**NAME: NKEMCHOR-ALBERT FAVOUR ONYINYE**

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**GROSS ANATOMY OF HEAD AND NECK**

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**ANATOMY OF THE TONGUE AND IT’S APPLIED ANATOMY**

The tongue is the muscular organ found in the vertebrate mouth. It is attached via muscles to the hyoid bone, mandible, styloid process, palate, and pharynx and divided into two parts by the V-shaped sulcus terminalis. These two parts, an anterior two thirds and a posterior one third, are structurally and developmentally distinct. The foramen cecum at the apex of the sulcus terminalis indicates the site of embryonic origin of the thyroglossal duct.

The following papillae cover the tongue and are used for taste perception:

**Vallate papillae**are arranged in a V-shape anterior to the sulcus terminalis and studded with numerous taste buds. Innervation is by the glossopharyngeal nerve (CN IX).

**Fungiform papillae** are mushroom-shaped papillae with erythematous domes, located on the lateral aspects and at the apex of the tongue.

**Filiform papillae** are slim, cone-shaped projections organized in rows parallel to the sulcus terminalis.

**Foliate papillae**are rarely found in humans (vestigial).

Another important part of the tongue is the lingual tonsil, a collection of nodular lymphatic tissue towards the posterior one-third of the dorsum of the tongue.

**MUSCLES OF THE TONGUE**

The tongue consists of intrinsic and extrinsic muscles and they include:

The tongue's intrinsic muscles include the following:

1. The **superior longitudinal lingual**muscle, which shortens the tongue and curls it upward.

2. The **inferior longitudinal lingual** muscle, which shortens the tongue and curls it downward.

3. The **transverse lingual** muscle, which elongates and narrows the tongue.

4. The **vertical lingual** muscle, which flattens the tongue.

The tongue's extrinsic muscles include the following:

1. The **genioglossus**muscle, which protrudes the tongue, and is innervated by the hypoglossal nerve (CN XII).

2. The **styloglossus**muscle, which draws up the sides of the tongue to create a trough for swallowing following adequate mastication. The pair of styloglossus muscles works together on each side to retract the tongue. The styloglossus muscle is innervated by the hypoglossal nerve (CN XII).

3. The **hyoglossus**muscle, which depresses and retracts the tongue and is innervated by the hypoglossal nerve (CN XII).

4. The **palatoglossus**muscle, which elevates the posterior tongue, closes the oropharyngeal isthmus, aids in the initiation of swallowing, and prevents the spill of saliva from the vestibule into the oropharynx by maintaining the palatoglossal arch. It is the only extrinsic muscle of the tongue that is not innervated by the hypoglossal nerve; instead, it is innervated by the vagus nerve (CN X).

Altogether, there are 8 muscles of the tongue.

**Blood and Lymphatic supply to the Tongue.**

Blood supply to the tongue is predominantly from the lingual artery, a branch of the external carotid artery between the superior thyroid artery and the facial artery, which departs at the level of the greater horn of the hyoid bone within the carotid triangle. After branching from the external carotid artery, the lingual artery passes deep to the hyoglossus muscle and superficial to the middle pharyngeal constrictor muscle. It then gives rise to the following four arteries:

1. The**suprahyoid artery**supplies the omohyoid, sternothyroid, and thyrohyoid muscles. They anastomose with the corresponding vessels from the opposite side.

2. The **dorsal lingual arteries**arise beneath the hyoglossus muscle and pass to the posterior part of the dorsum of the tongue. They supply the mucous membrane of this region as well as the glossopalatine arch, lingual tonsils, soft palate, and epiglottis. They anastomose with their corresponding vessels on the opposite side.

3. The **sublingual artery**branches at the anterior border of the hyoglossus muscle before passing between the genioglossus muscle and mylohyoid muscle to the sublingual gland. It supplies the sublingual gland before giving branches to the mylohyoid muscle. One branch from the sublingual artery passes posterior to the alveolar process of the mandible and anastomoses with the corresponding artery from the other side. A second branch of the sublingual artery pierces the mylohyoid muscle and anastomoses with the submental branch of the facial artery.

4. The **deep lingual artery**, which is the termination of the lingual artery, passes between the genioglossus muscle and inferior longitudinal muscle.

LYMPHATIC DRAINAGE

This is best grouped according to the region of the tongue that they drain. The **marginal** and **central groups** drain the anterior parts of the tongue, while the **dorsal group** drains lymph from the posterior third of the organ. It is not uncommon to see the central area of the tongue draining to both marginal and dorsal groups of lymph vessels.

The marginal lymph vessels will carry lymph to the **submandibular nodes** or to the **jugulo-omohyoid nodes**. It is not uncommon to see lymph vessels decussating to drain to contralateral lymph nodes. The vessels from the central region may go to the **deep cervical nodes**, with a particular preference for the jugulo-omohyoid or jugulodigastric nodes. The dorsal group of vessels also pass laterally on either side to eventually join the marginal vessels in their course to the jugulo-omohyoid and jugulodigastric vessels.

**INNERVATIONS OF THE TONGUE.**

The hypoglossal nerve (CN XII) provides motor innervation to all of the intrinsic and extrinsic muscles of the tongue except for the palatoglossus muscle, which is innervated by the vagus nerve (CN X). It runs superficial to the hyoglossus muscle. Lesions of the hypoglossal nerve cause deviation of the tongue to the ipsilateral (i.e., damaged) side.

Taste to the anterior two-thirds of the tongue is achieved through innervation from the chorda tympani nerve, a branch of the facial nerve (CN VII). General sensation to the anterior two-thirds of the tongue is by innervation from the lingual nerve, a branch of the mandibular branch of the trigeminal nerve (CN V3). The lingual nerve is located deep and medial to the hyoglossus muscle and is associated with the submandibular ganglion.

On the other hand, taste to the posterior one-third of the tongue is accomplished through innervation from the glossopharyngeal nerve (CN IX), which also provides general sensation to the posterior one-third of the tongue.

Taste perception also is performed by both the epiglottis and the epiglottic region of the tongue, which receives taste and general sensation from innervation by the internal laryngeal branch of the vagus nerve (CN X). Damage to the vagus nerve (CN X) causes contralateral deviation (i.e., away from the injured side) of the uvula.

**APPLIED ANATOMY OF THE TONGUE ( FUNCTIONS OF THE TONGUE)**

The tongue has 3 major functions.

**Taste Functions**

Chemicals that interact with the taste buds in the tongue are referred to as "tastants." Taste buds themselves are found within the various papillae of the tongue. Tastants interact with gustatory cell receptors in the taste buds, resulting in transduction of a taste sensation. The five broad categories of taste receptors are (1) sweet, (2) salty, (3) sour, (4) bitter, and (5) umami. The lingual papillae are divided into the vallate (or circumvallate), fungiform, filiform, and foliate papillae. More than half of the taste buds are located on the vallate papillae at the junction of the oral and oropharyngeal tongue or tongue base.

**Speech Functions**

Speech is produced in part by manipulation of the tongue in the mouth against the teeth and palate within the oral cavity. The intrinsic muscles of the tongue are involved primarily in shaping the tongue for speech.

**Food Manipulation Functions**

The tongue moves food around the mouth within the oral cavity by pressing it against the hard palate and out to the sides to enable mastication. It enables the formation of the food bolus in the oral preparatory phase of swallowing. It also takes part in the oral phase of swallowing by elevating and sweeping posteriorly to propel the food bolus past the anterior tonsillar pillar, triggering the swallowing reflex.

**CLINICAL ANATOMY OF THE TONGUE**

* **Ankyloglossia ("tongue-tie")** occurs due to an abnormal length of the frenulum linguae which causes limited manipulation of the tongue during speech and results in a speech impediment. In the most common form of ankyloglossia, the frenulum extends to the tip of the tongue. Ankyloglossia can be corrected by surgically severing the lingual frenulum.
* **Fissured tongue ("scrotal tongue," "plicated tongue")**occurs when several small furrows present on the dorsal surface of the tongue. It can be an oral manifestation of psoriasis. It is generally painless and benign, and is often associated with other syndromes (e.g., Down syndrome).
* **Geographic tongue ("migratory glossitis")**is a benign, asymptomatic condition characterized by the presence of large red patches with a greyish-white border covering the dorsum of an otherwise normal tongue. It is caused by inflammation of the mucous membrane of the tongue, which results in loss of lingual papillae. The lesions are known to migrate over time. The name arises from the map-like appearance of the tongue in this condition.

**Assignment 2: PARANASAL SINUSES**

The **paranasal sinuses** are **air cavities** that help circulate the air that is breathed in and out of the [respiratory system](/en/library/anatomy/the-respiratory-system). They are situated around the [nasal cavity](/en/library/anatomy/nasal-cavity) and they are all paired and sometimes symmetrical, while always being bilateral. There are four different pairs of sinuses and they are called the:

* **maxillary sinuses**
* **frontal sinuses**
* **sphenoidal sinuses**
* **ethmoidal sinuses**

**The Maxillary sinuses**

The maxillary sinuses are the **largest** of the all the paranasal sinuses. They have thin walls which are often penetrated by the long roots of the posterior maxillary [teeth](/en/library/anatomy/the-teeth). The **superior border** of this sinus is the [bony orbit](/en/library/anatomy/bones-of-the-orbit), the **inferior** is the maxillary alveolar bone and corresponding tooth roots, the **medial** **border** is made up of the [nasal cavity](/en/library/anatomy/nasal-cavity) and the **lateral** and **anterior** **border** are limited by the cheekbones.

Posteriorly, two anatomical spaces known as the pterygopalatine fossa and the [infratemporal fossa](/en/library/anatomy/infratemporal-fossa) exist.

The **submandibular lymph nodes** are the main destination during lymphatic drainage. The blood supply includes a contribution from the:

* **anterior** **superior** **alveolar** **artery**
* **middle** **superior** **artery**
* **posterior superior alveolar artery**

Innervation occurs through nerves of the same names as the arteries.

**Frontal sinuses**

**Anteriorly**, the frontal sinuses are contained by the forehead and the superciliary arches, **superiorly** and **posteriorly** by the anterior cranial fossa and **inferiorly** by the bony orbit, the anterior ethmoidal sinuses and the nasal cavity. **Medially** the sinuses face one another, separated by the midline.

This pair of sinuses are irregular in shape when compared to one another and is underdeveloped at birth. They reach their full size and shape around seven to eight years of age.

They drain primarily into the **ethmoidal infundibulum** and the corresponding lymph drainage occurs via the **submandibular lymph nodes**. It is innervated by the **ophthalmic nerve**, including the supraorbital and supratrochlear branches.

The frontal sinuses are supplied by the:

* **anterior ethmoidal artery**
* [supraorbital artery](/en/library/anatomy/supraorbital-artery)
* [supratrochlear artery](/en/library/anatomy/supratrochlear-artery)

**Sphenoidal sinuses**

The **most posterior** of all the sinuses in the head, the sphenoidal sinuses are large and irregular, just like their septum, which is made by the [sphenoid bone](/en/library/anatomy/the-sphenoid-bone). **Laterally**, a cavernous sinus exists which is part of the middle cranial fossa and also the carotid artery and cranial nerves [III](/en/library/anatomy/the-oculomotor-nerve), [IV](/en/library/anatomy/the-trochlear-nerve-and-the-abducent-nerve), V/I, [V/II](/en/library/anatomy/the-maxillary-branch-of-the-trigeminal-nerve)and [VI](/en/library/anatomy/the-trochlear-nerve-and-the-abducent-nerve) can be found.

The **anterior wall** separates this pair of sinuses from the nasal cavity, as does the hypophyseal fossa, the [pituitary gland](/en/library/anatomy/pituitary-gland) and the [optic chiasm](/en/library/anatomy/the-optic-nerve) **superiorly** and the [nasopharynx](/en/library/anatomy/the-pharynx)and pterygoid canal **inferiorly**.

The lymphatic drainage occurs in the same way as the posterior ethmoid sinus. The **posterior** **ethmoidal** **artery** and the **posterior lateral nasal branches** supply the sphenoidal sinuses.

The **posterior ethmoidal nerve** and the orbital branch of the **pterygopalatine ganglion**innervate them.

****Ethmoidal sinuses****

**Superior** to the ethmoidal sinus is the anterior cranial fossa and the [frontal bone](/en/library/anatomy/the-frontal-bone), **laterally**the orbit can be found, while the nasal cavity is situated **medially**. The ethmoid sinuses are unique because they are the only paranasal sinuses that are more **complex** than just a single cavity.

On each side of the midline, anywhere from three to eighteen **ethmoidal** **air** **cells** may be grouped together. These air cells are smaller individual sinuses grouped together to form one large one which encompass the anterior, middle and posterior nasal meatuses.

The anterior and middle ethmoid sinuses send their lymphatic drainage to the **submandibular lymph nodes** while the posterior ethmoid sinus sends its own to the **retropharyngeal lymph nodes**.

The **anterior** and **posterior** **ethmoidalarteries**, as well as the **posterior lateral nasal branches** provide an ample blood supply to this region. Meanwhile the **anterior** and **posterior** **ethmoidal** **nerves** and the **posteriorlateral** **superior** and **inferior** **nasal** **nerves** help innervate it.