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COURSE: GROSS ANATOMY OF HEAD AND NECK  
DEPARTMENT: MEDICINE AND SURGERY  
LEVEL: 300

Question 1) **Discuss the anatomy of the tongue and comment on its applied anatomy.**

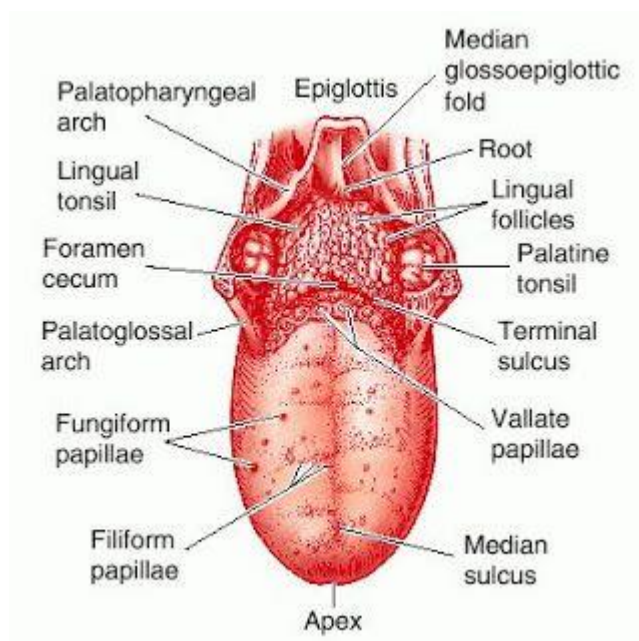


DIAGRAM OF THE TONGUE

### **THE TONGUE**

The tongue is a mobile muscular organ covered with mucous membrane. It can assume a variety of shapes and positions and is partly in the oral cavity and partly in oropharynx.

The tongue is a unique organ located in the oral cavity that not only facilitates perception of gustatory stimuli but also plays important roles in mastication and deglutition. Additionally, the tongue is an integral component of the speech pathway, as it helps with articulation.

The tongue is roughly 10cm long and has three main parts: the apex or tip, the body and the base.

- The **tip or apex** of the tongue is the most mobile aspect of the organ and it is directed anteriorly and sits immediately behind the incisor teeth.
- The tip is followed by the **body** of the tongue. It has a rough superior surface that abuts the palate and is populated with taste buds and lingual papillae and a smooth inferior surface that is attached to the floor of the oral cavity by the lingual frenulum.
- The base of the tongue is the most posterior part of the organ.

The tongue has 2 surfaces, the superior surface which is oriented in the horizontal plane and the pharyngeal surface which curves inferiorly and becomes oriented more in the vertical plane. The 2 surfaces are separated from each other by a V-shaped terminal sulcus of tongue. The tongue also has a midline groove which divides the anterior part of the tongue into right and left parts.

### **SUPERIOR SURFACE OF THE TONGUE**

The superior surface of the oral part of the tongue is covered by hundreds of papillae (the papillae increases the area of contact between the surface of the tongue and the contents of the oral cavity and the papillae have taste buds on their surfaces excepts filiform papillae), which includes:

- Filiform papillae are small cone-shaped projections of the mucosa that end in one or more points.
- Fungiform papillae are rounder in shape and larger than the filiform papillae, and tend to be concentrated along the margins of the tongue.
- Vallate Papillae are the largest of the papillae, which are blunt-ended cylindrical papillae invaginations in the tongue's surface — there are only about 8

to 12 vallate papillae in a single V-shaped line immediately anterior to the terminal sulcus of tongue.

- Foliate papillae are linear folds of mucosa on the sides of the tongue near the terminal sulcus of tongue.

### **INFERIOR SURFACE OF THE TONGUE**

A single median fold (the frenulum of tongue) is continuous with the mucosa covering the floor of the oral cavity and overlies the lower margin of a midline sagittal septum, which internally separates the right and left sides of the tongue. The frenulum allows the anterior part of the tongue to move freely.

### **MUSCLES OF THE TONGUE**

The bulk of the tongue is composed of muscle. The muscles of the tongue are intrinsic and extrinsic muscles of the tongue and all muscles except Hypoglossal nerve except for the palatoglossus, which is innervated by the vagus nerve [X].

The intrinsic group muscles include;

<b>Muscle name</b>	<b>Origin</b>	<b>Insertion</b>	<b>Innervation</b>	<b>Function</b>
Superior longitudinal (just deep to surface of tongue)	Submucosal connective tissue at the back of the tongue and from the median septum of the tongue	Muscle fibers pass forward and obliquely to submucosal connective tissue and mucosa on margins of tongue	Hypoglossal nerve [ XII ]	Shortens tongue; curls apex and sides of tongue
Inferior longitudinal (between genioglossus and	Root of tongue (some fibers from hyoid).	Apex of tongue	Hypoglossal nerve [ XII ]	Shortens tongue; uncurls apex and

hyoglossus muscles)				turns it downward.
Transverse	Median septum of the tongue	Submucosal connective tissue on lateral margins of tongue	Hypoglossal nerve [ XII ]	Narrows and elongates tongue.
Vertical	Submucosal connective tissue on dorsum of tongue.	Connective tissue in more ventral regions of tongue	Hypoglossal nerve [ XII ]	Flattens and widens tongue.

The superior and inferior longitudinal, transverse, and vertical muscles are confined to the tongue. They have their attachments entirely within the tongue and are not attached to the bone.

The extrinsic muscles of the tongue (genioglossus, hyoglossus, styloglossus, and palatoglossus) originate outside the tongue and attach to it. They mainly move the tongue but they can alter its shape as well.

Muscle name	Origin	Insertion	Innervation	function
Genioglossus	Superior mental spines	Body of hyoid; entire length of tongue	Hypoglossal nerve	Protrudes tongue; depresses center of tongue
Hypoglossus	Greater horn and adjacent part of body of hyoid bone.	Lateral surface of tongue	Hypoglossal nerve.	Depresses the tongue.
Styloglossus	Styloid process (anterolateral surface)	Lateral surface of tongue	Hypoglossal nerve [ XII ]	Elevates and retracts tongue.

Palatoglossus	Inferior surface of palatine aponeurosis	Lateral margin of tongue	Vagus nerve	Depresses palate; moves palatoglossal fold toward midline; elevates back of the tongue.
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## ARTERIAL SUPPLY

The major artery of the tongue is the Lingual Artery. This is a branch of the external carotid artery, that tranverses the region between the middle pharyngeal constrictor and hypoglossus in order to access the floor of the mouth. The branches include:

- The dorsal lingual arteries: they are relatively small derivatives of the lingual artery that arise medial to hypoglossus. It supplies the dorsal mucosa of the tongue, it also gives branches to the palatoglossus, soft palate, palatine tonsils and epiglottis.
- The Sublingual arteries: They course between the mylohyoid and genioglossus as it travels towards the sublingual glands in the floor of the oral cavity.
- As the lingual artery terminates near the lingual frenulum on the ventral surface of the ventral of the tongue, it is referred to as the deep lingual artery.

The lingual artery is supported by other branches of the external carotid artery, the facial artery and the ascending pharyngeal branch.

## VENOUS DRAINAGE

The veins of the tongue are named similarly to the arteries that they accompany. They are formed from numerous venous tributaries that eventually coalesce. As the deep lingual vein forms adjacent the apex of the tongue, it courses along the ventral surface of the tongue. As the deep lingual vein anastomosis with the sublingual vein, they become the vena comitans of hypoglossal nerve. The venous network eventually drains to the lingual vein that later join the facial or the

anterior division of the Retromandibular veins. Here, they form the common facial vein, which is a tributary to the internal Jugular vein.

The Vebae comitantes may drain directly to Internal jugular vein.

The dorsal lingual veins are responsible for draining the lateral margins and dorsal surface of the tongue. They travel alongside the similarly named Artery as they drain into the internal jugular vein.

## **LYMPHATIC DRAINAGE**

The lymphatic drainage of the tongue is quite exceptional.

Most of the lymphatic drainage converges toward and follows the venous drainage; however, lymph from the tip of the tongue, frenulum, and central lower lip runs an independent course. Lymph from the tongue takes four routes:

1. Lymph from the root drains bilaterally into the superior deep cervical lymph nodes.
2. Lymph from the medial part of the body drains bilaterally and directly to the inferior deep cervical lymph nodes.
3. Lymph from the right and left lateral parts of body drains to the submandibular lymph nodes on the ipsilateral side.
4. The apex and frenulum drain to the submental lymph nodes, the medial portion draining bilaterally.

All lymph from the tongue ultimately drains to the deep cervical nodes, and passes via the jugular venous trunks into the venous system at the right and left venous angles.

## **NERVE SUPPLY**

The tongue has multiple sources of innervation based on its embryological origins. The nerve supply to the tongue can be grouped based as efferent fibers that carry motor impulses, general sensory that conveys touch and proprioception, and special afferent that conveys gustatory impulses.

### Motor innervation

The muscles of the tongue arise from occipital myotomes that migrated to the floor of the pharyngeal apparatus during development. These primitive myocytes took the fibers of Hypoglossal nerve [CN XII] along with them during their journey. As a result, CN XII provides motor innervation to all the muscles of the tongue, except palatoglossus. As CN XII pierces the ventrolateral part of the pharyngeal tongue, it gives a branch to the geniohyoid muscle. Subsequently, it bifurcates into medial and lateral branches. The medial branch innervates the posterior part of the transverse and vertical muscles, as well as the medial part of the inferior longitudinal muscle, and the entire genioglossus. The lateral branch of CN XII innervates the lateral part of the inferior longitudinal, superior longitudinal, hyoglossus and styloglossus muscles.

While there is an agreement regarding the fact that the pharyngeal plexus brings motor fibers to the muscle, there is still some discrepancy regarding which component of the pharyngeal plexus (i.e. cranial part of accessory nerve [CN XI] or the vagus nerve [CN X]) that the fibers arise from. Some sources state that CN XI piggybacks on CN X to supply palatoglossus. However, other sources are adamant that there is no hitch-hiking, and that CN X is the nerve that supplies the palatoglossus. One thing is certain, and it's that nucleus ambiguus provides efferent fibers that innervate the skeletal muscles of the soft palate. Whether or not these fibers travel via CN X or CN XI is still uncertain.

### Tactile sensory innervation

The lingual nerve is a branch of CN V3. It is responsible for conveying general somatic afferent impulses from the anterior two-thirds of the tongue. Additionally, it also carries sensory information from the oral mucosa beneath the ventral surface of the tongue as well as the gingival mucosa of the lingual side of the mandible. General afferent impulses from the circumvallate papillae, along with the posterior third of the tongue are carried by fibers of glossopharyngeal nerve [CN IX].

### Taste innervation

There are three cranial nerves responsible for conveying taste sensation from the tongue to the brain. These are Facial nerve [CN VII], Glossopharyngeal nerve [CN IX], and (to a lesser extent) Vagus nerve [CN X]. The region of the tongue covered by each nerve is dependent on the proximity of the developing taste bud (and

lingual papilla) to the free nerve ending. CN VII mitigates special sensory signals from the anterior two-thirds of the tongue, as well as from the inferior part of the soft palate.

Fibers of the chorda tympani travel by means of the lingual nerve to detect impulses from the sulcal tongue. The postsulcal tongue, circumvallate papillae, palatoglossal arches, and oropharynx are governed by CN IX. CN X only provides supply to taste buds in the extreme areas of the pharyngeal tongue. These impulses are conveyed by the internal laryngeal branch of the vagus nerve.

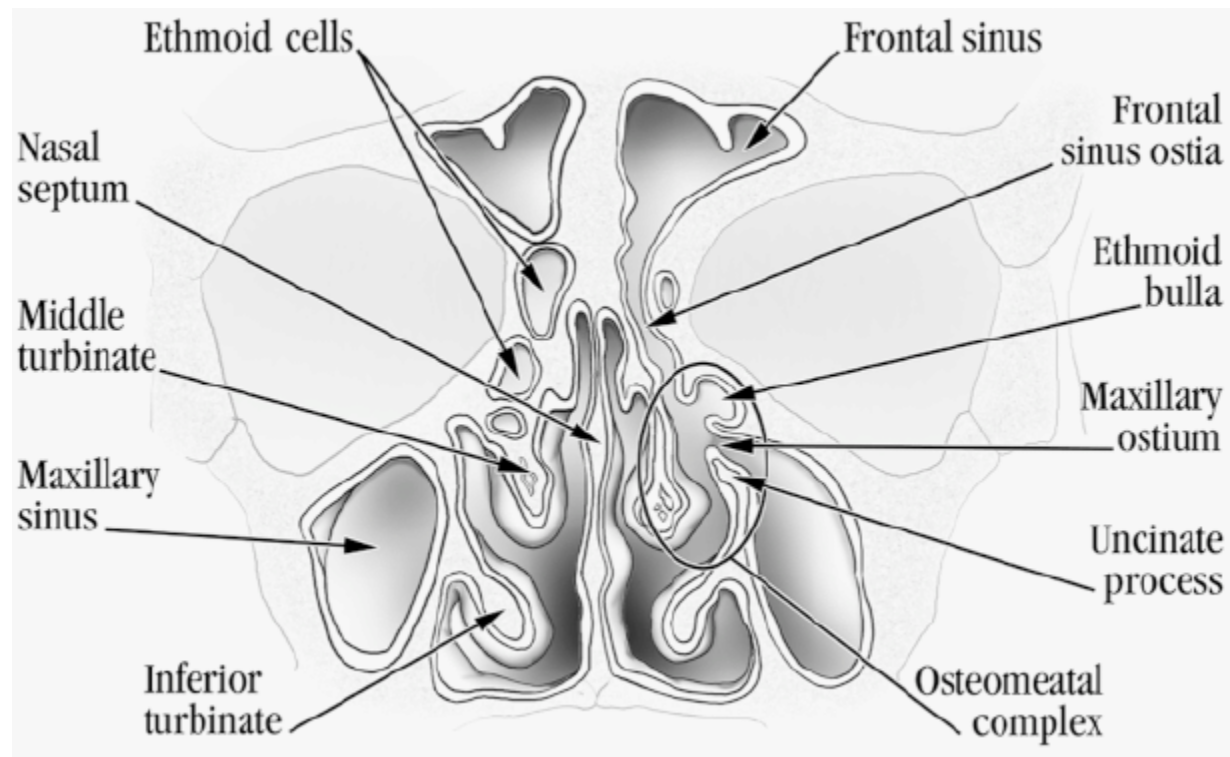
### CLINICAL ANATOMY

- 1) Thrush (candidiasis): A yeast called *Candidia albicans* grows over the surface of the mouth and tongue. Thrush can occur in almost anyone, but it occurs more often in people taking steroids or with suppressed immune systems, the very young and the elderly.
- 2) Oral Cancer: A growth or ulcer appears on the tongue and grows steadily. Oral cancer is more common in people who smoke and/or drink alcohol heavily.
- 3) Macroglossia: This can be broken down into various categories based on the cause. These include congenital, inflammatory, traumatic, cancerous and metabolic causes. Thyroid disease, lymphangiomas and congenital abnormalities are among some of the causes of enlarged tongue.
- 4) Burning Mouth/ Burning Tongue Syndrome: This is a relatively common anomaly. The tongue feels burned or scalded or strange tastes or sensations develop. Apparently harmless, burning mouth syndrome may be caused by a mild nerve problem.
- 5) Oral Leukoplakia: White patches appear on the tongue that can't be scraped off. Leukoplakia may be benign or it can progress to oral cancer.

Question 2) **Write an essay on the air sinuses.**



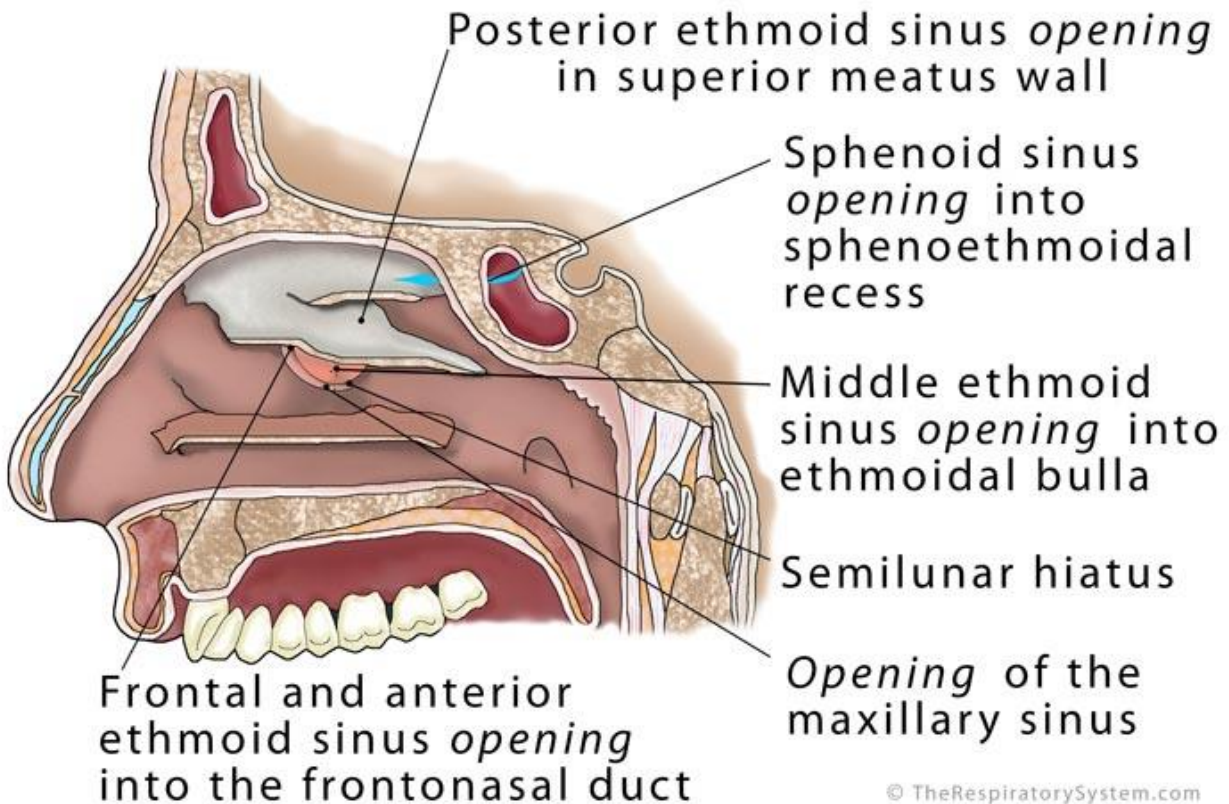
The paranasal sinuses are the air-filled extensions of the respiratory part of the nasal cavity. There are 4 paired sinuses, named according to the bone in which they are located; Frontal, Sphenoid, Ethmoid and Maxillary.



The general function is to humidification of inspired air and they reduce the weight of the skull also.

Sinuses are formed in childhood by the nasal cavity eroding into surrounding bone.

# Drainage of the Paranasal Sinus Cavities



- **FRONTAL SINUSES:** These are the most superior in location, found under the forehead. The frontal sinuses are variable in size, but always triangular-shaped. They drain into the nasal cavity through the frontonasal duct, which opens out at the hiatus semilunaris on the lateral wall.
- **SPHENOID SINUSES:** The sphenoid sinuses also lie relatively superiorly, at the level of the sphenothmoidal recess. They are found more posteriorly and related superiorly and laterally to the cranial cavity. The sphenoid sinuses drain out onto the roof of the nasal cavity.
- **ETHMOIDAL SINUSES:** There are 3 ethmoidal sinuses, Anterior, Middle and Posterior. They empty into the nasal cavity at different places:
  - Anterior – Hiatus semilunaris
  - Middle – Ethmoid bulla
  - Posterior – Superior meatus.

- **MAXILLARY SINUSES:** The largest of the sinuses. It is located laterally and slightly inferiorly to the nasal cavities. It drains into the nasal cavity at the hiatus semilunaris, underneath the frontal sinus opening. This is a potential pathway for spread of infection

### CLINICAL ANATOMY

As the paranasal sinuses are continuous with the nasal cavity, an upper respiratory tract infection can spread to the sinuses. Infection of the sinuses causes inflammation of the mucosa and is known as Sinusitis. If more than one sinus is affected, it is called **PANSINUSITIS**.