ANATOMY

بسم الله الرحمن الرحيم

MID | Lecture 2

The pharynx and the palatine tonsils (pt.1) & The palate (pt.2)

﴿ وَإِن تَتَوَلَّوْا يَسْتَبْدِلْ قَوْمًا غَيْرَكُمْ ثُمَّ لَا يَكُونُوا أَمْثَالَكُم ﴾

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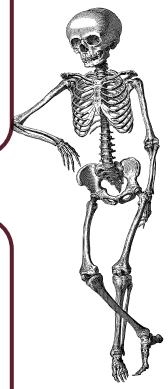


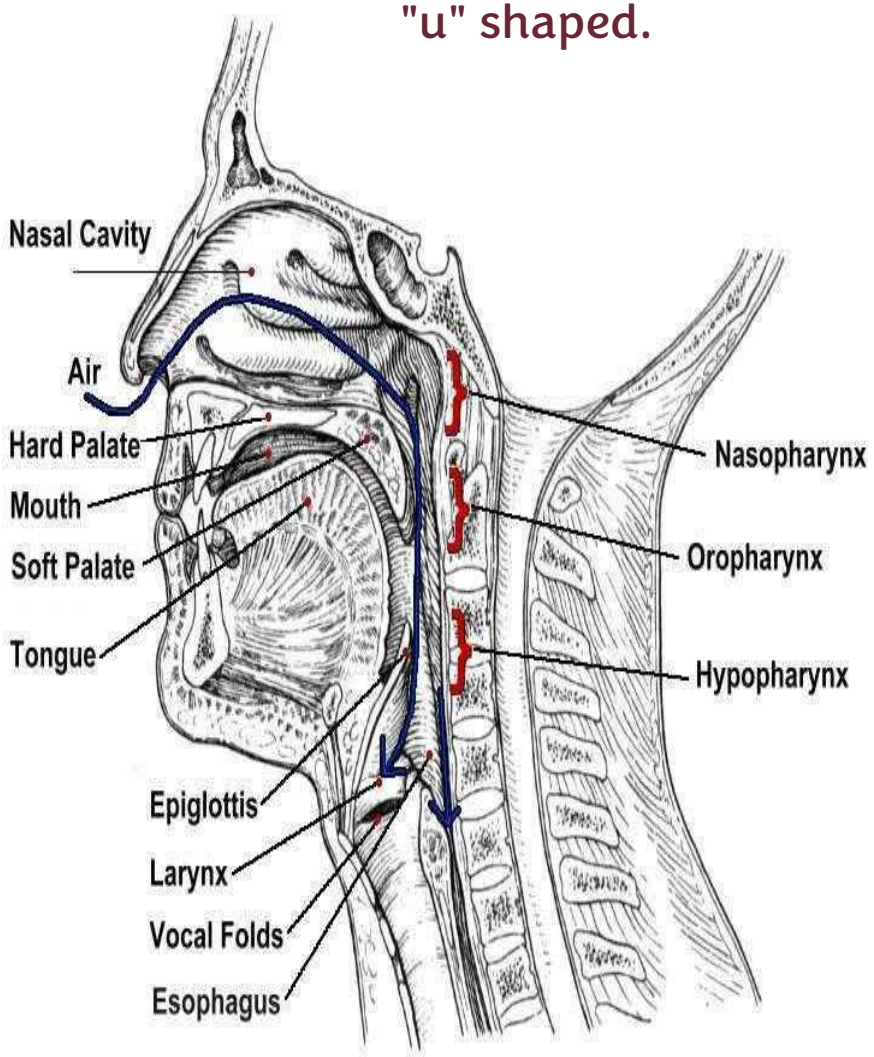
Color Code: Slides + Dr. doesn't mention | Slides + Dr. mentions | Extra from Dr.

~~*Click at the blue lobster to enter the quiz*~~

The Pharynx

- The pharynx is situated behind the nasal cavities, the mouth, and the larynx
- and may be divided into nasal, oral, and laryngeal parts
- The pharynx is funnel shaped extends from the base of the skull, its upper, wider end lying under the skull and its lower, narrow end becoming continuous with the esophagus opposite the sixth cervical vertebra

It's a muscular tube but is open anteriorly, it's "u" shaped.

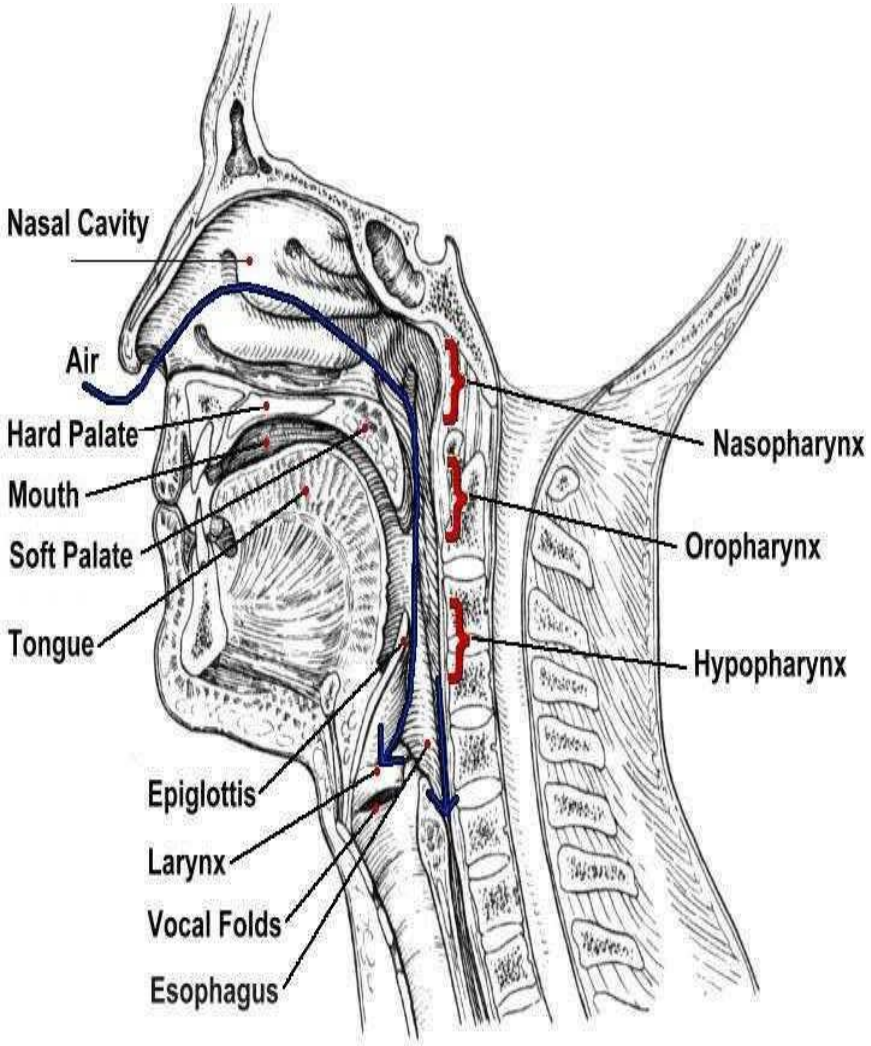


The Pharynx

- The pharynx has a musculomembranous wall, which is deficient anteriorly.
- Here, it is replaced by the posterior openings into the nose (choanae), the opening into the mouth, and the inlet of the larynx.
- By means of the auditory tube, the mucous membrane is also continuous with that of the tympanic cavity.

- The opening of the oral cavity is called oropharyngeal isthmus.
- The muscles lay between two connective tissue.
- But it's bound by the epiglottis.

- The epithelium type is stratified squamous non keratinizied after that we have a loose areolar connective tissue then a muscular layer, and finally connective tissue.



Further Explanation

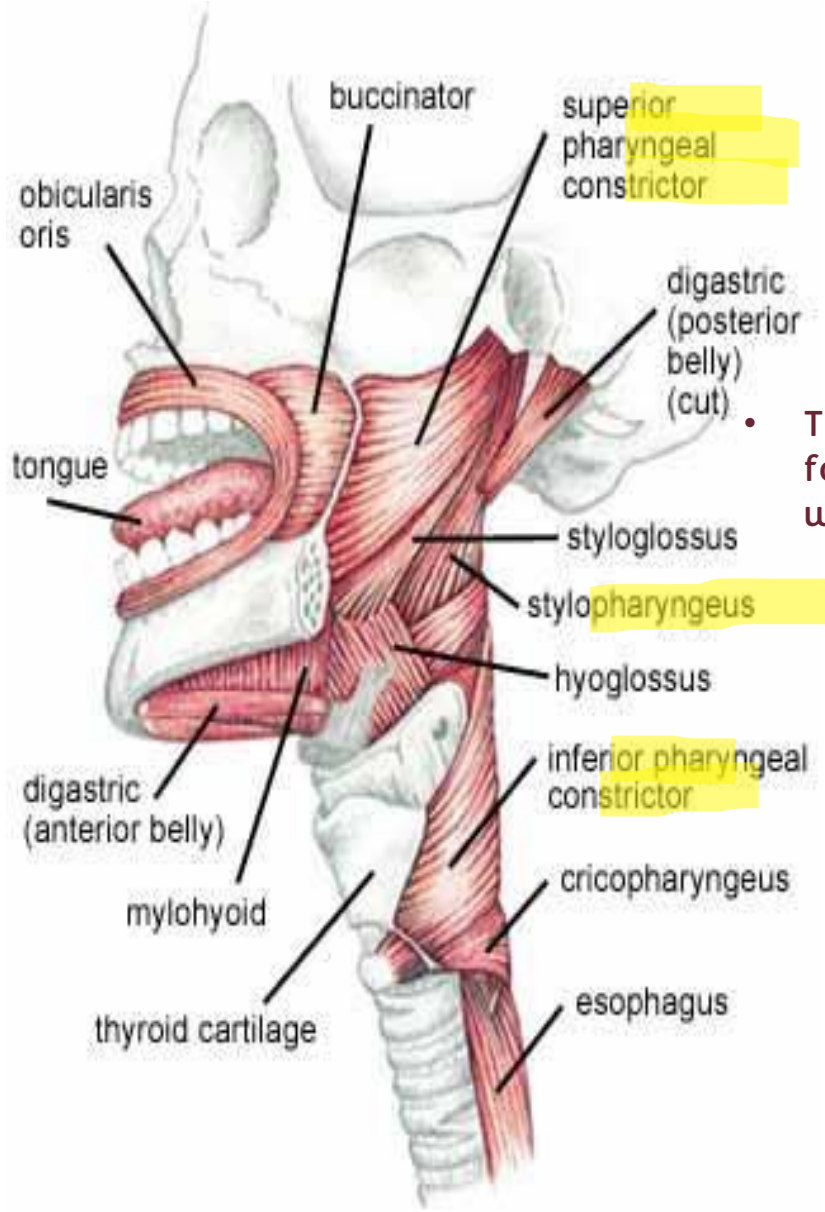
- The pharynx is divided into:

I. Nasopharynx: because anteriorly it opens on the nasal cavity.
II. Oropharynx: Anteriorly opens on the oral cavity.
III. Hypopharynx or laryngopharynx: anterior to the esophagus and pharynx.

- There is three main muscles in the pharynx, we call them constrictor muscles of the pharynx, superior middle and inferior.
- These muscle cause contraction and help the peristaltic movement for descending of the bolus, and its fibers are circular.
- On the other hand, we have 2 muscles that are oblique, the stylopharengus and the salpingopharengus, so we have 3 constrictors and 2 obliques.

Muscles of the Pharynx

- The muscles in the wall of the pharynx consist of the superior, middle, and inferior constrictor muscles
- whose fibers run in a somewhat circular direction, and the stylopharyngeus and salpingopharyngeus muscles, whose fibers run in a somewhat longitudinal direction.



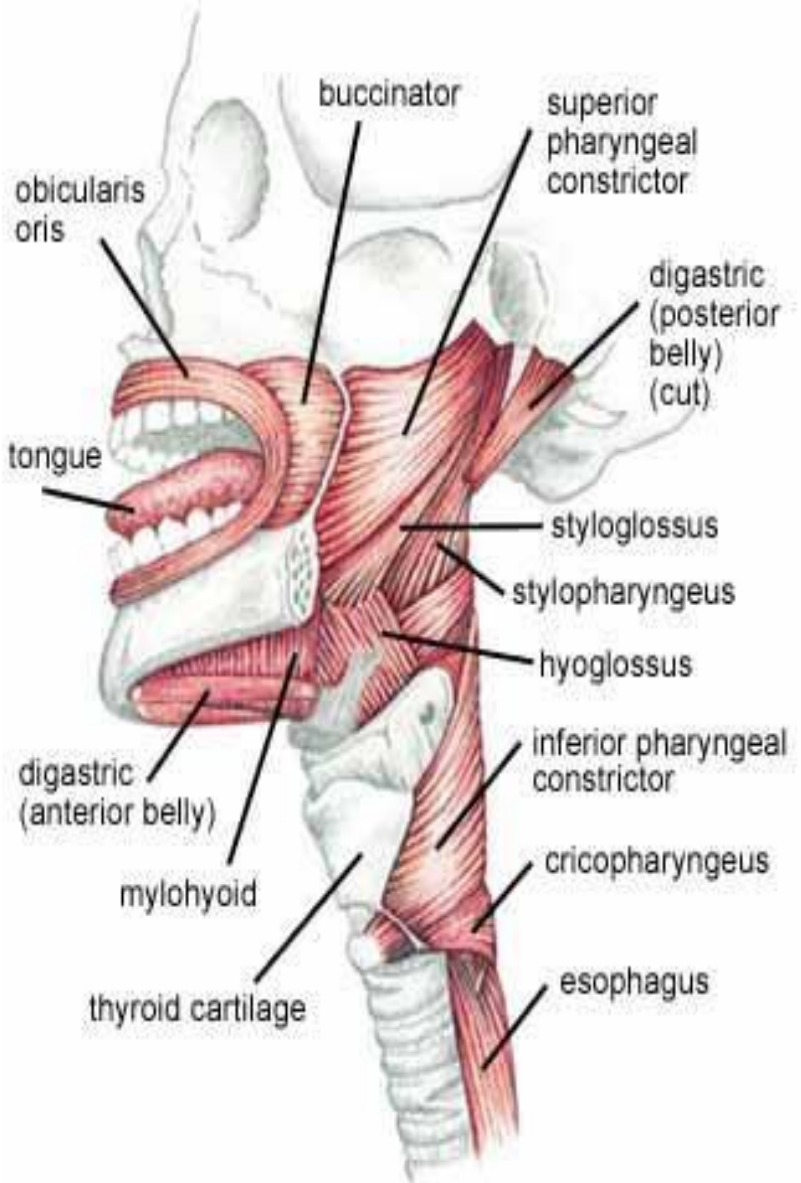
- The salpingopharyngus is found internally in the wall of the nasopharynx.

Further Explanation

- The three constrictors function is to propel the bolus downward to the esophagus.
- We have a fibrous line that descends mid posterior line starting at the pharyngeal tubercle (which is found in front of foramen magnum) which has a pharyngeal raphe attached to it for the insertion of constrictor muscles, **all of the pharyngeal muscles insert in the raphe.**

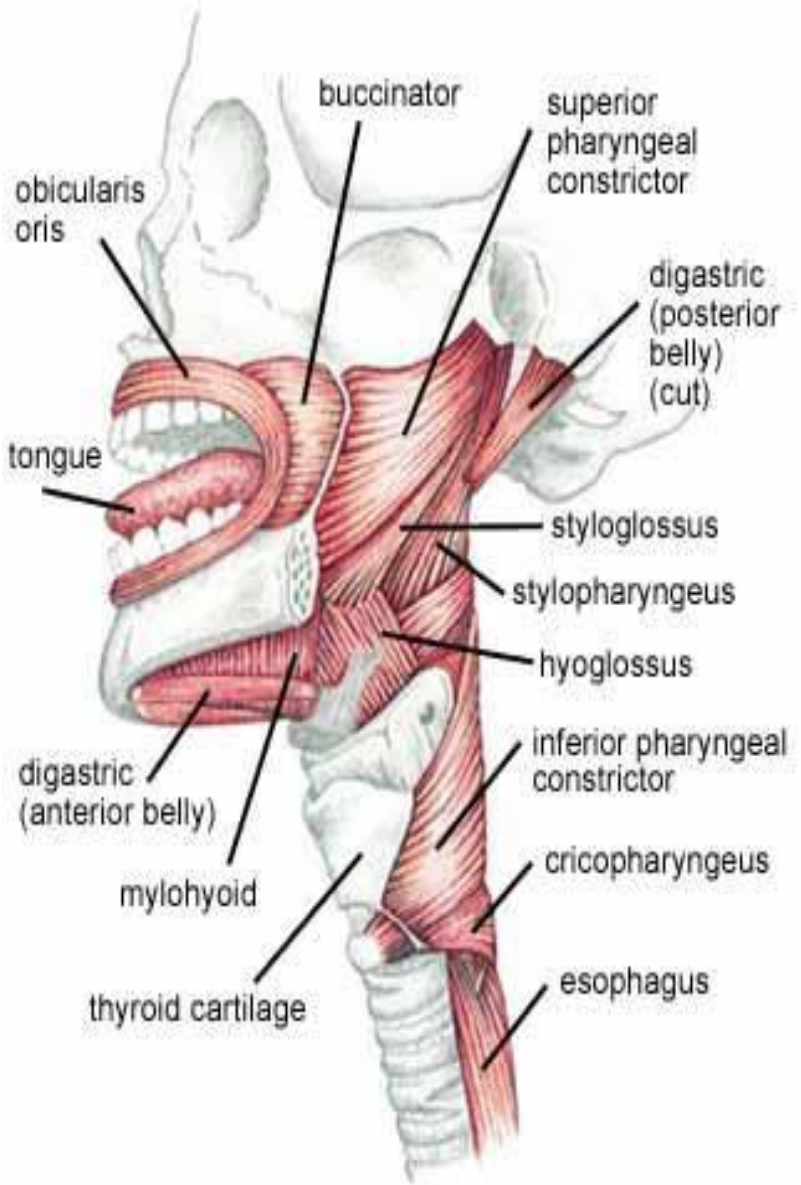
Muscles of the Pharynx

- The three constrictor muscles extend around the pharyngeal wall to be inserted into a fibrous band or raphe that extends from the pharyngeal tubercle on the basilar part of the occipital bone of the skull down to the esophagus



Muscles of the Pharynx

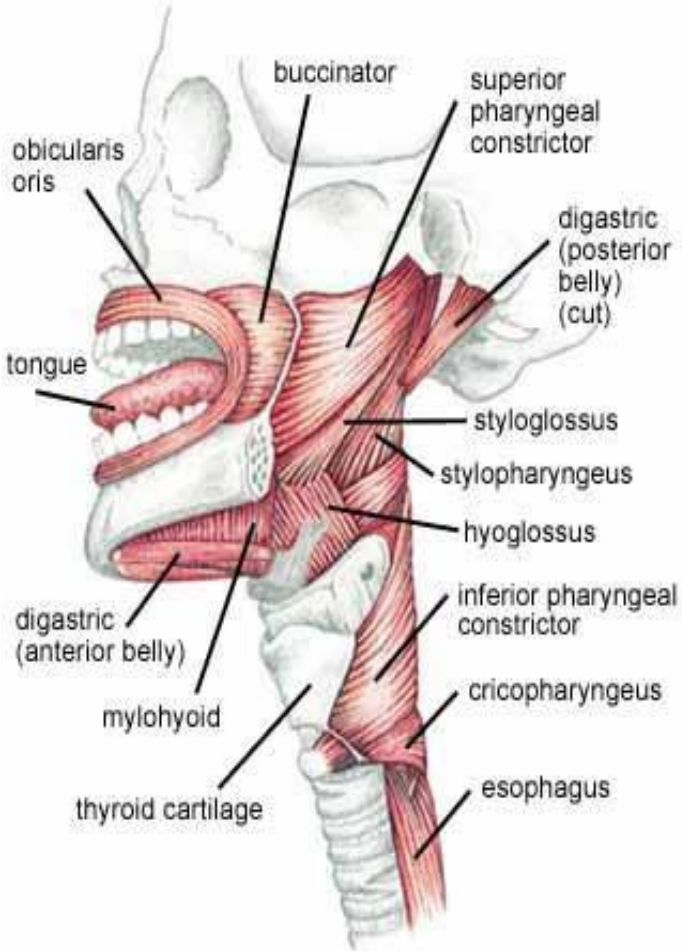
- The three constrictor muscles overlap each other so that the middle constrictor lies on the outside of the lower part of the superior constrictor and the inferior constrictor lies outside the lower part of the middle constrictor



Muscles of the Pharynx (cont.)

- The lower part of the inferior constrictor, which arises from the cricoid cartilage, is called the cricopharyngeus muscle
- The fibers of the cricopharyngeus pass horizontally around the lowest and narrowest part of the pharynx and act as a sphincter

- Cricopharyngeus is named so because its origin is cricoid cartilage, and it inserts into the pharynx.
- Its fibers are circular, so it works as a sphincter.



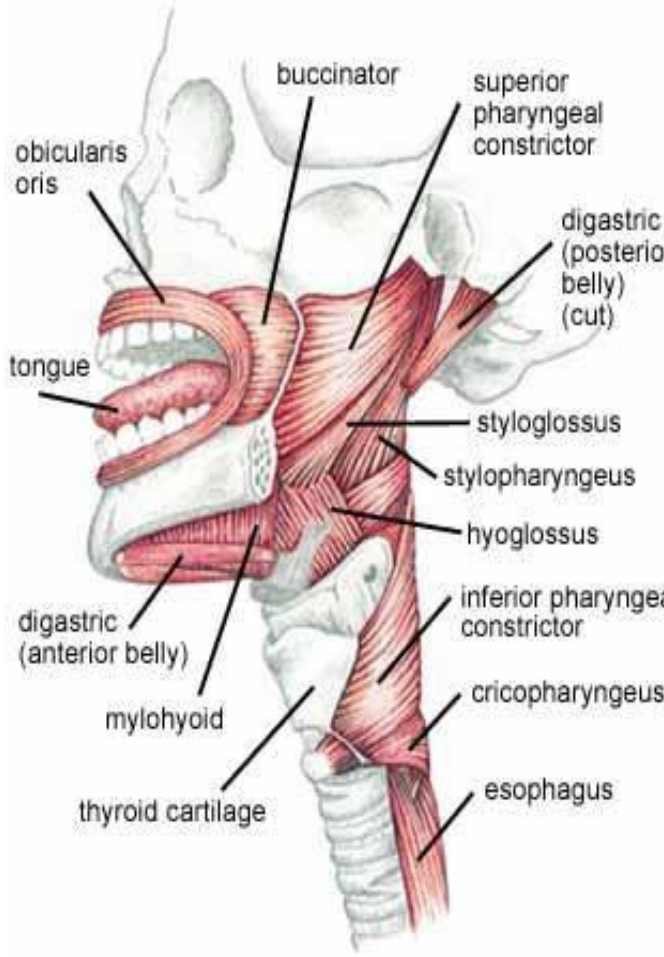
Further Explanation

- Cricopharengeus is always closed and only open if stimulated by the bolus, as the bolus descends and when it arrives at the mucosa of the cricopharengeus it opens, but why?
- To prevent the passage of air which goes back to the inlet of the larynx, but when its open air can pass and accumulate in the fundus (highest part of the stomach), so if we X-ray the abdomen, we will find black dots resembling air.

Muscles of the Pharynx (cont.)

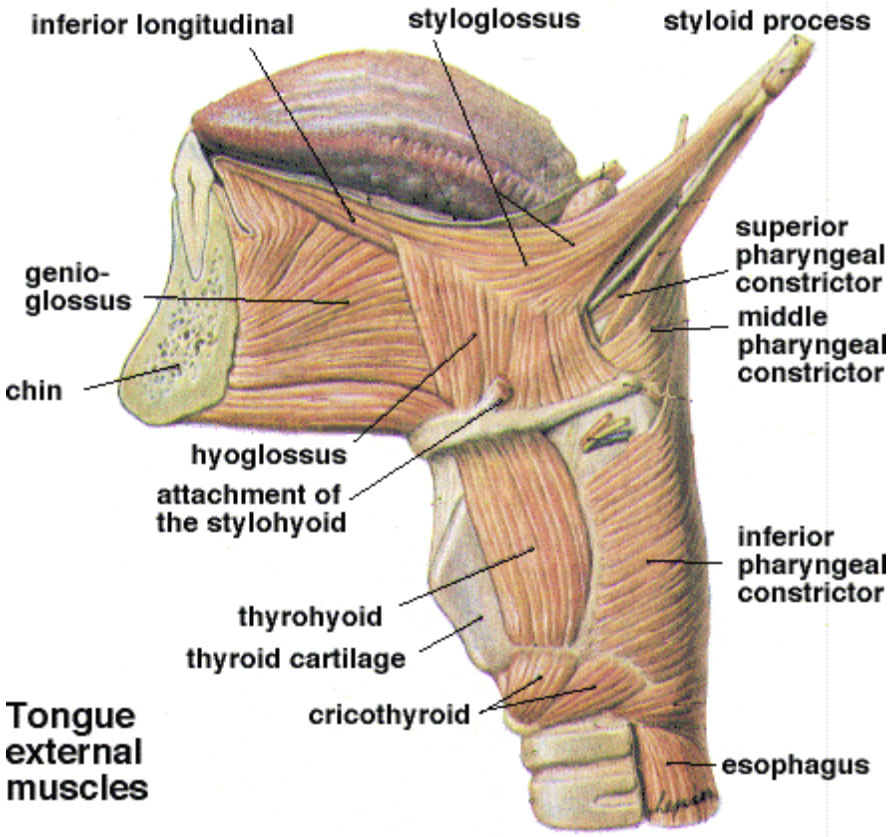
- Killian's dehiscence is the area on the posterior pharyngeal wall between the upper propulsive part of the inferior constrictor and the lower sphincteric part, the cricopharyngeus.

- Lays above the upper border of the cricopharyngeus.
- It's a very sensitive area, so any stimulation causes contraction and vomiting.



Muscles of the Pharynx

- Superior constrictor
- O: Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament, mylohyoid line of mandible
- Ins: Pharyngeal tubercle of occipital bone, raphe in midline posteriorly
- Inerrv: Pharyngeal plexus



Towards the esophagus

Which consists of three nerves: Vagus, accessory and glossopharyngeal.

Aids soft palate in closing off nasal pharynx, propels bolus downward

- Middle constrictor
- Lower part of stylohyoid ligament, lesser and greater cornu of hyoid bone

Insertion:

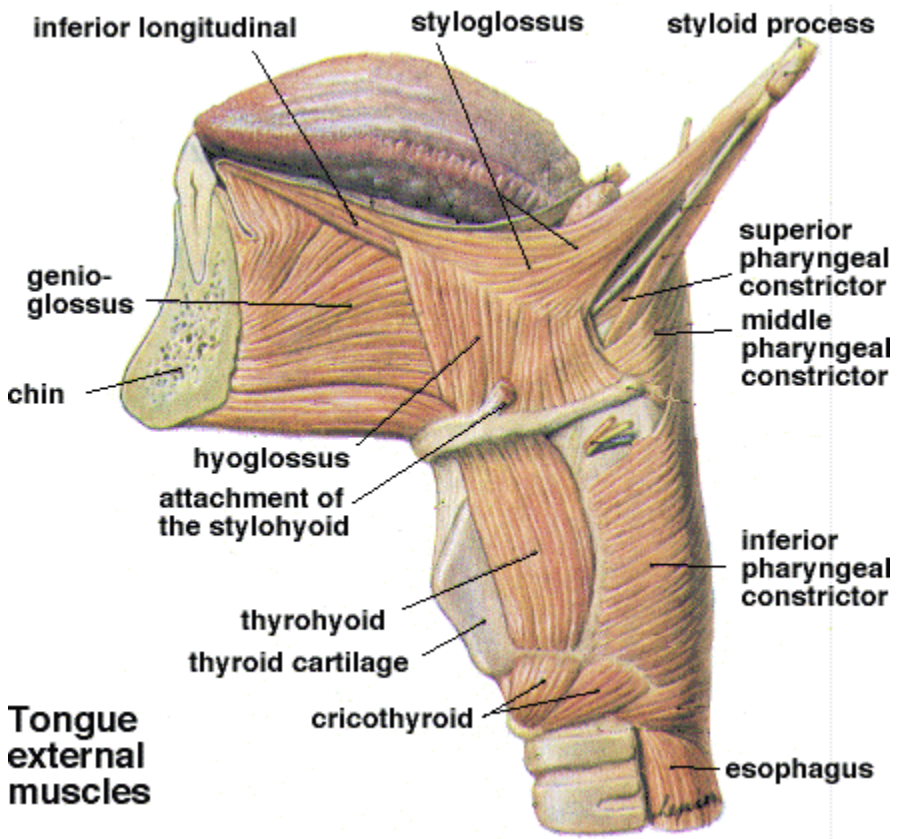
- Pharyngeal raphe

Innervation

- Pharyngeal plexus

Function:

- Propels bolus downward



- Inferior constrictor

Origin:

- Lamina of thyroid cartilage, cricoid cartilage

Insertion:

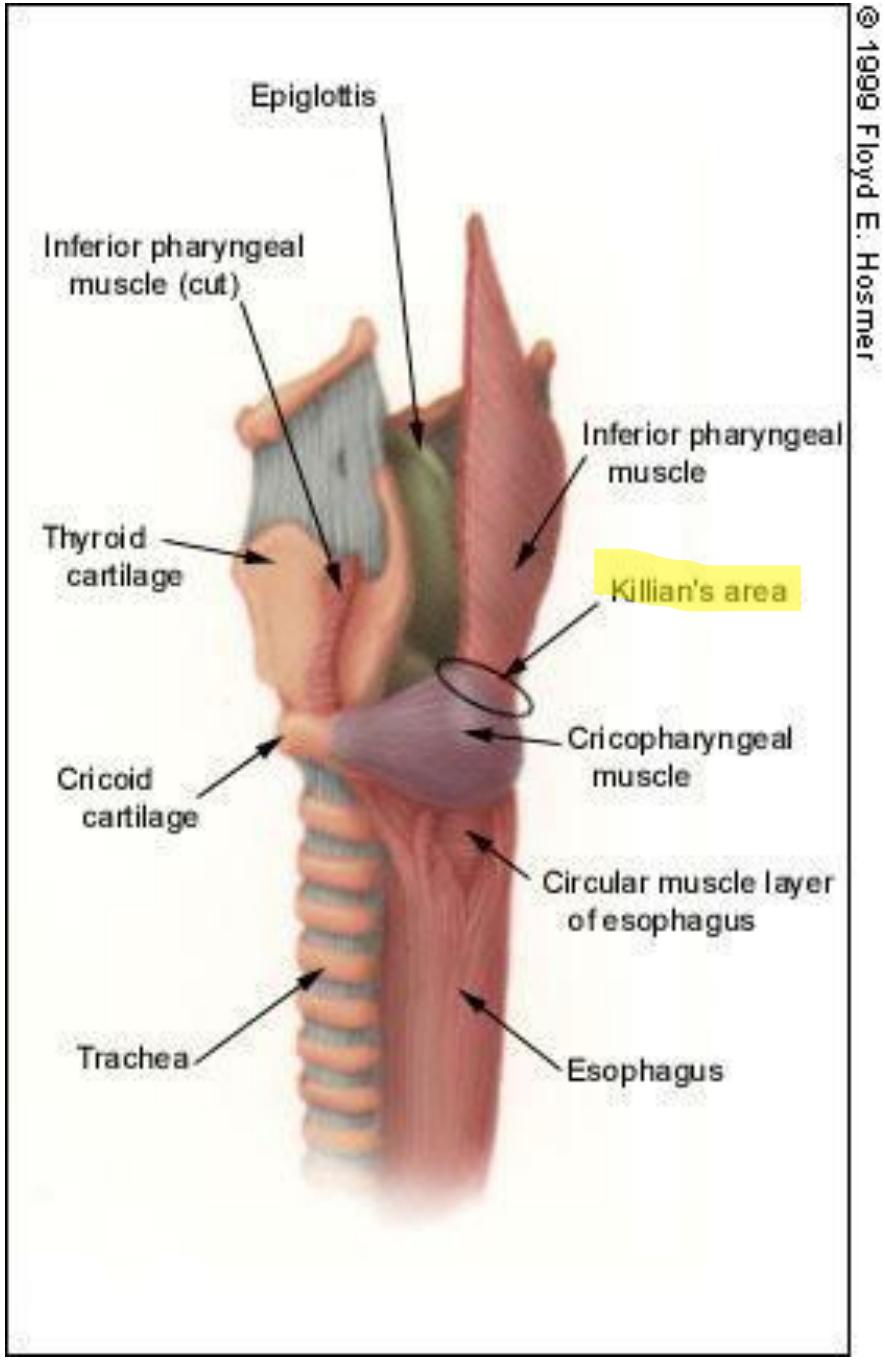
- Pharyngeal raphe

Innervation:

- Pharyngeal plexus

Function:

- Propels bolus downward

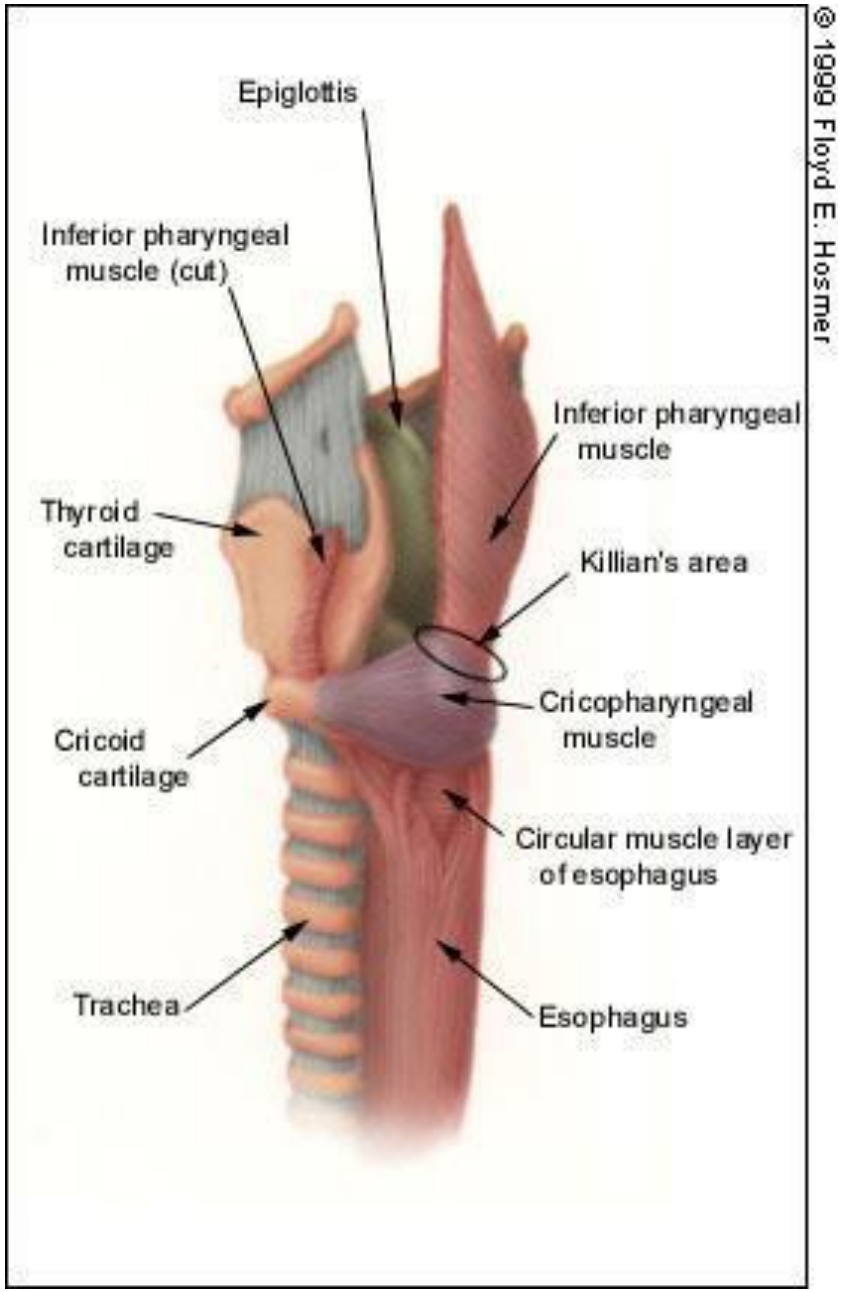


- Cricopharyngeus
- Lowest fibers of inferior constrictor muscle
- Sphincter at lower end of pharynx
- Stylopharyngeus

Origin:

- Styloid process of temporal bone Insertion: raphe
- Posterior border of thyroid cartilage
- Glossopharyngeal nerve
- Elevates larynx during swallowing

All muscles: pharyngeal plexus except for this bad boy right here.



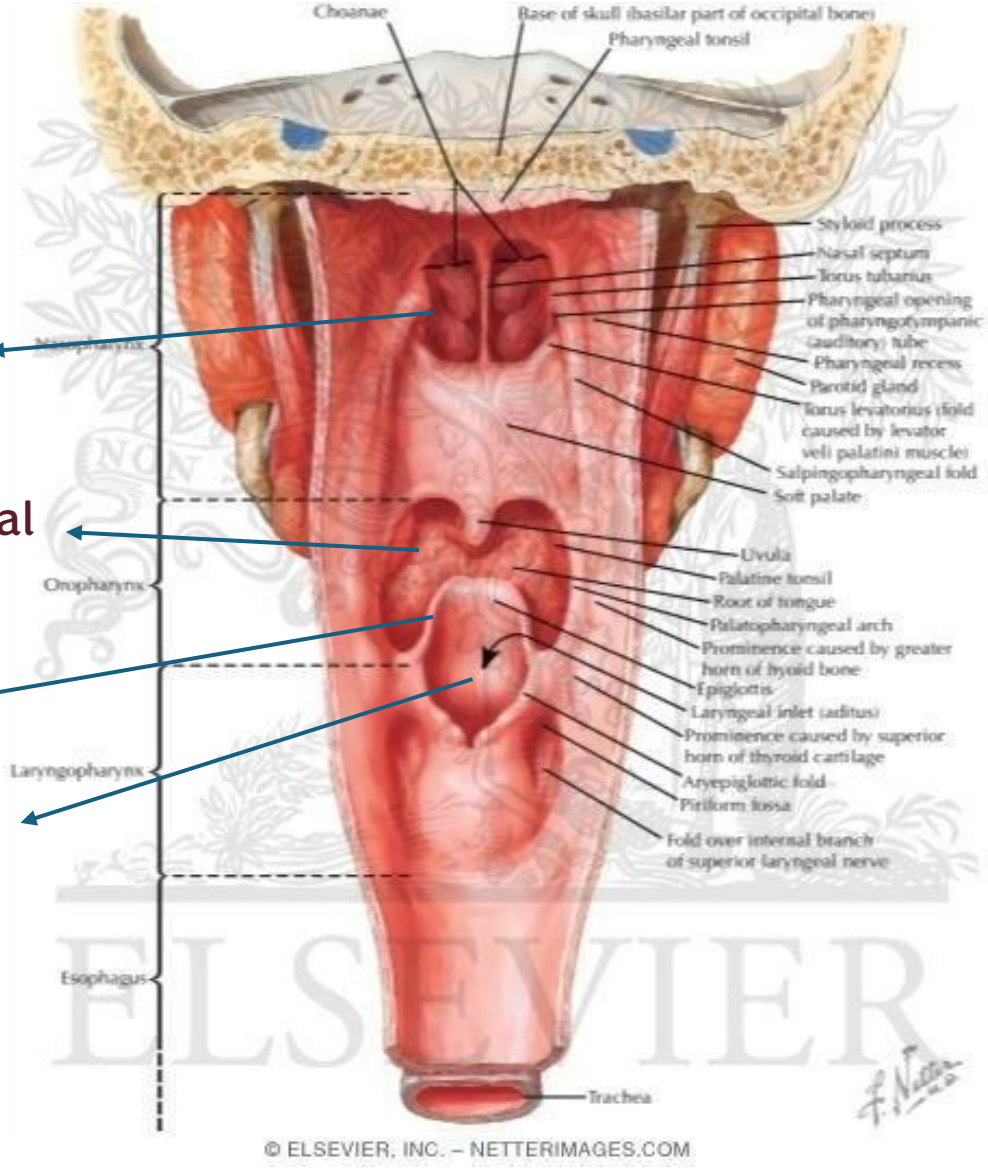
- Salpingopharyngeus
- Auditory tube
- Blends with palatopharyngeus
- Pharyngeal plexus
- Elevates pharynx

- Palatopharyngeus
- Palatine aponeurosis
- Posterior border of thyroid cartilage
- Pharyngeal plexus
- Elevates wall of pharynx, pulls palatopharyngeal arch medially

- The auditory tube is the opening of the eustachian tube which is important for the balance of air pressure on the tympanic membrane, that's why while on a plane or going to ghour (Jordan valley) there will be pressure on the tympanic membrane so to equalize the pressure we gulp.
- The disadvantage is that in kids who vomit while laying down some of the vomit ascends to the nasal cavity and through the eustachian tube enter the middle ear and causes otitis media so we remind doctors in the emergency room to check the tympanic membrane, because the whole problem might be otitis media.

Interior of the Pharynx

- The pharynx is divided into three parts: the nasal pharynx, the oral pharynx, and the laryngeal pharynx.
- Nasal Pharynx
- This lies above the soft palate and behind the nasal cavities
- In the submucosa of the roof is a collection of lymphoid tissue called the pharyngeal tonsil



Interior of the Pharynx

- The pharyngeal isthmus is the opening in the floor between the soft palate and the posterior pharyngeal wall
- On the lateral wall is the opening of the auditory tube, the elevated ridge of which is called the tubal elevation
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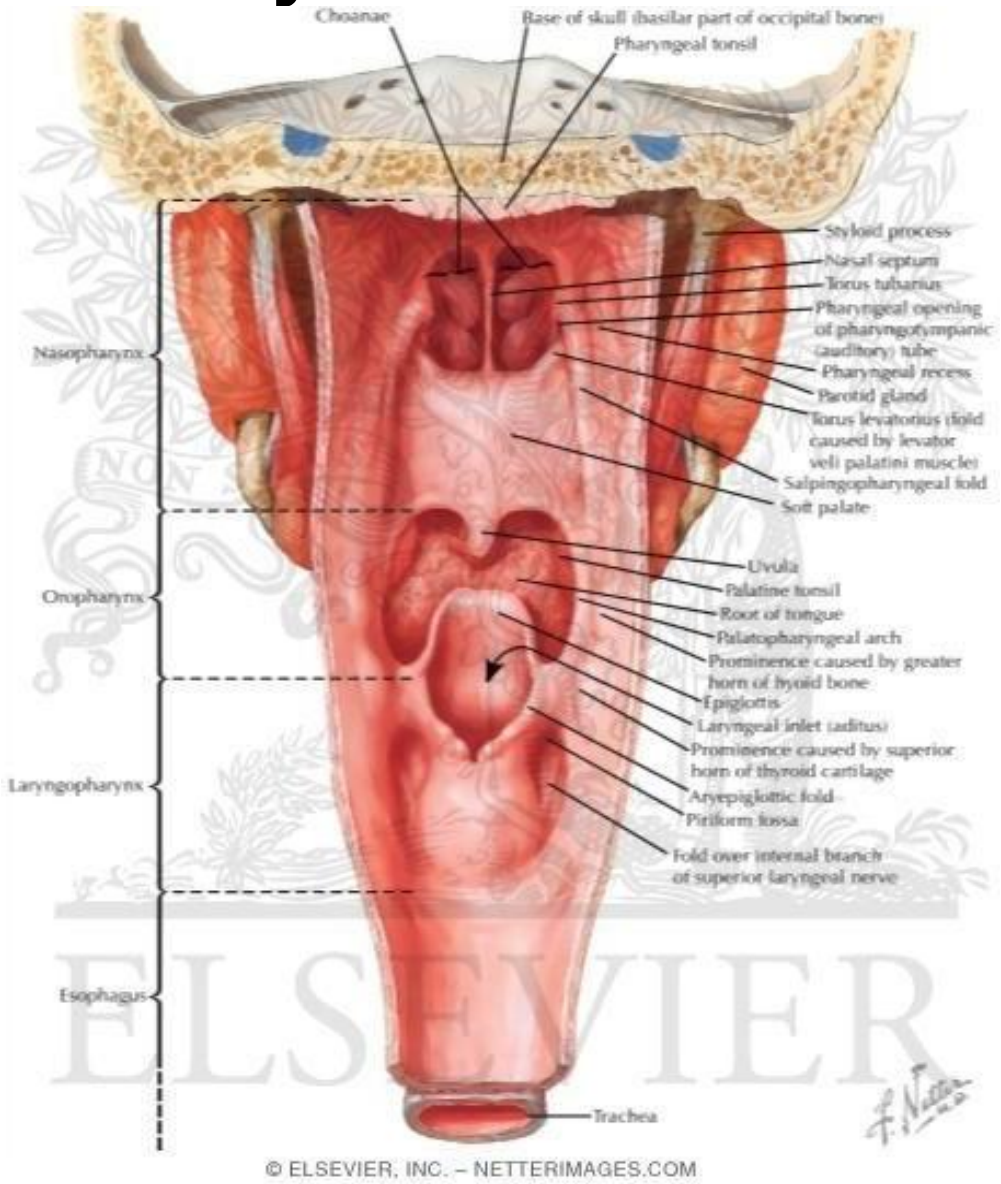


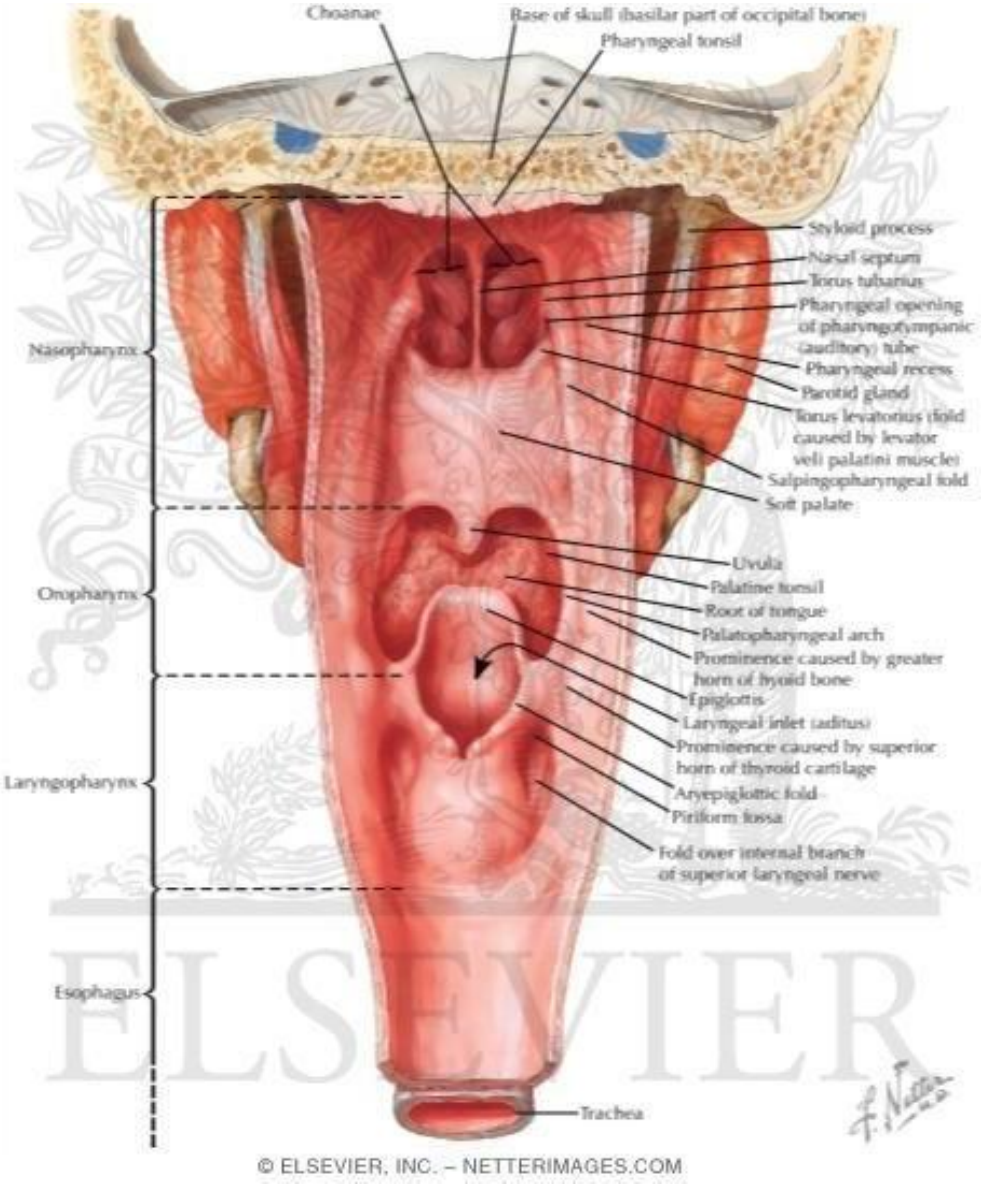
Pharynx from Inside:

- A coronal section shows **three anterior openings**:
- The **choanae** (posterior openings of the nasal cavity, which lead to the nasopharynx)
- The **oropharyngeal isthmus** (the opening of the oral cavity, which leads to the oropharynx)
- The epiglottis contain the **inlet of larynx** (third opening)
- Air enters through the inlet of the larynx to reach the trachea, which lies anterior to both the pharynx and the esophagus.

Interior of the Pharynx

- The pharyngeal recess is a depression in the pharyngeal wall behind the tubal elevation
- The salpingopharyngeal fold is a vertical fold of mucous membrane covering the salpingopharyngeus muscle.

- **The salpingopharngeal fold lie within the mid-sagittal section.**

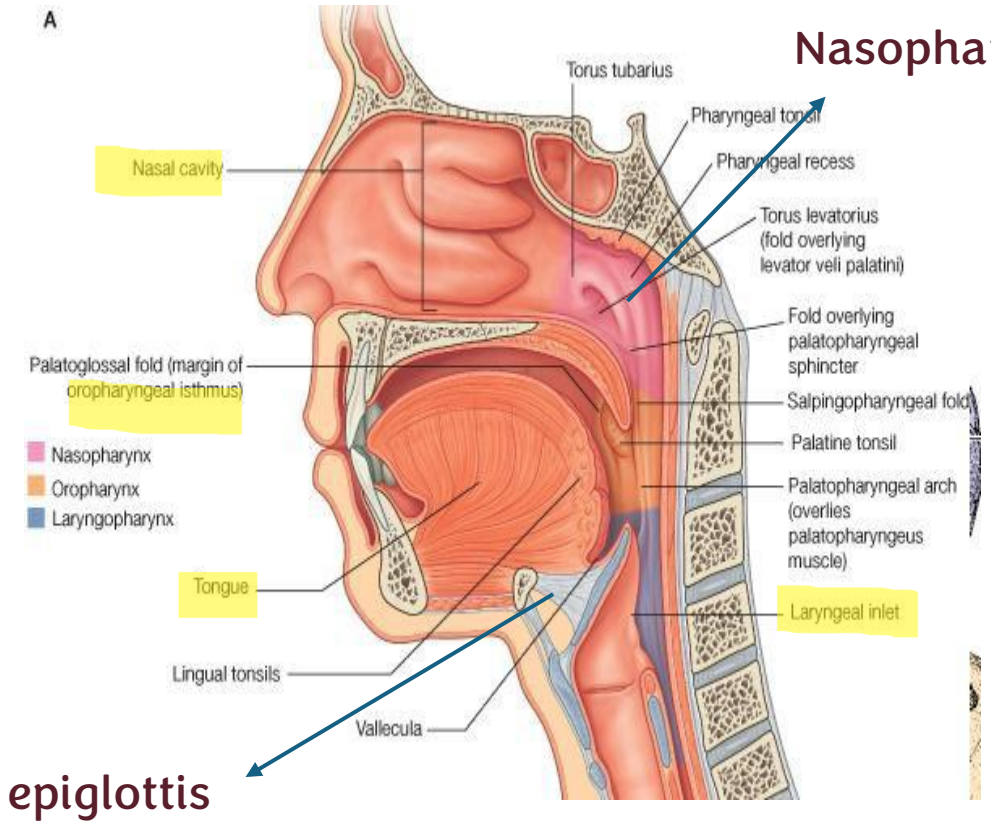


Oral Pharynx

- This lies behind the oral cavity
- The floor is formed by the posterior one third of the tongue and the interval between the tongue and epiglottis
- In the midline is the median glossoepiglottic fold

and on each side the lateral glossoepiglottic fold.

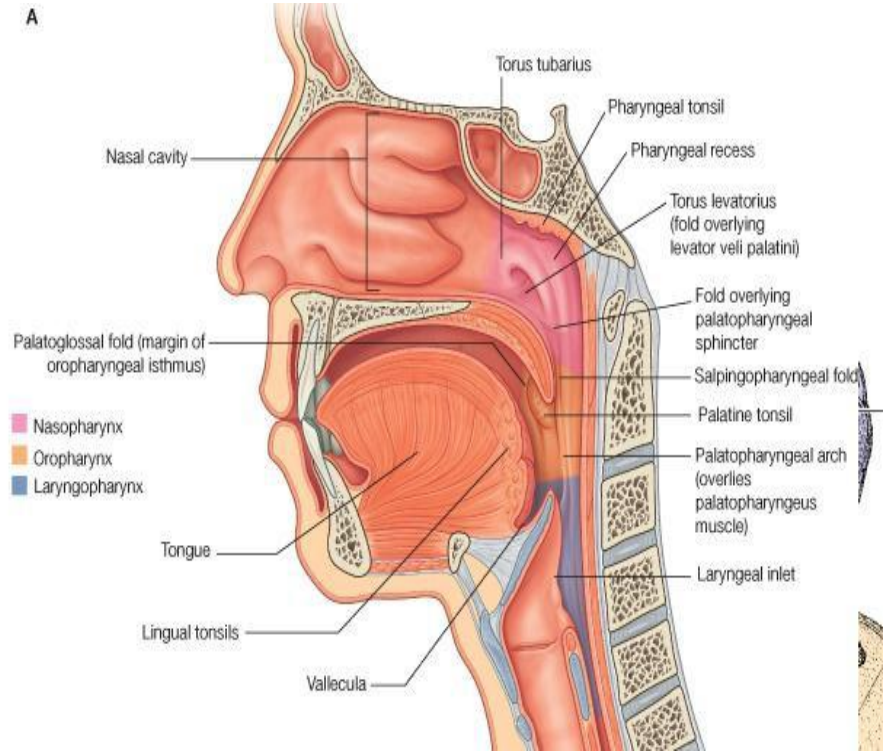
Mid-sagittal section



Oral Pharynx

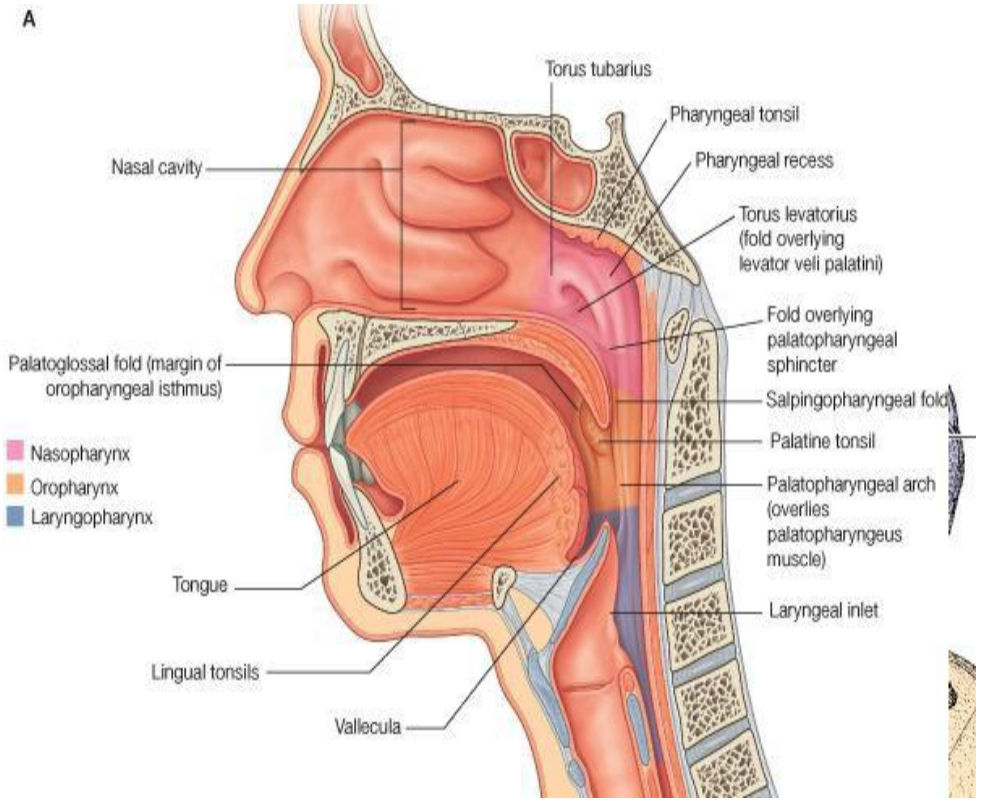
- The depression on each side of the median glossoepiglottic fold is called the vallecula
- On the lateral wall on each side are the palatoglossal and the palatopharyngeal arches or folds and the palatine tonsils between them

Connection between tongue and epiglottis is called aryepiglottic (glossoepiglottic) fold and the space between them is called vallecula which is a saliva-collecting site



Oral Pharynx

- interval between the two palatoglossal arches is called the oropharyngeal isthmus and marks the boundary between the mouth and pharynx.

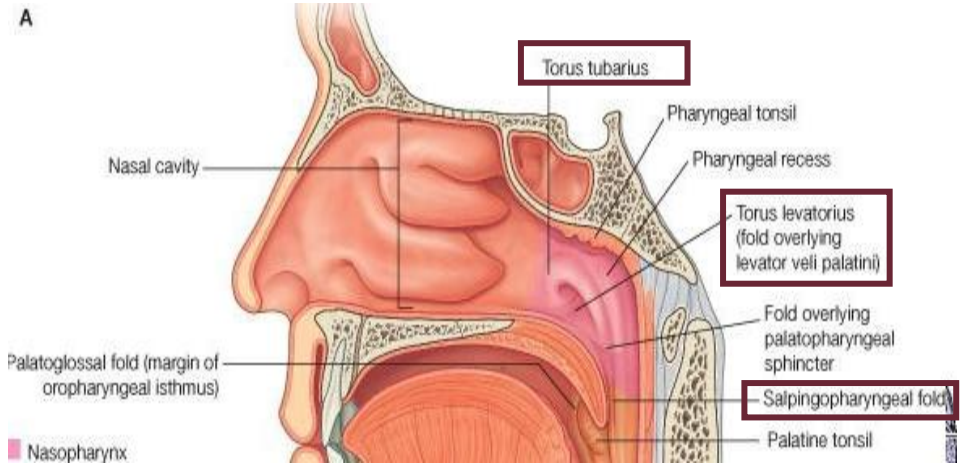


Additional Notes

- The nasopharynx starts at the base of the skull ending in the soft palate.
- Eustachian tube lies at the lateral wall starting by a structure called tubal elevation, while downward to it Is the salpingopharyngeal fold (process) closely related to the roof where pharyngeal tonsils are located.

❖ So tonsils in human body consists of:

1) Palatine tonsil.
2) Lingual tonsil.
3) Pharyngeal tonsils, that could be enlarged and inflamed leading to ***adenoid***, which symptoms include blocking the nasopharynx resulting in snorting as well as breathing orally especially in children.



Additional Notes

- Oral pharynx on the other hand contains palatine tonsils on the lateral wall of its oropharyngeal isthmus, where infections at that tonsils is named “Tonsillitis”.
- Epiglottis is a structure covering larynx inlet, as false (upward) and true (downward and responsible of speech) vocal cords exist.
- Piriform fossa is a depression between the pharynx and larynx, that is a common site for lodging of a foreign body especially fishbone, although its helpful by narrowing possible obstruction sites for physicians while treating such cases.

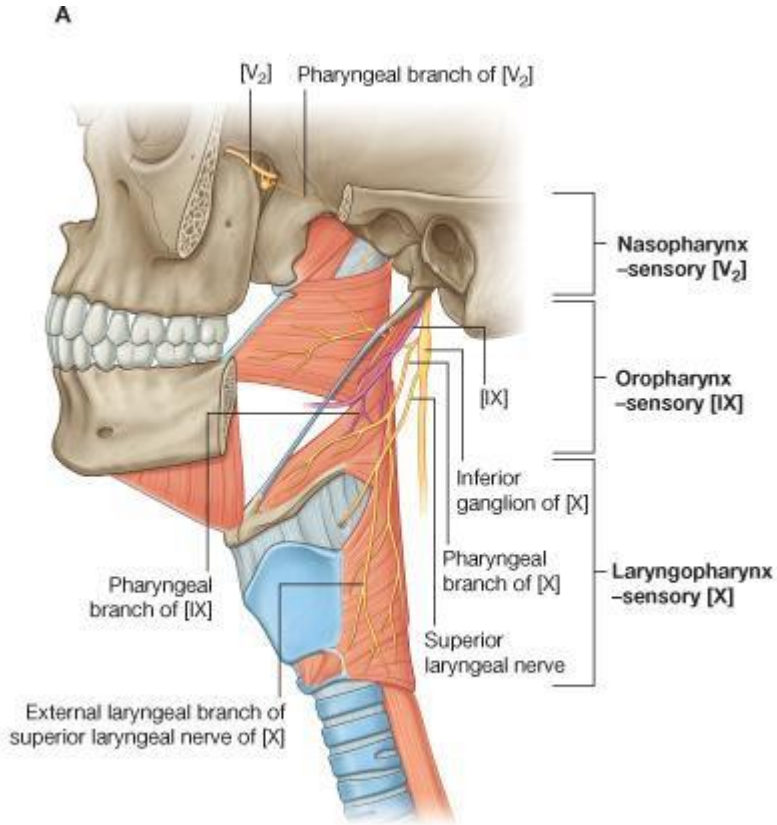
Laryngeal Pharynx

- This lies behind the opening into the larynx
- The lateral wall is formed by the thyroid cartilage and the thyrohyoid membrane
- The piriform fossa is a depression in the mucous membrane on each side of the laryngeal inlet

Sensory Nerve Supply of the Pharyngeal Mucous Membrane

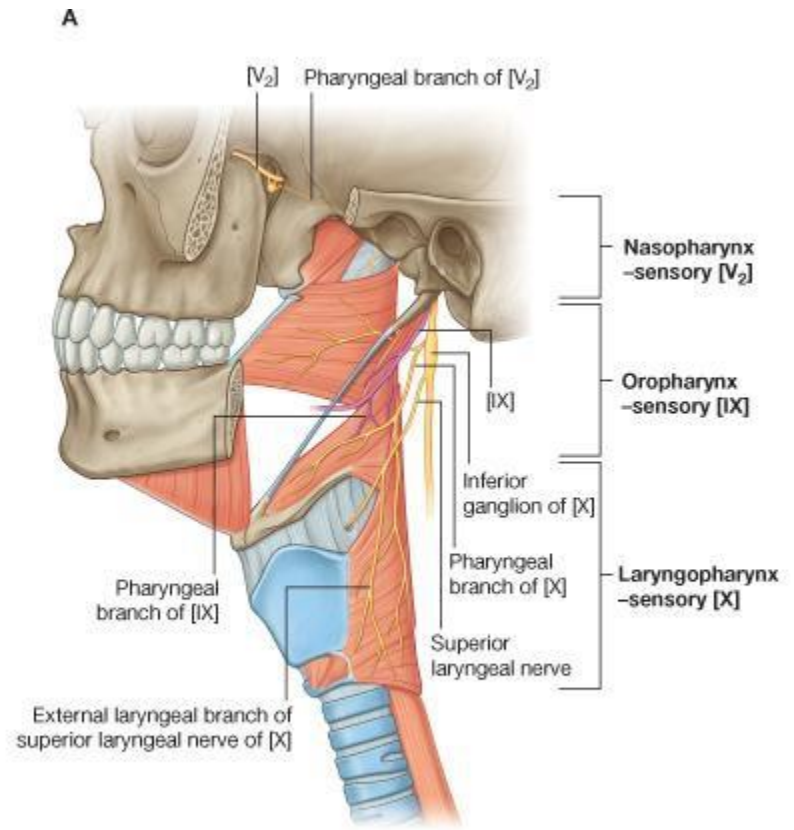
- Nasal pharynx: The maxillary nerve (V2)
- Oral pharynx: The glossopharyngeal nerve
- Laryngeal pharynx (around the entrance into the larynx): The internal laryngeal branch of the vagus nerve

- This nerve enters the larynx mucosa between the middle and inferior constrictor muscles of the pharynx.

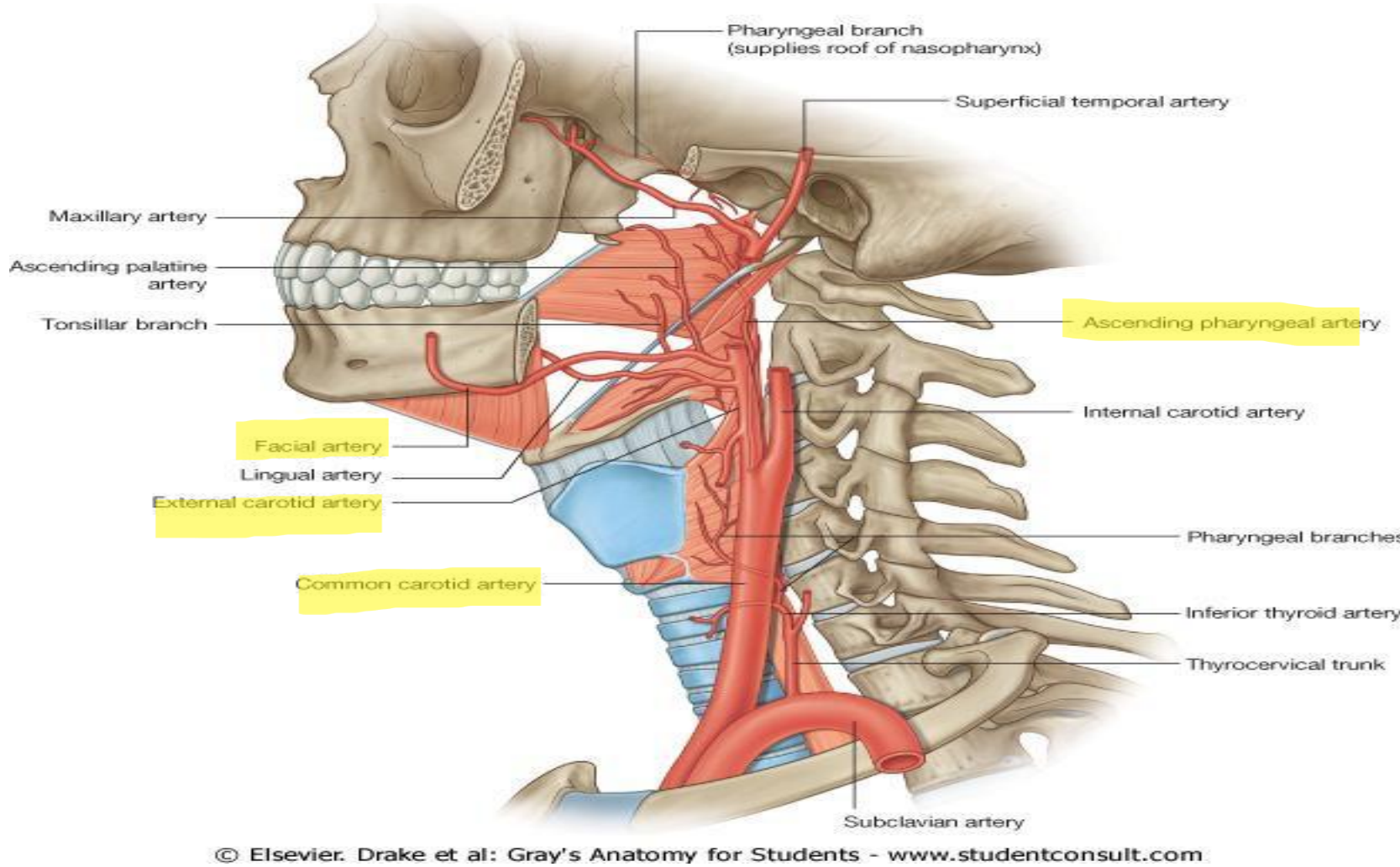


Sensory Nerve Supply of the Pharyngeal Mucous Membrane

- Blood Supply of the Pharynx
- Ascending pharyngeal, tonsillar branches of facial arteries, and branches of maxillary and lingual arteries
- Lymph Drainage of the Pharynx
- Directly into the deep cervical lymph nodes or indirectly via the retropharyngeal or paratracheal nodes into the deep cervical nodes



- Here is the common carotid artery dividing into external and internal carotid arteries, and while external carotid gives ascending pharyngeal as well as facial artery, internal carotid has no branches (in the neck).



Important: Pr. Almuhtaseb did not mention all of deglutition, you can just study slide that comes after, but he said that we should read the whole process, so I am going to leave it to your choice (I don't feel like muscles names are important though).

The Process of Swallowing (Deglutition)

- Masticated food is formed into a ball or bolus on the dorsum of the tongue and voluntarily pushed upward and backward against the undersurface of the hard palate
- This is brought about by the contraction of the styloglossus muscles on both sides, which pull the root of the tongue upward and backward
- The palatoglossus muscles then squeeze the bolus backward into the pharynx.

The Process of Swallowing (Deglutition)

- From this point onward the process of swallowing becomes an involuntary act.
- The nasal part of the pharynx is now shut off from the oral part of the pharynx by the elevation of the soft palate
- the pulling forward of the posterior wall of the pharynx by the upper fibers of the superior constrictor muscle, and the contraction of the palatopharyngeus muscles. This prevents the passage of food and drink into the nasal cavities

- The larynx and the laryngeal part of the pharynx are pulled upward by the contraction of the stylopharyngeus, salpingopharyngeus, thyrohyoid, and palatopharyngeus muscles
- The main part of the larynx is thus elevated to the posterior surface of the epiglottis, and the entrance into the larynx is closed
- The laryngeal entrance is made smaller by the approximation of the aryepiglottic folds, and the arytenoid cartilages are pulled forward by the contraction of the aryepiglottic, oblique arytenoid, and thyroarytenoid muscles.

- The bolus moves downward over the epiglottis, the closed entrance into the larynx, and reaches the lower part of the pharynx as the result of the successive contraction of the superior, middle, and inferior constrictor muscles
- Some of the food slides down the groove on either side of the entrance into the larynx, that is, down through the piriform fossae
- Finally, the lower part of the pharyngeal wall (the cricopharyngeus muscle) relaxes and the bolus enters the esophagus.

Additional Notes

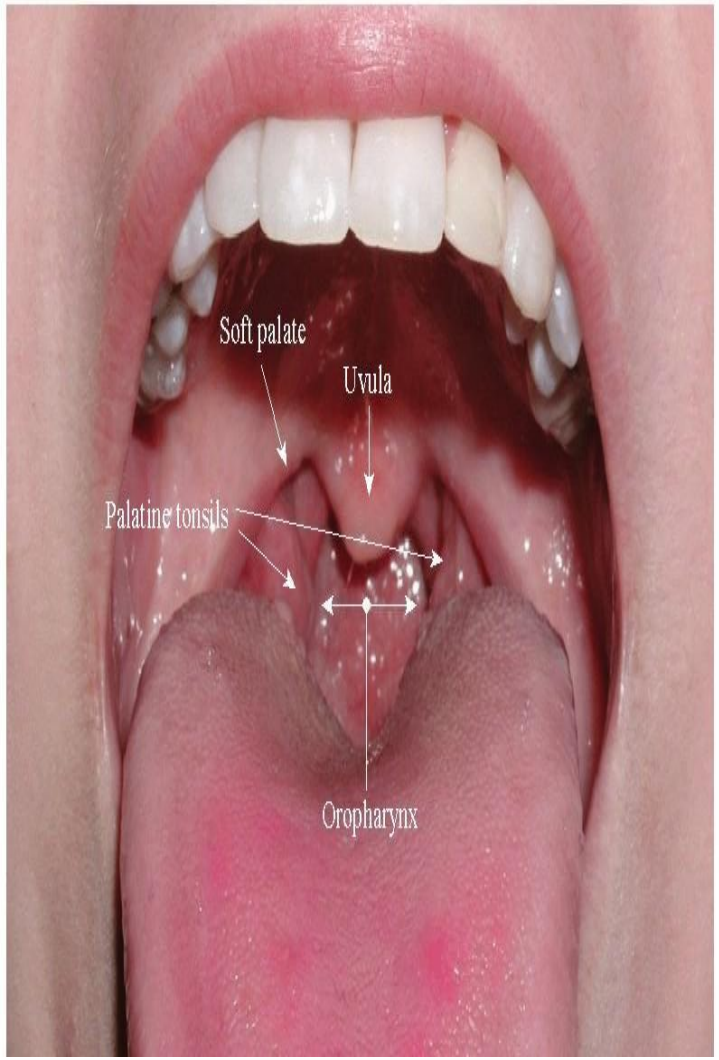
- **Eating is a complex process, which encompasses many steps going as:**

1) Upon food (bolus) enter pressure is made in the oral cavity.
2) Soft palate sense it then close the oropharynx (oropharyngeal isthmus) by moving downward, while the base of the tongue goes upward.
3) After the bolus pass, the soft palate returns upward and backward, so the posterior wall of the pharynx moves forward by a constrictor muscle leading to a closure of the nasopharynx (so food don't slide upward).
4) When a bolus moves down into the pharynx, it should not enter the laryngeal inlet, as doing so would trigger coughing reflexes until the bolus is expelled.
   To prevent this, the bolus pushes the epiglottis downward and backward, while the larynx moves upward along with the pharynx.
   This causes complete closure of the laryngeal inlet, directing the bolus into the esophagus.

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
- Each tonsil is covered by mucous membrane, and its free medial surface projects into the pharynx
- The surface is pitted by numerous small openings that lead into the tonsillar crypts.
- The tonsil is covered on its lateral surface by a fibrous capsule **loose connective tissue.**

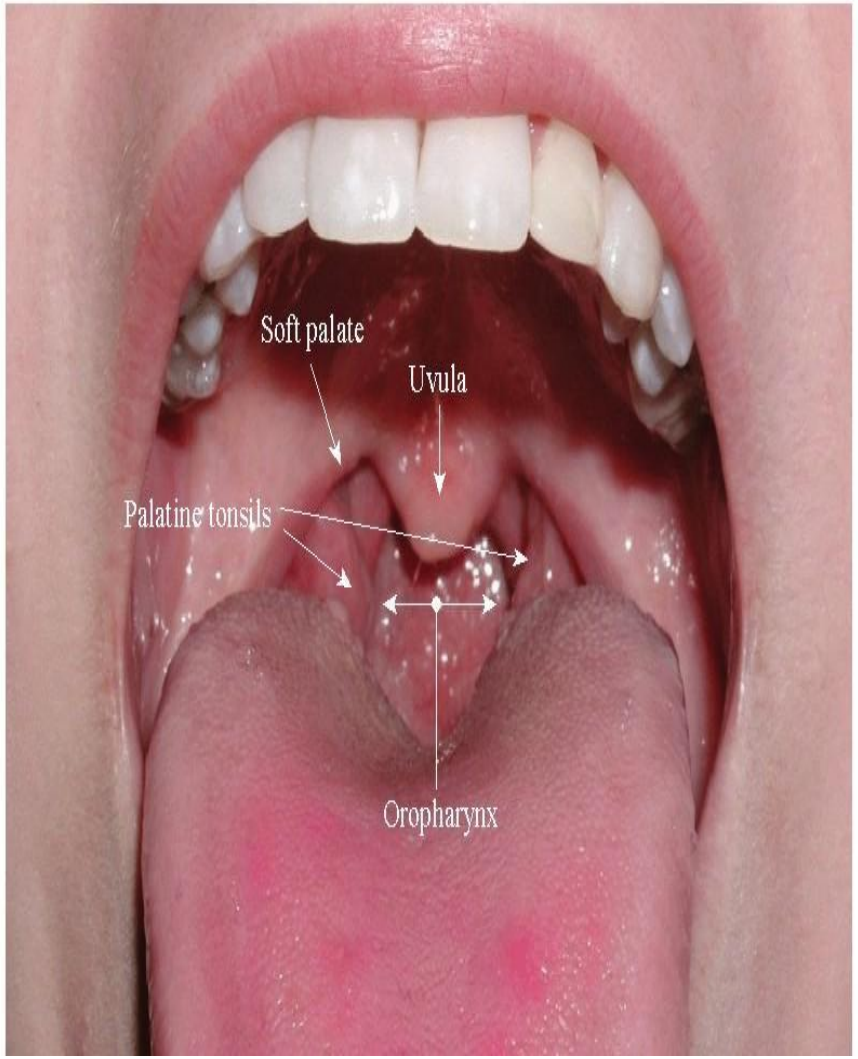
- It filters bacteria, viruses and foreign bodies in children, and it shrinks with aging after adulthood, making inflammation of it less common(like once instead of thrice a year).
- Where it is closely related to the mucosa.
- Here it's loosely connected making a room for nerves and blood vessels to pass into.



Palatine Tonsils

- The capsule is separated from the superior constrictor muscle by loose areolar tissue
- and the external palatine vein descends from the soft palate in this tissue to join the pharyngeal venous plexus
- Lateral to the superior constrictor muscle lie the styloglossus muscle, the loop of the facial artery, and the internal carotid artery.
- The tonsil reaches its maximum size during early childhood, but after puberty it diminishes considerably in size.

- Or supra palatine vein, along its course it pierces the superior constrictor muscle.
- Lateral surface is close to common carotid artery, tonsillar branch of facial artery and veins



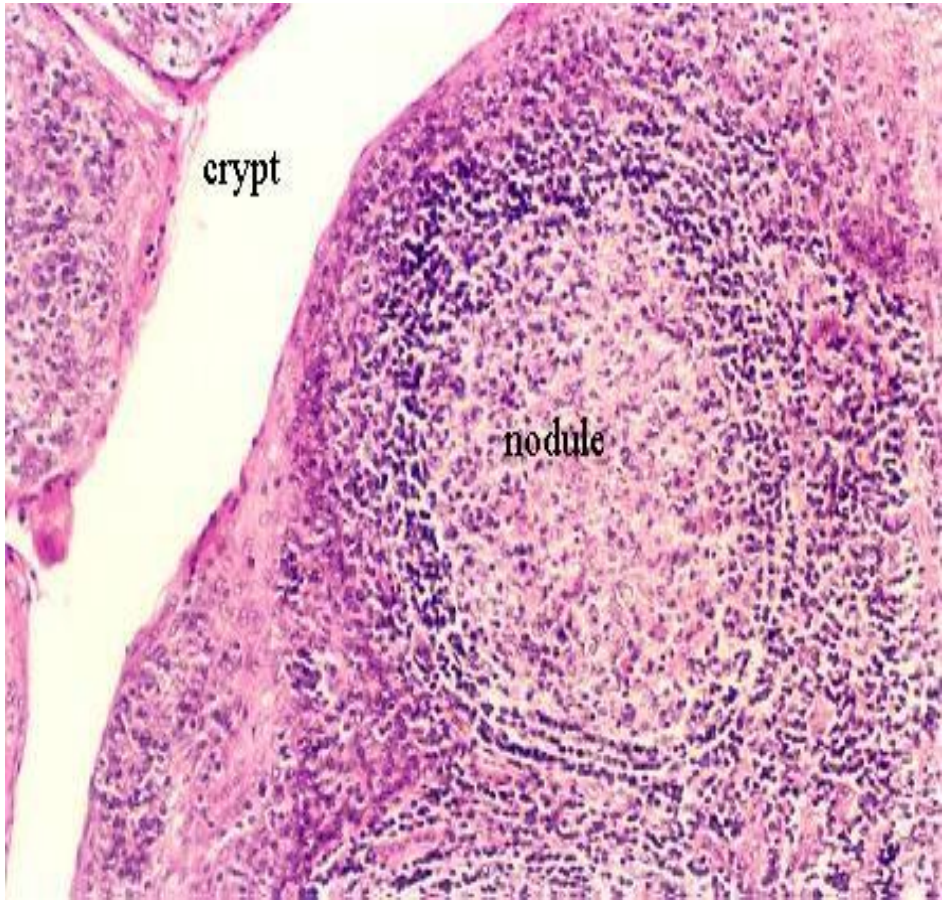
Additional Notes

- We perform a tonsillectomy because Streptococcus bacteria, which cause tonsillitis, may spread to the joints (leading to arthritis), the heart (causing rheumatic fever), and the kidneys (causing glomerulonephritis).
  Since the human body contains abundant lymphoid tissue, removing the tonsils does not cause any significant harm.

- If tonsillectomy is to be done in case of repetitive inflammation in children (4 or 5 times) patient should be under observation for 24 hours as post-operative bleeding coming from the vein is possible due to its course along superior constrictor muscle, as the physician might cut the vein or artery accidentally while doing the tonsillectomy then ligate it, this connection could be severed whenever the constrictor muscle contract at the first-day post-operation, that operation is totally safe for the body in case of function as there are other lymphoid tissues in the body to compensate.

Blood Supply

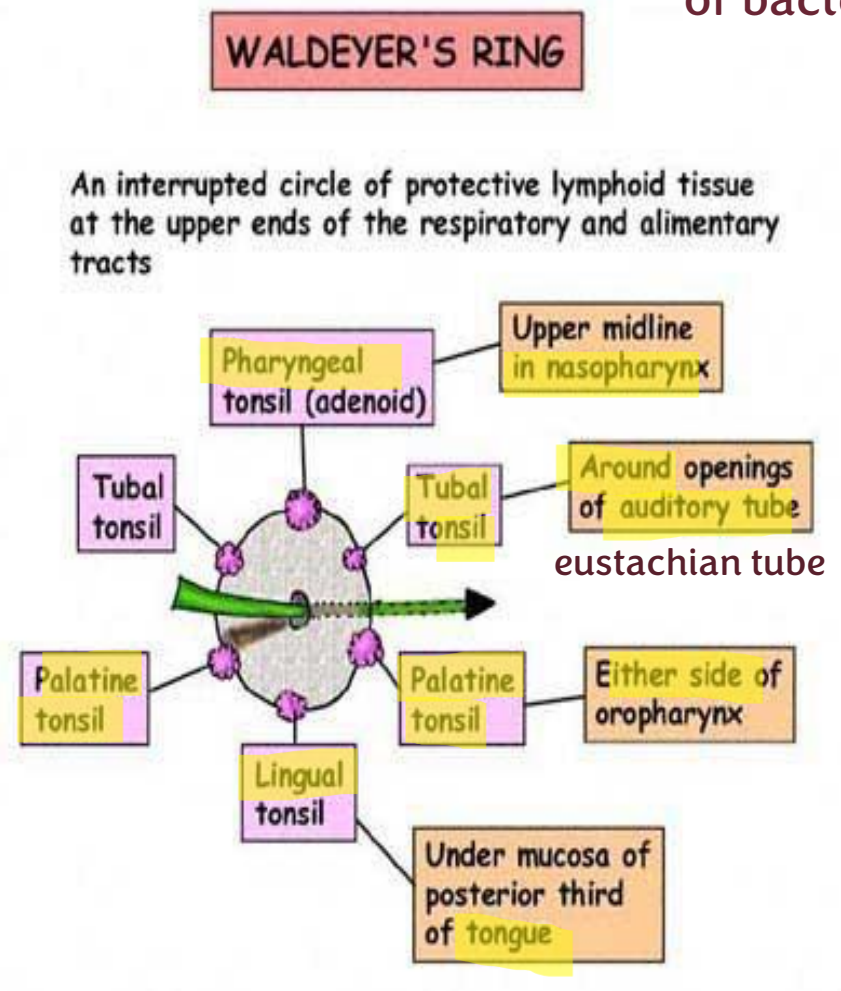
- The tonsillar branch of the facial artery. The veins pierce the superior constrictor muscle and join the external palatine **go to pharyngeal plexus of veins**, the pharyngeal, or the facial veins.
- Lymph Drainage of the Tonsil
- The upper deep cervical lymph nodes, just below and behind the angle of the mandible



Waldeyer's Ring of Lymphoid Tissue

Function: Filtration of bacteria

- The lymphoid tissue that surrounds the opening into the respiratory and digestive systems forms a ring
- The lateral part of the ring is formed by the palatine tonsils and tubal tonsils (lymphoid tissue around the opening of the auditory tube in the lateral wall of the nasopharynx)



That ring is around the oropharyngeal isthmus.

The pharyngeal tonsil in the roof of the nasopharynx forms the upper part, and the lingual tonsil on the posterior third of the tongue forms the lower part.

Sensations can be classified into general and special types, and further divided into sensory and motor.

- Sensory 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)

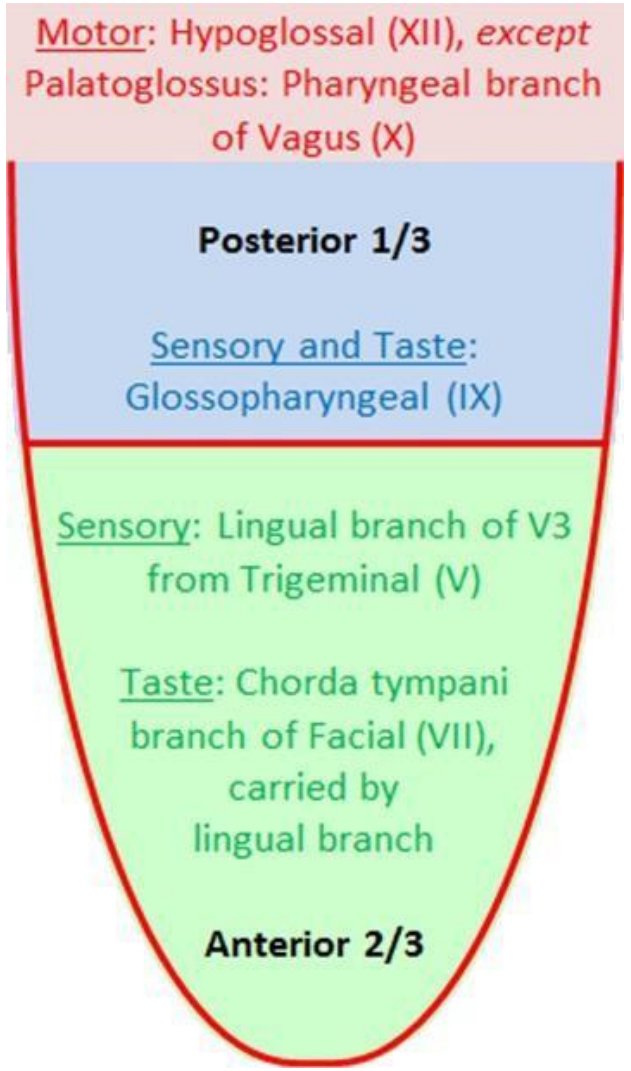
- Blood Supply
- The lingual artery, the tonsillar branch of the facial artery,(both are branches from external carotid artery. both give tonsillar branches, but lingual supplies the tongue) and the ascending pharyngeal artery supply the tongue

Veins are opposite to the arteries

- The veins drain into the internal jugular vein.

- Lymph Drainage (Next slide)
- tip: Submental lymph nodes
- Sides of the anterior two thirds: Submandibular and deep cervical lymph nodes
- Posterior third: Deep cervical lymph nodes

Important!



How does the posterior 1/3 have taste sensation even though it does not have taste buds? -that's because circumvallate papillae is present in the anterior compartment but its development belongs to the posterior one (it is also innervated by glossopharyngeal nerve).

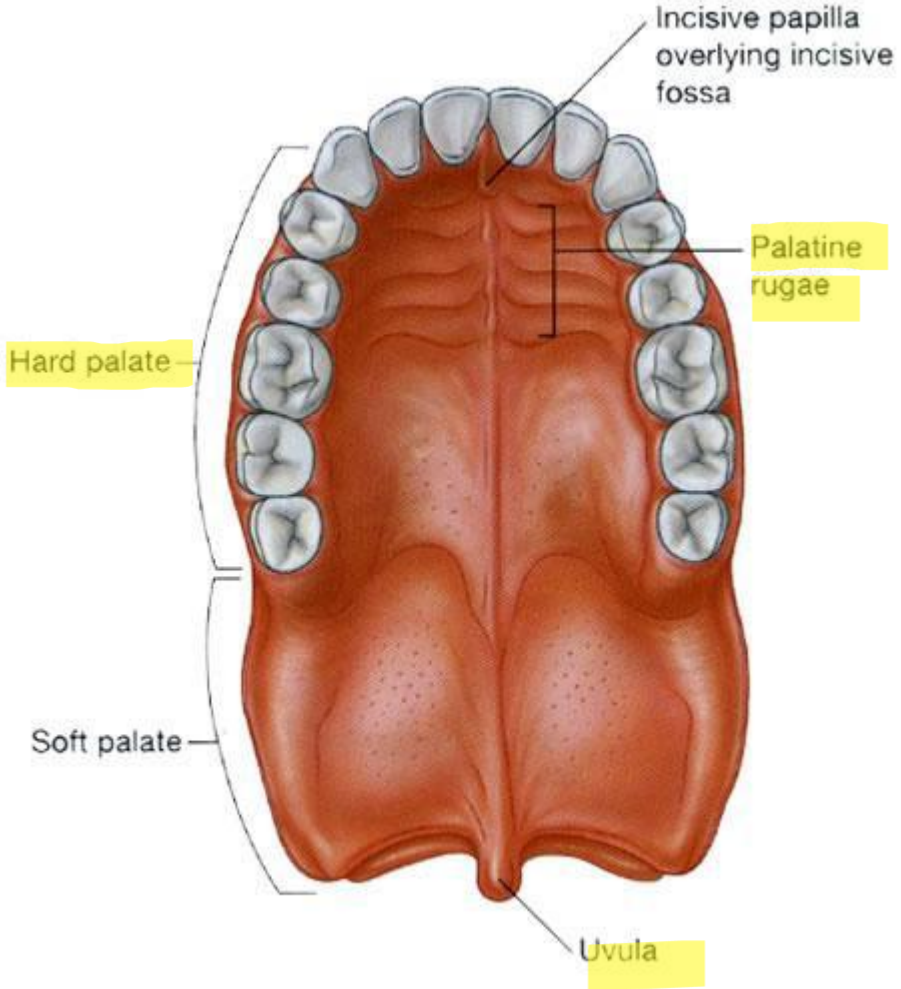
Additional Notes

- oral cavity and tongue (midline): like tip of the tongue, tip of the nose, philtrum and mid of lower lip drain to submental lymph nodes. Others go to submandibular and from there goes to 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 and the soft palate behind.
- Hard Palate: The hard palate is formed by the palatine processes of the maxillae and the horizontal plates of the palatine bones
- It is continuous behind with the soft palate.
- Soft Palate:
- 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 conica projection called the uvula.
- The soft palate is continuous at the sides with the lateral wall of the pharynx
- The soft palate is composed of mucous membrane, palatine aponeurosis, and muscles.



Additional Notes

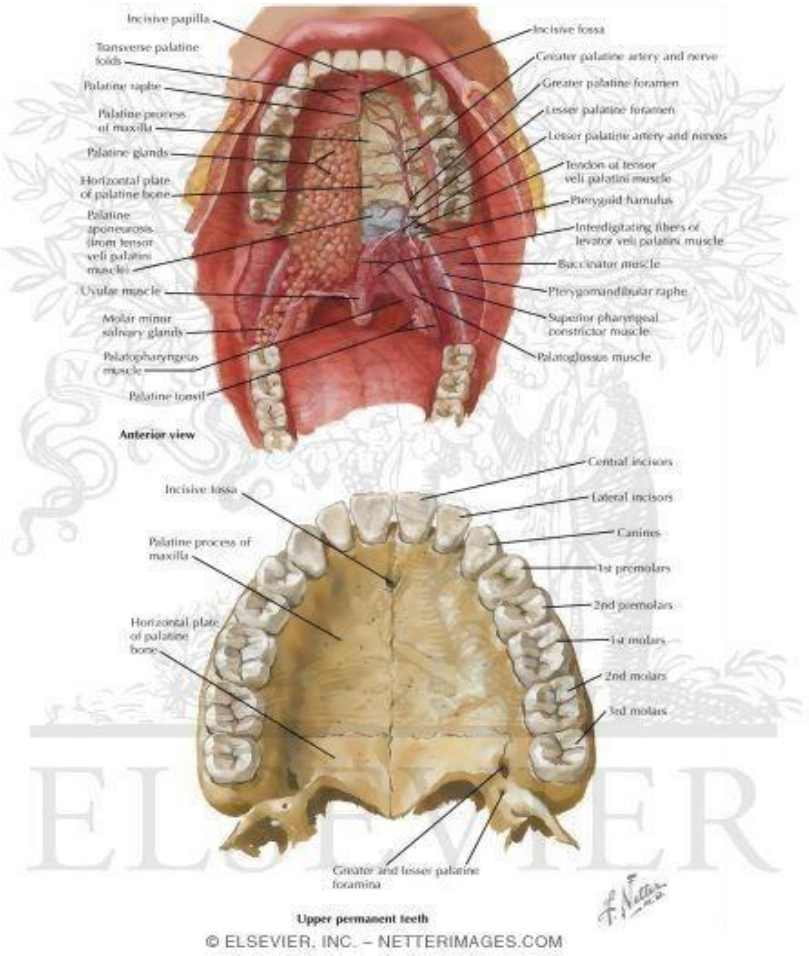
- Hard palate is dense and adherent with periosteum. It makes grooves (rugae).
- Soft palate is covered by loose connective tissue.
- A bony spine on the hard palate serves as the attachment site for the palatine tendon, which contributes to the formation of the soft palate.
- soft palate is made from the extension of palatine tendon.
- There is Greater and lesser palatine foramen through with leave greater and lesser palatine vessels and nerve.

Additional Notes

- The soft palate is a muscular structure composed of five muscles and covered by mucosa. It can move either upward and backward or downward and forward, depending on the functional need.
- When it moves upward and backward, it closes off the nasopharynx, as seen during vomiting, to prevent material from entering the nasal cavity.
- During mastication, tension is needed in the oral cavity, so the soft palate closes the oropharyngeal isthmus by moving downward and forward. This helps increase intraoral pressure.
- During swallowing, the soft palate suddenly elevates to open the oropharyngeal passage, allowing the bolus to pass into the oropharynx.

- The mucous membrane covers the upper and lower surfaces of the soft palate.
- The palatine aponeurosis is a fibrous sheet attached to the posterior border of the hard palate (starts from the spine)
- It is the expanded tendon of the tensor veli palatini muscle.

Palatine aponeurosis is made from right and left tensor veli palatini muscles that meet in the midline in which Its extension make the uvula.
Tensor= tense soft palate.



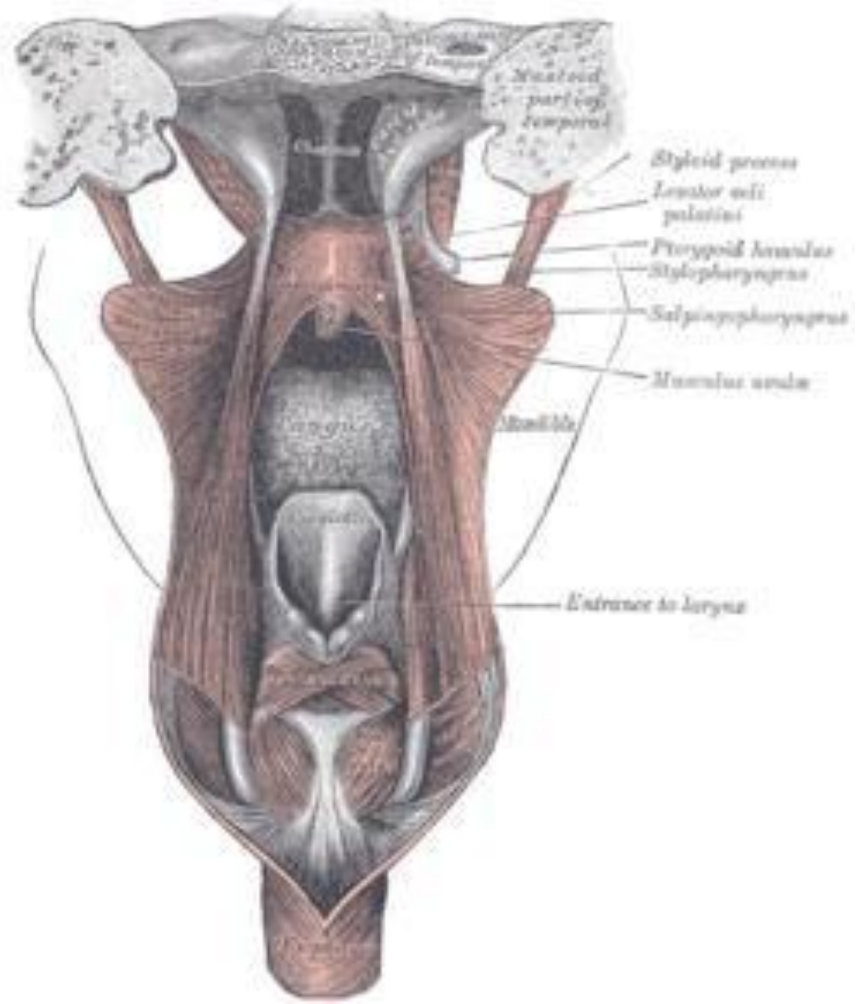
Muscles of the Soft Palate

- The muscles of the soft palate are the tensor veli palatini, the levator veli palatini **(elevation to close the nasopharynx)**, the palatoglossus, the palatopharyngeus, and the musculus uvulae

- The muscle fibers of the tensor veli palatini converge as they descend from their origin to form a narrow tendon, which turns medially around the pterygoid hamulus

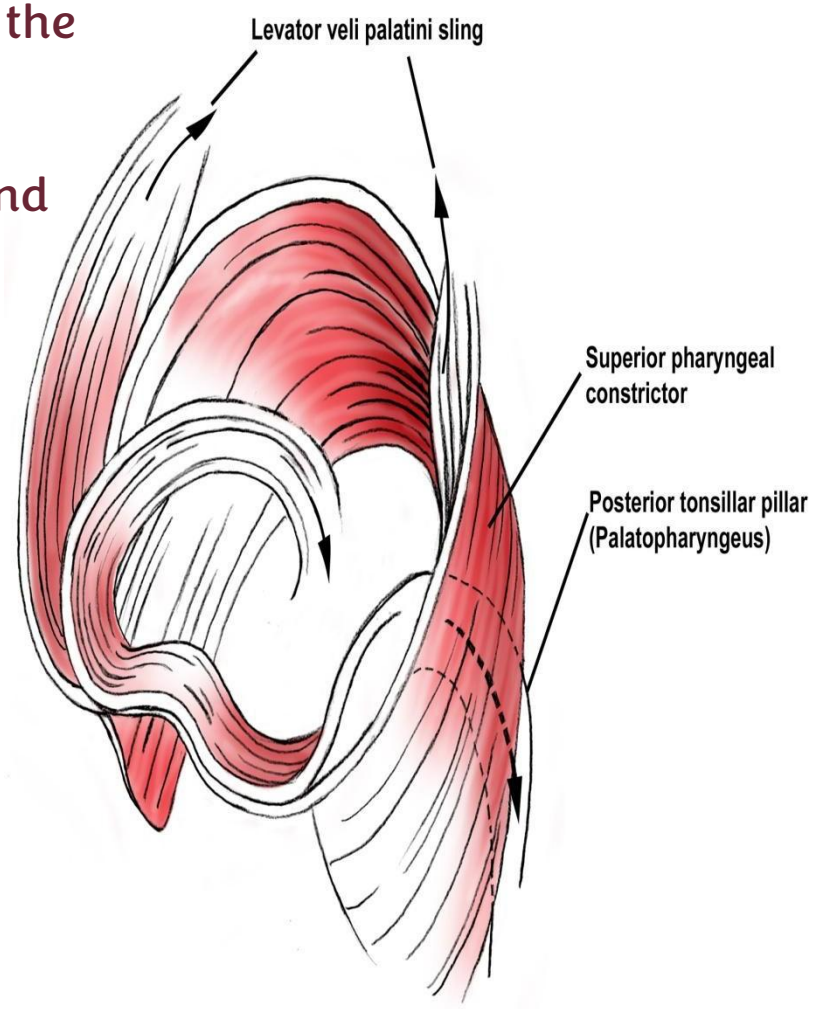
- The tendon, together with the tendon of the opposite side, expands to form the palatine aponeurosis

- 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.



- Levator veli palatini :
- O: Petrous part of temporal bone, auditory tube
- I: Palatine aponeurosis
- Innerv.: Pharyngeal plexus
- Action: Raises soft palate

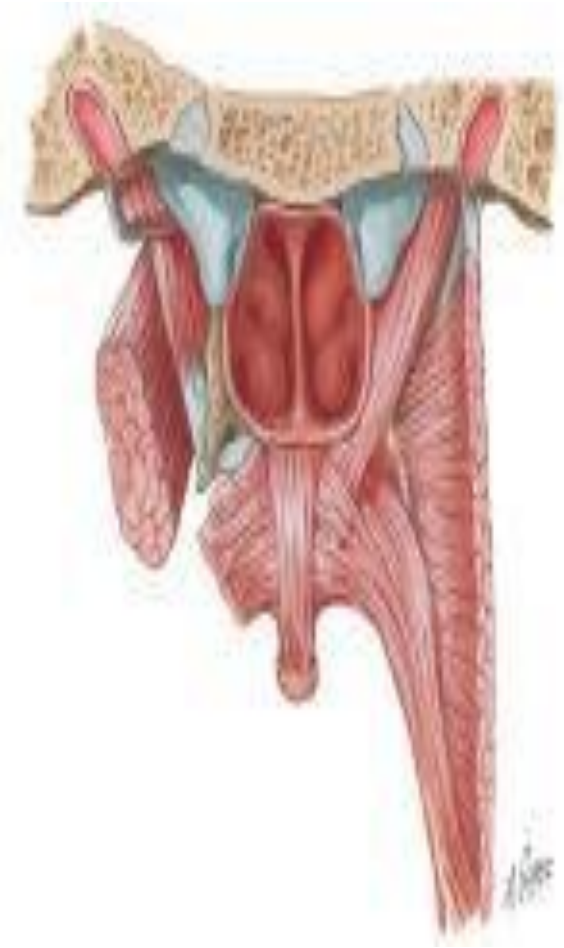
Pharyngeal plexus is located in the posterior wall of the pharynx.
It is made from 3 nerves: glossopharyngeal, accessory and vagus nerve (cranial accessory through vagus).



- Tensor veli palatini
- Spine of sphenoid, auditory tube
- With muscle of other side, forms palatine aponeurosis
- Nerve to medial pterygoid from stem of mandibular nerve (exception!!!)
- Tenses soft palate

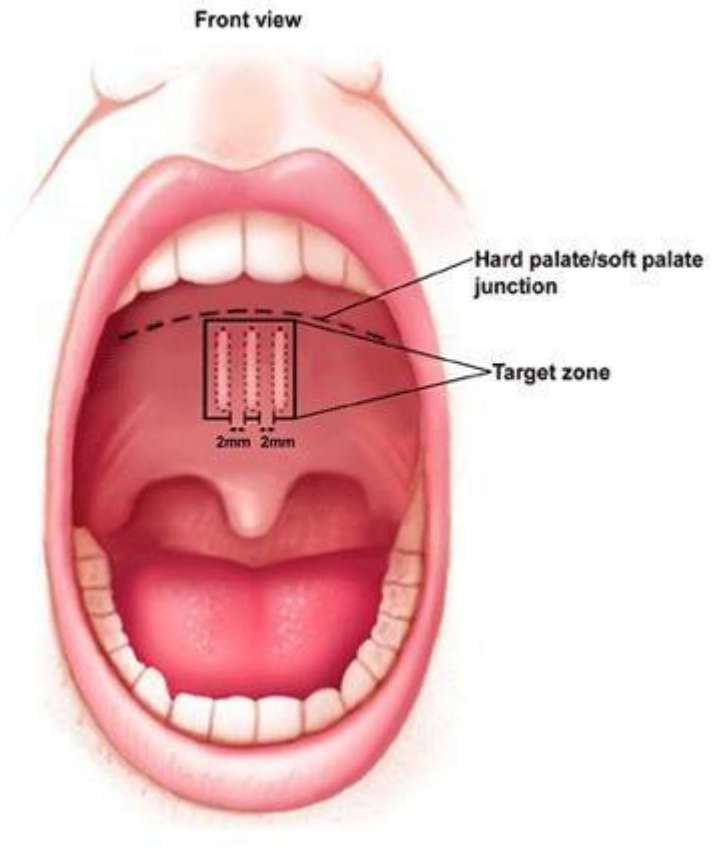
- Palatopharyngeus
- Palatine aponeurosis
- Posterior border of thyroid cartilage
- Innervation: Pharyngeal plexus
- Elevates wall of pharynx, pulls palatopharyngeal folds medially

- Musculus uvulae
- Posterior border of hard palate
- Mucous membrane of uvula
- Pharyngeal plexus
- Elevates uvula (soft palate)
- Present in the midline



Movements of the Soft Palate

- The pharyngeal isthmus (the communicating channel between the nasal and oral parts of the pharynx) is closed by raising the soft palate.
- Closure occurs during the production of explosive consonants in speech.
- 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
- By this means the nasal part of the pharynx is closed off from the oral part.



In rest, it is important for articulation of vowels
When someone says the letter N It leaves from the nose, so air enters nasal cavity. Other letters that leave through oral cavity enter through orpharyngeal isthmus
It is also important for respiration, you can either breathe from your nose or through the oral cavity

Nerve Supply of the 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

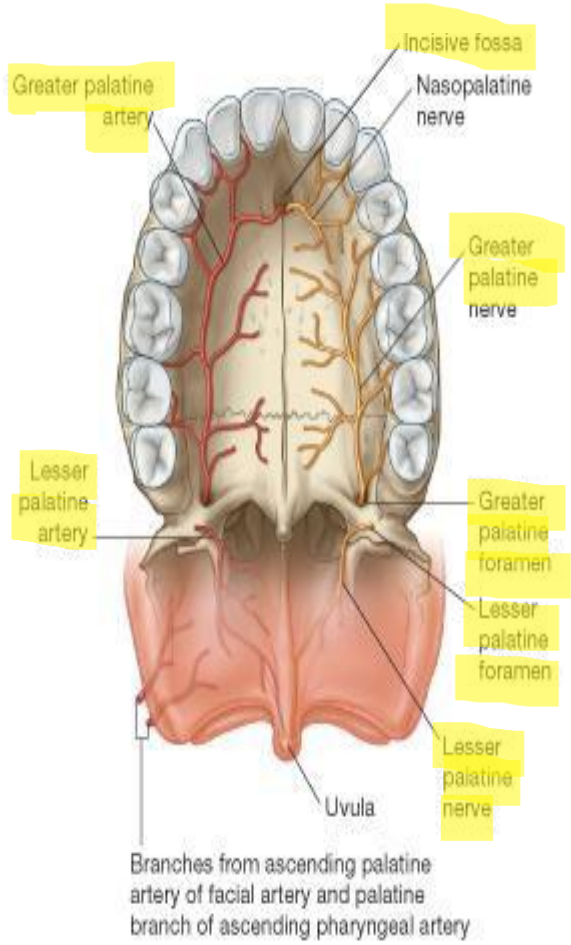
- The nasopalatine nerve, also a branch of the maxillary nerve, enters the front of the hard palate through the incisive foramen. (opposite to greater palatine artery)

- The glossopharyngeal nerve also supplies the soft palate through pharyngeal plexus.

- Blood Supply of the 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

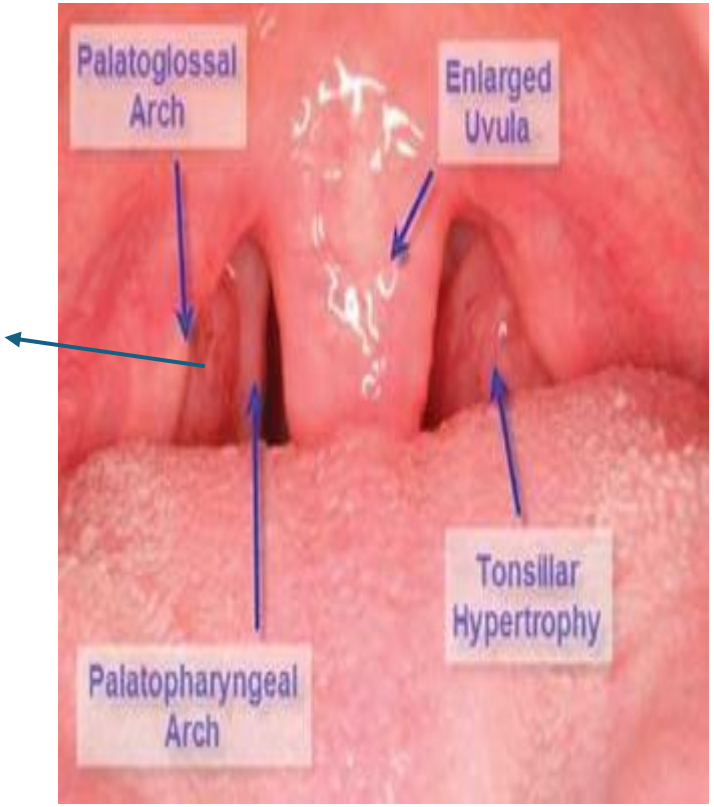
In the hard palate there is incisive fossa which contains incisive foramen. greater palatine artery supply nasal cavity (supply hard palate then go through incisive foramen to supply nasal cavity.



- 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

Palatine tonsil lies between palatoglossal and palatopharyngeal arches.

A disease caused enlarging of uvula



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	18, 20 and 26	Inlet of pharynx	Inlet of larynx
V1 → V2	45 and 50	Nasopharyngeal isthmus	Oropharyngeal isthmus

رسالة من الفريق العلمي:

Losing is just an opportunity to shine even brighter!

It don't matter what they say,
I'm Timeless.

“Takes, takes, takes and takes” – Sun tzu (probably).