

## The Mouth

The mouth extends from the lips to the oropharyngeal isthmus, that is, the junction of the mouth with the pharynx. It is subdivided into the **vestibule**, which lies between the lips and cheek externally and the gums and teeth internally, and the **mouth cavity proper**, which lies within the alveolar arches, gums, and teeth.

The **vestibule** is a slitlike space that communicates with the exterior through the oral fissures. When the jaws are closed, it communicates with the mouth cavity proper behind the third molar tooth on each side. Superiorly and inferiorly, the vestibule is limited by the reflection of the mucous membrane from the lips and cheeks onto the gums. The cheek forms the lateral wall of the vestibule and is made up of the buccinator muscle, which is covered on the outside by fascia and skin and is lined by mucous membrane. Opposite the upper second molar teeth, a small papilla is present on the mucous membrane, marking the opening of the duct of the parotid salivary gland.

The **mouth proper** has a roof, which is formed by the hard palate in front and the soft palate behind. The floor is formed 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 on the mandible. In the midline, a fold of mucous membrane called frenulum of the tongue connects the undersurface of the tongue to the floor of the mouth. On each side of the frenulum is a small papilla, on the summit of which is the orifice of the duct of the submandibular salivary gland. From the papilla, a rounded ridge of mucous membrane extends backward and laterally. It is produced by the underlying sublingual gland and is called the sublingual fold.

The **lips** consist of a sheet of muscle covered externally by the skin and internally by the mucous membrane and submucosa. The mucous membrane is continuous with the skin at the margins of the lips, and here the stratified squamous epithelium changes from a non-keratinizing to a keratinizing type. At its reflection on to the jaws, the mucous membrane forms a median, raised fold, the frenulum of the lip. The chief bulk of the lip is the muscular layer which is formed by the orbicularis oris and the various facial muscles which converge on it.

The **submucous** layer consists of areolar tissue which blends the mucous membrane to the muscular layer. It contains numerous mucous glands, the labial gland, with ducts which pierce the mucous membrane and open into the vestibule. In each lip there is an arterial arch formed by the labial branches of the facial arteries.

### Sensory Nerve Supply of the Mucous Membrane of the Mouth

The **roof** is supplied by the greater palatine and nasopalatine nerves. The nerve fibers travel in the maxillary nerve.

The **floor** is supplied by the lingual nerve, a branch of the mandibular nerve. The taste fibers travel in the chorda tympani nerve, a branch of the facial.

The **cheek** is supplied by the buccal nerve, a branch of the mandibular nerve.

## Teeth

The two sets of teeth make their appearance at different times of life. The first set, called the deciduous teeth, is temporary. The second set is called the permanent.

The **deciduous** teeth are 20 in number. 4 incisors, 2 canines, and 4 molars in each jaw. They begin to erupt at about the sixth month after birth and have all erupted by the end of the second year. The teeth of the lower jaw usually appear before those of the upper jaw.

The permanent teeth are 32 in number, including 4 incisors, 2 canines, 4 premolars, 6 molars in each jaw. They begin to erupt at 6 year. The last tooth to erupt is the third molar, and this may take place between the seventeenth and thirtieth years. The teeth of the lower jaw usually appear before those of the upper jaw.

## Tongue

The tongue is a mass of striated muscle covered with a mucous membrane. Its anterior two-thirds lies in the mouth, and the posterior third lies in the pharynx. The muscles attach the tongue to the styloid process and the soft palate above and to the mandible and hyoid bone below. The tongue is divided into two halves by a median 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 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.

The types of the papillae are present on the surface of the anterior two-thirds of the tongue: (1) the filiform papillae, (2) the fungiform papillae, and (3) the vallate papillae.

The **filiform** papillae are numerous, minutes, pointed projections which cover all of the oral part of the dorsum and the margins of the tongue. They are in rows parallel to the sulcus terminalis posteriorly, but transverse anteriorly. Their cornified apices may be broken up into thread-like processes.

The **fungiform** papillae, smaller and more numerous than the vallate papillae, are the bright red spots seen principally on the tip and margins of the living tongue, and also scattered over the remainder of the dorsum of the tongue. Each is attached by a narrow

base, and expands into a rounded knob-like free extremity. Most of them carry taste buds.

The **vallate** papillae are the largest, seven to 12 in number, which lie immediately anterior to the sulcus terminalis. Each has the shape of short cylinder sunk into the surface of the tongue, with a deep trench around it. The apposing walls of the trench are studded with taste buds.

The mucous membrane covering the posterior third is devoid of papillae but has a nodular irregular surface caused by the presence of underlying lymph nodules, the lingual tonsils.

The mucous membrane of the inferior surface of the tongue is smooth and 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 the 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.

### Muscles of the Tongue

The muscles of the tongue are divided into two types: (1) intrinsic and (2) extrinsic.

The intrinsic muscles are confined to the tongue and are not attached to bone. They consist of longitudinal, transverse, and vertical fibers. They are supplied by hypoglossal nerve and their action is to alter the shape of the tongue.

The extrinsic muscles are attached to bones and the soft palate. They are the genioglossus, the hyoglossus, the styloglossus and the palatoglossus.

Name of the muscle	Origin	Insertion	Nerve supply	Action
<b>Intrinsic muscles</b>				
Longitudinal Transverse vertical	Median septum and submucosa	Mucous membrane	Hypoglossal	Alters the shape of the tongue
<b>Extrinsic muscles</b>				
genioglossus	Mental spine of the mandible	Blends with other muscles of the tongue	hypoglossal	Protrudes apex of tongue through mouth
Hyoglossus	Body and the	Blends	hypoglossal	Depresses the tongue

	greater cornu of the hyoid	with other muscles of the tongue		
styloglossus	Styloid process of the temporal bone	Blends with other muscles of the tongue	hypoglossal	Draws tongue upward and backward
palatoglossus	Palatine aponeurosis	Side of tongue	Pharyngeal plexus	Pulls roots of tongue upward and backward

### Blood supply

The tongue is supplied by the lingual artery, the tonsillar branch of the facial artery, and the ascending pharyngeal artery. The veins drain into the internal jugular vein.

The tip of the tongue drains into the submental lymph nodes. The remainder of the anterior two-thirds of the tongue drains into the submandibular and deep cervical lymph nodes on both sides. Lymph from the posterior third of the tongue drains into the deep cervical lymph nodes.

The mucous membrane covering the anterior two-thirds of the tongue is supplied by the lingual nerve for general sensation. Taste fibers from the anterior two-thirds of the tongue, excluding the vallate papillae, run in the chorda tympani branch of the facial nerve.

General sensation and taste appreciation from the posterior third of the tongue, including the vallate papillae, are served by the glossopharyngeal nerve.

### The Pharynx

The pharynx is situated behind the nasal cavities, the mouth, and the larynx. It is somewhat funnel shaped, with its upper, wide 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 that is deficient anteriorly. Here it is replaced by the posterior nasal apertures, the oropharyngeal isthmus, and the inlet of the larynx. The wall of the pharynx has five layers: (1) mucous membrane, (2) submucosa, (3) pharyngobasilar fascia, (4) pharyngeal muscles, and (5) buccopharyngeal fascia.

The buccopharyngeal fascia covers the external surfaces of the pharyngeal muscles. The pharyngobasilar fascia lines the internal surfaces of the pharyngeal muscles and

attaches the pharynx to the base of the skull, to the auditory tube, and to the lateral margins of the posterior nasal aperture.

### **Muscles of the Pharynx**

The muscles of the pharynx consist of the superior, middle, and inferior constrictor muscles, whose fibers run in a more or less circular direction, and the stylopharyngeus and salpingopharyngeus muscles, whose fibers run in a more or less longitudinal direction, and the palatopharyngeus muscle.

The constrictor muscles form curved sheets, which lie in the posterior wall and sides of the pharynx. They are inserted posteriorly into a median fibrous raphe which descends from the pharyngeal tubercle on the base of the skull to the esophagus. Nerve supply: the pharyngeal plexus of the glossopharyngeal and vagus nerve, with additional supply to the inferior constrictor from the external and recurrent laryngeal nerves.

The inferior constrictor muscle arises from the side of the cricoid cartilage, the fascia covering cricothyroid, and the oblique line on the thyroid cartilage. It is inserted to the pharyngeal raphe. Inferiorly, it overlaps the beginning of the esophagus and the recurrent laryngeal nerve and inferior laryngeal artery ascending to the larynx. It propels the bolus downward.

The middle constrictor muscle is a fan-shaped muscle, that arises from the greater and lesser horn of the hyoid bone and from the lower part of the stylohyoid ligament. It is inserted to the pharyngeal wall at the pharyngeal raphe. It propels the bolus downward.

The superior constrictor muscle lies in the wall of the oral and nasal parts of the pharynx. It arises from the posterior margin of the medial pterygoid plate and the pterygoid hamulus, from the pterygomandibular ligament, from the mylohyoid line of the mandible, and from the mucous membrane of the mouth and the side of the tongue. It is inserted to the pharyngeal tubercle of the occipital bone, and is inserted posteriorly in midline to the pharyngeal raphe. It aids soft palate in closing off the nasal pharynx, and propels the bolus downward.

The successive contraction of the constrictor muscle propels the bolus of food into the esophagus. The lower fibers of the inferior constrictor muscle sometimes referred to as the **cricopharyngeus muscle**, are believed to exert a sphincteric effect on the lower end of the pharynx, preventing the entry of air into the esophagus between the acts of swallowing. The longitudinal muscles elevate the pharynx and larynx during swallowing.

### **Interior of the Pharynx**

The pharynx is divided into three parts: nasal, oral, and laryngeal.

#### **Nasal part of the Pharynx**

The nasal part of the pharynx lies behind the nasal cavities, above the soft palate and is continuous inferiorly with the oral part through the narrow pharyngeal isthmus. It has a roof, an anterior wall, a posterior wall, and lateral wall.

The **roof** is supported by the body of the sphenoid and the basilar part of the occipital bone. A collection of lymphoid tissue, called the pharyngeal tonsil, is present in the submucosa of this region.

The **floor** is formed by the sloping upper surface of the soft palate. The pharyngeal isthmus is the opening in the floor between the free edges of the soft palate and the posterior pharyngeal wall. During swallowing, this communication between the nasal and oral parts of the pharynx is closed by the elevation of the soft palate and the pulling forward of the posterior wall of the pharynx.

The **anterior wall** is formed by the posterior nasal apertures, separated by the posterior edge of the nasal septum.

The **posterior wall** forms a continuous sloping surface with the roof. It is supported by the anterior arch of the atlas vertebra.

The **lateral wall**, on each side, has the pharyngeal opening of the auditory tube. The posterior margin of the tube forms an elevation called the tubal elevation. The salpingopharyngeus muscle which is attached to the lower margin of the tube, produces a vertical fold of mucous membrane called the salpingopharyngeal fold. The pharyngeal recess is a small depression in the lateral wall behind the tubal elevation. A collection of lymphoid tissue in the submucosa behind the opening of the auditory tube is called the tubal tonsil.

### **The Oral Part of the Pharynx**

The oral part of the pharynx lies behind the mouth cavity and extends from the soft palate to the upper border of the epiglottis. It has a roof, a floor, an anterior wall, a posterior wall, and lateral walls.

The **roof** is formed by the undersurface of the soft palate and the pharyngeal isthmus. Small collections of lymphoid tissue are present in the submucosa on the undersurface of the soft palate.

The **floor** is formed by the posterior one-third of the tongue and the interval between the tongue and the anterior surface of the epiglottis. The mucous membrane covering the posterior third of the tongue is irregular in appearance because of the presence of the underlying lymphoid tissue, the lingual tonsil. The mucous membrane is reflected from the tongue onto the epiglottis. In the midline is an elevation, called median glossoepiglottic fold, and two lateral glossoepiglottic folds. The depression on each side of the median glossoepiglottic fold is called the vallecula.

The **anterior wall** opens into the mouth through the oropharyngeal isthmus. Below this opening is the pharyngeal part of the tongue.

The **posterior wall** is supported by the body of the second cervical vertebra and the upper part of the body of the third cervical vertebra.

The **lateral walls** on each side have the palatoglossal and the palato-pharyngeal arches or folds and the palatine tonsils between them.

The **palatoglossal arch** is a fold of mucous membrane covering the underlying palatoglossal muscle. The interval between the two palatoglossal arches marks the boundary between the mouth and the oral pharynx and is called oropharyngeal isthmus.

The **palatopharyngeal arch** is a fold of mucous membrane on the lateral wall of the oral part of the pharynx behind the palatoglossal arch. It covers the underlying palatopharyngeus muscle.

The **tonsillar sinus** is a triangular recess on the lateral wall of the oral pharynx between the palatoglossal arch in front and the palatopharyngeal arch behind. It is occupied by the palatine tonsil.

The **palatine tonsils** are two masses of lymphoid tissue located in the lateral walls of the oral part of the pharynx in the tonsillar sinus. Each tonsil is covered by mucous membrane, and its free medial surface projects into the cavity of the pharynx. The surface is pitted by numerous small openings, which lead into the tonsillar crypts. The tonsil is covered on its lateral surface by a layer of fibrous tissue called the capsule.

The tonsil reaches its maximum size during early childhood, but after puberty it diminishes considerably in size. The tonsil is related anteriorly to palatoglossal arch and posteriorly to the palatopharyngeal arch. Superiorly, it is related to the soft palate. Here, the tonsil becomes continuous with the lymphoid tissue on the undersurface of the soft palate. Inferiorly, the tonsil is related to the posterior third of the tongue. Here, the palatine tonsil becomes continuous with the lingual tonsil. Medially, it is related to the cavity of the oral part of the pharynx. Laterally, the tonsil is separated by the capsule from the superior constrictor muscle by loose areolar tissue.

The arterial supply to the tonsil is the tonsillar artery, a branch of the facial artery. The veins pierce the superior constrictor muscle and join the external palatine, the pharyngeal, or the facial veins. The lymph vessels join the upper deep cervical lymph nodes.

### **Laryngeal Part of the Pharynx**

The laryngeal part of the pharynx lies posterior to the larynx. It extends between the upper border of the epiglottis and the lower border of the cricoid cartilage. It decreases rapidly in width from above downward, so that the pharyngo-esophageal junction is a narrow part of the gut tube. It has an anterior wall, a posterior wall, and lateral walls.

The **anterior wall** is formed by the inlet of the larynx and by mucous membrane covering the posterior surface of the larynx.

The **posterior wall** is supported by the bodies of the third, fourth, fifth, and sixth cervical vertebrae.

The **lateral wall** is supported by the thyroid cartilage and the thyrohyoid membrane. A small but important groove in the mucous membrane, called the piriform fossa, is situated on each side of the laryngeal inlet. It leads obliquely downward and backward from the region of the back of the tongue to the esophagus. The piriform fossa is bounded medially by aryepiglottic and laterally by the lamina of the thyroid cartilage and the thyrohyoid membrane.

### **Nerve Supply of the Pharynx**

The nerve supply of the pharynx is from the pharyngeal plexus, the plexus is formed from branches of the glossopharyngeal, vagus, and sympathetic nerves.

The **motor nerve supply** is derived from the cranial part of the accessory nerve, which, via the branch of the vagus to the pharyngeal plexus, supplies all the muscle of the pharynx except the stylopharyngeus, which is supplied by the glosso-pharyngeal nerve.

The **sensory nerve supply** of the mucous membrane of the nasal part of the pharynx is mainly from the maxillary nerve. The mucous membrane of the oral pharynx is mainly supplied by the glossopharyngeal nerve. The mucous membrane around the entrance into the larynx is supplied by the internal laryngeal branch of the vagus nerve.

The **arterial supply** of the pharynx is derived from branches of the ascending pharyngeal, the ascending palatine, the facial, the maxillary, and the lingual arteries.

The **veins** drain into the pharyngeal venous plexus, which in turn drains into internal jugular vein.

The **lymph vessels** from the pharynx drain either directly into the deep cervical lymph nodes or indirectly via the retropharyngeal or paratracheal nodes.

### **The Palate**

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

The **hard palate** is formed by the palatine processes of the maxillae and the horizontal plates of the palatine bones. It is bounded by the alveolar arches, and behind it is continuous with the soft palate. It forms the floor of the nasal cavities. The undersurface of the hard palate is covered with mucoperiosteum and possesses a median ridge, on either side of which the mucous membrane shows corrugations.

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 (1) mucous membrane, (2) palatine aponeurosis, and (3) muscles. 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. It is the expanded tendon of the tensor veli palatini.

### **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 **tensor veli palatini** arises from the spine of the sphenoid and the auditory tube. The muscle fibers 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 at the midline of the soft palate. Action: it makes the anterior part of the soft palate rigid (tenses the soft palate).

The **levator veli palatine** arises from the petrous part of the temporal bone and the medial side of the auditory tube. It is inserted into the superior surface of the palatine aponeurosis. Action: the two muscles raise the soft palate symmetrically.

The **palatoglossus** muscle is attached to the inferior surface of the palatine aponeurosis and meets the opposite muscle in the midline. It is mingle with the muscles of the posterolateral part of the tongue. Action: the two muscles, acting together, draw the soft palate inferiorly on to the posterior part of the dorsum of the tongue.

The **palatopharyngeus** muscle arises from the palatine aponeurosis at the superior surface of the soft palate and the posterior margin of the hard palate. It is inserted into the posterior border of the lamina of the thyroid cartilage. Action: the main mass of the muscle depresses the soft palate on to the posterior part of the dorsum of the tongue, and prevent the soft palate from being forced into the nasal part of the pharynx.

The **musculus uvulae** arise from the posterior border of the hard palate and inserted into the mucous membrane of the uvula. It elevates the 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 foramen. 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.

The blood supply of the palate is through the greater palatine branch of the maxillary artery, the ascending palatine branch of the facial artery, and the ascending palatine artery.

### **The Mechanism of Swallowing**

The food is broken down in the mouth by grinding action of the teeth, and is mixed with the saliva by the movements of the tongue and the action of the buccinator muscle. The thoroughly mixed food is now formed into a bolus on the dorsum of the tongue and 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 contraction of the palatoglossus muscles now squeezes the bolus backward into the oral part of the pharynx. The process of the swallowing is an involuntary act from this point.

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 pharyngeal wall by the superior constrictor muscle, and the contraction of the palatopharyngeus muscle.

The larynx and the laryngeal part of the pharynx are now pulled upward by the contraction of the stylopharyngeus, salpingopharyngeus, thyrohyoid, and palatopharyngeus muscle. The main part of the larynx is thus elevated to the posterior surface of the epiglottis, and the entrance to the larynx is closed.

The bolus moved downward over the epiglottis, the closed entrance into the larynx, and reaches the lower part of the pharynx as a result of successive contractions of the superior, middle, and inferior constrictors muscles. Some of the food slide down the grooves on either side of the entrance of the larynx, that is down through the piriform fossae.

Finally the lower fibers of the inferior constrictor muscle and the cricopharyngeus muscle relax, and the bolus enters the esophagus.