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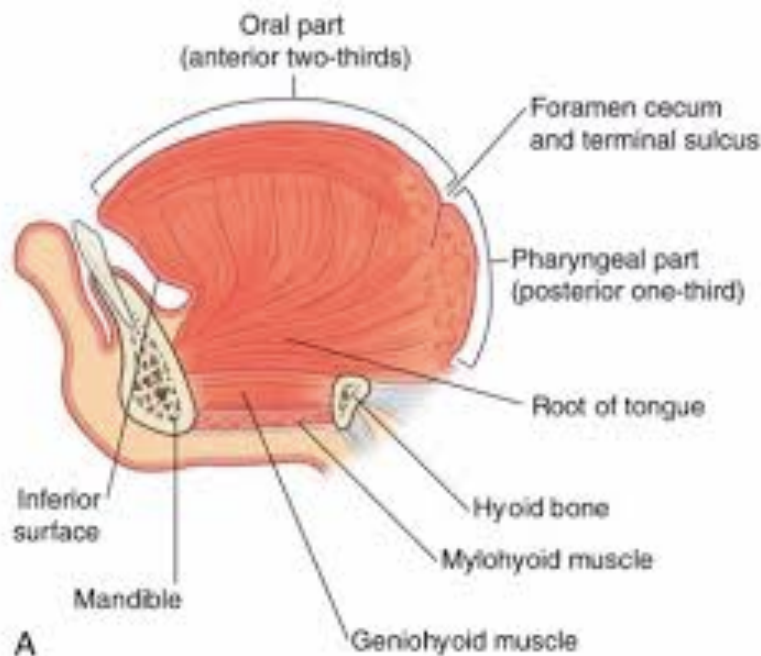
COURSE: GROSS ANATOMY OF THE HEAD AND NECK(ANA301)

QUESTIONS

- 1) Discuss the anatomy of the tongue and comment on its applied anatomy
- 2) Write an essay on the air sinuses

ANSWERS

1) GROSS ANATOMY OF THE TONGUE



THE TONGUE

The tongue is a mass of muscle that is almost completely covered by a mucous membrane. It is a mobile muscular organ that can assume a variety of shapes and positions. It occupies most of the oral cavity and partly of the oropharynx. It is known for its role in taste, but it also assists with mastication (chewing), deglutition (swallowing), articulation (speech), and oral cleansing.

Additionally, the tongue is an integral component of the speech pathway, as it helps with articulation. There is a significant variability in the length of the tongue among individuals; on average, the organ is roughly 10 cm long.

Parts and Surfaces of the tongue

- i) A root
- ii) A body
- iii) An apex
- iv) A curved dorsum
- v) An inferior surface

PARTS OF THE TONGUE

It has 3 main parts:

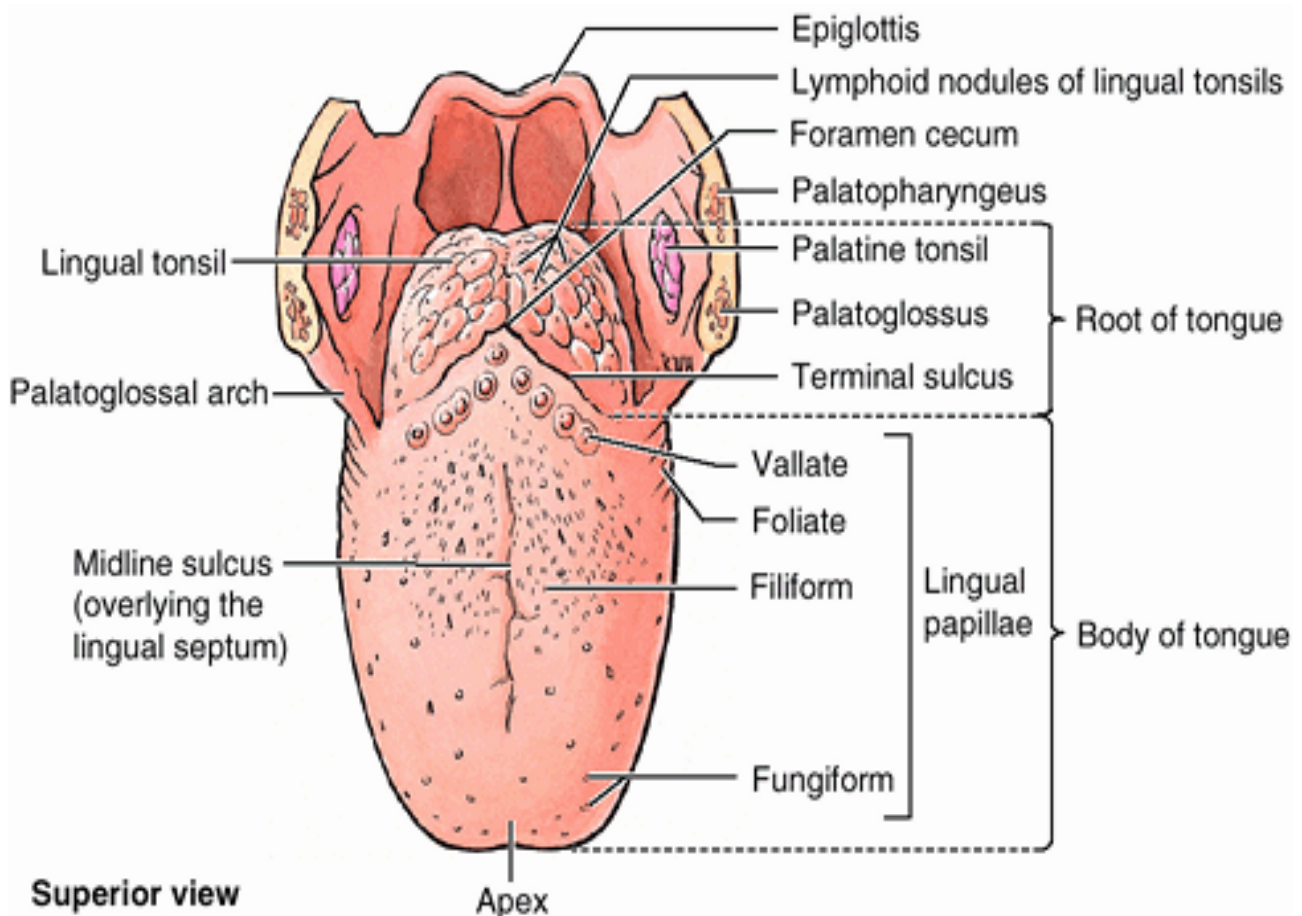
- a) THE APEX OR TIP: It is the most anterior and most mobile aspect of the organ. It is the anterior end of the body, which rests against the incisor teeth
- b) THE BODY: It has a rough dorsal (superior) surface that abuts the palate and is populated with taste buds and lingual papillae, and a smooth ventral (inferior) surface that is attached to the floor of the oral cavity by the lingual frenulum. It is the anterior two thirds of the tongue.
- c) THE BASE: It is the most posterior part of the organ. It is populated by numerous lymphoid aggregates known as the lingual tonsils along with foliate papillae along the posterolateral surface. It forms the ventral wall of the oropharynx.

Another important point to note is that the tongue is embryologically divided into anterior and a posterior part. The anterior part is also called the **ORAL OR PRESULCAL PART** of the tongue. Conversely, the posterior part of the tongue is referred to as the **PHARYNGEAL OR POSTSULCAL** part of the tongue.

DIAGRAM OF THE TONGUE SHOWING ITS DIVISIONS

RELATIONS OF THE TONGUE

-) Anteriorly and laterally by the upper and lower parts of the teeth
-) Superior it is bordered by the hard (anterior part) and soft (posterior part) palates



-) Inferiorly, the root of the tongue is continuous with the mucosa of the floor of the oral cavity; with the sublingual salivary glands and vascular bundles being located below the mucosa of the floor of the oral cavity.
-) Posterior to the base of the tongue is the dorsal surface of the epiglottises and laryngeal inlet and the posterior wall of the oropharynx.

THE ROOT OF THE TONGUE: It refers to a part of the presulcal tongue that is attached to the floor of the oral cavity. It is usually referred to as the posterior third of the tongue. It is attached to the mandible and hyoid bone.

THE DORSUM OF THE TONGUE: the posterosuperior surface, which is located partly in the oral cavity and partly in the oropharynx. It has a V shaped groove called the **TERMINAL SULCUS** or **GROOVE(SULCUS TERMINALIS)**.

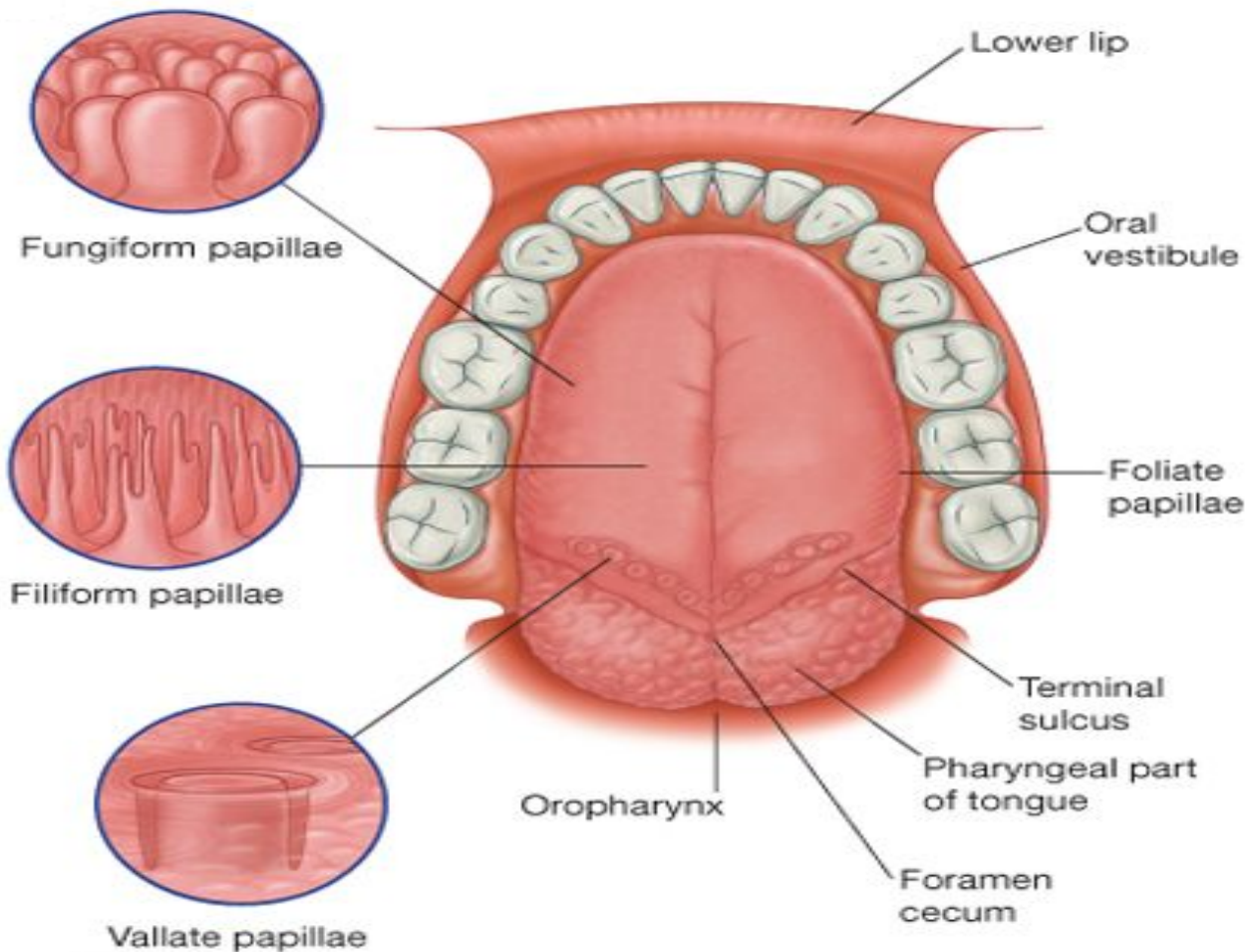
ANTERIOR TWO THIRDS OF THE TONGUE

- It includes the apex and body of the tongue.
- It terminates the sulks terminals; which can be seen extending laterally in an oblique direction from the foramen cecum towards the palatoglossal arch.
- The mucous membrane on the anterior part of the tongue is rough because of the presence of numerous small lingual papillae (small nipple like process).

- The mucosa of the dorsal surface of the tongue is made up of circumvallate, filiform and fungiform papillae
 - a) Circumvallate papillae: Large and flat topped, they lie directly anterior to the terminal sulks and are arranged in a v shaped row.
 - b) Filiform papillae: Long and numerous, they contain different afferent nerve endings that are sensitive to touch.
 - c) Fungiform papillae: Mushroom shaped pink or red spots, they are scattered among the filiform papillae but are most numerous at the apex and margins of the tongue.
- There is also a longitudinal midline groove running in an anteroposterior direction from the tip of the tongue to the frame cecum.
- This marks the embryological point of fusion of the lateral lingual swellings that formed the oral tongue.
- It also represents the location of the median lingual(fibrous) septum of the tongue that inserts in the body of the hyoid bone.
- On the lateral surface of the oral tongue are foliate papillae arranged as a series of vertical folds. They are poorly developed in humans.

NOTE: The circumvallate, foliate and most of the fungiform papillae contain taste buds.

- The ventral mucosa is smooth and continuous with the mucosa of the floor of the mouth and the inferior gingiva.
- The mucous membrane over the anterior part of the dorsum of the tongue is thin and closely attached to the underlying muscle.
- A shallow midline groove of the tongue divides the tongue into right and left halves called the MEDIAN SULCUS.



POSTERIOR THIRD OF THE TONGUE

- The remainder of the tongue that lies posterior to the sulcus terminalis is made up by the base of the organ.
- It lies behind the palatoglossal folds and functions as the anterior wall of the oropharynx.
- It DOES NOT have lingual papillae.
- Its mucosa is populated by aggregates of lymphatic tissue known as the lingual tonsils.

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- The mucosa is also continuous with the mucosa of the laterally located palatine tonsils, the lateral oropharyngeal walls and the posterior epiglottis and glossoepiglottic folds.
- The mucous membrane of the posterior part of the tongue is thick and freely movable.

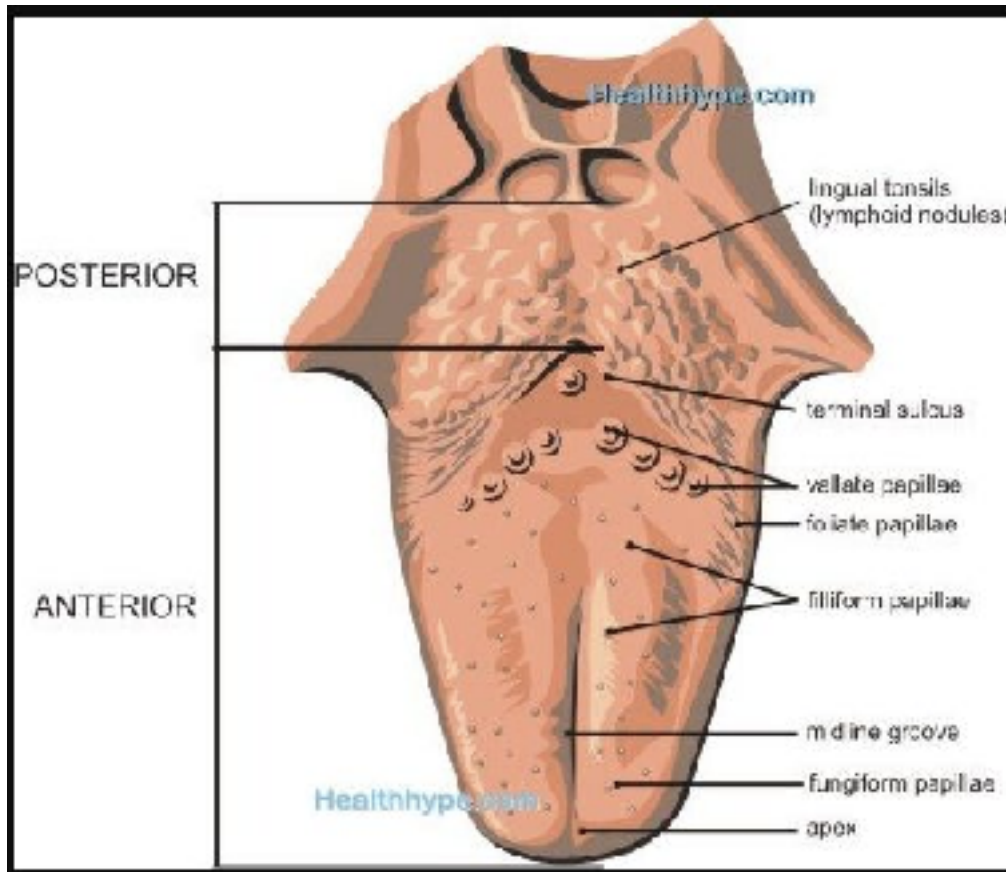
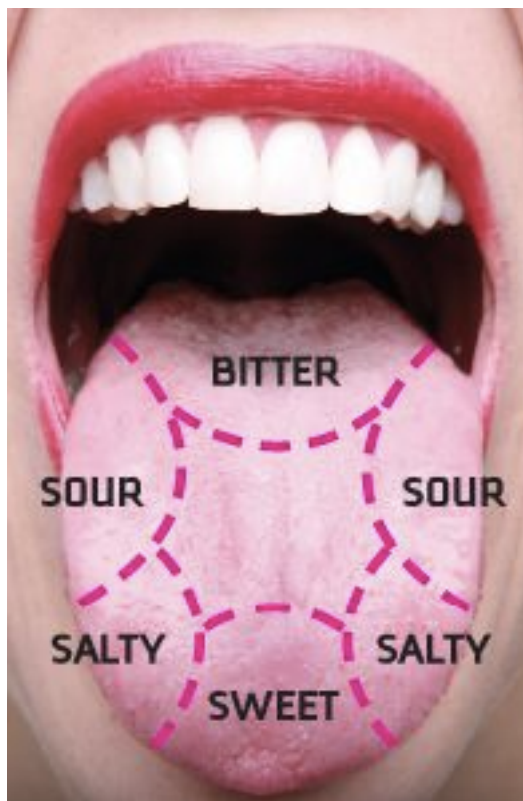


DIAGRAM DIFFERENTIATING THE ANTERIOR AND POSTERIOR PART OF THE TONGUE

NOTE

There are four basic taste sensations: sweet, salty, sour and bitter

- Sweetness is detected at the apex
- Saltiness is detected at the anterolateral margins
- Sourness is detected at the posterolateral margins
- Bitterness is detected at the posterior part of the tongue



MUSCLES

There are muscles that extend outside of the tongue to anchor it to the surrounding bony structures known as the **EXTRINSIC MUSCLES**. The other set of muscles are confined to each half of the organ and contribute to altering the shape of the organ; these are the **INTRINSIC MUSCLES**.

A) INTRINSIC TONGUE MUSCLES:

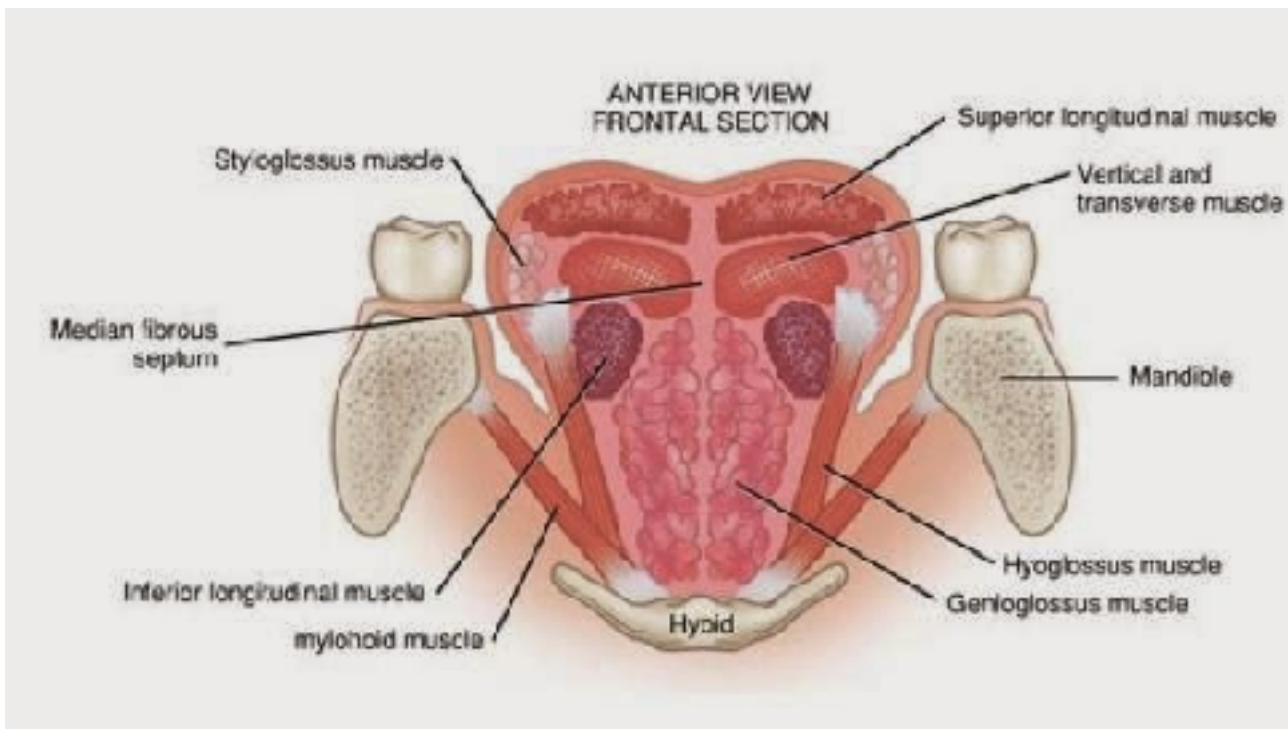
It is made up of four paired muscles:

-) Superior longitudinal muscle: They are made up of thin layer of muscle fibres travelling in a mixture of oblique and longitudinal axes just deep to the superior mucosal surface of the organ. These muscles are responsible for retracting and broadening of the tongue, as well as elevating the tip of the tongue. The net effect of these muscles results in shortening of the organ.

-) Inferior longitudinal muscle: They travel above the ventral submucosa of the tongue. These fibres travel between hypoglossus and genioglossus as it arises from the base of the tongue and body of the hyoid bone. The fibres end in the apex of the tongue, allowing the muscle to pull the tip of the tongue inferiorly and also shortening the tongue.

-) Transverse muscle: Deep to the ventral muscles is the layer of transverse muscles of the tongue. They take a lateral route, extending from the either Side of the medial lingual septum(origin) to the fibrous submucosa along the lateral margins of the tongue(insertion). As these muscles contract, they cause the tongue to narrow and elongate.

-) Vertical muscle: They arise from the root of the organ and genioglossus muscle and insert into the median fibrous septum, along the entire length of the tongue. These muscles facilitate flattening and widening of the tongue.



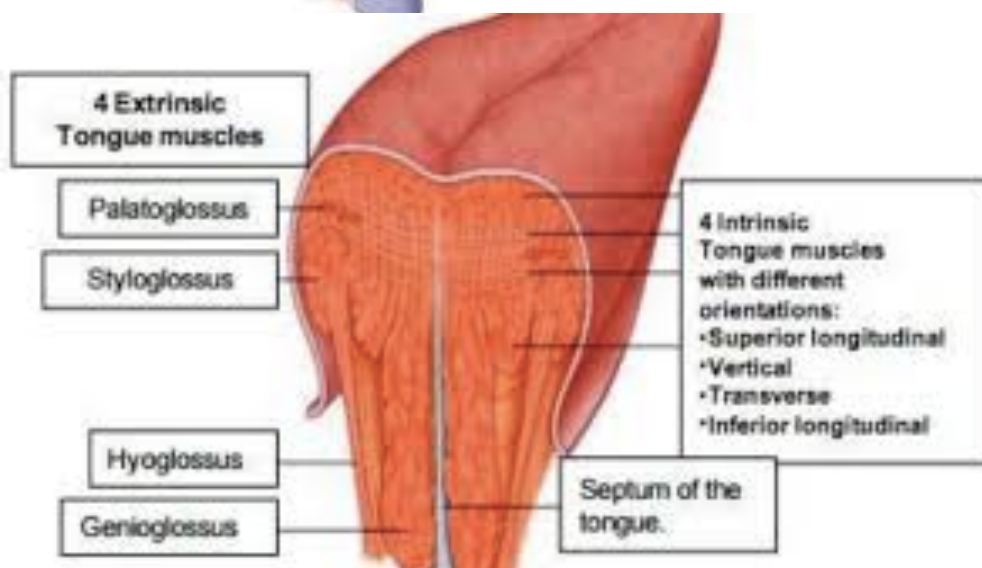
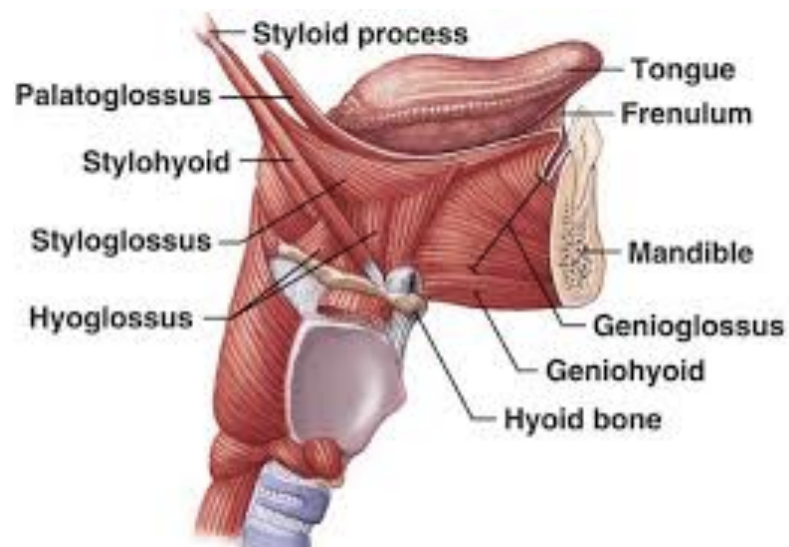
The intrinsic tongue muscles can operate independently, or in a combination with each other to give rise to numerous shapes. This is an important feature of the tongue as it facilitates molding of the food particles into a bolus in preparation for deglutition and speech.

B) **EXTRINSIC TONGUE MUSCLES:**

There are four pairs of extrinsic muscles:

- Genioglossus: It arises from below. It originates from the slender tendon that is attached to the superior genial tubercle found on the inner surface of the symphysis menti. This attachment prevents the tongue from falling backward and obstructing the airway when an individual is in supine position.
- Hyoglossus: It originates from the entire greater Cornu of the hyoid bone as a slender, quadrilateral muscle. It takes a vertical course cranially, where it pierces the inferolateral margins of the tongue and subsequently blends between the inferior longitudinal muscles and the styloglossus.
- Styloglossus: It originates from the anterolateral surface of the styloid process. It assists in the retraction of the tongue (moving it poster superiorly). It is the smallest and shortest of the three styloid muscles.

- Palatoglossus: It is anatomically a part of the pharyngeal group of muscles. It originates from the oral part of the aponeurosis of the soft palate. It elevates the dorsal surface of the tongue and while working synergistically with the contralateral palatoglossus to act as the sphincter as the oropharyngeal isthmus.



VASCULATURE OF THE TONGUE

ARTERIAL SUPPLY:

- The arteries of the tongue are derived from the lingual artery which arises from the external carotid artery.

Entering the tongue, the lingual artery passes deep to the hyoglossus muscle and gives rise to the:

- The dorsal lingual arteries which supply the posterior part(root)
- The deep lingual arteries supply the anterior part

- The deep lingual arteries communicate with each other near the apex of the tongue.
- The dorsal lingual arteries are prevented from communicating by the lingual septum.

VENOUS DRAINAGE

- The veins of the tongue are named similarly to the arteries that they accompany.
- The veins of the tongue are the dorsal lingual veins, which accompany the lingual artery
- The deep lingual veins begin at the apex of the tongue, run posteriorly beside the lingual frenulum to join the sublingual vein
- The sublingual veins in elderly people are often varicose(enlarged and tortuous)
- All these lingual veins terminate, directly or indirectly in the internal jugular vein.

LYMPHATIC DRAINAGE

- Lymph from the posterior third drains into the superior deep cervical lymph nodes
- Lymph from the medial part of the anterior two thirds drains directly to the inferior deep cervical lymph nodes
- Lymph from the lateral part of the anterior two thirds drains into the submandibular lymph nodes
- The apex and frenulum drain to the submental lymph nodes
- The posterior third and the medial part of the anterior two thirds drain bilaterally.

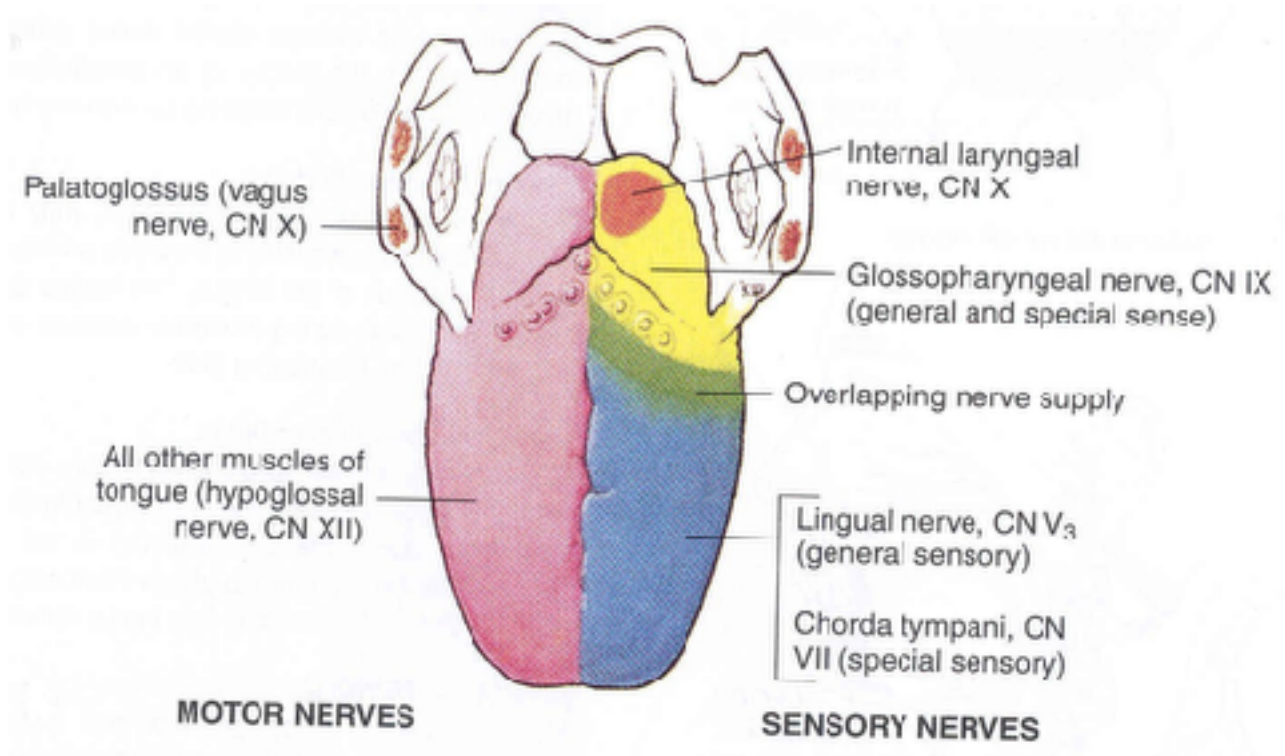
INNERVATION OF THE TONGUE

The nerve supply to the tongue can be grouped based as efferent fibres that carry motor impulses, general sensory that conveys touch and proprioception and special afferent that conveys gustatory impulses.

- **MOTOR INNERVATION**: All muscles of the tongue, except the palatoglossus (actually a palatine muscles supplied by the vagus nerve(X) of the pharyngeal plexus), receive motor innervation from the hypoglossal nerve(CNXII).
- **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 fibres of CN IX.

NOTE: Hence CN VII, CN IX and CN X provide nerve fibres for taste; those from CN VII are ultimately conveyed by CN V3.



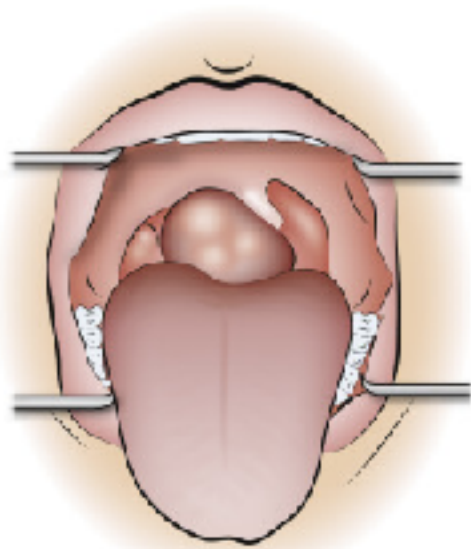
CLINICAL ANATOMY

- **ANKYLOGLOSSIA:** The lingual frenulum is a small fold of mucous membrane that connects the middle of the lower surface of the tongue to the floor of the mouth. If it is too short, often from birth, the tongue may be abnormally retracted into the lower jaw. This lower position leads to a condition that is colloquially known as being tongue tied.

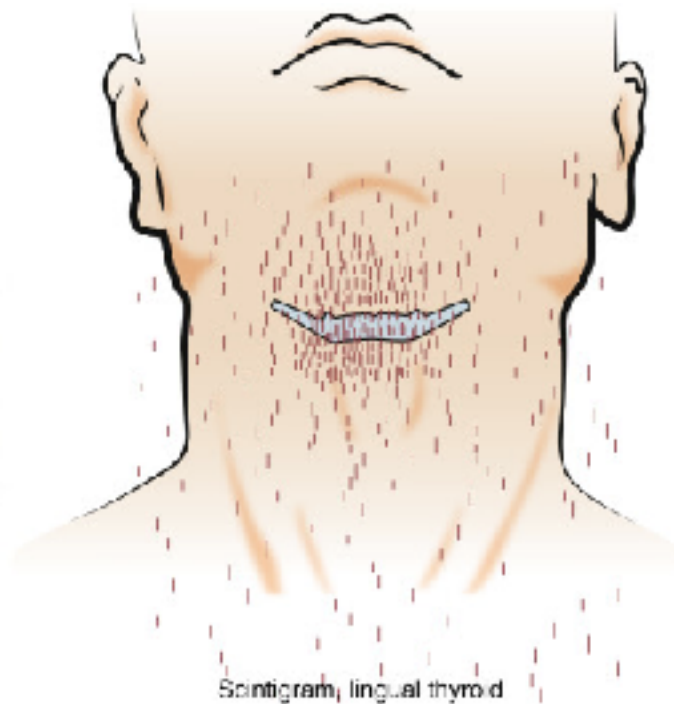
It may be recognised with early infancy swallowing problems and speech impairment at school age as the short frenulum may interfere with tongue movements and function. It can be treated by frenulectomy.



- **FRENULECTOMY**: Clipping the frenulum is a simple surgery. It may be necessary for infants to free the tongue for normal speech development.
- **LINGUAL CARCINOMA**: This is more likely due to infections from human papillomavirus (HPV) or from the use of tobacco, including chewing or smoking. A lingual carcinoma in the posterior part of the tongue metastasise the superior deep cervical lymph nodes on both sides, whereas a tumor in the anterior part usually does not metastasise to the inferior deep cervical lymph nodes until late in the disease. These nodes are related to the internal jugular veins, metastases from the tongue may be widely distributed through the submental and submandibular regions and along the internal jugular veins in the neck.
- **ABERRANT THYROID GLAND**: The thyroid gland typically descends within the embryo along the thyroglossal duct. In some cases, remnants of the thyroid gland may remain behind. These may be found in the root of the tongue or even in the neck. In some cases, it may be treated with radioactive iodine and long term thyroid replacement for post- surgical hypothyroidism is necessary.

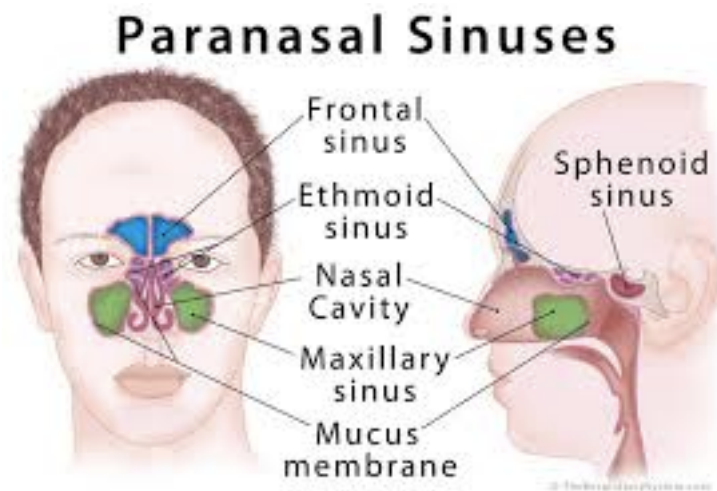


Lingual thyroid



Scintigram, lingual thyroid

2). AIR SINUSES



Sinus is a hollow, cavity, recess, or pocket; a large channel containing blood; a suppurating tract; or a cavity within a bone.

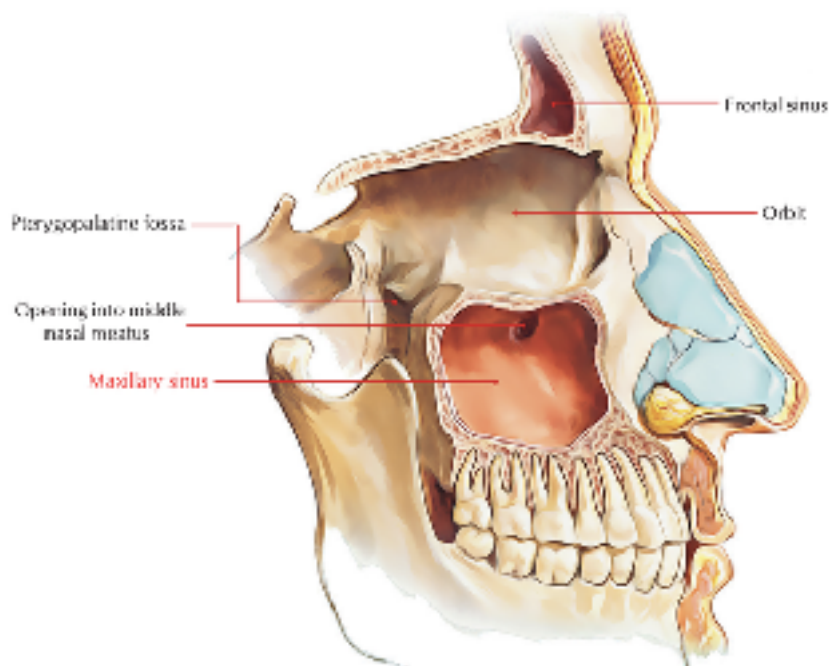
The air sinuses, four on each side, are cavities in the bones that adjoin the nose. They are outgrowths from the nasal cavity and retain their communications with it by means of drainage opening, or ostia. Consequently, their lining is mucous membrane similar to that found in the nose. The mucus secretion formed is propelled by small, hairlike processes called cilia through the ostia of the sinuses to the nasal cavity. From there it is eventually swallowed or expelled. All sinuses are absent or small at birth; they gradually enlarge until puberty, when they usually grow rapidly.

The paranasal sinuses are air cavities that help circulate the air that is breathed in and out of the respiratory system. They are situated around the 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

A) **MAXILLARY SINUSES:** They are the largest of all the paranasal sinuses. Each is a pyramidal space, its roof formed by the floor of the eye socket, and its floor by the palate and teeth-bearing bone. They have thin walls which are often penetrated by the long roots of the posterior maxillary teeth. The superior border of this sinus is the bony orbit, the inferior is the maxillary alveolar bone and corresponding tooth roots, the medial border is made up of the 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 exist.



VASCULARIZATION, INNERVATION AND LYMPHATICS

i) the submandibular lymph nodes are the main destination during lymphatic drainage.

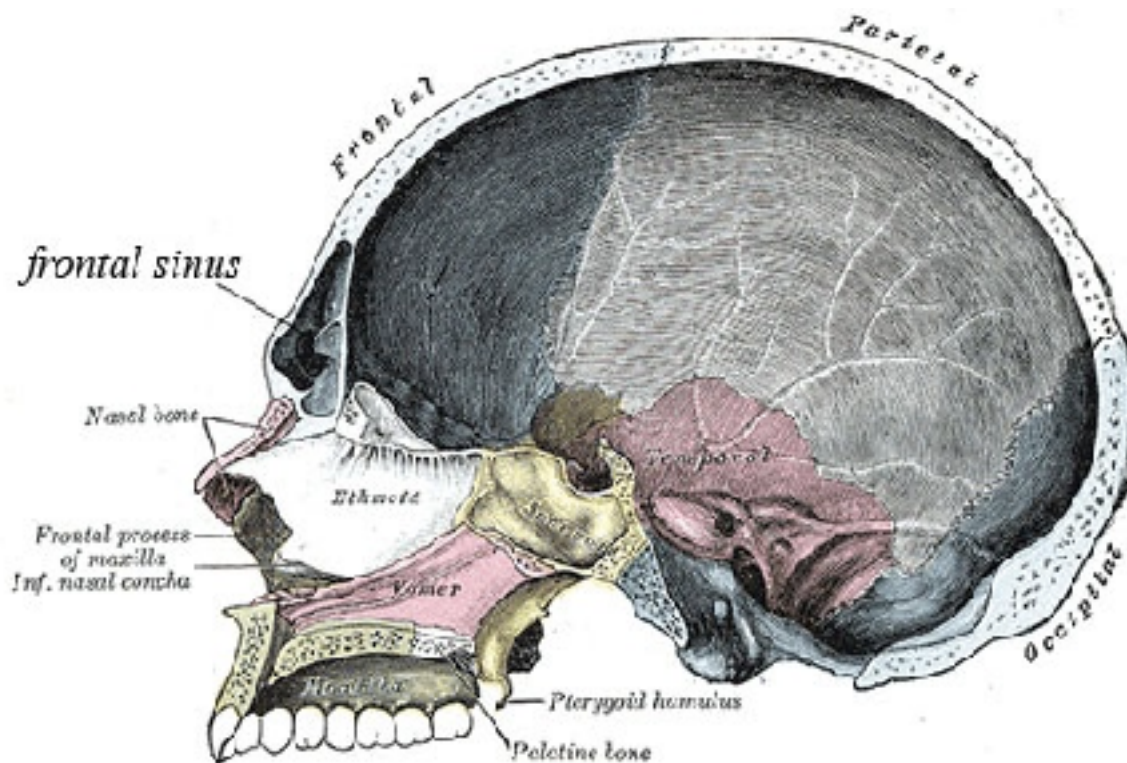
ii) The blood supply includes a contribution from the ANTERIOR SUPERIOR ALVEOLAR ARTERY, MIDDLE SUPERIOR ARTERY and POSTERIOR SUPERIOR ALVEOLAR ARTERY.

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

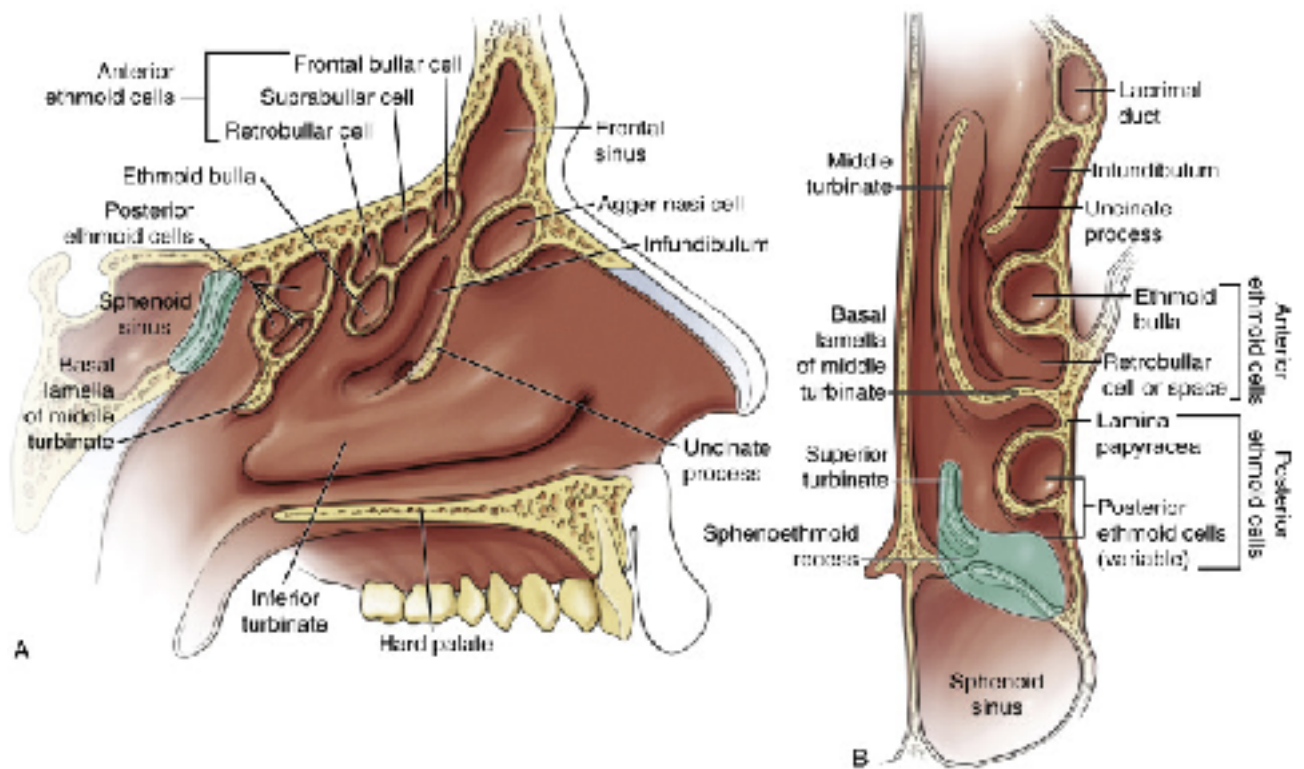
NOTE: The nerves supplying the upper teeth run through the front wall of the sinus and may be irritated during acute astral infections with resultant toothache.

B) **FRONTAL SINUSES:** The two frontal sinuses are situated in the frontal bone immediately above and between the eye sockets, or orbits. They are usually unequal in size and have the same shape of an irregular pyramid with its apex directed upward.

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 each one another, separated by the midline. The thin bony wall separating the two cavities sometimes is absent.



VASCULARIZATION, INNERVATION AND LYMPHATICS



i) They drain primarily into the ethmoidal infundibulum and the corresponding laminae drainage occurs via the submandibular lymph nodes.

ii) It is innervated by the OPHTHALMIC NERVE, including the supraorbital and supratrochlear

iii) The blood supply includes ANTERIOR ETHMOIDAL ARTERY, SUPRAORBITAL ARTERY and SUPRATROCHLEAR ARTERY.

C) **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. They are situated back of the nose in the sphenoidal bone, which forms a forward part of the base of the skull and contains the depression, or fossa for the pituitary gland. Laterally, a cavernous sinus exists which is part of the middle cranial fossa and also the carotid artery and the cranial nerves II, IV, V/I, V/II and VI.

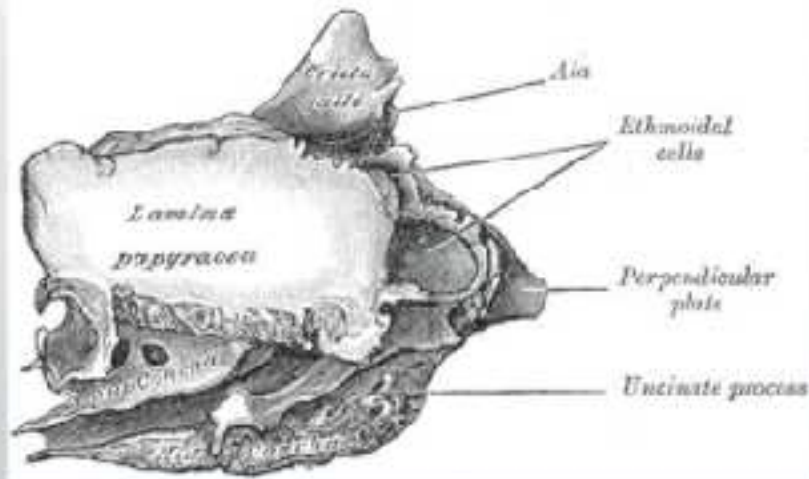
The anterior wall separates this pair of sinuses from the nasal cavity, as does the hypophyseal fossa, the pituitary gland and the optic chiasm superiorly and the nasopharynx and pterygoid canal inferiorly

VASCULARIZATION, INNERVATION AND LYMPHATICS

i) The lymphatic drainage occurs in the same way as the posterior ethmoid sinus.

ii) The posterior ethmoidal artery and the posterior lateral nasal branches supply the sphenoidal sinuses.

Ethmoid sinus



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

- D) **ETHMOIDAL. SINUSES:** Their walls form most of the inner walls of the eye socket and are joined together by a thin perforated plate of bone at the roof of the nose. This bone, the cribriform plate, transmits the olfactory nerves that carry the sense of smell. Superior to the ethmoidal sinus is the anterior cranial fossa and the frontal bone, laterally the orbit can be found while the nail 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.

VASCULARIZATION, INNERVATION and LYMPHATICS

- i) The anterior and middle ethmoid sinuses and their lymphatic drainage to the submandibular lymph nodes while the posterior ethmoidal sinus sends its own to the retropharyngeal lymph nodes.
- ii) The anterior and posterior ethmoidal arteries as well as the posterior lateral nasal branches provide an ample blood supply to this region.

- iii) The anterior and posterior ethmoidal nerves and the posterior lateral superior and inferior nasal nerves help innervate it

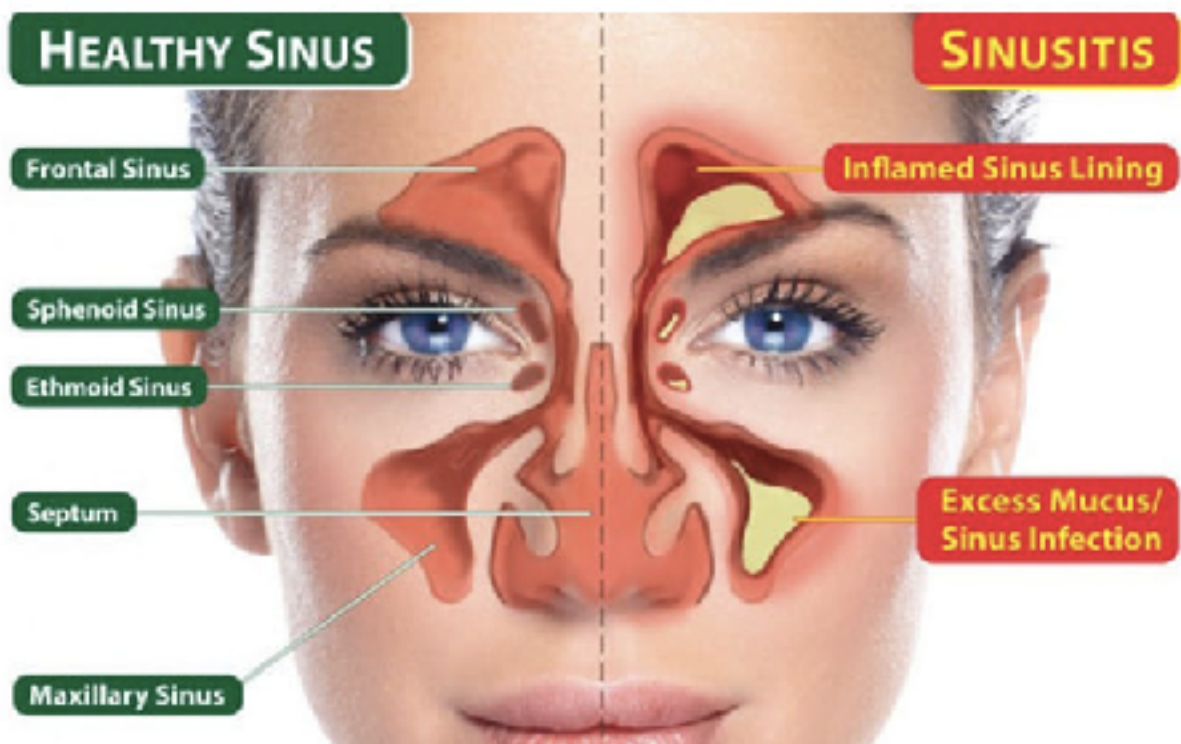
FUNCTIONS OF THE PARANASAL SINUSES

- a) The presence of the sphenoidal and frontal sinuses is related to an increased area of olfaction and consequent improvement in the sense of smell.
- b) Ethmoidal air cells are found only in higher apes and humans and are probably the result of restriction of the olfactory area.
- c) the maxillary sinuses play a part in phonetician, that they aid in conservation of heat from the nasal fosse, and that they served to lighten the skull.
- d) It contributes to facial skeleton
- e) Regulation of intranasal pressure
- f) humidifying and warming inspired air
- g) increasing surface for olfaction

CLINICAL ANATOMY

- a) SINUSITIS: It is extremely common outpatient case which presents as an inflammation of the epithelia of the sinuses. The causes can either be a viral or bacterial infection, or an allergic reaction. The inflammation can be acute or chronic and the maxillary sinuses are the most

Sinusitis Treatment



frequently affected. Antivirus, antibiotics and antihistamines are prescribed in persistent cases.

- b) POLYPS: It consists of nasal lining, may grow from both the maxillary and ethmoidal sinuses and cause nasal obstruction. They occur most commonly as a result of nasal allergy and require surgical removal.
- c) CANCERS OF THE PARANASAL SINUSES: Cancers affecting the paranasal sinuses are rare, especially in the sphenoidal and frontal area. They occur most commonly Among the Bantu of South Africa, where they are related to the long term use of a homemade snuff that is carcinogenic.