

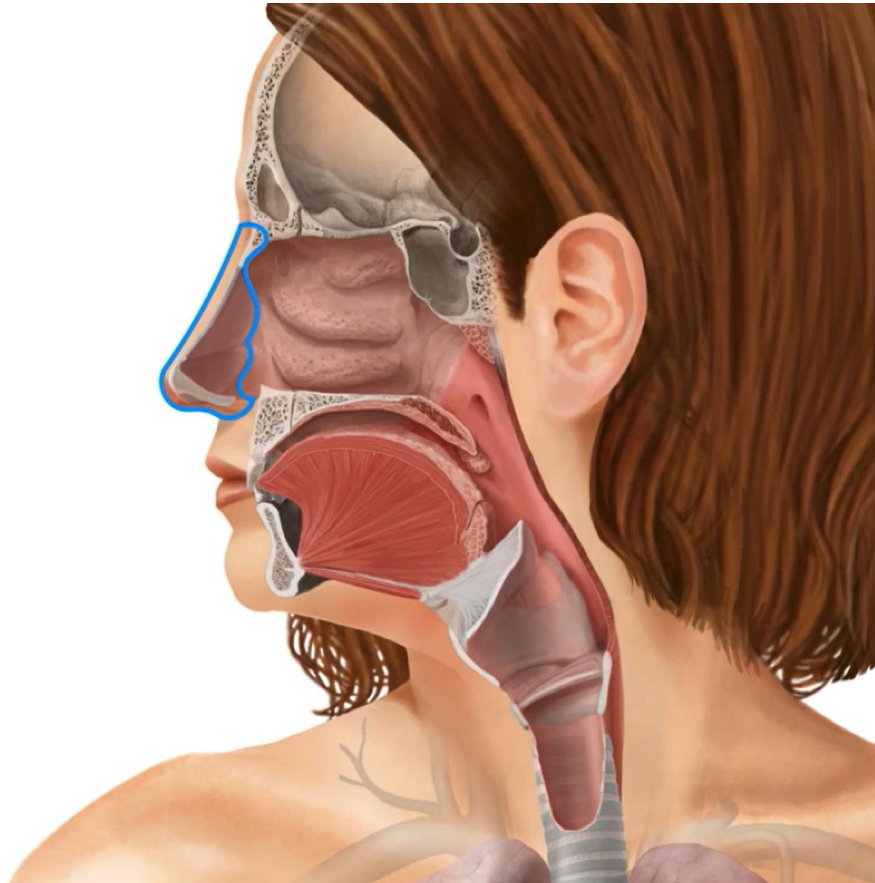
بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

The Nasal Cavities and Paranasal Sinuses

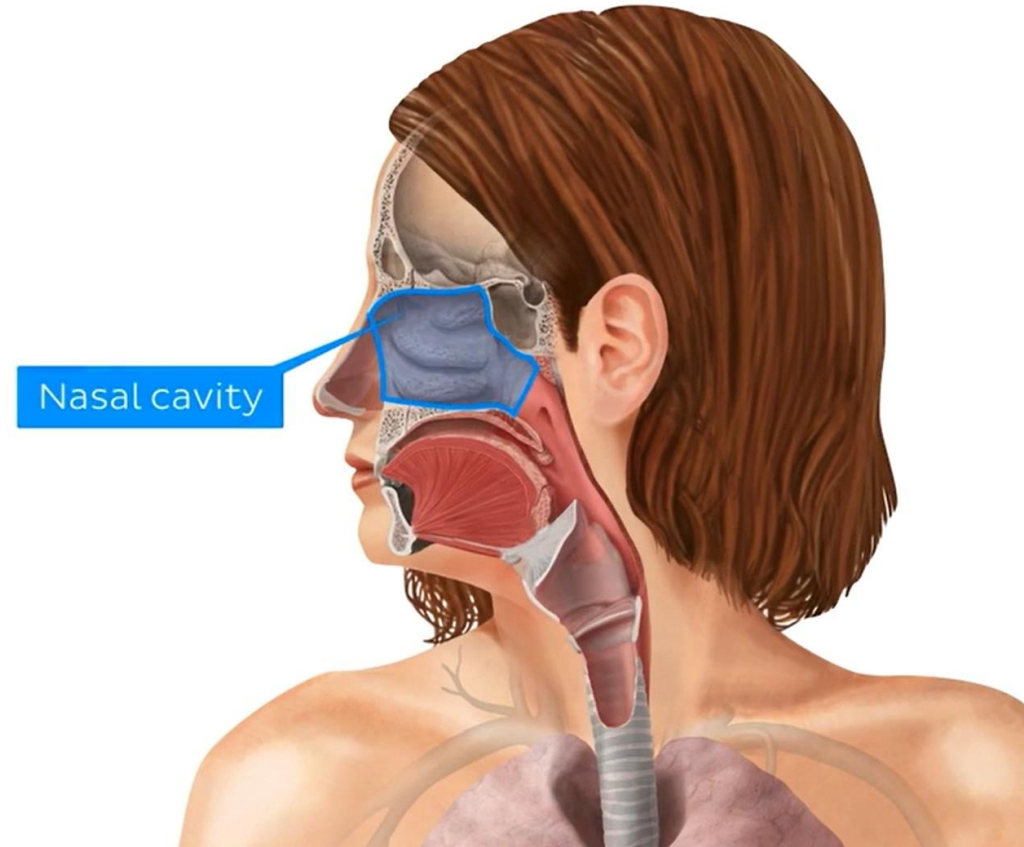
Done by: Ahmad Aymman

INTRO

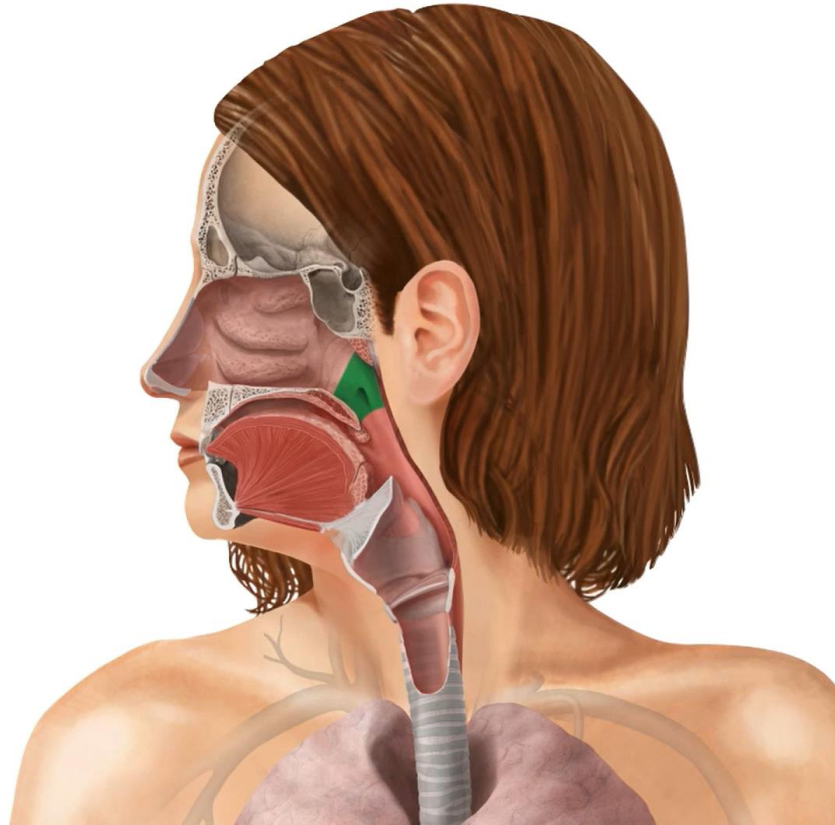
Organs of the respiratory system include the nose and the nasal cavity, the pharynx, which includes the nasopharynx, the oropharynx and the laryngopharynx, the larynx الحنجرة, which is involved in phonation (articulation: formation of sound), the larynx contains the vocal cords that are responsible for speech, then we have the trachea, the right and left main bronchi, the right and left main bronchi enter the lungs, where they branch and supply the alveoli, which are responsible for gas exchange.



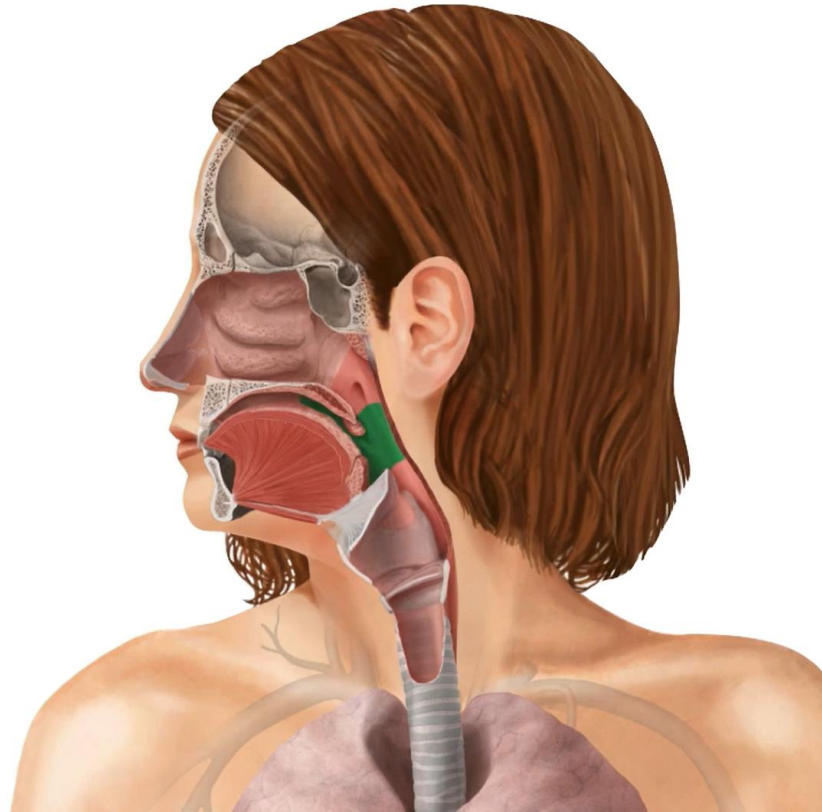
The External Nose



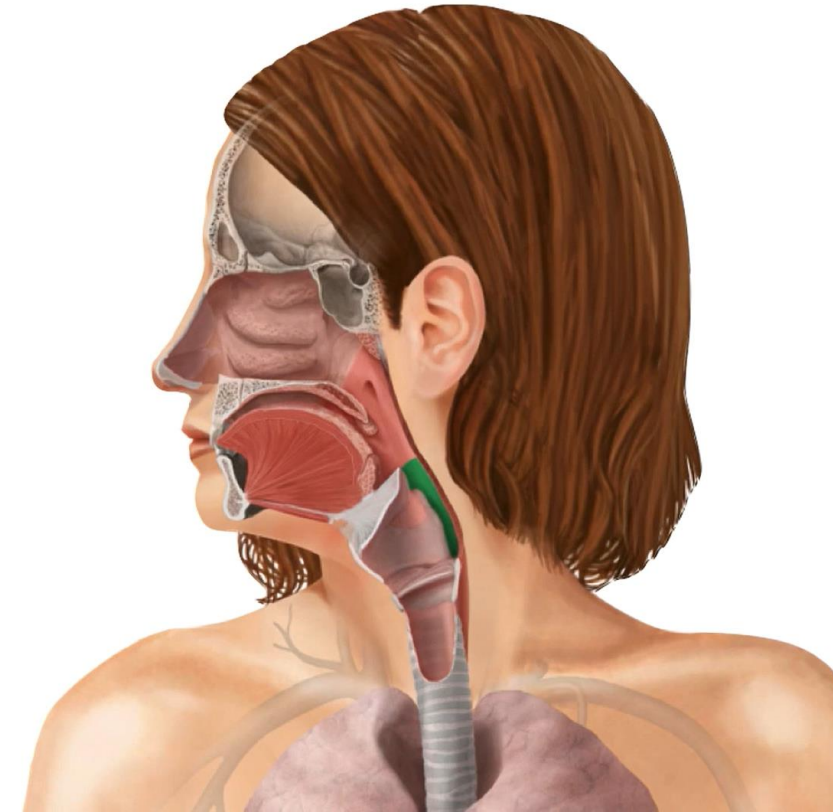
The Nasal Cavity



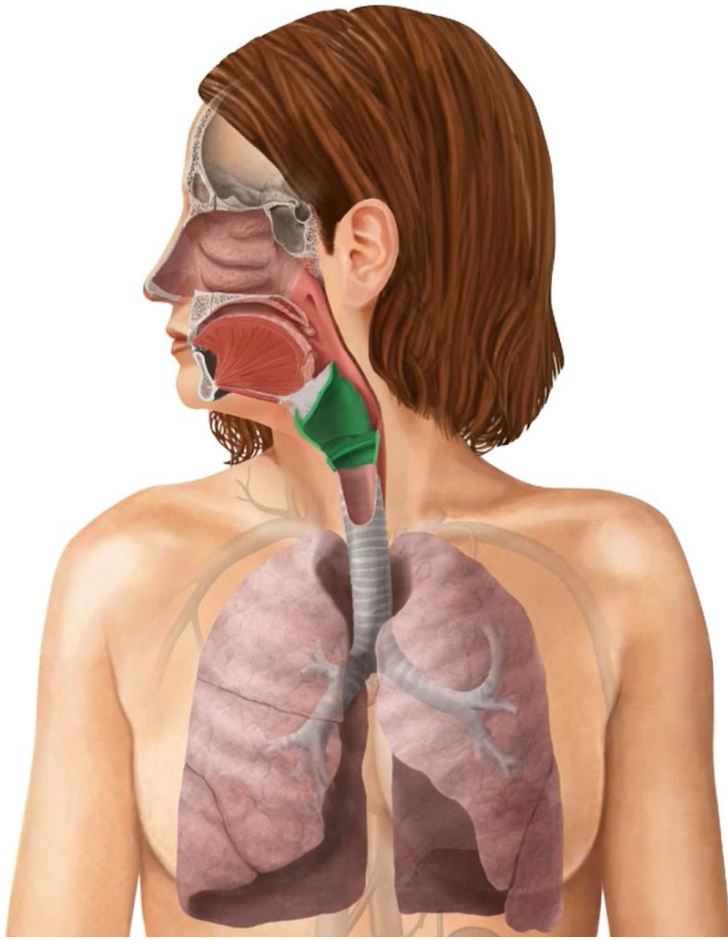
The Nasopharynx



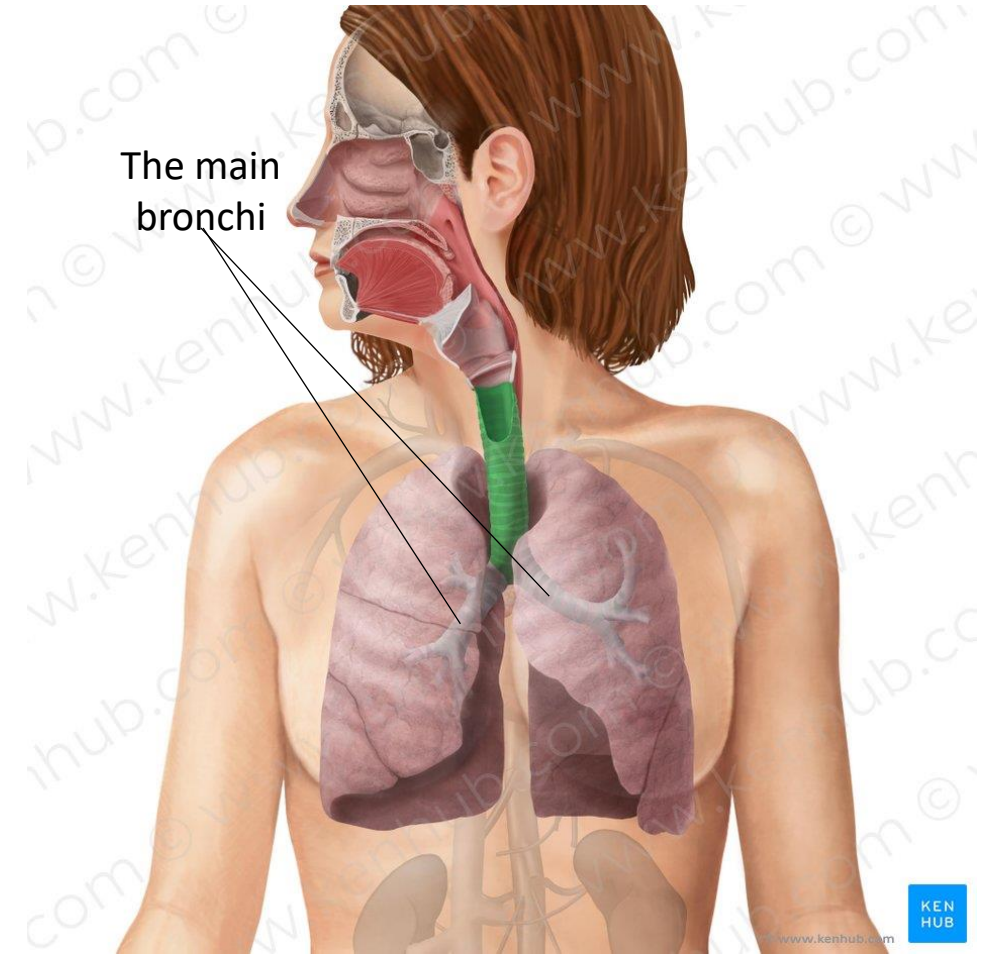
The Oropharynx



The Laryngopharynx



The Larynx

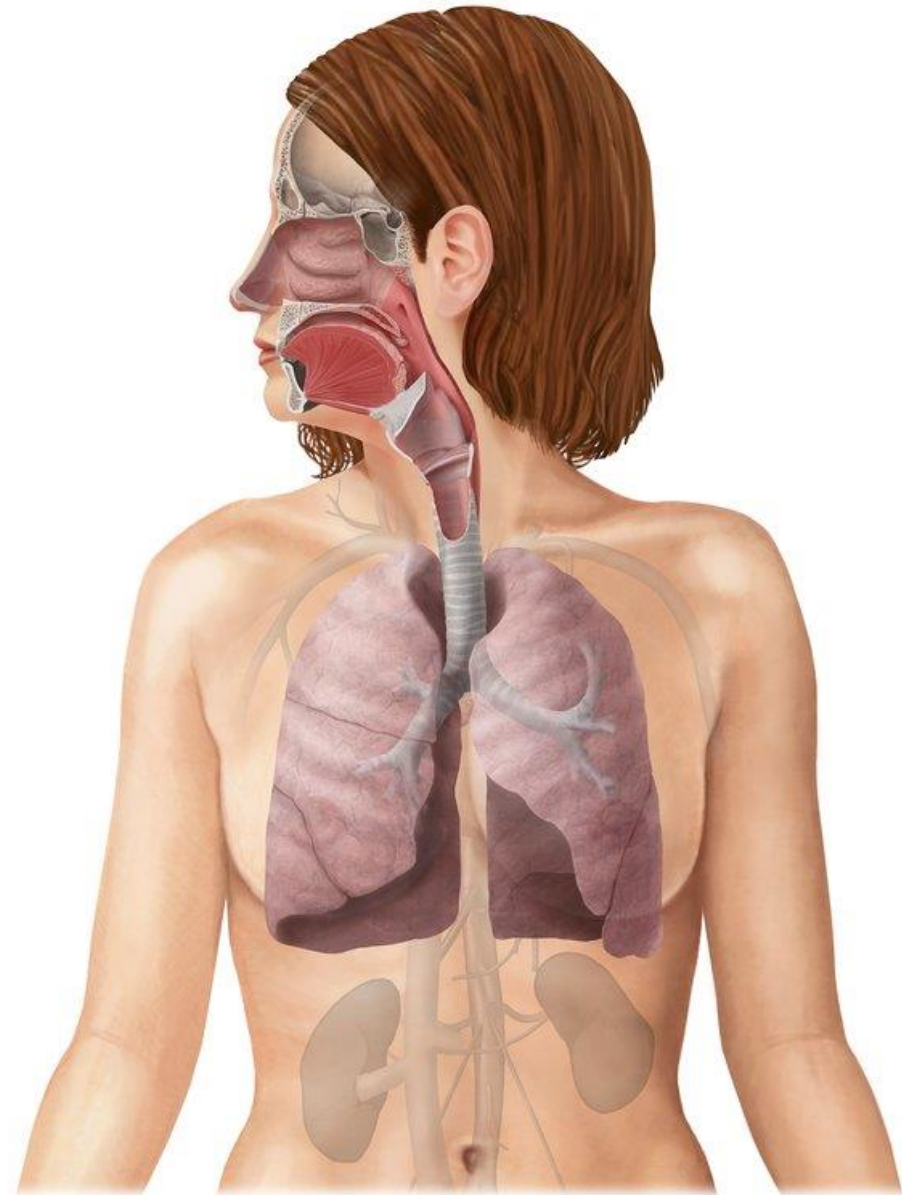


The Trachea

Functions of The Respiratory System:

- 1- Provides gas exchange.
- 2- regulates blood pH.
- 3- Filters the inspired air.
- 4- contains receptors for smell and produces vocal sounds (phonation).
- 5- Excretes small amounts of water and heat.

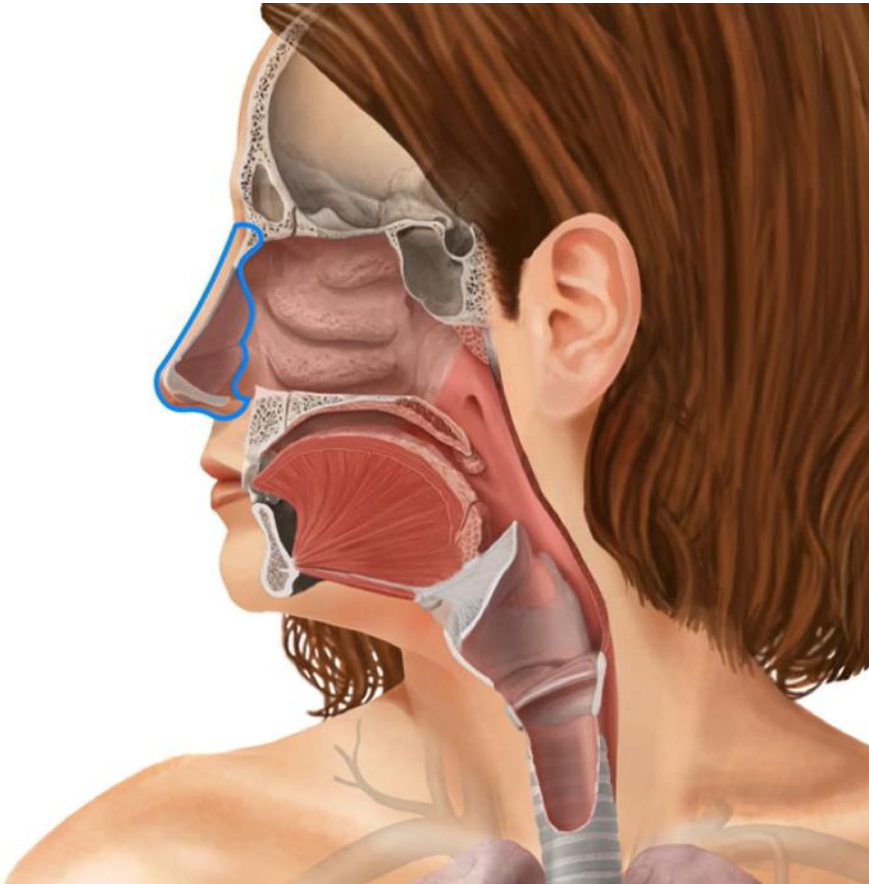
Note: the respiratory system is divided into: The upper respiratory tract which includes the nasal cavity, the paranasal sinuses, the pharynx and the portion of the larynx above the vocal cords and the lower respiratory tract includes the larynx below the vocal cords, the trachea, bronchi, bronchioles and the lungs.



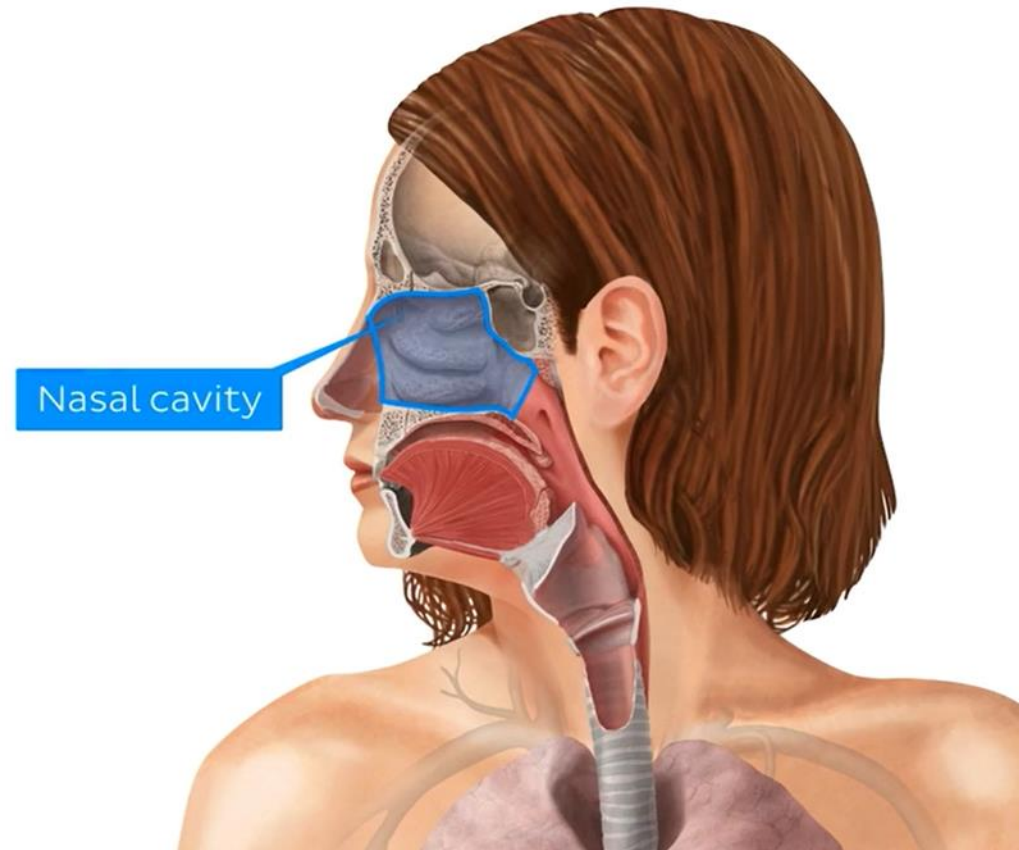
THE NOSE



The nose is divided into the external nose and the nasal cavity.



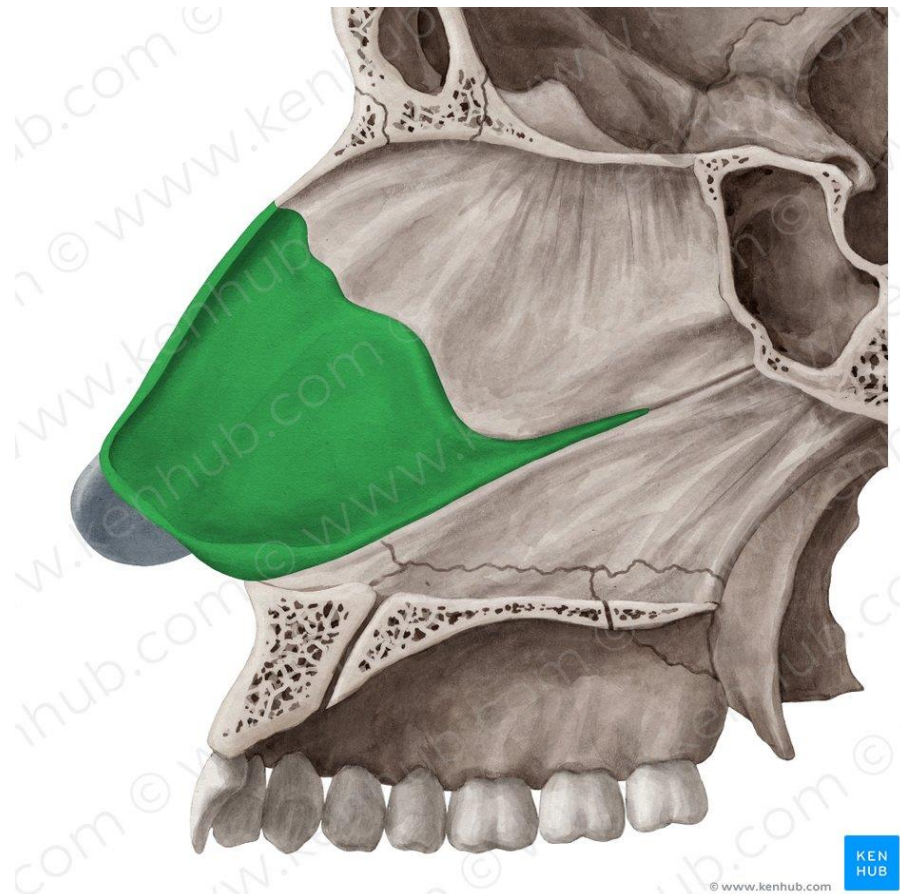
The External Nose



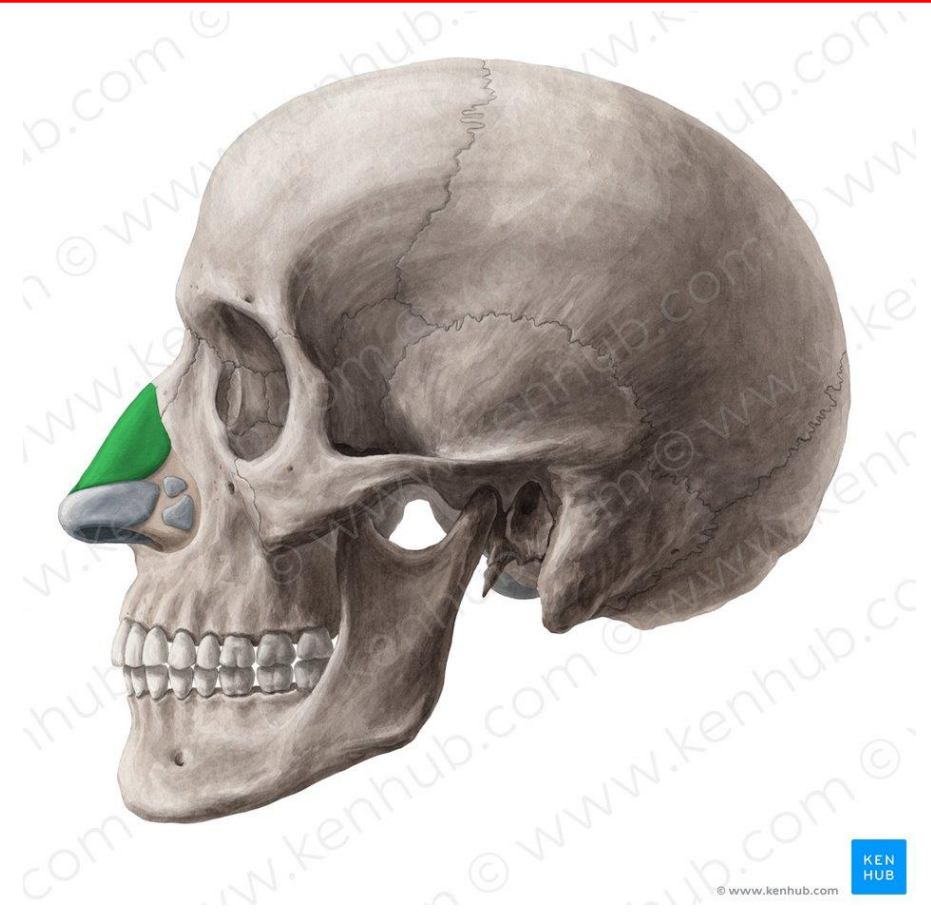
The Nasal Cavity

SKELETAL FRAMEWORK OF THE EXTERNAL NOSE

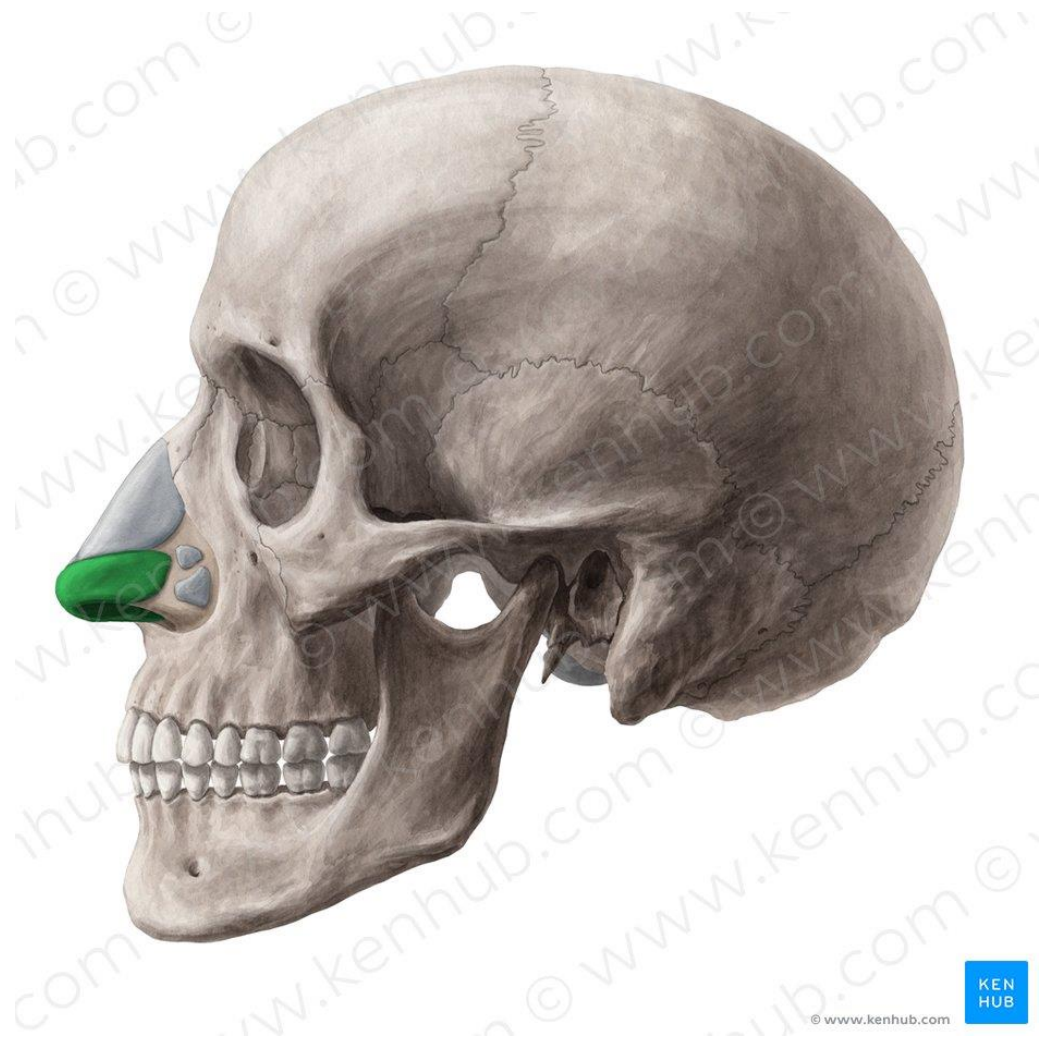
The External nose is composed partly of bone and mainly of cartilage, the cartilaginous framework of the nose is composed of:



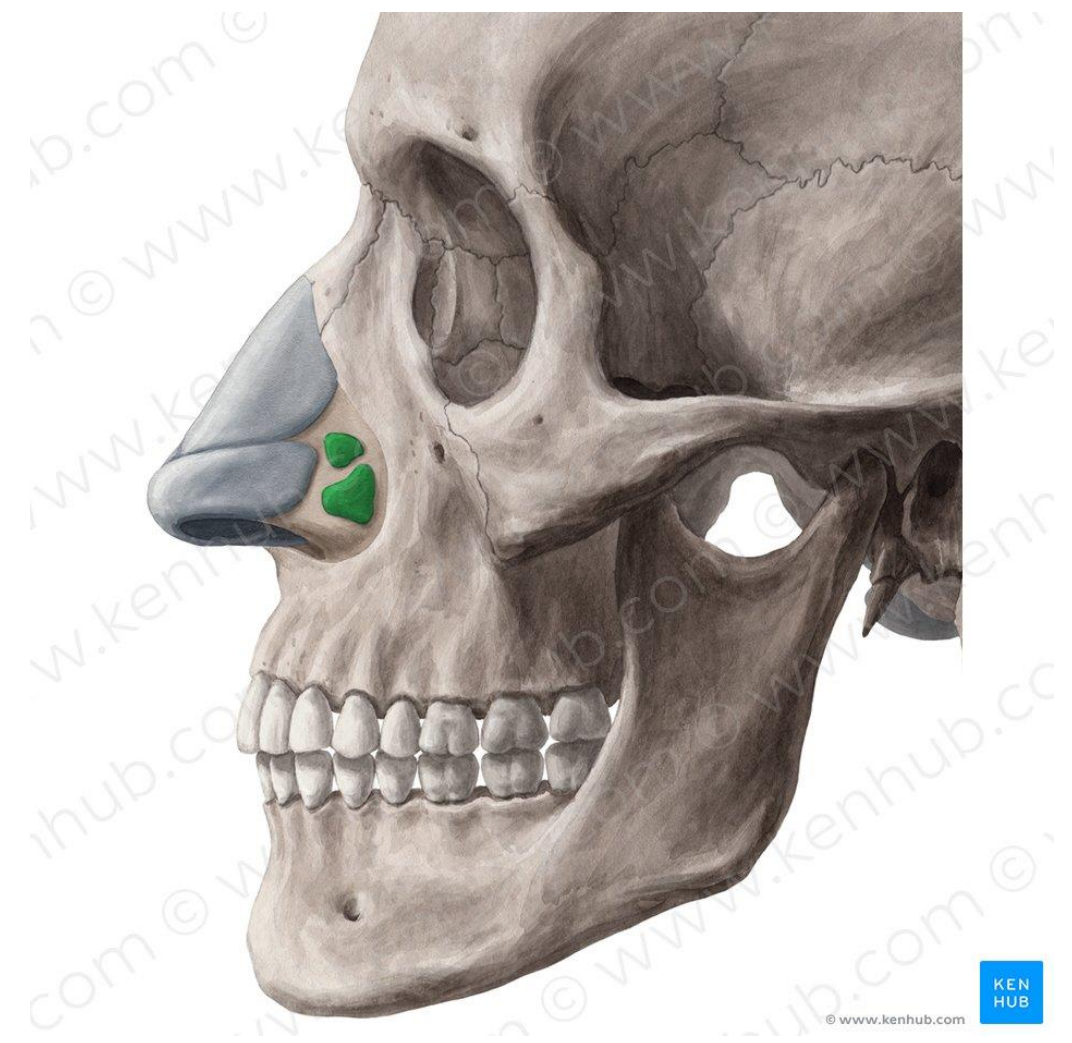
The septal cartilage



Two Lateral Nasal Cartilages

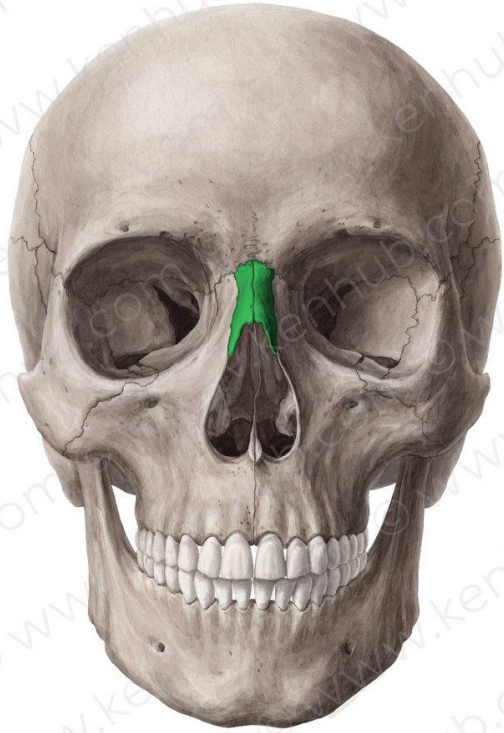


Major Alar Cartilage

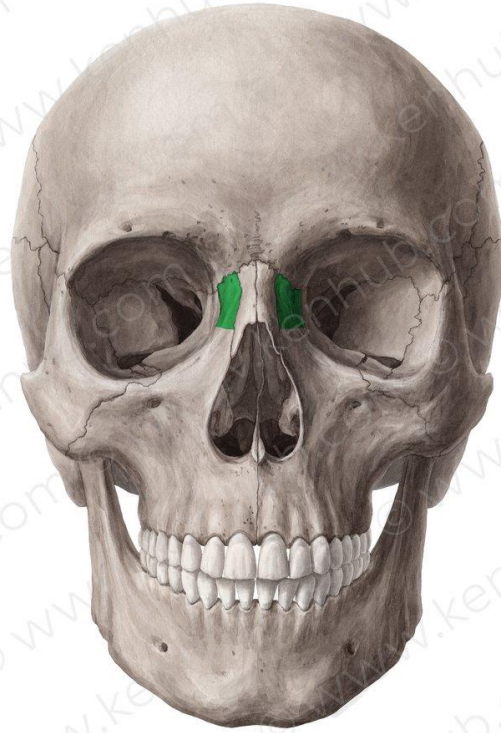


Minor Alar Cartilage

The bony framework of the external nose is composed of:



Nasal Bones



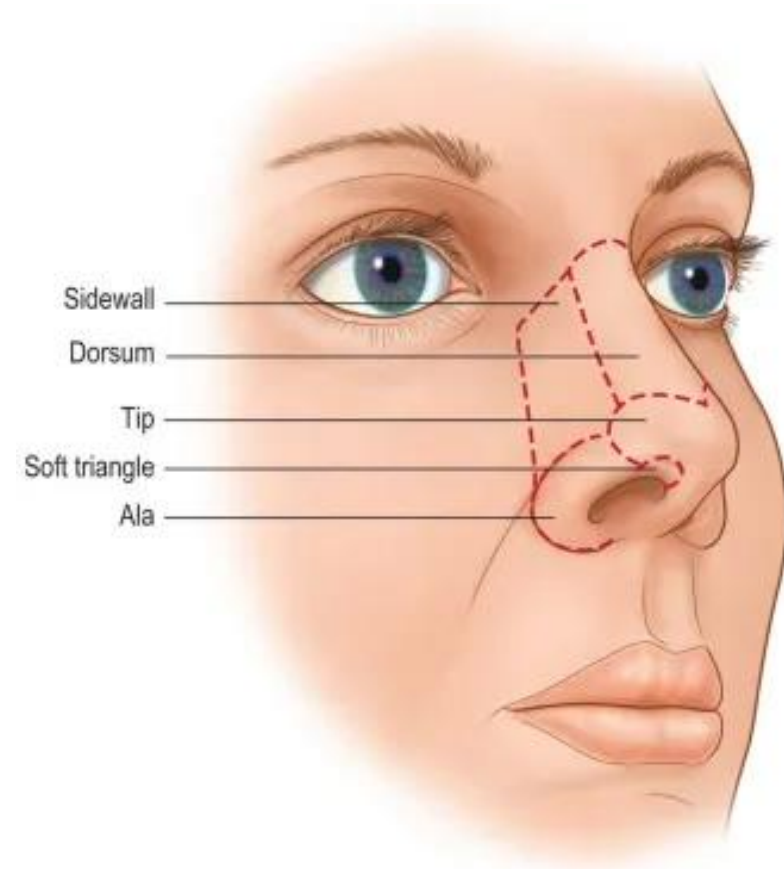
Frontal Processes of Maxillae



Nasal Part of The Frontal
Bones

ADDITIONAL: SURFACE ANATOMY OF THE EXTERNAL NOSE

Notice the bridge (dorsum) of the nose and the alae 😊



Clinical note: fetal warfarin syndrome is a group of symptoms that result from taking the anticoagulant warfarin during pregnancy, as you can see, it results in severe deformity of the nasal skeleton.

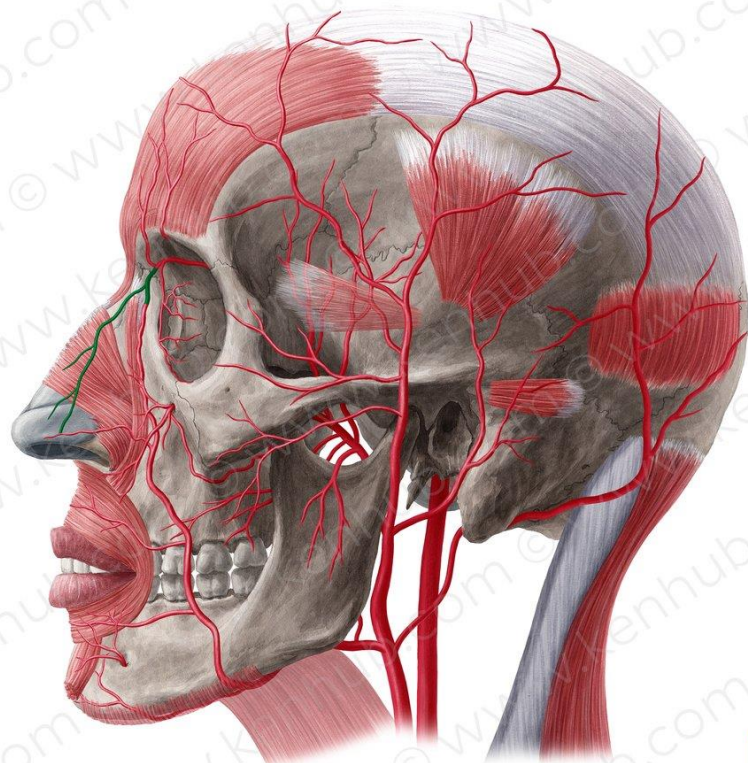


Important: this slide is for fun only, it is not for studying and not required for the exam 😬

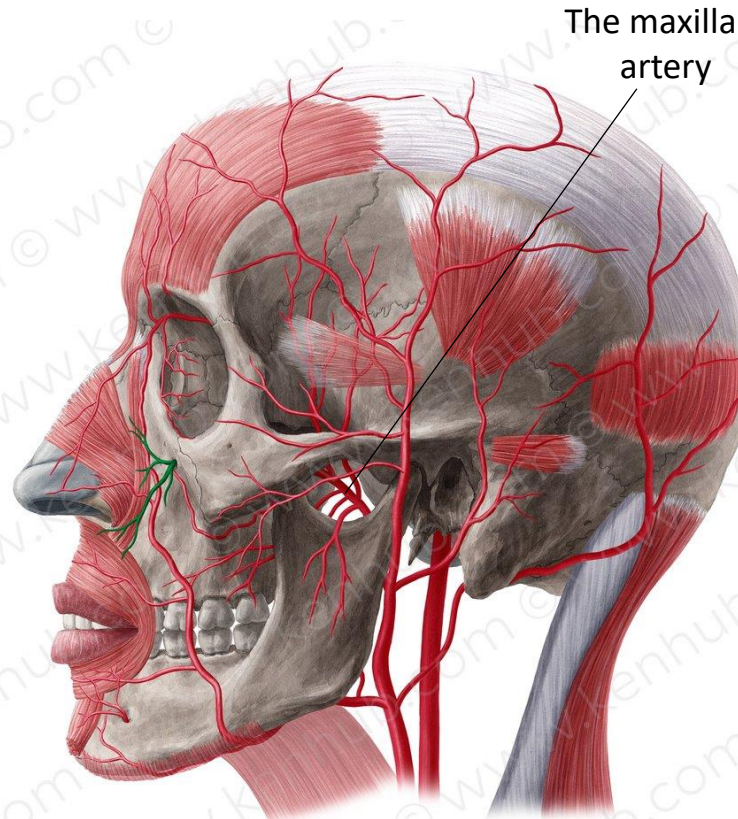
Look at this poor angel 😬

ARTERIAL SUPPLY OF THE EXTERNAL NOSE

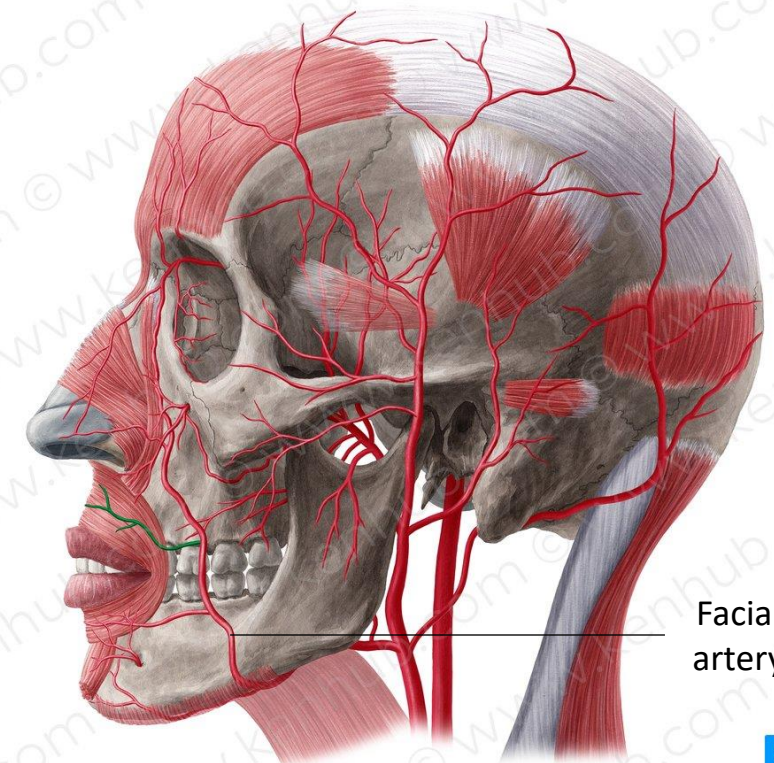
The external nose is supplied by branches of the **ophthalmic** and the **maxillary** arteries.
The ala and the lower part of the septum by the **superior labial branch** of the facial artery.



A branch of the ophthalmic artery to the nose

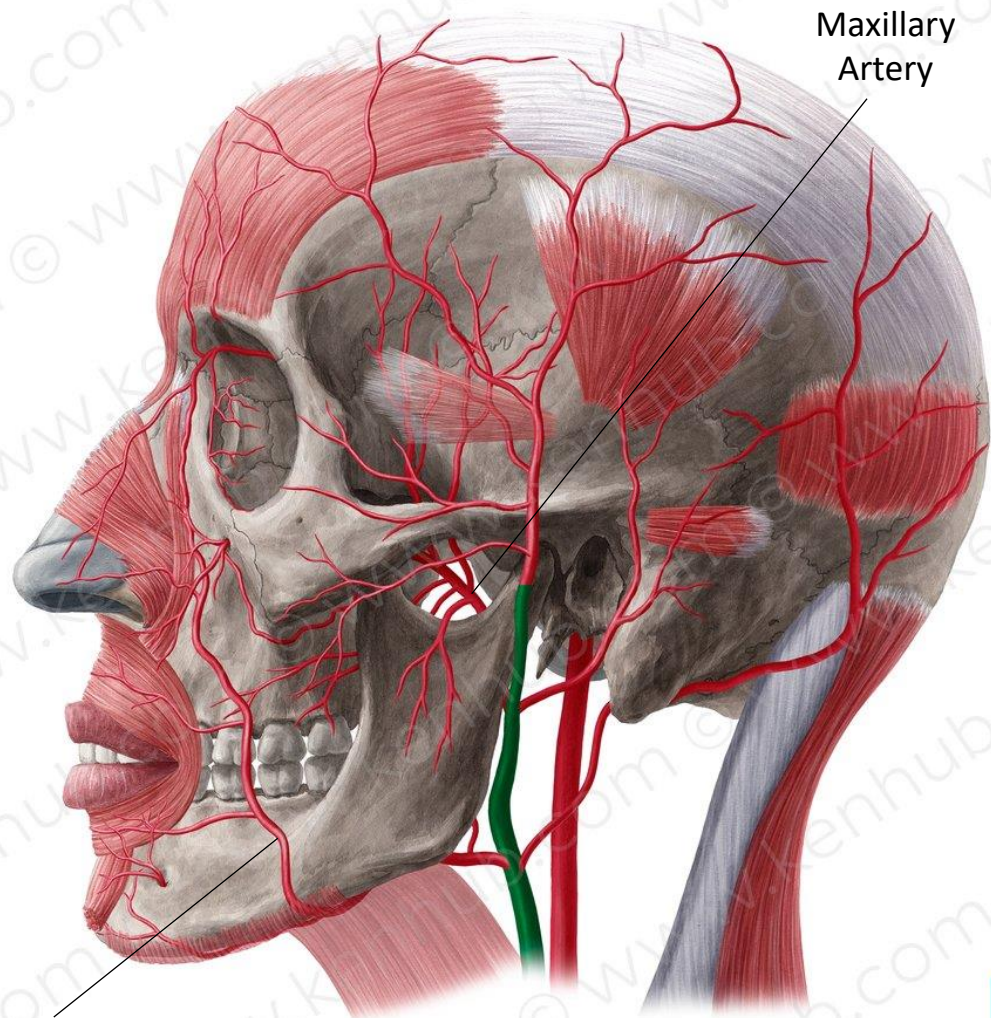


A branch of the maxillary artery to the nose



Superior Labial Artery

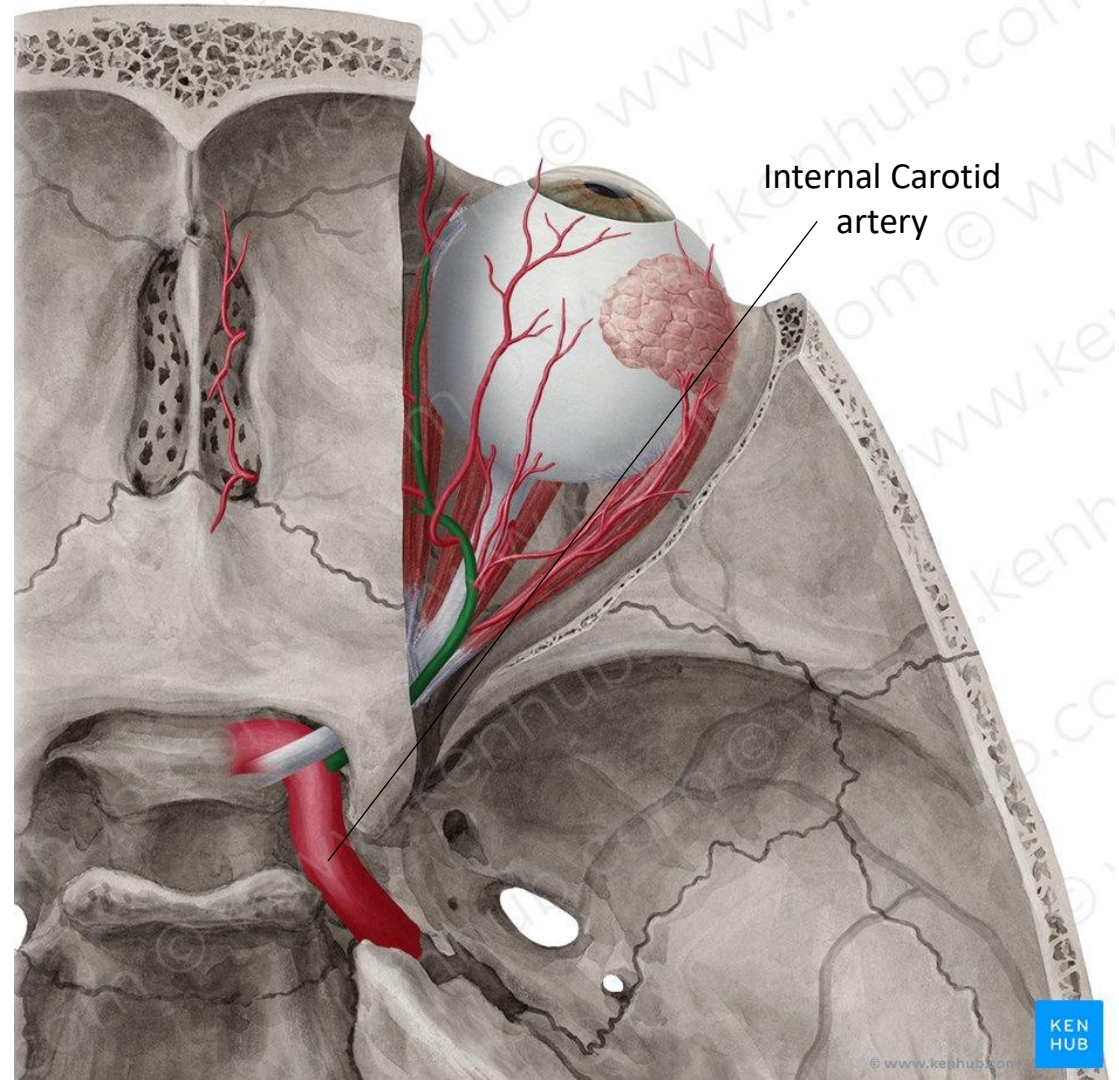
Note: the **facial** and **maxillary** artery are branches of the **external carotid artery**, while the **ophthalmic artery** is a branch of the **internal carotid artery**.



Facial Artery

Maxillary Artery

The External Carotid Artery



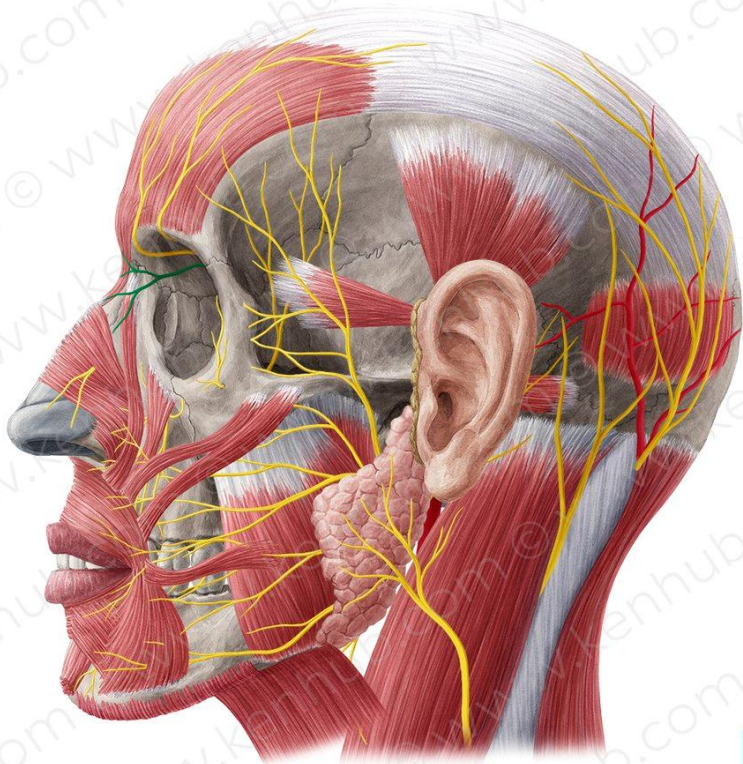
Internal Carotid artery

The Ophthalmic Artery

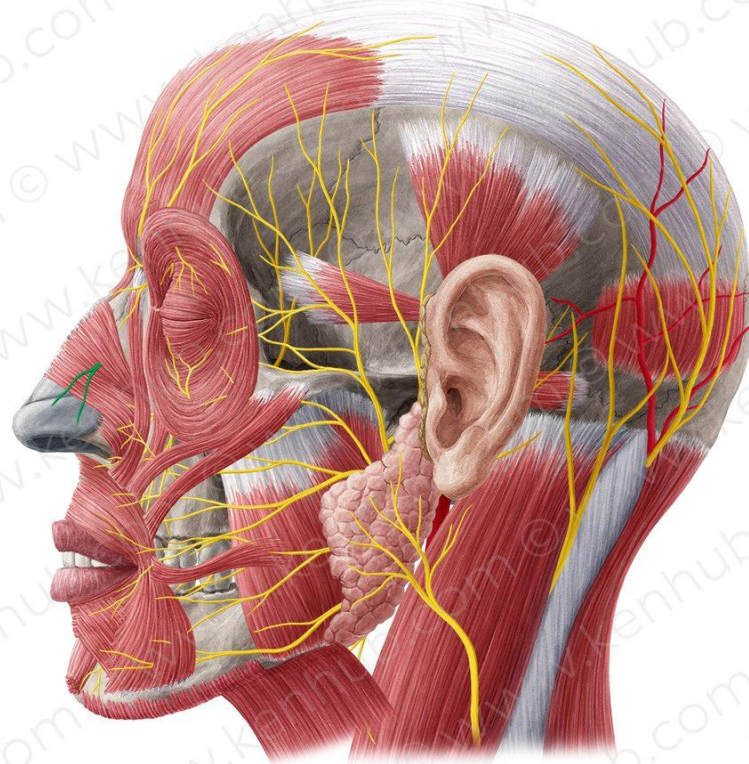
NERVE SUPPLY OF THE EXTERNAL NOSE

Sensory innervation of the nose is provided by:

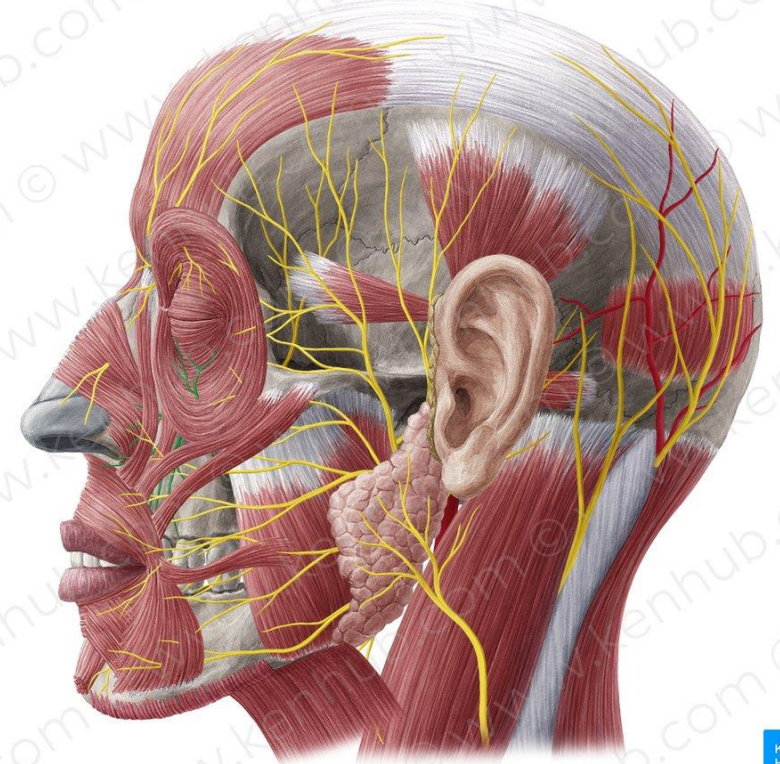
- Infratrochlear and external nasal branches of the ophthalmic nerve
- infraorbital branch of the maxillary nerve



Infratrochlear Nerve

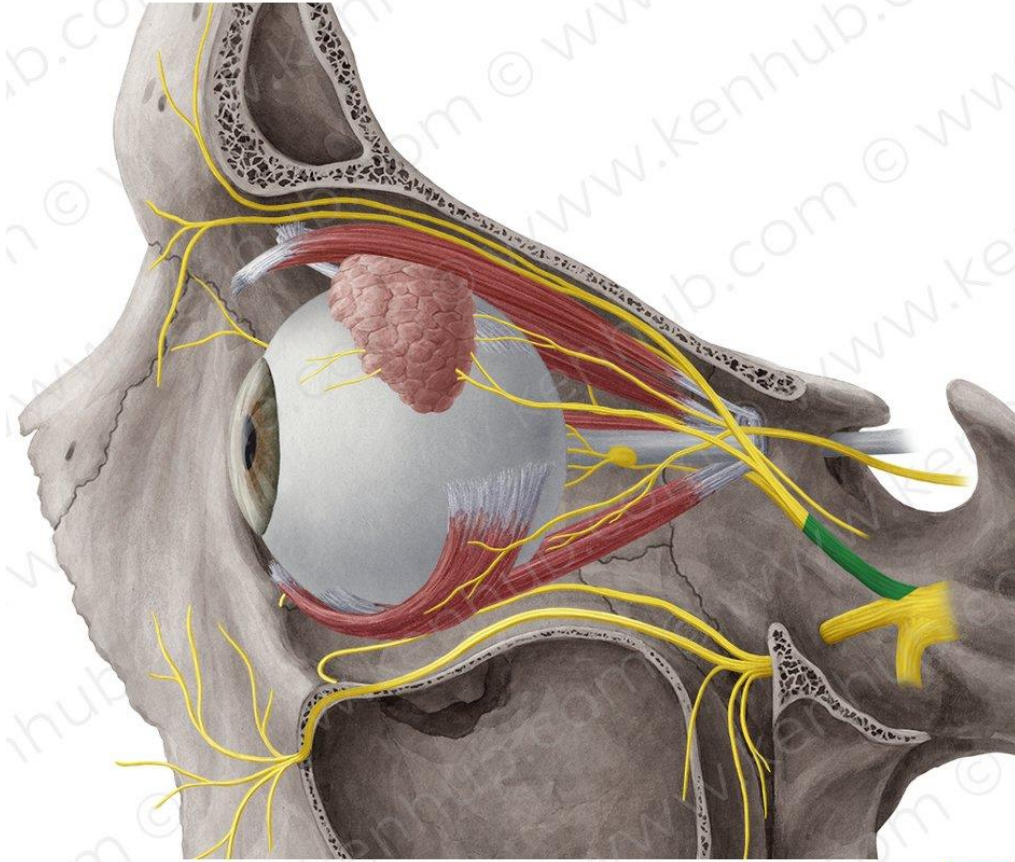


External nasal Nerve

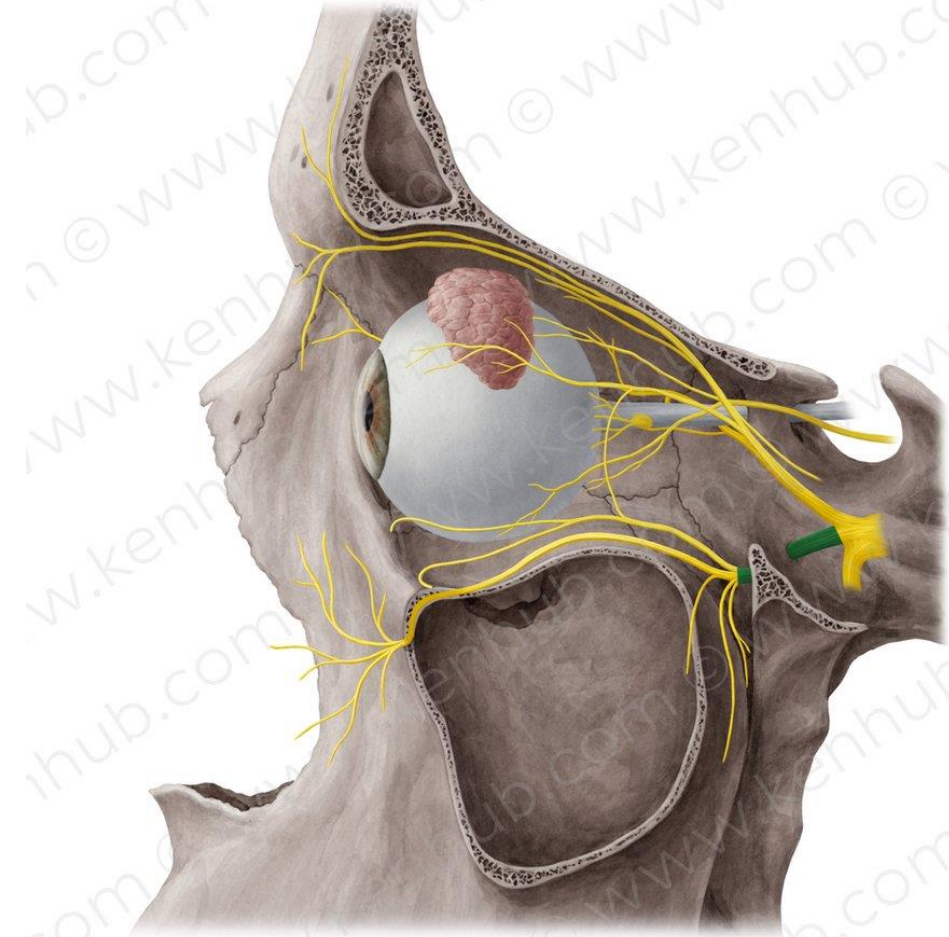


Infraorbital Nerve

Note: both the ophthalmic and the maxillary nerves are divisions of the trigeminal nerve (cranial nerve V).



The Ophthalmic Nerve



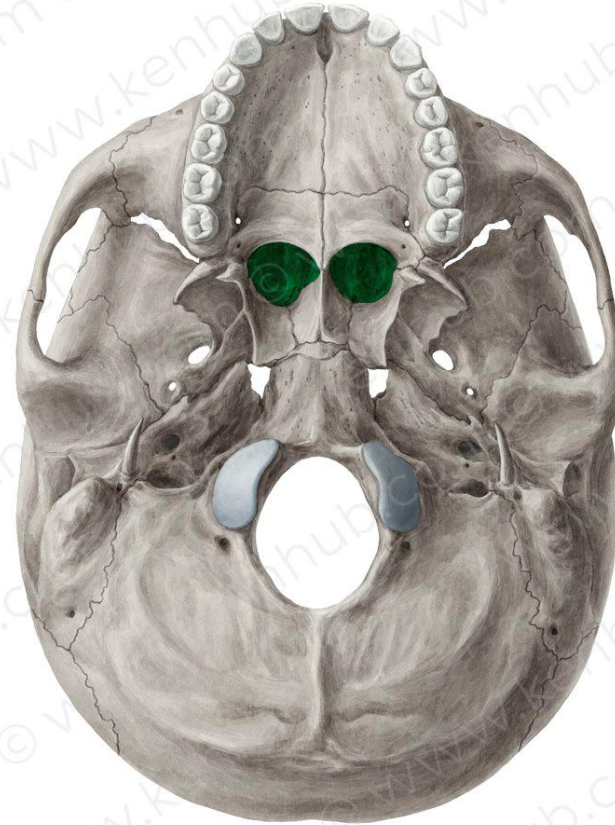
The Maxillary Nerve

THE NASAL CAVITY

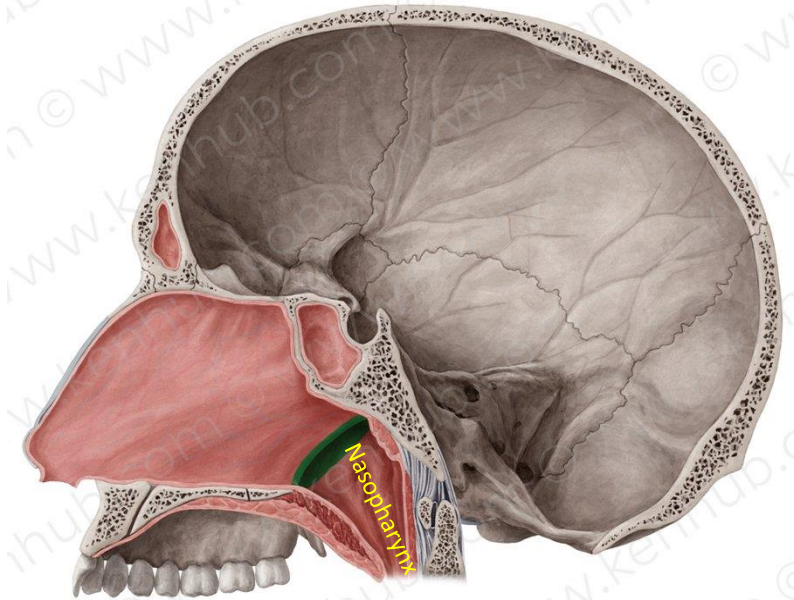
The nasal cavity extends from the nostrils (also called the nares of the anterior nasal apertures) in front to the posterior nasal apertures (choana), it opens into the nasopharynx.



The nares, nostrils or anterior nasal apertures

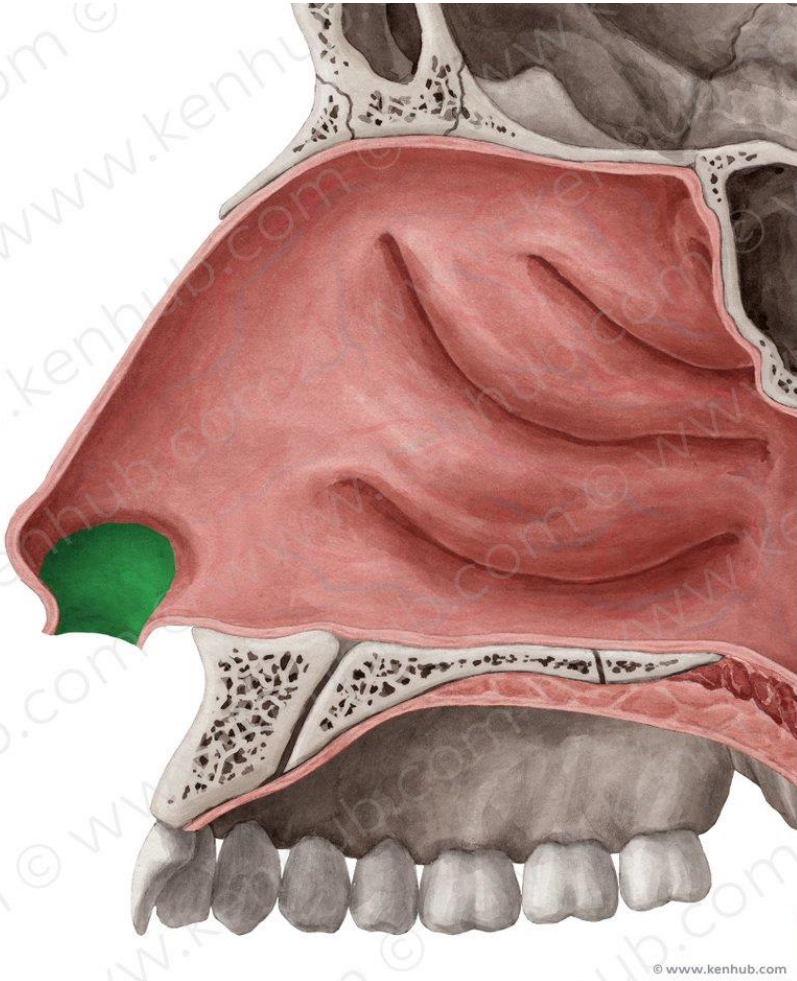


The choanae as viewed from a norma basalis externa



The choanae

The **nasal vestibule** is the area of the nasal cavity lying just inside the **nostril**, this area is lined by **skin** (keratinized stratified squamous epithelium) instead of the regular respiratory **epithelium** (which is pseudostratified simple ciliated columnar epithelium with goblet cells), moreover, the nasal vestibule contains **hair follicles** which we call **vibrissae**.

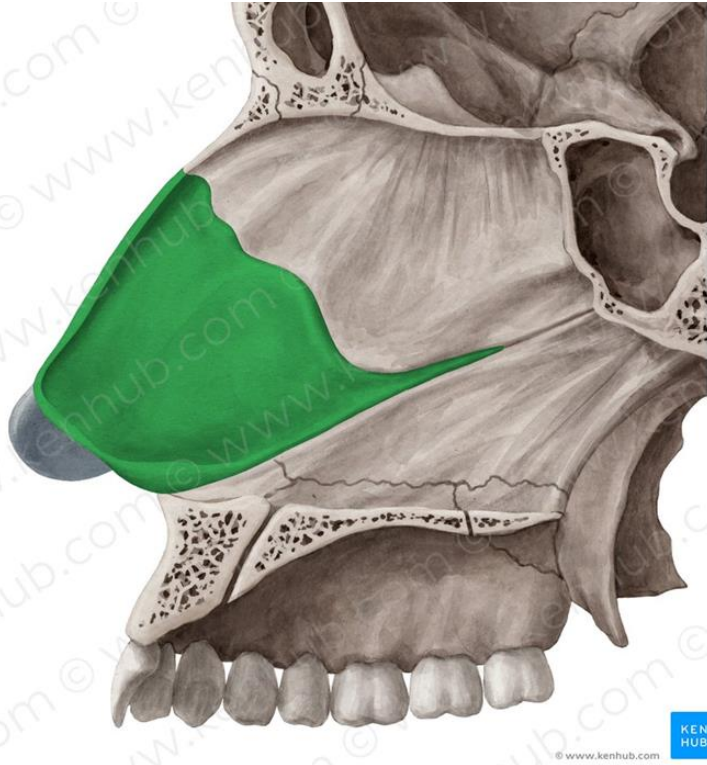


The nasal vestibule

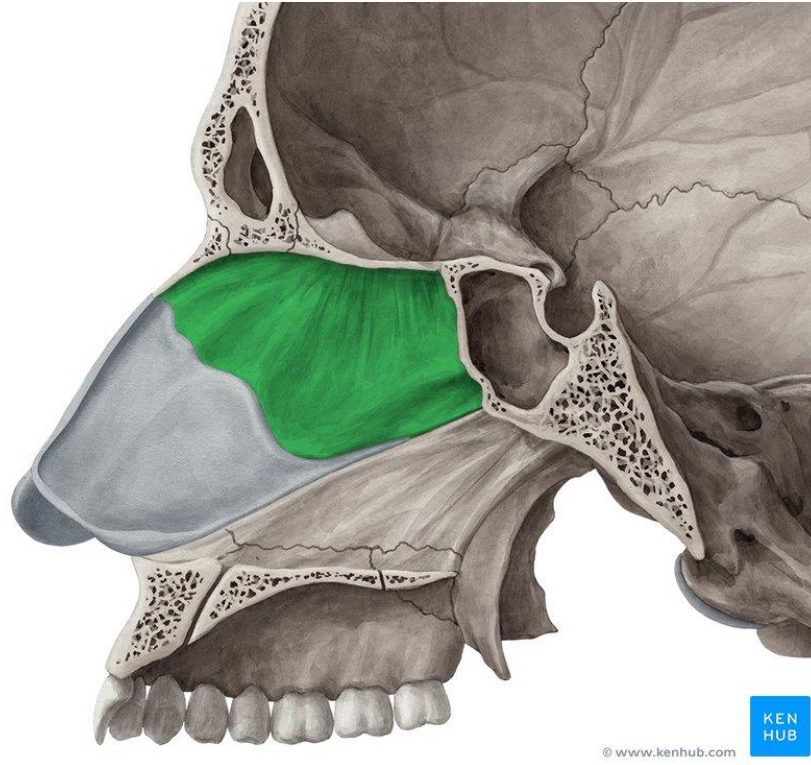


Vibrissae at their best 🤪 🤪

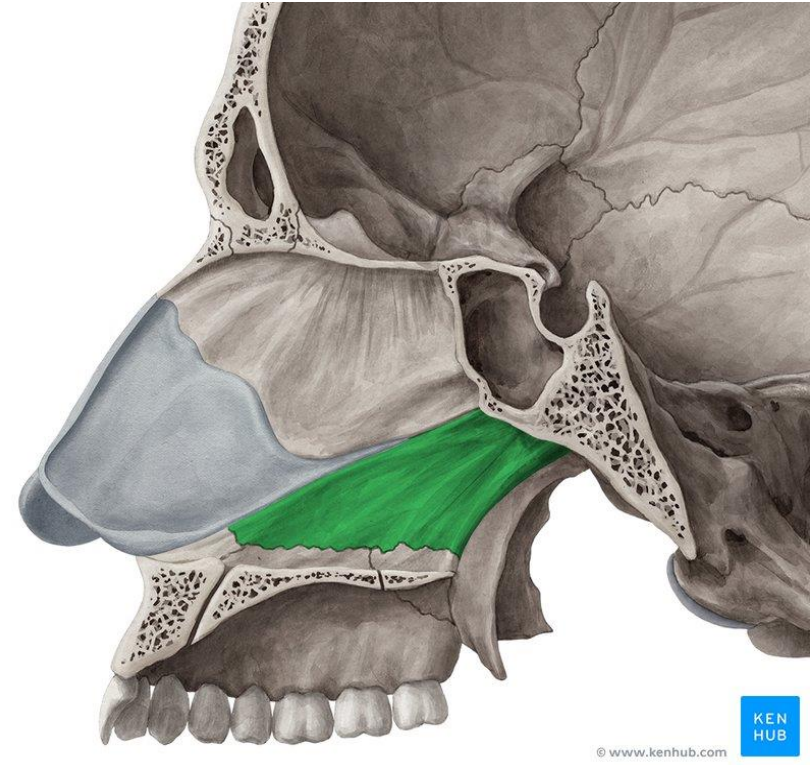
The nasal cavity is divided into right and left halves by the **nasal septum**, the nasal septum is made up of the **septal cartilage**, the **perpendicular (vertical) plate of ethmoid bone**, and the **vomer**.



The septal cartilage



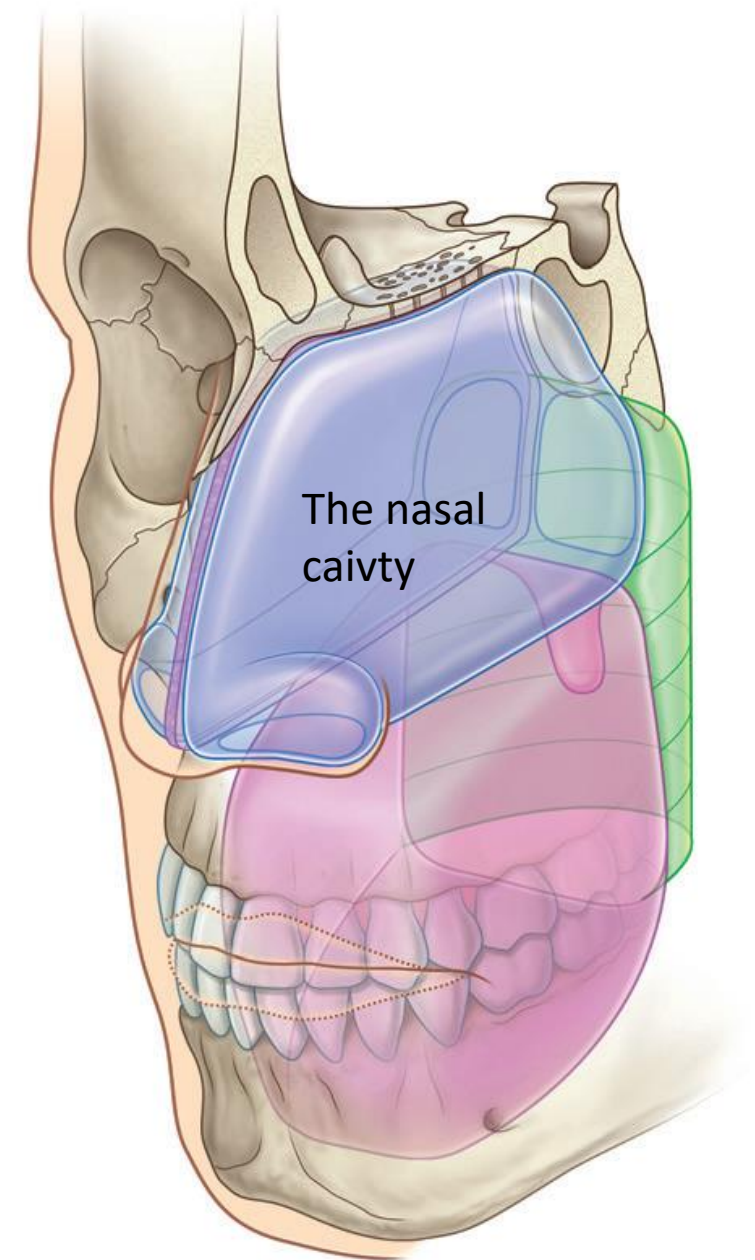
The perpendicular (vertical plate of ethmoid bone)



The Vomer

Functions of the nasal cavity:

1. Respiratory
2. Olfactory
3. Resonance of voice
4. Drainage of lacrimal fluid
5. Protective
 - Sneezing
 - Filtration
 - Proteolytic enzymes
 - Warming and moistening the air

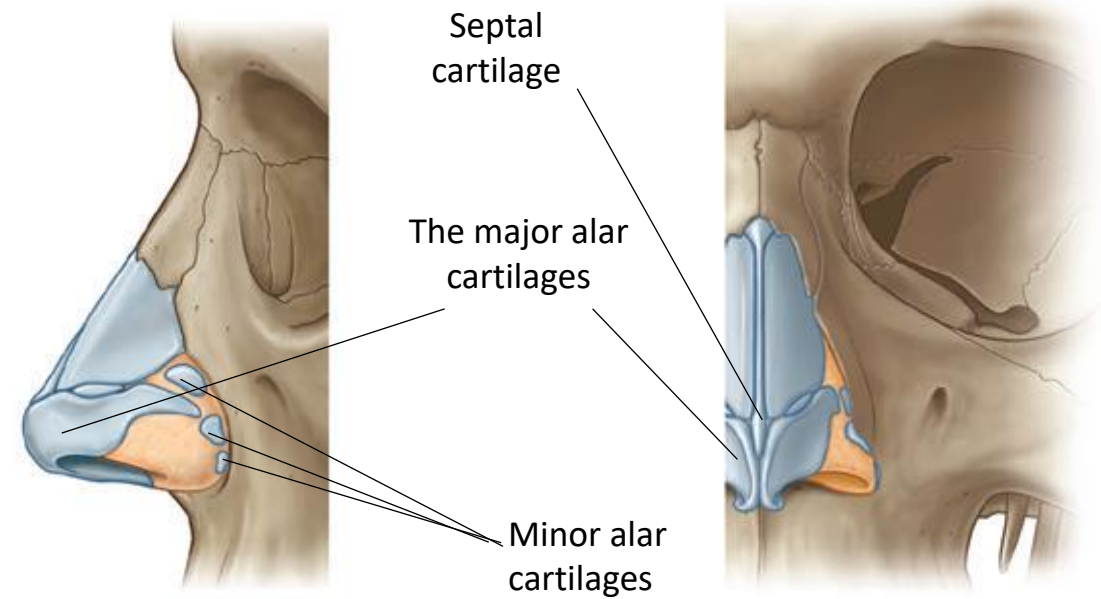
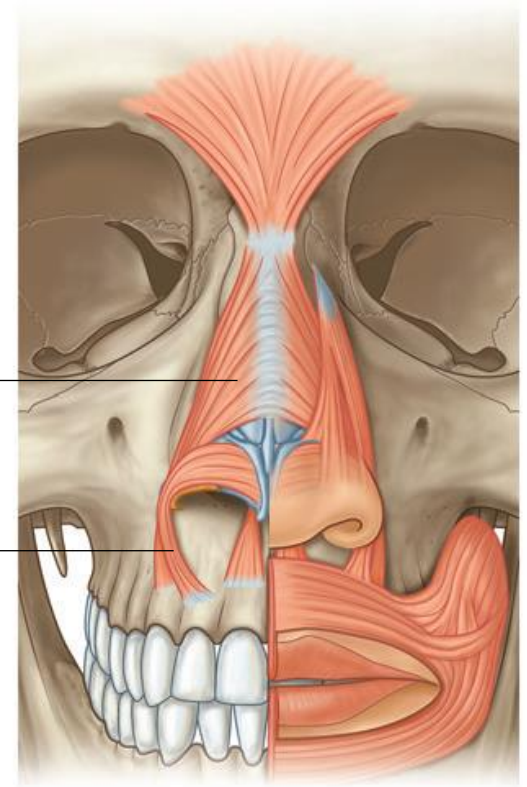


THE NARES

The nares, the nostrils or the anterior openings of the nasal cavities, that held open by the surrounding alar cartilages and septal cartilage, nares are continuously open, they can be widened or narrowed further by the action of the related muscles of facial expression.

The transverse part of the nasalis muscle is also referred to as compressor naris, as it narrows the nares

The alar part of nasalis muscle is also referred to as dilator naris, as it widens the nares.



THE CHOANAE

The choanae are the openings between the nasal cavities and the nasopharynx, they are rigid openings that are completely surrounded by bone.

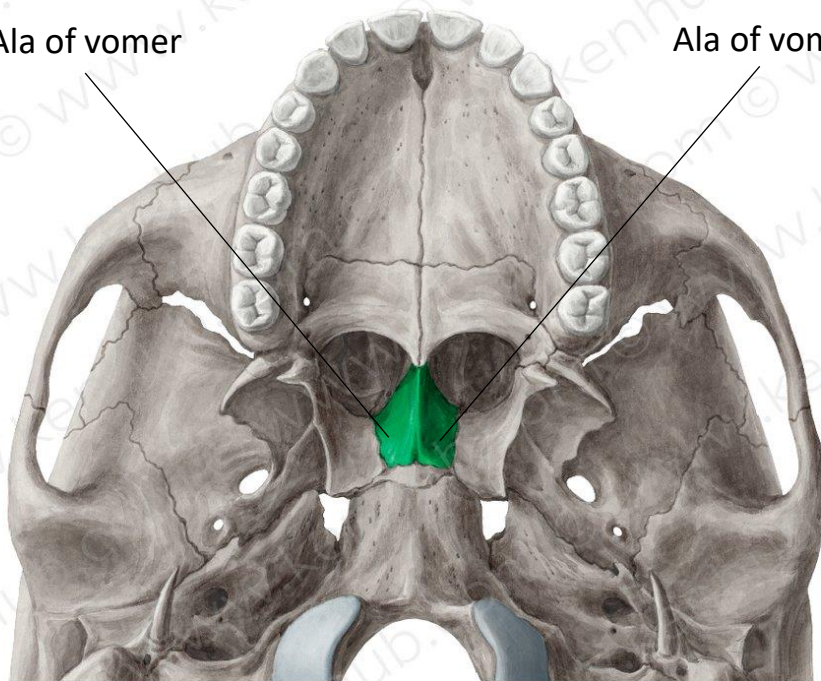
Boundaries of the Choanae:

- Medially, the vomer.
- Laterally, the medial plate of the pterygoid process of the sphenoid bone.
- Superiorly, ala of vomer, vaginal process of the medial pterygoid plate and the body of sphenoid.
- Inferiorly, the horizontal plate of the palatine bone.

The Vomer

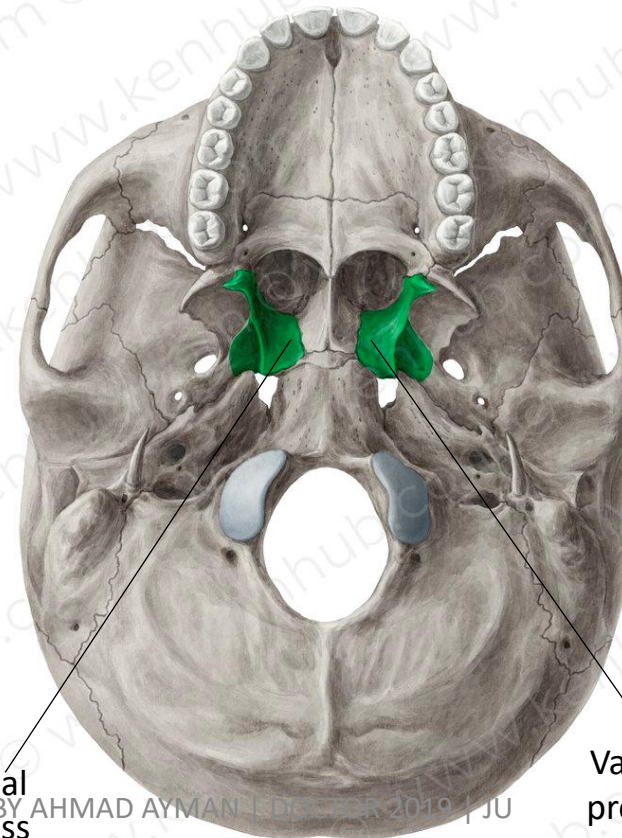
Ala of vomer

Ala of vomer

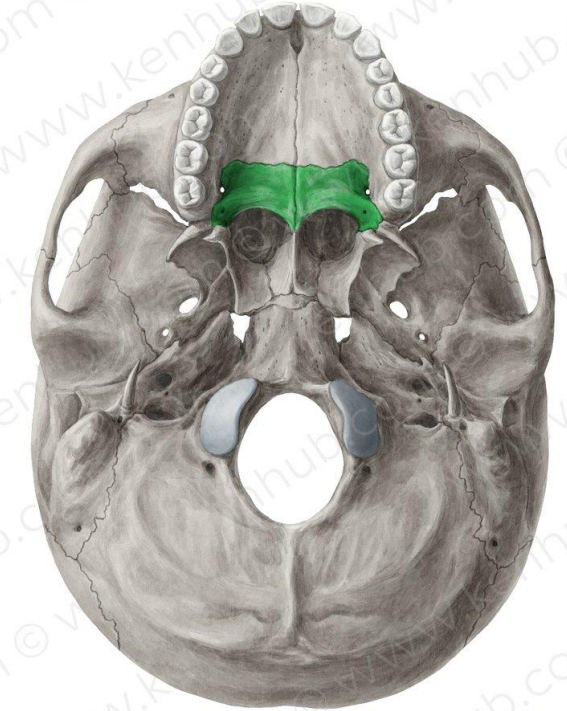


Medial pterygoid plate

Vaginal process

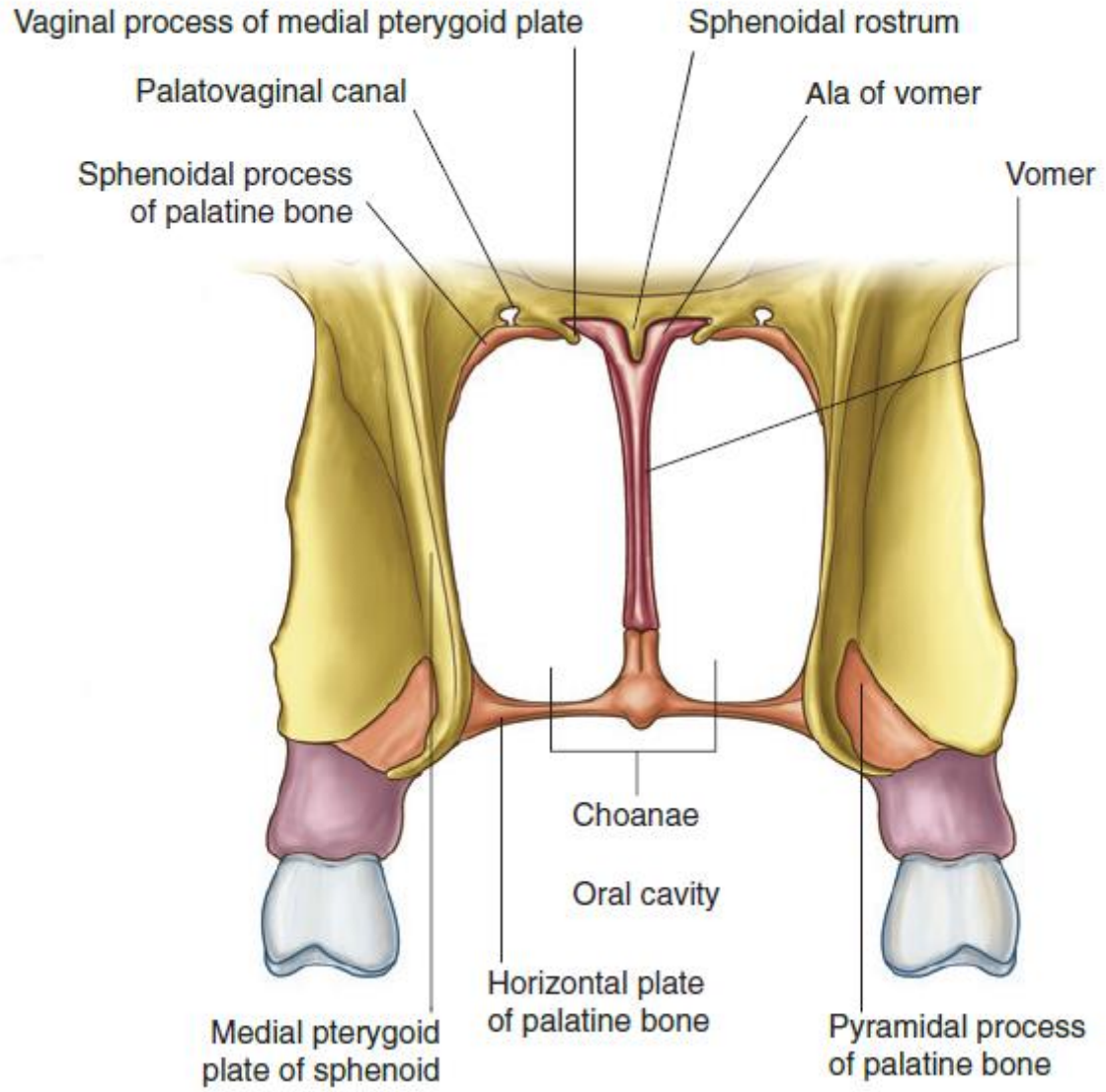


Vaginal process



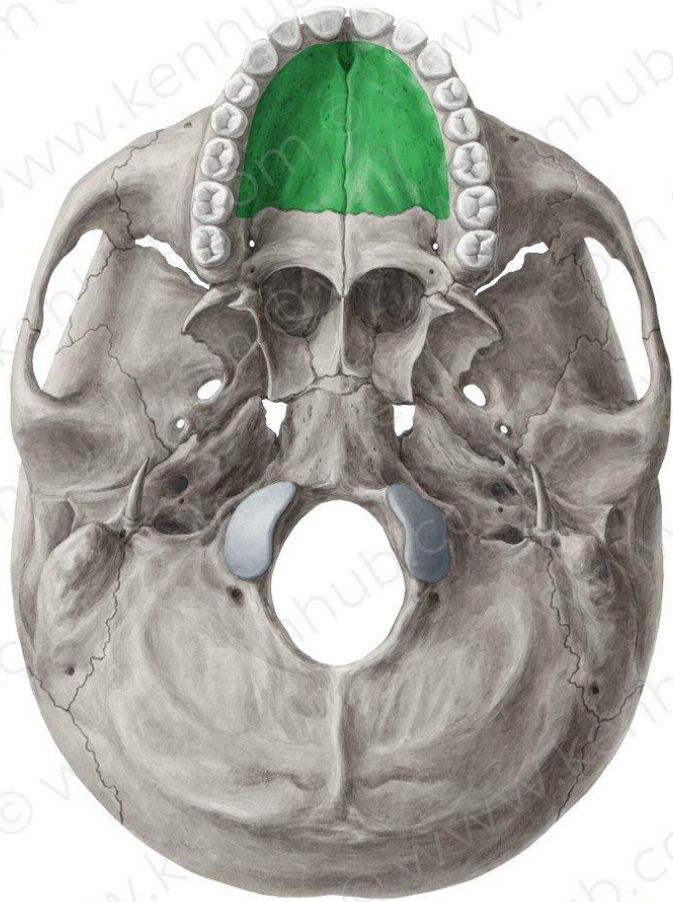
Horizontal plates of palatine bones

Additional pic for the borders of the choanae 😊

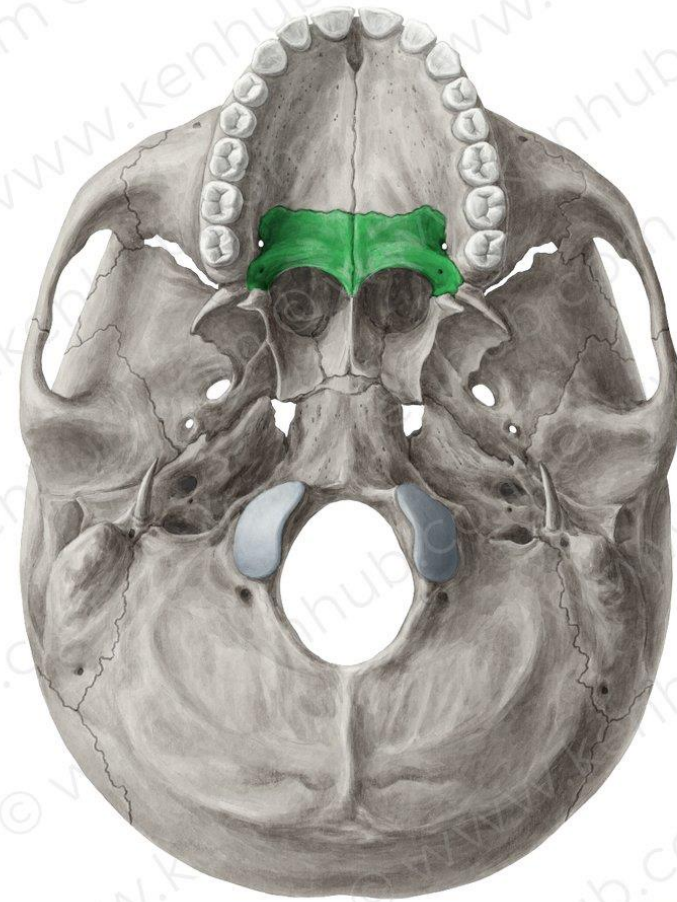


BOUNDARIES OF THE NASAL CAVITY: THE FLOOR

The floor of the nasal cavity is formed by the upper surface of the hard palate, which is in turn formed by the palatine process of the maxillae and the horizontal process of the palatine bones.



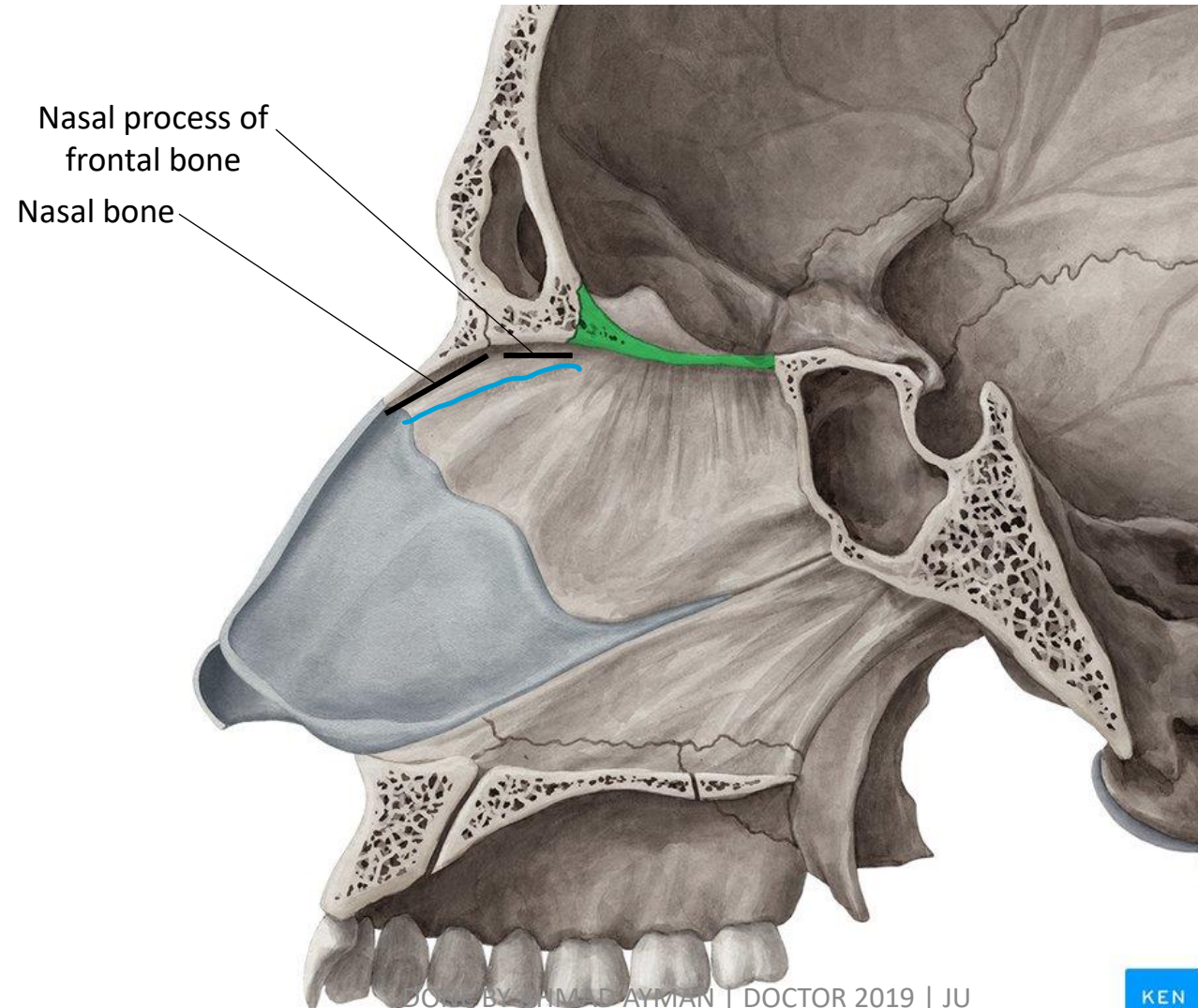
Palatine process of the maxillae



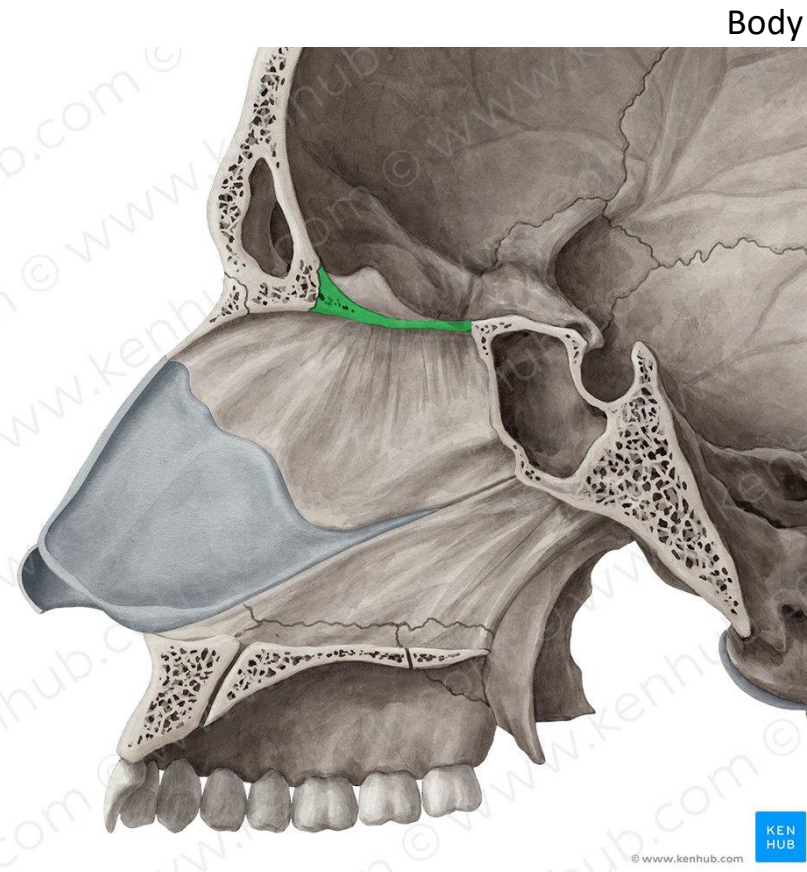
Horizontal plates of the palatine bones.

BOUNDARIES OF THE NASAL CAVITY: THE ROOF

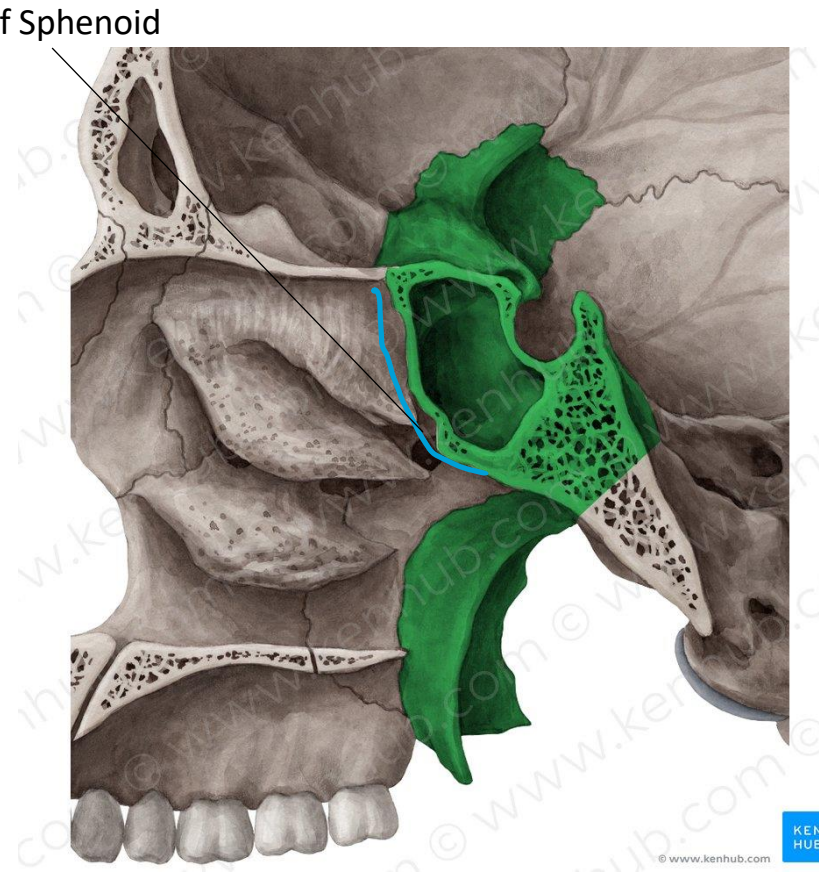
- The roof of the nasal cavity has three parts, an anterior sloping part, a middle horizontal part, and a posterior sloping part.
- The anterior sloping part is made form the nasal bones and the nasal process of the frontal bone



- The middle horizontal part is formed by the cribriform plate of ethmoid bone.
- The posterior sloping part is formed by the anterior surface of the body of sphenoid, the ala of vomer and the vaginal process of the palatine bone.

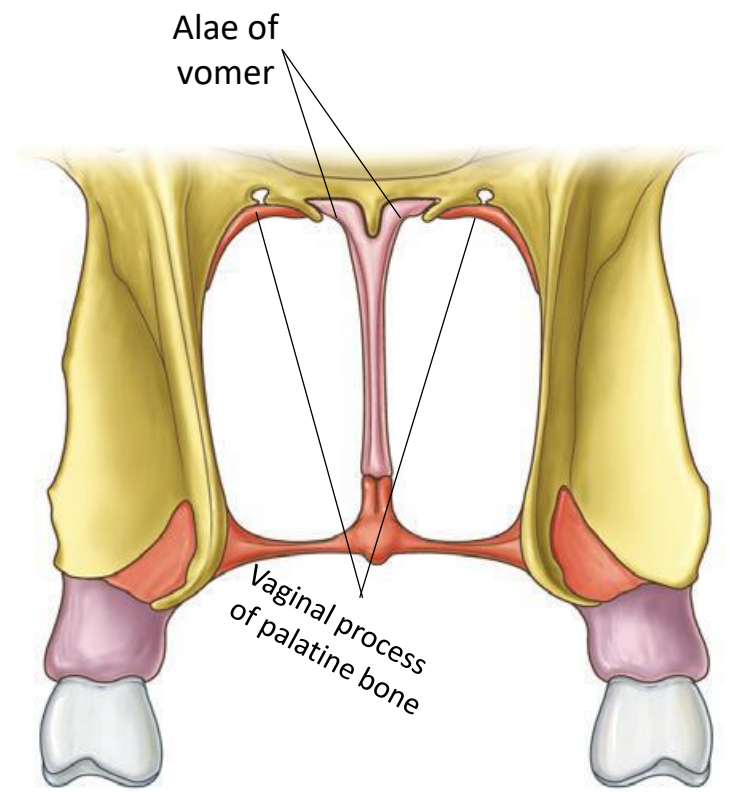


The cribriform plate of ethmoid bone.



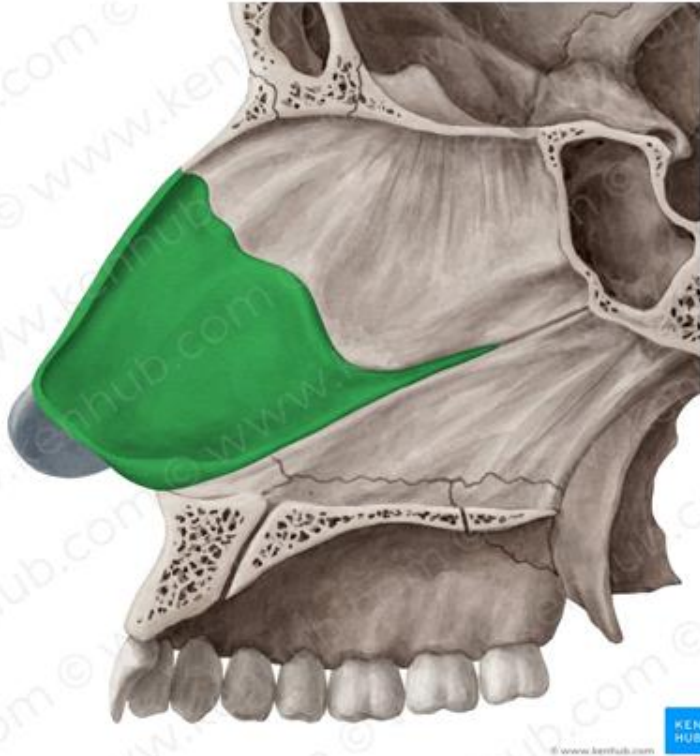
Body of sphenoid bone

Note: in this view, the nasal septum is removed.

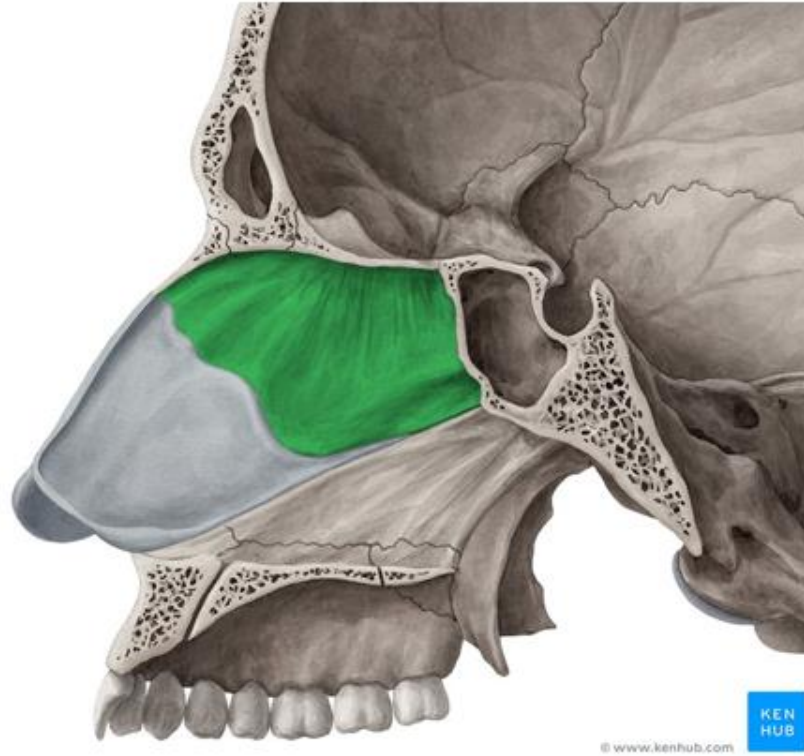


BOUNDARIES OF THE NASAL CAVITY: THE MEDIAL WALL (THE NASAL SEPTUM)

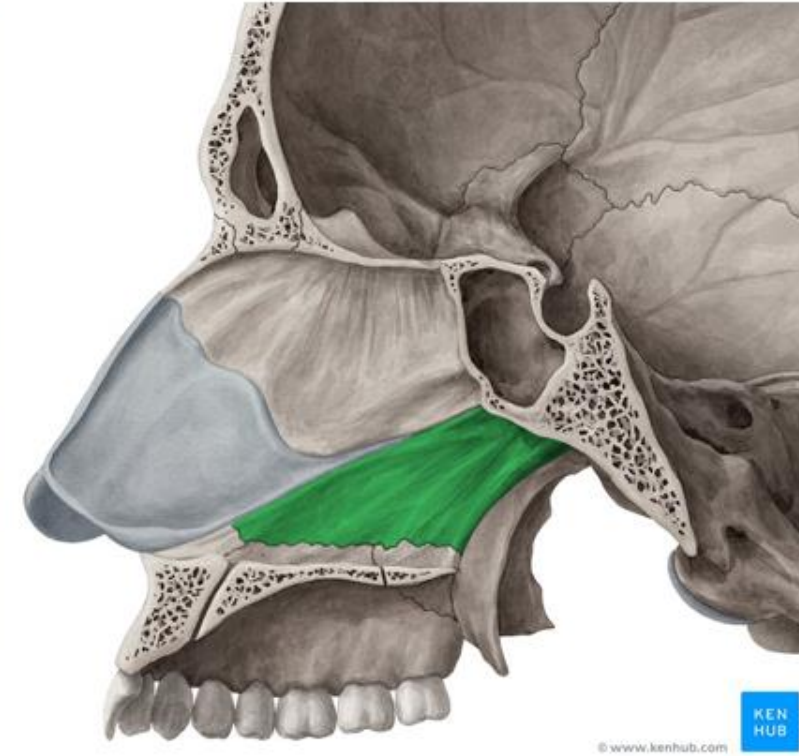
As we've been saying, the nasal septum is formed by the septal cartilage, the perpendicular plate of ethmoid bone, and the vomer bone



The septal cartilage



The perpendicular (vertical plate of ethmoid bone)



The Vomer

Clinical note: deviated nasal septum انحراف الوتيرة

The nasal septum is typically situated in the midline, however, septal deviation to one side or the other is not uncommon, and it usually occurs due to trauma, it might produce nasal occlusion and is treated surgically.

Important: this slide is for fun only, it is not for studying and not required for the exam 😊

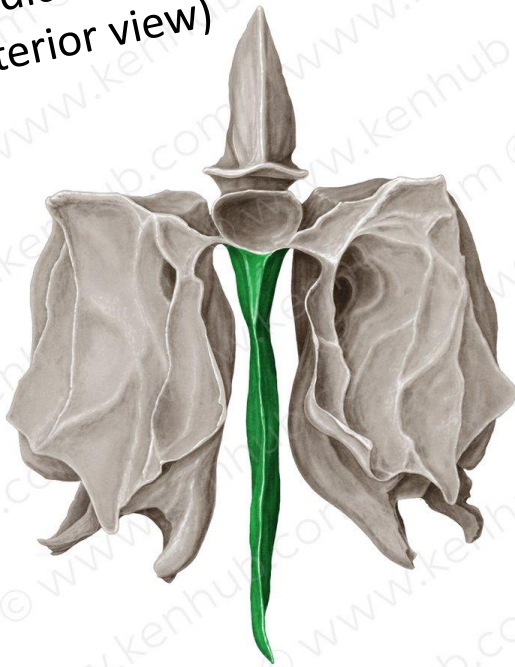


BOUNDARIES OF THE NASAL CAVITY: THE LATERAL WALL: ETHMOID BONE

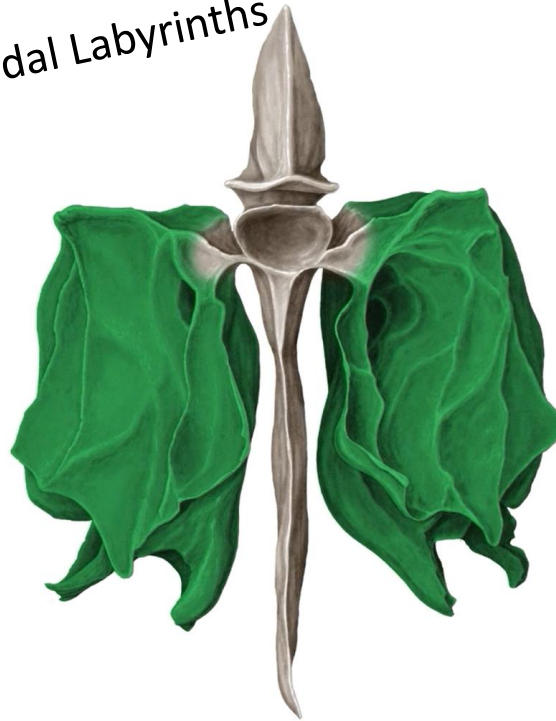
You'd never be able to understand the anatomy of the lateral wall of the nasal cavity without understanding the anatomy of the ethmoid bone, so I'll put some slide explaining its anatomy, please consider that this is not an exam material 😊.

The ethmoid bone is cuboidal in overall shape, it is composed of two rectangular box-shaped **ethmoidal labyrinths**, one on each side, united superiorly across the midline by a perforated sheet of bone called the **cribriform plate** (which we've seen previously), a second sheet of bone called the **perpendicular plate** (which we've seen previously) descends vertically in the median sagittal plane from the cribriform plate to form part of the nasal septum.

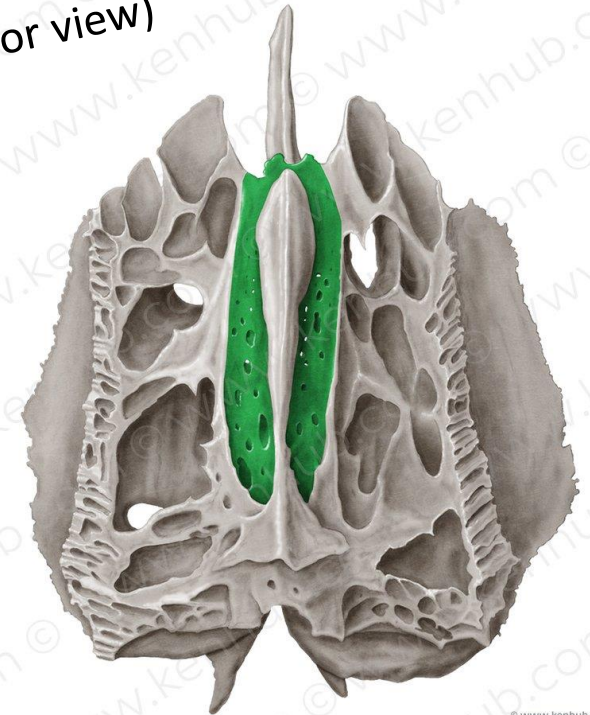
Perpendicular plate
(posterior view)



Ethmoidal Labyrinths

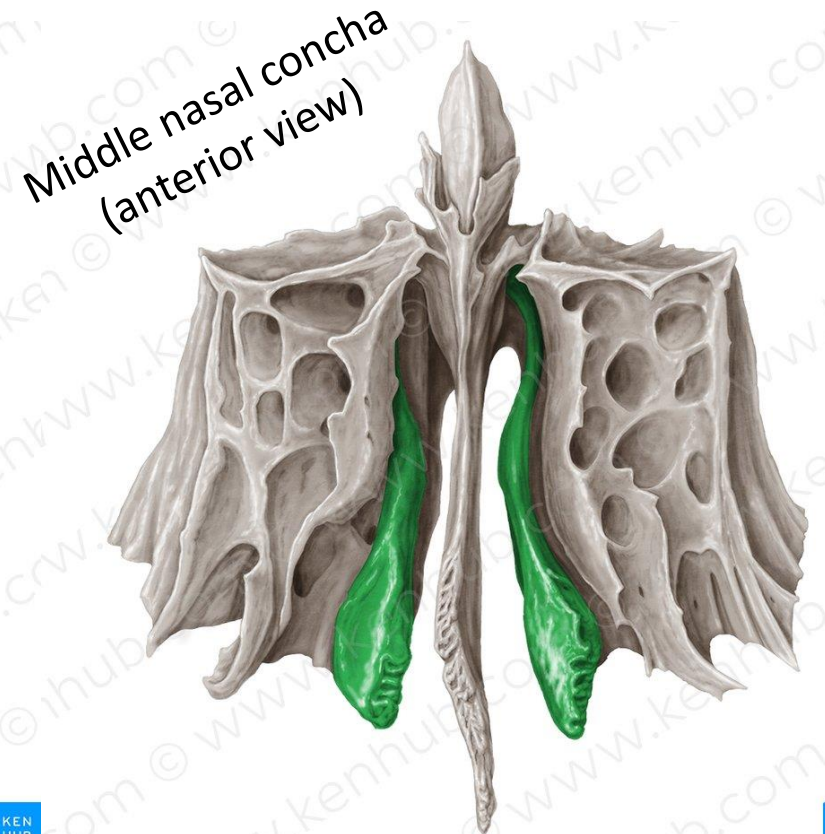
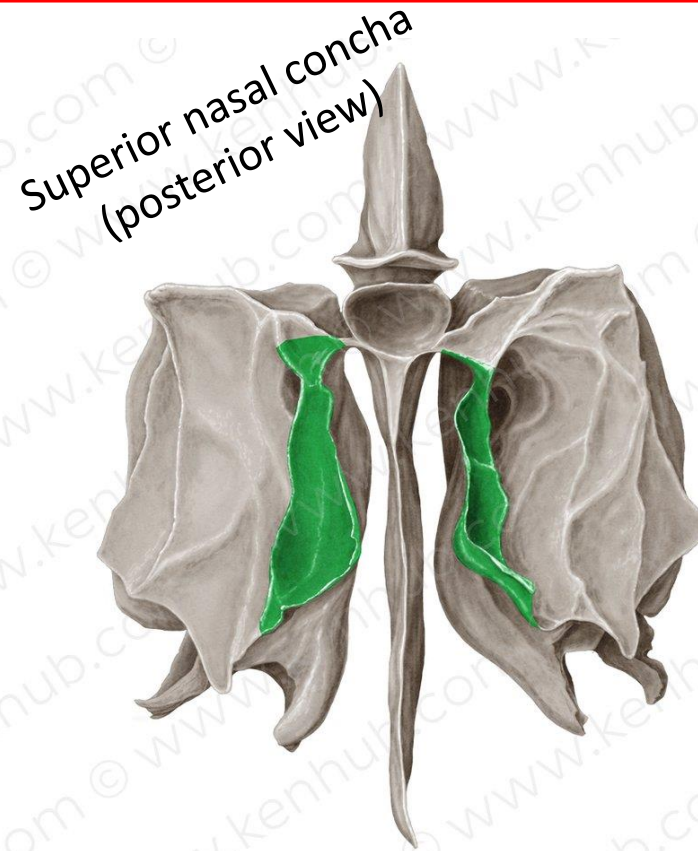
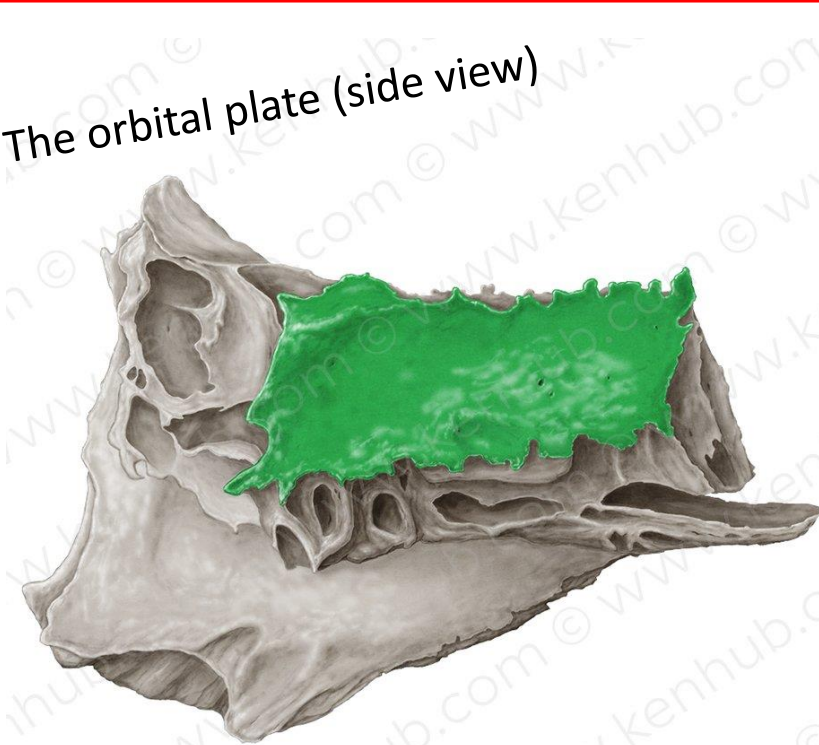


Cribriform plate
(superior view)



Each ethmoidal labyrinth is composed of two sheets of bone:

- The lateral sheet of bone is called the **orbital plate**, it forms a part of the medial wall of the orbit.
- The medial sheet of bone forms the upper part of the lateral wall of the nasal cavity and it has two processes and a swelling: the two processes are the **superior and the middle nasal conchae**, the prominent swelling (bulge) is the **ethmoidal bulla**, on the medial wall of the labyrinth.

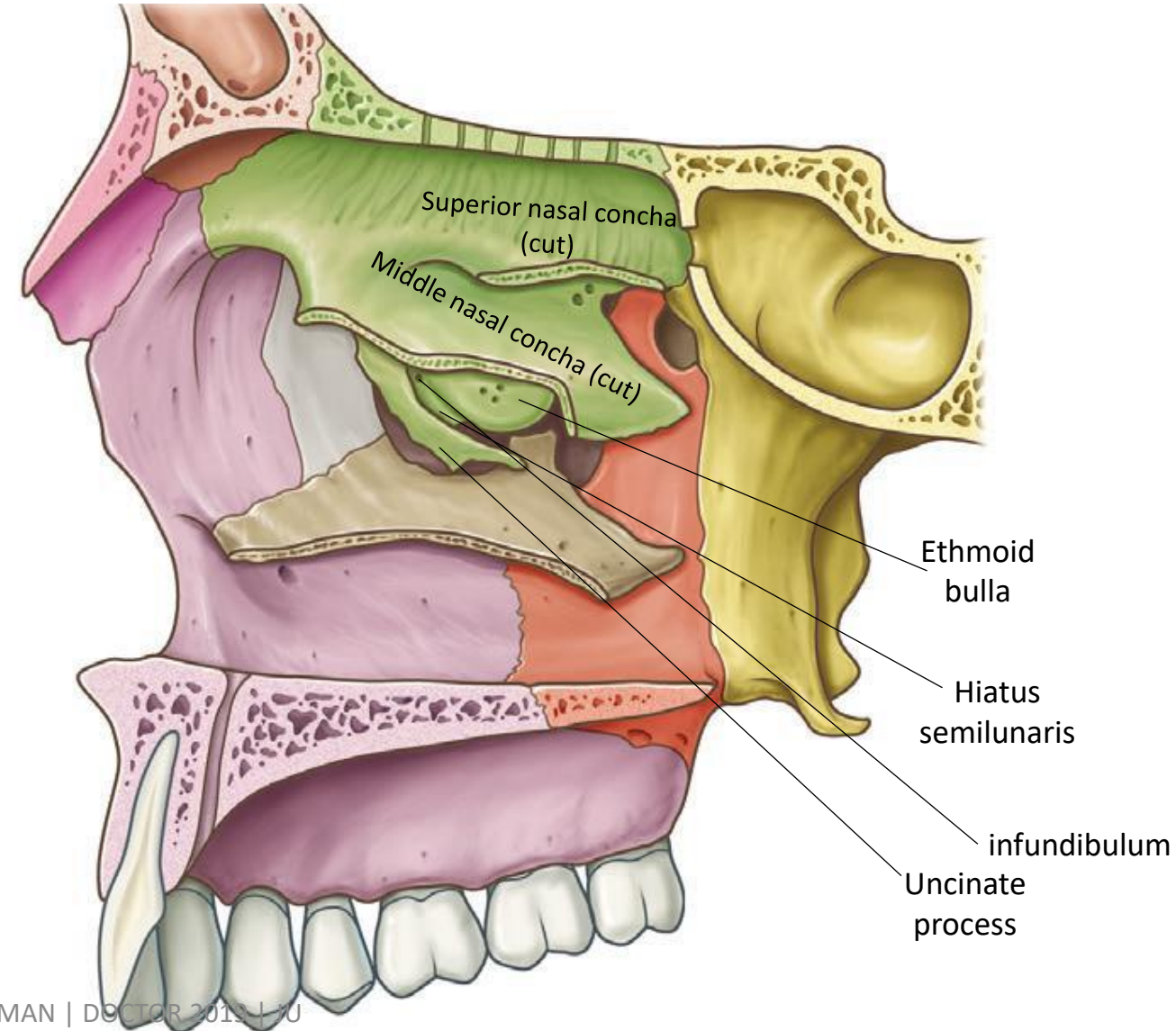
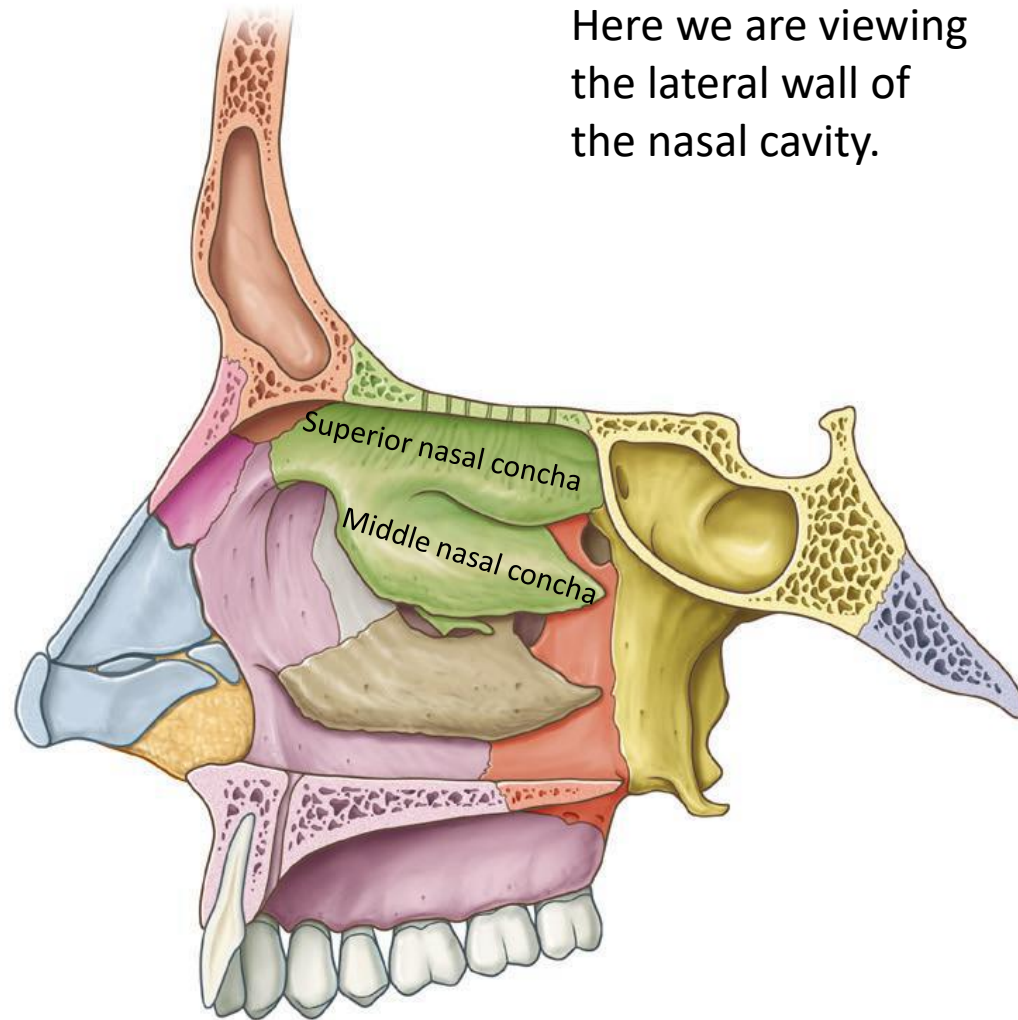


Extending from just under the bulla is a groove called the **ethmoidal infundibulum**, which continues upward, and narrows to form a channel that penetrates the ethmoidal labyrinth and opens into the frontal sinus, this channel is for the **frontonasal duct**, which drains the frontal sinus.

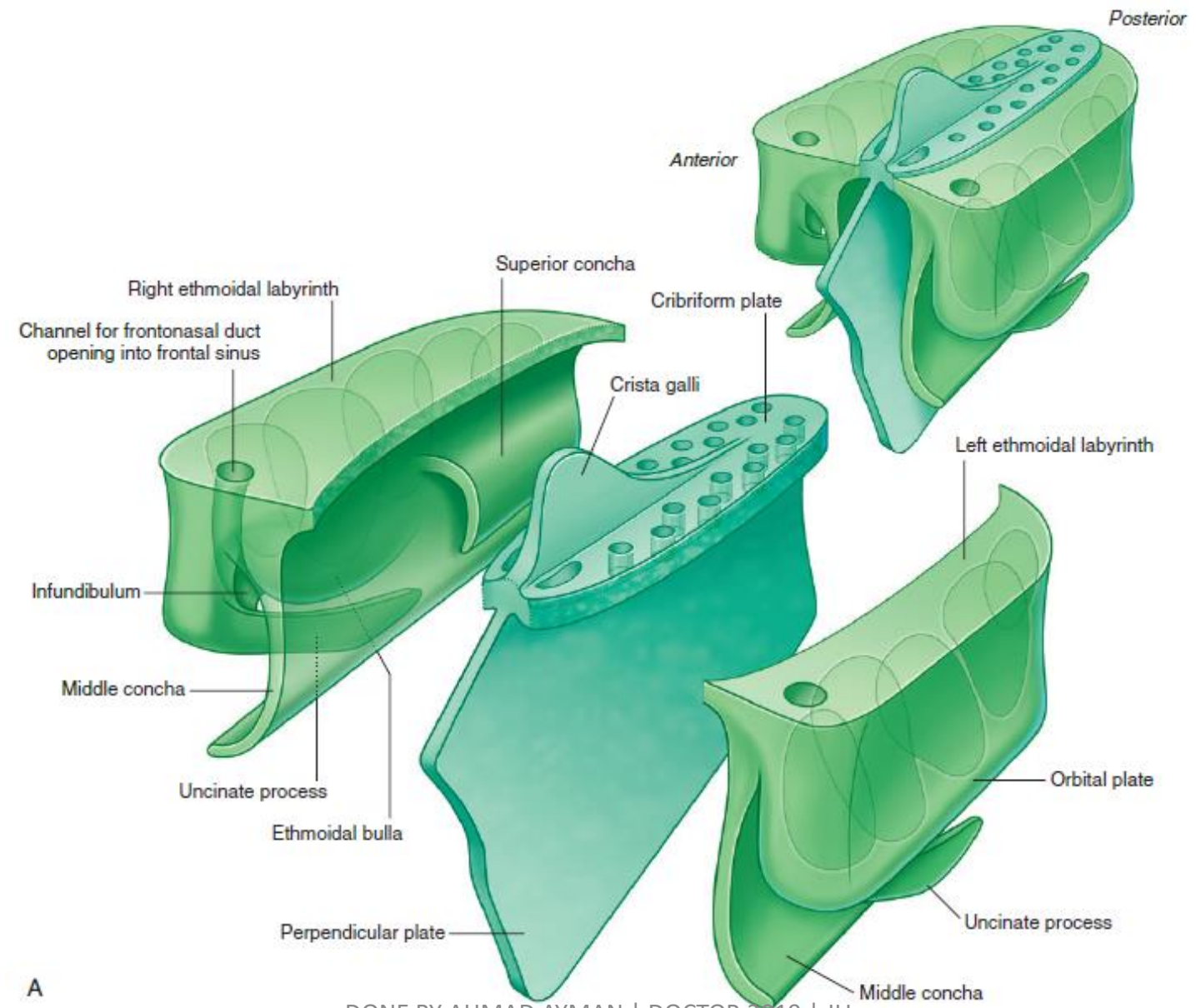
The ethmoidal labyrinth also has a delicate irregular bony projection on its anterior surface called the **uncinate process**.

Inferior to the **ethmoidal bulla** is a curved gutter called the **semilunar hiatus**.

Here we are viewing the lateral wall of the nasal cavity.



Another illustration of the ethmoid bone to ensue understanding (note that the labyrinths are hollow, they contain the ethmoidal air cells which discuss in a minute).

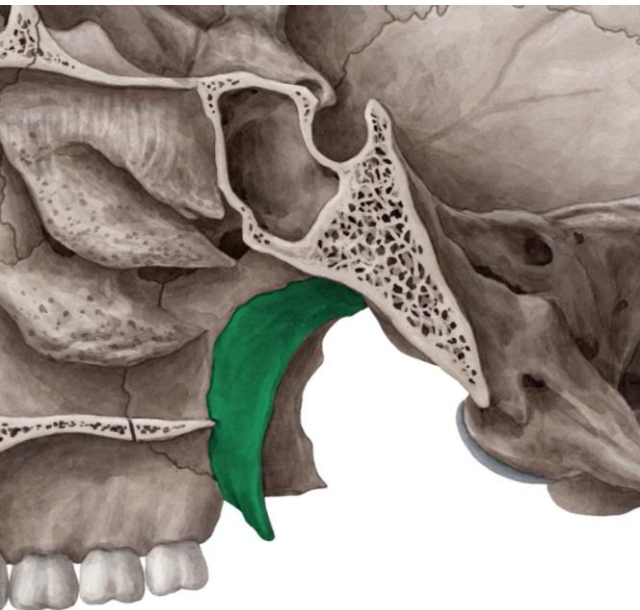


Now, we're done with the ethmoid bone and we can proceed to our material 😊

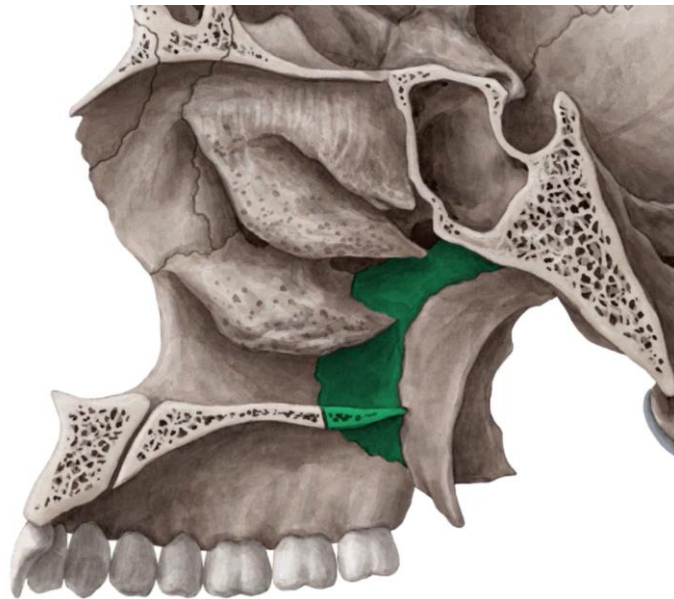
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BOUNDARIES OF THE NASAL CAVITY: THE LATERAL WALL.

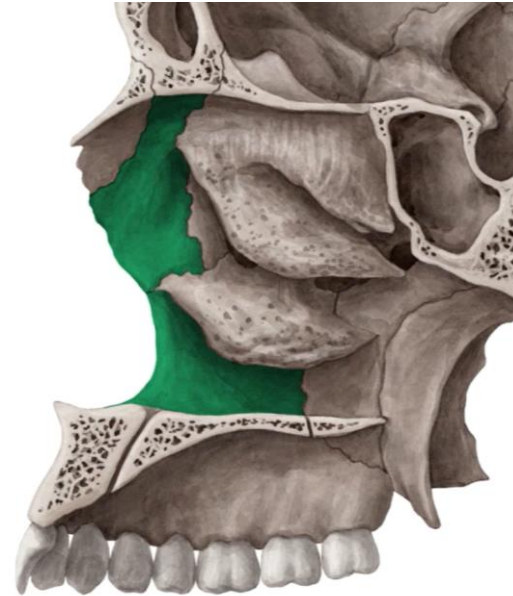
The lateral wall of the nasal cavity is complex, it is formed by bone, cartilage and soft tissues, bones that contribute to this wall include the medial pterygoid plate of sphenoid bone, perpendicular plate of palatine bone, medial surfaces of the maxilla and the lacrimal bones, ethmoidal labyrinth and inferior nasal concha.



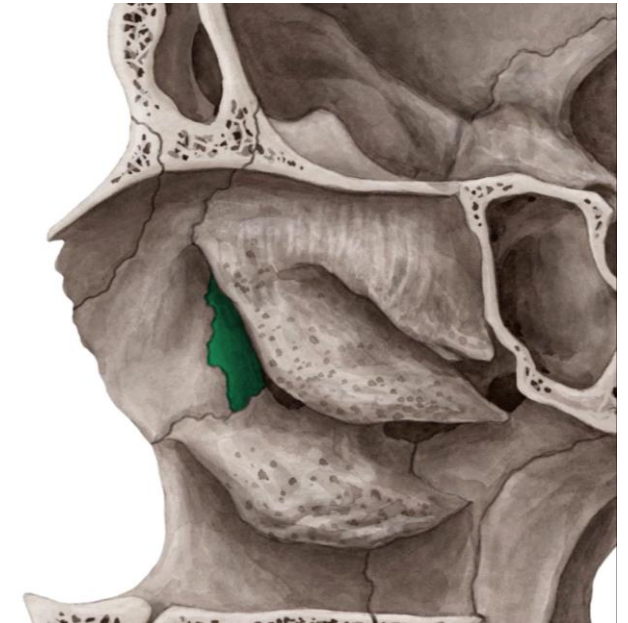
Medial Pterygoid Plate



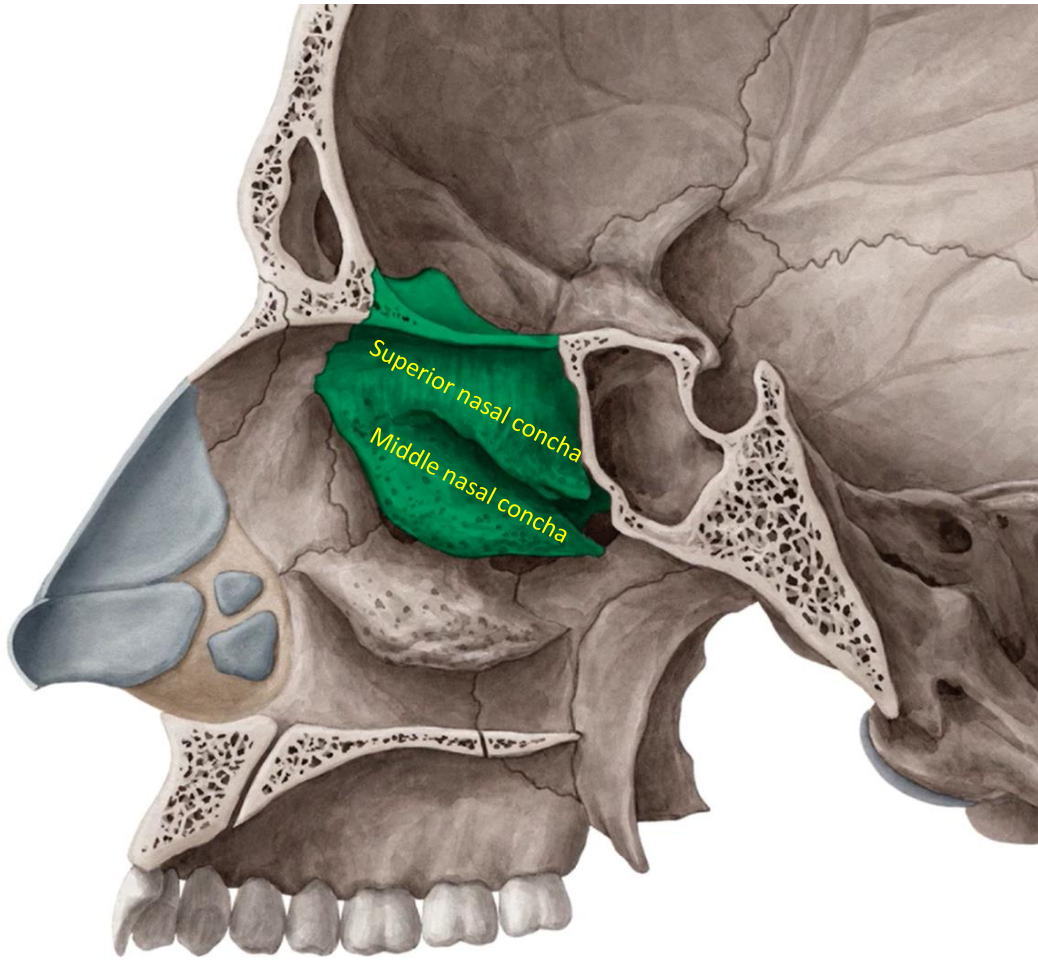
Perpendicular plate of
palatine bone



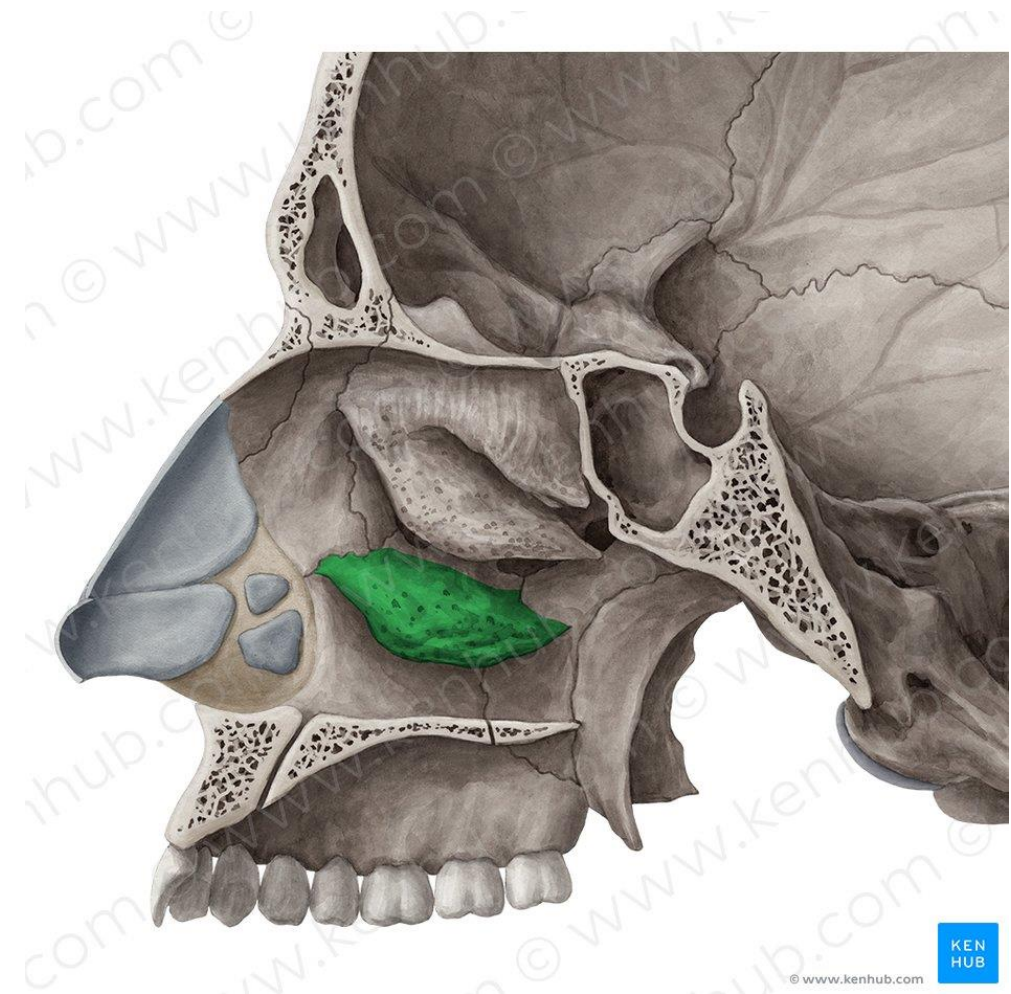
Medial surface of the
maxilla



Medial surface of the lacrimal
bone



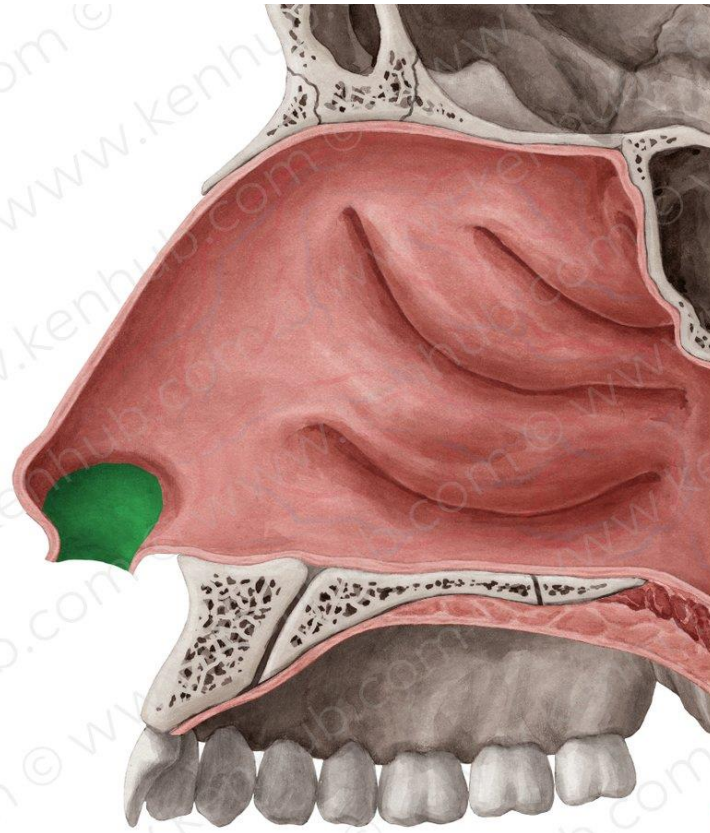
Ethmoid bone, notice that the ethmoidal labyrinth contributes to the superior and middle nasal conchae



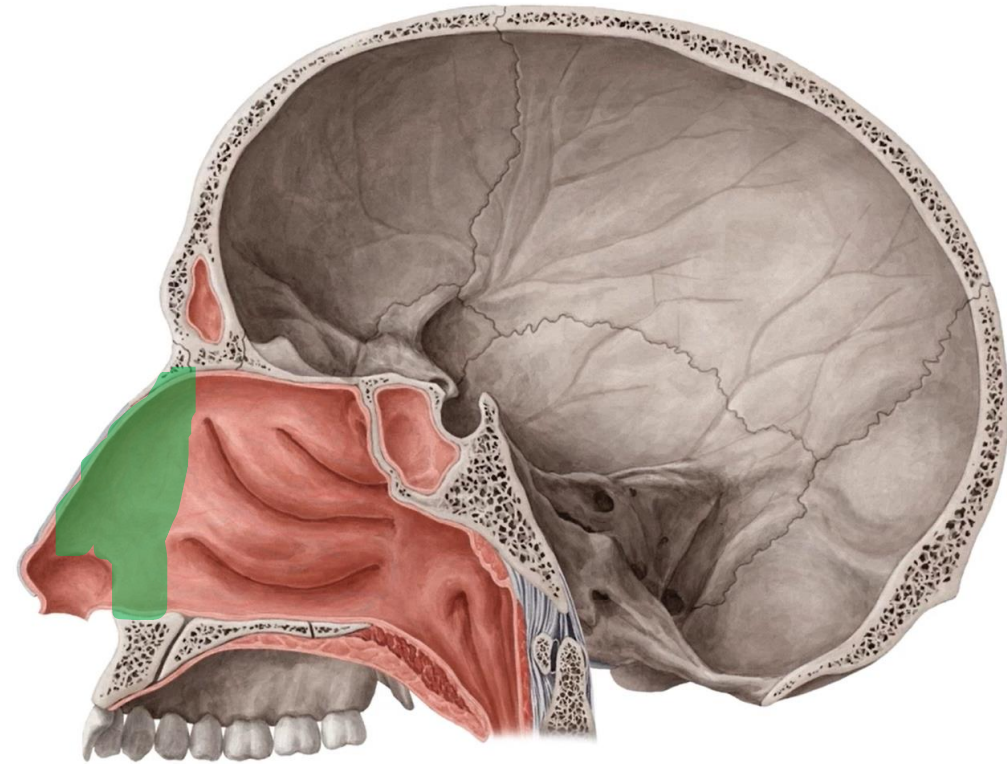
In contrast to the superior and middle ones, the inferior nasal concha is a bone by itself.

Parts of the nasal cavity:

- The nasal Vestibule is the area of the nasal cavity lying just inside the nostril, it is covered with skin and contains thick hairs called vibrissae (we've seen that before)
- Nasal antrum (atrium)
- Posterior part contains three conchae, three meatuses, and one recess.



Nasal Vestibule



Nasal Antrum

MUCOSA OF THE NASAL CAVITY

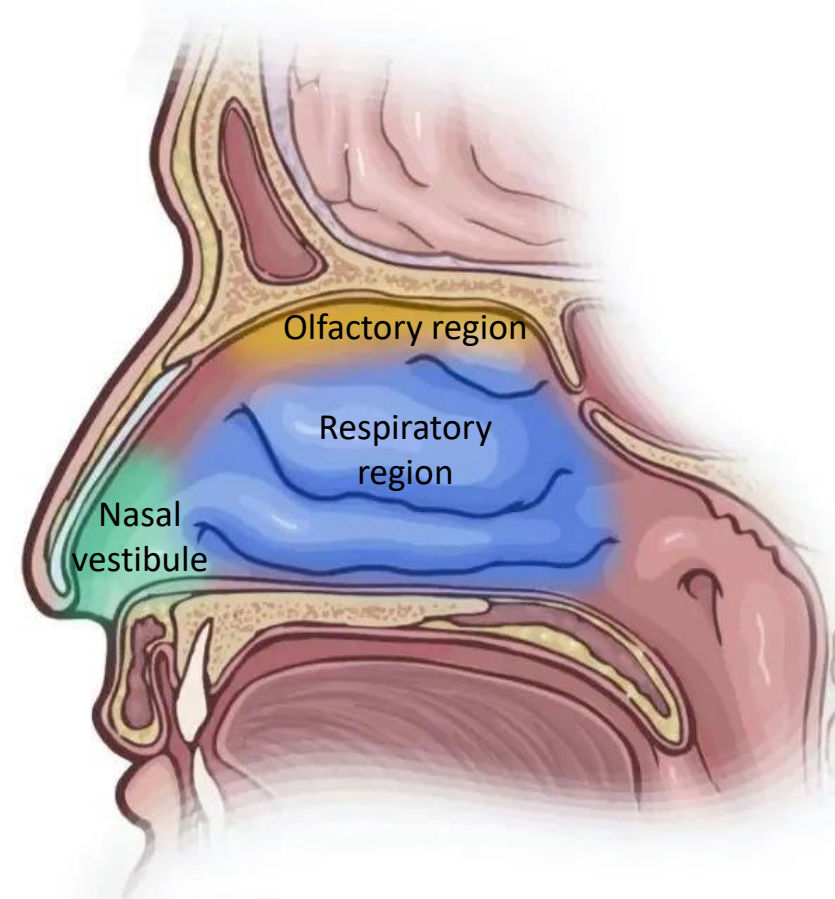
The nasal cavity is lined with respiratory mucous membrane (that is pseudostratified ciliated columnar epithelium with goblet cells)

Except :

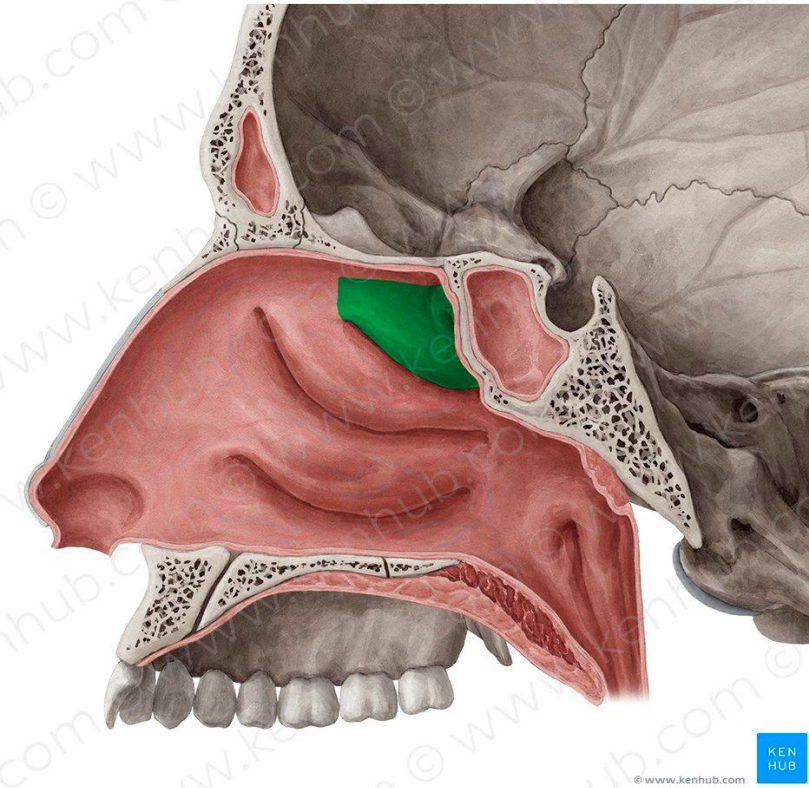
1. The vestibule that is lined with modified skin and has coarse hairs
2. Above the superior concha is lined with olfactory mucous membrane and contains nerve endings

Functions of the nasal mucosa:

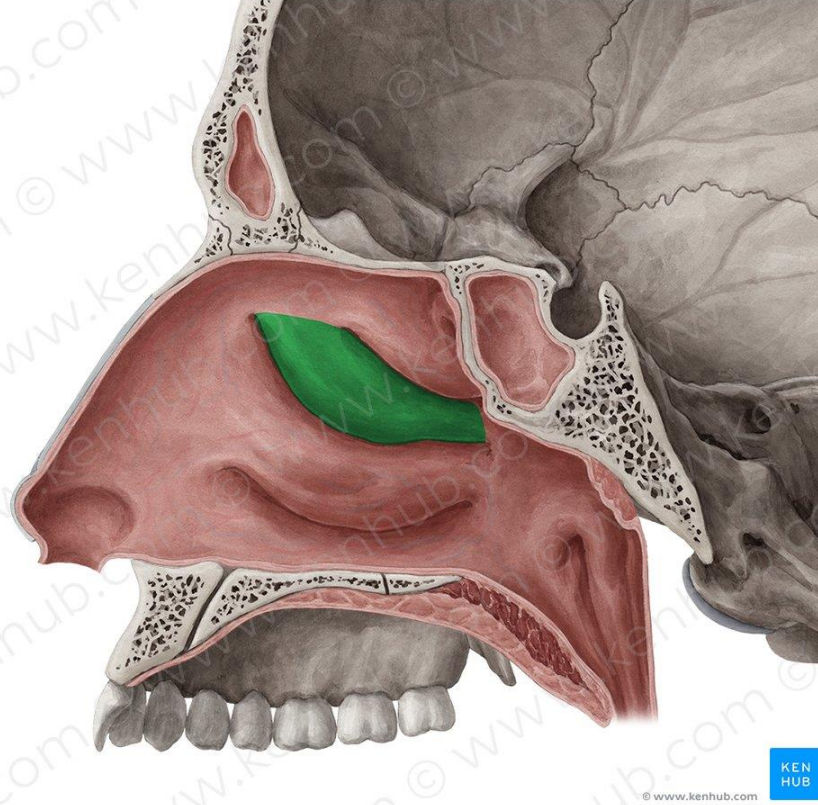
- 1- large plexus of veins in the submucous connective tissue is present in the respiratory region, warm blood in the venous plexuses serves to heat up the inspired air as it enters the respiratory system.
- 2- Mucous traps foreign particles and organisms in the inspired air



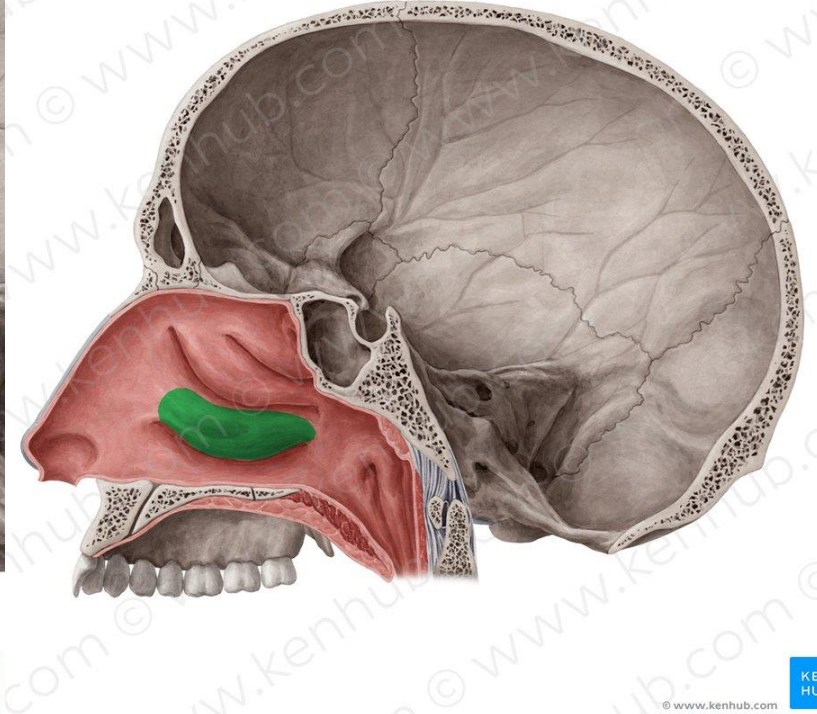
NASAL CHONCHAE (NOT CHOANAE 😊) AND MEATEUSES



Superior nasal concha

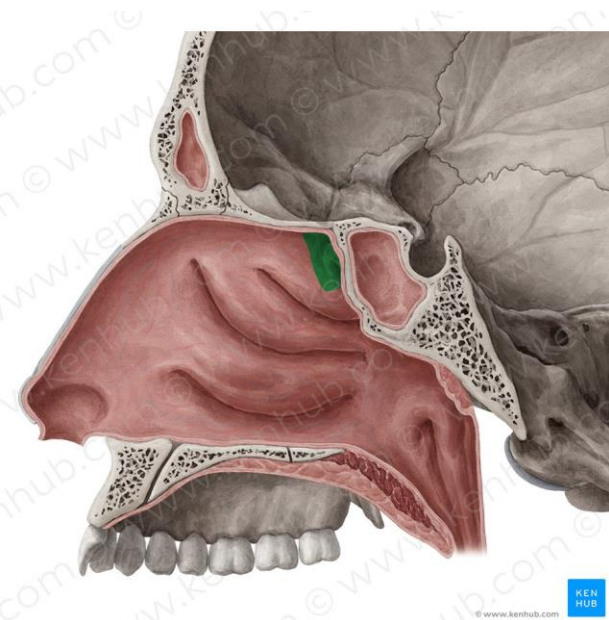


Middle nasal concha

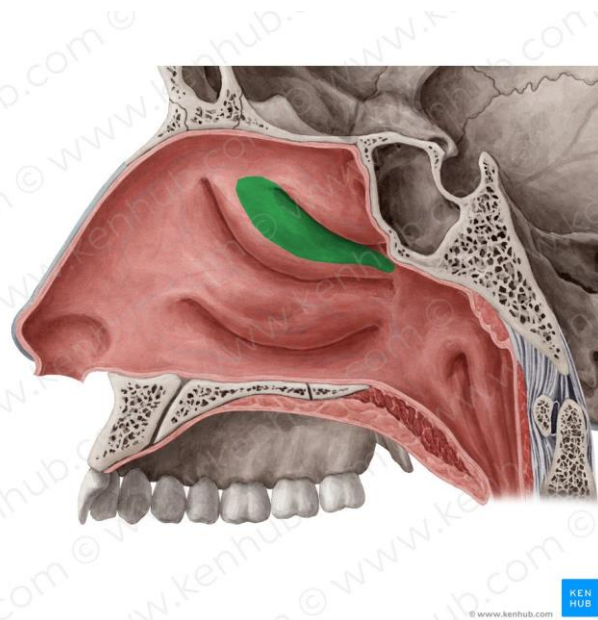


Inferior nasal concha

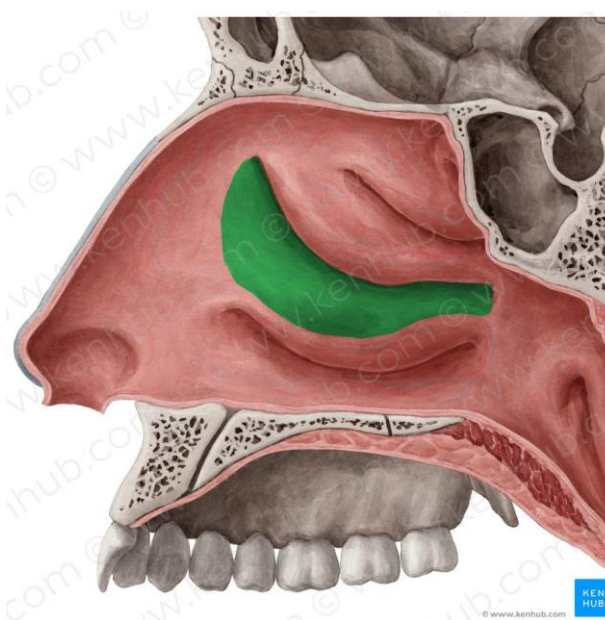
- All Conchae extend medially across the nasal cavity, separating it into four air channels: the inferior, middle, and superior nasal meatuses, and a Sphenoethmoidal recess.
- The Anterior end of each concha curves inferiorly to form a lip that overlies the end of the related meatus



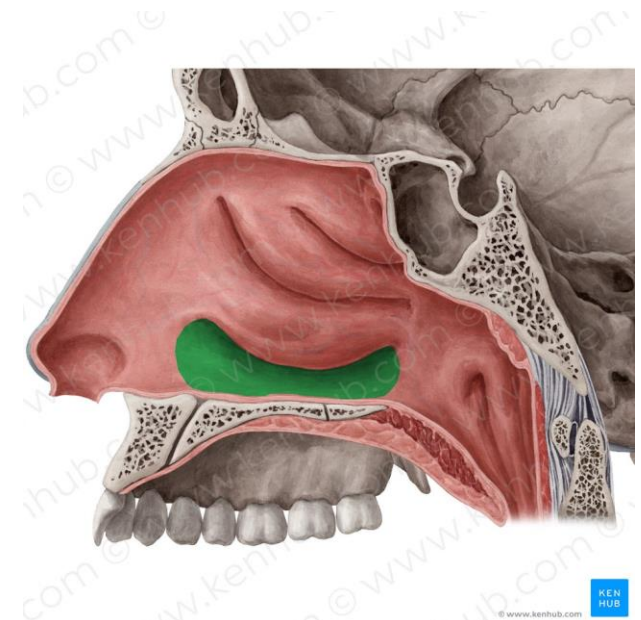
Sphenoethmoidal Recess



Superior Nasal Meatus

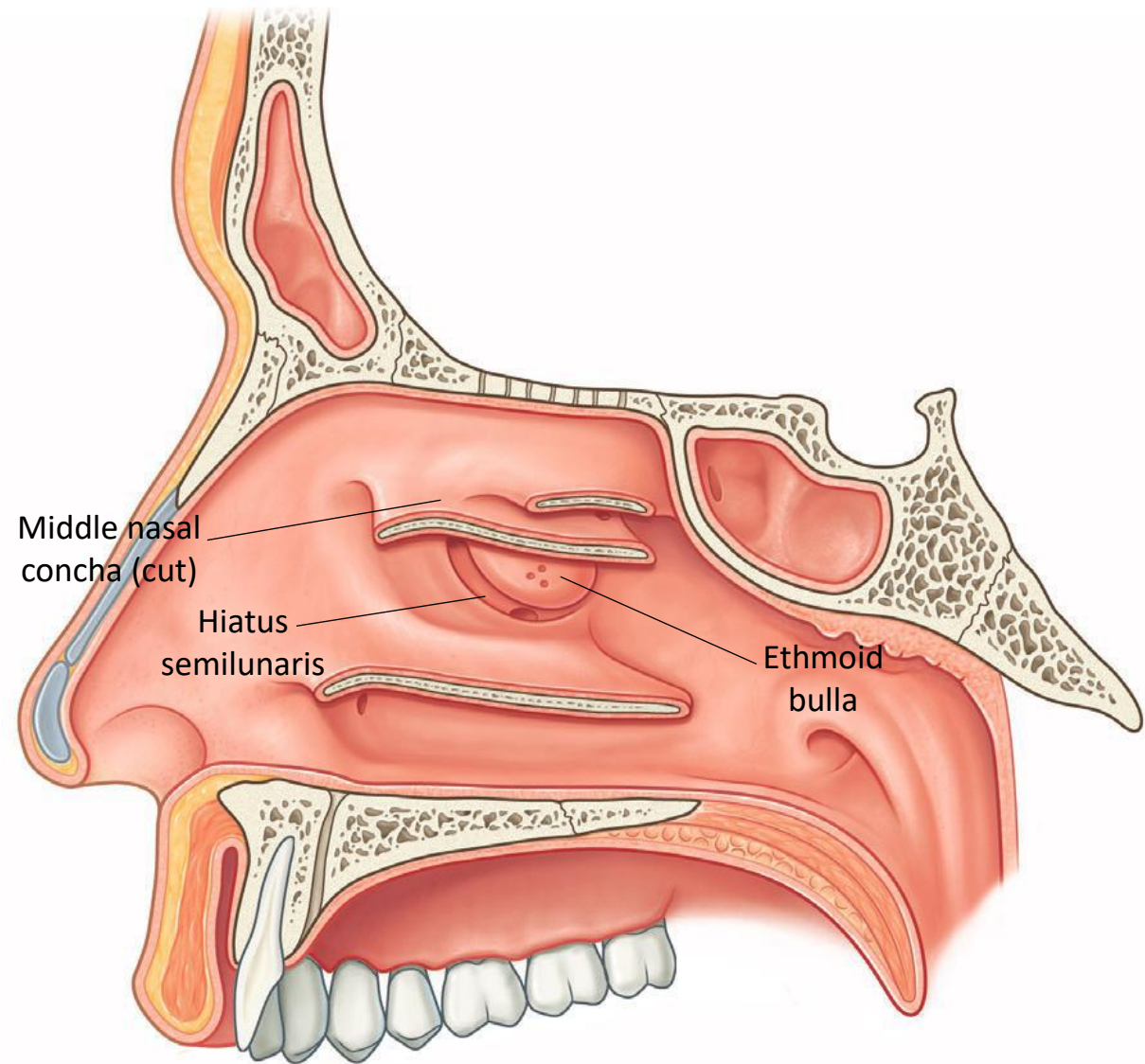


Middle Nasal Meatus

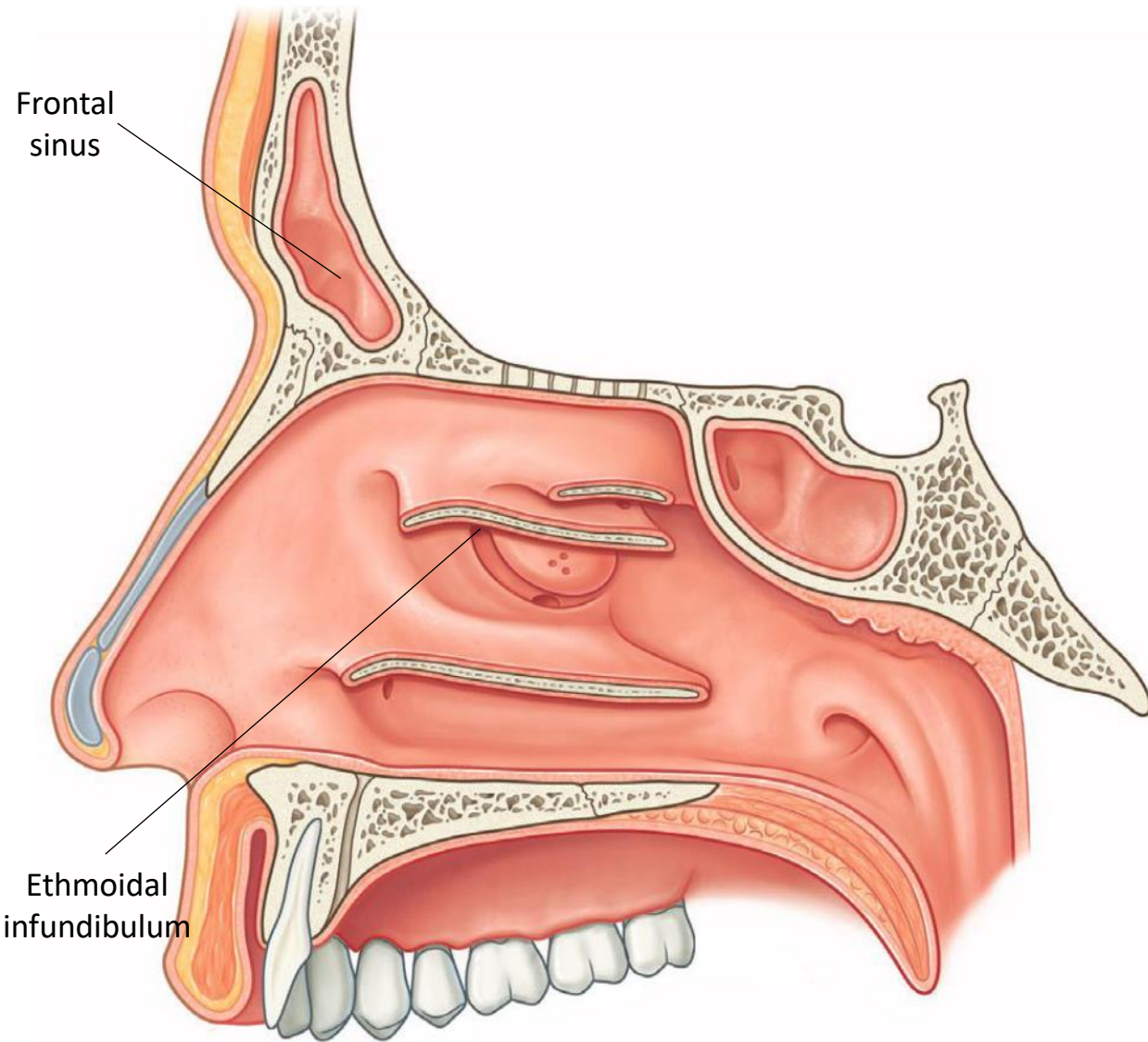


Inferior nasal meatus

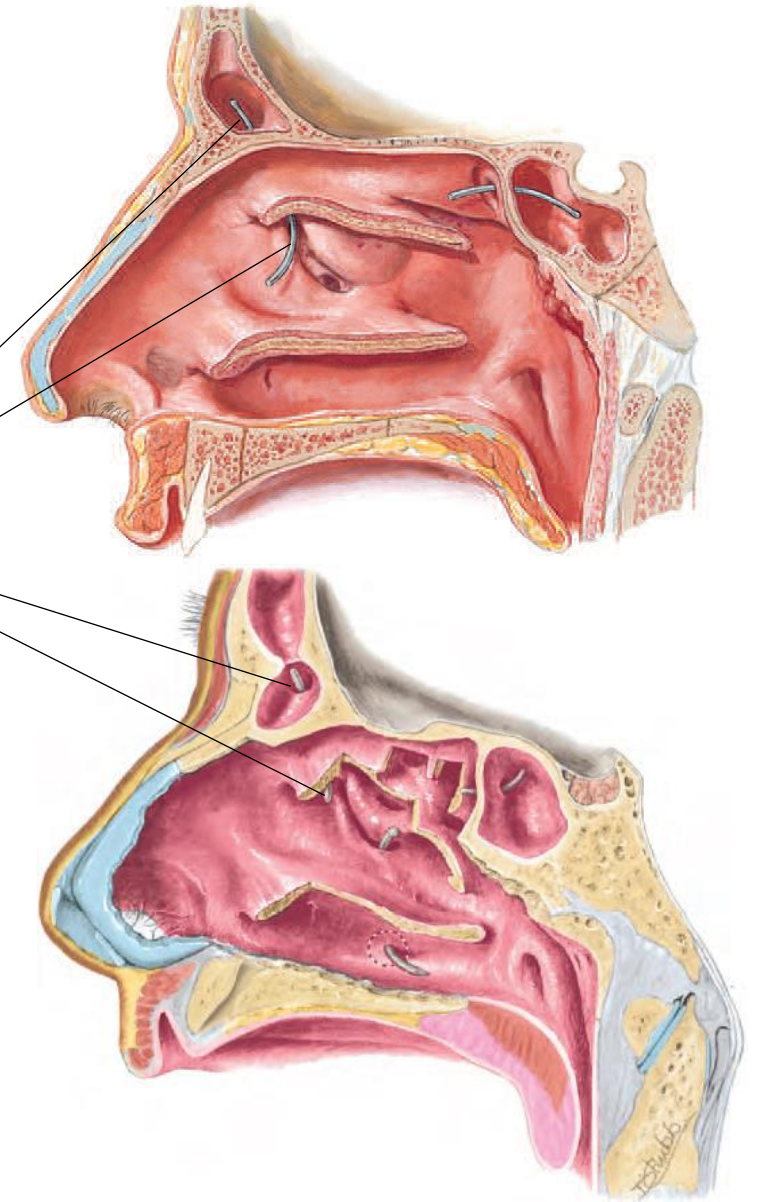
- lateral wall of the middle meatus elevates to form the dome-shaped **Ethmoidal bulla**
- Formed by the underlying middle ethmoidal cells, which expand the medial wall of the ethmoidal labyrinth.
- Inferior to the ethmoidal bulla is a curved gutter called the **Hiatus semilunaris**



Anterior end of the hiatus semilunaris forms a channel called the **ethmoidal infundibulum**, this infundibulum curves upwards and continues as the **frontonasal duct** through the anterior part of the **ethmoidal labyrinth** to open into the **frontal sinus**.

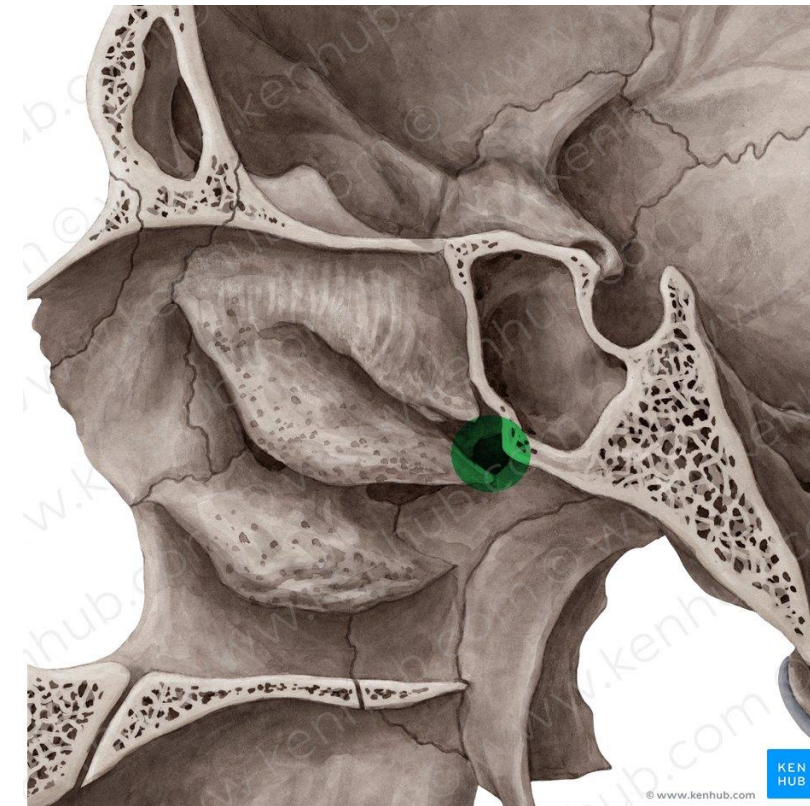
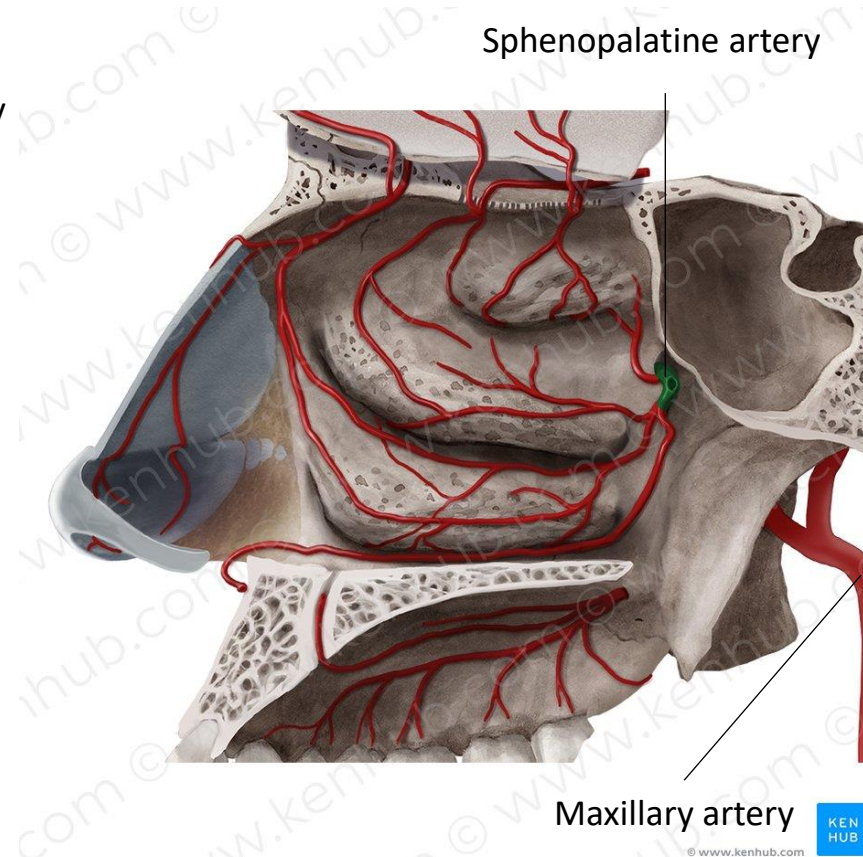
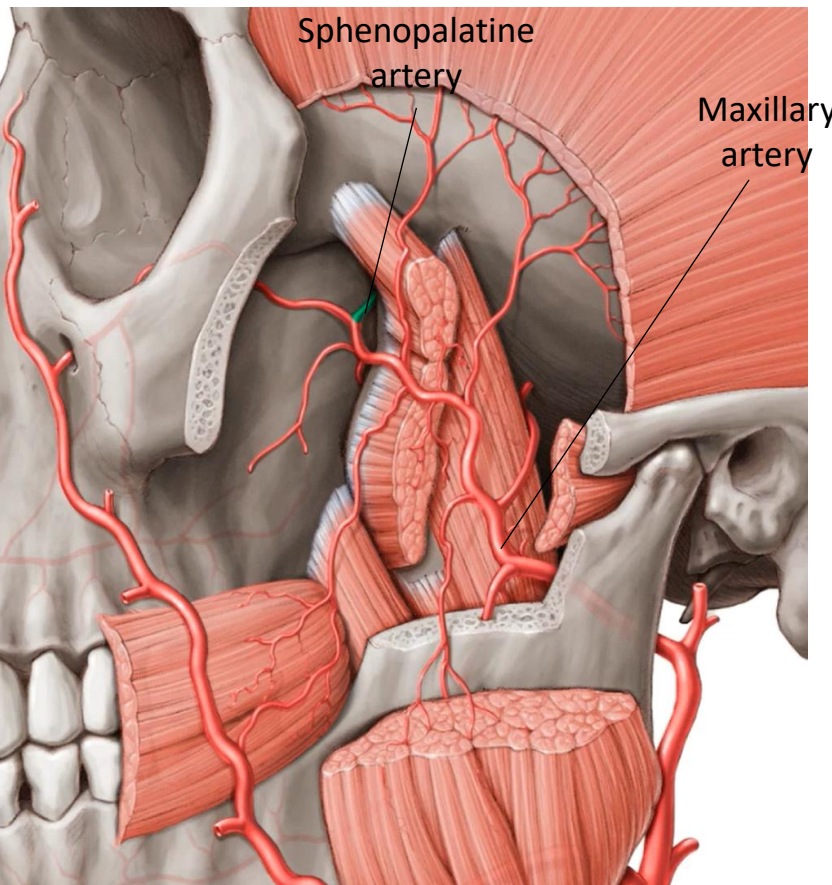


These threads are inserted in the frontonasal duct



ARTERIAL SUPPLY OF THE NASAL CAVITY: THE SPHENOPALATINE ARTERY

- The sphenopalatine artery is the largest vessel supplying the nasal cavity, the sphenopalatine artery is a terminal branch of the maxillary artery in the pterygopalatine fossa, it arises in the pterygopalatine fossa and enters the nasal cavity by passing medially through the sphenopalatine foramen.
- Gives long and short branches, the long supplies the lateral wall while the short supplies the septum.



The sphenopalatine foramen

Branches of the sphenopalatine artery are:

1. Posterior lateral nasal (short) branches

supply a large part of the lateral wall (specifically, the posterior superior quadrant of the nasal cavity)

2. Posterior septal (long) branches

Pass over the roof of the cavity and onto the nasal septum and contribute to the blood supply of the medial wall



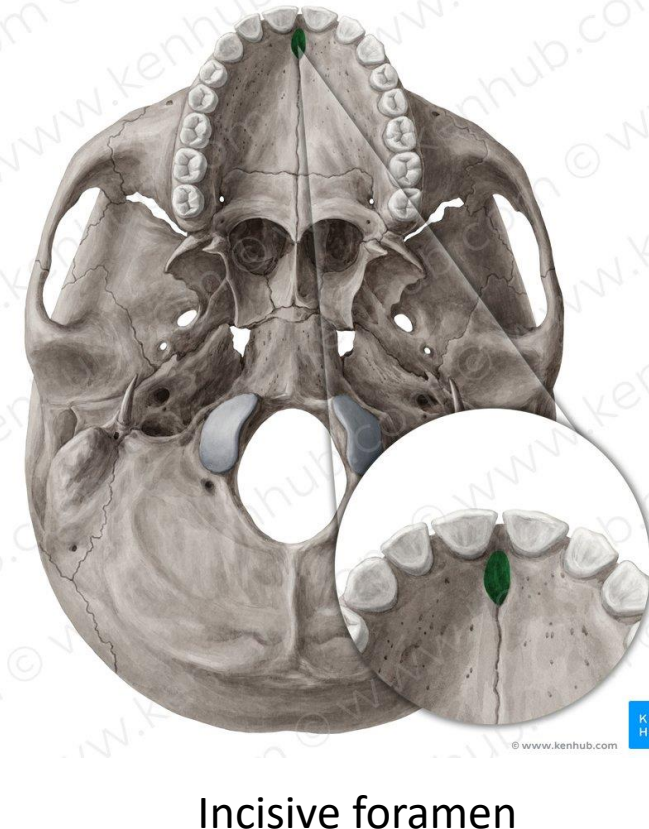
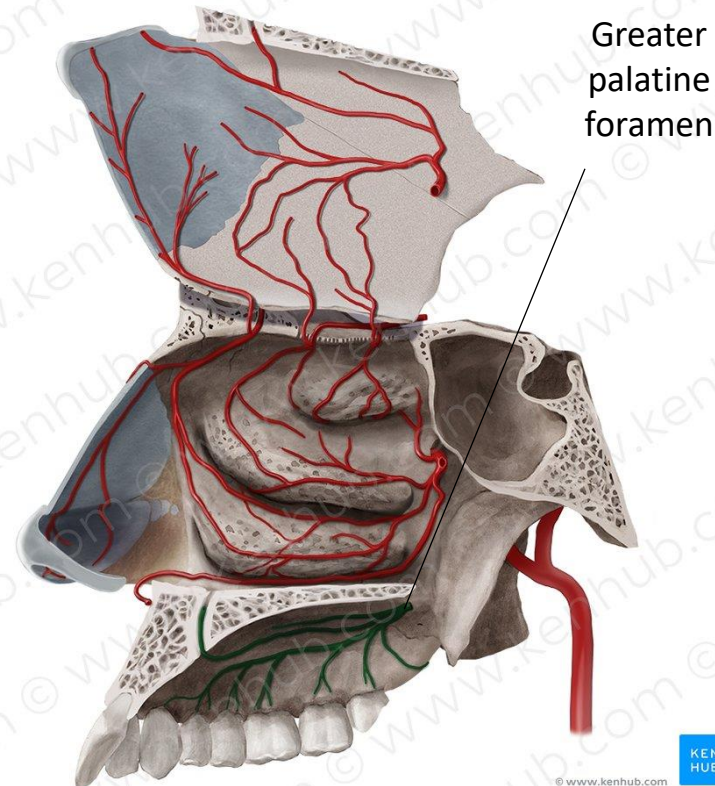
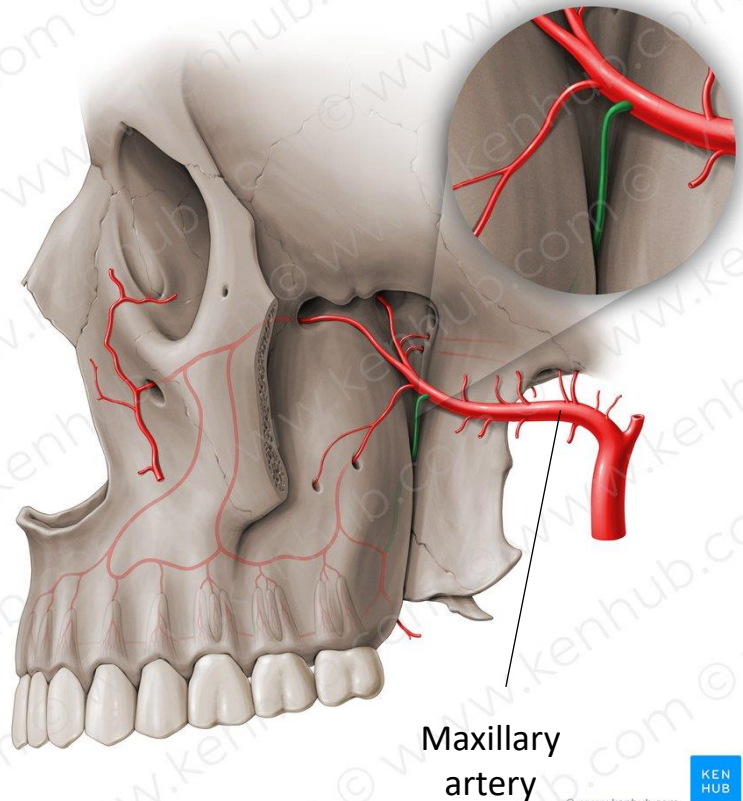
The posterior lateral branches



The posterior septal branches

ARTERIAL SUPPLY OF THE NASAL CAVITY: THE GREATER PALATINE ARTERY

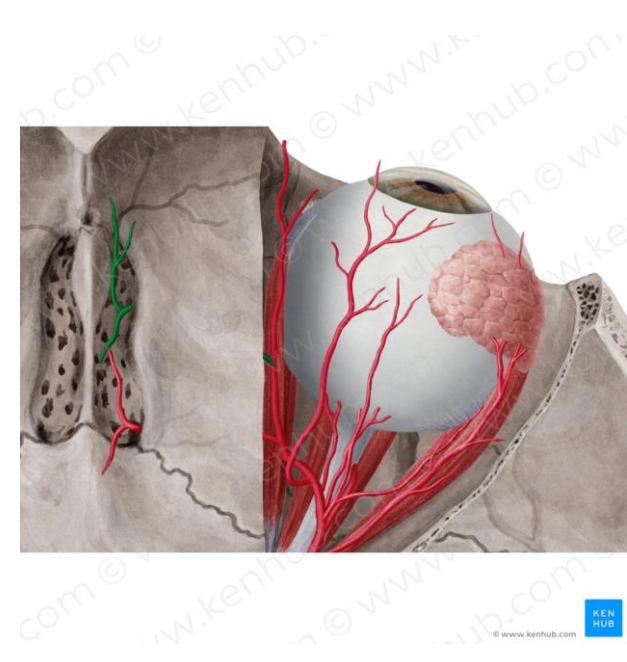
The greater palatine artery arises in the pterygopalatine fossa as a branch of the maxillary artery it passes through the greater palatine foramen from the pterygopalatine fossa into the oral cavity, then it enters the nasal cavity by passing up through the incisive canal, it supplies the anterior regions of the medial wall and adjacent floor (the posterior inferior and anterior inferior quadrants).



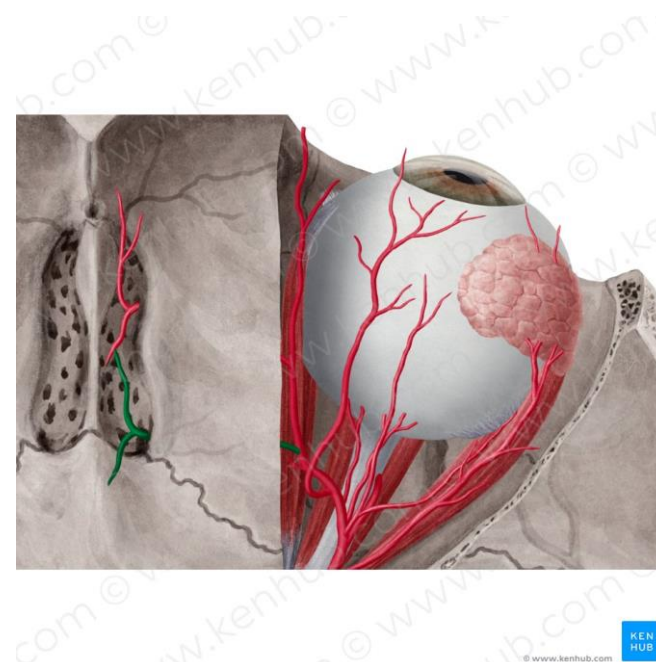
ARTERIAL SUPPLY OF THE NASAL CAVITY: THE ANTERIOR AND POSTERIOR ETHMOIDAL ARTERIES.

The anterior and posterior ethmoidal arteries originate in the orbit from the ophthalmic artery (which is itself a branch of the internal carotid artery), and supply the medial (septal) and lateral wall of the nasal cavity, specifically the anterior superior quadrant.

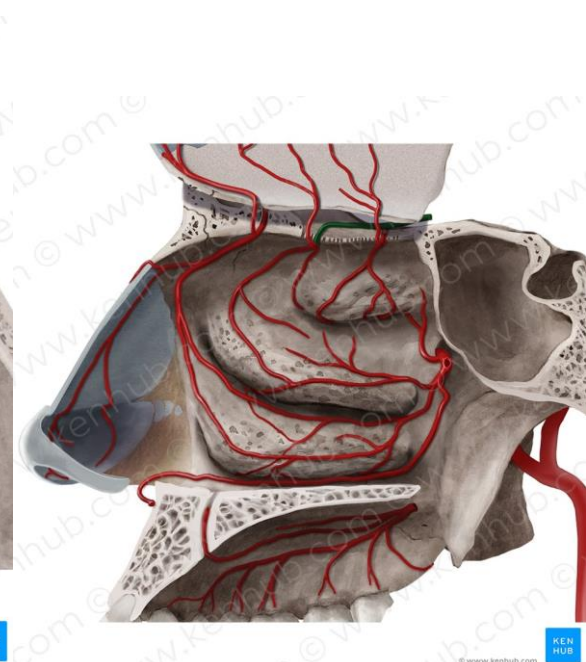
The anterior ethmoidal artery descends through a slit-like foramen lateral to the crista galli, while the posterior ethmoidal artery descends into the nasal cavity through the cribriform plate and has branches to the upper parts of the medial and lateral walls.



Anterior Ethmoidal Artery

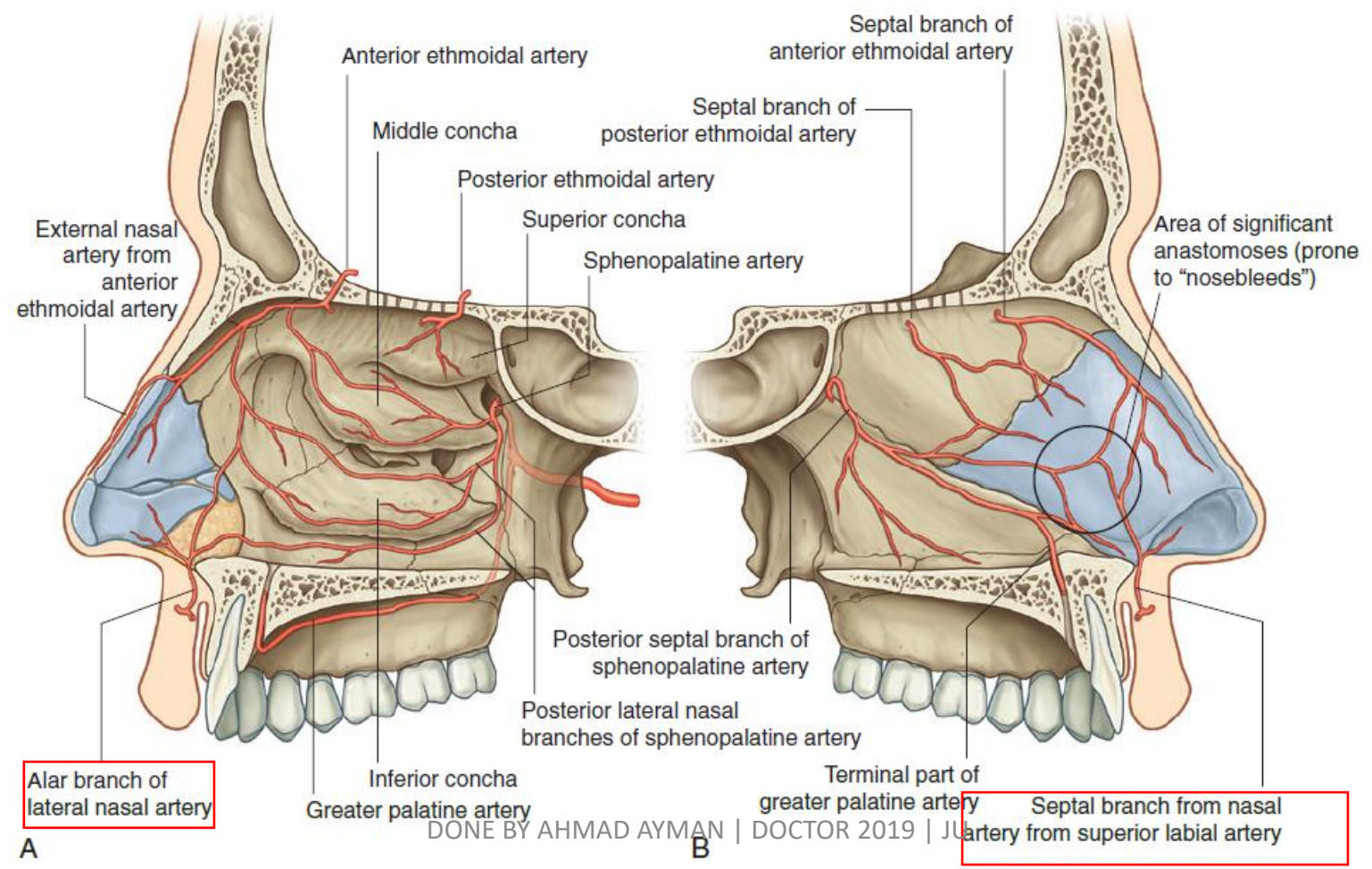


Posterior Ethmoidal Artery

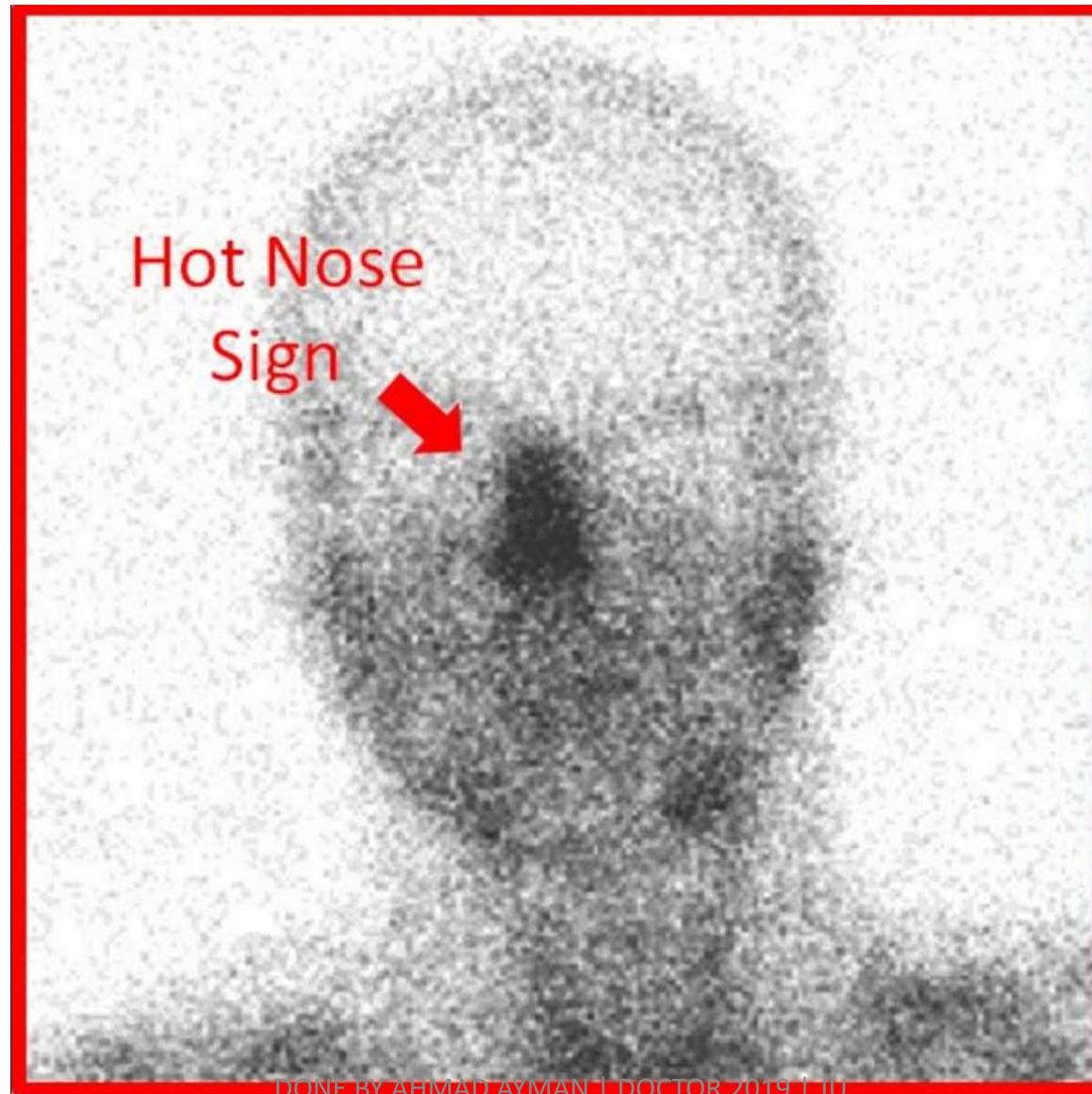


ARTERIAL SUPPLY OF THE NASAL CAVITY: THE SUPERIOR LABIAL AND LATERAL NASAL ARTERIES.

- The superior labial artery and the lateral nasal artery originate from the facial artery on the front of the face.
- The superior labial artery gives an **alar** branch that supplies the region around the naris and a septal branch supplies that supplies the anterior regions of the nasal septum.
- The lateral nasal arteries supply blood of the external nose, it gives alar branches that pass around the lateral margin of the naris and supply the nasal vestibule.



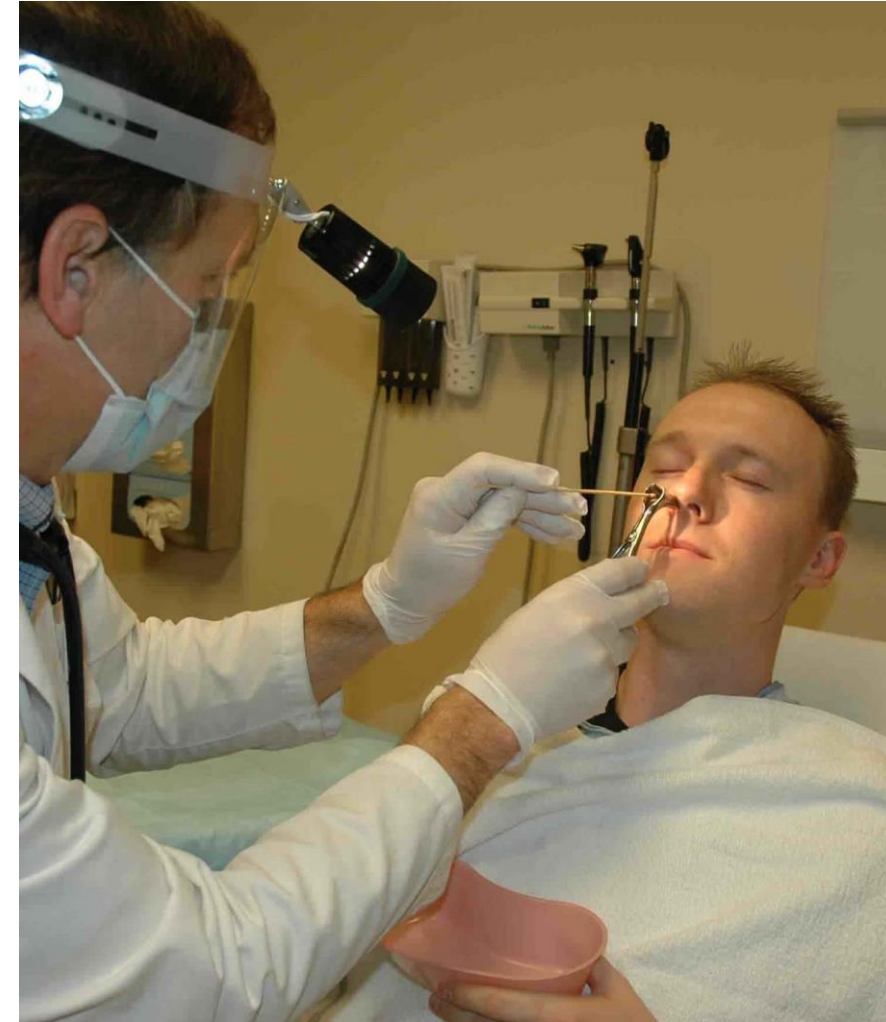
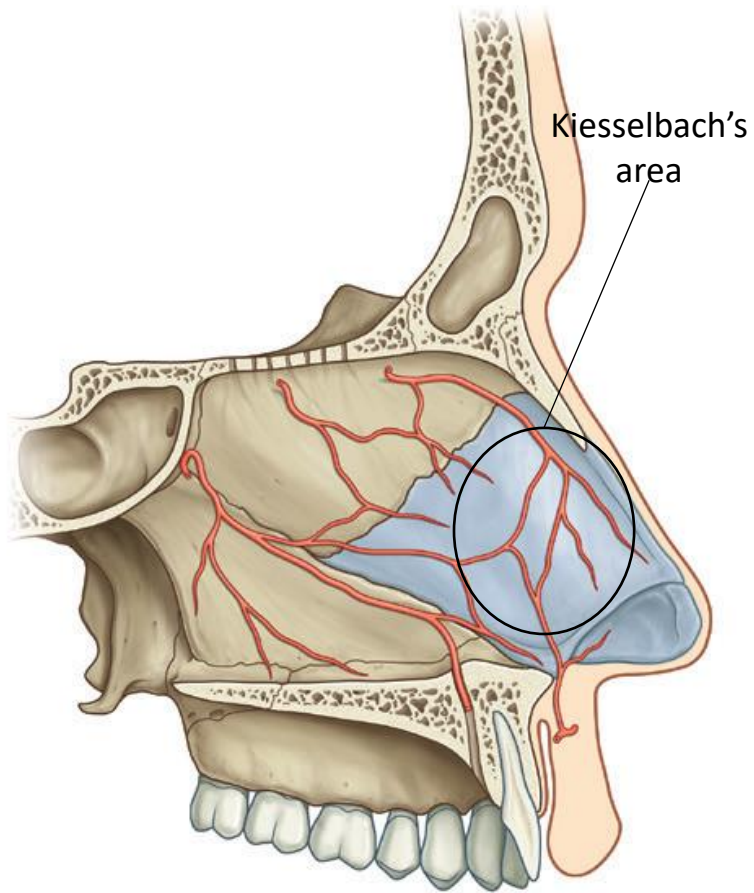
Clinical note: because the blood supply of the nasal cavity is derived from both the external carotid and internal carotid arteries, brain death, in which the internal carotid artery is doomed, results in increased perfusion to the nasal cavity through the external carotid artery, resulting in this nice sign which we see on brain perfusion scans.



Important: this slide is for fun only, it is not for studying and not required for the exam 😊

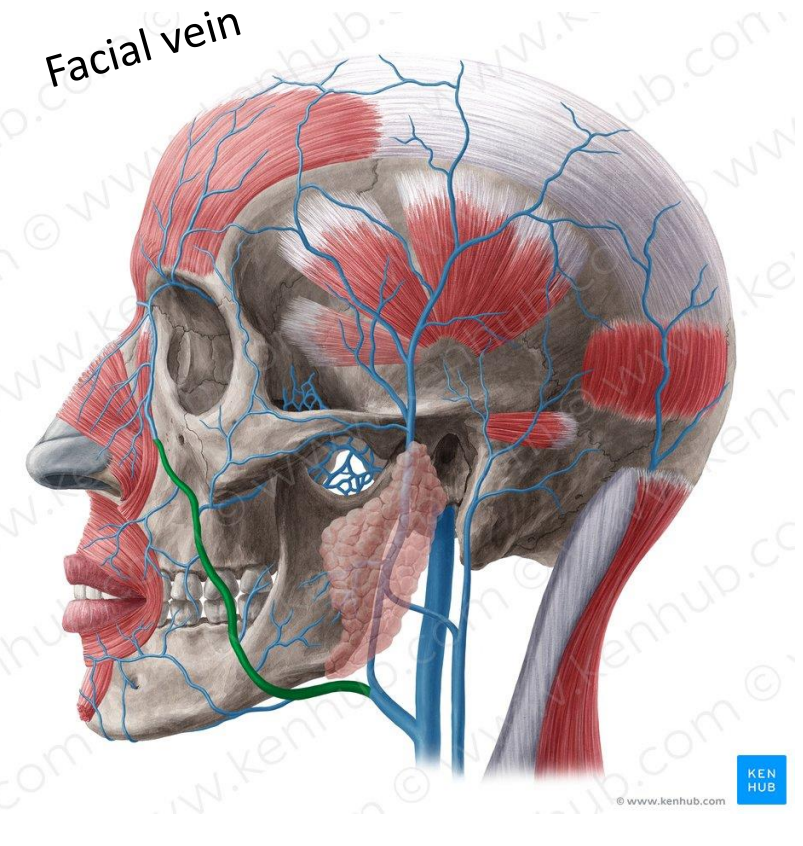
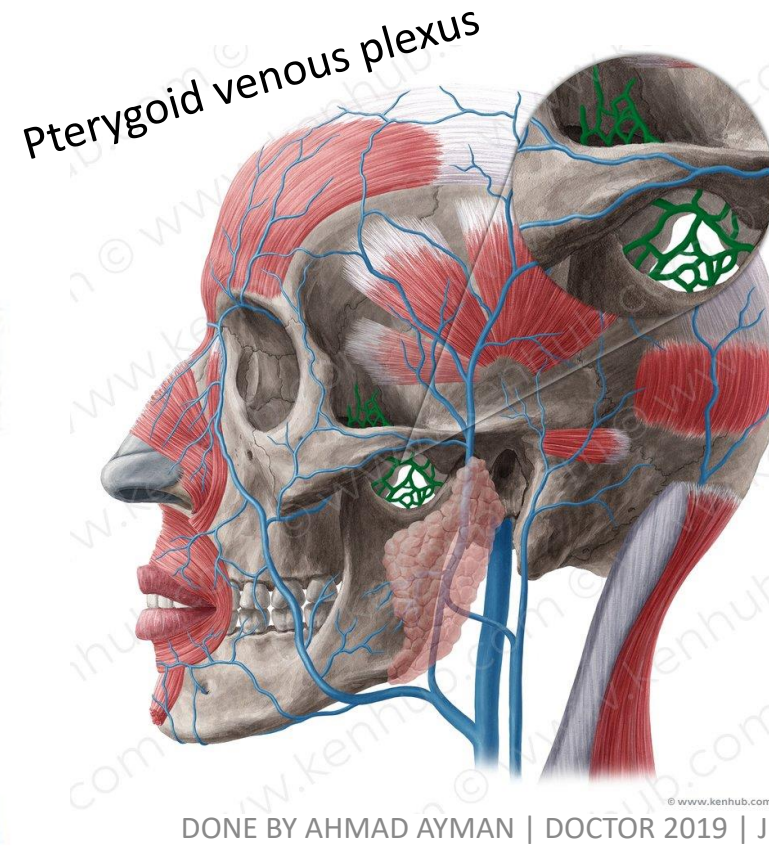
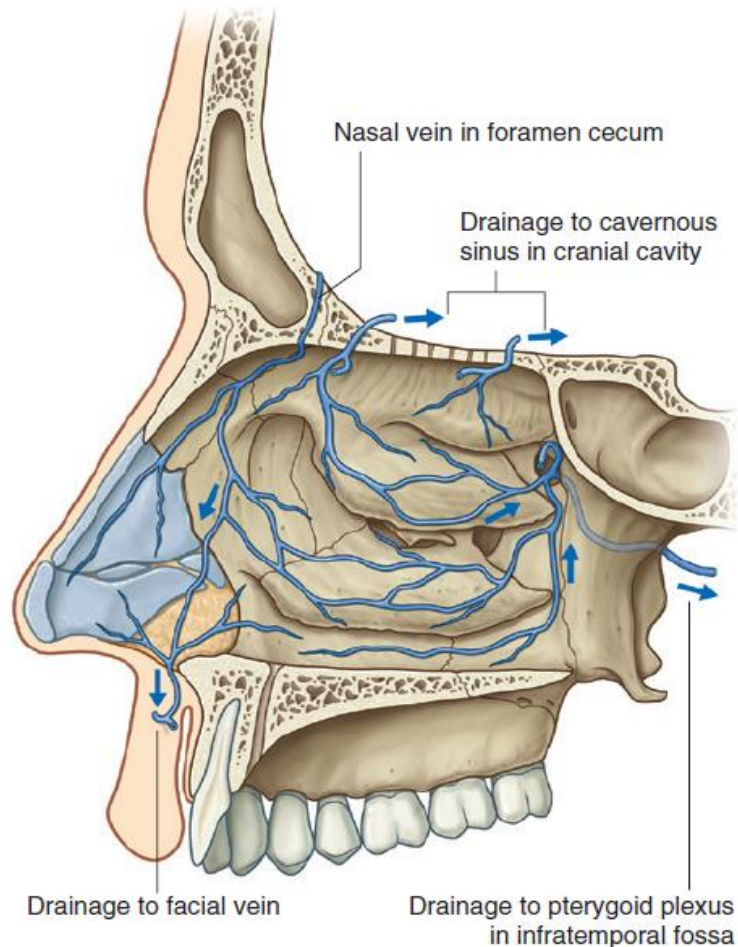
EPISTAXIS

- Blood vessels that supply the nasal cavities form extensive anastomoses with each other
- In the anterior region of the medial wall (septum), there are anastomoses relatively close to the surface (**Kiesselbach's area**), this area is the major site of 'nose bleeds' or epistaxis.
- Cauterization of the long sphenopalatine and the superior labial arteries is essential for treatment of epistaxis

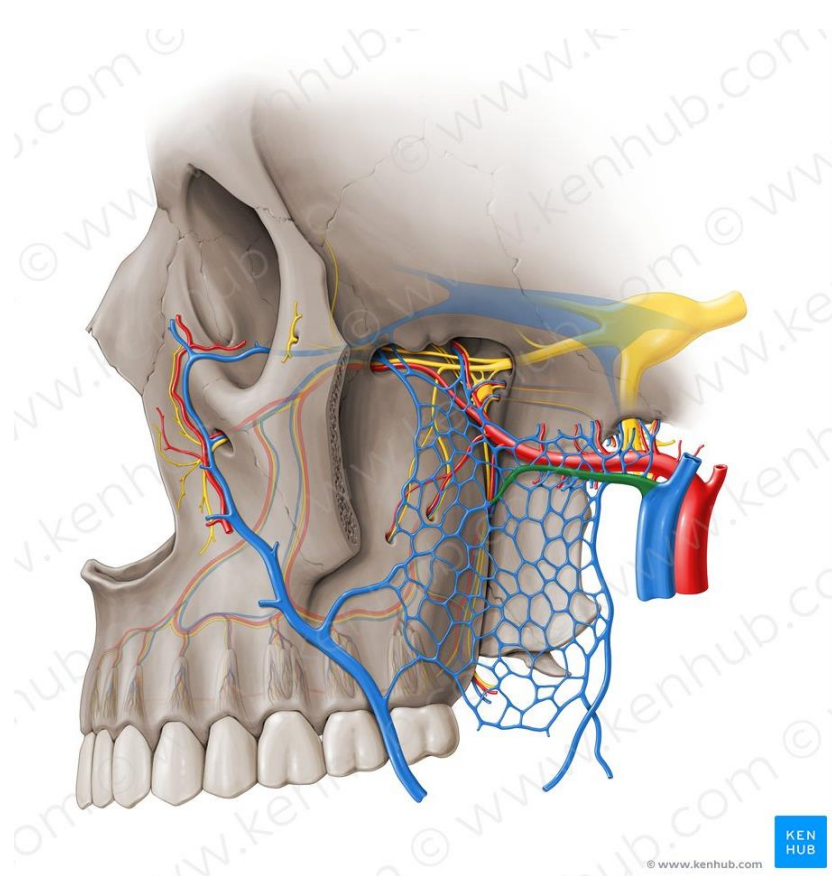


VENOUS DRAINAGE OF THE NASAL CAVITY

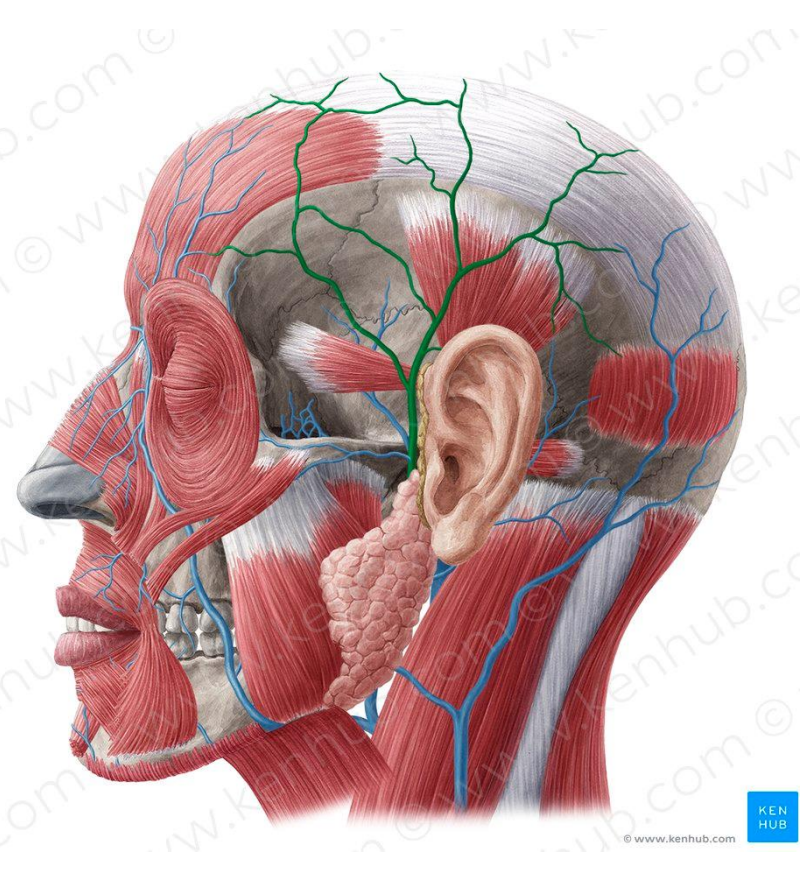
- Veins draining the nasal cavities generally follow the arteries
- veins that pass with branches originate from the maxillary artery drain into the **pterygoid plexus (those drain the posterior two thirds of the nasal cavity)**
- veins from anterior regions of the nasal cavities join the facial vein (those drain the anterior third of the nasal cavity)



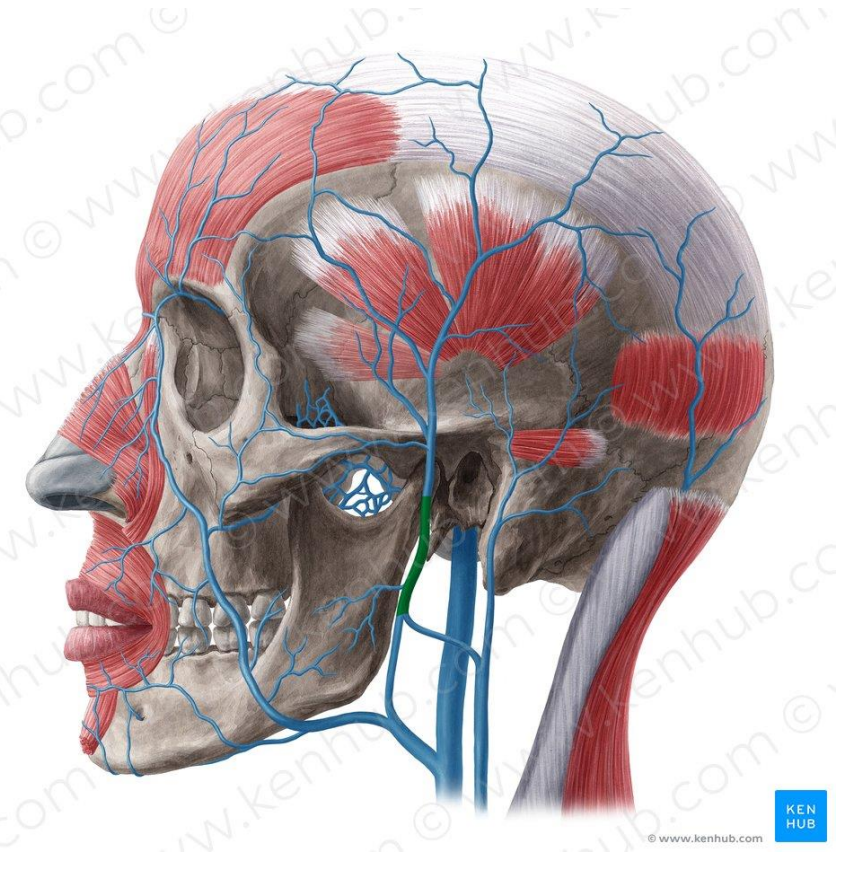
The pterygoid venous plexus drain into the maxillary vein, which unites with the superficial temporal vein in the substance of the parotid gland forming the retromandibular vein, which then drains into the jugular veins.



Maxillary vein



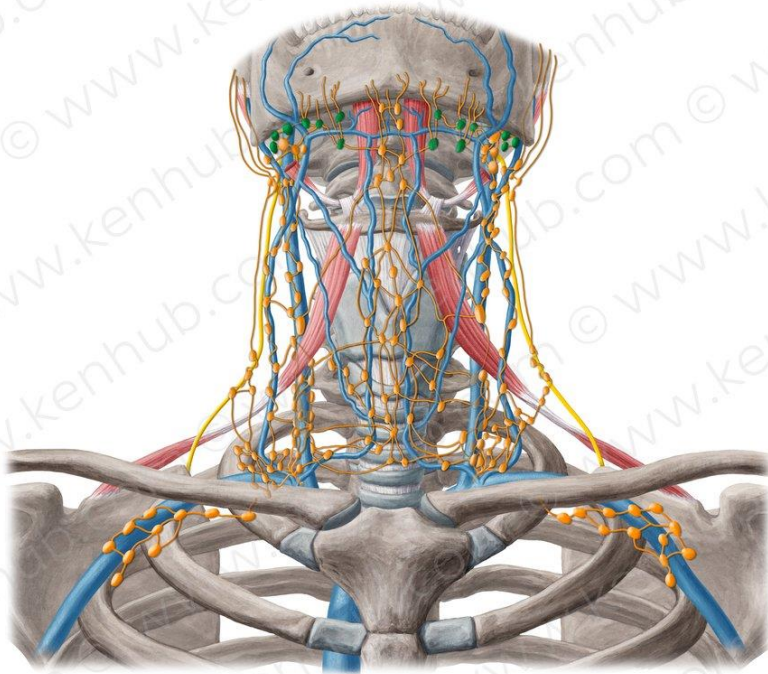
Superficial Temporal Vein



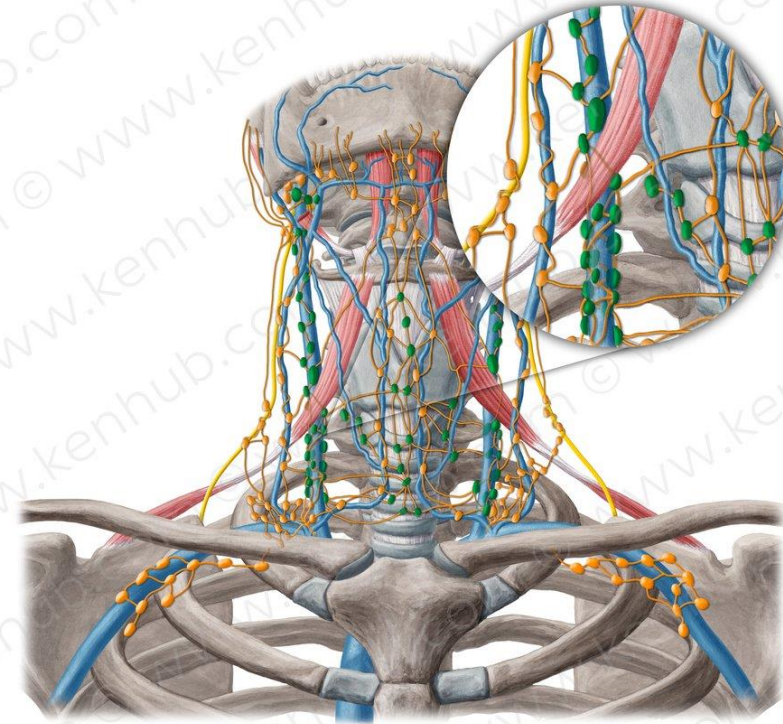
Retromandibular Vein

LYMPHATIC DRAINAGE OF THE NASAL CAVITY

- Lymph from anterior regions drains onto the face by passing around the margins of the nares
- These lymphatics connect with the **submandibular nodes**
- **Lymph from upper and posterior regions drain into retropharyngeal lymph nodes which in turn drain into the deep cervical lymph nodes which are located around the internal jugular vein.**



Submandibular nodes

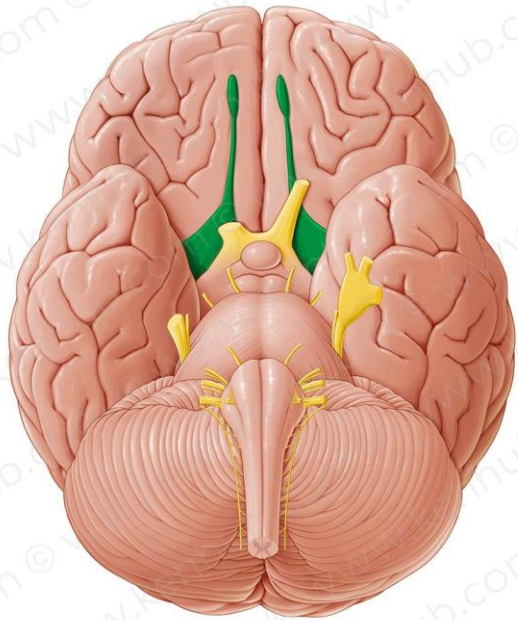


Deep cervical nodes

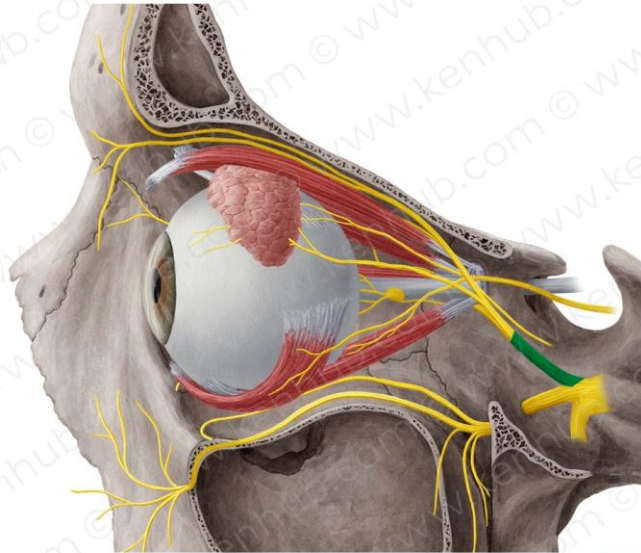
INNERVATION OF THE NASAL CAVITY

Nerves that innervate the nasal cavity include

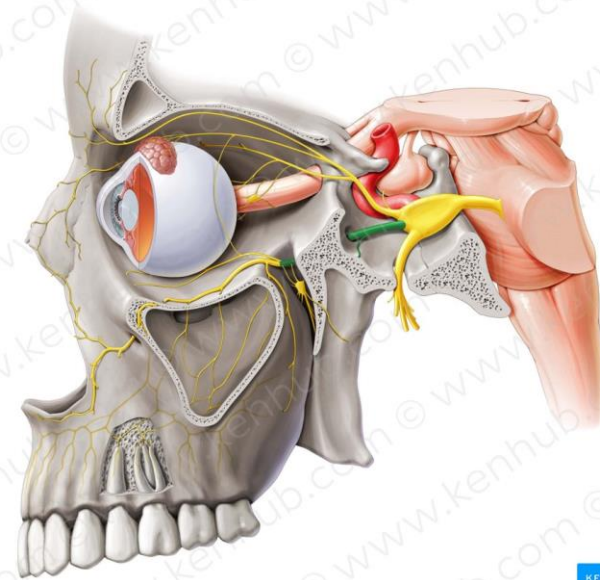
1. The olfactory nerve (CN I) for olfaction (special sensation)
2. Branches of the ophthalmic (CN V₁) and maxillary (CN V₂) nerves for general sensation
3. Parasympathetic fibers from the facial nerve (CN VII), Secretomotor innervations of mucous glands



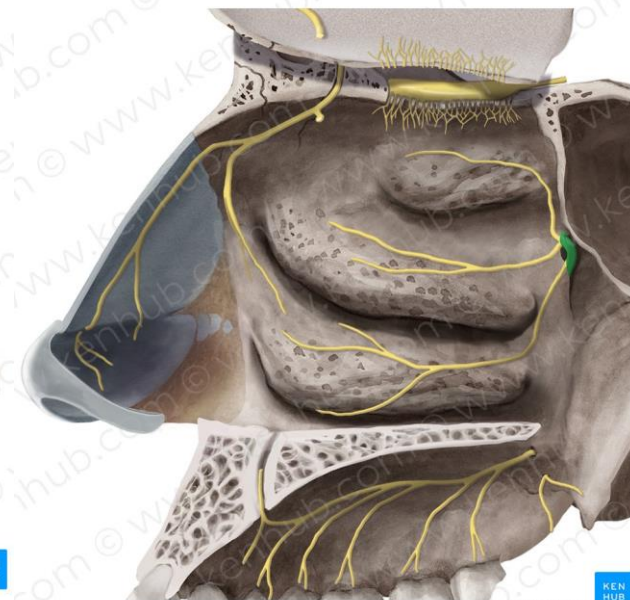
The Olfactory Nerve



The Ophthalmic Nerve



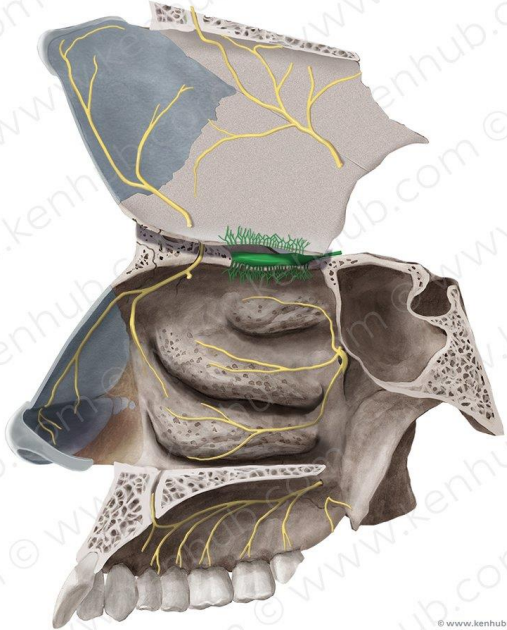
The Maxillary Nerve



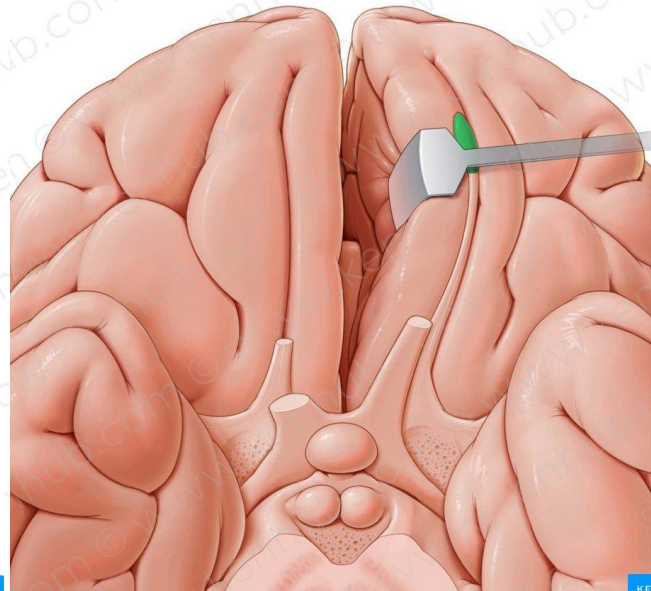
The Pterygopalatine Ganglion,
in which the preganglionic
fibers of the facial nerve
synapse

INNERVATION OF THE NASAL CAVITY: THE OLFACTORY NERVE (CN I)

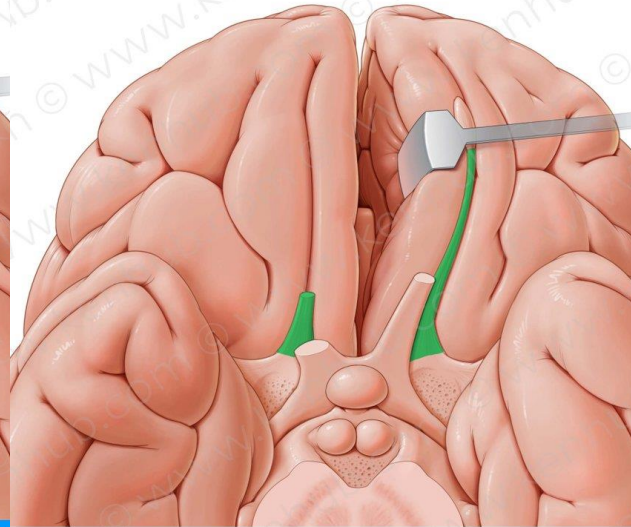
- The olfactory nerve is composed of axons from receptors in the olfactory epithelium at the top of each nasal cavity
- Pass superiorly through the cribriform plate to synapse with the olfactory bulb of the brain.
- The olfactory bulb is then connected to the olfactory tract, which transmit impulses from the olfactory bulb from to the primary olfactory cortex of the brain, which resides in the temporal lobe.



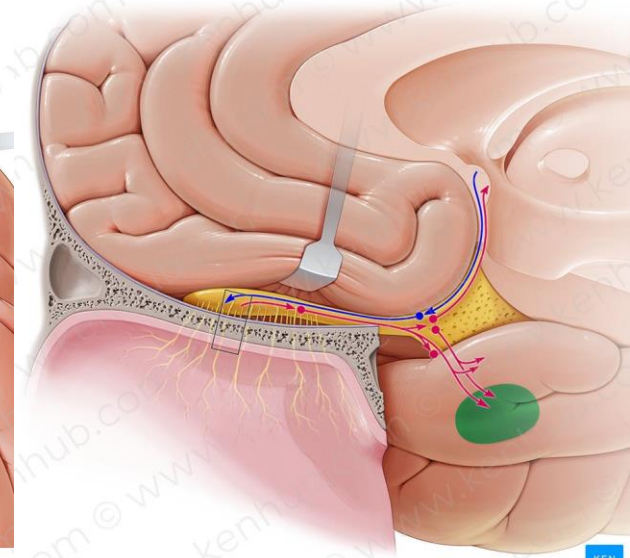
Olfactory Nerve



Olfactory Bulb



Olfactory Tract

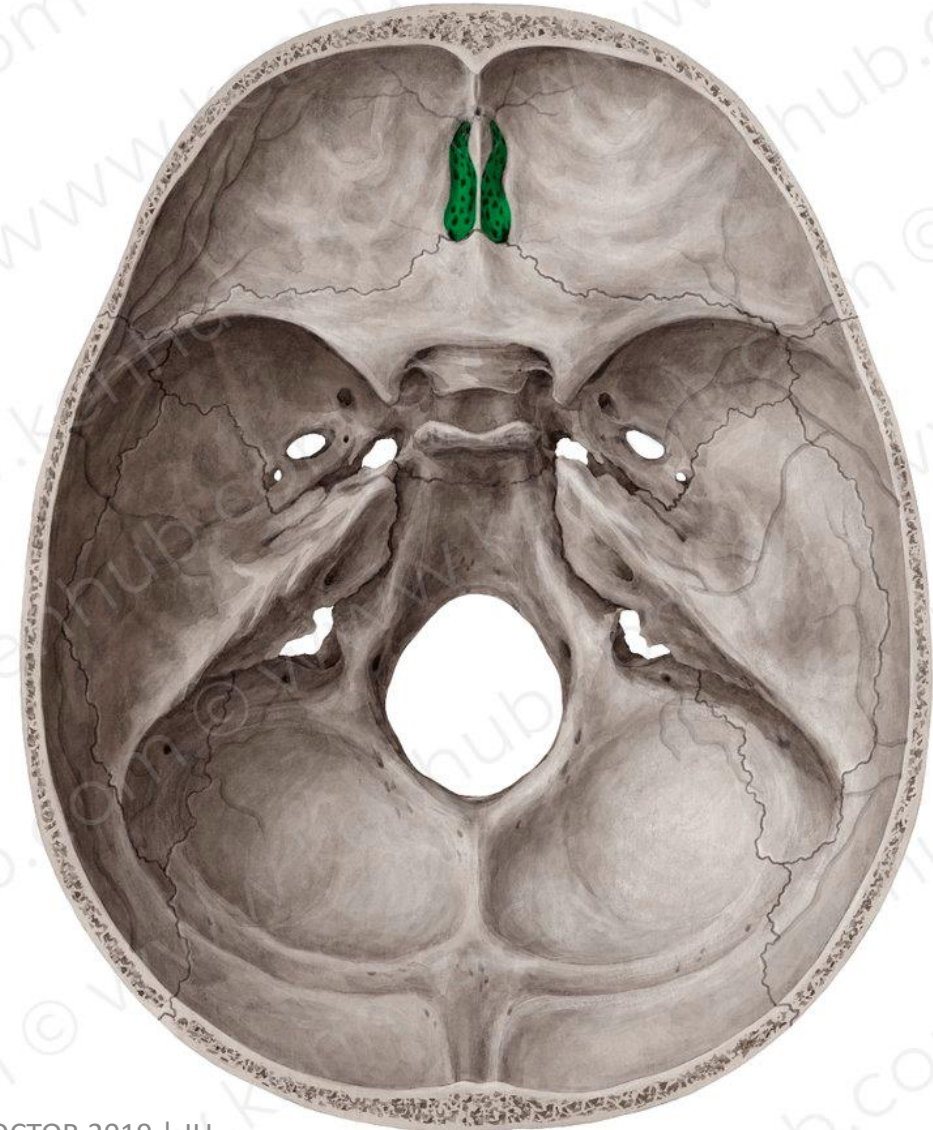


Olfactory cortex

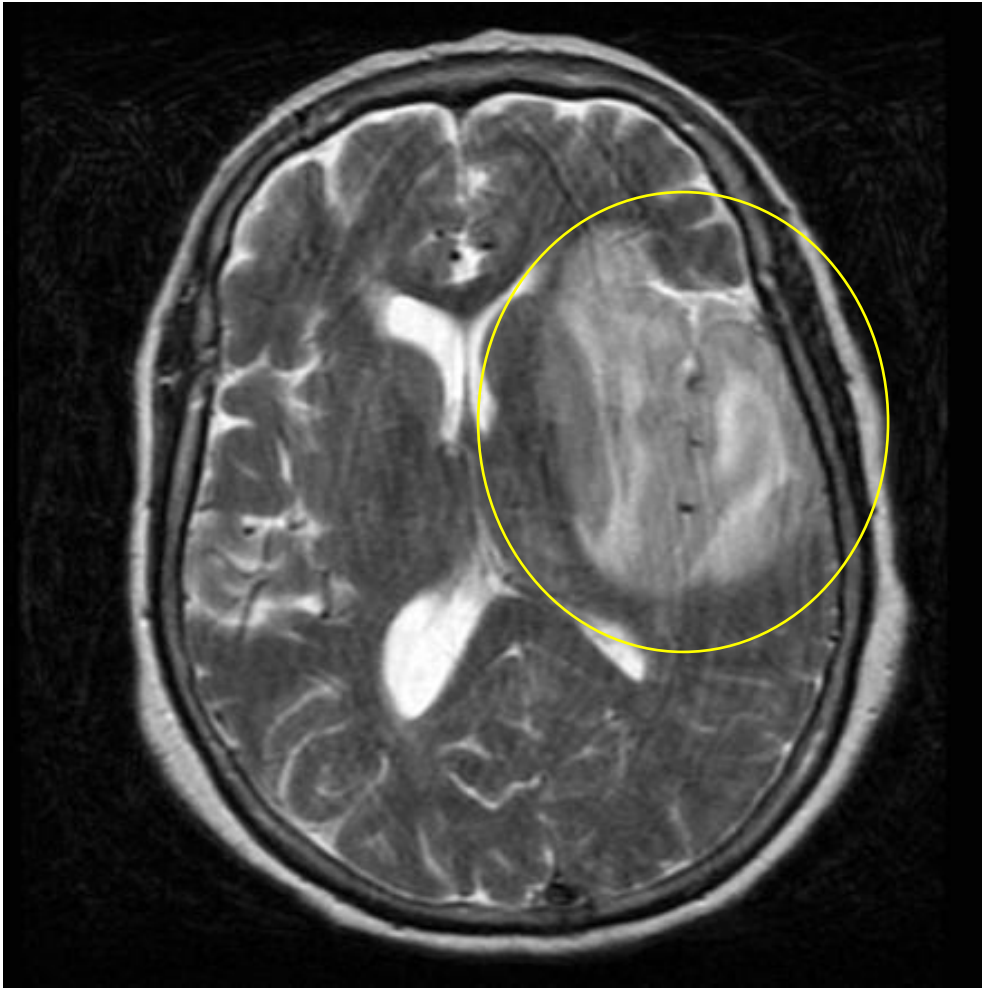
Fibers of the olfactory nerve leave the nasal cavity into the olfactory bulb by passing through the **cribriform plate** of ethmoid bone.

Additional note (not for the exam): because it links the nasal cavity to the cranial cavity, the cribriform plate is an important passage for respiratory infections to ascend and cause meningitis or encephalitis.

Additional note (not for the exam): trauma to the cribriform plate commonly results in anosmia (loss of smell), but if you have anosmia, please check if you have COVID-19

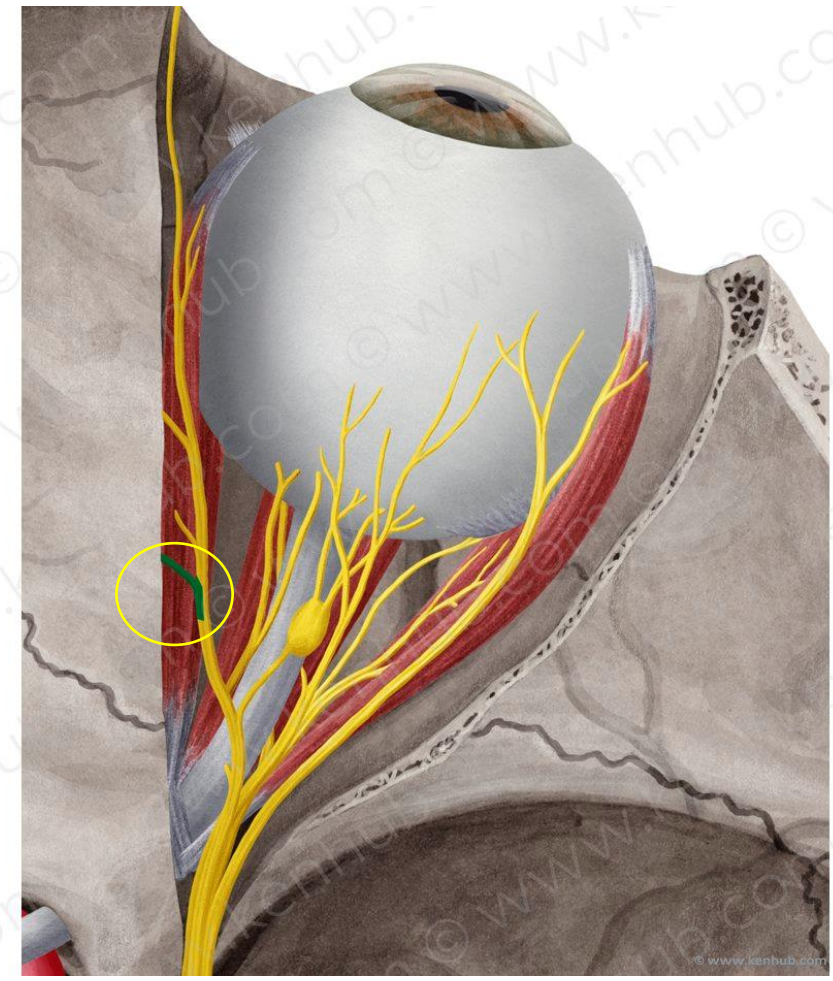
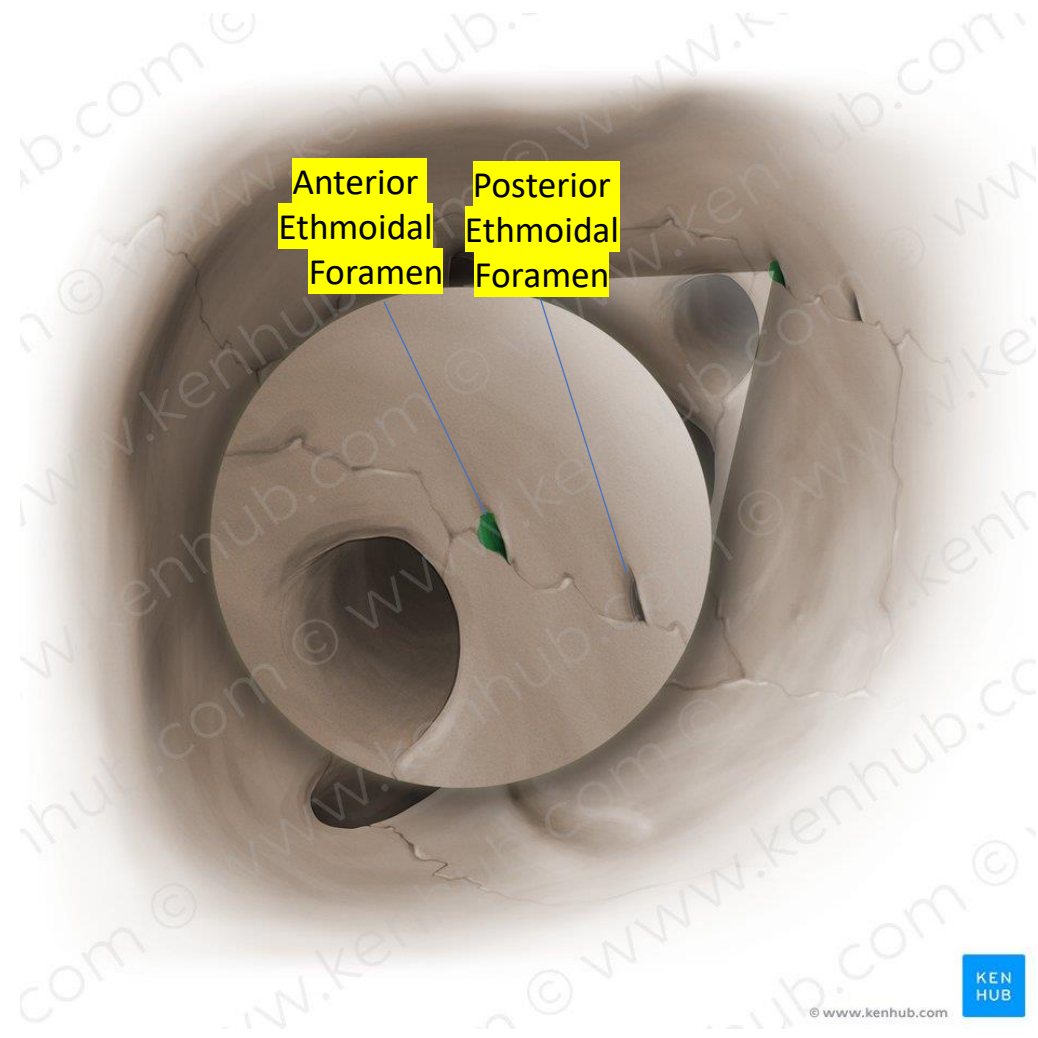


Clinical note: Encephalitis is inflammation of brain tissue, it is commonly caused by herpes simplex virus, this virus causes inflammation of the temporal lobe preferentially, it is thought that this is because this virus uses the olfactory nerve to reach the brain.



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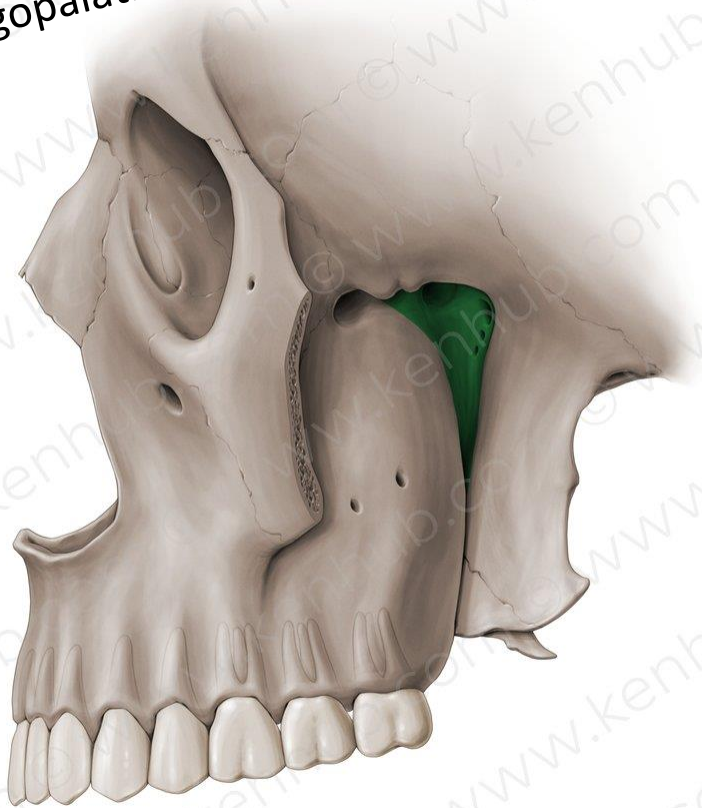
The Posterior ethmoidal nerve leaves the orbit through a canal in the medial wall of the orbit, it terminates by supplying the mucosa of the ethmoidal cells and sphenoidal sinus, it does not extend into the nasal cavity itself.



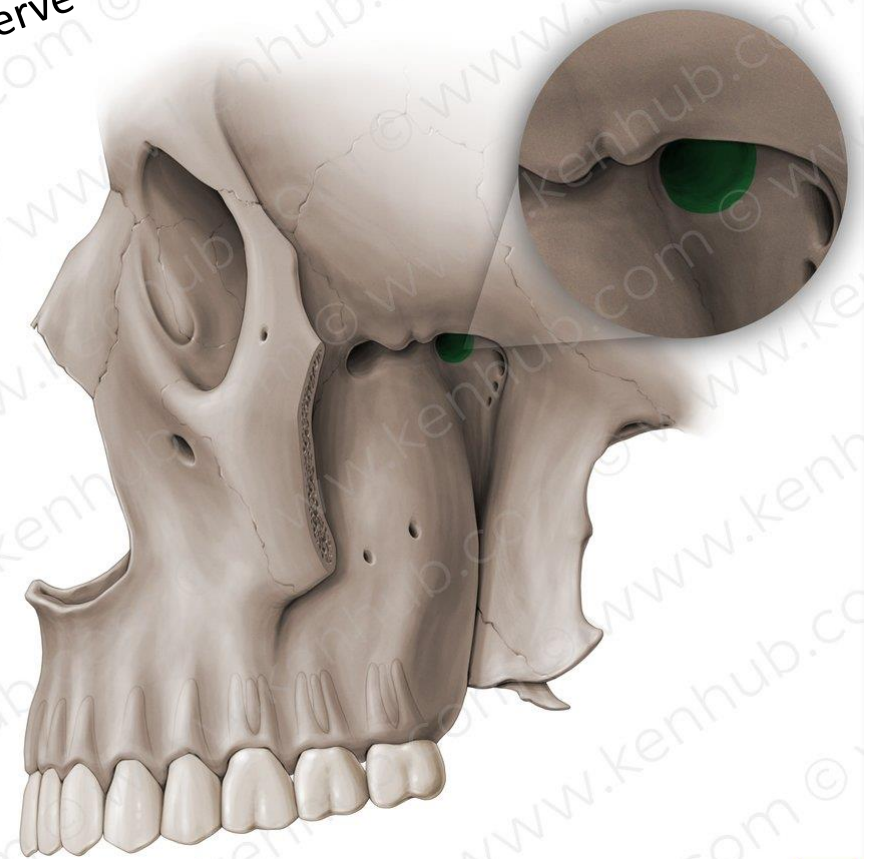
INNERVATION OF THE NASAL CAVITY: BRANCHES OF THE MAXILLARY NERVE (CN V₂)

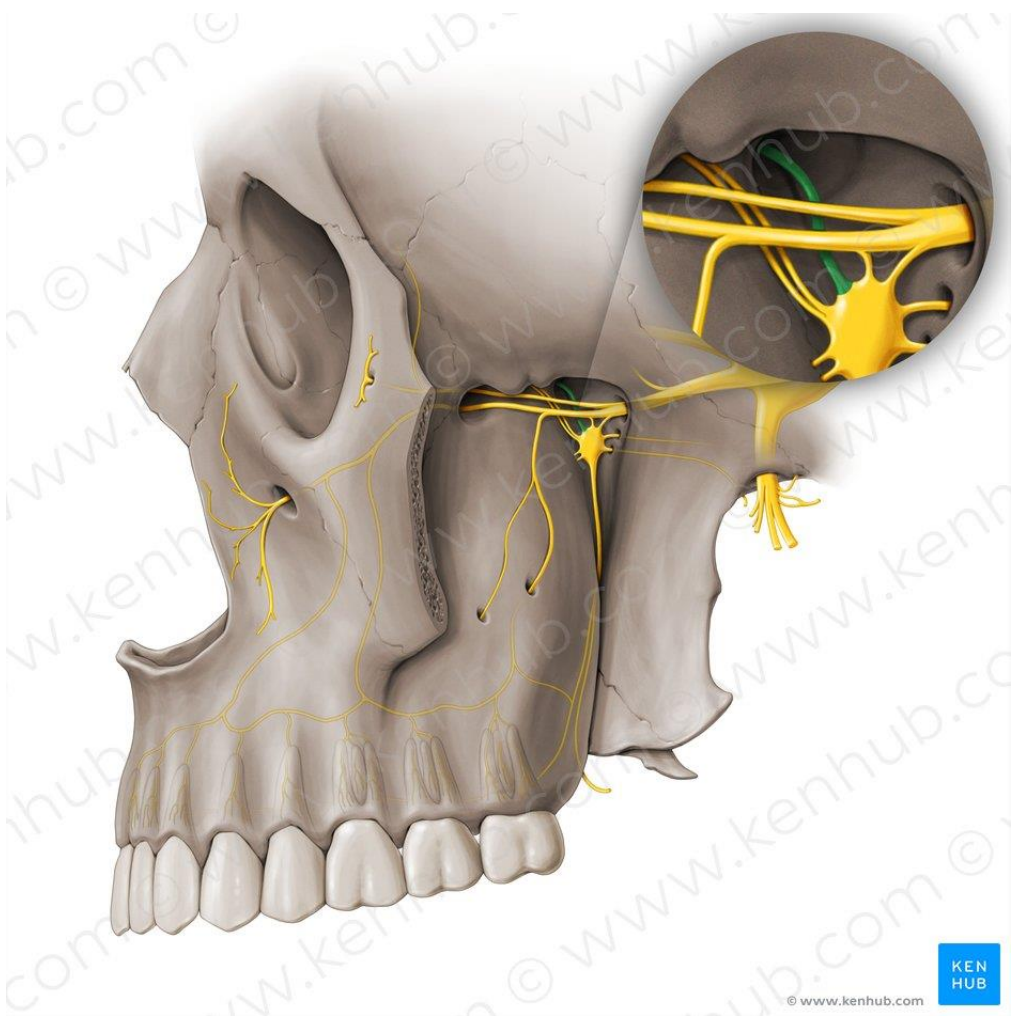
- These branches originate in the **pterygopalatine fossa** just lateral to the lateral wall of the nasal cavity, they leave the fossa to enter the nasal cavity by passing medially through the sphenopalatine foramen (just like the sphenopalatine artery)
- The Largest of these branches is the **nasopalatine nerve**, it enters the nasal cavity through the sphenopalatine foramen, then it pass through the incisive canal onto the roof of the oral cavity, and terminates by supplying the oral mucosa posterior to the incisor teeth

Pterygopalatine fossa

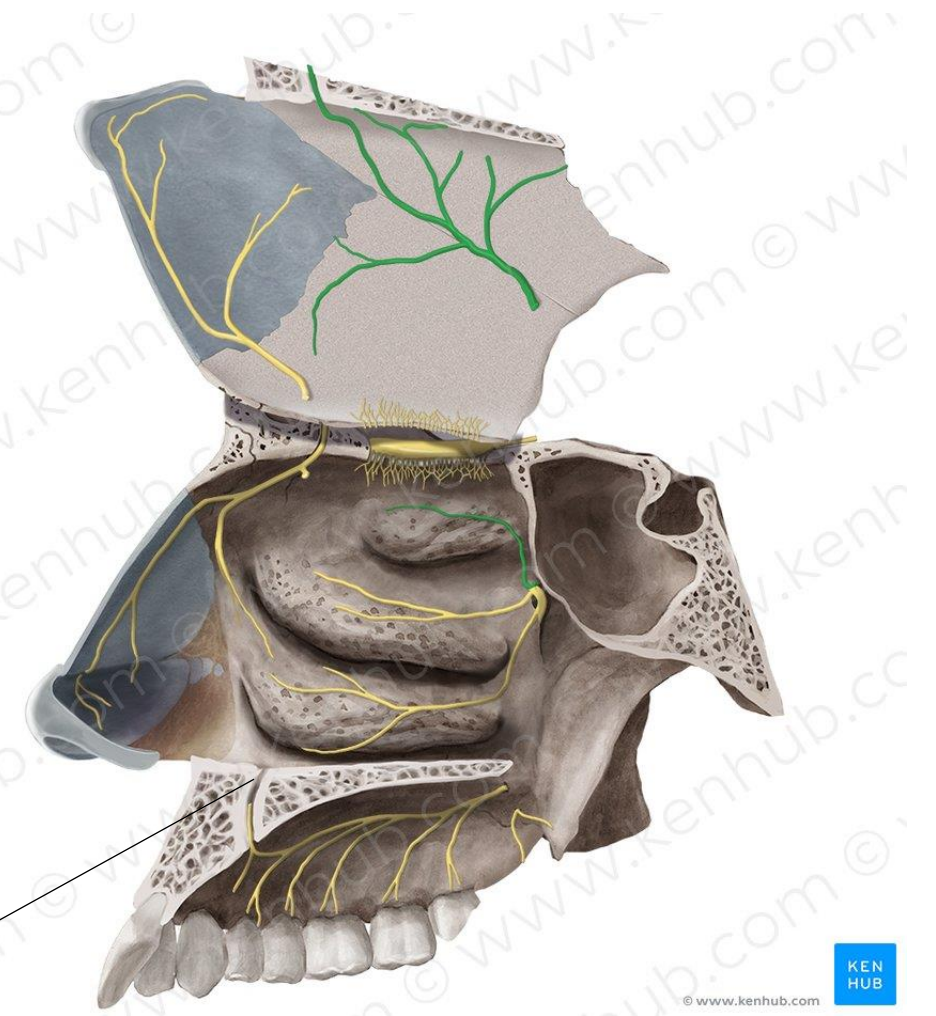


Nasopalatine Nerve





Nasopalatine Nerve

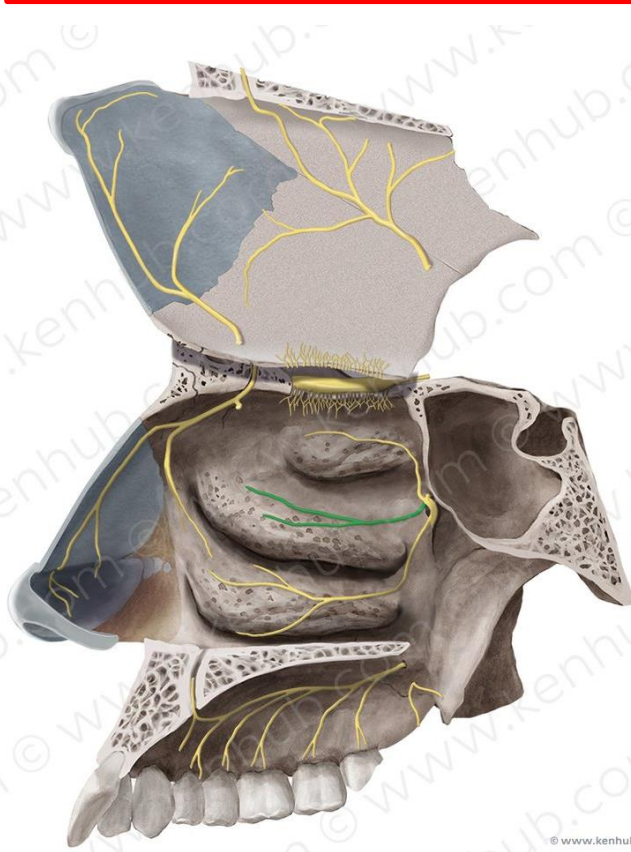


Incisive foramen

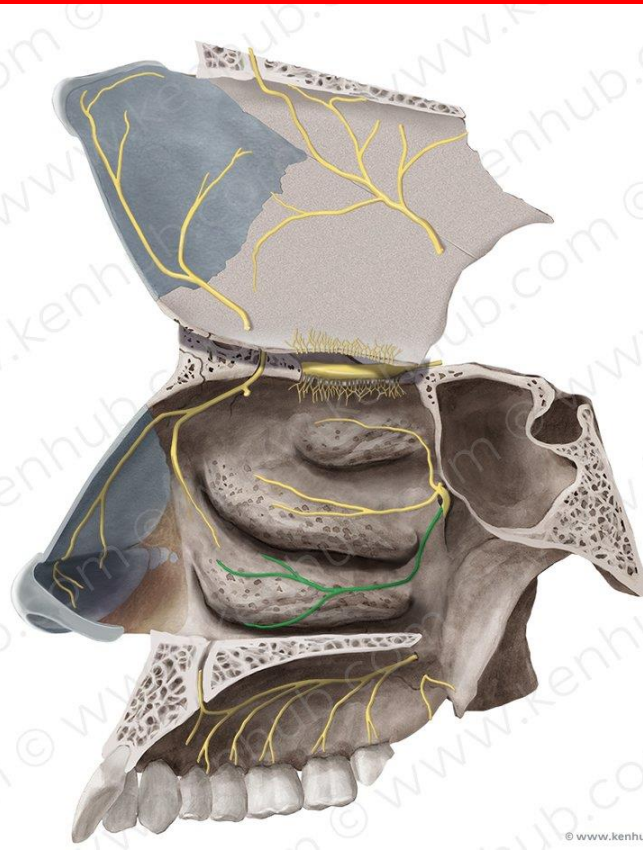
The nasopalatine nerve in the nasal cavity.

Other branches of the nasal cavity that supply the nasal cavity include:

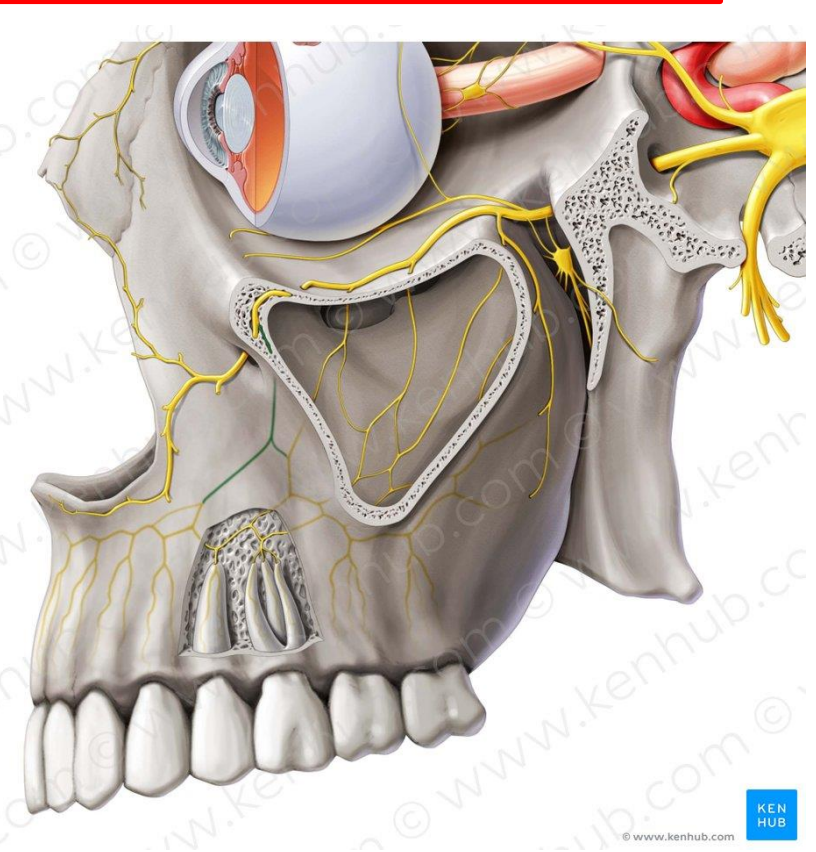
1. Posterior superior lateral nasal nerves pass forward on and supply the lateral wall of the nasal cavity;
2. Posterior superior medial nasal nerves cross the roof to the nasal septum and supply both these regions
3. Posterior inferior nasal nerves originate from the greater palatine nerve, innervate the lateral wall of the nasal cavity
4. Anterior superior alveolar branch of the infra-orbital nerve supply the lateral wall near the anterior end of the inferior concha.



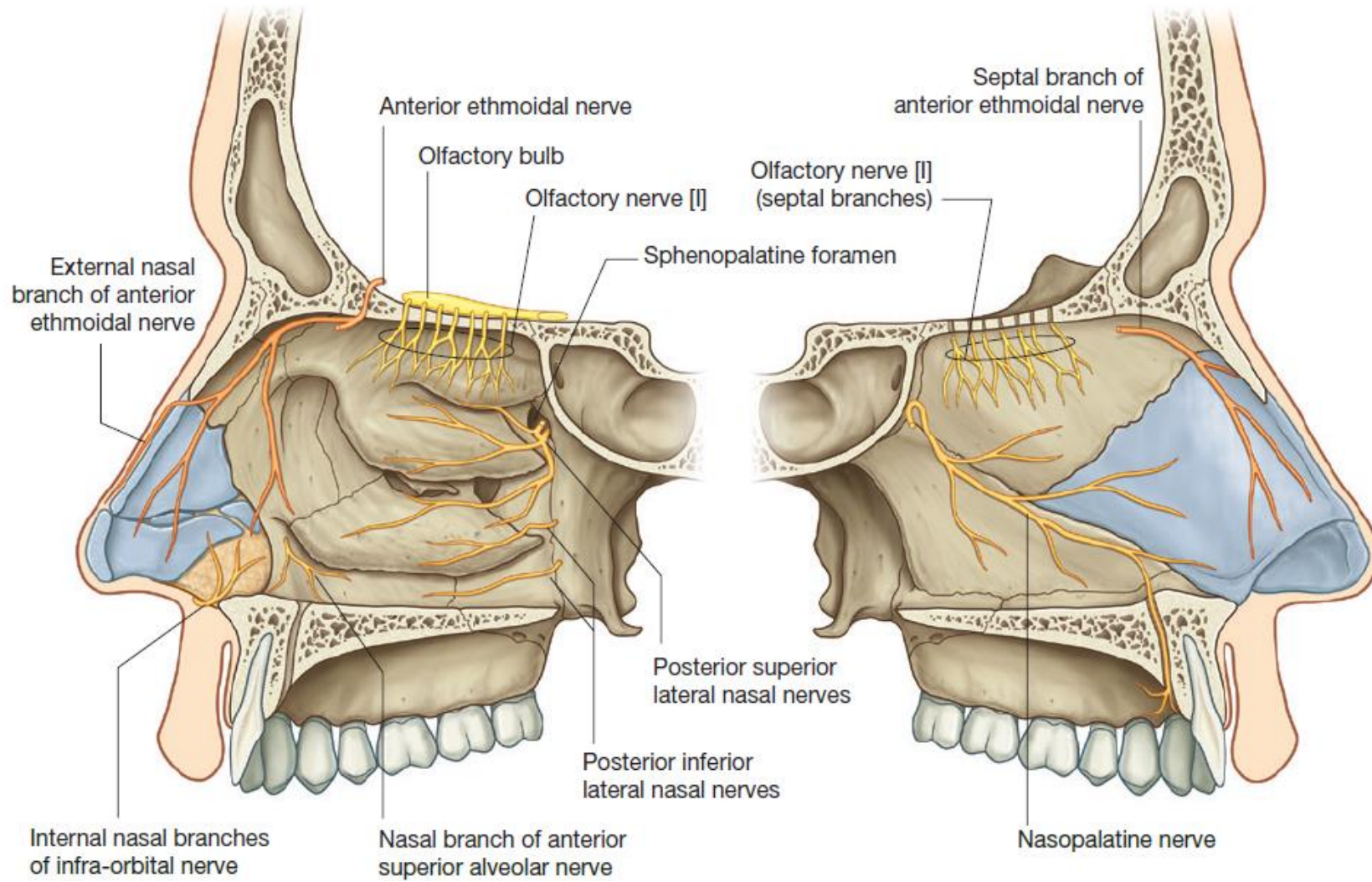
Posterior Superior Lateral Nasal Nerves



Posterior inferior Nasal Nerves



Anterior superior alveolar Nerve



This is a summary of innervation

SUMMARY OF BLOOD SUPPLY AND INNERVATION OF THE NASAL CAVITY

1. Postero-superior quadrant:

Posterior-superior lateral nerve and vessels (short sphenopalatine)

2. Postero-inferior quadrant:

Greater palatine nerve and vessels

3. Antero-superior quadrant :

Ant. Ethmoidal nerve (internal and external nerve) and artery

4. Antero-inferior quadrant :

Ant. Superior alveolar nerve and branches from the facial and greater palatine artery

5. Nasal septum:

Lower posterior part by the long sphenopalatine nerve

Upper anterior part by the septal branch of the anterior ethmoidal nerve.

Blood supply by the long sphenopalatine artery.

PARANASAL SINUSES

There are four paranasal air sinuses-the ethmoidal air cells, and the sphenoidal, maxillary, and frontal sinuses

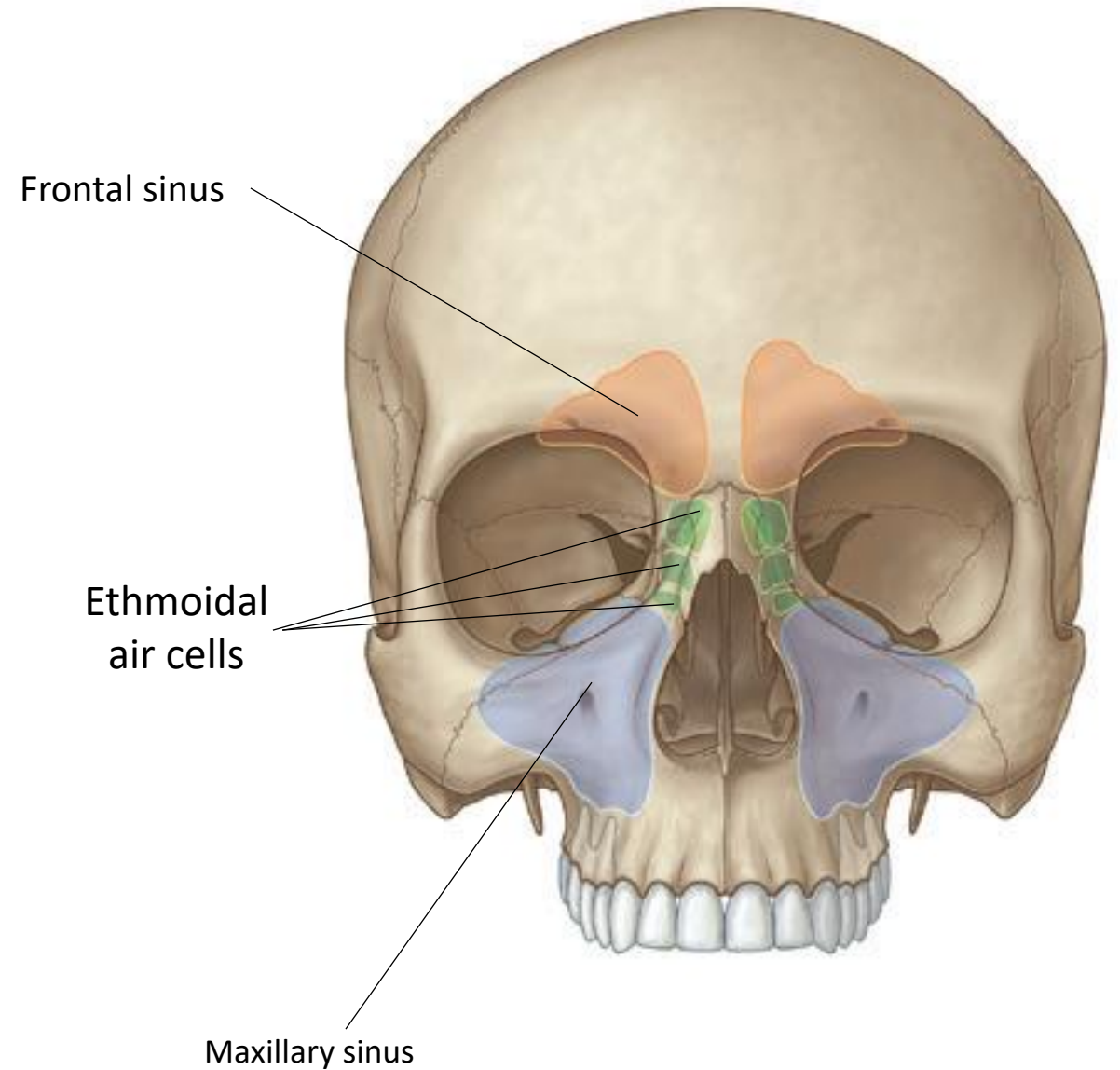
All are:

- lined by respiratory mucosa, which is ciliated and mucus secreting;
- open into the nasal cavities;
- innervated by branches of the trigeminal nerve [V].

(so a paranasal sinus is a cavity within the bones of the face that is connected to the nasal cavity).

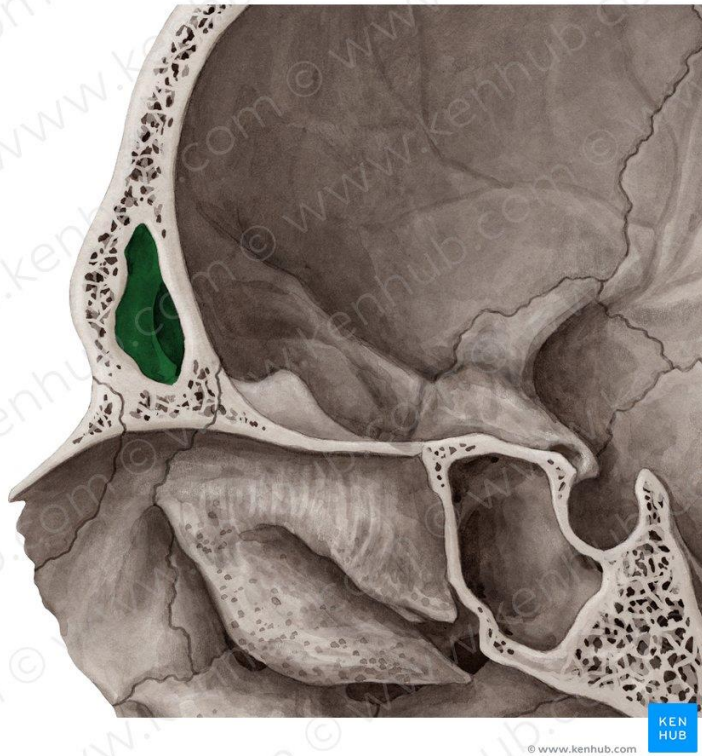
Functions of paranasal sinuses:

1. Resonance of the voice
2. Decrease the weight of the skull
3. Protection

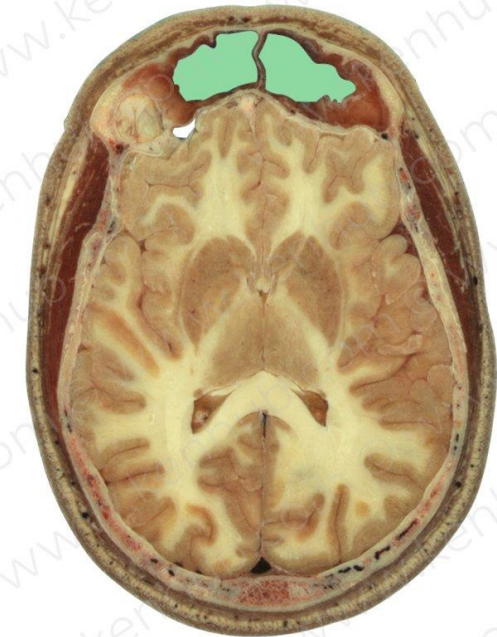
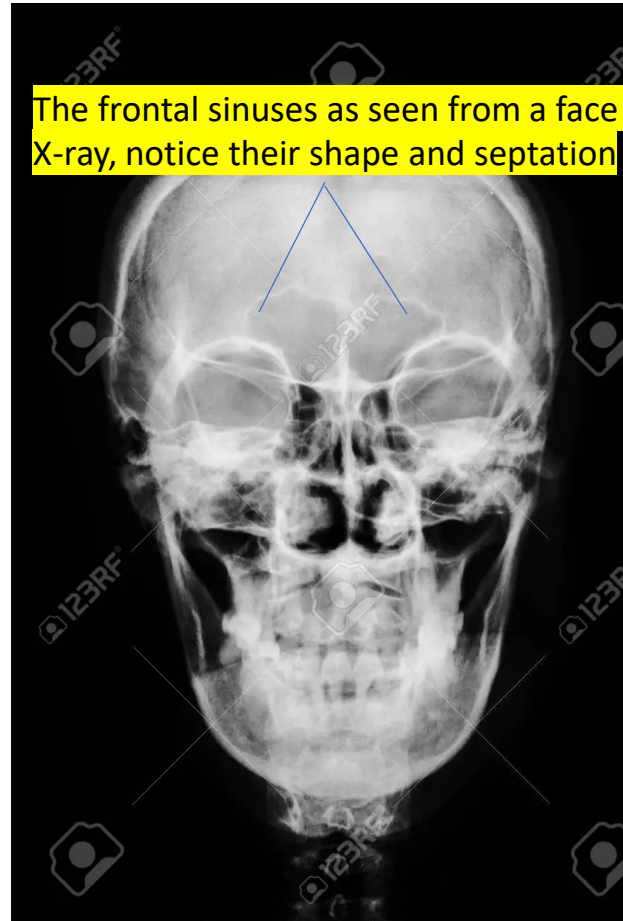


THE FRONTAL SINUS

We have one frontal sinus on each side, they are separated by a septum.
The frontal sinuses are triangular in shape and are located in the part of the frontal bone under the forehead.

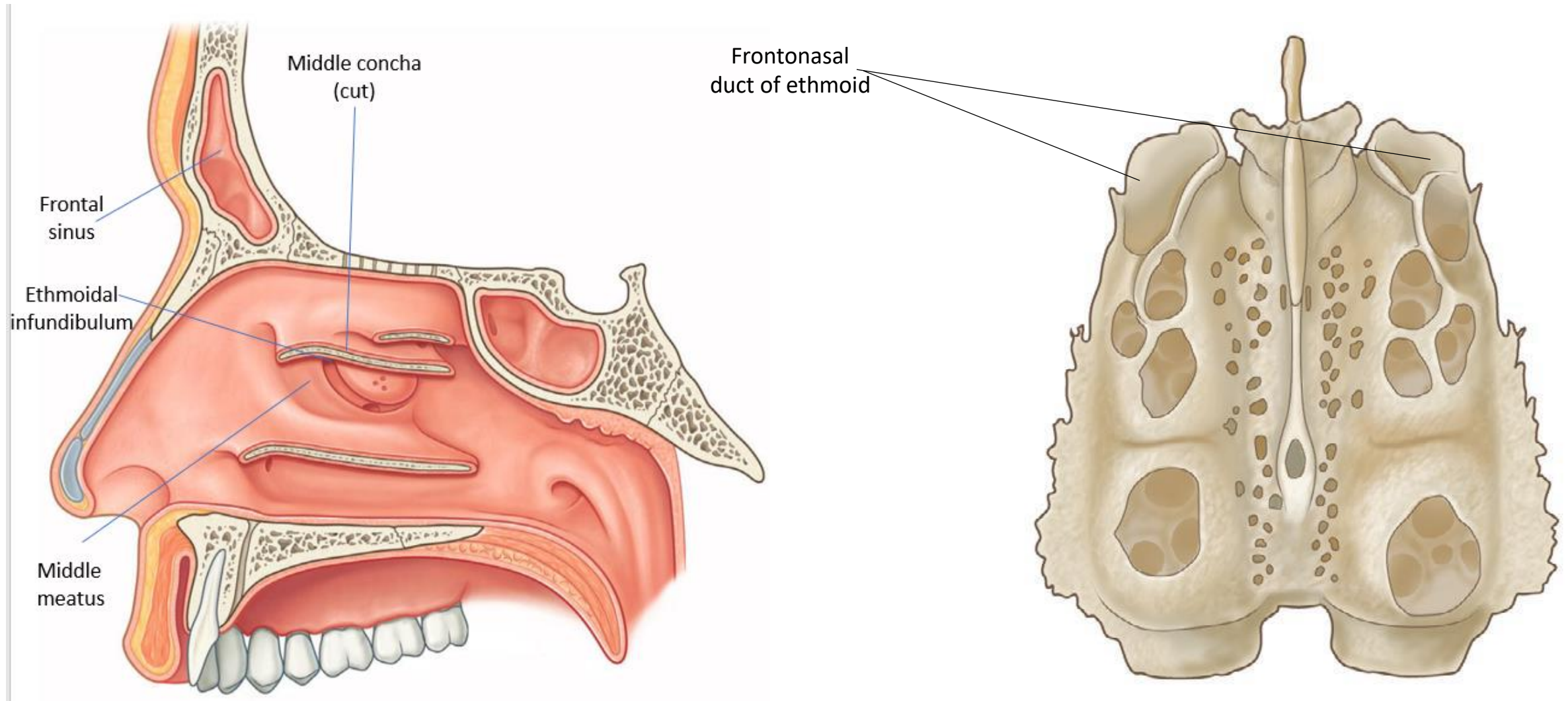


The right frontal nasal, parasagittal view.

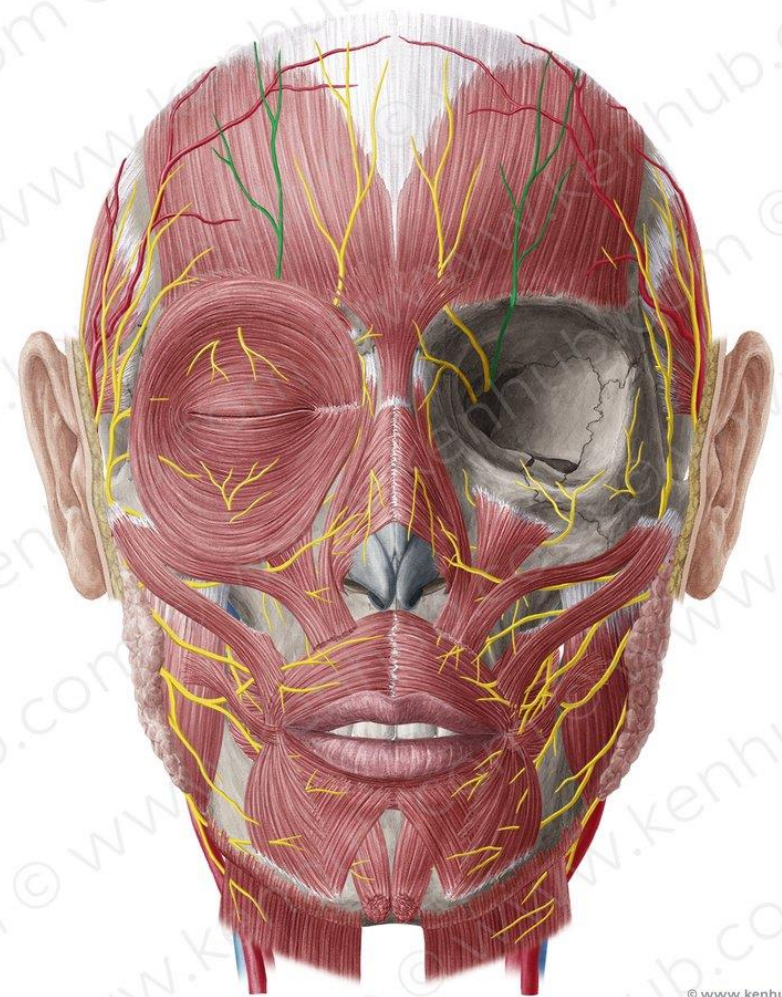
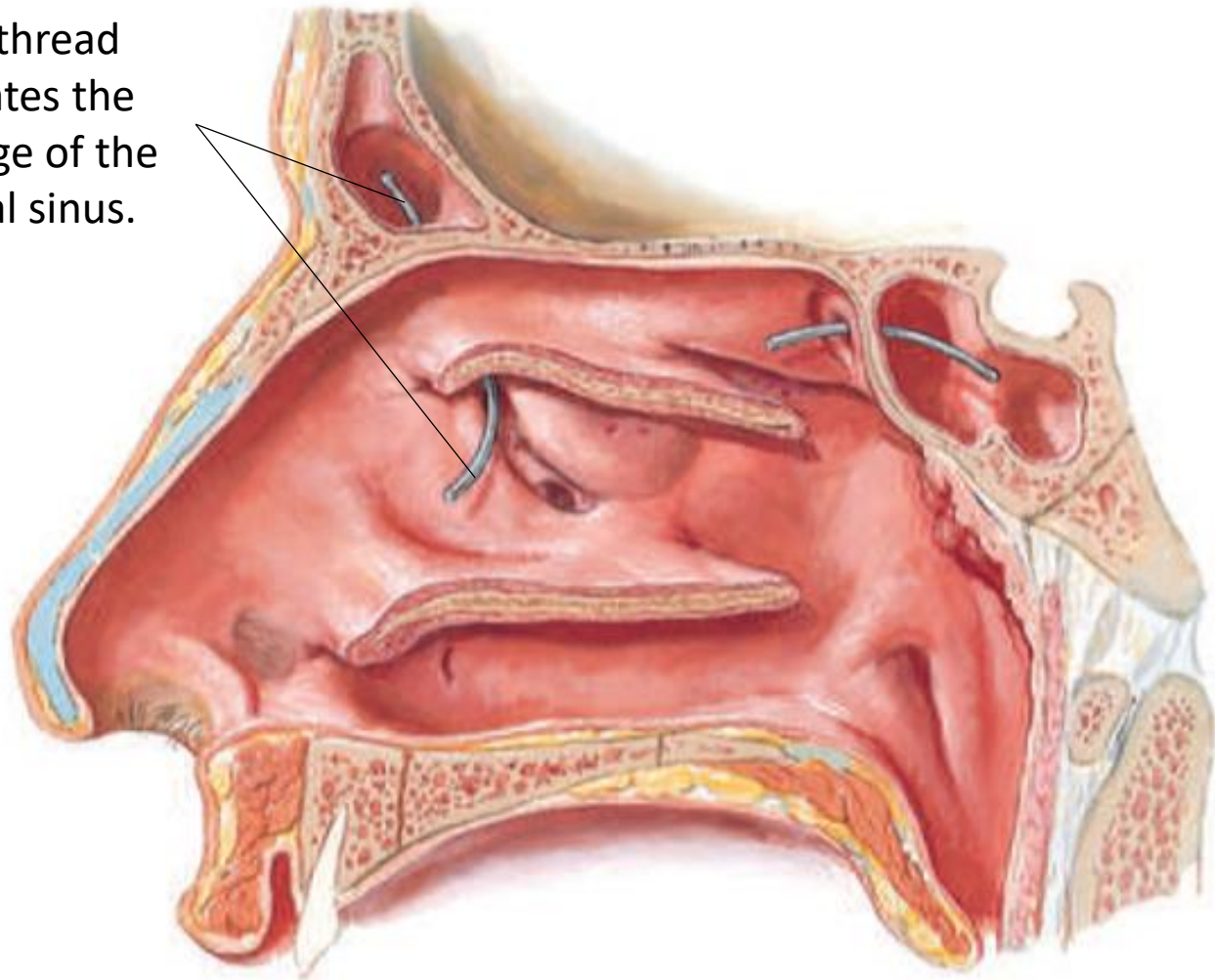


Again here, they are viewed from a transverse section.

The frontal sinuses drain onto the lateral wall of the middle nasal meatus via the frontonasal duct, which continues as the ethmoidal infundibulum.



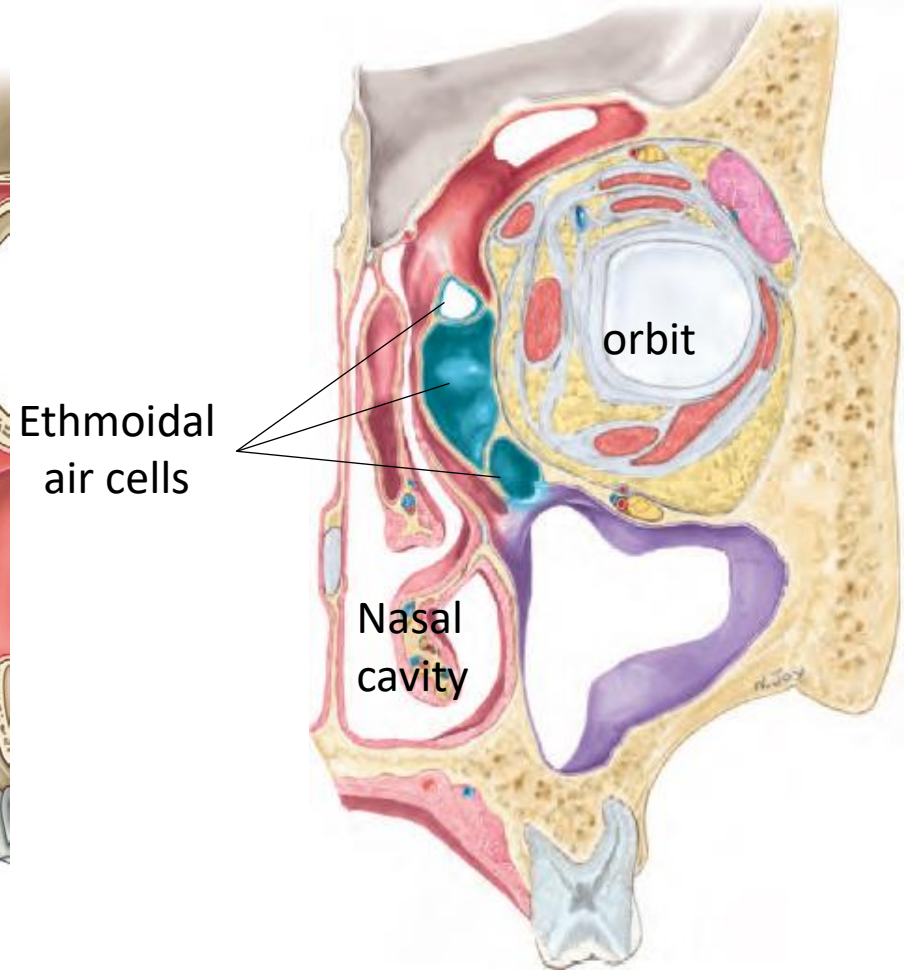
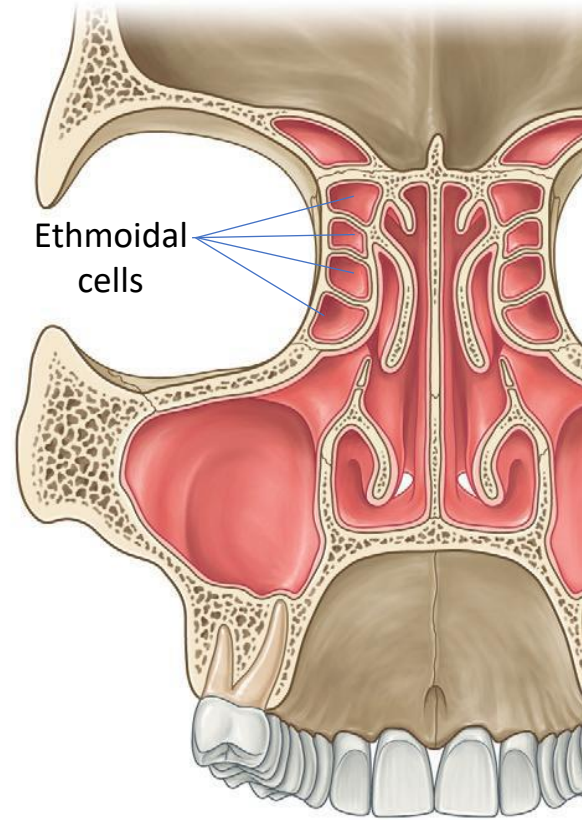
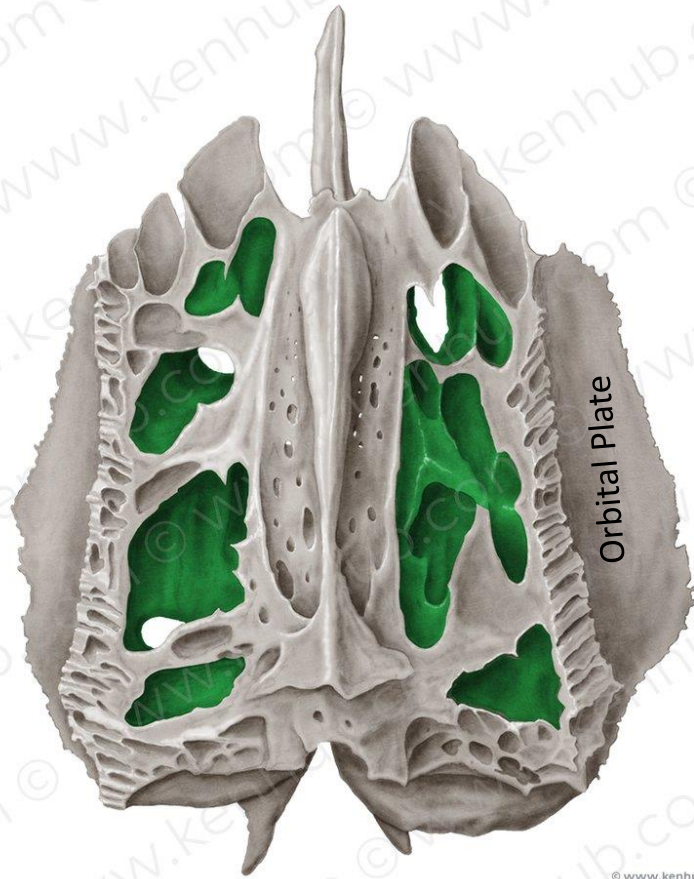
This thread indicates the drainage of the frontal sinus.



The frontal sinuses are innervated by branches of the supraorbital branch of the frontal branch of the ophthalmic division of the trigeminal nerve.

THE ETHMOIDAL AIR CELLS

These are multiple air sinuses located within the ethmoidal labyrinths, each cluster of cells is separated from the orbit by the thin orbital plate of the ethmoidal labyrinth, they are divided into anterior, middle and posterior air sinuses according to their site of drainage.



The anterior ethmoidal cells open into the ethmoidal infundibulum or the frontonasal duct;

The middle ethmoidal cells open onto the ethmoidal bulla

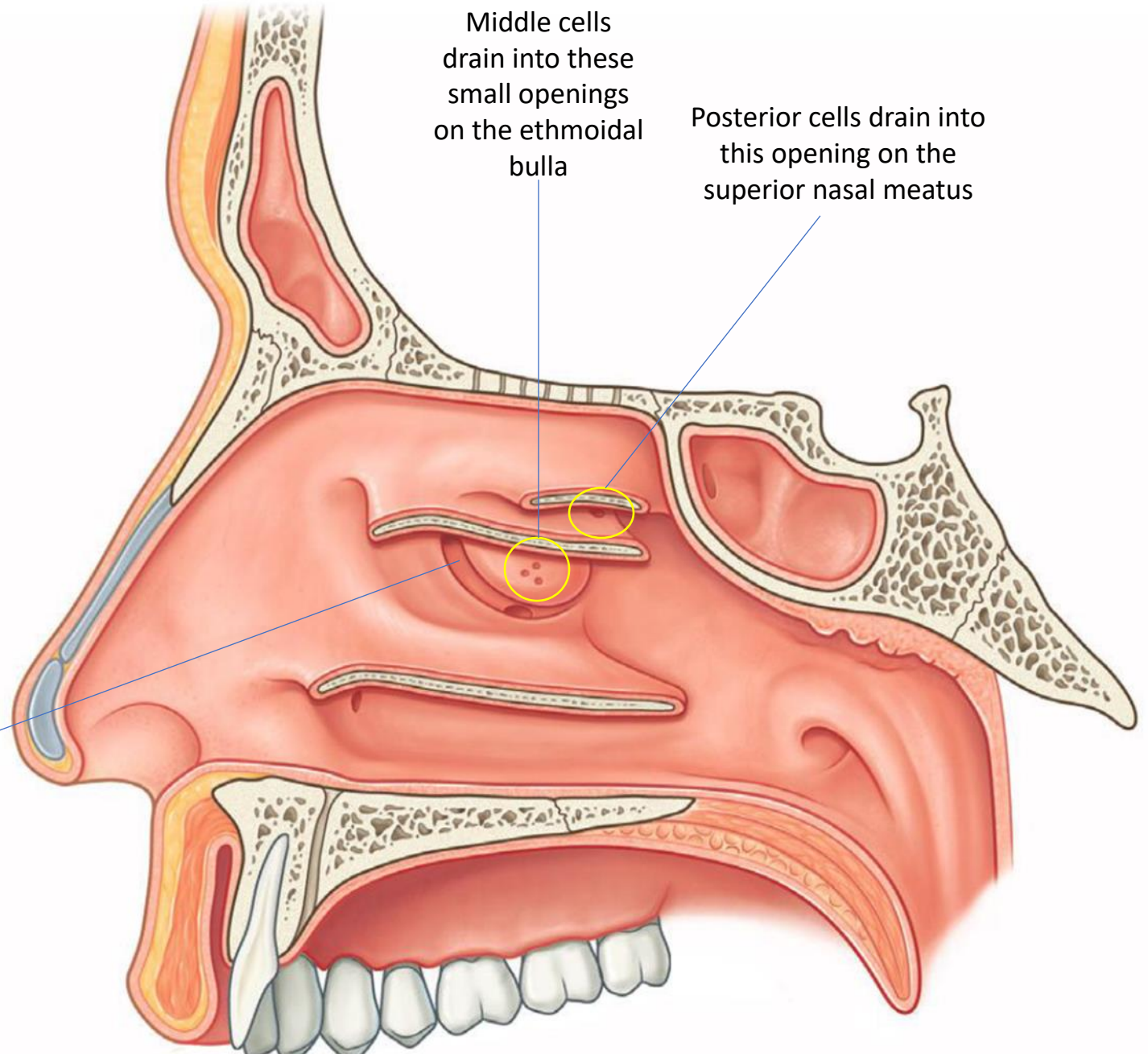
The posterior ethmoidal cells open onto the lateral wall of the superior nasal meatus.

All the ethmoidal air cells innervated by the **anterior** and **posterior ethmoidal branches** of the nasociliary nerve from the ophthalmic nerve (which we've seen previously)

Anterior cells drain into the infundibulum along with the frontal sinus

Middle cells drain into these small openings on the ethmoidal bulla

Posterior cells drain into this opening on the superior nasal meatus

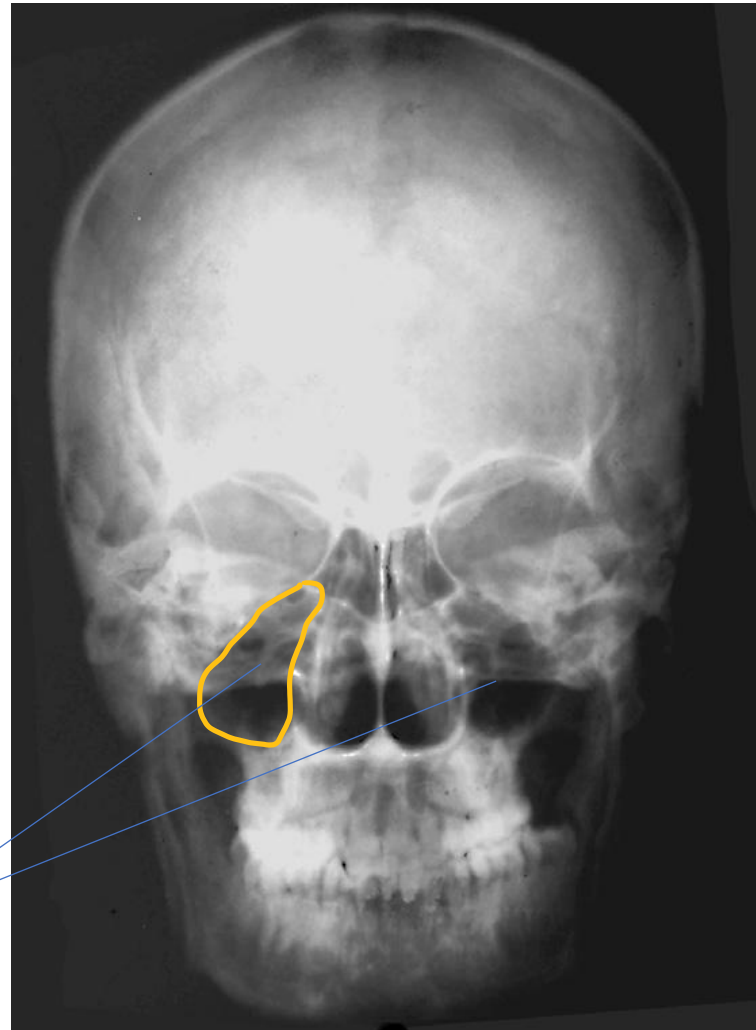


MAXILLARY SINUSES

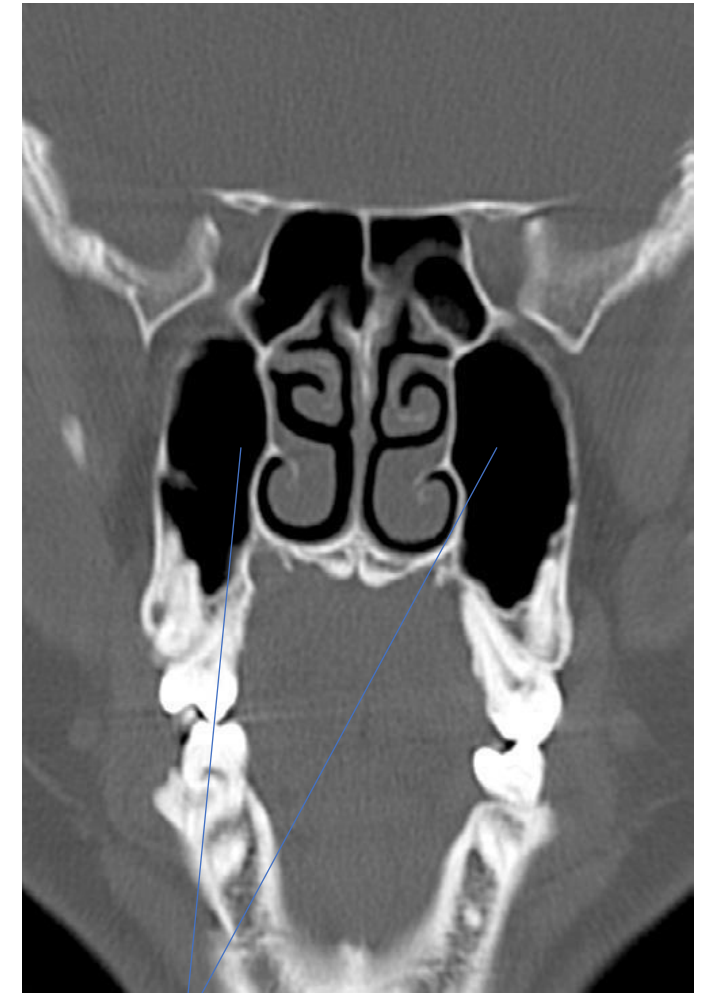
The maxillary sinuses are the largest of the paranasal sinuses and completely fill the bodies of the maxillae, they are pyramidal in shape with their apex directed laterally and their base deep to the lateral wall of the adjacent nasal cavity



Maxillary sinuses

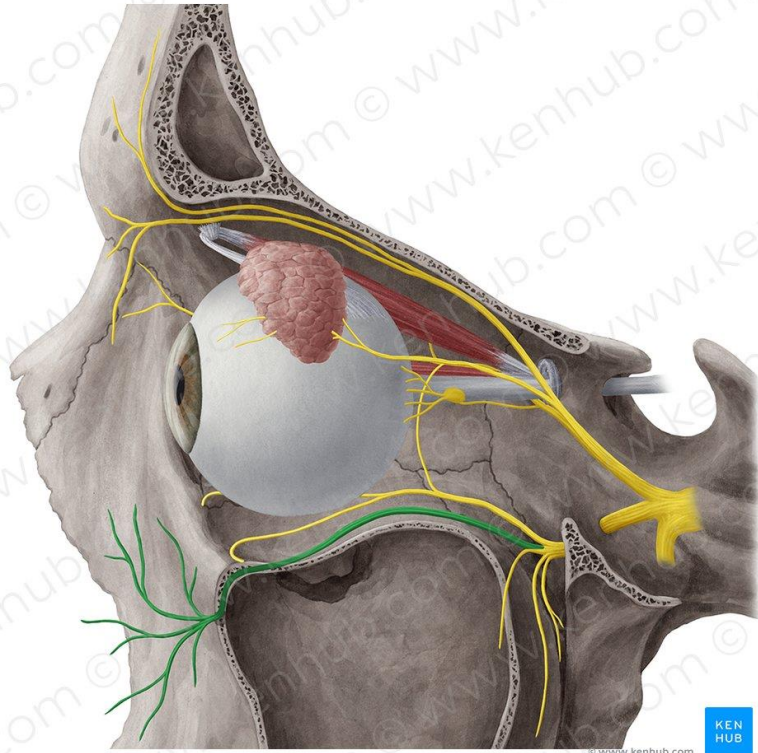


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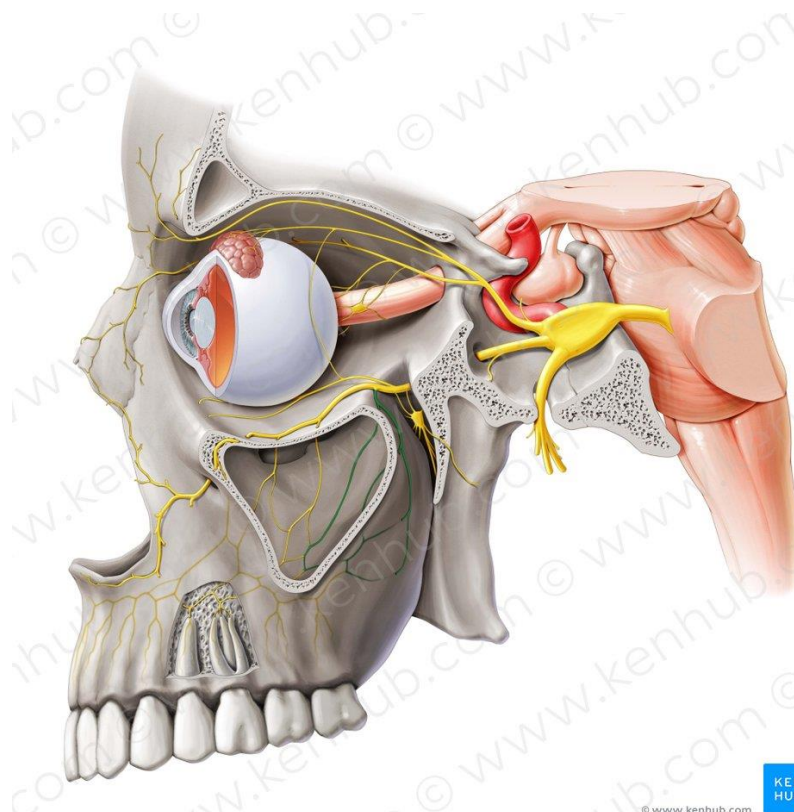


As seen from a CT scan.

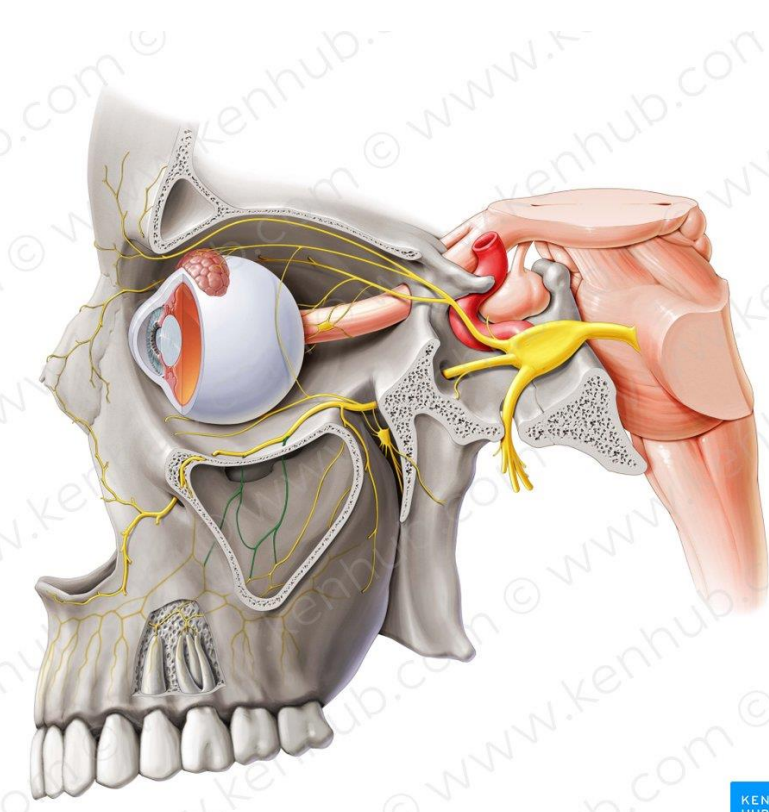
The maxillary sinuses are innervated by infra-orbital and alveolar branches of the maxillary nerve (CN V₂)



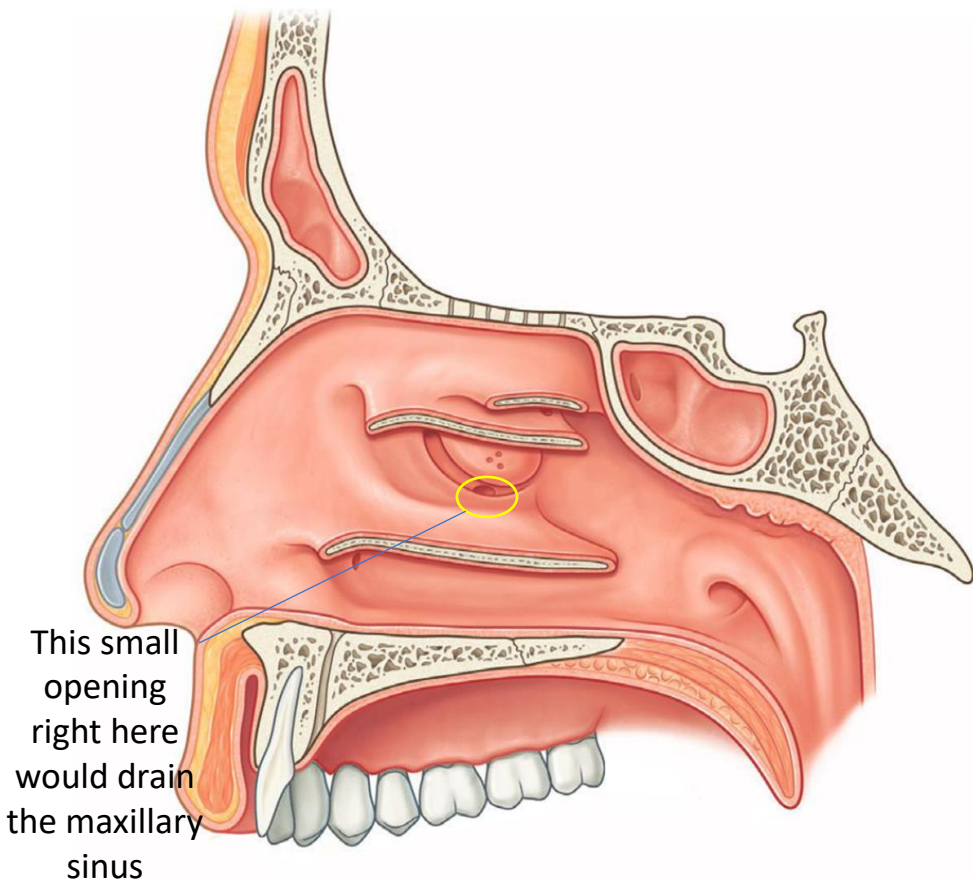
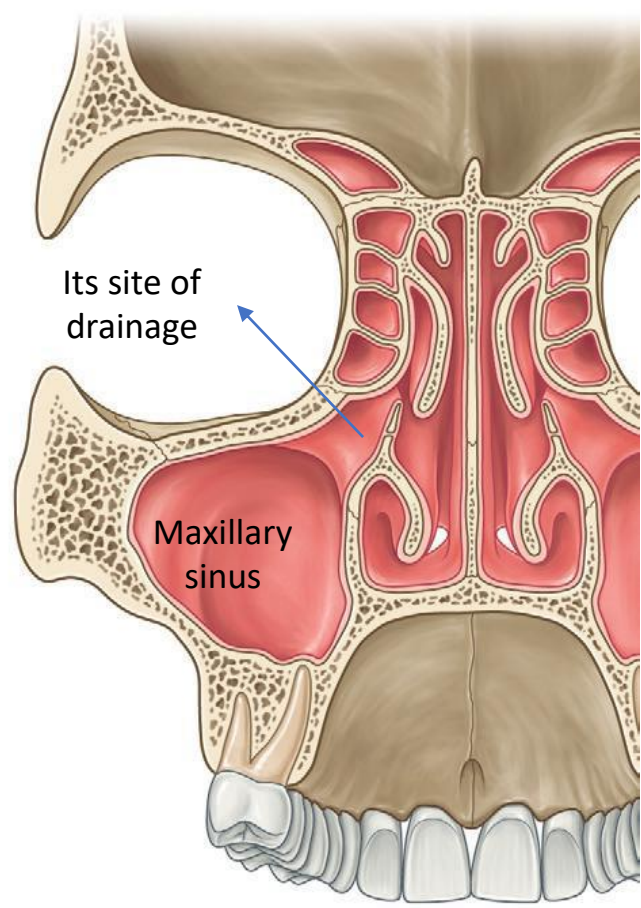
Infraorbital nerve



Alveolar branches of the maxillary nerve

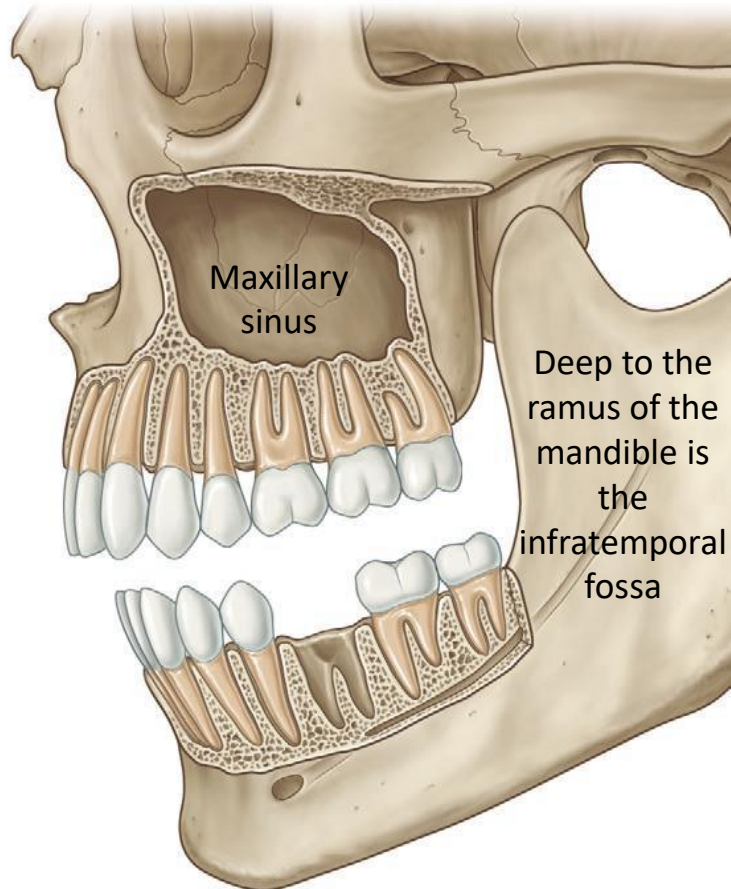


The maxillary sinus drains in the middle nasal meatus through hiatus semilunaris (this is too high up, so the drainage of the maxillary sinus is especially bad, that's why it is the most vulnerable to inflammations, because the site of drainage is high up, prostration **السجود** would enhance the drainage, that's why the facial pain of sinusitis would increase upon prostration.

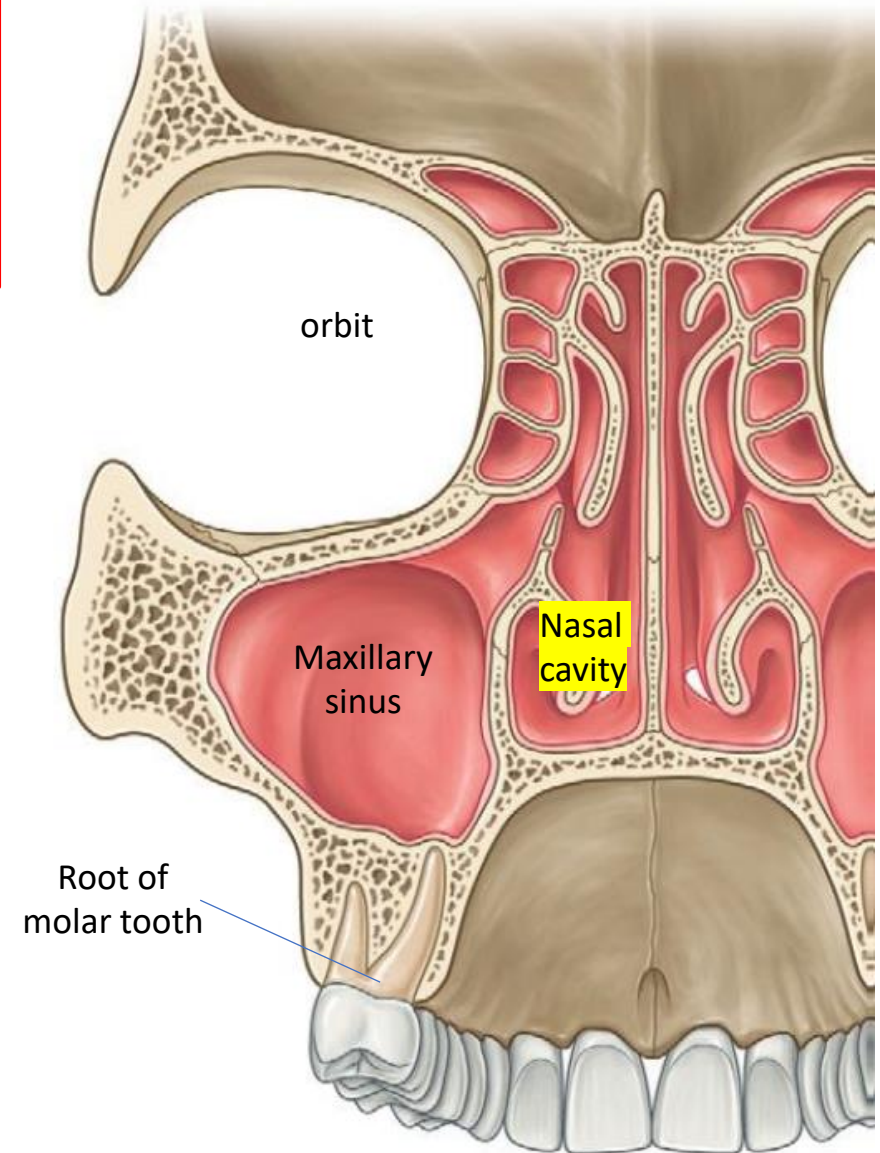


Relations of the maxillary sinus :

- Related above to the orbit.
- Related below to the roots of the upper molar and premolar teeth.
- Related behind to the infratemporal fossa.
- Related medially to the lower part of the nasal cavity.



Note: due to the close relation between the maxillary sinus and the molar teeth, a dental extraction might result in formation of a fistula between the socket of the tooth and the maxillary sinus, which might result in sinusitis.



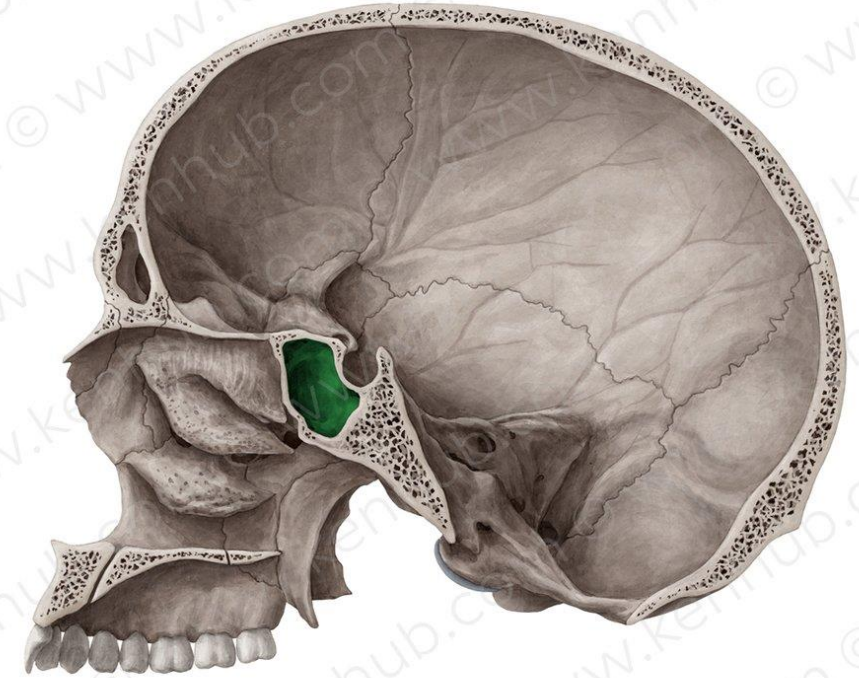
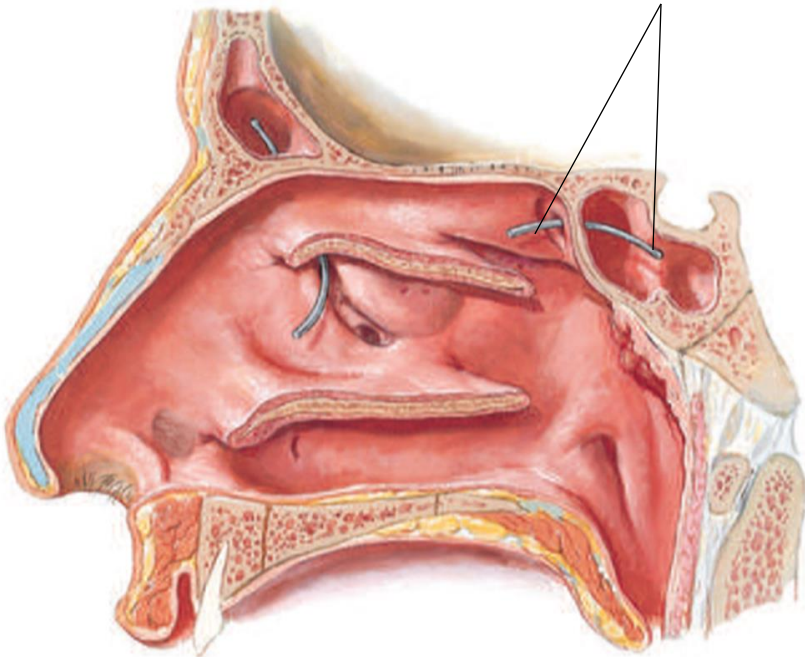
SPHENOIDAL SINUS

- It is located within the body of the sphenoid
- It opens into the roof of the nasal cavity on the wall of the sphenoidal recess

Innervation :

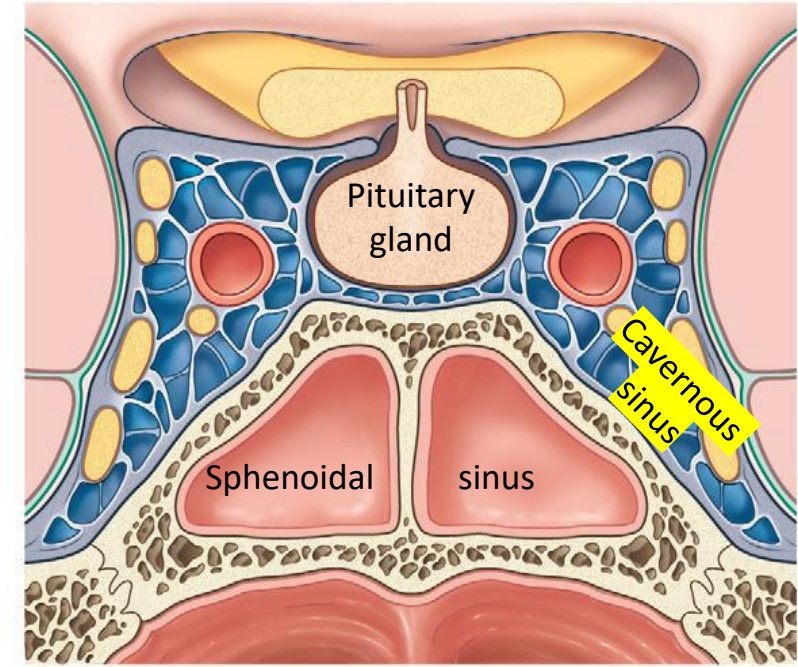
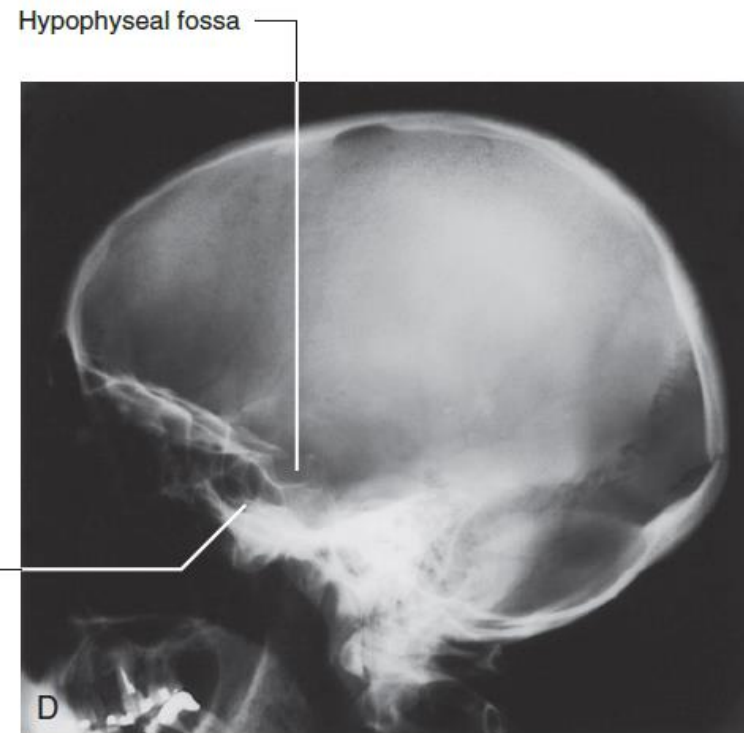
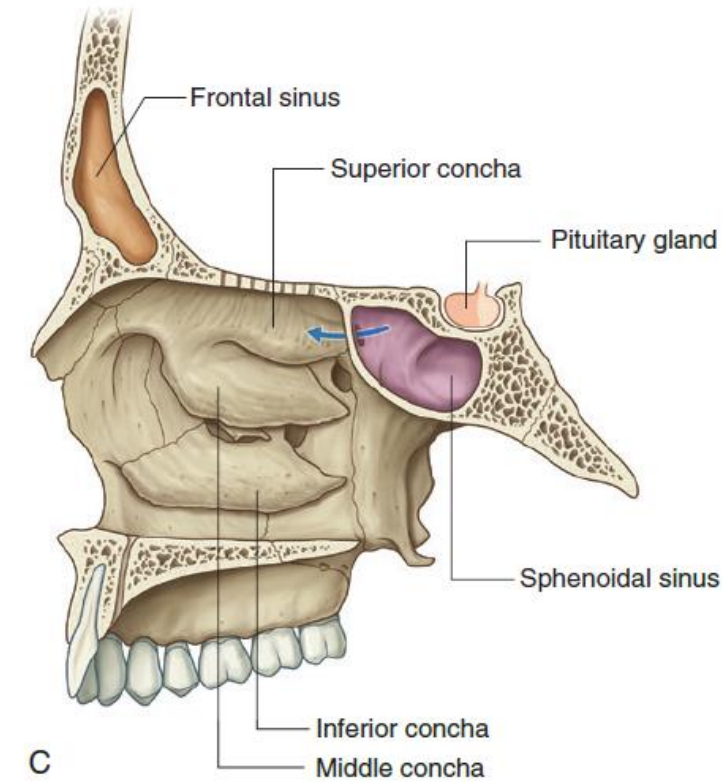
- The posterior ethmoidal branch of the ophthalmic nerve (CN V₁);
- The maxillary nerve (CN V₂) via orbital branches

Drainage of the sphenoidal sinus

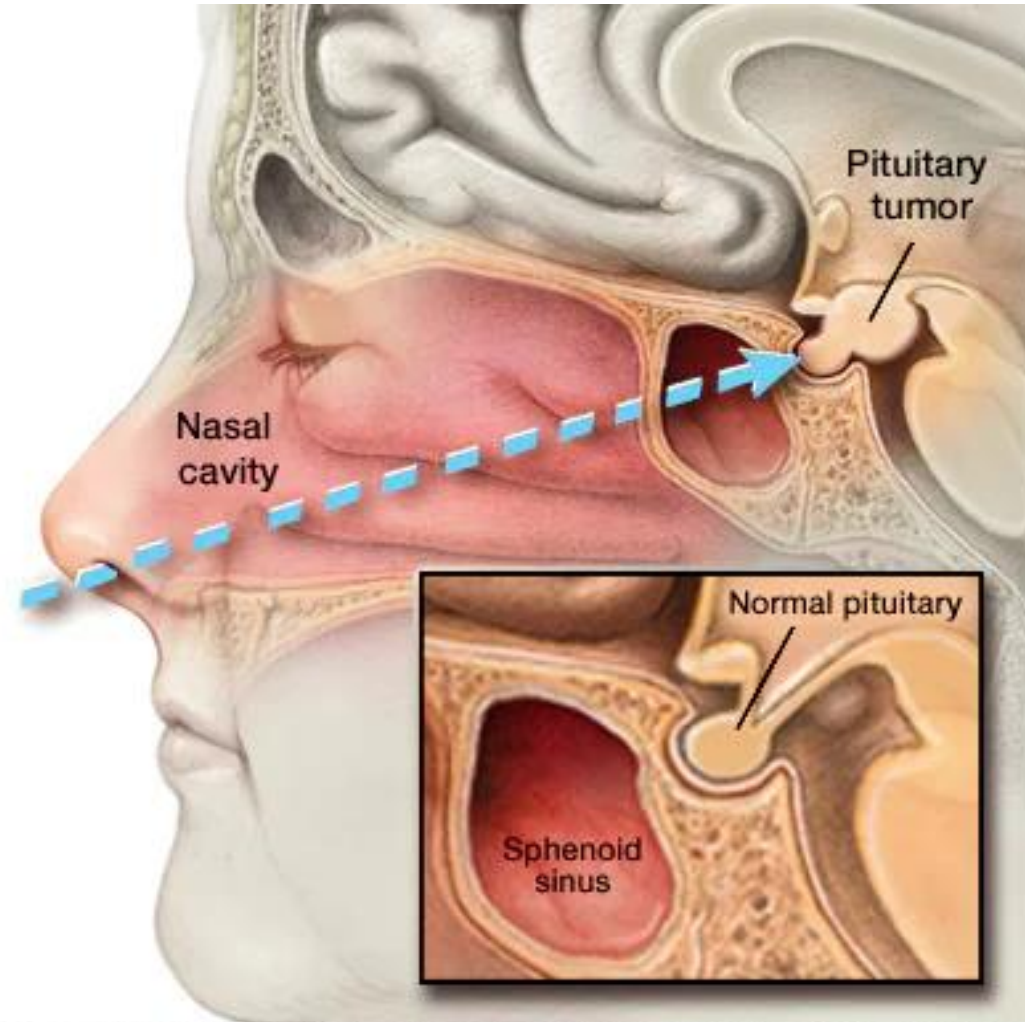


Relations of the sphenoidal sinus:

- Above to the pituitary gland and to the optic chiasm (the pituitary gland can be surgically approached)
- Laterally to the cavernous sinuses;
- Below and in front, to the nasal cavities.



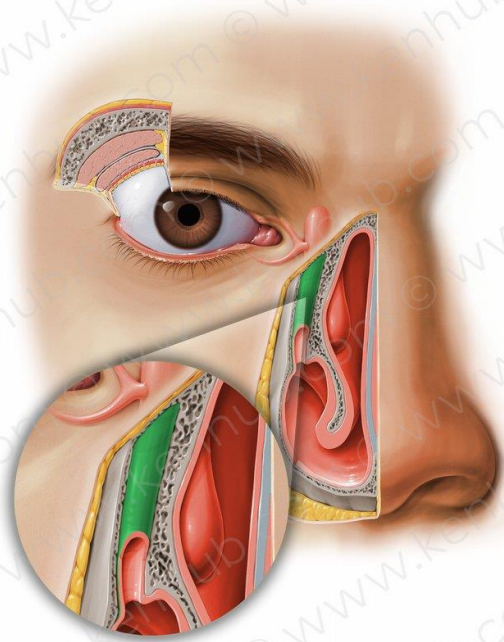
Clinical note: transsphenoidal hypophysectomy is a surgery that utilizes the sphenoidal sinus, we put the instrument in the nose, then we pass through the sphenoidal recess to reach the sphenoidal sinuses, through which we drill to reach the pituitary gland and resect it if there was a tumor.



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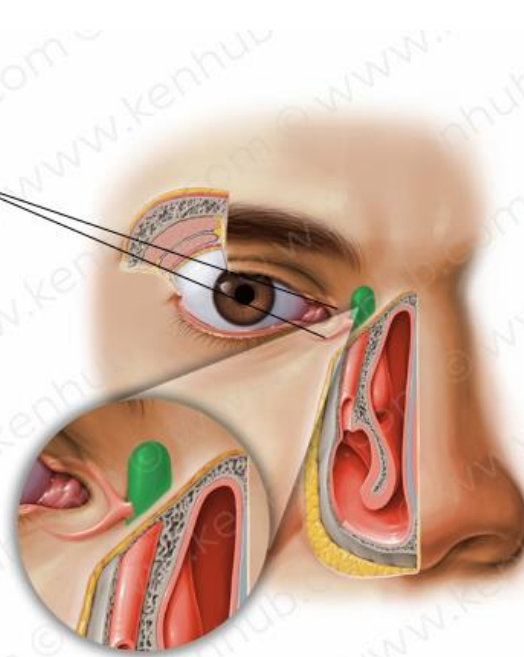
The Nasolacrimal duct opens onto the lateral wall of the inferior nasal meatus, this duct drains the tears from the lacrimal sac onto the nose, that why crying results in a runny nose.

Blocking of this duct can occur in children, either proximally, at the middle or distally, this results is tears dropping onto the face and resulting in inflammation, so it must me recanalized.

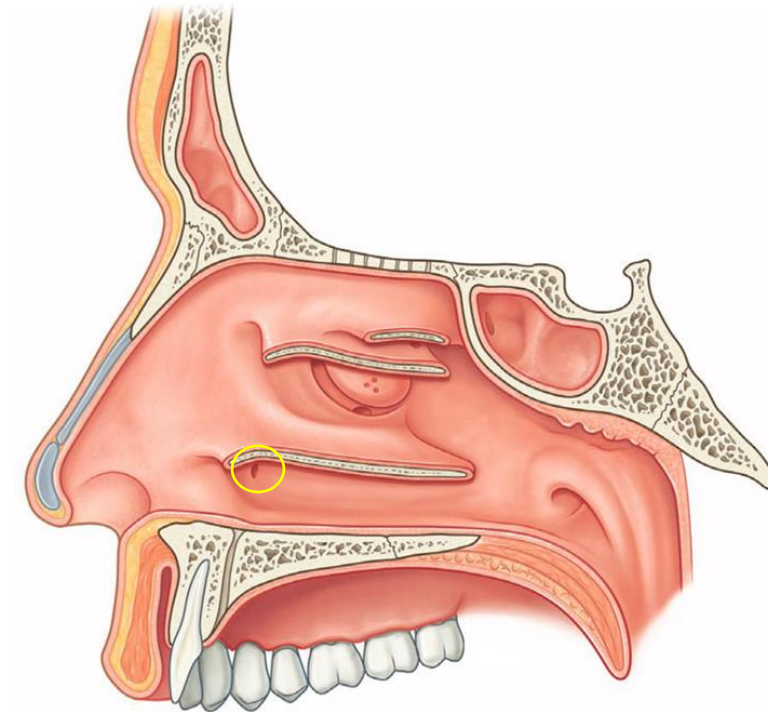


Nasolacrimal Duct

Lacrimal
canaliculi,
open into
lacrimal
puncta



Lacrimal Sac



The site of drainage of the
nasolacrimal duct