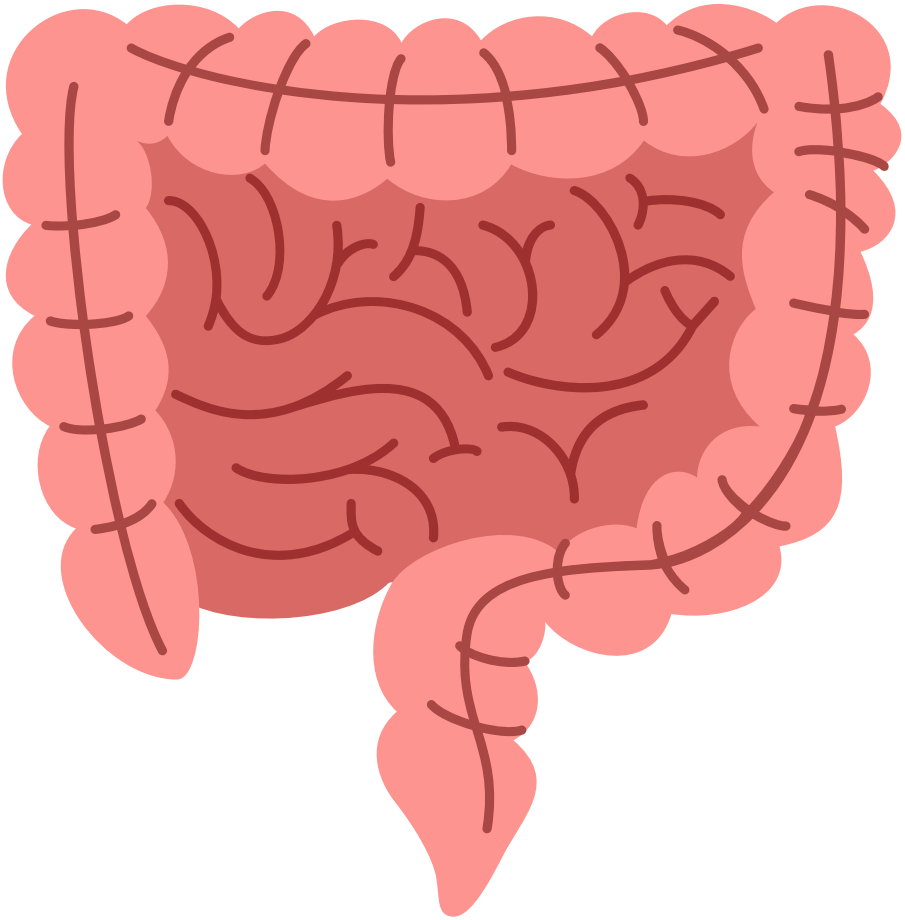
GIS

Sheet no.1

Anatomy



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➔ Note! Additional pictures were added for clarification from doctor 2017 sheet.
Underlined sentences are from the slides but were not mentioned by the doctor during the lecture.

➢ 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 by 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 (orifice)**.

B. Accessory (association) digestive organs

- The **tongue** and the **teeth**.
- The **salivary glands**:
  ①The parotid ②submandibular ③sublingual glands + minor glands such as labial, palatal and lingual glands.
  – These glands empty their secretions into the oral cavity where digestion begins.
- The **liver and gallbladder** (they have a duct connecting them with the duodenum).
- The **pancreas** (has a pancreatic duct that also opens into the duodenum).

Side note

-The small intestine has three parts: the duodenum, jejunum, and ileum.
-The large intestine is divided into 4 parts: the ascending colon which begins with the cecum, the transverse colon, the descending colon and the sigmoid colon.

➢ The Digestive Tract in the Head and Neck

The Oral Cavity (the mouth)

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

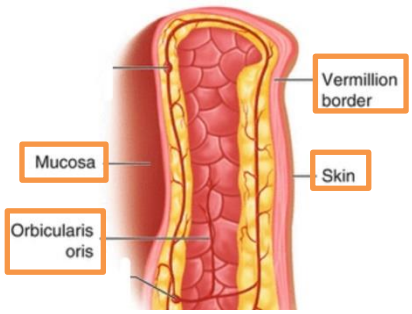
✓ An **anterior** opening (the space between the upper and the lower lips).
✓ A **posterior** opening called oropharyngeal isthmus (leads into the pharynx).

A. The anterior opening

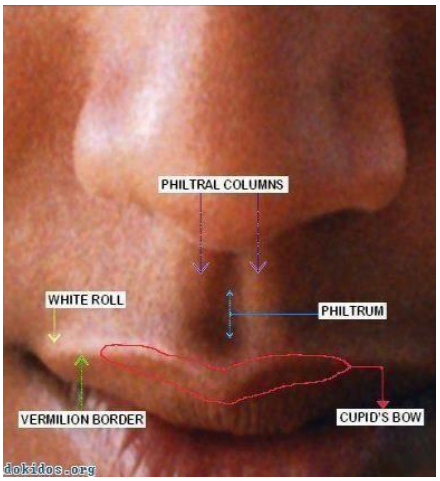
- It lies between the upper and the lower lip and is surrounded by the lips.
- The lips are the two fleshy folds that surround the oral orifice. They are muscular organs; their core is formed by a striated muscle called the orbicularis oris muscle.

Histology of the Lips:

- The lip is covered by three different areas:
  outer: the skin, inner area: mucosa and between them lies the transitional zone.
- **The skin** of the lip consists of stratified squamous keratinized epithelium.
  It has hairfollicles (thick in men; mustache), sebaceous and sweat 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.
  consists of a **modified squamous epithelium.**
  its 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 mucosa** (from inside) consists of stratified squamous *non-keratinized* epithelium.
  It has labial glands—mucus 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 (where the maxillary prominence meets with the nasomedial prominence → the nasomedial prominence wasn't mentioned by the doctor but we took it in MSS embryology).
- [Median folds of mucous membrane "the labial frenulum" connects the inner surface of the lips to the gums].

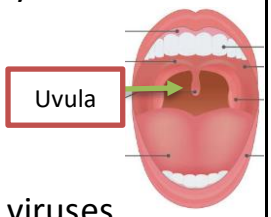


- **Orbicularis Oris Muscle**
  - ✓ A striated muscle (voluntary).
  - ✓ It is supplied by the facial nerve.
  - ✓ It has circular fibers that is why it functions as a sphincter to close the lips and it is important in whistling. This muscle is also responsible for pronunciation.
  - ✓ The inability to whistle and the drooping of saliva on one side is a sign of facial nerve paralysis on that side.

- The anterior opening also includes 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)

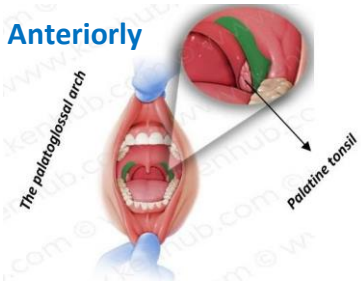
- It is the posterior orifice of the oral cavity and the entrance into the pharynx.
- Has 4 boundaries:
  Roof: the soft palate and its extension the uvula (lies in the middle)
  Floor: posterior third of the tongue.
  Both sides: palatine tonsils



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

There are two folds at the two lateral sides of the Oropharyngeal Isthmus:

1) Anterior one called the **palatoglossal fold.**
2) Posterior one called the **palatopharyngeal fold**.

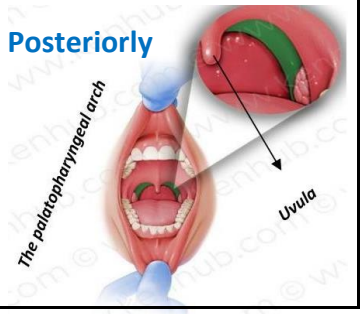


✓ The palatoglossal fold extends from the palate to the tongue. Has the palatoglossus muscle.

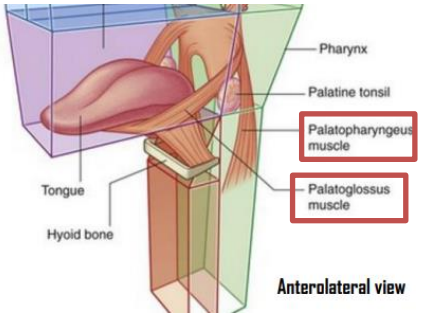
palato→ palate / glossal → tongue

✓ The palatopharyngeal fold extends from the palate to the pharynx. Has the palatopharyngeus muscle.

palato → palate / pharyngeal → pharynx



- Between these two muscles lay the palatine tonsils (at the two sides of the oropharyngeal isthmus).

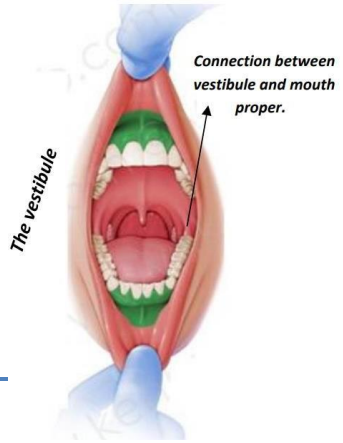


you can see the palatopharyngeus & palatoglossus muscles here

The mouth cavity is divided into the vestibule & the mouth proper

A) The Vestibule:

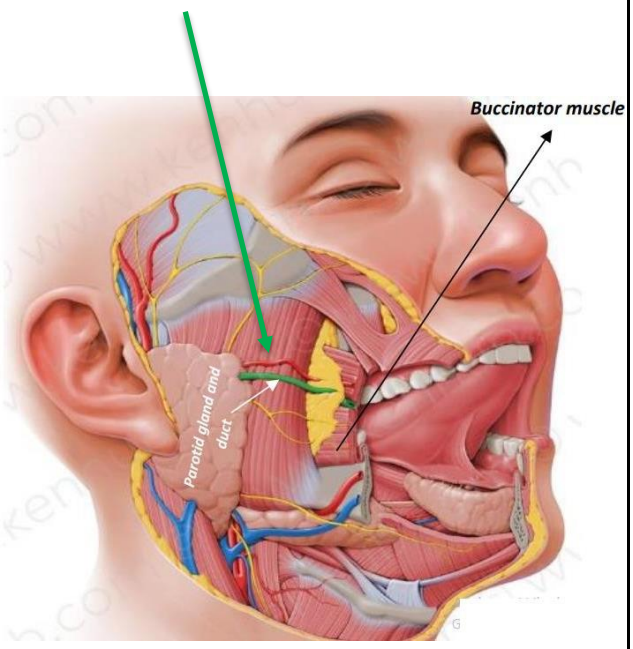
- The vestibule is the cavity outside the closed teeth.
- Its where you move the toothbrush to brush your teeth when the upper and the lower jaw are closed.



- its bounded:
  - ∝ Anteriorly by the two lips.
  - ∝ Posteriorly: the **closed** teeth and gum.
  - ∝ Laterally: by the cheek, which is made up by the buccinator muscle.
- [The vestibule is limited above and below by the reflection of the mucous membrane from the lips and cheeks to the gums]
- communications:
  – with the exterior through the oral fissure between the lips.
  – with the mouth proper behind the third (last) molar tooth on eachside when the jaws are closed.
- Function:
  The vestibule helps in mastication, it **receives** the parotid ducts and their secretions that are important for digestion.
  The **duct** of the parotid salivary gland (found 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) is lined form the outside by skin (keratinized stratified squamous epithelium) and from the inside by mucous membrane (Non-keratinized stratified squamous epithelium).
- The buccinators muscle is used for blowing and is 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.

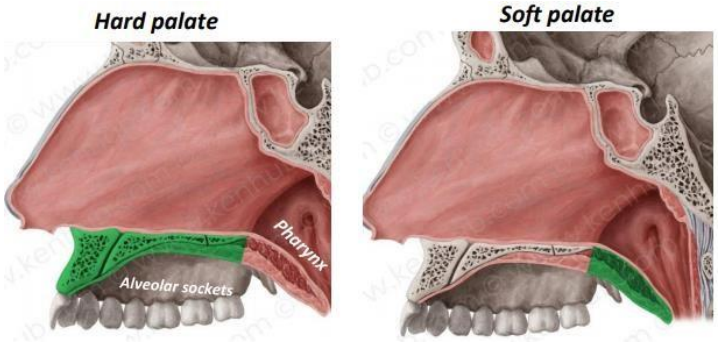


B) The Mouth Proper:

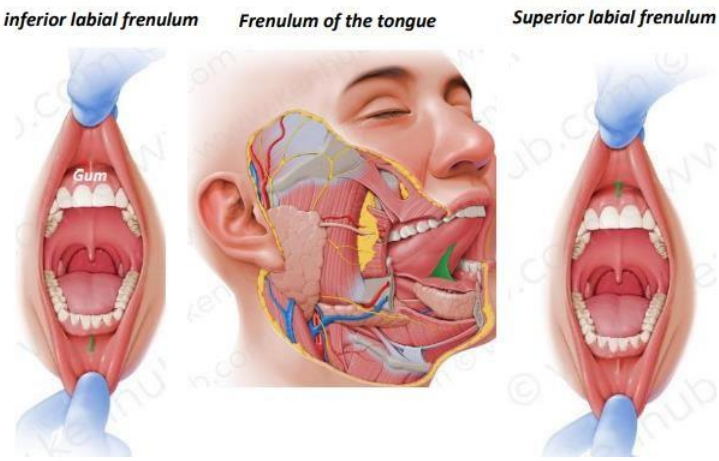
- The mouth proper is the cavity found inside the closed teeth.
- **Boundaries**:
  - ∝ Roof: the hard palate in front and the soft palate in the back which ends with the uvula.
  - ∝ Floor: formed largely by the anterior two thirds of the tongue (dorsum aspect) and by the reflection of the mucous membrane from the sides of the tongue to the gum of the mandible.
  - ∝ Sides: the teeth and cheeks (buccinator muscle lined by mucous membrane).
  - ∝ Posteriorly: Oropharyngeal isthmus with its folds and tonsils.

• Mucous Membrane of the Mouth

- 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): over the hard palate & the gingiva (gums)
  the hard mucosa is strongly attached to the alveolar periosteum (found on the border of the alveolar socket).
  – Soft mucosa: over the soft palate, the floor of the mouth, and the sublingual gland.

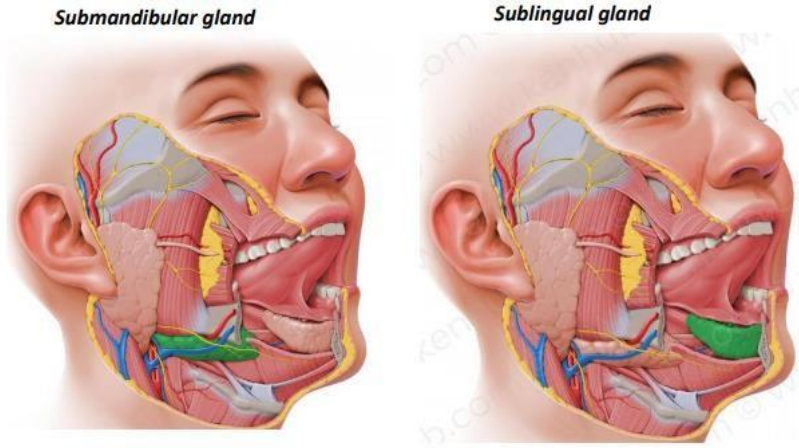


- **Folds** of the mucosa are called the **frenulum**
  - ∝ **Lingual frenulum**: mucosal fold of the tongue connects the under surface of the tongue in the midline to the floor of the mouth.
  - ∝ **Superior labial frenulum**: which connects the inner surface of upper lip to the mouth.
  - ∝ **Inferior labial frenulum**: which connects the innersurface of lower lip to the mouth.



- 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).
- 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.

- [In the vestibule the mucous membrane is tethered to the buccinator muscle by elastic fibers in the submucosa and this prevents redundant folds of mucous membrane from being bitten between the teeth when the jaws are closed].

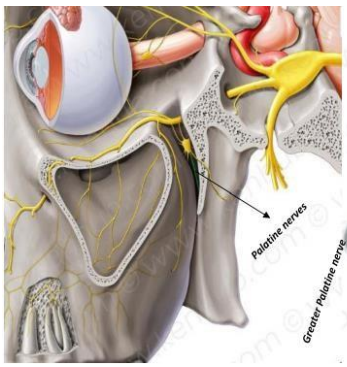


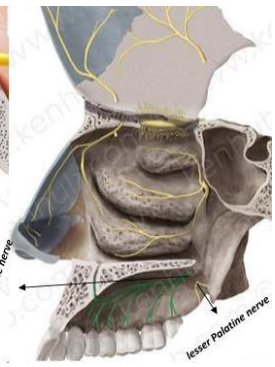
- **Salivary Glands:**
  - Three major glands: the parotid gland, the submandibular and the sublingual gland.
  - Minor glands such as palatal, labial and lingual glands which secrete mucous.
  - They are important because the oral cavity must be moist ➔ the dryness of the oral cavity permits the bacteria to grow and cause infection.

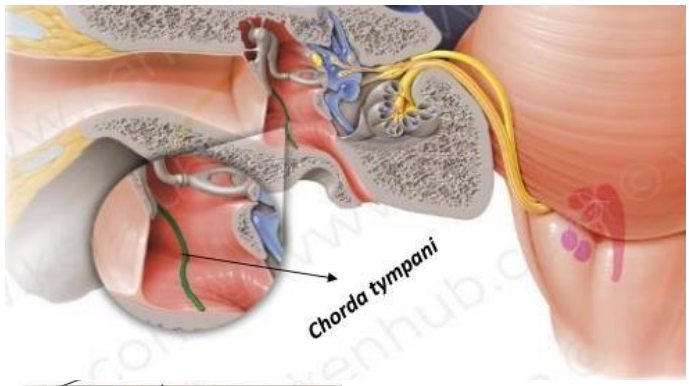
- **Sensory Innervation of the Mouth (important)**
  - ✓ **Roof** –upper jaw (hard & soft palates): the greater palatine and nasopalatine nerves from the maxillary division of thetrigeminal nerve.
  - ✓ **Floor** —lower jaw: The lingual nerve general (common) sensations ➔ touch, pain and temperature. It is a branch of the mandibulardivision 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), 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).

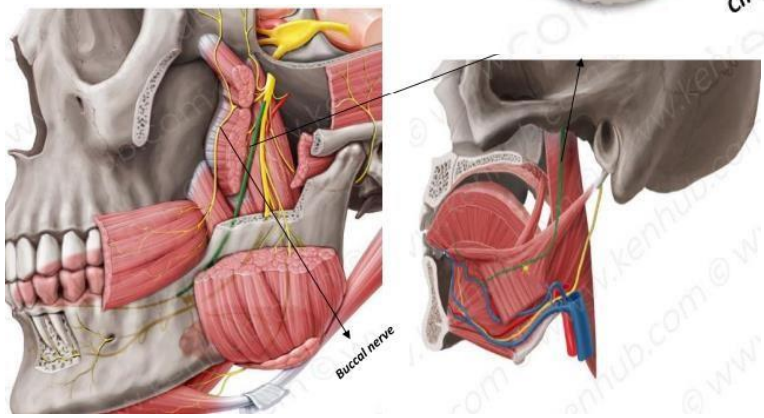
Remember! The trigeminal nerve is the 5th cranial nerve which gives 3 divisions: The ophthalmic (sensory to the eye), the maxillary (supplies the maxilla and the upper teeth) and the mandibular (supplies the mandible and the lower teeth)

Sensory Innervation of The mouth







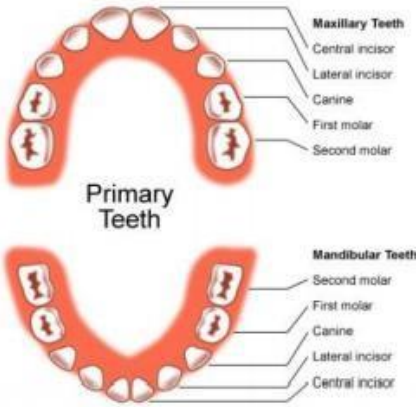


The Teeth:

- Found within the alveolar sockets of the upper and lower jaw (maxilla and mandible).
- 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.
- There are two types of teeth: deciduous and permanent.

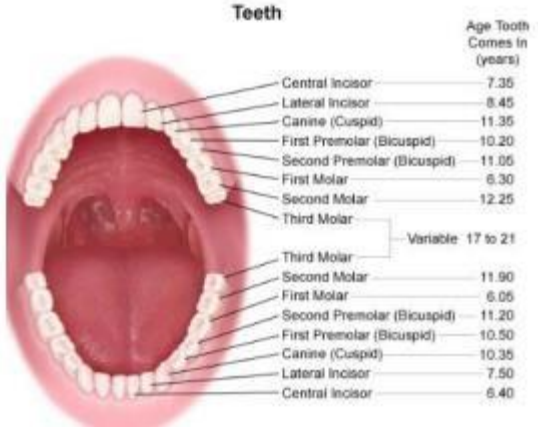
A. Deciduous Teeth (Milk teeth):

- ✓ There are 20 deciduous teeth (10 in each jaw): 4 incisors قواطع, 2 canines أنياب , and 4 molars طواحين 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).

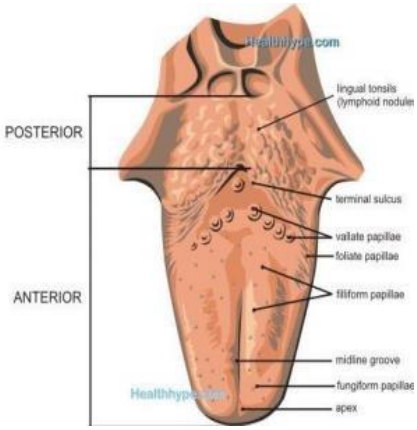


B. Permanent Teeth:

- ✓ There are 32 permanent teeth (16 at each jaw): four incisors, two canines, four *premolars*, and six molars (including wisdom teeth) in each jaw.
- ✓ They begin to erupt at 6 years of age and have all erupted by the age of 12. Except for the third molar (wisdom teeth) which may happen between the ages of 17 and 30 (they may erupt normally but, some cause an infection, or they do not erupt at all).
- ✓ The teeth of the lower jaw appear before those of the upper jaw.



- **The Tongue: Muscular organ**
  - The tongue is a mass of striated muscle covered with mucous membrane (has no bones).
  - Muscles attach the tongue to the styloid process and the soft palate above and to the mandible and the hyoid bone below.
  - The tongue is divided into right and left halves in the midline by a median fibrous septum.
    → both halves are identical in the number of muscles, nerves



  - the mucus membrane of the upper surface of the tongue is divided into anterior two thirds & a posterior third by foramen cecum and sulcus terminalis (V-shaped)
    → these thirds are **different** in which:

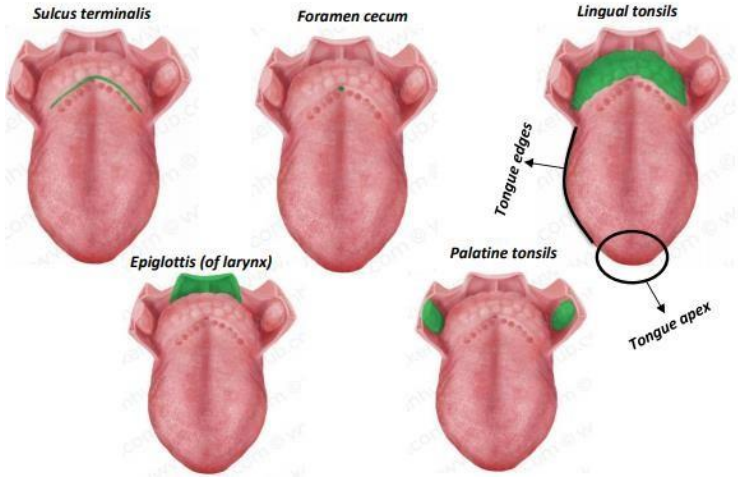
Posterior third

• leads to the pharynx
has an irregular surface caused by the presence of underlying lymph
• made of **lymphoid tissue** lingual tonsils (lymphatic nodules), devoid of papillae
• Epithelium
stratified squamous nonkeratinized epithelium (like the floor of the mouth).

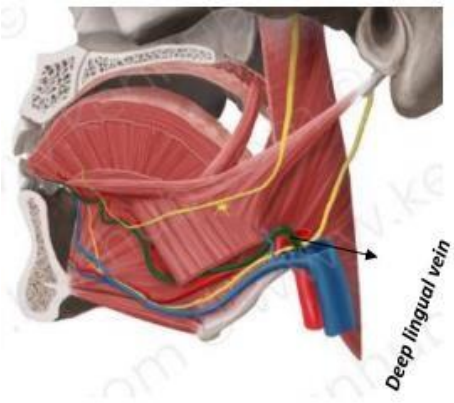
Anterior 2/3rds

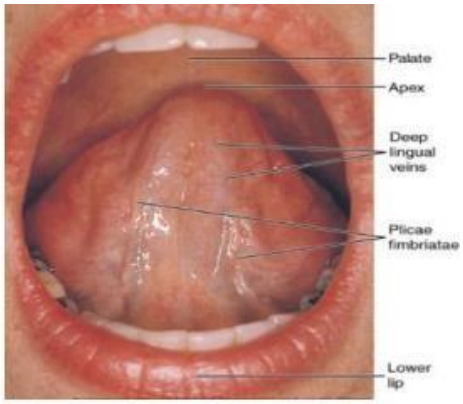
• Has the four **taste buds** (lingual papillae)
• Epithelium
stratified squamous **para-keratinized**
para-keratinized →it was keratinized but certain injuries induce changes, and it doesn't go back to its original state after repair)

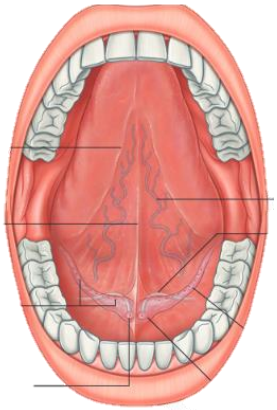
  - The apex of the sulcus projects backward and is marked by a small pit, the foramen cecum.
  - The foramen cecum is an embryologic remnant and marks the site of the upper end of the thyroglossal duct. It is a landmark for where the thyroid gland is first formed before descending into the neck around the larynx.



- 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 fringedfold called the plica fimbriata]



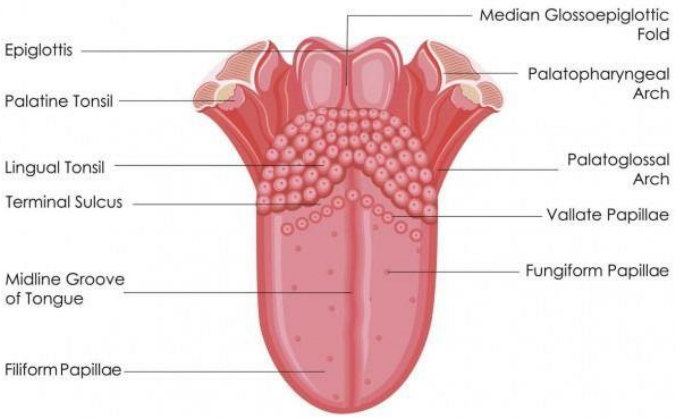




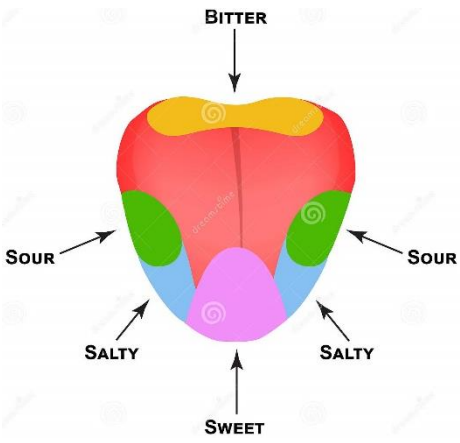
- **Taste Buds (Papillae):**

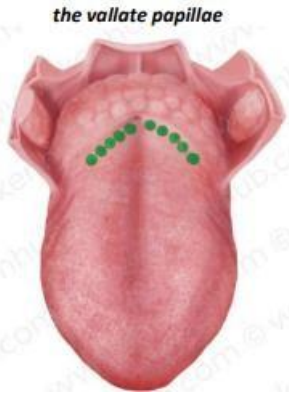
- Four types of papillae are present on the upper surface of the anterior two thirds ofthe tongue:

  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 tastebuds
  4) **The foliate papillae**

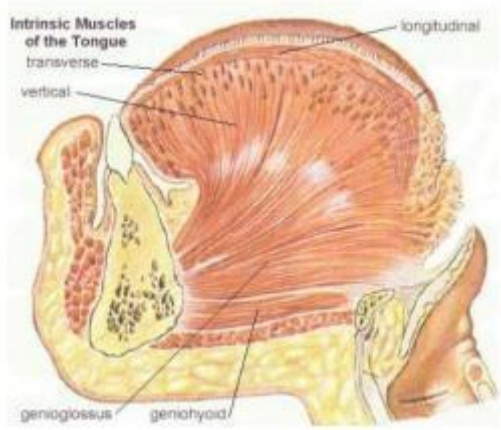


The tip of the tongue has sweet tastebuds, and the sides have sour & salt tastebuds





- **Muscle of The Tongue**
  - The muscles of the tongue are divided into two types: **intrinsic and extrinsic.**
  - **Intrinsic Muscles:**



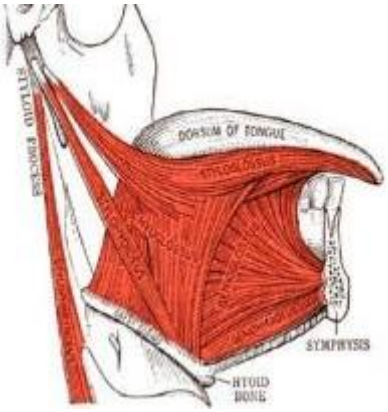
✓ These muscles are confined to the tongue andare not attached to bone. (Found inside the tongue)
✓ They consist of longitudinal, transverse, oblique and vertical fibers. (different directions)
✓ **Nerve supply**: Hypoglossal nerve (motor).
✓ **Action**: Alter the shape of the tongue.

  - **'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 the insert on the tongue.
✓ Extrinsic muscles form the bulk of the tongue. They are striated (voluntary) muscles.

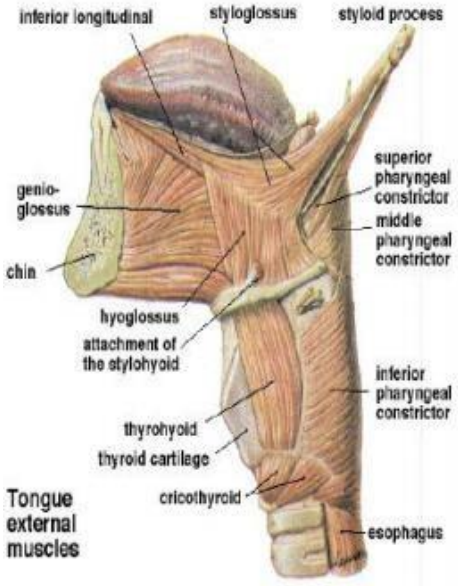
Muscle	Origin	Insertion	Function	Nerve Supply
Palatoglossus	Palatine aponeurosis	Blends with each other, the palatoglossus inserts at sides of the tongue	[Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus]	**Pharyngeal plexus** through the vagus nerve (Cranial accessory nerve)
Styloglossus	Styloid process of temporal bone		[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

****ALL muscles of the tongue (intrinsic & extrinsic) are supplied by the Hypoglossal nerve except the palatoglossus muscle**



✓ 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. Normally, the tongue is straight but if the nerve was injured on one side, the tongue will be deviated towards the same paralyzed site.

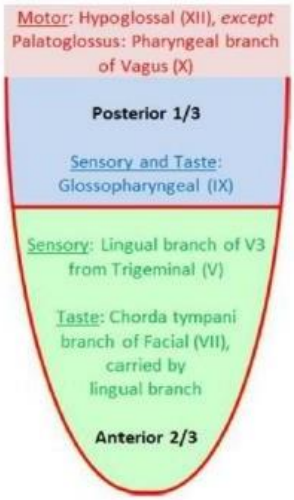
- Summary of **muscle movements**:
  - ∝ **Protrusion**: the genioglossus muscles on both sides acting together.
    → basically it's the action of sticking ur tongue out 😆
  - ∝ **Retraction**: Styloglossus and [hyoglossus] muscles on both sides acting together.
  - ∝ **Depression**: Hyoglossus muscles on both sides acting together.
  - ∝ [Retraction and elevation of the posterior third: 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:**

✓ Posterior 1/3: Glossopharyngeal for both.
✓ Anterior 2/3: sensory (lingual nerve), taste (chorda tympani).
Remember that motor innervation is by Hypoglossal & pharyngeal plexuses for palatoglossus ONLY.



- **Blood Supply (three arteries):**

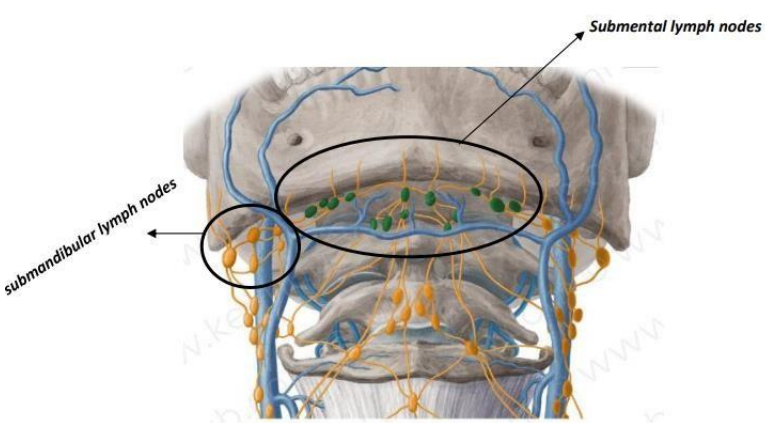
✓ The lingual artery.
✓ The tonsillar branch of the facial artery
✓ The ascending pharyngeal artery supply the tongue
all branches from external carotid artery

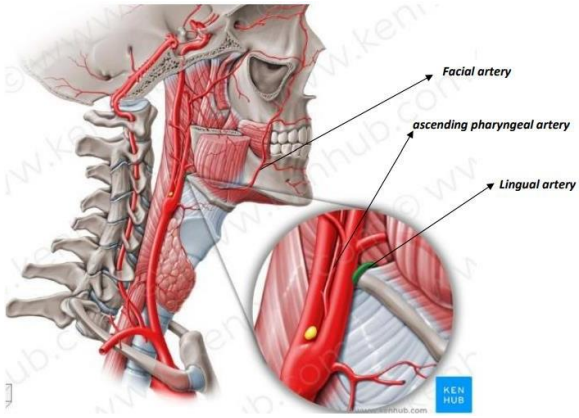
- **Venous drainage (lingual veins):**

✓ The veins drain into the internal jugular vein.

- **Lymph Drainage:**

✓ Tip of the tongue: Submental lymph nodes.
✓ Sides of the anterior two thirds: Submandibular and deep cervical lymph nodes.
✓ Posterior third: Deep cervical lymph nodes.



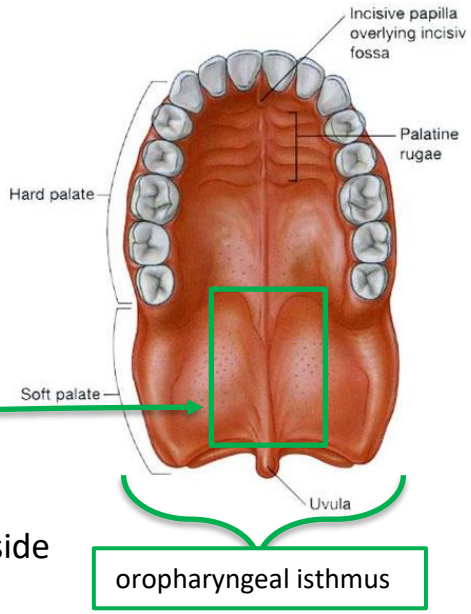


The Palate

• The palate forms the roof of the mouth and the floor of the nasal cavity.
• It is divided into two parts:
the hard palate in front & the soft palate behind.

Hard Palate

- The hard palate is formed by two parts the **palatine processes of the maxillae** & **horizontal plates of the palatine bones**
- continuous behind with the soft palate.
- has a foramen anteriorly the incisive foramen that connects the hard palate with the nasal cavity, nerves & arteries pass through this foramen



Soft Palate

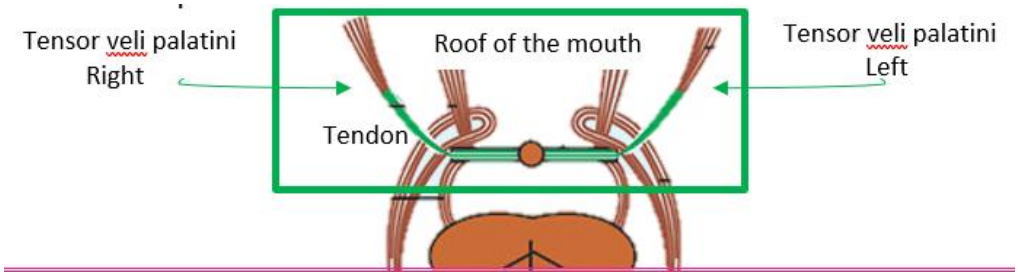
- Formed by **Palatine aponeurosis** which is the meeting point of the Tensor villi palatini muscles on the right & left side
- The soft palate is composed of
  1) mucous membrane: covers the upper and lower surfaces of the soft palate.
  2) palatine aponeurosis: a fibrous sheet attached to the posterior border of the hard palatine. It is the expanded tendon of the tensor veli palatini muscle.
  3) muscles
- The soft palate is a mobile fold attached to the posterior border of the hard palate
- Its free posterior border presents in the midline a conical projection called the uvula that's seen on the roof of the oropharynx.
- The soft palate is continuous at the sides with the lateral wall of the pharynx.

Muscles of the Soft Palate

• The muscles of the soft palate are:
1) tensor veli palatini 2) levator veli palatini 3) palatoglossus 4) palatopharyngeus
5) musculus uvulae (the uvula itself)

• How's the palatine aponeurosis formed?
The fibers of the tensor veli palatini muscles meet in the midline as they descend from their origin to form a narrow tendon, which turns medially around the pterygoid hamulus
Then the tendon of both tensor veli palatini muscles from the right & left sides, expand to form the palatine aponeurosis.

• When the muscles of the two sides contract, the soft palate is tightened so that the soft palate may be moved upward or downward as a tense sheet.



Muscles of the Soft Palate

Muscle	Origin	Insertion	Action	Nerve supply
Levator veli palatini	Petrous part of temporal bone, auditory tube	Palatine aponeurosis	**Raises** soft palate	Pharyngeal plexus
Tensor veli palatini	Spine of sphenoid, auditory tube	With muscle of other side, forms palatine aponeurosis	**Tenses** soft palate	****Nerve to medial pterygoid from mandibular nerve**
Palatopharyngeus	Palatine aponeurosis	Posterior border of thyroid cartilage	Elevates wall of pharynx, pulls palatopharyngeal folds medially	Pharyngeal plexus
Musculus uvulae	Posterior border of hard palate	Mucous membrane of uvula	Elevates uvula	Pharyngeal plexus

***Note that all muscles are innervated by the pharyngeal plexus except the tensor veli palatini**

- Recall from MSS embryo that cleft in the uvula can occur during embryonic development if the fusion of the maxillary processes fails forming a bifid uvula.

Movements of the Soft Palate

• Normally the soft palate is relaxed to maintain the space between the oropharynx & nasopharynx opened for air inhalation.

→The pharyngeal isthmus is closed by **raising the soft palate.**

→Remember that The pharyngeal isthmus is the communicating channel between the nasopharynx & the oropharynx.

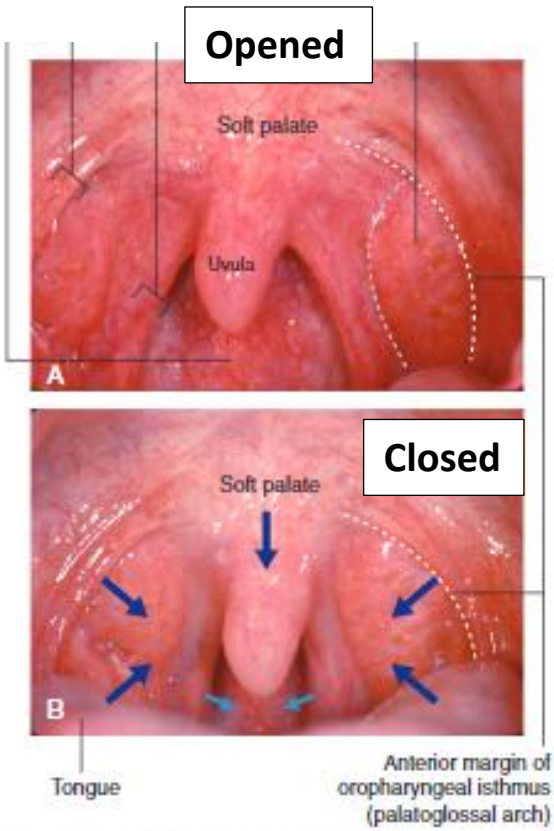
• Closure occurs during mastication (pressure inside the oral cavity is increased) & the production of explosive consonants in speech.

- Closure is **important during vomiting** to prevent the vomit from going out of the nasal cavity and restrict its exit via the oral cavity.

• The soft palate is raised by the contraction of the levator veli palatini on each side.

• At the same time, the upper fibers of the superior constrictor muscle contract and pull the posterior pharyngeal wall forward

• The palatopharyngeus muscles on both sides also contract so that the palatopharyngeal arches are pulled medially, like side curtains.

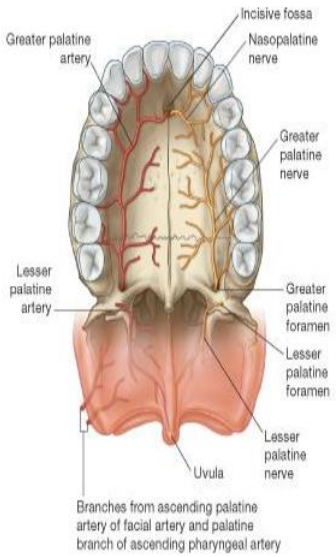


Closure of oropharyngeal isthmus
- Medial and downward movement of palatoglossal arches
- Medial and downward movement of palatopharyngeal arche
- Upward movement of tongue
- Downward and forward movement of soft palate

- **So eventually by the movement of these muscles the nasal part of the pharynx is closed off from the oral part.**

Nerve Supply of the Soft Palate

- The greater and lesser palatine nerves from the maxillary division of the trigeminal nerve enter the palate through the greater and lesser palatine foramina
- The nasopalatine nerve, also a branch of the maxillary nerve, enters the front of the hard palate through the incisive foramen.
- The glossopharyngeal nerve also supplies the soft palate



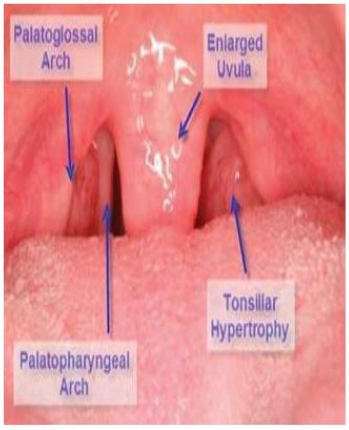
Blood Supply of the Soft Palate

- The greater palatine branch of the maxillary artery, the ascending palatine branch of the facial artery, and the ascending pharyngeal artery.

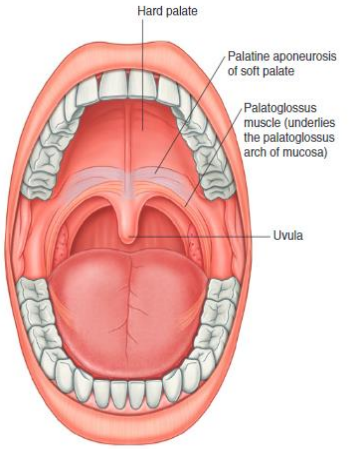
Lymph Drainage of the Palate Deep Cervical Lymph Nodes

The doctor didn't add any extra info about this slide

- The palatoglossal arch is a fold of mucous membrane containing the palatoglossus muscle, which extends from the soft palate to the side of the tongue
- The palatoglossal arch marks where the mouth becomes the pharynx.
- The palatopharyngeal arch is a fold of mucous membrane behind the palatoglossal arch
- runs downward and laterally to join the pharyngeal wall.
- The muscle contained within the fold is the palatopharyngeus muscle.
- The palatine tonsils, which are masses of lymphoid tissue, are located between the palatoglossal and palatopharyngeal arches

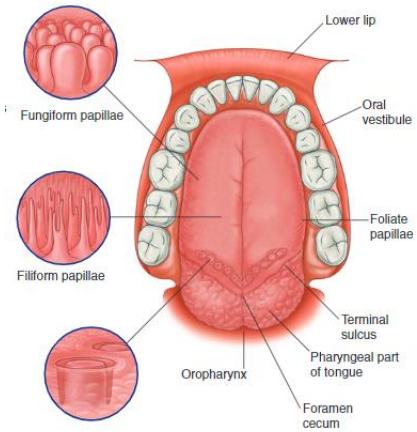


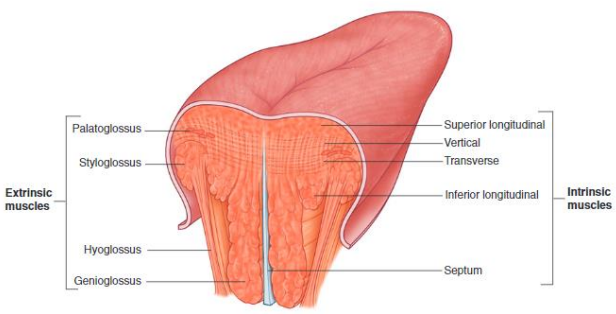
Extra pictures from Gray's



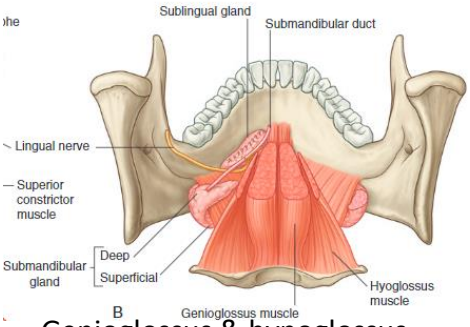
- Palatoglossal fold.
- palatopharyngeal fold.
- Palatine tonsils
- Palatoglossus Muscle
- uvula
- palatine aponeurosis

Taste buds





Intrinsic & extrinsic muscles of the tongue



Genioglossus & hypoglossus