



# GI ANATOMY

Sheet no.1



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020

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Underlined → mentioned in 020 lecture only.

## ➤ Introduction into the Gastrointestinal System

The gastrointestinal system is an organ system; it is divided into:

A. The Alimentary canal (also known as the digestive tract): a tube that begins with oral cavity (the mouth) and ends downwards in the anal canal. It includes the oral cavity, which transforms food into a bolus which will be swallowed into the pharynx then into the esophagus, the stomach, the small intestines then into the large intestines, rectum and the finally into the anal canal.

B. Accessory (association) digestive organs: are organs that are associated with the GIT, including:

- The tongue and the teeth in the oral cavity.
- The salivary glands: ① the parotid ② submandibular ③ sublingual glands + minor glands such as labial, palatal and lingual glands.

– These glands empty their secretions into the oral cavity (specifically in the floor of the mouth) where the digestion begins.

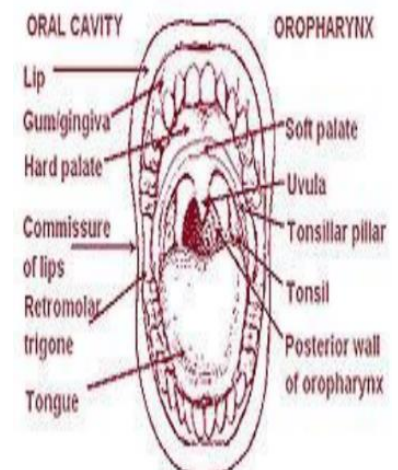
- The liver and gallbladder (they have a duct called common bile duct connecting them with the duodenum).
- The pancreas (has a duct called pancreatic duct that also opens into the duodenum)

## ➤ The Digestive Tract in the Head and Neck:

1- The oral cavity (the mouth) 2- salivary glands 3- pharynx.

# THE MOUTH CAVITY

- The mouth extends from the lips to the pharynx.
- The entrance into the pharynx, the oropharyngeal isthmus, is formed on each side by the palatoglossal fold.
- The mouth cavity is divided into the vestibule & the mouth proper



# THE VESTIBULE

▪ The vestibule lies between the lips and the cheeks externally and the gums and the teeth internally, it is the cavity outside the closed teeth covered by mucosa from inside

▪ It is where you move the toothbrush to brush your teeth when the upper and the lower jaw are closed.

▪ its bounded:

∞ Anteriorly: by the two lips.

∞ Posteriorly: the closed teeth and gum.

∞ **The Lateral wall of the vestibule is formed by the cheek, which is made up by the buccinator muscle and is lined with mucous membrane.**

▪ **The vestibule is limited above and below by the reflection of the mucous membrane from the lips and cheeks to the gums.**

▪ communications:

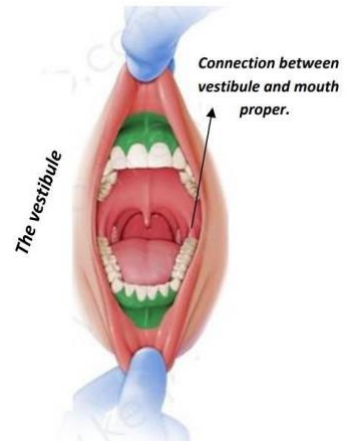
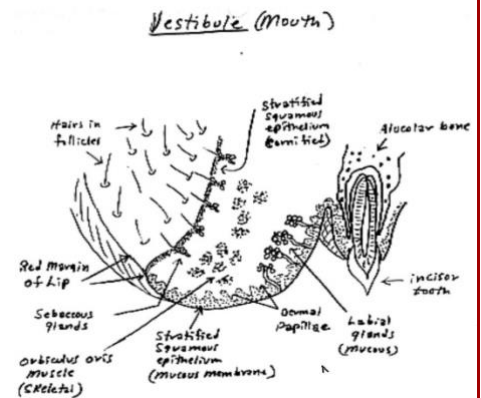
– **This slit-like space communicates with the exterior through the oral fissure between the lips.**

– **When the jaws are closed, it communicates with the mouth proper behind the third (last) molar tooth on each side.**

▪ Function:

- The vestibule helps in mastication; it receives the parotid ducts and their secretions that are important for digestion.

- It receives **the duct of the parotid salivary gland** (found in front of the ear, over the ramus of the mandible) **opens on a small papilla into the vestibule opposite to the upper second molar tooth**, it also contains minor glands.

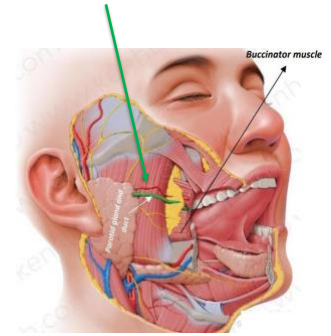


## • The Buccinator Muscle:

▪ The cheeks (buccinator muscle) are lined from the outside by skin (keratinized stratified squamous epithelium) and from the inside by mucous membrane (non-keratinized stratified squamous epithelium).

▪ The buccinator muscle are used for blowing and are supplied by the motor facial nerve.

▪ **The tone of the buccinator muscle and that of the muscles of the lips (orbicularis oris) keeps the walls of the vestibule in contact with one another.**



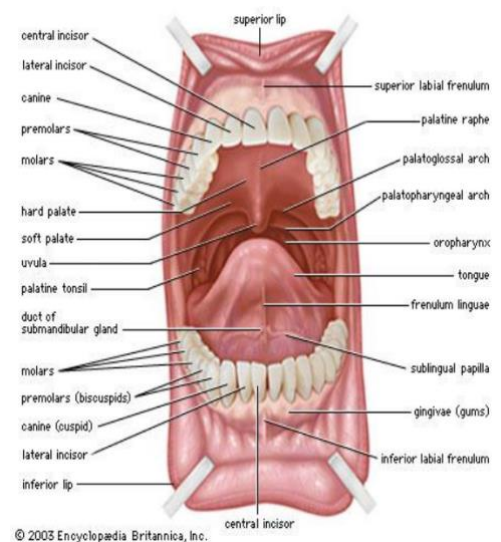
## THE MOUTH PROPER:

▪ The mouth proper is the cavity found inside the closed teeth.

▪ **The mouth proper has a roof and a floor.**

▪ **Boundaries:**

∞ **The roof of the month is formed by the hard palate in front and the soft palate behind which ends with the uvula.**



∞ **The floor is formed largely by the anterior two thirds of the tongue (dorsum aspect) and by the reflection of the mucous membrane from the sides of the tongue to the gum of the mandible.**



∞ Lateral sides: the teeth and cheeks (buccinator muscle lined by mucous membrane).

∞ Posteriorly: Oropharyngeal isthmus with its folds and tonsils.

\***The oral cavity has two openings:**

✓ An anterior opening (the space between the upper and the lower lips).

✓ A posterior opening called oropharyngeal isthmus (leads into the pharynx).

### A. The anterior opening

▪ It is bounded by the upper and the lower lips.

▪ The anterior opening is important for eating and talking.

# THE LIPS:

▪ The lips are the two fleshy folds that surround the oral orifice. They are muscular organs; **the substance of the lips is made up by the orbicularis oris muscle** (striated muscle) **and the muscles that radiate from the lips into the face.**

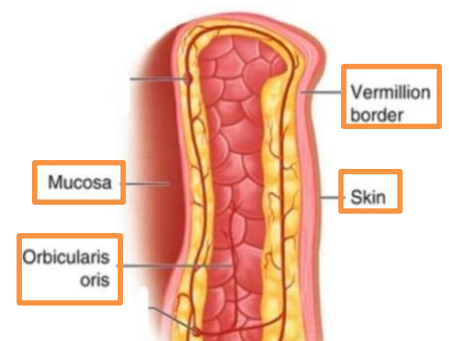
▪ The lip is covered by three different areas:

**They are covered on the outside by skin and are lined on the inside by mucous membrane** and between them lies the transitional zone.

➤ **The skin** of the lip (from outside) consists of stratified squamous **keratinized** epithelium. It has hair follicles (thick in men; mustache), sebaceous and sweat glands.

➤ **The mucosa** (from inside) consists of stratified squamous non-keratinized epithelium. It is rich with labial glands—mucus glands (minor glands).

➤ **The transitional zone** (Vermilion zone): the reddish part of the lip, rich in blood vessels which makes it red and nerve terminals which makes it very sensitive, that's why they have more sensation than the surrounding areas.

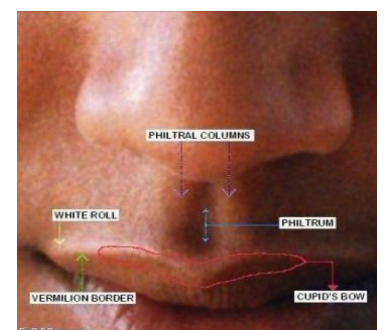


-Consists of a **modified squamous epithelium**. (Para-keratinized epithelium)

-It's called the transitional zone because it's different from the skin and the mucosa as it has no hair follicles, sebaceous glands or sweat glands.

▪ The upper lip differs from the lower lip by having **the Philtrum a shallow vertical groove seen in the midline of its outer surface**. It is formed in the embryo by the left and right maxillary prominence growth.

▪ If the two parts of the maxillary prominence did not adhere, the newborn would have hair lip.



\*The doctor said maxillary prominence, but it is actually the medial nasal prominence, we took it in MSS embryology.

▪ **Median folds of mucous membrane “the labial frenulum” connects the inner surface of the lips to the gums.**

▪ **Orbicularis Oris Muscle:**

- A stratified muscle (Voluntary).
- It is supplied by the facial nerve.
- It has circular fibers that is why it functions as a sphincter to close the lips or to whistle.
- This muscle is also responsible for pronunciation.
- The inability to whistle and the drooping of saliva on one side is a sign of facial nerve paralysis on that side.



▪ The lips **also include labial blood vessels, nerves, connective tissues and many minor salivary glands that secrete mucous.**

**B. The posterior opening** (Oropharyngeal Isthmus or Isthmus of the Fauces)

- It is the posterior orifice of the oral cavity that leads to the pharynx (Oropharynx). (Pharynx is divided into: 1-Nasopharynx 2-Oropharynx 3-Laryngeopharynx.)

▪ Has **4** boundaries:

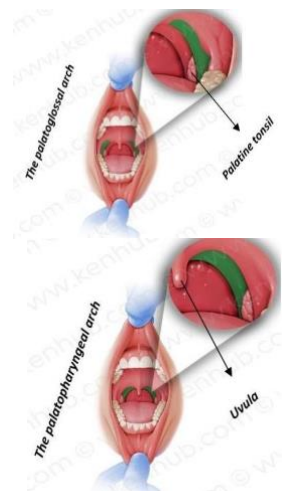
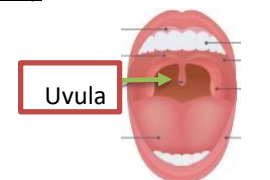
**Roof:** the soft palate and its extension the uvula (lies in the middle)

**Floor:** posterior third of the tongue.

**Both sides:** palatine tonsils

The palatine tonsils lie between two folds at the two lateral sides of the Oropharyngeal Isthmus:

- 1) Anterior one called the **palatoglossal fold**, which contains the palatoglossus muscle, and it is connected to the tongue.
- 2) Posterior one called the **palatopharyngeal fold**, which contains the palatopharyngeus muscle, and it is connected to the pharynx.

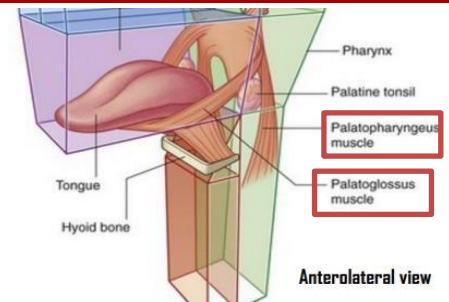


palato → palate, glossal → tongue, pharyngeal → pharynx

- The palatine tonsils (especially in children) aid in the filtration of bacteria and viruses. (Infection of the palatine tonsil is called tonsillitis)

(Children keep putting things in their mouths and this can cause repetition (4 - 5 times a year) of tonsillitis -> it's dangerous, because the

Streptococcus bacteria that causes the tonsillitis has many complications that may affect the joints, heart and kidneys, and in this case, tonsillectomy is recommended)



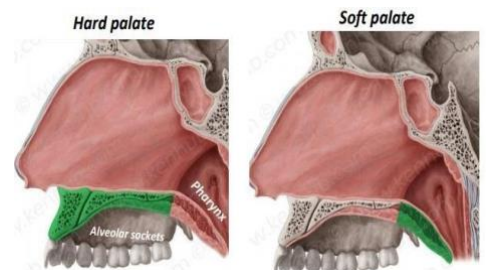
## MUCOUS MEMBRANE OF THE MOUTH

- **In the vestibule the mucous membrane is tethered to the buccinator muscle by elastic fibers in the submucosa.**

- **prevent redundant folds of mucous membrane from being bitten between the teeth when the jaws are closed.**

- It is composed of stratified squamous non-keratinized epithelium.
- Rich in minor salivary glands.
- Two types of mucosae (hard & soft) – have the same structure:
  - **Hard mucosa** (tough/ dense connective tissue): over the hard palate & the gingiva (gums- sockets of the teeth).

- **The mucous membrane of the gingiva, or gum, is strongly attached to the alveolar periosteum.**



- **Soft mucosa** (loose connective tissue): over the soft palate, the floor of the mouth, the sublingual gland, covering the buccinator muscle and surrounding the tongue.

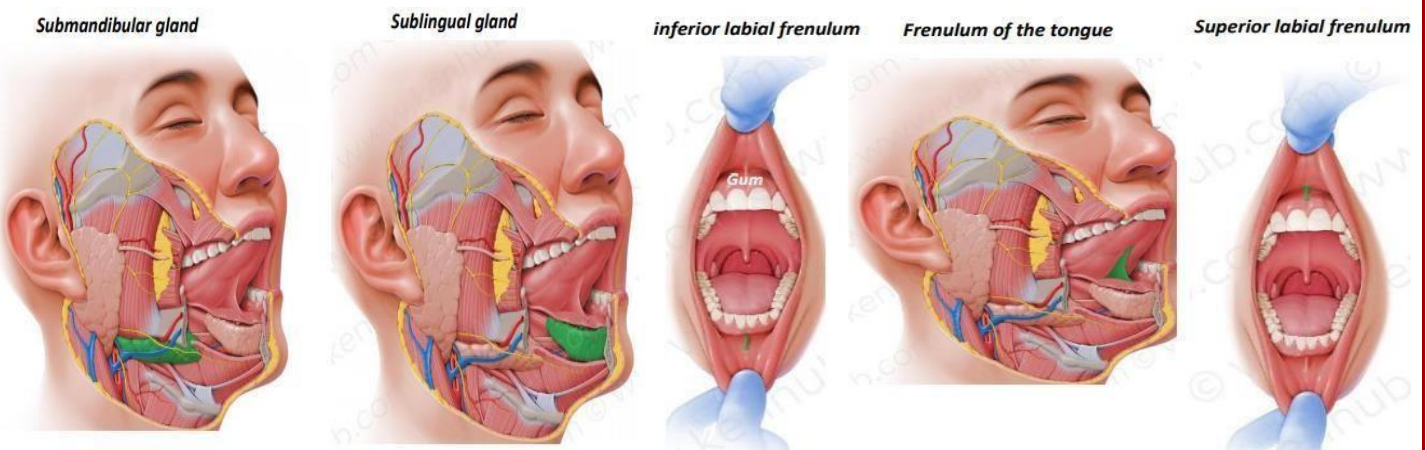
- Folds of the soft mucosa are called the frenulum:

▪ **Superior labial frenulum:** which connects the inner surface of upper lip to the gum.

▪ **Inferior labial frenulum:** which connects the inner surface of lower lip to the mouth.

▪ **fold of mucous membrane called the frenulum of the tongue** (Lingual frenulum) **connects the undersurface of the tongue in the midline to the floor of the mouth.**

- On the lower surface, close to the frenulum we can find: small papilla, Lingual artery, lingual vein (most lateral, the only one that can be seen, appears blue) and lingual nerve.
- **The submandibular duct of the submandibular gland opens onto the floor of the mouth on the summit of a small papilla on either side of the frenulum of the tongue, the ducts of the sublingual gland open into the same fold.**
- **Lateral to the frenulum, the mucous membrane forms a fringed fold, the plica fimbriata**
- **The sublingual gland projects up into the mouth, producing a low fold of mucous membrane, the sublingual fold**
- **Numerous ducts of the gland open on the summit of the fold.**



**-Uvula:** is a part of soft palate presents in midline, covered by loose connective tissue mucosa.

- It has a muscle: Musculus Uvulae, so that's mean it can move upward and downward.

-On the lateral sides of uvula, we have palatine tonsils & 2 folds: palatoglossal and palatopharyngeal.

## **SENSORY INNERVATION OF THE MOUTH (IMPORTANT)**

✓ **Roof** –upper jaw (hard & soft palates): **greater palatine and nasopalatine nerves from the maxillary division of the trigeminal nerve.**

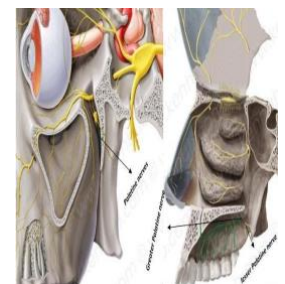
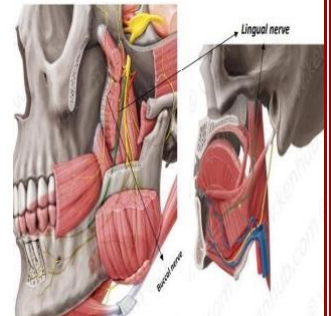
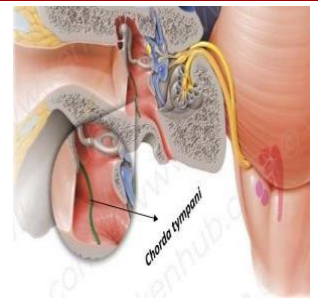
✓ **Floor** —lower jaw: **The lingual nerve general (common sensation - touch, pain, pressure and temperature-). It is a branch of the mandibular division of the trigeminal nerve.**



✓ **Taste buds** (special sensation): **fibers travel in the chorda tympani nerve, a branch of the facial nerve.** It innervates the anterior two-thirds only as the posterior third lack taste buds.

✓ **Cheeks: the buccal nerve** (sensory to mucosa and skin), **a branch of the mandibular division of the trigeminal nerve** (remember that the buccinator muscle's motor supply is a branch from the facial nerve (motor buccal nerve)).

Remember: The trigeminal nerve is the 5th cranial nerve which gives 3 divisions: The ophthalmic (sensory to the eye), the maxillary (supplies the maxilla and the upper teeth) and the mandibular (supplies the mandible and the lower teeth)



## **THE TEETH:** (an accessory structure in oral cavity)

▪ Found within the alveolar sockets of the upper and lower jaw (maxilla and mandible).

▪ The main function of teeth is grinding of food, they are also used to pronounce different letters like: **T**, **L**.

▪ **The gingivae (gums) are specialized regions of the oral mucosa that surround the teeth and cover adjacent regions of the alveolar bone,** surrounded by tough mucosa, (This gum is covered by dense connective tissue, that is adherent to periosteum).

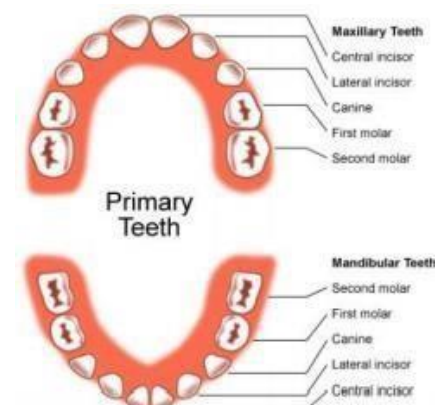
▪ There are two types of teeth: deciduous and permanent.

### **A. Deciduous Teeth (Milk teeth):** (الاسنان اللبنية)

✓ **There are 20 deciduous teeth** (10 in each jaw): **4 incisors** قواطع , **2 canines** انياب and **4 molars** اطواحين in each jaw.

✓ **They begin to erupt about 6 months after birth and have all erupted by the end of 2 years.**

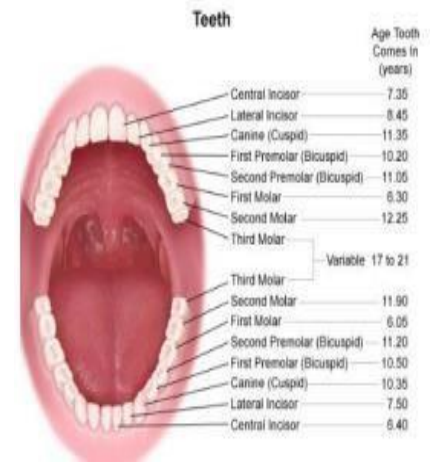
✓ **The teeth of the lower jaw usually appear before those of the upper jaw** (specifically the incisors).



## B. Permanent Teeth:

✓ There are **32 permanent teeth** (16 at each jaw): **four incisors** (2 central and 2 lateral), **two canines**, **four premolars** (appear when you smile), and **six molars** (including wisdom teeth) **in each jaw**.

✓ They begin to erupt at **6 years of age** and most of them would have erupted by the age of 12. **Except for the third molar** (wisdom teeth), **it is the last tooth to erupt which may happen between the ages of 17 and 30** (they may erupt normally but, some cause an infection, abscess, or they do not erupt at all, so they are usually extracted).



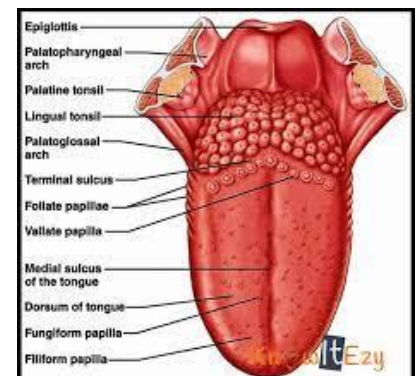
✓ The teeth of the lower jaw appear before those of the upper jaw.

## THE TONGUE: MUSCULAR ORGAN (accessory organ)

▪ The tongue is a mass of striated muscle covered with mucous membrane (has no bones).

▪ The muscles attach the tongue to the styloid process and the soft palate above and the mandible and the hyoid bone below.

▪ The tongue is divided into right and left halves in the midline by a median fibrous septum.



\*The tongue is important in: mastication, deglutition (swallowing), articulation and taste.

▪ Both halves are identical in the number of muscles, nerves, blood supply and lymphatic drainage.

▪ The tongue has an upper surface (the dorsum) and a lower surface.

▪ The mucous membrane of the upper surface of the tongue is divided into anterior two thirds & a posterior third by foramen cecum and sulcus terminalis (inverted V-shaped sulcus).

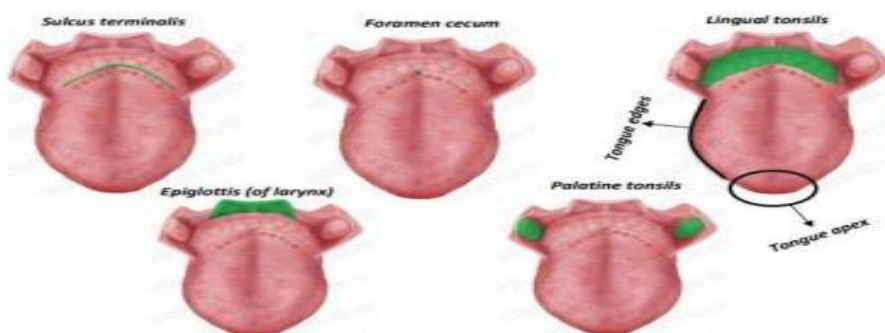
▪ The upper surface is filled with taste buds. The mucous membrane covering the posterior third of the tongue is devoid of papillae but has an irregular surface caused by the presence of underlying lymph nodules, the lingual tonsil.

- The apex of the sulcus projects backward and is marked by a small pit, the foramen cecum.
- The foramen cecum is an embryologic remnant and marks the site of the upper end of the thyroglossal duct (which forms a band of fibrous tissue). It is a landmark for where the thyroid gland is first formed before descending into the neck around the larynx.
- The difference between the thirds:

### Posterior third (lymphoid structure)

### Anterior 2/3rds

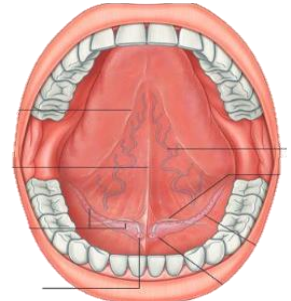
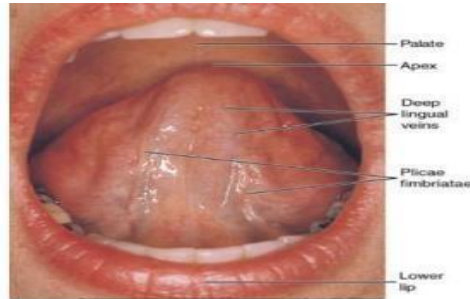
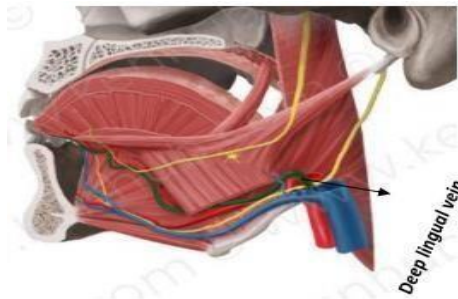
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|--|--|
| <ul style="list-style-type: none"> <li>- Leads to the pharynx so it can't be seen from the anterior opening.</li> <li>- Has an irregular surface caused by the presence of underlying lymph.</li> <li>- Made of <b>lymphoid tissue</b> - lingual tonsils (lymphatic nodules), devoid of papillae.</li> <li>- <u>Stratified squamous non-keratinized epithelium (like the floor of the mouth)</u></li> <li>- Embryologically: is formed from 3<sup>rd</sup> pharyngeal arch.</li> <li>- It is innervated by glossopharyngeal</li> </ul> | <ul style="list-style-type: none"> <li>- Has the four taste buds (lingual papillae)</li> <li>- Epithelium stratified squamous para-keratinized</li> <li><b>para-keratinized</b> → it was keratinized but certain injuries induce changes, and it doesn't go back to its original state after repair)</li> <li>- Embryologically: is formed from 1<sup>st</sup> pharyngeal arch.</li> <li>- It is innervated by chorda tympani</li> </ul> |
|--|--|
- Lower surface of the tongue → stratified squamous non-keratinized epithelium.
  - Dorsum of the tongue → stratified squamous Para-keratinized epithelium. (because it is susceptible to injury)



- The mucous membrane on the inferior surface of the tongue is reflected from the tongue to the floor of the mouth.
- In the midline anteriorly, the undersurface of the tongue is connected to the

floor of the mouth by a fold of mucous membrane, the frenulum of the tongue.

▪ On the lateral side of the frenulum, the deep lingual vein can be seen through the mucous membrane. Lateral to the lingual vein, the mucous membrane forms a fringed fold called the plica fimbriata.



### • Taste Buds (Papillae):

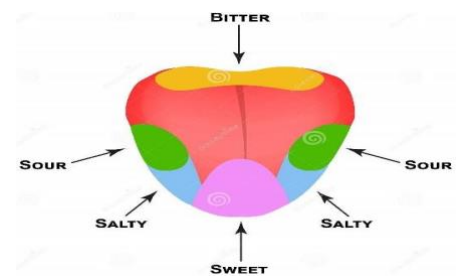
▪ Three types of papillae are present on the upper surface of the anterior two-thirds of the tongue:

1) **filiform papillae**: most abundant.

2) **The fungiform papillae**: mushroom shape.

3) **The vallate papillae**: 12 -18 Circumvallate papillae

in front of the sulcus terminalis. It contains bitter taste buds (for Bitter taste), so if you want to avoid the bitter taste, eat with the tip of your tongue.



There is another type of taste buds which is **foliate papillae**: in human, they are rudimentary. In other mammals, they are well developed.

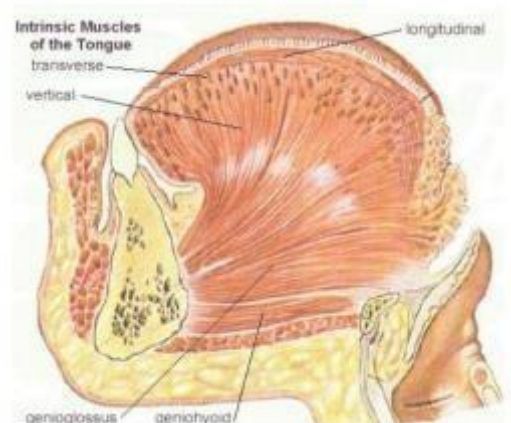
▪The tip of the tongue has sweet taste buds, and the sides have sour & salt taste buds.

## MUSCLE OF THE TONGUE

▪The muscles of the tongue are divided into two types: **intrinsic and extrinsic**.

→ **Intrinsic Muscles**:

▪These muscles are confined to the tongue and are not attached to bone. (Found inside the tongue)



▪They consist of longitudinal, transverse (oblique) and vertical fibers. (Different directions)

▪Nerve supply: Hypoglossal nerve (motor).

▪Action: Alter the shape of the tongue, for whistling for example.

→Extrinsic Muscles:

▪These muscles are attached to bones and the soft palate and they end by attaching to the tongue, with their origin surrounding the tongue from the skull, mandible and hyoid and the insertion into the tongue.

Muscle	Origin	Insertion	Function	Nerve Supply
Palatoglossus	Palatine aponeurosis	The palatoglossus inserts at sides of the tongue	[Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus]	Pharyngeal plexus through the vagus nerve (Cranial accessory nerve)
Styloglossus	Styloid process of temporal bone	blend with each other	[Draws tongue upward and backward]	Hypoglossal nerve
Hyoglossus	Body and greater horn of hyoid bone		[Depresses tongue]	Hypoglossal nerve
Genioglossus	Superior genial spine of mandible		Protrudes apex of tongue through mouth	Hypoglossal nerve

▪Extrinsic muscles form the bulk of the tongue. They are striated (voluntary) muscles.

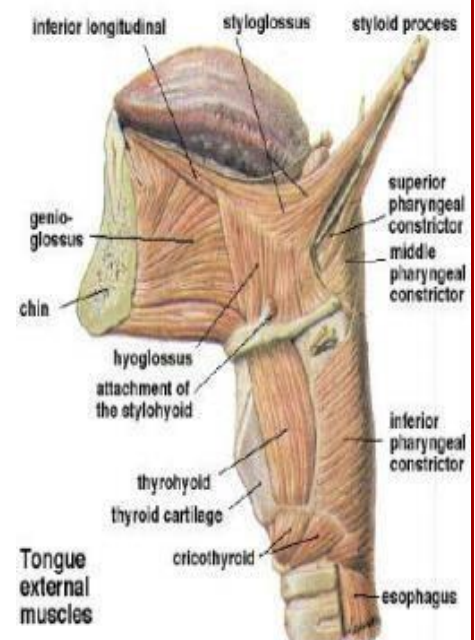
▪Nerve supply: Hypoglossal nerve

▪ALL muscles of the tongue (intrinsic & extrinsic) are supplied by the Hypoglossal nerve (cranial nerve 12), except the palatoglossus muscle (accessory nerve).

▪The genioglossus is the most important muscle. Fan shaped muscle inserts at the base of the tongue posteriorly.

▪In order to diagnose an injury to the hypoglossal nerve, the patient should be asked to bring out his tongue outward.

▪Normally, the tongue is straight but if the nerve was injured on one side, the tongue will be



deviated toward the same paralyzed site.

▪ **Summary of muscle movements:**

→ **Protrusion: the genioglossus muscles on both sides acting together.** basically, it's the action of sticking your tongue out 😊.

→ **Retraction (pulling the tongue inside): Styloglossus and hyoglossus muscles on both sides acting together.**

→ **Depression (pulling the tongue downwards): Hyoglossus muscles on both sides acting together.**

→ **Retraction and elevation of the posterior third (pulling the tongue upward and backward): Styloglossus and palatoglossus muscles on both sides acting together.**

→ **Shape changes: Intrinsic muscles.**

**Innervation, blood supply and lymphatic drainage of the tongue**

▪ **Sensory and taste innervation:**

→ **Anterior two thirds: Lingual nerve branch of mandibular division of trigeminal nerve (general sensation) and chorda tympani branch of the facial nerve (taste)**

• **Posterior third: Glossopharyngeal nerve (general sensation and taste for Circumvallate papillae)**

▪ Remember that motor innervation is by Hypoglossal & pharyngeal plexuses for palatoglossus ONLY.

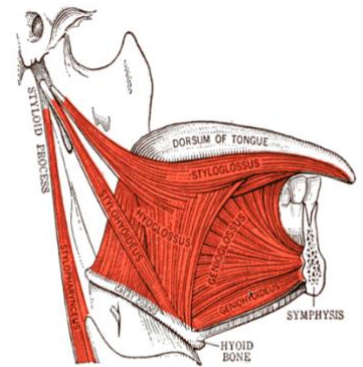
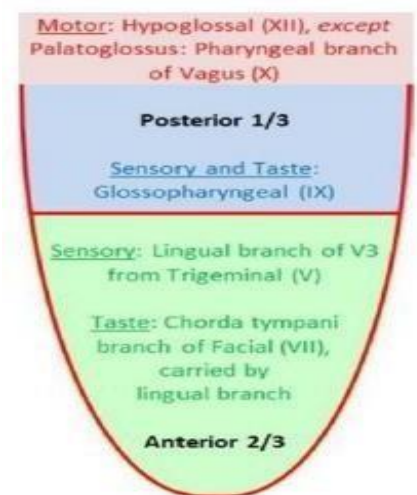


FIG. 89. SOME OF THE MUSCLES OF THE TONGUE. Viewed from the right side.



**BEST WISHES** 😊

# V2

→ The changes are highlighted.

→ Here are some explanations to help you to further understand some points:

- Page 11, the table:

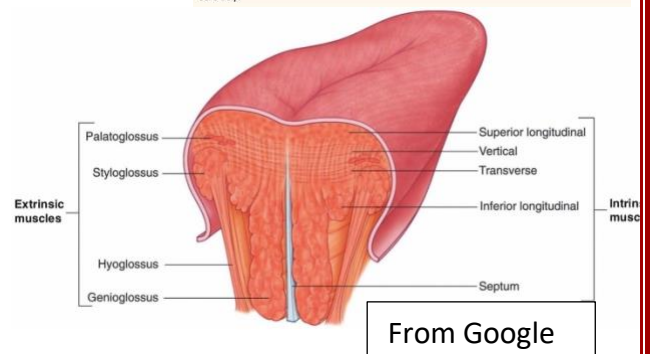
1- The anterior 2/3 has the four table buds → the doctor's slides and the book say that there are only three types, however, and as it is mentioned in the next page, there is another type, the foliate papillae, which are rudimentary in humans.

2- Embryologically: is formed from 1<sup>st</sup> /3<sup>rd</sup> pharyngeal arch → Although we took in MSS embryology course that the tongue is formed from the 1<sup>st</sup> and 2<sup>nd</sup> pharyngeal pouches, the doctor and the book say that it actually originates from the arches.

- Page 13:

1- They consist of longitudinal, transverse (oblique) and vertical fibers → The doctor's slides, the book and Google only mention longitudinal, transverse and vertical, however, in the lecture, the doctor said: longitudinal, oblique and vertical, Soooo ...=)

2- The table → note that all extrinsic muscles blend with each other, except Palatoglossus it is inserted into the side of the tongue.



This is what was mentioned in the slides: **Insertion: Blends with each other, the palatoglossus inserts at Side of tongue.**

- Page 14: Remember that motor innervation is by Hypoglossal & pharyngeal plexuses for palatoglossus ONLY → there are two sources of innervation: pharyngeal plexuses for palatoglossus, and Hypoglossal for the rest.