Lecture 1 in Anatomy of G.I.T

(The Mouth, The Tongue, The Palate, The Salivary Glands and The Pharynx)

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The Mouth

The Lips

The lips are two fleshy folds that surround the oral orifice. They are covered on the outside by skin and are lined on the inside by mucous membrane. The substance of the lips is made up by the orbicularis oris muscle and the muscles that radiate from the lips into the face. Also included are the labial blood vessels and nerves, connective tissue, and many small salivary glands. The philtrum is the shallow vertical groove seen in the midline on the outer surface of the upper lip. Median folds of mucous membrane the labial frenulae connect the inner surface of the lips to the gums.

The Mouth Cavity

The mouth extends from the lips to the pharynx. The entrance into the pharynx, the **oropharyngeal isthmus**, is formed on each side by the palatoglossal fold.

The mouth is divided into the vestibule and the mouth cavity proper:-

1- Vestibule

The vestibule lies between the lips and the cheeks externally and the gums and the teeth internally. This slit-like space communicates with the exterior through the oral fissure between the lips. When the jaws are closed, it communicates with the mouth proper behind the third molar tooth on each side. The vestibule is limited above and below by the reflection of the mucous membrane from the lips and cheeks to the gums.

The lateral wall of the vestibule is formed by the cheek, which is made up by the buccinator muscle and lined with mucous membrane. The tone of the buccinator muscle and that of the muscles of the lips keeps the walls of the vestibule in contact with one another. The **duct of the parotid salivary gland** opens on a small papilla into the vestibule opposite the upper second molar tooth.

2- Mouth Proper

The mouth proper has a roof and a floor:-

A- Roof of Mouth:- The roof of the mouth is formed by the hard palate in front and the soft palate behind .

B- Floor of Mouth:- The floor is formed largely by the anterior two thirds of the tongue and by the reflection of the mucous membrane from the sides of the tongue to the gum of the mandible. A fold of mucous membrane called the **frenulum of the tongue** connects the undersurface of the tongue in the midline to the floor of the mouth. Lateral to the frenulum, the mucous membrane forms a fringed fold, the **plica fimbriata**.

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 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.

Mucous Membrane of the Mouth

In the vestibule, the mucous membrane is tethered is buccinator muscle by elastic fibers in the submucosa prevent redundant folds of mucous membrane from bitten between the teeth when the jaws are closed. The mucous membrane of the gingiva, or gum, is strongly
to the alveolar periosteum.

Sensory Innervation of the Mouth

Roof: The **greater palatine** and **nasopalatine** from the maxillary division of the trigeminal nerve.

Floor: The **lingual nerve** (common sensation), a branch of the mandibular division of the trigeminal nerve. The taste fibers travel in the **chorda tympani nerve**, a branch of the facial nerve.

Cheek: The **buccal nerve**, a branch of the mandibular division of the trigeminal nerve (the buccinator muscle is innervated by the buccal branch of the facial nerve).

The Tongue

The tongue is a mass of striated muscle covered with mucous membrane. The 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 by a median **fibrous septum.**

Mucous Membrane of the Tongue

The mucous membrane of the upper surface of the tongue can be divided into anterior and posterior parts by a **V-shaped sulcus**, the **sulcus terminalis**. The apex of the sulcus projects backward and is marked by a small pit, the **foramen cecum**. The sulcus serves to divide the tongue into the anterior two thirds, or **oral part**, and the posterior third, or **pharyngeal part**. The foramen cecum is an embryologic remnant and marks the site of the upper end of the thyroglossal duct.

Three types of papillae are present on the upper surface of the anterior two thirds of the tongue: the **filiform papillae**, the **fungiform papillae**, and the **vallate papillae**. The mucous membrane covering the posterior third of the tongue is devoid of papillae but has a nodular irregular surface caused by the presence of underlying lymph nodules, the **lingual tonsil**.

The mucous membrane on the inferior surface of the tongue is reflected from the tongue to the floor of the mouth. In the midline anteriorly, the undersurface of the tongue is connected to the floor of the mouth by a fold of mucous membrane, the **frenulum of the tongue**. On the lateral side of the frenulum, the deep lingual vein can be seen through the mucous membrane. Lateral to the lingual vein, the mucous membrane forms a fringed fold called the plica fimbriata.

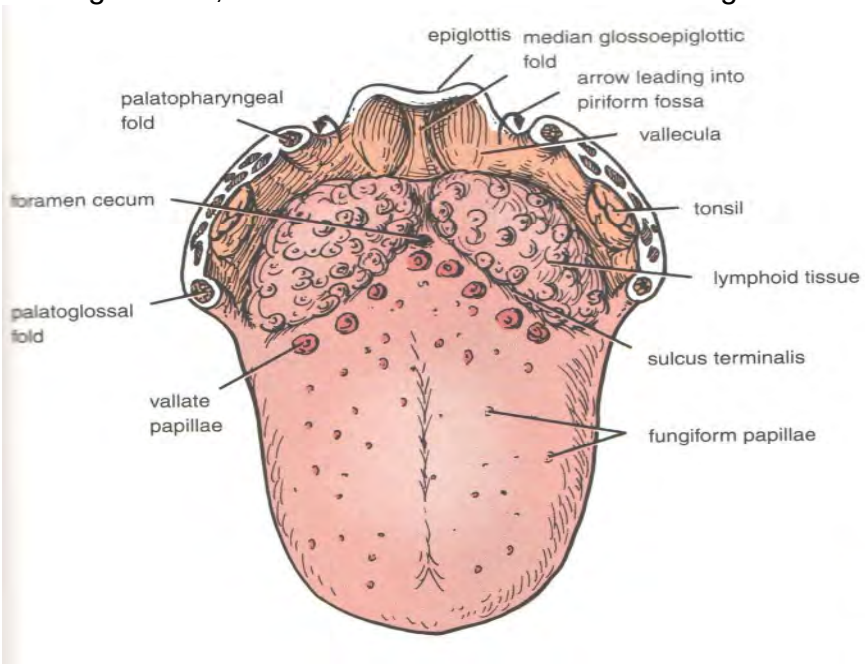

Figure 2-13 Dorsal surface of the tongue showing the valleculae, the epiglottis, and the entrance into the piriform fossa on each side (arrows).

Muscles of the Tongue

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

Intrinsic Muscles:- These muscles are confined to the tongue and are not attached to bone. They consist of longitudinal, transverse, and vertical fibers.

Nerve supply: Hypoglossal nerve.

Action: Alter the shape of the tongue.

Extrinsic Muscles:- These muscles are attached to bones and the soft palate. They are the genioglossus, the hyoglossus, the styloglossus, and the palatoglossus.

Nerve supply: Hypoglossal nerve.

Action: Alter the position of the tongue within the mouth.

Table 2-2 Muscles of Tongue

Muscle	Origin	Insertion	Nerve Supply	Action
Intrinsic Muscles				
Longitudinal Transverse Vertical	Median septum and submucosa	Mucous membrane	Hypoglossal nerve	Alters shape of tongue
Extrinsic Muscles				
Genioglossus	Superior genial spine of mandible	Blends with other muscles of tongue	Hypoglossal nerve	Protrudes apex of tongue through mouth
Hyoglossus	Body and greater cornu of hyoid bone	Blends with other muscles of tongue	Hypoglossal nerve	Depresses tongue
Styloglossus	Styloid process of temporal bone	Blends with other muscles of tongue	Hypoglossal nerve	Draws tongue upward and backward
Palatoglossus	Palatine aponeurosis	Side of tongue	Pharyngeal plexus	Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus

Blood Supply of the Tongue:-

The **lingual artery**, the **tonsilar branch** of the facial artery, and the **ascending pharyngeal artery** supply the tongue. The veins drain into the **internal jugular vein**.

Lymph Drainage of the Tongue:-

Tip: Submental lymph nodes.

Sides of the anterior two thirds: Submandibular and deep cervical lymph nodes.

Posterior third: Deep cervical lymph nodes.

Sensory Innervation of the Tongue:-

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

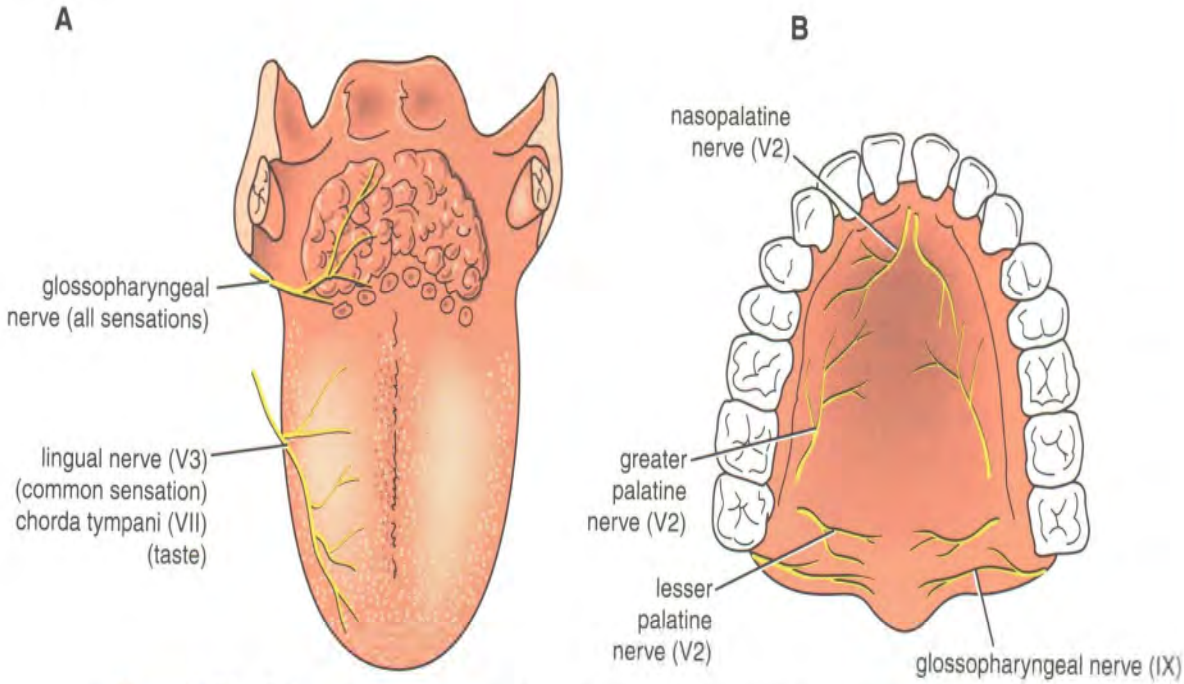

Figure 2-10 **A.** Sensory nerve supply to the mucous membrane of the tongue. **B.** Sensory nerve supply to the mucous membrane of the hard and soft palate; taste fibers run with branches of the maxillary nerve (V2) and join the greater petrosal branch of the facial nerve.

Movements of the Tongue:-

Protrusion: The **genioglossus** muscles on both sides acting together.
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.

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.

The 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 conical 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.

The Mucous Membrane of The Palate

The mucous membrane covers the upper and lower surfaces of the soft palate.

Palatine Aponeurosis

The palatine aponeurosis is a fibrous sheet attached to the posterior border of the hard palate. It is the expanded tendon of the tensor veli palatini muscle.

Muscles of the Soft Palate

The muscles of the soft palate are the **tensor veli palatini**, the **levator veli palatini**, 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.

Table 2-3 Muscles of the Soft Palate

Muscle	Origin	Insertion	Nerve Supply	Action
Tensor veli palatini	Spine of sphenoid, auditory tube	With muscle of other side, forms palatine aponeurosis	Nerve to medial pterygoid from mandibular nerve	Tenses soft palate
Levator veli palatini	Petrous part of temporal bone, auditory tube	Palatine aponeurosis	Pharyngeal plexus	Raises soft palate
Palatoglossus	Palatine aponeurosis	Side of tongue	Pharyngeal plexus	Pulls root of tongue upward and backward, narrows oropharyngeal isthmus
Palatopharyngeus	Palatine aponeurosis	Posterior border of thyroid cartilage	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

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. The **glossopharyngeal nerve** also supplies the soft palate.

Blood Supply of the Palate

The blood supply of the palate consists of 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

Lymph is drained from the palate by the **deep cervical lymph nodes**.

Palatoglossal Arch

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.

Palatopharyngeal Arch

The palatopharyngeal arch is a fold of mucous membrane behind the palatoglossal arch that 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.

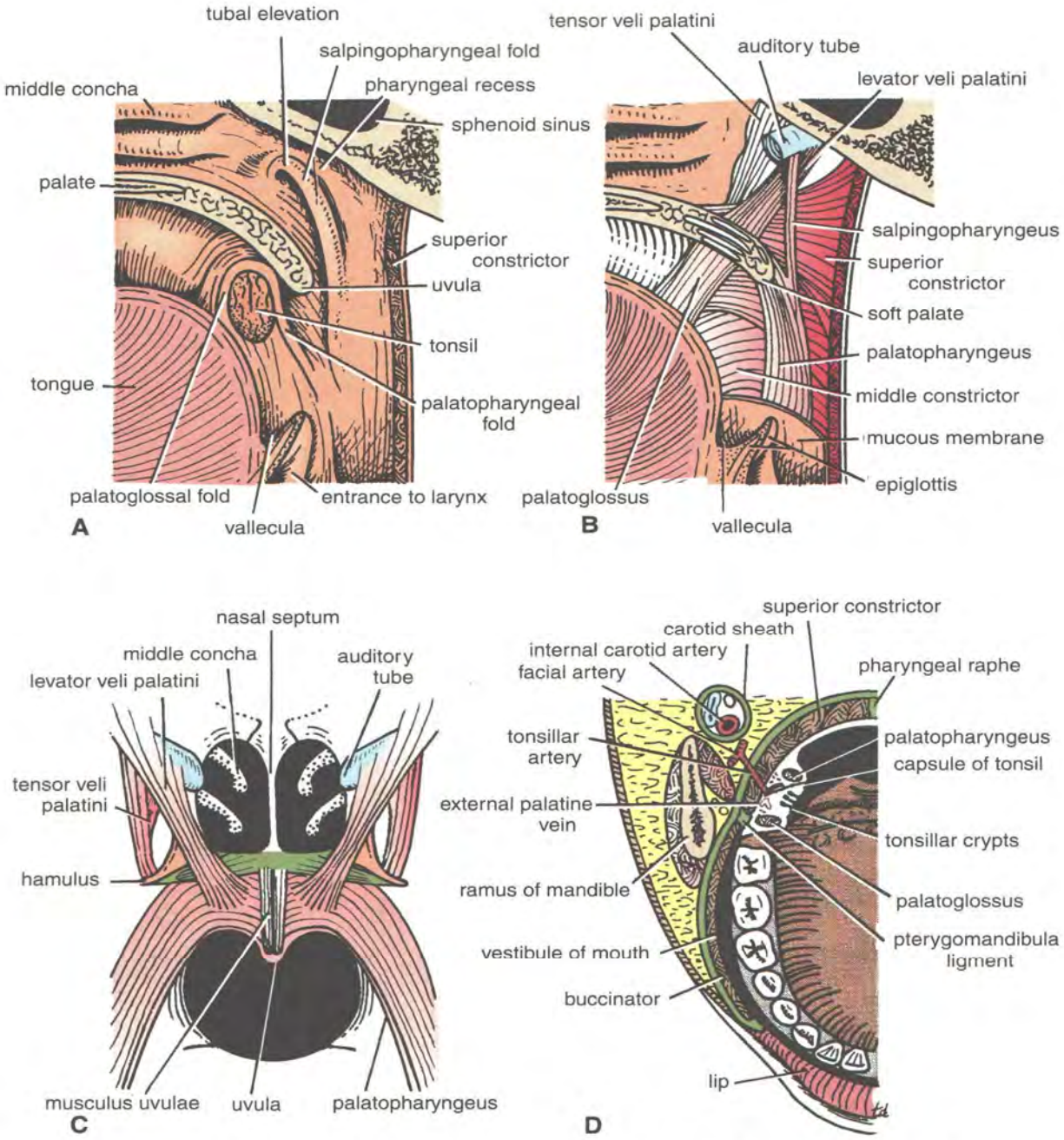

Figure 2-17 **A.** Junction of the nose with the nasal part of the pharynx and the mouth with the oral part of the pharynx. Note the position of the tonsil and the opening of the auditory tube. **B.** Muscles of the soft palate and the upper part of the pharynx. **C.** Muscles of the soft palate seen from behind. **D.** Horizontal section through the mouth and the oral part of the pharynx showing the relations of the tonsil.

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.

The Salivary Glands

1- Parotid Gland

The parotid gland is the largest salivary gland and is composed mostly of serous acini. It lies in a deep hollow below the external auditory meatus, behind the ramus of the mandible and in front of the sternocleidomastoid muscle. The facial nerve divides the gland into **superficial** and **deep** lobes. The **parotid duct** emerges from the anterior border of the gland and passes forward over the lateral surface of the masseter. It enters the vestibule of the mouth upon a small papilla opposite the upper second molar tooth.

Nerve Supply of The Parotid Gland

Parasympathetic secretomotor supply arises from the **glossopharyngeal nerve**. The nerves reach the gland via the **tympanic branch**, the **lesser petrosal nerve**, the **otic ganglion**, and the **auriculotemporal nerve**.

2- Submandibular Gland

The submandibular gland consists of a mixture of serous and mucous acini. It lies beneath the lower border of the body of the mandible and is divided into superficial and deep parts by the mylohyoid muscle. The deep part of the gland lies beneath the mucous membrane of the mouth on the side of the tongue. The **submandibular duct** emerges from the anterior end of the deep part of the gland and runs forward beneath the mucous membrane of the mouth. It opens into the mouth on a small papilla, which is situated at the side of the frenulum of the tongue.

Nerve Supply of The Submandibular Gland

Parasympathetic secretomotor supply is from the **facial nerve** via the **chorda tympani** and the **submandibular ganglion**. The postganglionic fibers pass directly to the gland.

3- Sublingual Gland

The sublingual gland lies beneath the mucous membrane (sublingual fold) of the floor of the mouth, close to the frenulum of the tongue. It has both serous and mucous acini, with the latter predominating. The **sublingual ducts** (8 to 20 in number) open into the mouth on the summit of the sublingual fold.

Nerve Supply of The Sublingual Gland

Parasympathetic secretomotor supply is from the **facial nerve** via the **chorda tympani** and the **submandibular ganglion**. Postganglionic fibers pass directly to the gland.

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, with its upper, wider end lying under the skull, and its lower, narrow end becoming continuous with the esophagus opposite the sixth cervical vertebra. 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 the mucous membrane of the tympanic cavity.

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 three constrictor muscles extend round 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. 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.

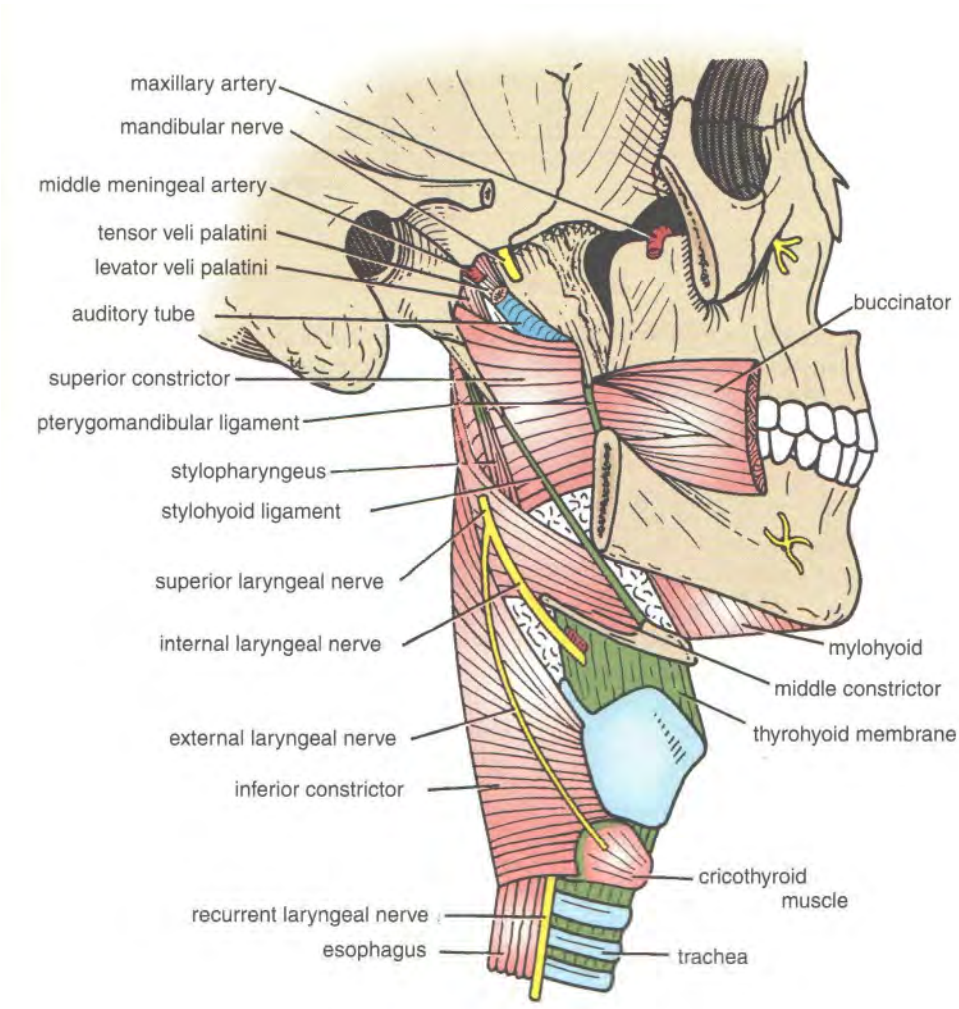

Figure 2-20 The three constrictors of the pharynx; the superior and recurrent laryngeal nerves are also shown.

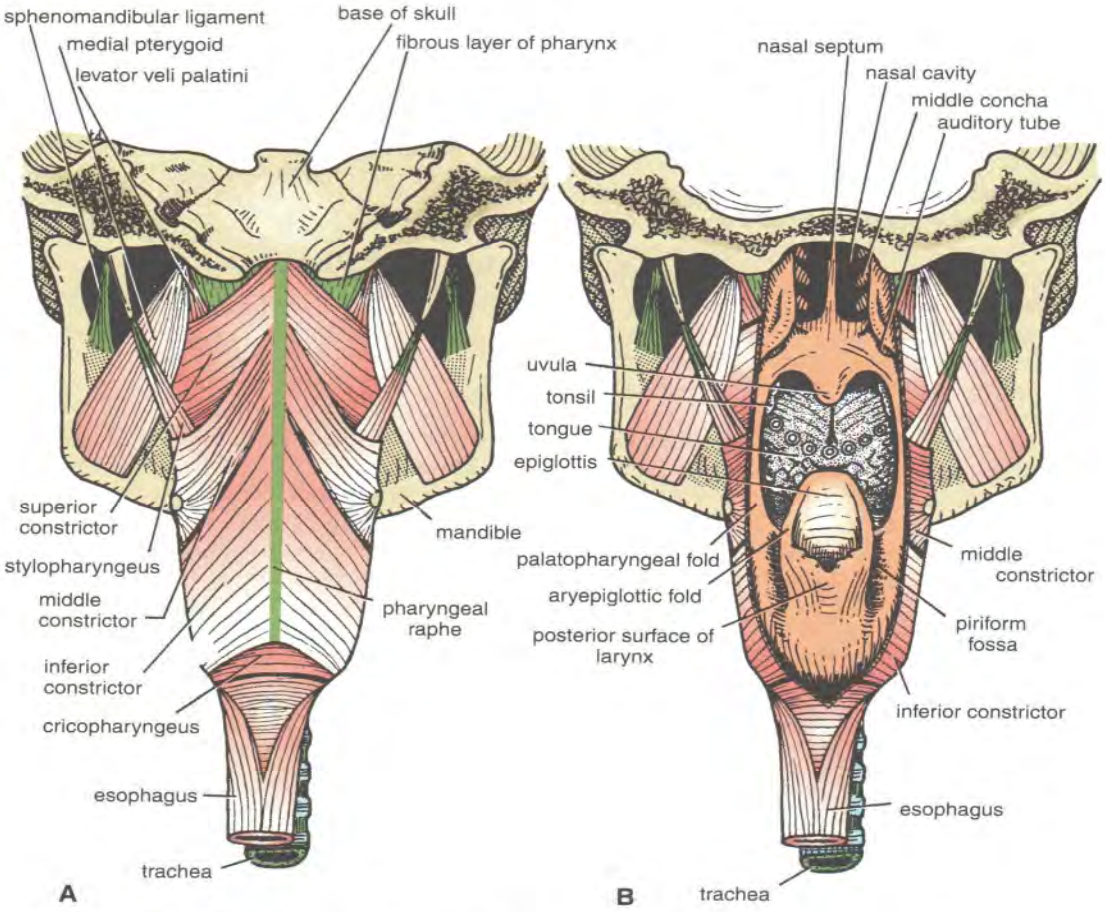

Figure 2-21 The pharynx seen from behind. **A.** Note the three constrictor muscles and the position of the stylopharyngeus muscles. **B.** The greater part of the posterior wall of the pharynx has been removed to display the nasal, oral, and laryngeal parts of the pharynx.

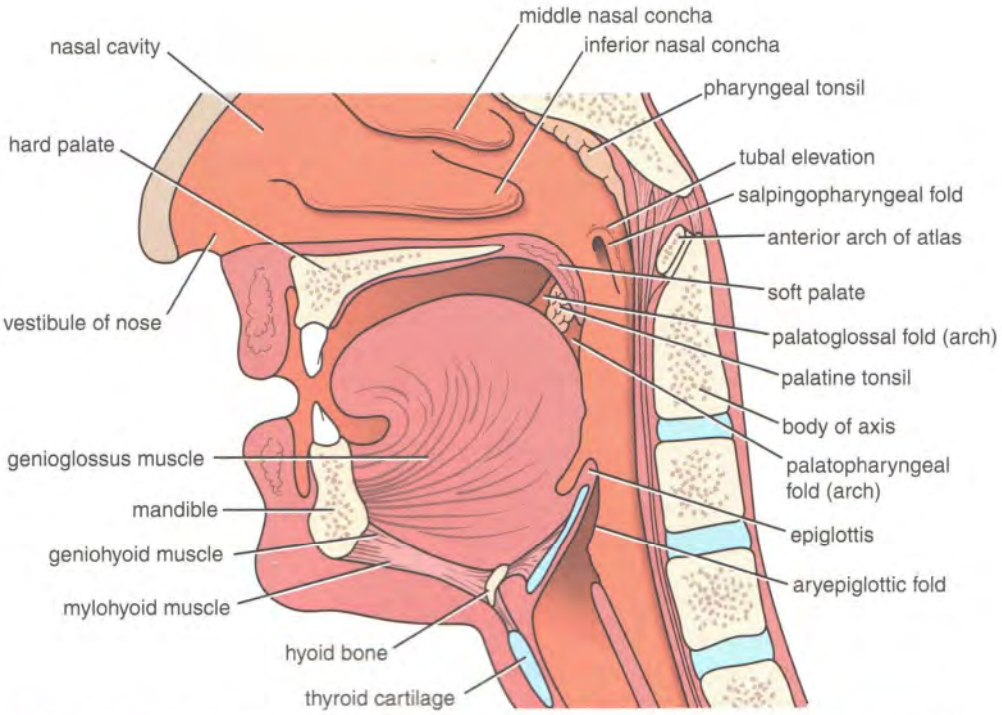

Figure 2-22 Sagittal section of the head and neck showing the relations of the nasal cavity, mouth, pharynx, and larynx.

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 round the lowest and narrowest part of the pharynx and act as a sphincter. **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.

Table 2-4 Muscles of the Pharynx

Muscle	Origin	Insertion	Nerve Supply	Action
Superior constrictor	Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament, mylohyoid line of mandible	Pharyngeal tubercle of occipital bone, raphe in midline posteriorly	Pharyngeal plexus	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	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Inferior constrictor	Lamina of thyroid cartilage, cricoid cartilage	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Cricopharyngeus	Lowest fibers of inferior constrictor muscle			Sphincter at lower end of pharynx
Stylopharyngeus	Styloid process of temporal bone	Posterior border of thyroid cartilage	Glossopharyngeal nerve	Elevates larynx during swallowing
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

Interior of Pharynx

The pharynx is divided into three parts: the **nasal pharynx**, the **oral pharynx**, and the **laryngeal pharynx**:-

1- Nasal Pharynx

The nasal pharynx 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**. 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**. 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.

2- Oral Pharynx

The oral pharynx 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 is the **lateral glossoepiglottic fold**. 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. The palatoglossal arch is a fold of mucous membrane covering the palatoglossus muscle. The interval between the two palatoglossal arches is called the

oropharyngeal isthmus and marks the boundary between the mouth and pharynx. The palatopharyngeal arch is a fold of mucous membrane covering the palatopharyngeus muscle. The recess between the palatoglossal and palatopharyngeal arches is occupied by the **palatine tonsil**.

3- Laryngeal Pharynx

The laryngeal pharynx 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.

Blood Supply of Pharynx

Ascending pharyngeal arteries, **tonsillar branches** of facial arteries, and **branches of maxillary** and **lingual arteries** compose the blood supply of the pharynx.

Lymph Drainage of Pharynx

Lymph drains from the pharynx directly into the **deep cervical lymph nodes** or indirectly via the **retropharyngeal** or **paratracheal nodes** into the deep cervical nodes.