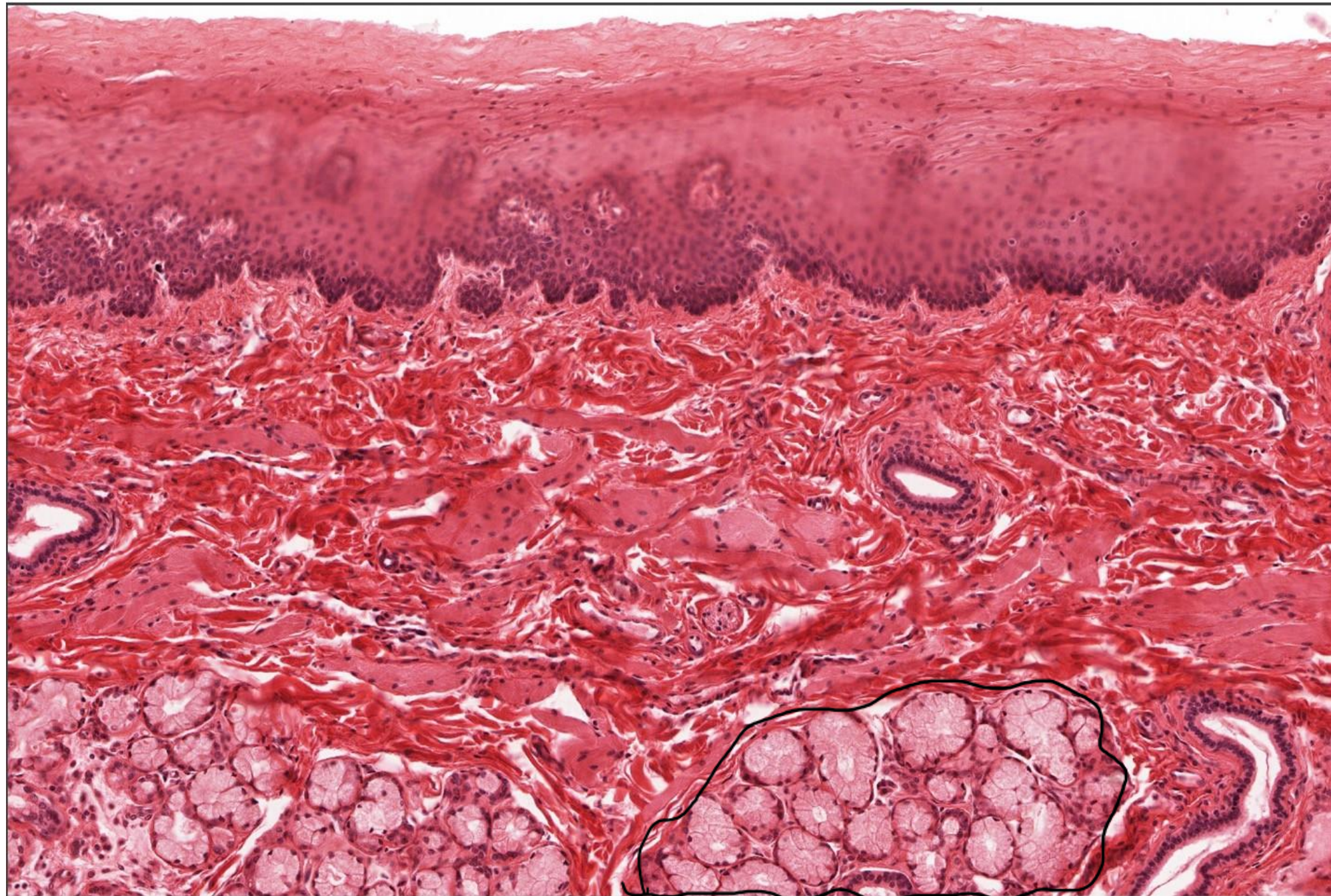
Serous

Mucous

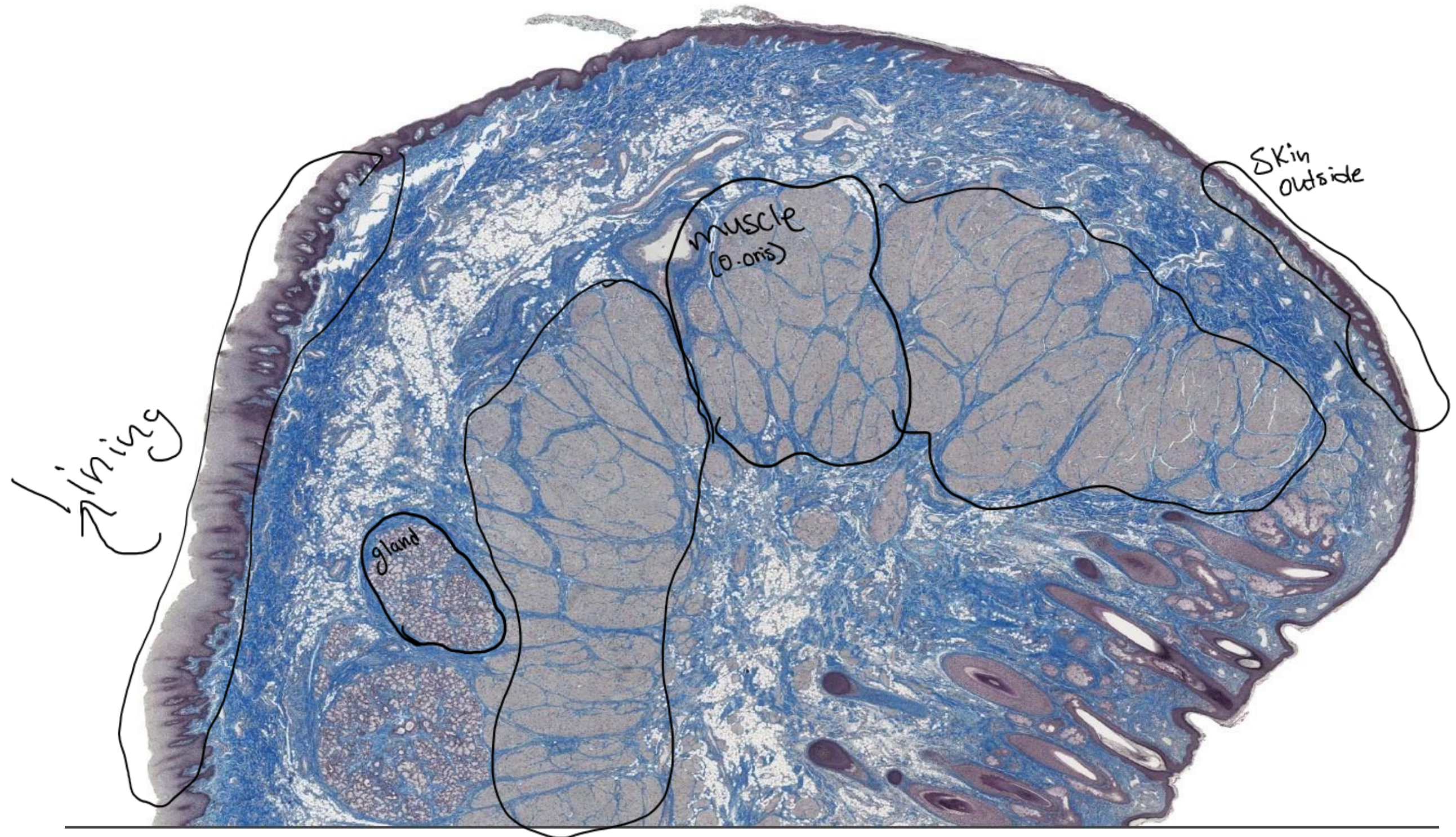
Salivary gland



\*lining!



\*lip

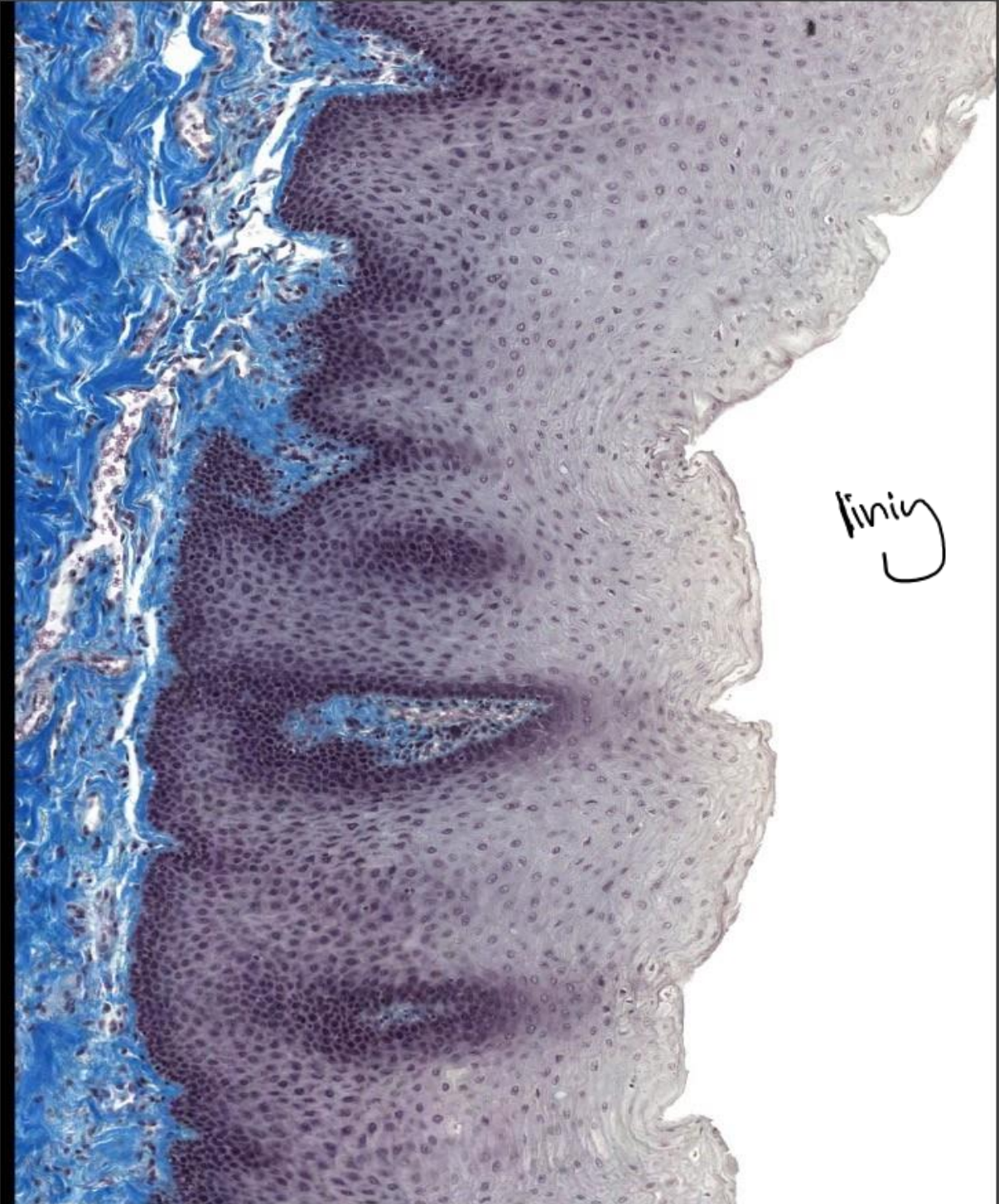
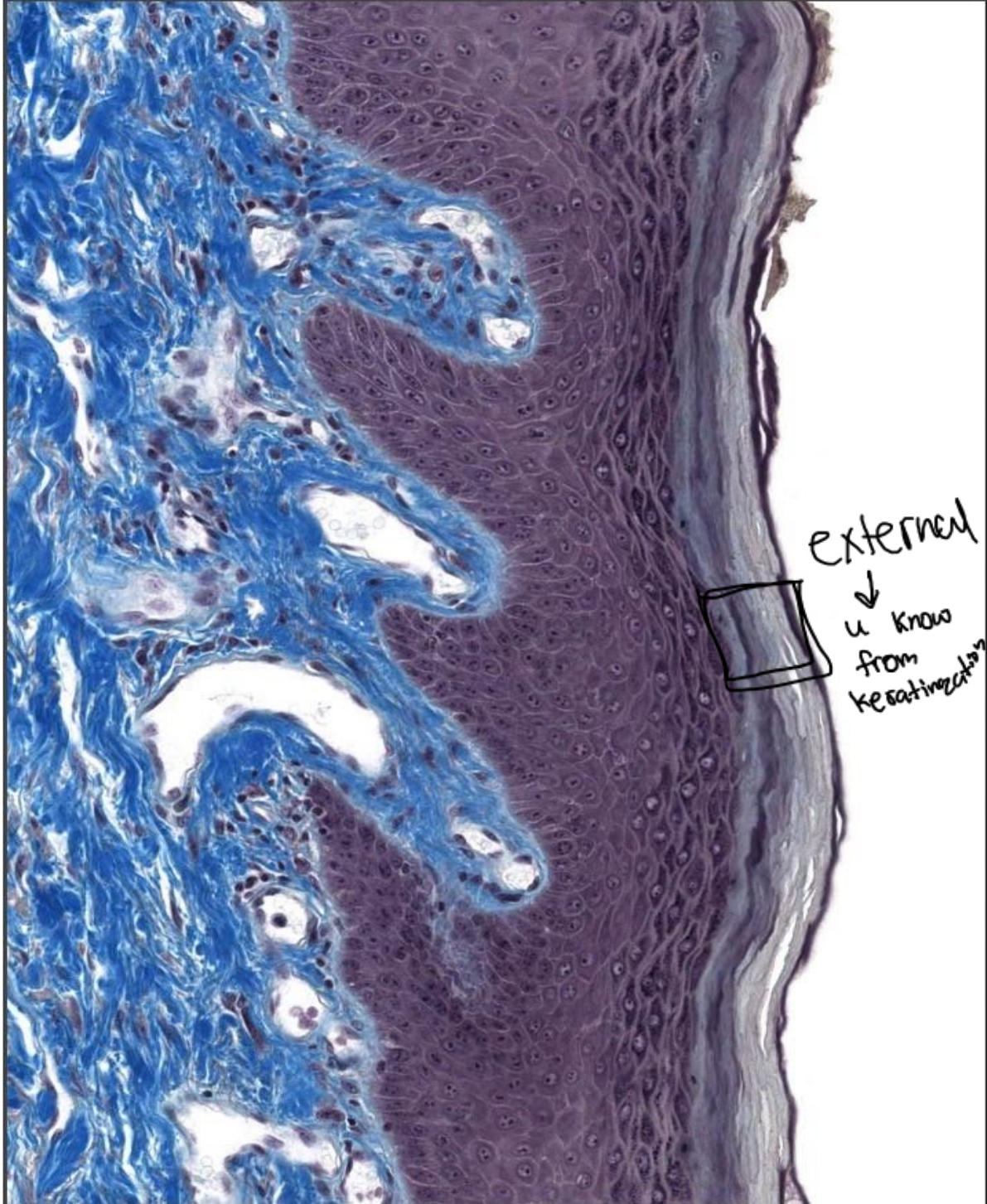


skin  
outside

muscle  
(O. oris)

gland

lining



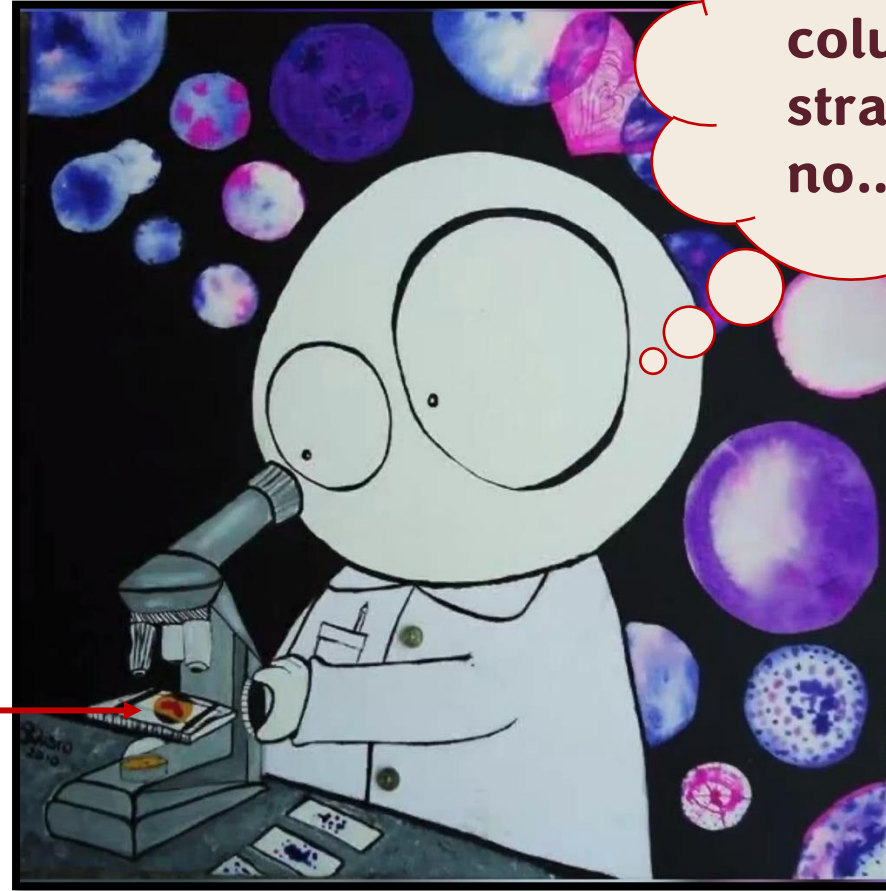
# \* tongue

---



**Click on this 2nd Year mid Student to have n access to the quiz!**

**There is no specimen  
actually ;)**



**This is simple  
columnar, no  
stratified, no no  
no... it is simple**

any one who get less than 20/30 after first time studying this modified;

**Dr.Gada Is Mad At You**

# رسالة من الفريق العلمي:

(فَتَعَالَى اللَّهُ الْمَلِكُ الْحَقُّ<sup>ق</sup> وَلَا تَعْجَلْ بِالْقُرْآنِ مِنْ قَبْلِ أَنْ يُقْضَىٰ إِلَيْكَ وَحْيُهُ<sup>ص</sup> وَقُلْ رَبِّ زِدْنِي عِلْمًا)

وقل يا محمد: ربّ زدني علماً إلى ما علمتني، أمره بمسألته من فوائد العلم ما لا يعلم.

فأمره تعالى بزيادة في العلم، وأهمّها علم كتابه الكريم؛ فإنه الموصل إلى الترقّي في العلوم والمعارف والمنافع في الدنيا والآخرة، و لم يأمره سبحانه وتعالى بطلب الزيادة في الشيء إلا في العلم دلالة واضحة على فضيلة العلم، وأنه أفضل الأعمال، (فلم يزل صلى الله عليه وسلم في الزيادة والترقي في العلم حتى توفاه الله تعالى)

وهذا المطلب كان من مطالب الصحابة رضي الله عنهم أجمعين فكان من دعاء عبدالله بن مسعود رضي الله عنه: (اللَّهُمَّ زِدْنِي إِيمَانًا وَيَقِينًا وَفَهْمًا، أَوْ قَالَ: وَوَعِلْمًا).

وقل رب زدني علماً

# For any feedback, scan the code or click on it.



Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	Slide 11; last note	Then we have sphincter <b>which is skeletal.</b>	Then we have 2 sphincters : <b>1) External anal Sphincter which is SKELETAL</b> <b>2) Internal anal Sphincter which is smooth.</b>
V1 → V2			