**ASSIGNMENT.**

**QUESTIONS:**

1) Discuss the Anatomy of the tongue and comment on its applied anatomy

2) Write an essay on the air sinuses

**ANSWER.**

1. The tongue is a [muscular](https://en.wikipedia.org/wiki/Muscular) [organ](https://en.wikipedia.org/wiki/Organ_%28anatomy%29) in the [mouth](https://en.wikipedia.org/wiki/Mouth) of most [vertebrates](https://en.wikipedia.org/wiki/Vertebrate) that manipulates food for [mastication](https://en.wikipedia.org/wiki/Mastication) and is used in the act of [swallowing](https://en.wikipedia.org/wiki/Swallowing). It has importance in the [digestive system](https://en.wikipedia.org/wiki/Digestive_system) and is the primary organ of [taste](https://en.wikipedia.org/wiki/Taste) in the [gustatory system](https://en.wikipedia.org/wiki/Gustatory_system). The tongue's upper surface (dorsum) is covered by [taste buds](https://en.wikipedia.org/wiki/Taste_buds) housed in numerous [lingual papillae](https://en.wikipedia.org/wiki/Lingual_papilla). It is sensitive and kept moist by [saliva](https://en.wikipedia.org/wiki/Saliva) and is richly supplied with [nerves](https://en.wikipedia.org/wiki/Nerve) and [blood vessels](https://en.wikipedia.org/wiki/Blood_vessel). The tongue also serves as a natural means of [cleaning](https://en.wikipedia.org/wiki/Oral_hygiene) the teeth. A major function of the tongue is the enabling of [speech](https://en.wikipedia.org/wiki/Speech) in [humans](https://en.wikipedia.org/wiki/Human) and [vocalization](https://en.wikipedia.org/wiki/Animal_communication) in other animals.

The human tongue is divided into two parts, an [oral](https://en.wikipedia.org/wiki/Oral_cavity) part at the front and a [pharyngeal](https://en.wikipedia.org/wiki/Pharynx) part at the back. The left and right sides are also separated along most of its length by a vertical section of [fibrous tissue](https://en.wikipedia.org/wiki/Connective_tissue) (the [lingual septum](https://en.wikipedia.org/wiki/Lingual_septum)) that results in a groove, the median sulcus, on the tongue's surface.

There are two groups of muscles of the tongue. The four intrinsic muscles alter the shape of the tongue and are not attached to bone. The four paired extrinsic muscles change the position of the tongue and are anchored to bone.

The anterior *oral* part is the visible part situated at the front and makes up roughly two-thirds the length of the tongue. The posterior *pharyngeal* part is the part closest to the [throat](https://en.wikipedia.org/wiki/Throat), roughly one-third of its length. These parts differ in terms of their [embryological development](https://en.wikipedia.org/wiki/Embryogenesis) and [nerve supply](https://en.wikipedia.org/wiki/Innervation).

The anterior tongue is, at its apex, thin and narrow. It is directed forward against the lingual surfaces of the lower [incisor](https://en.wikipedia.org/wiki/Incisor) teeth. The posterior part is, at its root, directed backward, and connected with the [hyoid bone](https://en.wikipedia.org/wiki/Hyoid_bone) by the [hyoglossi](https://en.wikipedia.org/wiki/Hyoglossi%22%20%5Co%20%22Hyoglossi) and [genioglossi](https://en.wikipedia.org/wiki/Genioglossi%22%20%5Co%20%22Genioglossi) muscles and the [hyoglossal membrane](https://en.wikipedia.org/wiki/Hyoglossal_membrane%22%20%5Co%20%22Hyoglossal%20membrane), with the [epiglottis](https://en.wikipedia.org/wiki/Epiglottis) by three [glossoepiglottic folds](https://en.wikipedia.org/wiki/Glossoepiglottic_folds%22%20%5Co%20%22Glossoepiglottic%20folds) of mucous membrane, with the [soft palate](https://en.wikipedia.org/wiki/Soft_palate) by the [glossopalatine arches](https://en.wikipedia.org/wiki/Glossopalatine_arches%22%20%5Co%20%22Glossopalatine%20arches), and with the [pharynx](https://en.wikipedia.org/wiki/Pharynx) by the [superior pharyngeal constrictor muscle](https://en.wikipedia.org/wiki/Superior_pharyngeal_constrictor_muscle) and the [mucous membrane](https://en.wikipedia.org/wiki/Mucous_membrane). It also forms the anterior wall of the [oropharynx](https://en.wikipedia.org/wiki/Oropharynx).

The average length of the human tongue from the [oropharynx](https://en.wikipedia.org/wiki/Oropharynx) to the tip is 10 cm. The average weight of the human tongue from adult males is 70g and for adult females 60g.

In [phonetics](https://en.wikipedia.org/wiki/Phonetics) and [phonology](https://en.wikipedia.org/wiki/Phonology), a distinction is made between the tip of the tongue and the blade (the portion just behind the tip). Sounds made with the tongue tip are said to be [apical](https://en.wikipedia.org/wiki/Apical_consonant), while those made with the tongue blade are said to be [laminal](https://en.wikipedia.org/wiki/Laminal_consonant%22%20%5Co%20%22Laminal%20consonant).

**Upper surface of the tongue**

The upper surface of the tongue is called the dorsum, and is divided by a groove into symmetrical halves by the median sulcus. The foramen cecum marks the end of this division (at about 2.5 cm from the root of the tongue) and the beginning of the terminal sulcus. The foramen cecum is also the point of attachment of the [thyroglossal duct](https://en.wikipedia.org/wiki/Thyroglossal_duct%22%20%5Co%20%22Thyroglossal%20duct) and is formed during the descent of the [thyroid diverticulum](https://en.wikipedia.org/wiki/Thyroid_diverticulum) in [embryonic development](https://en.wikipedia.org/wiki/Human_embryogenesis).

The terminal sulcus is a shallow groove that runs forward as a shallow groove in a V shape from the foramen cecum, forwards and outwards to the margins (borders) of the tongue. The terminal sulcus divides the tongue into a posterior [pharyngeal](https://en.wikipedia.org/wiki/Pharynx) part and an anterior [oral](https://en.wikipedia.org/wiki/Oral_cavity) part. The pharyngeal part is supplied by the [glossopharyngeal nerve](https://en.wikipedia.org/wiki/Glossopharyngeal_nerve) and the oral part is supplied by the [lingual nerve](https://en.wikipedia.org/wiki/Lingual_nerve) (a branch of the mandibular branch (V3) of the [trigeminal nerve](https://en.wikipedia.org/wiki/Trigeminal_nerve)) for somatosensory perception and by the [chorda tympani](https://en.wikipedia.org/wiki/Chorda_tympani) (a branch of the [facial nerve](https://en.wikipedia.org/wiki/Facial_nerve)) for [taste perception](https://en.wikipedia.org/wiki/Taste).

Both parts of the tongue develop from different [pharyngeal arches](https://en.wikipedia.org/wiki/Pharyngeal_arch).

#### Undersurface of the tongue

On the undersurface of the tongue is a fold of mucous membrane called the [frenulum](https://en.wikipedia.org/wiki/Frenulum_of_tongue) that tethers the tongue at the midline to the floor of the mouth. On either side of the frenulum are small prominences called [sublingual caruncles](https://en.wikipedia.org/wiki/Submandibular_gland#Structure) that the major salivary [submandibular glands](https://en.wikipedia.org/wiki/Submandibular_gland) drain into.

#### Muscles

The eight muscles of the human tongue are classified as either *intrinsic* or *extrinsic*. The four intrinsic muscles act to change the shape of the tongue, and are not attached to any bone. The four extrinsic muscles act to change the position of the tongue, and are anchored to bone.

## Extrinsic Muscles

The **extrinsic** muscles are as follows:

### Genioglossus

* Attachments: Arises from the mandibular symphsis. Inserts into the body of the hyoid bone and the entire length of the tongue.
* Function: Inferior fibres protrude the tongue, middle fibres depress the tongue, and superior fibres draw the tip back and down
* Innervation: Motor innervation via the [hypoglossal nerve](https://teachmeanatomy.info/head/cranial-nerves/hypoglossal/) (CNXII).

### Hyoglossus

* Attachments: Arises from the hyoid bone and inserts into the side of the tongue
* Function: Depresses and retracts the tongue
* Innervation: Motor innervation via the [hypoglossal nerve](https://teachmeanatomy.info/head/cranial-nerves/hypoglossal/) (CNXII).

### Styloglossus

* Attachments: Originates at the styloid process of the temporal bone and inserts into the side of the tongue
* Function: Retracts and elevates the tongue
* Innervation: Motor innervation via the [hypoglossal nerve](https://teachmeanatomy.info/head/cranial-nerves/hypoglossal/) (CNXII).

### Palatoglossus

* Attachments: Arises from the palatine aponeurosis and inserts broadly across the tongue
* Function: Elevates the posterior aspect of the tongue
* Innervation: Motor innervation via the [vagus nerve](https://teachmeanatomy.info/head/cranial-nerves/vagus-nerve-cn-x/) (CNX).

##### **Intrinsic Muscles.**

Four paired intrinsic muscles of the tongue originate and insert within the tongue, running along its length. They are the [superior longitudinal muscle](https://en.wikipedia.org/wiki/Superior_longitudinal_muscle_of_tongue), the [inferior longitudinal muscle](https://en.wikipedia.org/wiki/Inferior_longitudinal_muscle), the [vertical muscle](https://en.wikipedia.org/wiki/Vertical_muscle_of_tongue), and the [transverse muscle](https://en.wikipedia.org/wiki/Transverse_muscle_of_tongue). These muscles alter the shape of the tongue by lengthening and shortening it, curling and uncurling its apex and edges as in [tongue rolling](https://en.wikipedia.org/wiki/Tongue_rolling), and flattening and rounding its surface. This provides shape and helps facilitate speech, swallowing, and eating.

The superior longitudinal muscle runs along the upper surface of the tongue under the mucous membrane, and elevates, assists in retraction of, or deviates the tip of the tongue. It originates near the [epiglottis](https://en.wikipedia.org/wiki/Epiglottis), at the [hyoid bone](https://en.wikipedia.org/wiki/Hyoid_bone), from the median fibrous septum.

The inferior longitudinal muscle lines the sides of the tongue, and is joined to the styloglossus muscle.

The vertical muscle is located in the middle of the tongue, and joins the superior and inferior longitudinal muscles.

The transverse muscle divides the tongue at the middle, and is attached to the [mucous membranes](https://en.wikipedia.org/wiki/Mucous_membrane) that run along the sides.

## Vasculature

The **lingual artery** (branch of the external carotid) does most of the supply, but there is a branch from the facial artery, called the **tonsillar artery,** which can provide some collateral circulation. Drainage is by the **lingual vein.**

**Nerve supply**

Innervation of the tongue consists of motor fibers, [special sensory](https://en.wikipedia.org/wiki/Special_visceral_afferent) fibers for taste, and [general sensory](https://en.wikipedia.org/wiki/General_visceral_afferent) fibers for sensation.

* Motor supply for all intrinsic and extrinsic muscles of the tongue is supplied by [efferent motor nerve fibers](https://en.wikipedia.org/wiki/Efferent_nerve_fiber) from the [hypoglossal nerve](https://en.wikipedia.org/wiki/Hypoglossal_nerve) (CN XII), with the exception of the [palatoglossus](https://en.wikipedia.org/wiki/Palatoglossus%22%20%5Co%20%22Palatoglossus), which is innervated by the [vagus nerve](https://en.wikipedia.org/wiki/Vagus_nerve) (CN X).

Innervation of taste and sensation is different for the anterior and posterior part of the tongue because they are derived from different embryological structures ([pharyngeal arch](https://en.wikipedia.org/wiki/Pharyngeal_arch) 1 and pharyngeal arches 3 and 4, respectively).

* Anterior two thirds of tongue (anterior to the [vallate papillae](https://en.wikipedia.org/wiki/Lingual_papilla%22%20%5Cl%20%22Circumvallate_papillae%22%20%5Co%20%22Lingual%20papilla)):
	+ Taste: chorda tympani branch of the [facial nerve](https://en.wikipedia.org/wiki/Facial_nerve) (CN VII) via [special visceral afferent](https://en.wikipedia.org/wiki/Special_visceral_afferent) fibers
	+ Sensation: lingual branch of the mandibular (V3) division of the [trigeminal nerve](https://en.wikipedia.org/wiki/Trigeminal_nerve) (CN V) via [general visceral afferent](https://en.wikipedia.org/wiki/General_visceral_afferent) fibers
* Posterior one third of tongue:
	+ Taste and sensation: [glossopharyngeal nerve](https://en.wikipedia.org/wiki/Glossopharyngeal_nerve) (CN IX) via a mixture of special and general visceral afferent fibers
* Base of tongue
	+ Taste and sensation: internal branch of the [superior laryngeal nerve](https://en.wikipedia.org/wiki/Superior_laryngeal_nerve) (itself a branch of the [vagus nerve](https://en.wikipedia.org/wiki/Vagus_nerve%22%20%5Co%20%22Vagus%20nerve), CN X)

**Lymphatic Drainage**

* The lymphatic drainage of the tongue is as follows:
* Anterior two thirds – initially into the submental and submandibular nodes, which empty into the deep cervical lymph nodes
* Posterior third – directly into the deep cervical lymph nodes.

### Function

#### Taste

Chemicals that stimulate [taste receptor](https://en.wikipedia.org/wiki/Taste_receptor) cells are known as [tastants](https://en.wikipedia.org/wiki/Gustatory_cortex%22%20%5Cl%20%22Tastant_concentration-dependent_neuronal_activity%22%20%5Co%20%22Gustatory%20cortex). Once a tastant is dissolved in [saliva](https://en.wikipedia.org/wiki/Saliva), it can make contact with the [plasma membrane](https://en.wikipedia.org/wiki/Plasma_membrane) of the gustatory hairs, which are the sites of taste [transduction](https://en.wikipedia.org/wiki/Transduction_%28physiology%29).

The tongue is equipped with many [taste buds](https://en.wikipedia.org/wiki/Taste_buds) on its [dorsal](https://en.wikipedia.org/wiki/Anatomical_terms_of_location) surface, and each taste bud is equipped with taste receptor cells that can sense particular classes of tastes. Distinct types of taste receptor cells respectively detect substances that are sweet, bitter, salty, sour, spicy, or taste of [umami](https://en.wikipedia.org/wiki/Umami). Umami receptor cells are the least understood and accordingly are the type most intensively under research.

#### Mastication

The tongue is an important accessory organ in the digestive system. The tongue is used for crushing food against the hard palate, during mastication and manipulation of food for softening prior to swallowing. The [epithelium](https://en.wikipedia.org/wiki/Epithelium) on the tongue's upper, or dorsal surface is [keratinised](https://en.wikipedia.org/wiki/Keratin%22%20%5Co%20%22Keratin). Consequently, the tongue can grind against the hard palate without being itself damaged or irritated

#### Speech

The intrinsic muscles of the tongue enable the shaping of the tongue which facilitates [speech](https://en.wikipedia.org/wiki/Speech).

#### Intimacy

The tongue plays a role in [physical intimacy](https://en.wikipedia.org/wiki/Physical_intimacy) and [sexuality](https://en.wikipedia.org/wiki/Human_sexuality). The tongue is part of the [erogenous zone](https://en.wikipedia.org/wiki/Erogenous_zone) of the mouth and can be used in intimate contact.

**Applied Anatomy.**

## Tongue Conditions

* [Thrush](https://www.webmd.com/oral-health/guide/dental-health-thrush) (candidiasis): *Candida albicans* (a yeast) 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.
* [Oral cancer](https://www.webmd.com/oral-health/guide/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.
* Macroglossia (big tongue): 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 an enlarged tongue.
* [Geographic tongue](https://www.webmd.com/oral-health/tongue-problem-basics-sore-or-discolored-tongue-and-tongue-bumps): Ridges and colored spots migrate over the surface of the tongue, periodically changing its appearance. Geographic tongue is a harmless condition.
* [Burning mouth/burning tongue syndrome](https://www.webmd.com/oral-health/burning-mouth-syndrome-mefref): a relatively common problem. 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.
* Atrophic glossitis (bald tongue): The tongue loses its bumpy texture, becoming smooth. Sometimes this is due to anemia or a B vitamin deficiency.
* [Canker sores](https://www.webmd.com/oral-health/guide/canker-sores) (aphthous ulcers): Small, painful ulcers appear periodically on the tongue or mouth. A relatively common condition, the cause of canker sores is unknown; they are unrelated to the cold sores caused by herpes viruses. Canker sores are not contagious.
* [Oral leukoplakia](https://www.webmd.com/oral-health/guide/dental-health-leukoplakia): White patches appear on the tongue that can’t be scraped off. Leukoplakia may be benign, or it can progress to oral cancer.
* [Hairy tongue](https://www.webmd.com/oral-health/black-hairy-tongue): Papillae can overgrow the surface of the tongue, giving it a white or black appearance. Scraping off the papillae corrects this harmless condition.
* [Herpes stomatitis](https://www.webmd.com/a-to-z-guides/understanding-cold-sores-basics): The herpes virus can uncommonly cause cold sores on the tongue. Herpes virus cold sores are usually on the lip.
* [Lichen planus](https://www.webmd.com/skin-problems-and-treatments/lichen-planus): A harmless condition that can affect the skin or the mouth. The cause is unknown; however, it is believed to be caused by the immune system attacking the skin and lining of the mouth.



DIAGRAM OF THE TONGUE.

2. The nasal cavity is a roughly cylindrical, midline, airway passage that extends from the nasal ala anteriorly to the choana posteriorly. It is divided in the midline by the nasal septum. On each side, it is flanked by the maxillary sinuses, and roofed by the frontal, ethmoid, and sphenoid sinuses, in an anterior to posterior fashion. While seemingly simple, sinonasal anatomy is composed of intricate and subdivided air passages and drainage pathways that connect the sinuses.

**STRUCTURE AND FUNCTION.**

There are 4 paired sinuses in humans. They are all in line with pseudostratified columnar epithelium.

* The maxillary sinuses: Largest of the paranasal sinuses, located under the eyes in the maxillary bones.
* The frontal sinuses: Located superior to the eyes within the frontal bone
* The ethmoid sinuses: Formed from several discrete air cells within the ethmoid bone between the nose and eyed
* The sphenoid sinuses: Located within the sphenoid bone

The function of the paranasal sinuses is debated. However, they are implicated in several roles:

* Decreasing the relative weight of the skull
* Increasing the resonance of the voice
* Providing a buffer against facial trauma
* Insulating sensitive structures from rapid temperature fluctuations in the nose
* Humidifying and heating inspired air
* Immunological defense

To develop a strong understanding of paranasal sinus anatomy, it is also important to understand the anatomical relationships of the sinuses to surrounding structures. The lateral nasal wall contains many structures and recesses that are important for understanding paranasal sinus anatomy.

* Turbinates: Three to 4 bony shelves covered by erectile mucosa, serve to increase the interior surface area
* Meatuses: Three spaces located beneath each turbinate. The superior meatus provides drainage for the sphenoid and posterior ethmoid sinuses. The middle meatus provides drainage for the frontal, anterior ethmoid, and maxillary sinuses. The inferior meatus contains the orifice of the nasolacrimal duct
* Uncinate process: A sickle-shaped, thin, bony part of the ethmoid bone, covered by mucoperiosteum, medial to the ethmoid infundibulum and lateral to the middle turbinate
* Ethmoid infundibulum: This is a pyramidal space facilitating drainage of the maxillary, anterior ethmoid, and frontal sinuses. The superior attachment of the uncinate process determines the spatial relationship of the frontal sinus drainage (discussed in another section)
* Semilunar hiatus: This is a gap that empties the ethmoid infundibulum and is located between the uncinate process and the ethmoid bulla
* Osteomeatal complex (OMC): Region referring to the anterior ethmoids containing the ostia of the maxillary, frontal, and ethmoid sinuses. This is located lateral to the middle turbinate. While not a discrete anatomic structure, it is instead a collection of several middle meatus structures including the middle meatus, uncinate process, ethmoid infundibulum, anterior ethmoid cells, and ostia of the anterior ethmoid, maxillary, and frontal sinuses.
* Nasal Fontanelles: Area of the lateral nasal wall where no bone exists. The natural ostium of the maxillary sinus is located in the anterior fontanelle.

**Maxillary Sinus**

The maxillary sinus is located under the eyes in the maxillary bone. Adjacent structures include the lateral nasal wall, the orbital floor, and the posterior maxillary wall which contains the pterygopalatine fossa. The maxillary sinus is innervated by the infraorbital nerve (CN V2). The maxillary and facial arteries supply the sinus, and the maxillary vein supplies venous drainage. As mentioned already, the maxillary sinus drains into the ethmoid infundibulum. There is typically only one ostium per maxillary sinus; however, cadaver studies have shown 10% to 30% have an accessory ostium. The size of the maxillary sinus at adult stage is approximately 15 mL, making it the largest paranasal sinus.

**Frontal Sinus**

The frontal sinus is located superior to the orbit and within the frontal bone. The typical volume at the adult stage is 4 to 7 mL. The frontal sinus drains into the frontal recess via the middle meatus. As noted previously, this drainage can be variable, either medial or lateral to the uncinate, depending on its attachment. The frontal sinus vasculature consists of the supraorbital and supratrochlear arteries and ophthalmic and supraorbital veins. Similarly, it's innervation is provided by the supraorbital and supratrochlear nerves (CNV1). Several anatomical spaces/structures are important to frontal sinus anatomy:

* Frontal recess: Drainage space between the frontal sinus and semilunar hiatus that is bounded by the posterior wall of the agger nasi cell, lamina papyracea, and the middle turbinate.
* Frontal sinus infundibulum: Space that drains into the frontal recess that is located superior to the agger nasi cells
* Frontal cells: anterior ethmoid cells that pneumatize the frontal recess. These cells may cause obstruction or persistent sinus disease. They are located posterior and superior to the agger nasi cell, and there are 4 types as classified by Bent and Kuhn:
1. Type I: Single cell above the agger nasi cell but below the floor of the frontal sinus
2. Type II: Multiple cells above the agger nasi, may extend into the frontal sinus
3. Type III: Single large cell that extends supraorbitally through the floor of the frontal sinus, attaches to the anterior table
4. Type IV: Single isolated cell that is contained within the frontal sinus

**Sphenoid Sinus**

The sphenoid sinuses are located centrally and posteriorly within the sphenoid bone. They drain into the sphenoethmoidal recess located within the superior meatus. The sphenopalatine artery supplies the sinus, and venous drainage is via the maxillary vein. Innervation is provided by the sphenopalatine nerve, which is comprised of parasympathetic fibers and CN V2. The typical adult size is 0.5 to 8 mL. Several important structures have a close anatomical relationship to the sphenoid sinus. The carotid artery is located adjacent to the lateral wall of the sinus, and in 25% of patients, it is dehiscent in this area. The optic nerve is also located adjacent to the lateral wall of the sinus and can be dehiscent in up to 5% of individuals.

**Ethmoid Sinuses**

* There are 3 to 4 cells at birth and develop into 10 to 15 by adulthood for a total volume of 2 to 3 mL. They are located between the eyes. The anterior ethmoids drain into the ethmoid infundibulum, in the middle meatus. The posterior ethmoid sinuses drain into the sphenoethmoidal recess located in the superior meatus. The ethmoid sinuses are supplied by the anterior and posterior ethmoid arteries, respectively. These arteries are branches of the ophthalmic artery, which is a branch off of the internal carotid artery. This is an important anatomical relationship to realize because endovascular embolization of the ethmoid arteries should be avoided when treating epistaxis due to the possibility of retrograde movement of the embolization material into the ICA resulting in possible CVA. Ethmoid sinus venous drainage is by the maxillary and ethmoid veins. The anterior and posterior ethmoid veins provide innervation.
* The complex ethmoidal labyrinth can be reduced into a series of lamellae based on embryologic precursors. These lamellae are obliquely oriented and lie parallel to each other.
1. The first lamella is the uncinate process.
2. The second lamella corresponds to the ethmoid bulla.
3. The third lamella is also known as the basal or ground lamella of the middle turbinate. This lamella serves as the division of the anterior and posterior ethmoids. The anterior part inserts vertically into the crista ethmoidalis. The middle portion attaches obliquely into the lamina papyracea. The posterior third attaches to the lamina papyracea as well but in a horizontal fashion.
4. The fourth lamella is the superior turbinate.
* The agger nasi cell is the most anterior of the anterior ethmoid cells. It is found anterior and superior to the middle turbinate attachment to the lateral wall. The posterior wall of the agger nasi cell forms the anterior wall of the frontal recess.
* The ethmoid bulla is the largest of the anterior ethmoid cells that lies above the infundibulum. This structure is important because the anterior ethmoid artery courses over the roof of this cell.

**BLOOD SUPPLY AND LYMPHATICS.**

The major artery of the maxillary sinus is the internal maxillary artery, a branch of the external carotid artery. The ethmoid and frontal sinuses have a variety of blood supplies, including meningeal vessels for the cribriform plate above the ethmoid sinuses, as well as the posterior wall of the frontal air cells. The sphenoid sinuses may derive blood supply from small branches of the cavernous internal carotid arteries. Rarely, an aneurysm of the internal carotid artery may invaginate into the sphenoid sinus, making endovascular coiling the preferred technique for aneurysm obliteration.

**INNERVATION.**

The major nerve running below the frontal sinus is the first division of the fifth cranial nerve. The major nerve of the inferior aspect of the maxillary sinus is the second division of the fifth cranial nerve. This nerve has sensory but no specific motor functions, as opposed to the third division of cranial nerve five, the latter of which has both sensory (primarily skill of the jaw and the teeth) and motor functions (primarily muscles of mastication).

**MUSCULATURE.**

The frontalis muscle runs over the frontal skull and sinus region and is part of the mechanism of facial expression. The levator muscles of the lips are anchored over the maxillary sinuses. The zygomatic projection of the maxilla is part of the anchorage of the masseter muscle, a powerful closure of the jaw.

**CLINICAL SIGNIFICANCE.**

### Inflammation

The paranasal sinuses are joined to the [nasal cavity](https://en.wikipedia.org/wiki/Nasal_cavity) via small orifices called [ostia](https://en.wikipedia.org/wiki/Sinus_ostium%22%20%5Co%20%22Sinus%20ostium). These become blocked easily by allergic inflammation, or by swelling in the nasal lining that occurs with a [cold](https://en.wikipedia.org/wiki/Common_cold). If this happens, normal drainage of [mucus](https://en.wikipedia.org/wiki/Mucus) within the sinuses is disrupted, and [sinusitis](https://en.wikipedia.org/wiki/Sinusitis) may occur. Because the maxillary posterior teeth are close to the maxillary sinus, this can also cause clinical problems if any disease processes are present, such as an infection in any of these teeth. These clinical problems can include secondary sinusitis, the inflammation of the sinuses from another source such as an infection of the adjacent teeth.

These conditions may be treated with drugs such as [decongestants](https://en.wikipedia.org/wiki/Decongestant), which cause vasoconstriction in the sinuses; reducing inflammation; by traditional techniques of [nasal irrigation](https://en.wikipedia.org/wiki/Nasal_irrigation); or by [corticosteroid](https://en.wikipedia.org/wiki/Corticosteroid).

### Cancer

Malignancies of the paranasal sinuses comprise approximately 0.2% of all malignancies. About 80% of these malignancies arise in the maxillary sinus. Men are much more often affected than women. They most often occur in the age group between 40 and 70 years. [Carcinomas](https://en.wikipedia.org/wiki/Carcinoma) are more frequent than [sarcomas](https://en.wikipedia.org/wiki/Sarcoma). Metastases are rare. [Tumours](https://en.wikipedia.org/wiki/Neoplasm%22%20%5Co%20%22Neoplasm) of the sphenoid and frontal sinuses are extremely rare.



Paranasal sinuses seen in a frontal view.



Lateral projection of the paranasal sinuses.

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**LEVEL: 300**