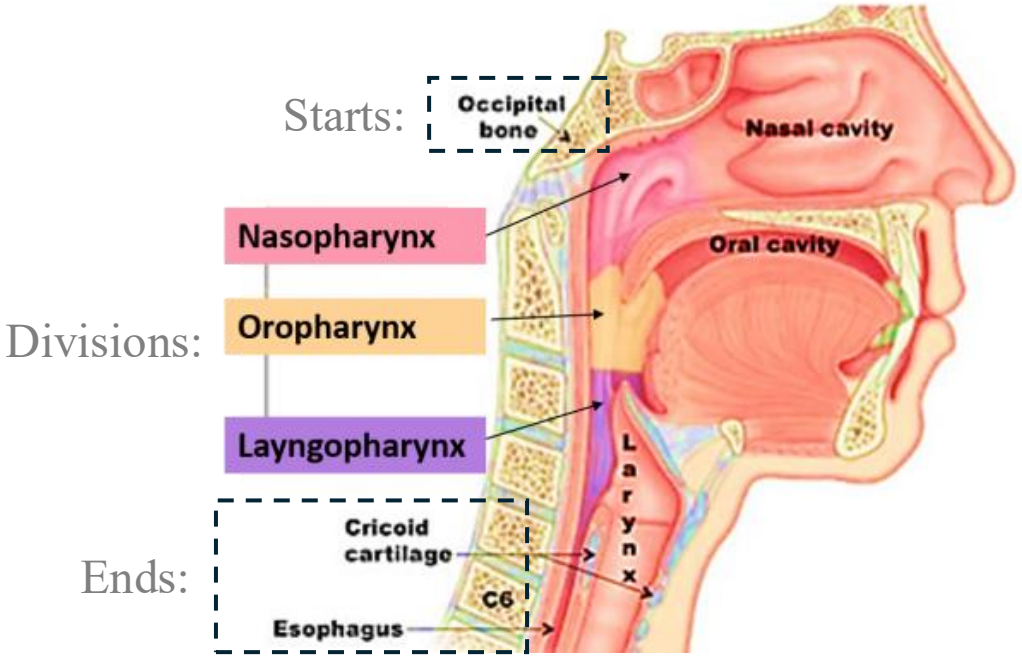
L (2) – The pharynx, palatine tonsils & palate.

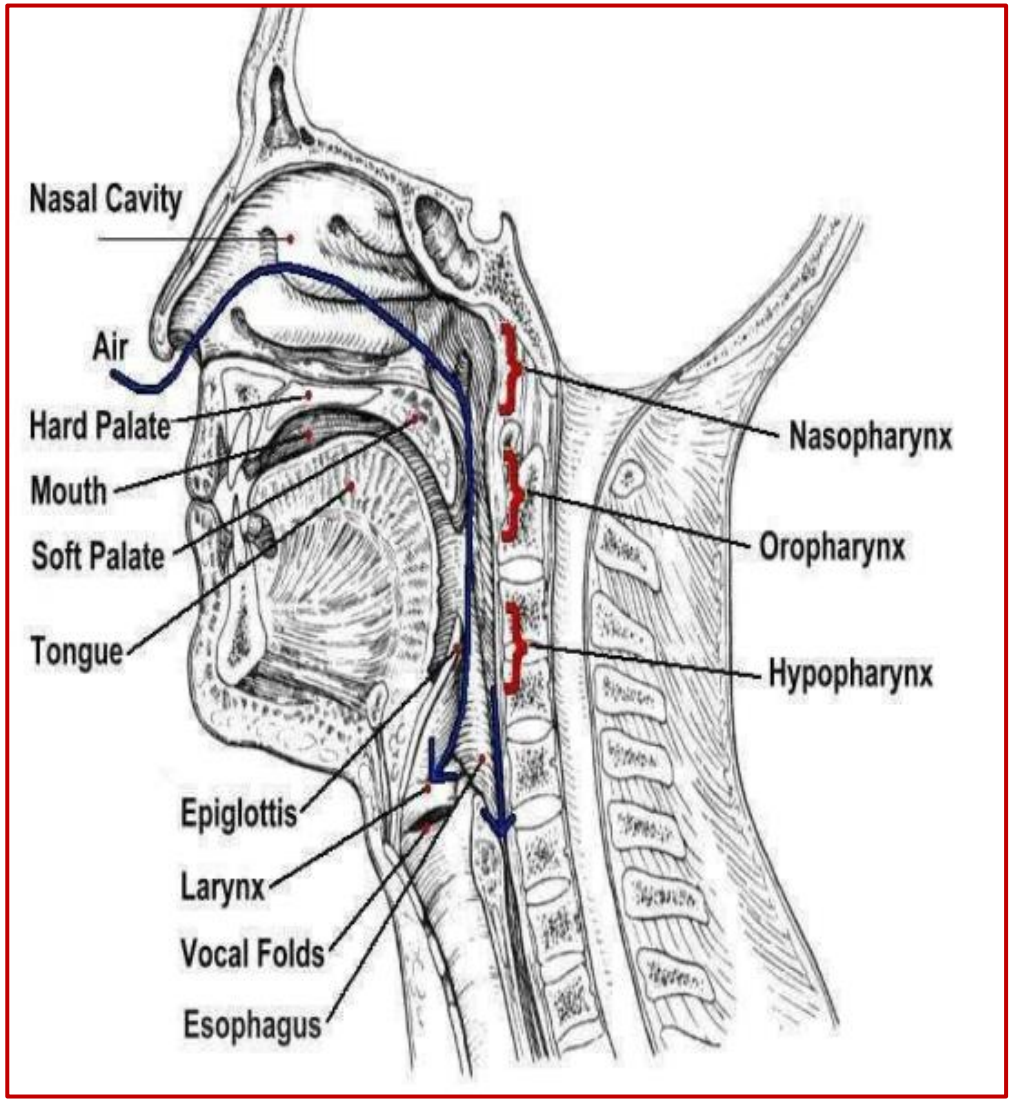
Written by: Sara Alkhateeb (23)

Reviewed by: Rasha AlHamra

1- The pharynx

- The pharynx is a muscular, funnel-shaped structure that extends from the **base of the skull** to the **level of the sixth cervical vertebra (C6).** where it continuous as the esophagus .
- Although it is a muscular tube, it remains open anteriorly, giving it a characteristic "U" shape.

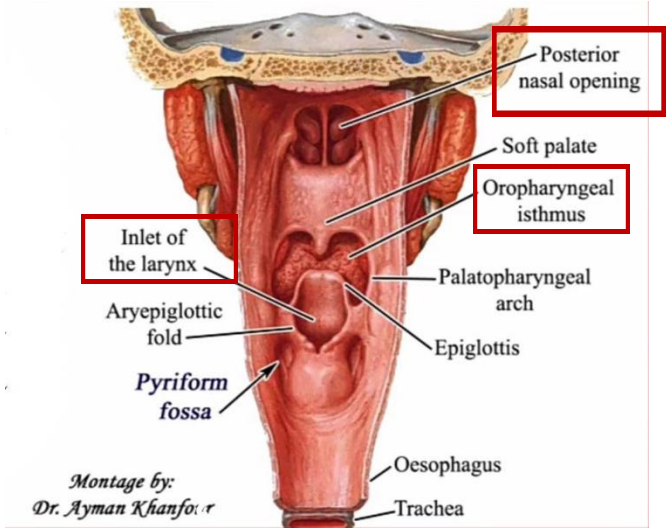




1- The pharynx

The pharyngeal wall is Musculo-membranous but anteriorly deficient, where it is replaced by three major openings:

- The **posterior nasal apertures** (choanae)
- The **oropharyngeal isthmus** (mouth opening)
- The **laryngeal inlet**

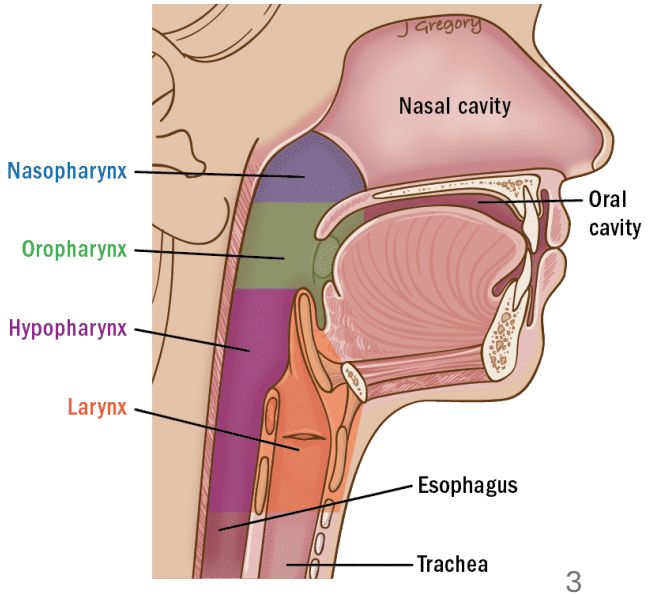


- **Divisions of the Pharynx:**

1.Nasopharynx: Located behind the nasal cavity; communicates with the nasal passages anteriorly through posterior nasal apertures.

2.Oropharynx: Lies behind the oral cavity; opens anteriorly into the mouth through oropharyngeal isthmus.

3.Laryngopharynx (Hypopharynx): Positioned posterior to the larynx and superior to the esophagus.



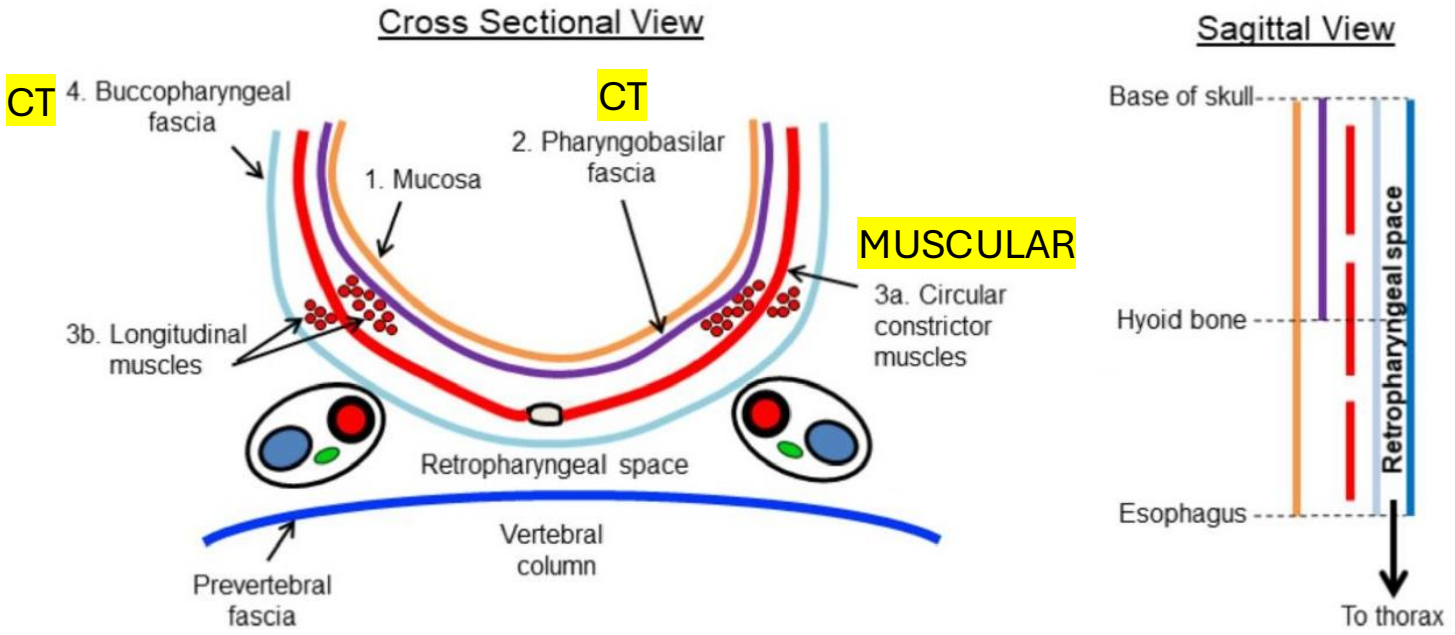
2- Pharyngeal wall

➢ Relate to HISTOLOGY

The wall of the pharynx consists of several distinct layers(musculomembranous):

- Epithelium: lined primarily by **non-keratinized stratified squamous epithelium**.
- **Loose areolar connective tissue**
- **Muscular layer**
- **Outer connective tissue**

The muscular layer lies between two connective tissue layers, providing both support and flexibility.



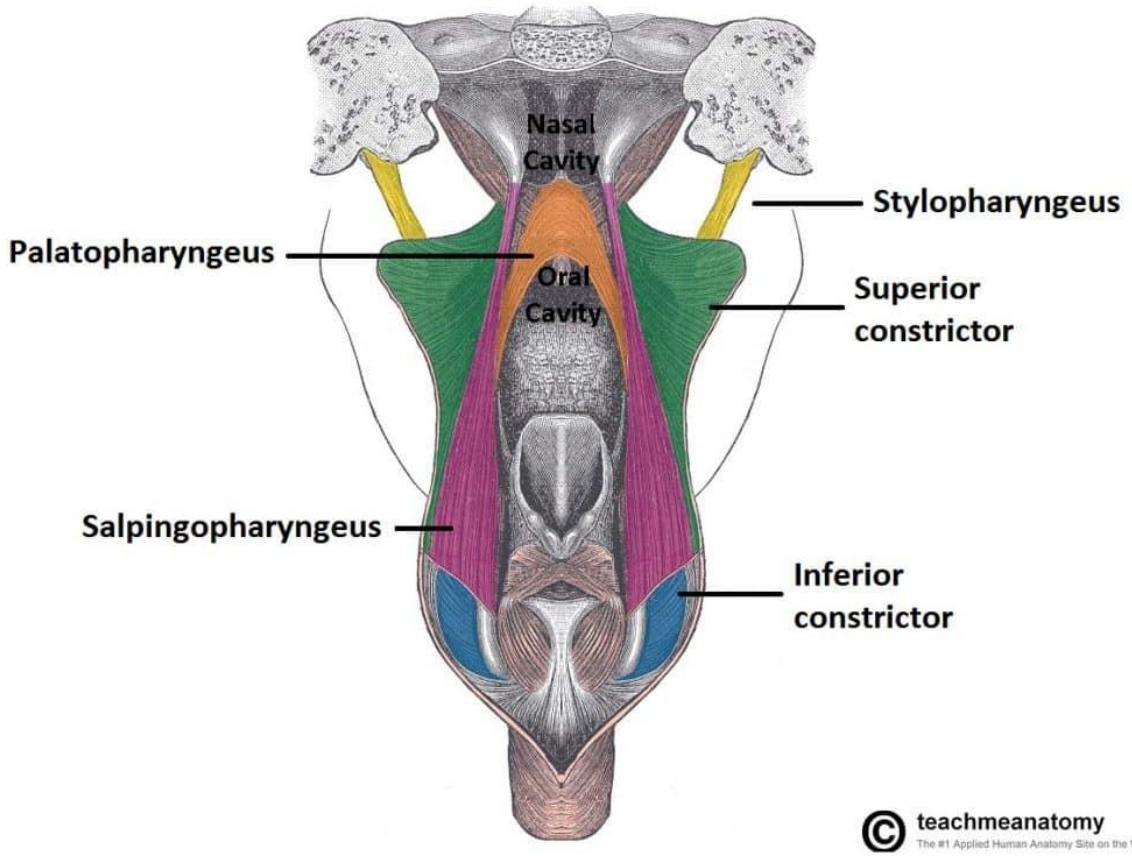
3- Muscles of the Pharynx

The muscular wall of the pharynx contains two groups of muscles based on their orientation:

- Three circular **constrictor muscles**: (main muscles)
  1. Superior constrictor
  2. Middle constrictor
  3. Inferior constrictor

- Two **oblique/ Longitudinal muscles**:
  1. Stylopharyngeus
  2. Salpingopharyngeus

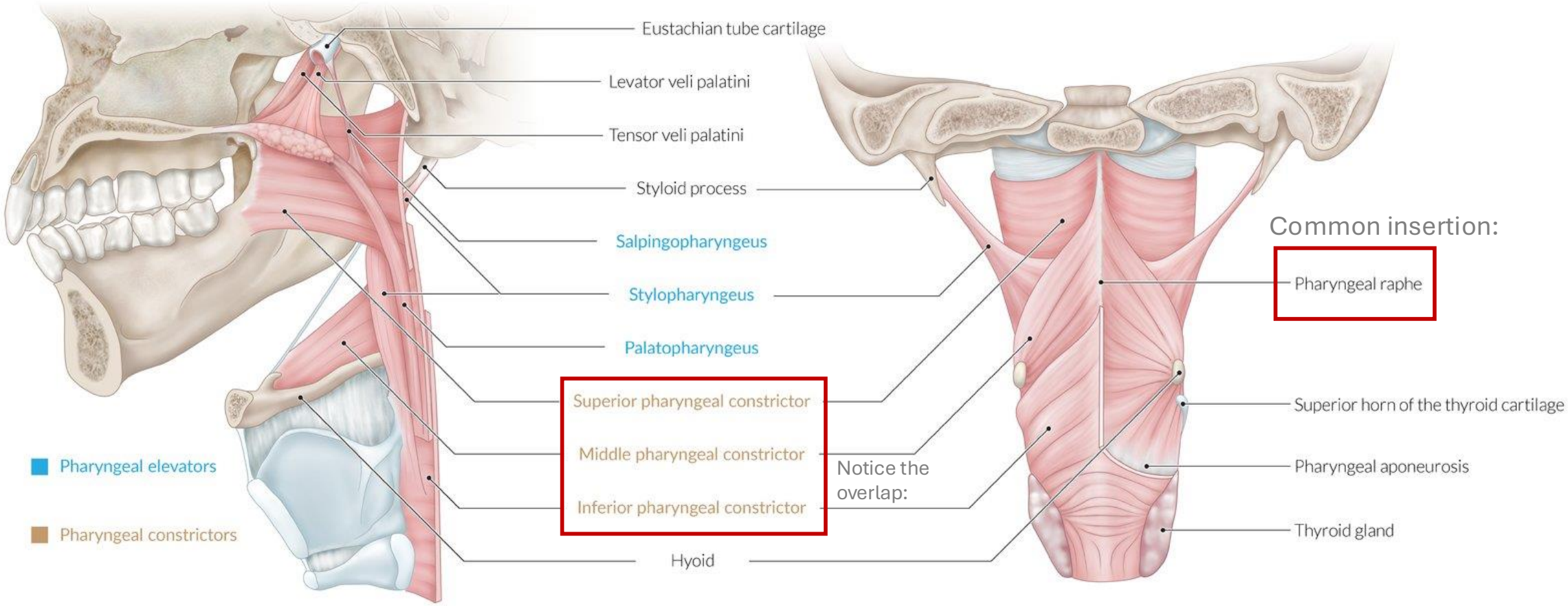
Note that:
All pharyngeal muscles are innervated by the pharyngeal plexus except the **stylopharyngeus**, which is supplied by the **glossopharyngeal nerve.**



4- Constrictor Muscles of the Pharynx

-	Origin	Insertion	Innervation	Action
Superior constrictor	Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament, & mylohyoid line of the mandible.	**Pharyngeal raphe** ↓ midline fibrous seam that begins at the **pharyngeal tubercle**, located just anterior to the foramen magnum of the occipital bone, down to the esophagus.	**Pharyngeal plexus** formed by: • Vagus N. • Accessory N. • Glosso-pharyngeal N.	**propels the bolus downward** (These muscles run in a circular direction, contract sequentially to generate peristaltic movement, pushing the bolus of food downward from the oropharynx to the esophagus.)
Middle constrictor	hyoid bone.			
Inferior constrictor -next slide-	Lamina of thyroid cartilage, cricoid Cartilage.			

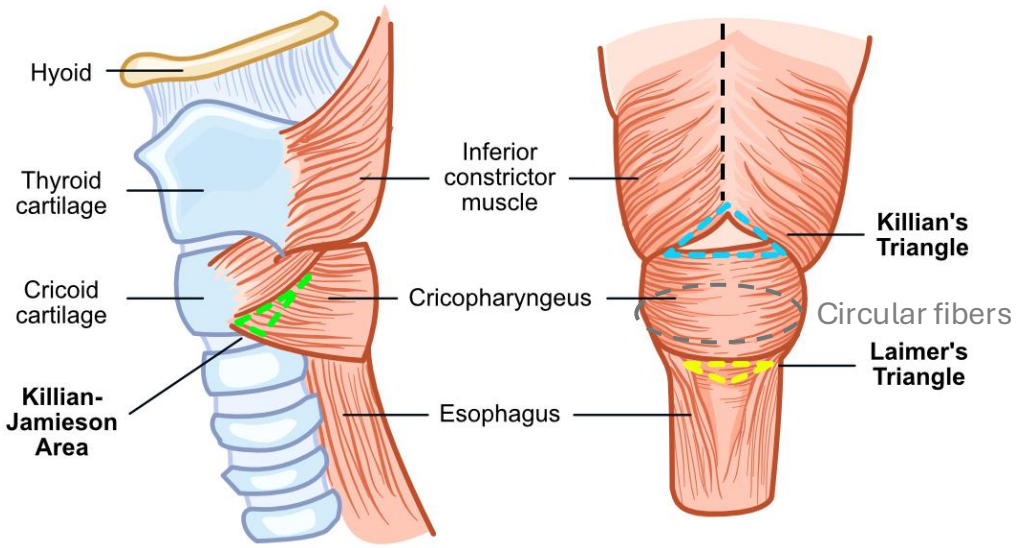
4- Constrictor Muscles of the Pharynx



4- Constrictor Muscles of the Pharynx

- **Cricopharyngeus Muscle (lower part of the Inferior Constrictor):**

Origin:	**Insertion**:
Cricoid cartilage	Pharyngeal raphe



- Function: Since the fibers are circular it acts as a physiological sphincter at the junction between the pharynx and the esophagus.

! The cricopharyngeus is normally contracted (closed) and only opens reflexively in response to the bolus touching its mucosa. This prevents: Air from entering the esophagus, which could otherwise accumulate in the stomach (fundus) & be seen as ☹ **black air bubbles on abdominal X-rays**.

- **Killian's Dehiscence** A weak triangular area in the pharyngeal wall located just above the upper border of the cricopharyngeus. It is sensitive and prone to herniation. Stimulation here often causes ☹ **reflexive vomiting**.

5 - Longitudinal (Oblique) Muscles

❑ Stylopharyngeus Muscle

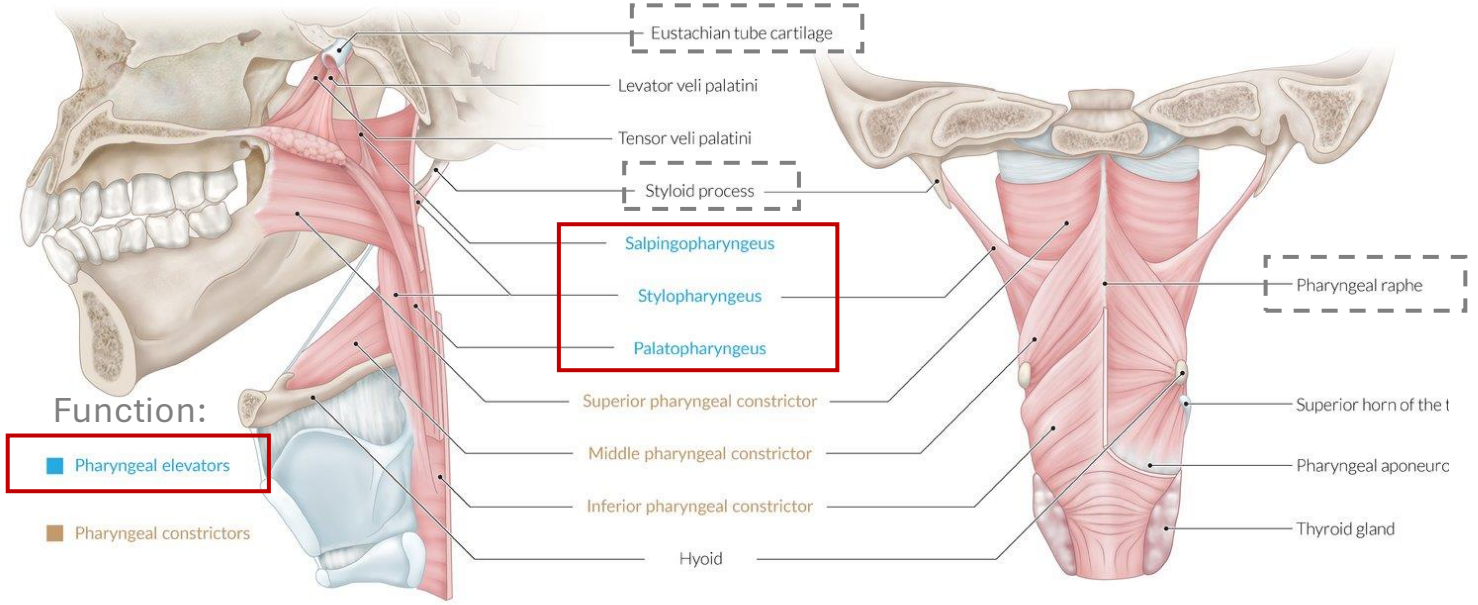
Origin: styloid process

Insertion: Pharyngeal raphe

❑ Salpingopharyngeus M.

Origin: *(auditory) tube

Insertion: Pharyngeal raphe



- Found internally in the wall of the nasopharynx

*The auditory tube, serves as a connection between the middle ear and the nasopharynx. Its primary function is to equalize air pressure on both sides of the tympanic membrane (eardrum) thus maintaining normal hearing and preventing discomfort.

In children, the Eustachian tube is shorter, wider, and more horizontal, which makes it easier for substances to travel from the pharynx to the middle ear. Thus, when a child vomits while lying down, part of the vomit may reach the nasal cavity and ascend through the **Eustachian tube into the middle ear.** This can result in ☹ **otitis media (middle ear infection),** that's why examination of tympanic membrane is crucial in emergencies.

6- Interior of the Pharynx

A coronal section of the pharynx reveals three anterior openings that allow communication between the pharynx and other parts (nose, mouth & larynx)

- REPEATED INFO, just to make things in context.

1.Choanae:

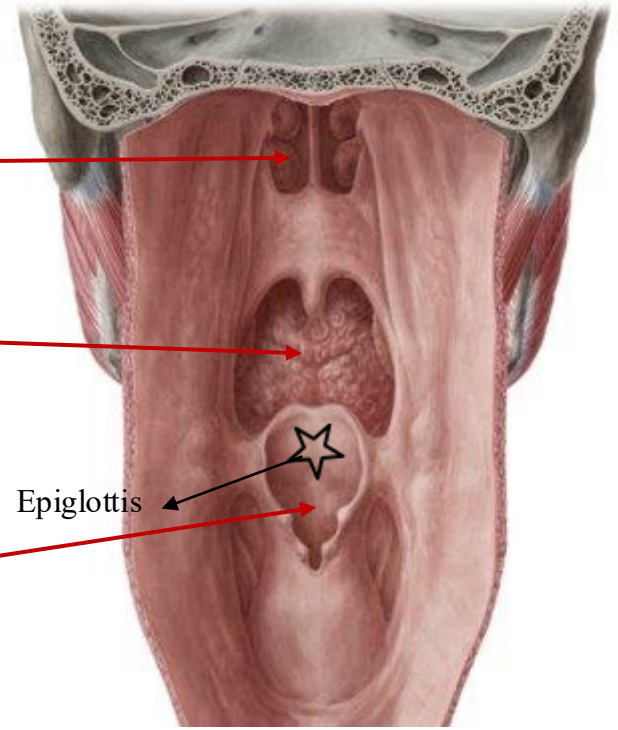
- These are the posterior openings of the nasal cavity.
- They lead into the nasopharynx.

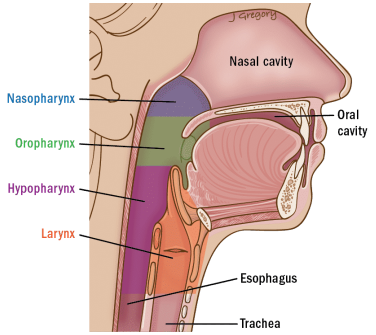
2.Oropharyngeal Isthmus:

- This is the opening from the oral cavity into the oropharynx.

3.Inlet of the Larynx:

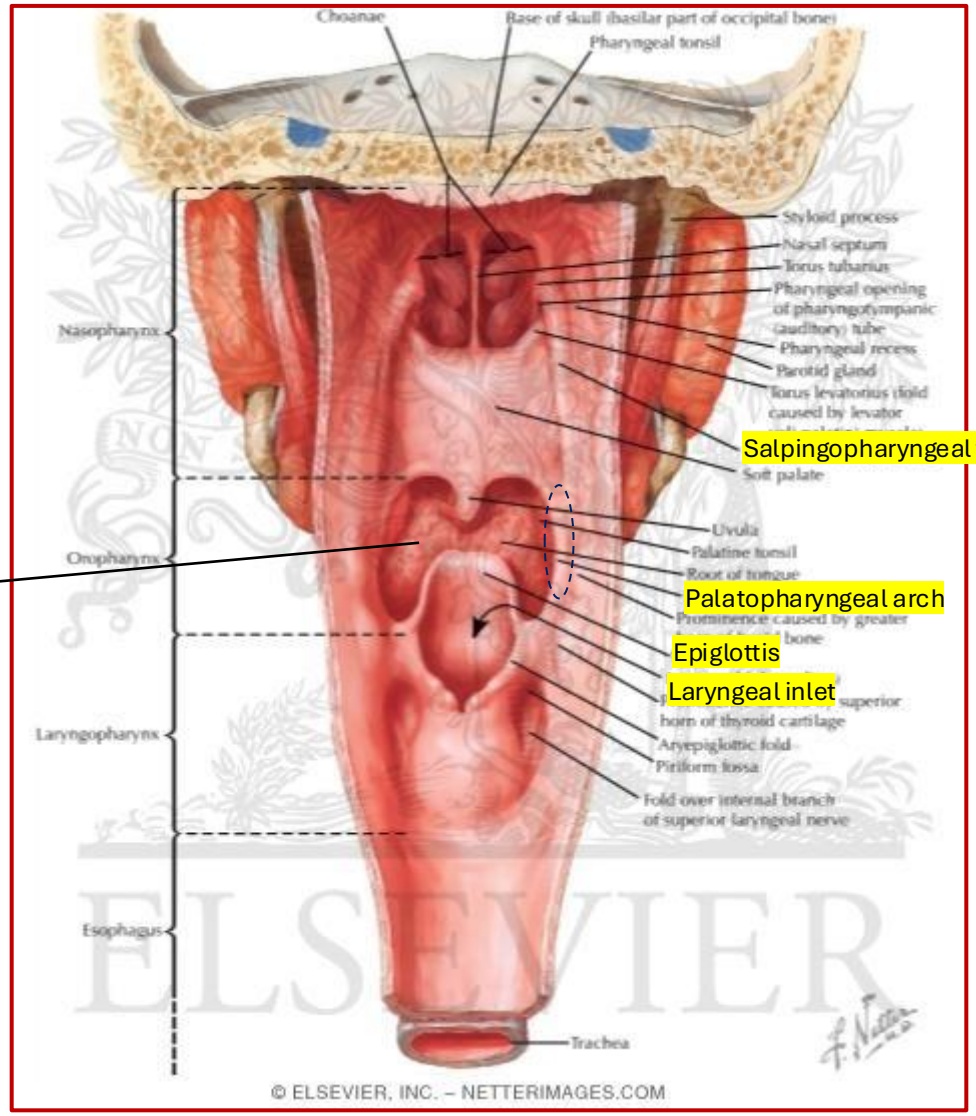
- This is the opening from the laryngopharynx into the larynx.
- It is bordered by the epiglottis.
- Opening from the pharynx to the larynx, allowing air to enter the trachea.





laryngopharynx is a point at which the pharynx divides *anteriorly* into the larynx → trachea and *posteriorly* into the esophagus.

6- Interior of the Pharynx



lies within the mid-sagittal section.

7- Nasopharynx

The nasopharynx begins at the base of the skull and ends at the soft palate.

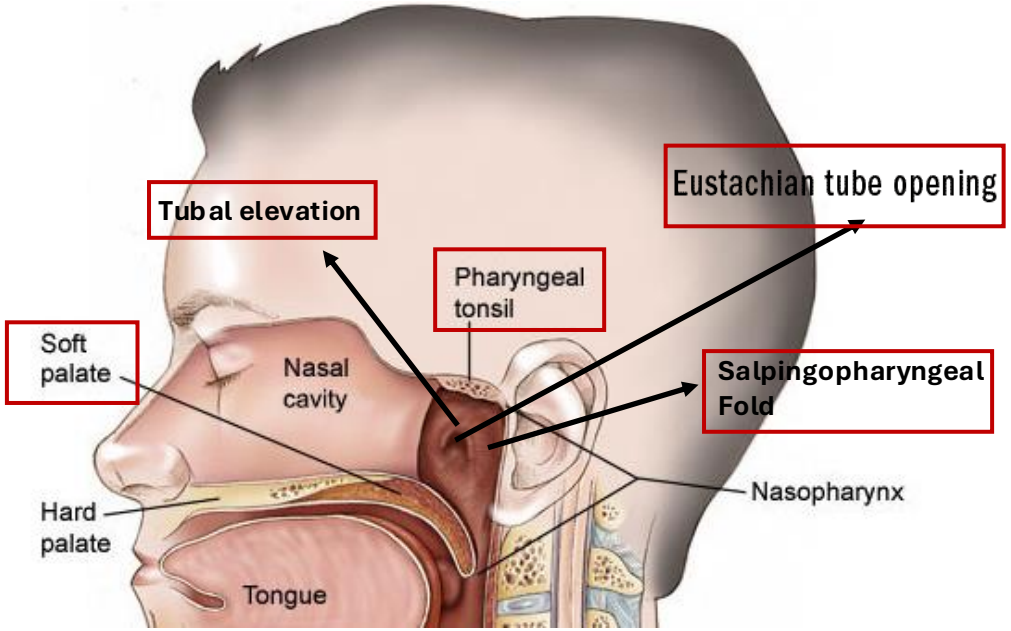
Structures inside the Nasopharynx:

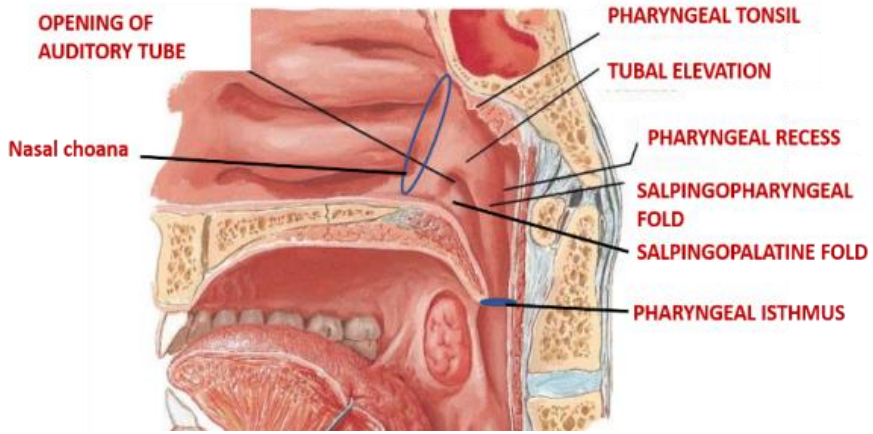
1- On the lateral side walls, there is an **opening** for the **Eustachian tube** This opening is seen as a bump called the **tubal elevation**. Just below the tubal elevation, there's a fold of tissue called the **Salpingopharyngeus fold**.

2- On the roof of the nasopharynx are the **pharyngeal tonsils**.

If *pharyngeal tonsils become swollen (often in children), they are called ☹ **adenoids**. Swollen adenoids block the nasal air passage, so Air cannot easily pass through the nose.
This forces the child to breathe through the mouth, leading to:

- Snorting sounds
- Mouth breathing
- Sometimes, even speech problems or sleep disturbances.





Tonsils are masses of lymphoid tissue that protect the body by trapping bacteria and viruses from entering through the mouth and nose. Main tonsils are Palatine, lingual and pharyngeal tonsils

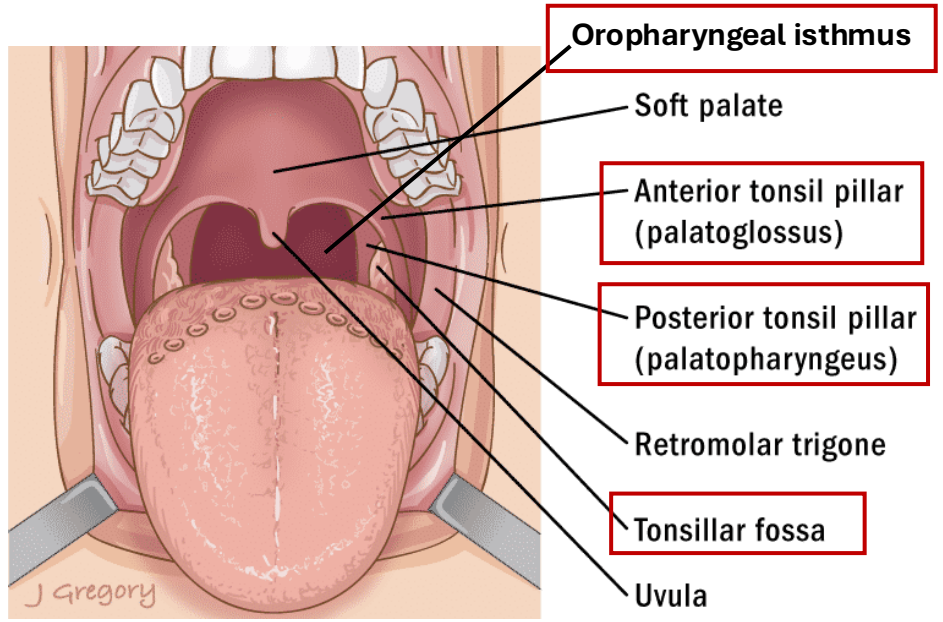
8- Oropharynx

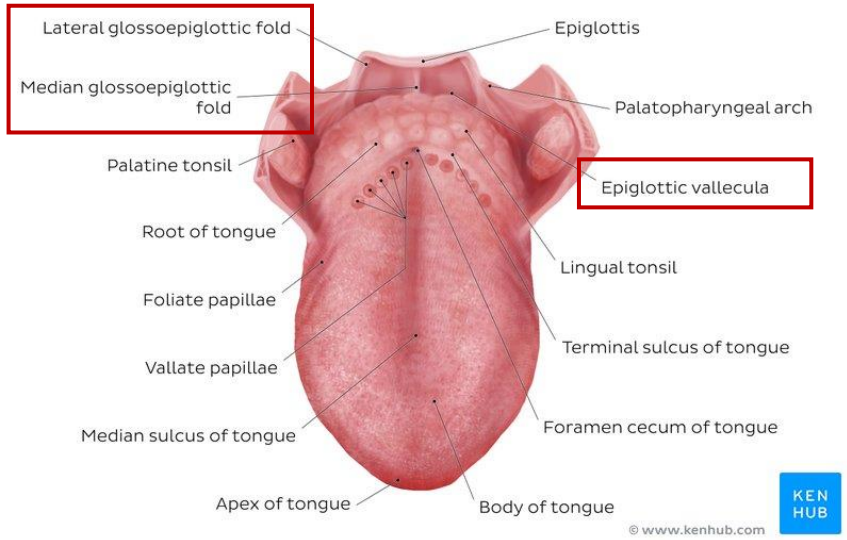
- Oropharynx Lies behind the oral cavity and extends from the soft palate up to the upper border of epiglottis.

Structures inside the Oropharynx:

1) **Palatine tonsils** in the tonsillar fossa between the palatoglossal and palatopharyngeal arches.- Slide 20
2) **Oropharyngeal isthmus**, marking the transition from the oral cavity to the pharynx.
3) **Glossoepiglottic (aryepiglottic) folds**, connecting the tongue to the epiglottis.
4) **Vallecula**: A depression between aryepiglottic folds, where saliva may collect.

- The oropharynx contains the **palatine tonsils** on the lateral walls near the oropharyngeal isthmus. Infection of these tonsils is called ☹ **tonsillitis.**

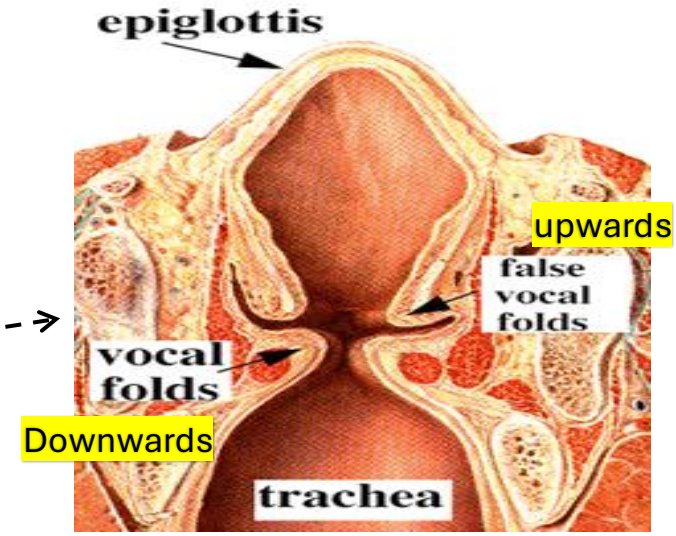




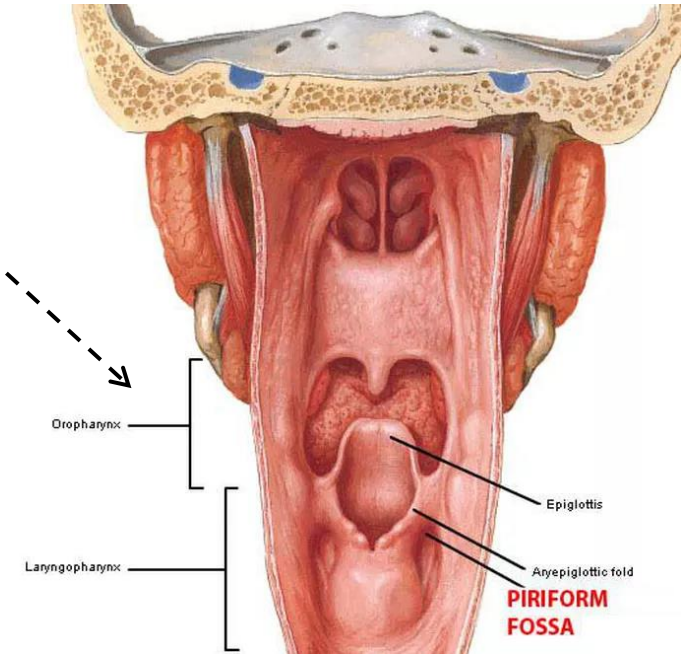
9- Laryngopharynx (Hypopharynx)

- It lies behind the larynx and extends from the upper border of the epiglottis down to the lower border of the cricoid cartilage (around the C6 vertebral level). It is continuous below with the esophagus.

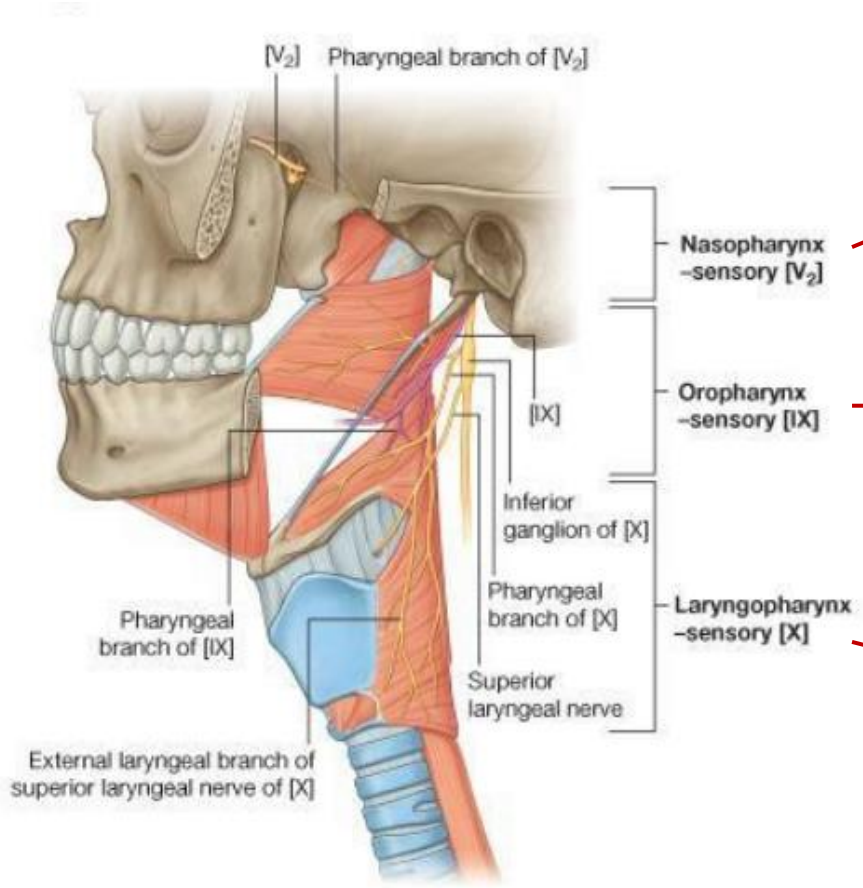
- Epiglottis protects the laryngeal inlet during swallowing. It lies above the false and true vocal cords, the latter being crucial for phonation (speech production).



- **Piriform fossa**: is a depression in the mucous membrane on each side of the laryngeal inlet. It lies between the pharynx and the larynx. It is a common site for ☹ **foreign body lodgment**, especially **fishbones**. Clinically, the piriform fossa is significant because it confines potential obstruction sites, facilitating easier identification and removal of foreign bodies by healthcare providers.



10- Sensory Nerve Supply of the Pharyngeal Mucous Membrane

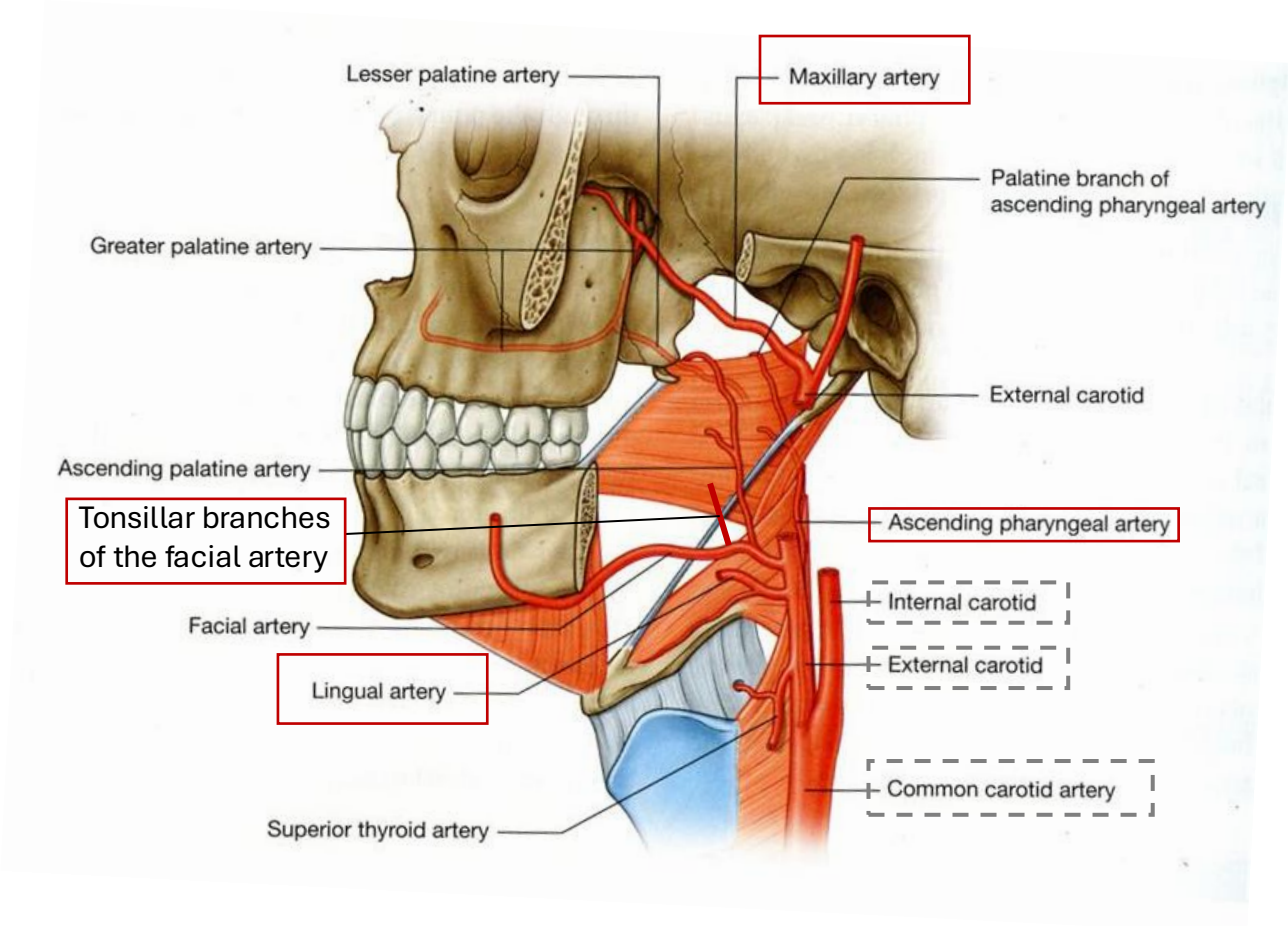


- **Nasopharynx**: Sensory innervation by the maxillary nerve (CN V2).
- **Oropharynx**: Sensory innervation by the glossopharyngeal nerve (CN IX).
- **Laryngopharynx**: Sensory innervation by the internal laryngeal branch of the vagus nerve (CN X) This branch enters the mucosa between the middle & inferior constrictor muscles of the pharynx.

11 - Blood Supply of the Pharynx

- The **common carotid artery** bifurcates into:
  - **i.** **External carotid artery** supplies the pharynx through the above branches.
  - **ii.** **Internal carotid artery** gives no branches in the neck.

- The pharynx receives arterial blood from multiple branches of the **external carotid artery**, including:
  - **Ascending pharyngeal artery**
  - **Tonsillar branches of the facial artery**
  - **Branches of the maxillary artery**
  - **Branches of the lingual artery**

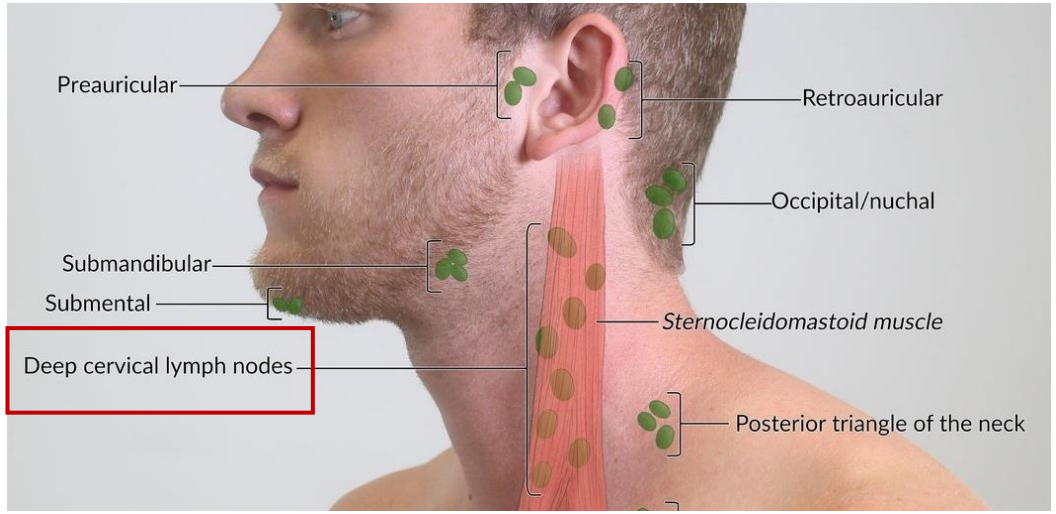


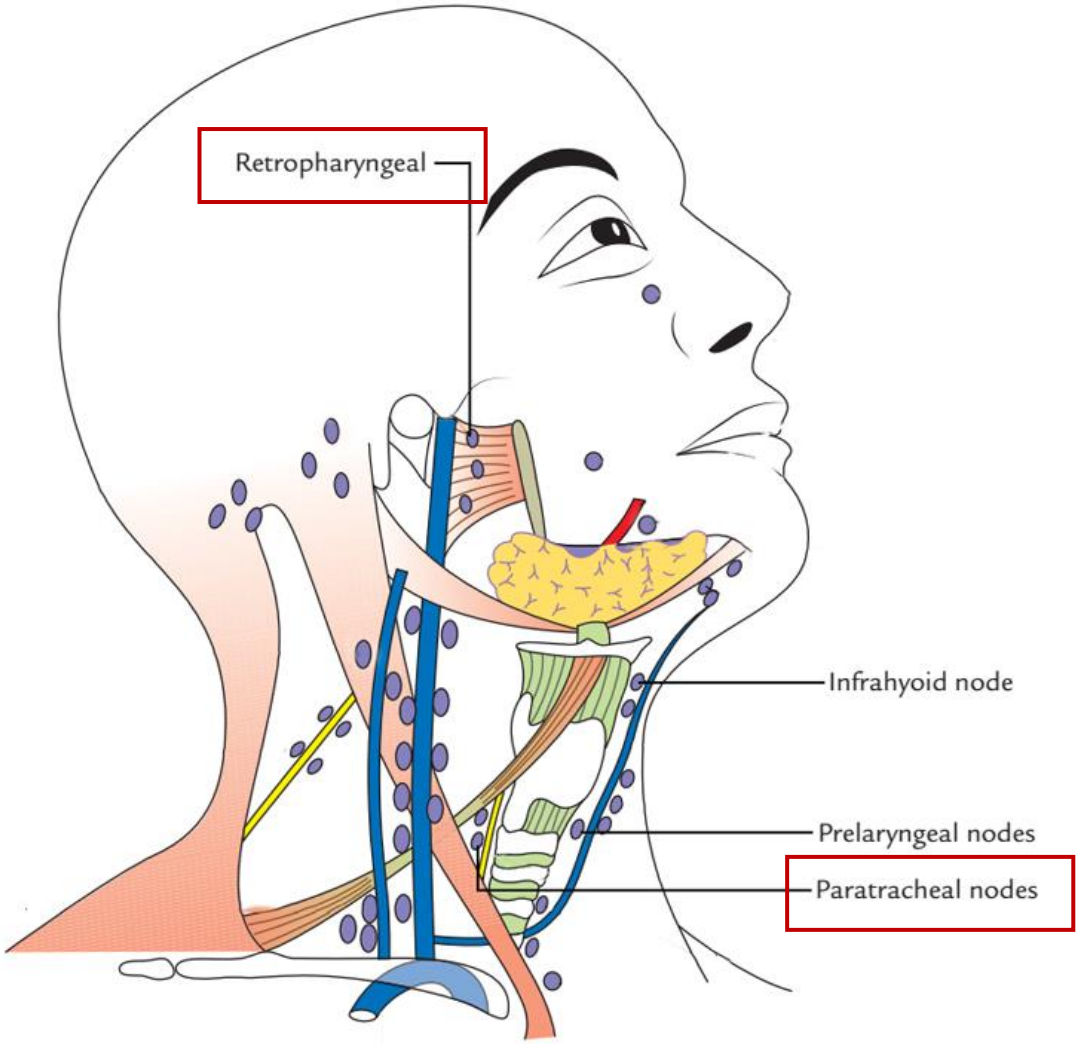
12 - Lymph Drainage of the Pharynx

- Lymph from the pharynx drains **directly** into the **deep cervical lymph nodes**

Or

- **Indirectly** via the **retropharyngeal** and **paratracheal nodes**, which then drain into the **deep cervical nodes**.





13- Process of Swallowing (Deglutition)

- **Relate to PHSIOLOGY**

•Bolus Formation and Pressure

→ When the food bolus enters the oral cavity, pressure builds up against the palate.

•Closure of the Oropharyngeal Isthmus

→ The soft palate senses this and moves downward to close the oropharyngeal isthmus, while the base of the tongue moves upward to push the bolus backward.

•Closure of the Nasopharynx

→ After the bolus passes the isthmus, the soft palate moves upward and backward, while the posterior wall of the pharynx moves forward (by a constrictor muscle), closing the nasopharynx to prevent food from going upward.

•Protection of the Airway (Laryngeal Inlet)

→ As the bolus moves into the pharynx, the epiglottis bends downward and backward under the pressure of the bolus, while the larynx and pharynx move upward.

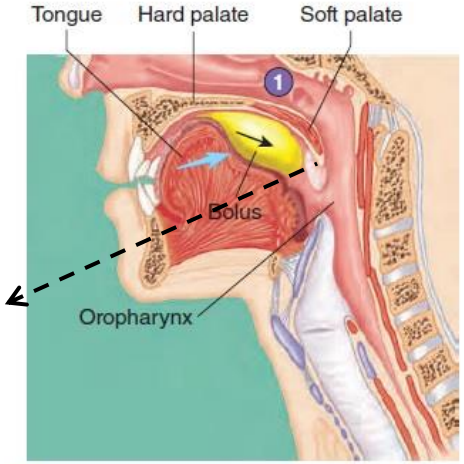
→ This movement closes the laryngeal inlet completely, preventing food from entering the airway and triggering a cough reflex.

→ The bolus is then safely directed into the esophagus.

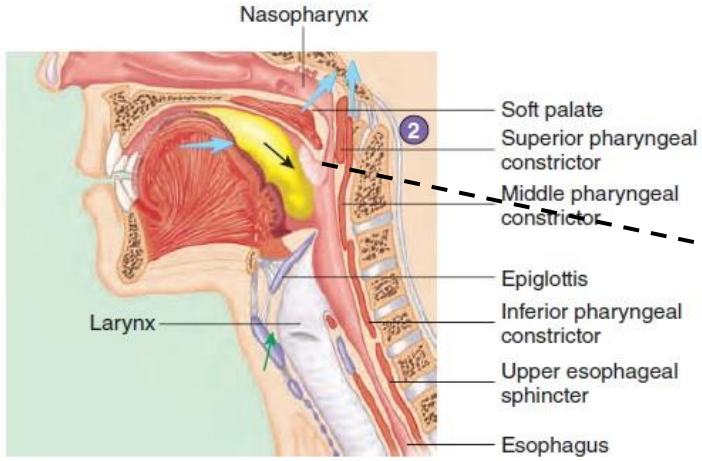
Extra slide: - READ ONLY -

Deglutition

Bolus forms → Pressure builds in the mouth.
Soft palate moves down → Closes the passage to the pharynx; tongue pushes food backward.

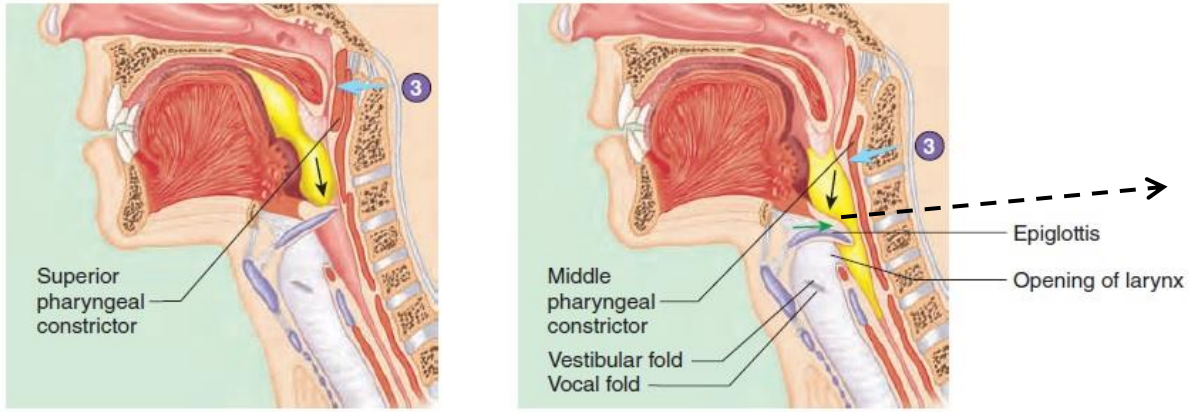


1 During the **voluntary phase**, a bolus of food (*yellow*) is pushed by the tongue against the hard and soft palates and posteriorly toward the oropharynx (*blue arrow* indicates tongue movement; *black arrow* indicates movement of the bolus). *Tan:* bone; *purple:* cartilage; *red:* muscle.



2 During the **pharyngeal phase**, the soft palate is elevated, closing off the nasopharynx. The pharynx and larynx are elevated (*blue arrows* indicate muscle movement; *green arrow* indicates elevation of the larynx).

Soft palate moves up → Closes the nasopharynx so food doesn't go up.

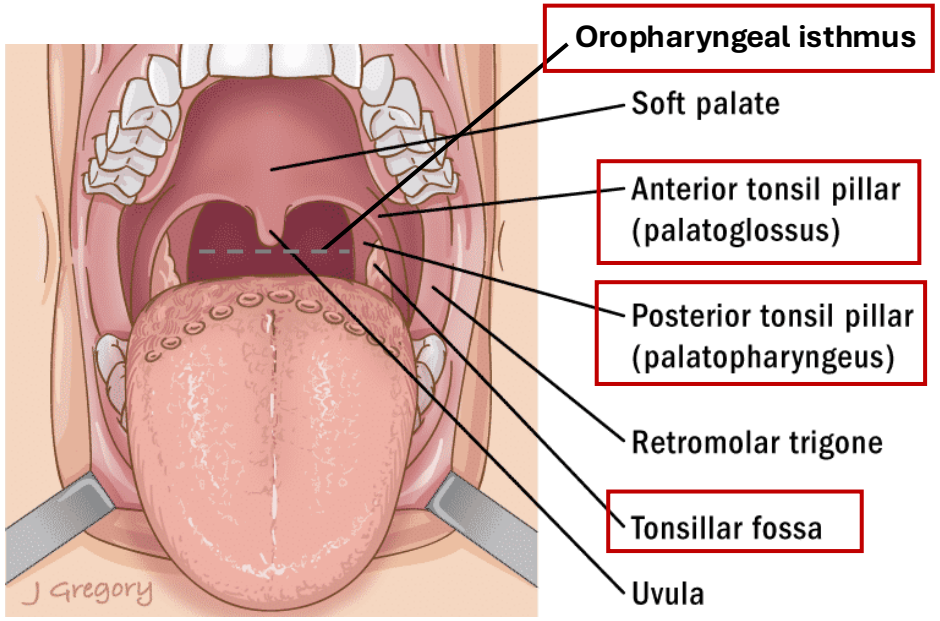


3 Successive constriction of the pharyngeal constrictors from superior to inferior (*blue arrows*) forces the bolus through the pharynx and into the esophagus. As this occurs, the vestibular and vocal folds expand medially to close the passage of the larynx. The epiglottis (*green arrow*) is bent down over the opening of the larynx largely by the force of the bolus pressing against it.

Epiglottis bends down → Larynx moves up to close the airway, and food goes safely into the esophagus.

14- Palatine tonsils

- The palatine tonsils are two masses of lymphoid tissue, each located in the depression on the lateral wall of the oral part of the pharynx (oropharyngeal isthmus) between the palatoglossal and palatopharyngeal arches

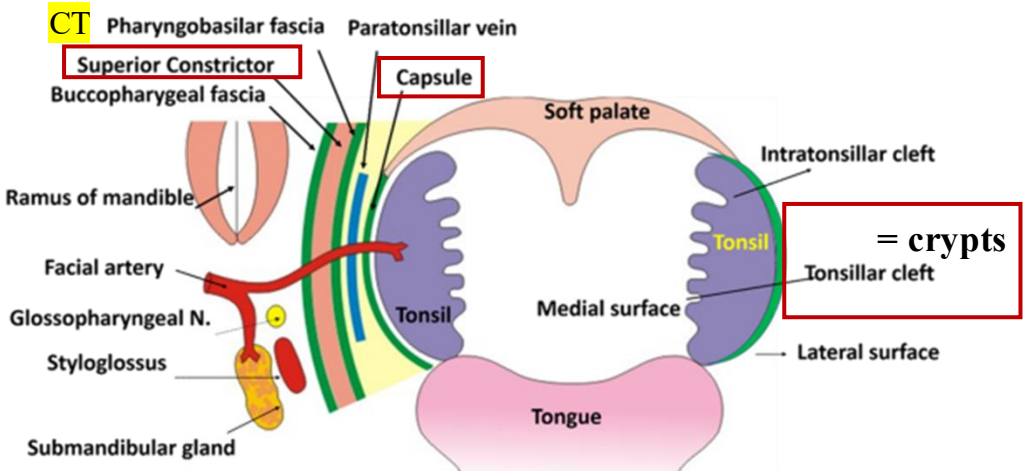


➢ Structure:

- Each tonsil is covered by mucous membrane, with its **free medial surface** projecting into the pharynx. The surface is pitted by numerous small openings that lead into *tonsillar crypts.

- The **lateral surface** is covered by a fibrous capsule and loose connective tissue. This loose connection allows nerves and blood vessels to pass through.

- The **capsule** is separated from the superior constrictor muscle by a loose areolar CT layer.

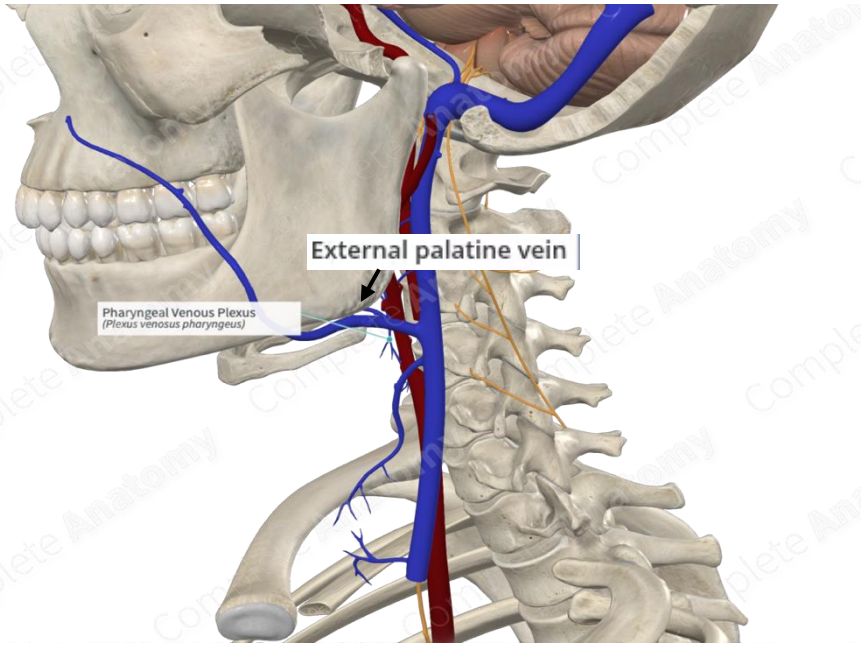


Tonsillar crypts are small pockets in the tonsil that help catch germs for the immune system, but they can also be sites of infection!

14- Palatine tonsils

➢ Relations:

- The **external palatine vein** (also called supra-palatine vein) descends from the soft palate in this tissue and drains into the pharyngeal venous plexus.
- The lateral surface of the tonsil lies close to:
  - **The common carotid artery,**
  - **The tonsillar branch of the facial artery**
  - **Nearby veins**.



➢ Function and Clinical Note:

- The **tonsils** filter bacteria, viruses, and foreign bodies, especially important in children.
- They reach maximum size during early childhood.
- After puberty, the tonsils shrink, making ☹ **tonsillitis** less common (e.g., infection once a year instead of three times).
- When inflamed, the loose connection to surrounding tissues allows infection to spread easily. thus, should be treated immediately – see next slide

14- Palatine tonsils

➢ **Clinical Note: -** comp.

- ☺ **Tonsillectomy** is often performed due to ☹ **recurrent tonsillitis** **(4 to 5 times per year)** in children, which can be caused by **Streptococcus bacteria**. If left untreated, these bacteria may spread to other parts of the body, leading to complications such as:
  - **Arthritis** (joint inflammation)
  - **Rheumatic fever** (heart inflammation)
  - **Glomerulonephritis** (kidney damage)

- Patients should be observed for 24 hours after surgery due to **potential post-operative bleeding!**, as the vein running along the superior constrictor muscle could be accidentally cut during surgery. If the vein or artery is cut, it may need to be ligated. The constrictor muscle contraction post-operation could lead to severing the connection, causing bleeding.

- Removing the tonsils does not cause significant harm because the body has other lymphoid tissue to compensate.

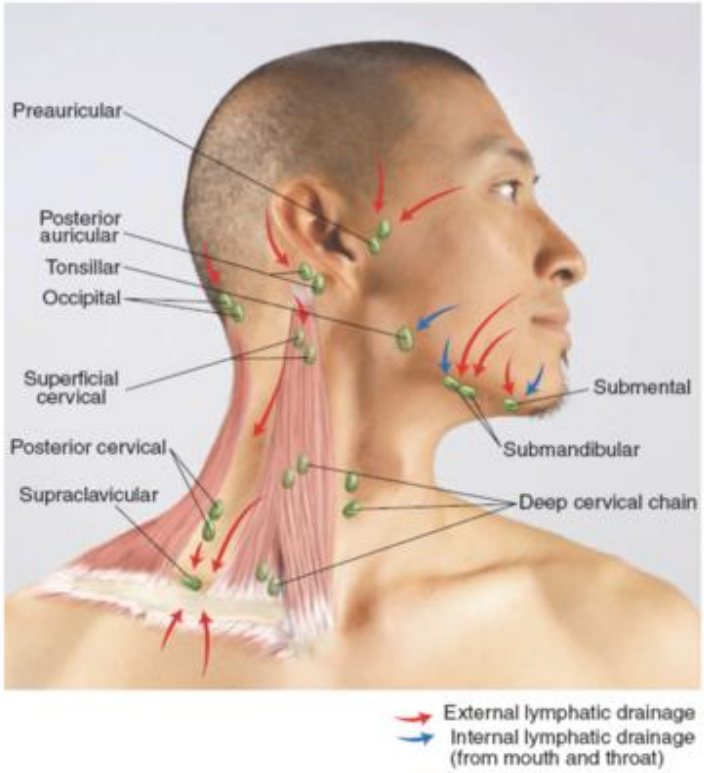
14- Palatine tonsils

➢ Blood supply:

- Arterial supply → **tonsillar branch of the facial artery**.
- Venous drainage → The veins that drain the tonsils pierce the superior constrictor muscle and then join the external palatine vein, which drains into the pharyngeal venous plexus.

➢ Lymph drainage:

- The tonsils drain into the upper deep cervical lymph nodes, located just below and behind the angle of the mandible.



15- Tonsils

Recall: Tonsils are lymphoid tissues in the pharynx that help filter bacteria and viruses.

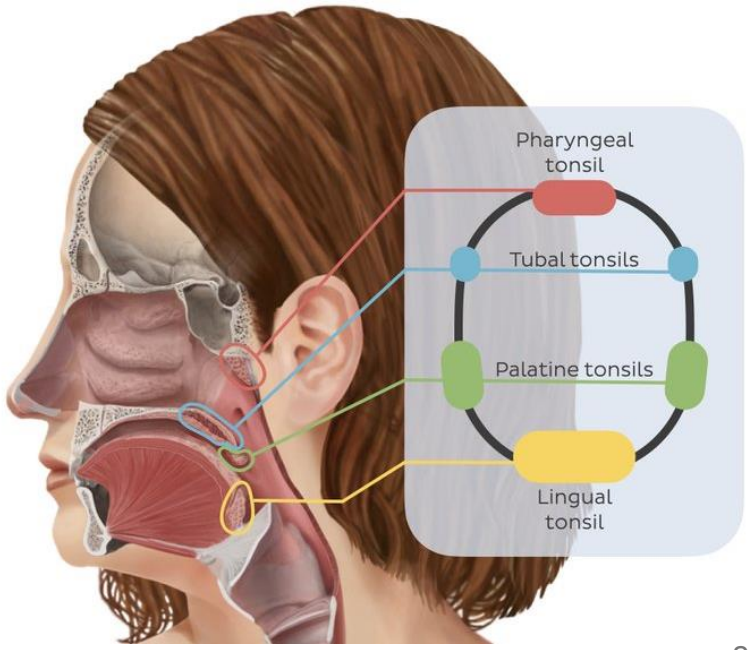
- Palatine Tonsils
- Pharyngeal Tonsil (Adenoid)
- Lingual Tonsils
- Tubal Tonsils

They form a lymphoid ring (Waldeyer's Ring) providing immune defense

➢ Waldeyer's Ring of Lymphoid Tissue

The **Waldeyer's Ring** is a lymphoid tissue ring around the oropharyngeal isthmus, made up of:

- **Lateral part**: Formed by the **palatine tonsils** and **tubal tonsils** (around the opening of the auditory tube).
- **Upper part**: Formed by the **pharyngeal tonsil** (in the roof of the nasopharynx).
- **Lower part**: Formed by the **lingual tonsil** (at the posterior third of the tongue).

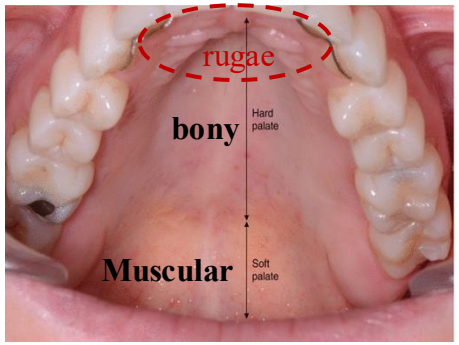


16- The palate

- 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 and the **soft palate** behind.

Hard palate

- Formed by the palatine processes of the maxillae and the horizontal plates of the palatine bones.
- Dense and adherent with periosteum.
- It makes grooves (rugae).
- Has a bony spine for attachment of the palatine tendon, which contributes to the soft palate's formation – slide 26.



Feel it on yourself ;)

Soft palate

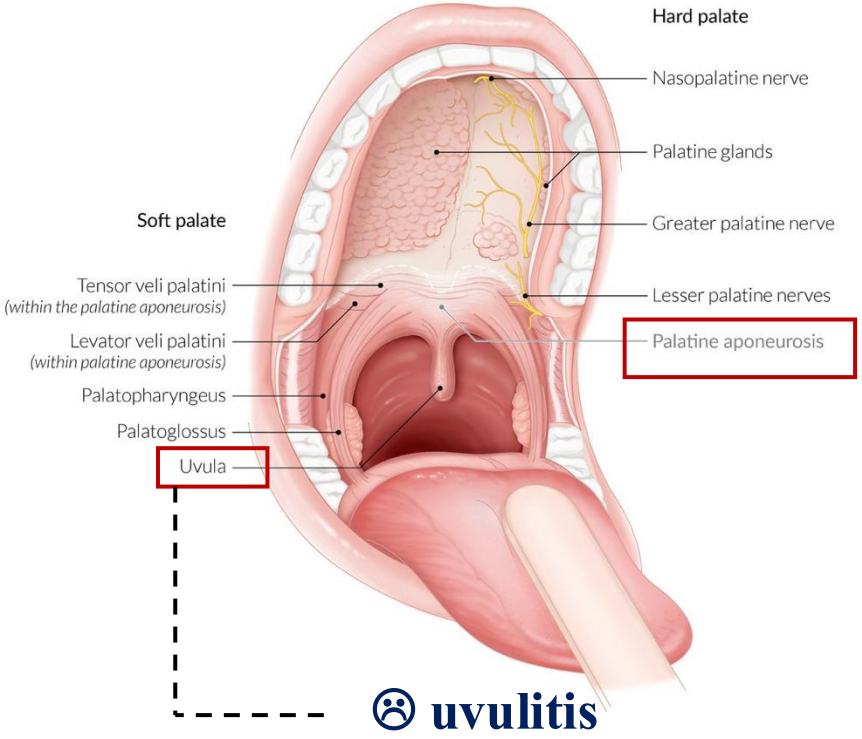
- A muscular structure composed of five muscles – slide 27.
- Made from the extension of palatine tendon & Covered by mucosa (loose CT) – slide 26.
- It can move in different directions - slide 28.

17- Soft palate

- The **soft palate** is lined by **mucous membrane** on both its upper and lower surfaces to keep it moist and protected. Under this mucosa lies a strong **fibrous sheet** called the **palatine aponeurosis**. This aponeurosis attaches to the **posterior edge** of the **hard palate**, starting from a small bony point called the **palatine spine**.

- The **palatine aponeurosis** is the **expanded tendon** of the **tensor veli palatini muscle**. Both the **right and left tensor veli palatini muscles** come together at the midline to form this aponeurosis. At its end, the aponeurosis extends downwards to help form the **uvula**.

- **Greater and lesser palatine foramina** are located in the hard palate and allow the passage of the greater and lesser palatine vessels and nerves, which are involved in the sensory and blood supply to the soft palate and other structures of the oral cavity.



☹ **uvulitis**

Multiple Diseases can lead to uvula enlargement.

18- Soft palate muscles

Muscle	Origin	Insertion	Innervation	Action
Tensor Veli Palatini	Auditory tube	Palatine aponeurosis	★ Nerve to medial pterygoid (Mandibular N.)	Tenses the soft palate
Levator Veli Palatini	Petrous part of temporal bone, auditory tube	Palatine aponeurosis	**Pharyngeal plexus** formed by: • Accessory N. • Glosso-pharyngeal N. • Cranial Accessory through vagus N. Located in the post. Pharngeal wall	Elevates the soft palate thus closing the nasopharynx
Palatoglossus	Palatine aponeurosis	Tongue		Elevates the tongue, closes the oropharyngeal isthmus
Palatopharyngeus	Palatine aponeurosis	Pharyngeal wall		Elevates the pharynx during swallowing
Musculus Uvulae	Palatine aponeurosis	Uvula		Elevates the uvula (soft palate)

19- Soft palate movements

At rest:

- plays a role in **speech**, especially in the articulation of vowels. For example, when pronouncing the letter "N", the air passes through the nasal cavity (nasopharynx stays open). Other sounds that need to exit through the oral cavity require the soft palate to block the nasopharyngeal isthmus, so air is directed forward.
- The soft palate is also important in **respiration**: You can breathe through the nose (nasal pathway open) Or through the mouth (if soft palate adjusts position).

Movements of the Soft Palate Based on Functional Needs:

Movement	**Function**	**Explanation**
Upward and backward	**Closes nasopharynx/nasopharyngeal isthmus**	Seen during **vomiting** to prevent vomit from entering nasal cavity.
Downward and forward	**Closes oropharyngeal isthmus**	Happens during **mastication** (chewing) to create tension and increase intraoral pressure.
Sudden elevation	**Opens oropharyngeal passage**	During **swallowing**, allows food (bolus) to pass from the mouth into the pharynx.

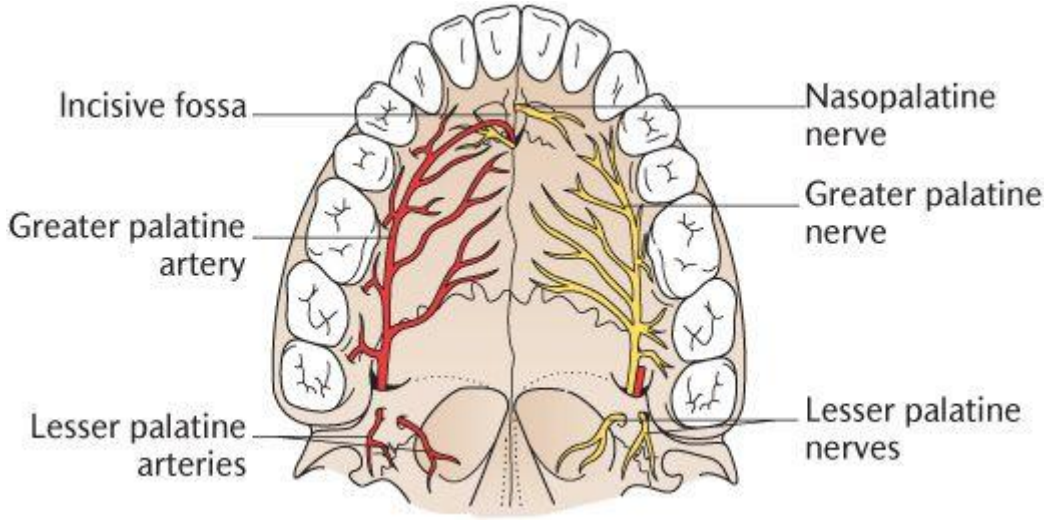
20- Palate Innervation

Nerve Supply of the Palate:

- **Nasopalatine nerve (branch of maxillary nerve):** Enters the front of the hard palate through the incisive foramen.*(Opposite to the course of greater palatine artery).
- **Glossopharyngeal nerve**: Supplies the soft palate through the pharyngeal plexus.

Blood Supply of the Palate:

- *Greater palatine branch of the maxillary artery.
- Ascending palatine branch of the facial artery.
- Ascending pharyngeal artery.



Lymphatic Drainage of the Palate:

To the **deep cervical lymph nodes**.

***Note about the Hard Palate:**

Incisive fossa contains the incisive foramen. Greater palatine artery
Supplies the hard palate, then passes through the incisive foramen to supply the nasal cavity.