بسم الله الرحمن الرحيم

DOPAMINE SCIENTIFIC TEAM

ANATOMY

MID | Lecture 1

Nose & ParaNasal Sinuses

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Reviewed by: Leen Mamoon

﴿وَلَقَدْ نَعْلَمُ أَنَّكَ يَضِيقُ صَدْرُكَ بِمَا يَقُولُونَ ﴿٩٧﴾ فَسَبِّحْ بِحَمْدِ رَبِّكَ وَكُن مِّنَ السَّاجِدِينَ﴾

سبحان الله وبحمده، سبحان الله العظيم

وَلِلَّهِ الْأَسْمَاءُ الْحُسْنَى فَادْعُوهُ بِهَا

المعنى: العظيم ذو الكبرياء، المتعالي عن صفات خلقه، القاهر لعتاتهم، ولا يوصف بهذا الاسم على سبيل المدح سواه سبحانه وتعالى.

الورود: ورد مرة واحدة في القرآن.

الشاهد: ﴿ٱلْعَزِيزُ ٱلْجَبَّارُ ٱلْمُتَكَبِّرُ ۚ سُبْحَٰنَ ٱللَّهِ عَمَّا يُشْرِكُونَ﴾ [الحشر:٢٣].

٣٣

اضغط هنا لشرحٍ أكثر تفصيلًا

- Prof. Dr.Mohammed Hisham Al-Muhtaseb

السلام عليكم ورحمة الله وبركاته
الملف ترتب بشكل مختلف شوي عن شرح الدكتور بالمحاضرة وعن ترتيب السلايدات، كونه الدكتور كان بشرح أشياء ببداية المحاضرة وبرجع بكررها بنهايتها وبحكي عنها بتفاصيل أكثر، إذا حابين تبعوا مع كلام الدكتور، فتنقلوا بين العناوين وبرضو فيه علامات تدلكم وين انحكى عن الموضوع أكثر، بالتوفيق..

The Nasal Cavity

"اللهم إني أسألك فهم النبيين، وحفظ المرسلين، وإلهام الملائكة المقربين، اللهم اجعلنا من الذين يستمعون القول فيتبعون أحسنه، ويسّر علينا حفظ ما نتعلمه وفهمه والعمل به"

1- Components & Structural Organization of the RS

1) Nose (External Nose & Nasal cavity)

2) Pharynx, which is divided into:

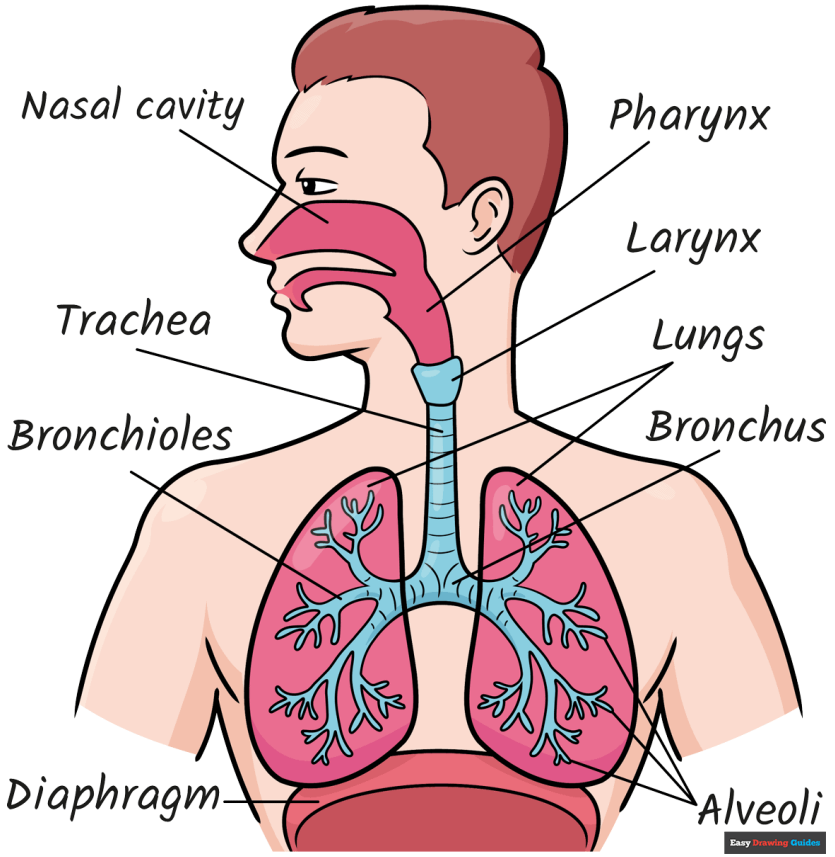
- Nasopharynx
- Oropharynx
- Laryngopharynx

3) Larynx

4) Trachea

5) Bronchial tree within the lungs

✓ Right and left main bronchi
✓ Secondary bronchi
✓ Tertiary bronchi



Bronchi contain cartilage, which helps maintain airway patency.

1- Components & Structural Organization of the RS

✓ **Bronchioles:**

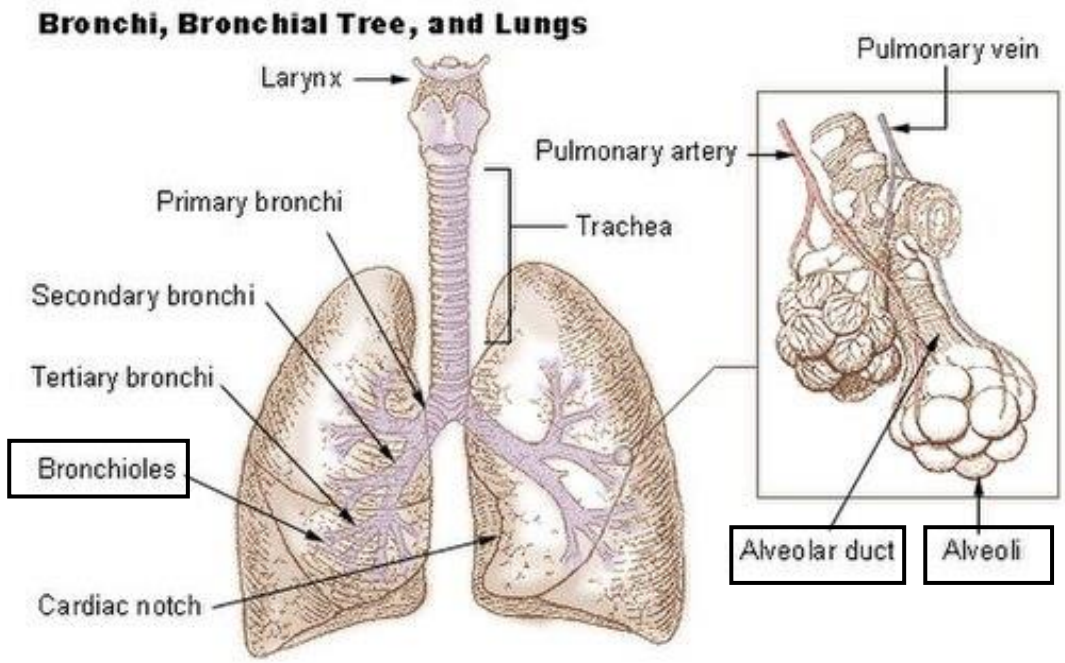
- *Lack cartilage*
- Divided into:

✓ Conducting bronchioles → air passage only

✓ Respiratory bronchioles → gas exchange

✓ **Respiratory bronchioles**

- **Alveolar ducts**
- **Alveoli**
- Lined by **simple squamous epithelium.**
- Each lung contains billions of alveoli.
- Each alveolus is surrounded by the largest capillary network in the body for gas exchange.



2- Function of the RS

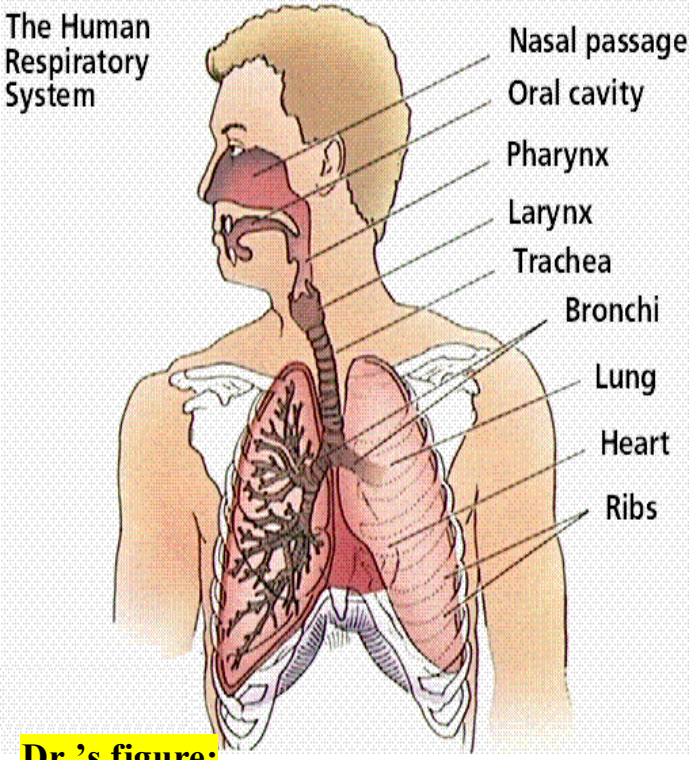
- Provides for **gas exchange**
- ✓ The alveoli and surrounding capillaries are the primary site of gas exchange, ensuring that oxygen enters the bloodstream and carbon dioxide is removed efficiently.

- **Regulates blood PH** which is directly influenced by the levels of oxygen and carbon dioxide in the blood.

- **Filters the inspired air.** *Slide 13/21*

- Contains receptors for **smell**, and produce **vocal sounds** (phonation), The true vocal cords in the larynx are responsible for vibration and sound production during phonation *slide 19/ 41*

- **Excretes** small amounts of water and heat. *slide 24*



Dr.'s figure:

2- Function of the RS

➢ Related to CLINICAL :

- ✓ When a patient arrives at the emergency department, the **first** priority is to assess respiration, it is essential to determine whether the patient breathing or not. **Oxygen deprivation for as little as 2 to 5 minutes can lead to brain death.**

- ✓ Patients referred to the pulmonary section often undergo arterial blood gas analysis, which measures **oxygen (O_2), carbon dioxide (CO_2)**, and **blood pH.**
- ✓ *Note:* arterial blood is used, not venous blood, as it reflects the gas exchange in the lungs and provides information about the acid–base balance of the blood.

3- Anatomy of the External Nose

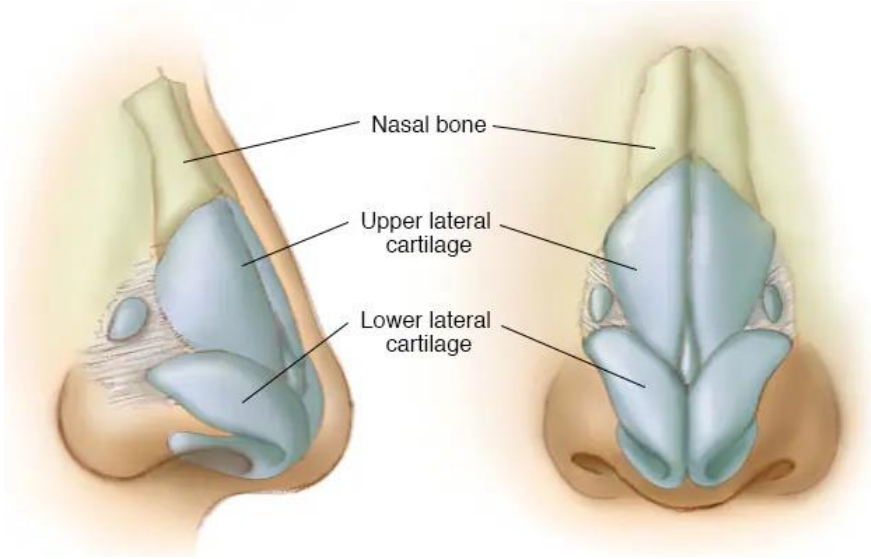
- **Anteriorly Cartilaginous framework** (All are plates of **hyaline cartilage) :**

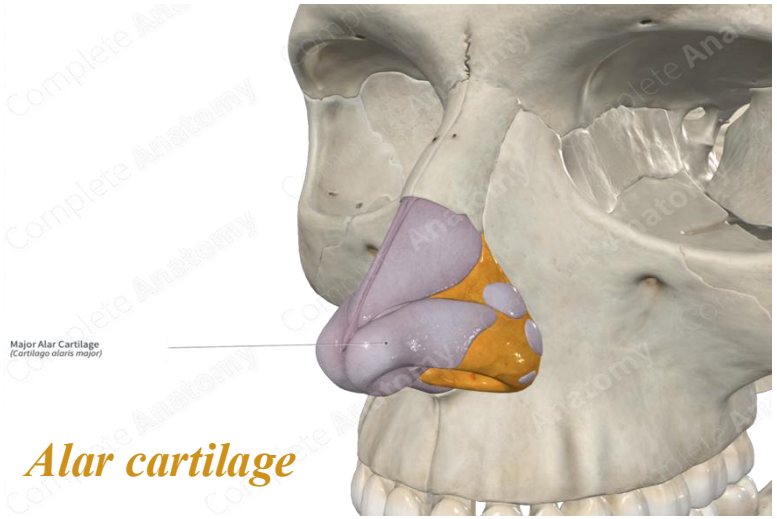
1. Lateral nasal cartilage (Superior & inferior)

2. Alar cartilage (bulge)

✓ Located on the lateral side of the nose

✓ Composed of cartilage, fat, and muscles Includes dilator and compressor muscles, which help control nostril movement.

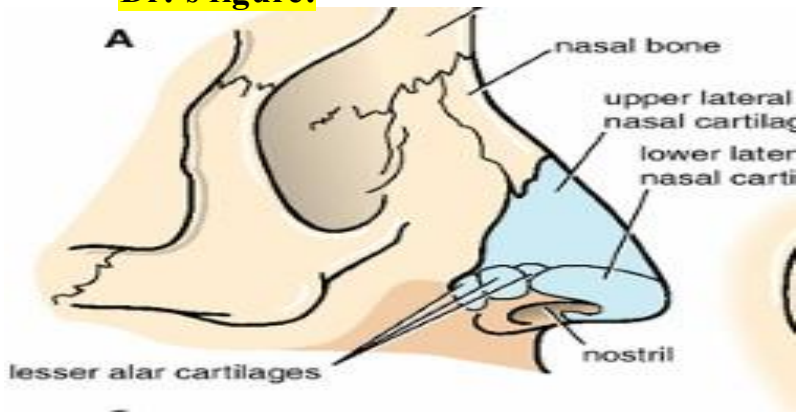




Alar cartilage

3- Anatomy of the External Nose

Dr.'s figure:



- **Anteriorly Cartilaginous framework** (All are plates of **hyaline cartilage) :**

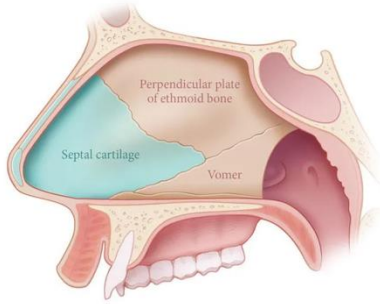
3. Nasal Septum

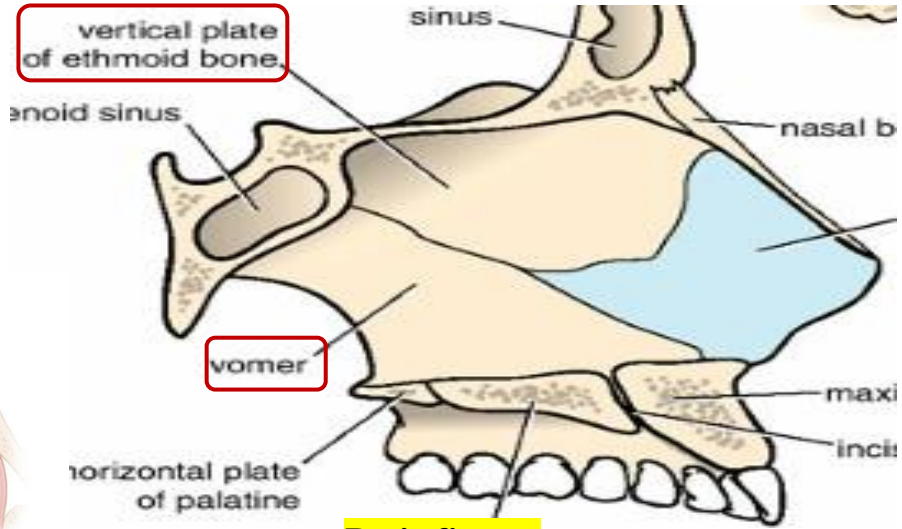
- Forms the **medial wall** of the nasal cavity, dividing it into two chambers.
- Composed of three main parts:

✓ ***Anterior*** cartilaginous part

✓ ***Perpendicular/ Vertical*** plate of the ethmoid bone

✓ ***Vomer***



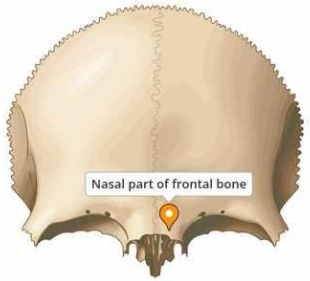


Dr.'s figure:

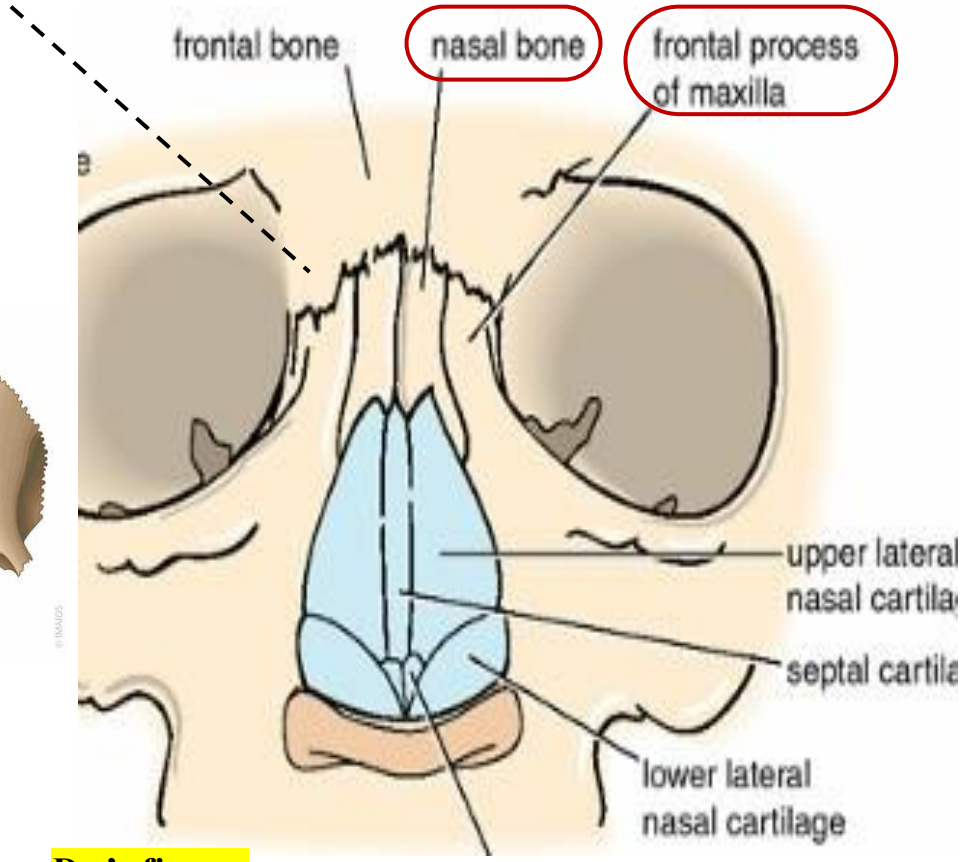
3- Anatomy of the External Nose

➢ Root Bony framework :

1. The nasal bone
2. Frontal process of maxilla
3. Nasal part of the frontal bone



*Maxillary Process of the Frontal Bone



Dr.'s figure:

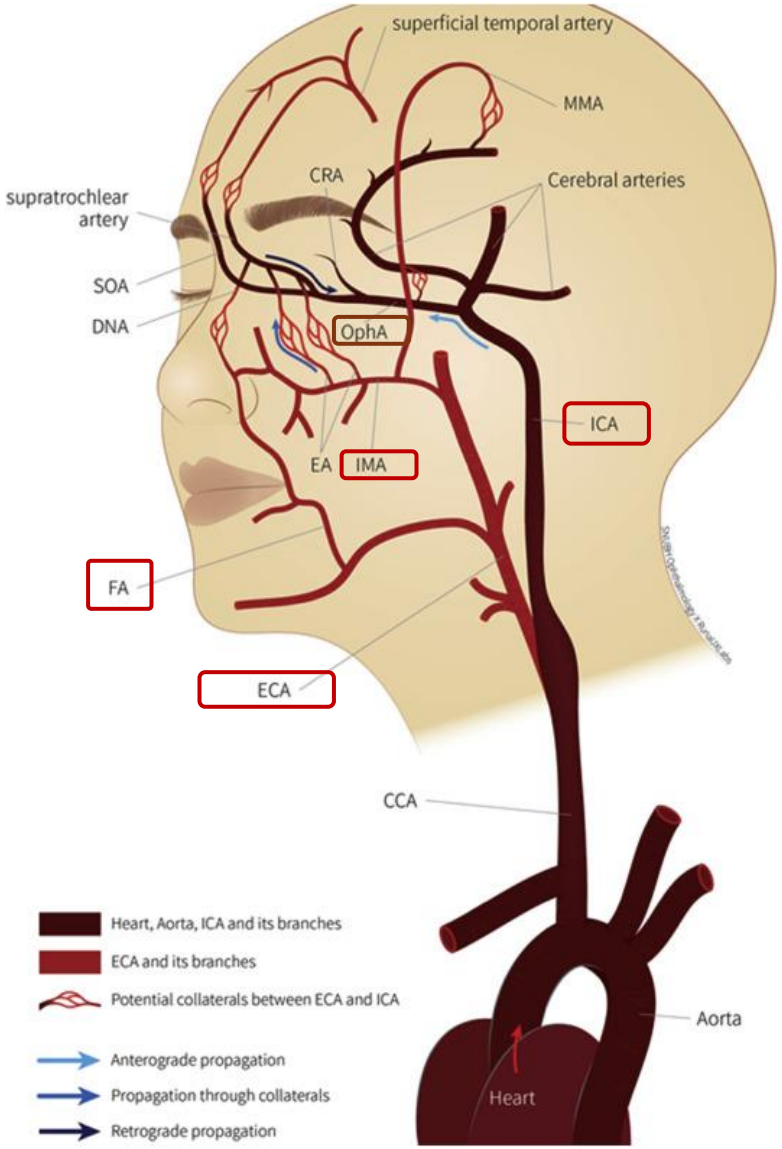
***The maxillary process of the frontal bone Provides support to the nasal bones.**

3- Anatomy of the External Nose

➢ Blood Supply

✓ Branches of the **ophthalmic (**Branch of the **internal** carotid artery) **and the maxillary arteries (**Terminal branch of the **external** carotid artery).

✓ ala and the lower part of the septum by branches from the **facial artery (**branch of the **external** carotid artery) which supplies the face and upper lip as well.

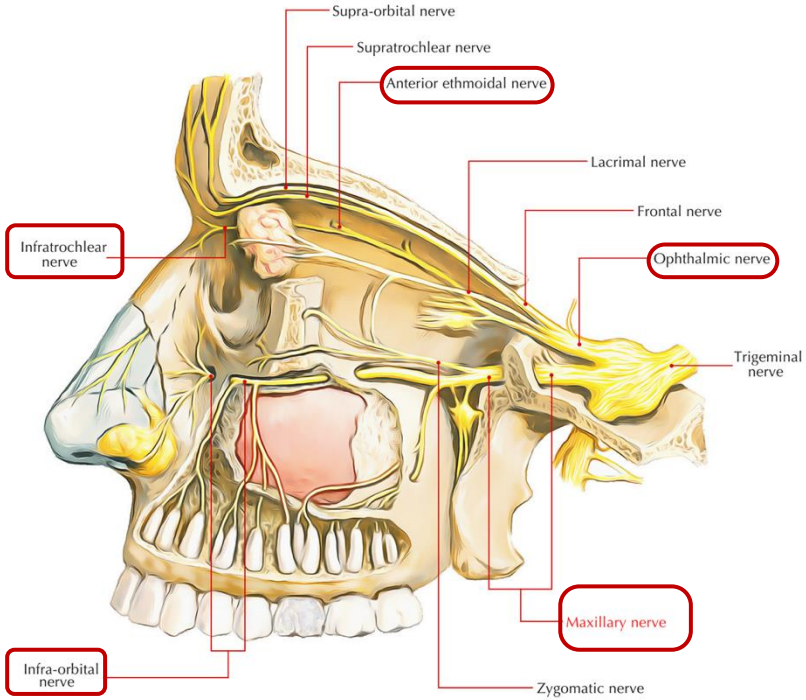


3- Anatomy of the External Nose

➢ Nerve Supply

✓ **Ophthalmic nerve**

- Gives rise to the **external nasal branch** (terminal branch of the anterior ethmoidal nerve) and **Infratrochlear Nerve .**



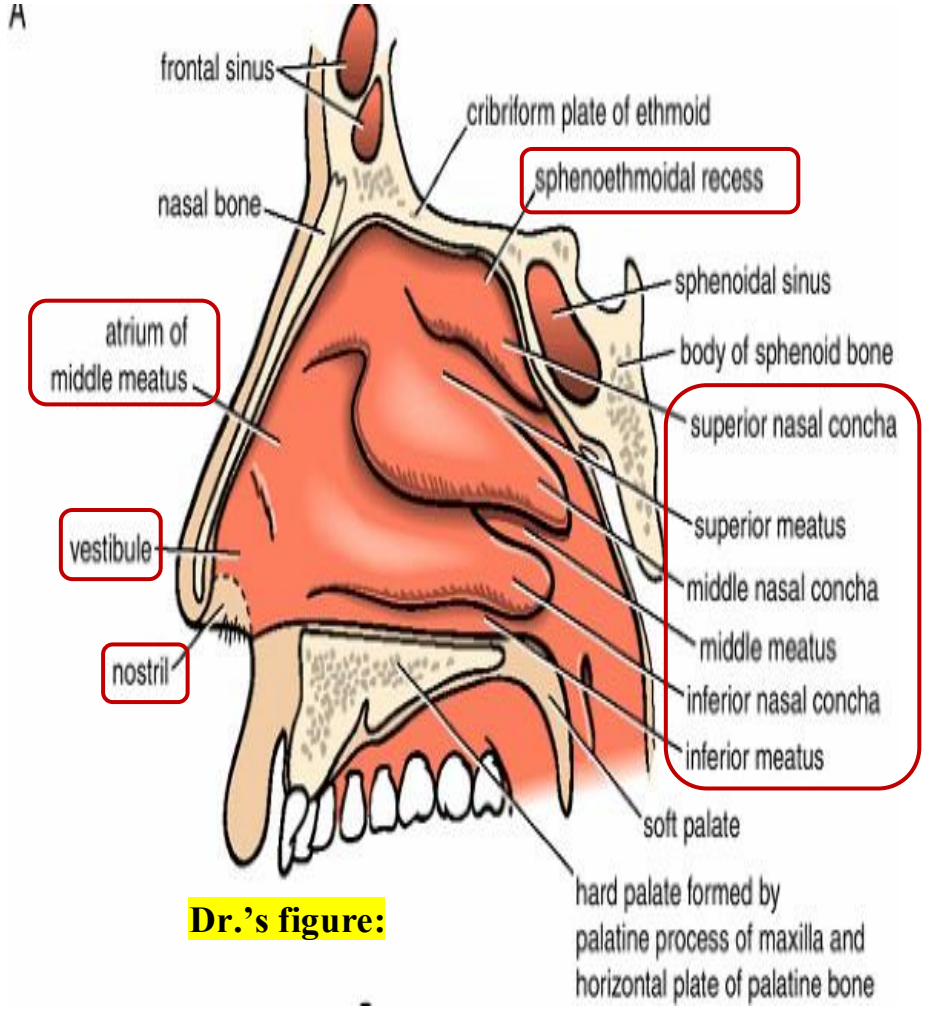
✓ **Maxillary nerve**

- Gives rise to the **infraorbital nerve**
- The infraorbital nerve travels with branches of the maxillary artery, providing both nerve and arterial supply.
- The terminal branches of the infraorbital nerve supply:
  - Upper lip (labial branch)
  - Lower part of the nose (nasal branch)
  - Lower eyelid (palpebral branch)

4- Anatomy of the Nasal Cavity

- ✓ The nasal cavity consists of **two chambers**, separated by the **nasal septum.**
- ✓ Each nasal cavity has: **Lateral wall, Floor, Roof, medial wall.**
- ✓ Air enters the nasal cavity through the external nasal opening **(nares).**
- ✓ Immediately inside the opening is the **nasal vestibule.**
- It contains **vibrissae** (thick nasal hairs) that provide pre-filtration of inspired air.
- ✓ Above the vestibule lies the **atrium of the nasal cavity.**

All parts will be discussed in detail in the coming slides.



Dr.'s figure:

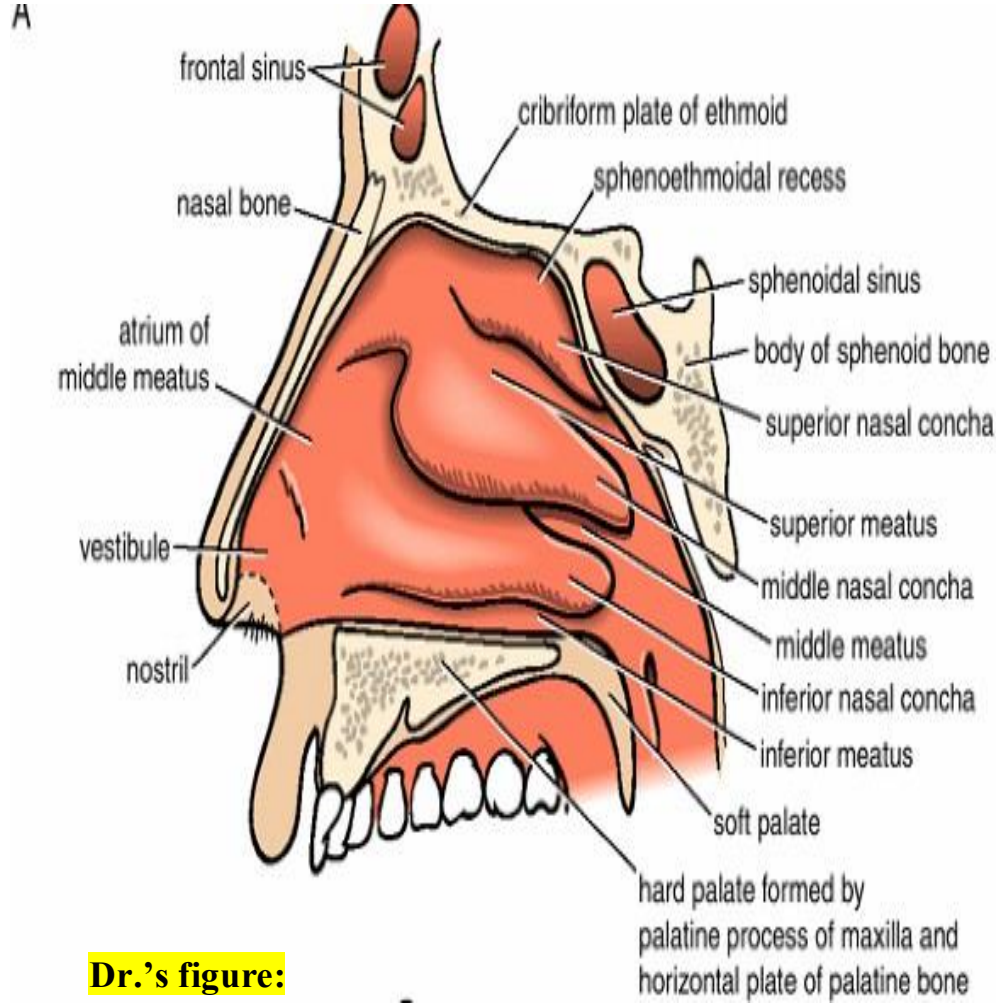
4- Anatomy of the Nasal Cavity

➢ Functions of the Nasal Cavity

- ✓ **Respiration**
- ✓ **Olfaction**
- ✓ **Resonance of Voice**

- The nasal cavity and paranasal sinuses act as resonating chambers, giving each person a unique voice.
- Paranasal sinuses are air-filled cavities within certain skull bones(Frontal sinus, Maxillary sinus , Ethmoidal sinuses, Sphenoidal sinus)
- Each sinus drains into the nasal cavity through its own duct, allowing air to enter, which contributes to voice resonance.

Discussed in detail on slide 28-32



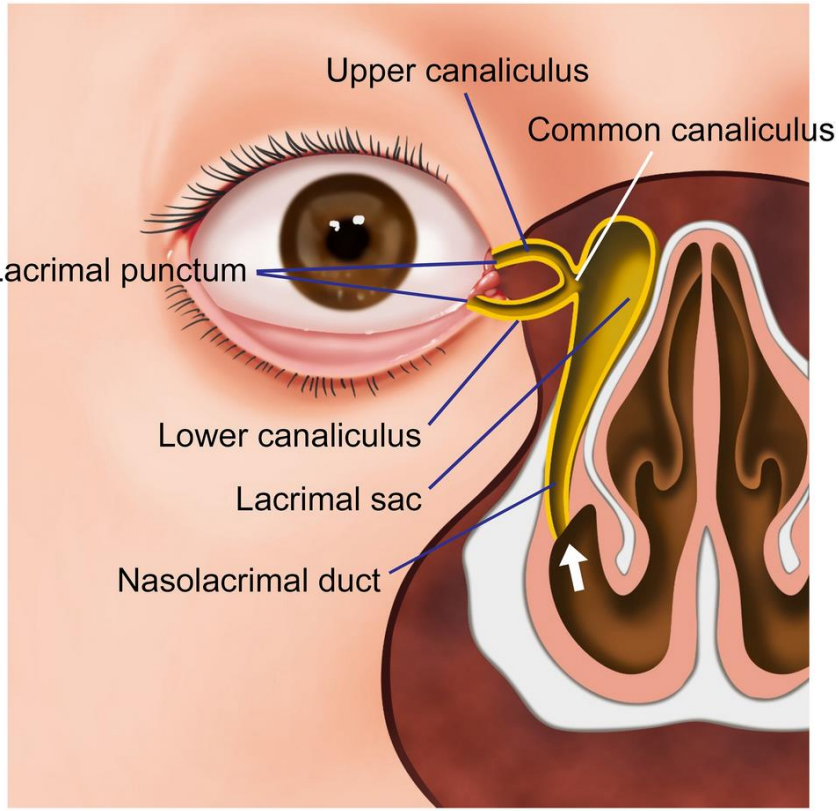
Dr.'s figure:

4- Anatomy of the Nasal Cavity

➢ Functions of the Nasal Cavity

✓ Lacrimal Drainage

- Tears produced by the lacrimal gland (in the roof of orbital cavity) flow through the lacrimal canaliculi into the lacrimal sac (medial angle of the eye)
- From the lacrimal sac, tears are drained into the nasal cavity via the **nasolacrimal duct**, opening into the **inferior meatus.**
- This system explains why tears sometimes drain into the nose when crying.



✓ Protective :

- (Sneezing, Filtration, Proteolytic enzymes, Warming and moistening the air) *slide 24*

4- Anatomy of the Nasal Cavity

➢ Related to CLINICAL :

- If the **nasolacrimal duct** is blocked, tears cannot drain properly and instead overflow onto the cheek.
- This causes epiphora (excessive tearing), redness, and eye irritation.
- Children may also experience itching and discomfort around the eyes.
- Treatment: Establish proper drainage, sometimes via probing or surgical intervention to clear the obstruction.

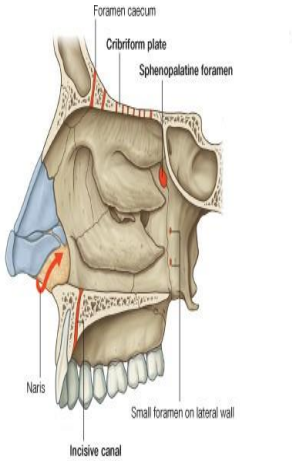
5- Anatomy of the Nasal Cavity

Nares & Choana

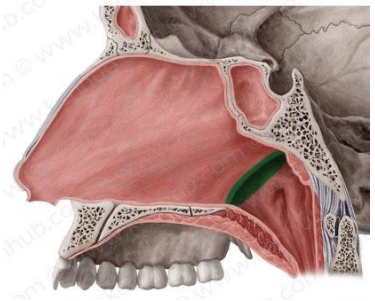
✓ The **nares** represents the **anterior** nasal openings while the **choana** represents the **posterior** opening of the nasal cavity and is **continuous with the nasopharynx**.

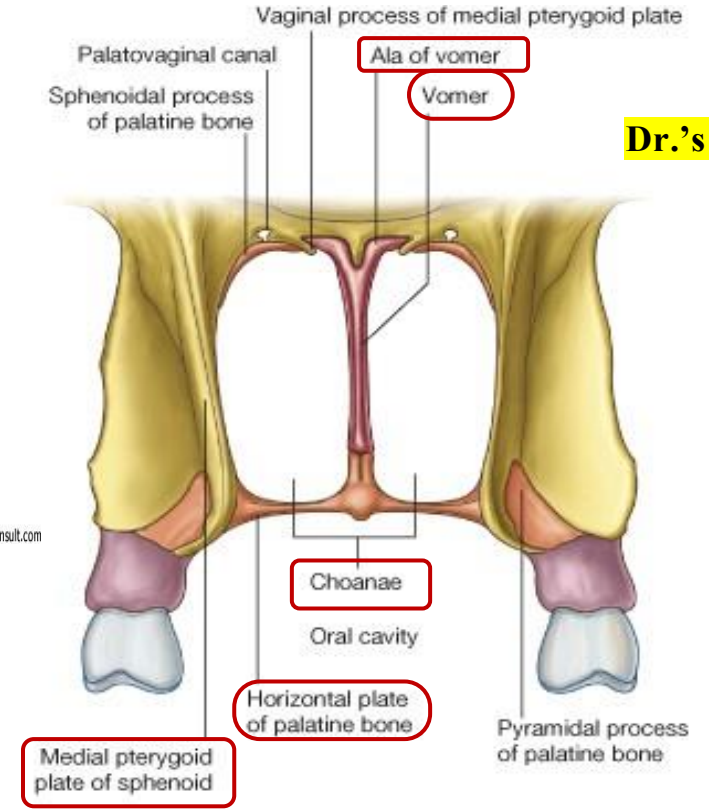
Boundary	Structure
Medial	Vomer
Lateral	Medial pterygoid plate of the sphenoid bone
Superior	Ala of Vomer
Inferior/ base	Palatine bone

Boundaries of the Choana



Dr.'s figure:





Dr.'s figure:

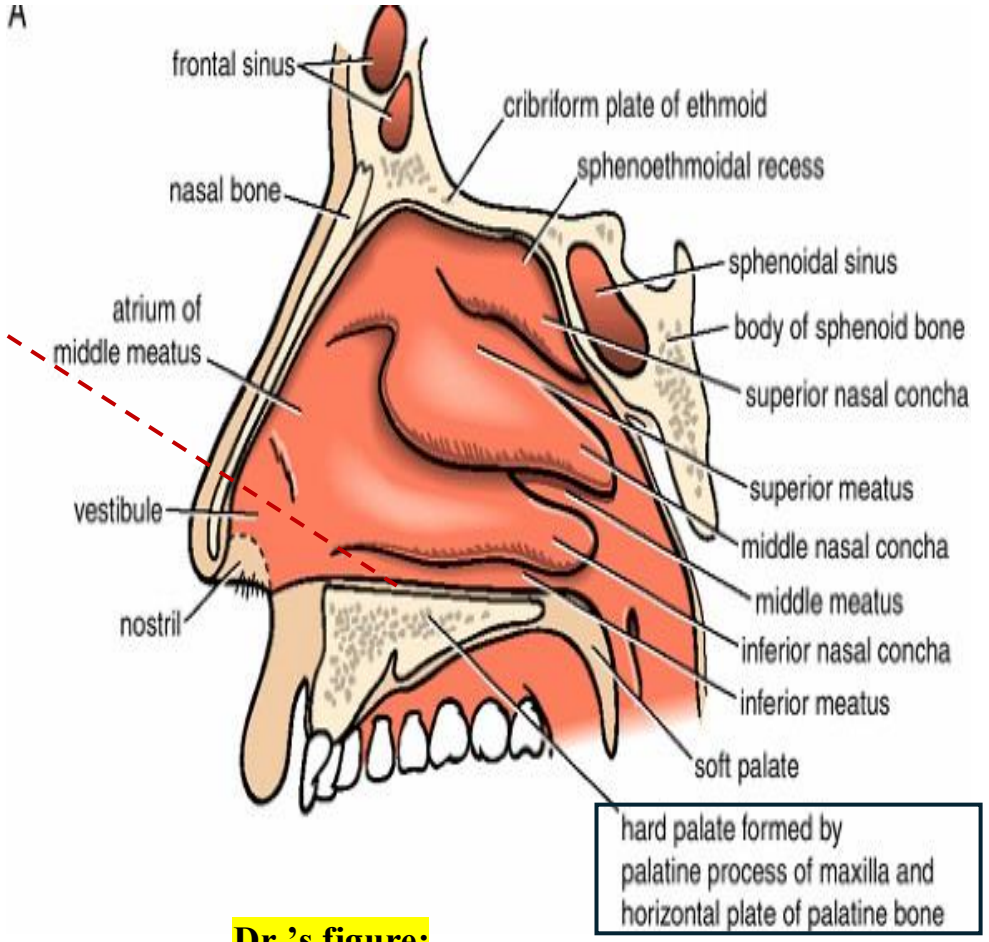
recommended video

6- Anatomy of the Nasal Cavity
Floor

➢ **The upper surface of the hard palate**
✓ which consist of:

1. **Anteriorly,** Palatine process of the **maxilla.**

2. **Posteriorly,** Horizontal plate of the **palatine bone.**



Dr.'s figure:

7- Anatomy of the Nasal Cavity
Roof

1. **Sloping anterior part:**

✓ Nasal spine of the frontal bone and the nasal bones

2.Horizintal middle part:

✓ The cribriform plate of the ethmoid bone

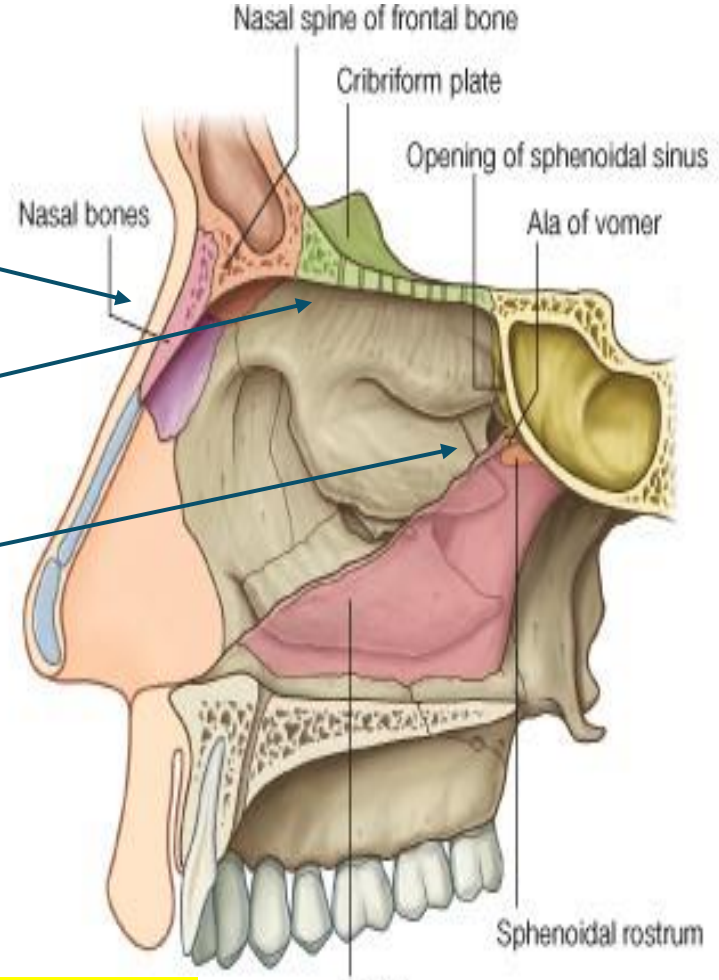
- *The cribriform plate is perforated by multiple olfactory nerve filaments that transmit olfactory (smell) sensation.*

3. **Sloping posterior part:**

✓ Anterior surface of the **sphenoid bone (body)**

✓ Ala of the **vomer**

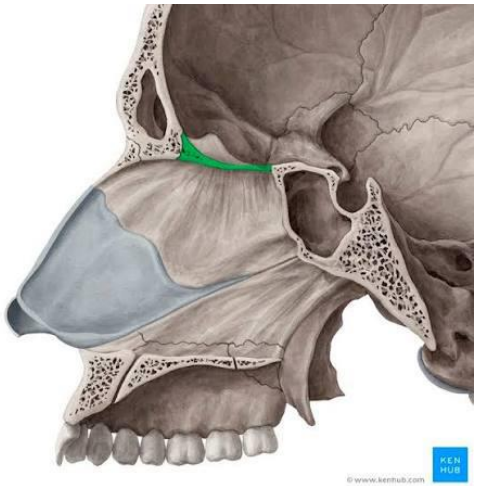
✓ **Vaginal process** of the palatine bone

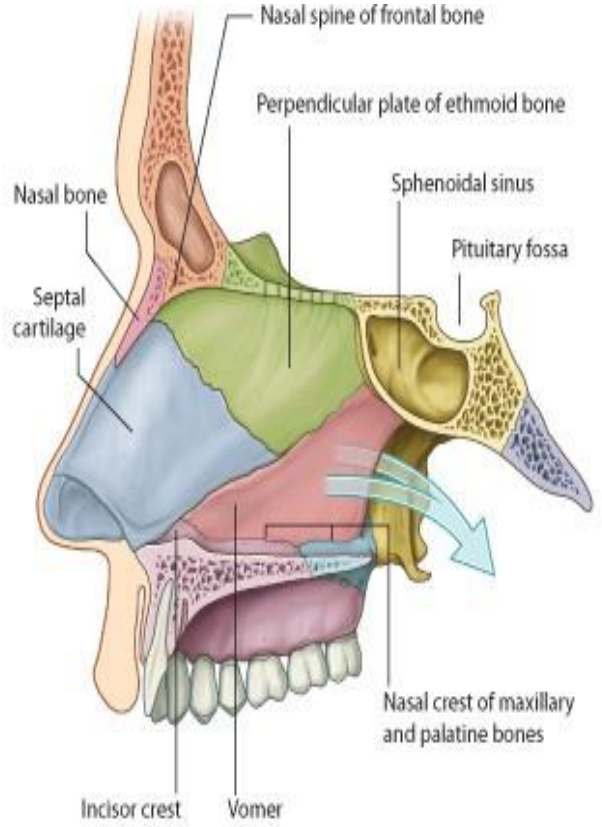


Dr.'s figure:

8- Anatomy of the Nasal Cavity
Medial wall

- **Septal nasal cartilage** **anteriorly.**
- **Posteriorly** **vomer** and the **perpendicular plate of ethmoid** bone.





Dr.'s figure:

9- Anatomy of the Nasal Cavity
Lateral wall

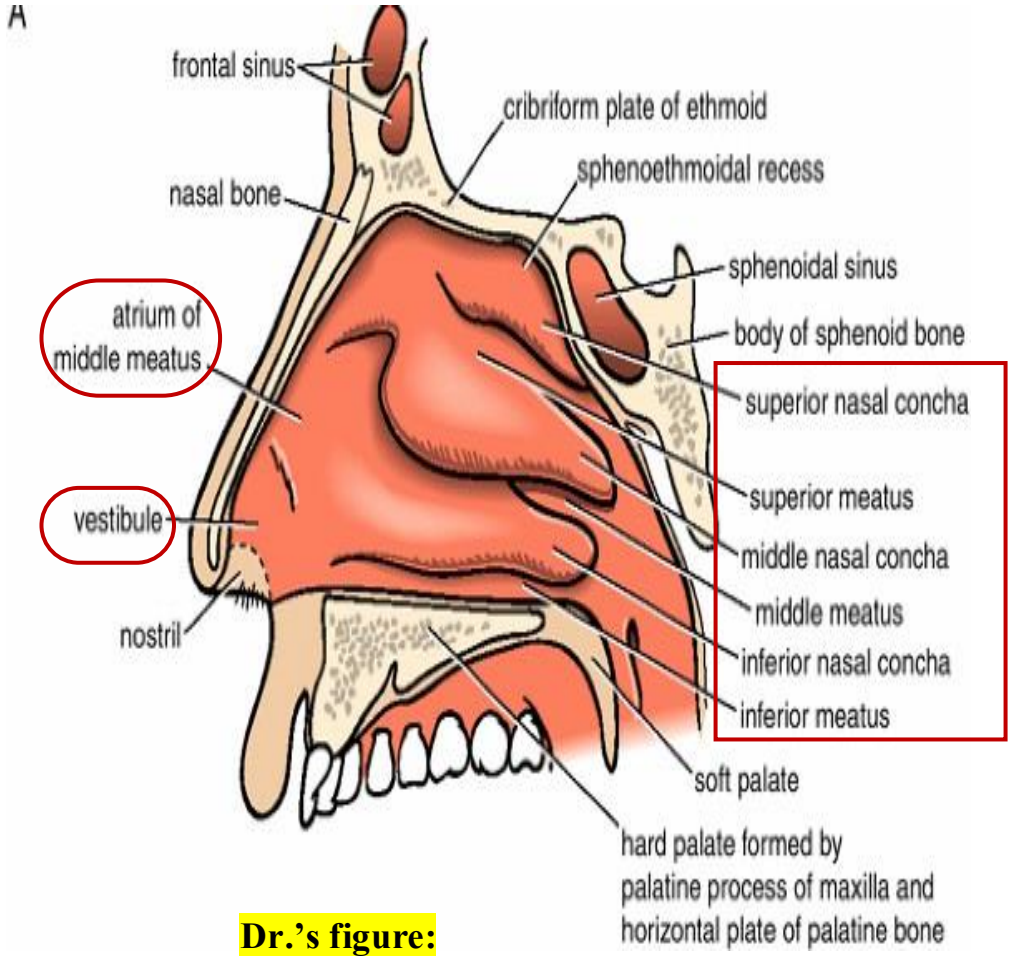
➢ **Parts:**

1. Vestibule is the area of the nasal cavity lying just inside the nostril Covered with skin and contains thick hairs **(vibrissae) For air filtration.**

2. Antrum (atrium)

3. Posterior part contain **3 conchae**, **3 meatuses**, and **one recess**.

Slide 25-27



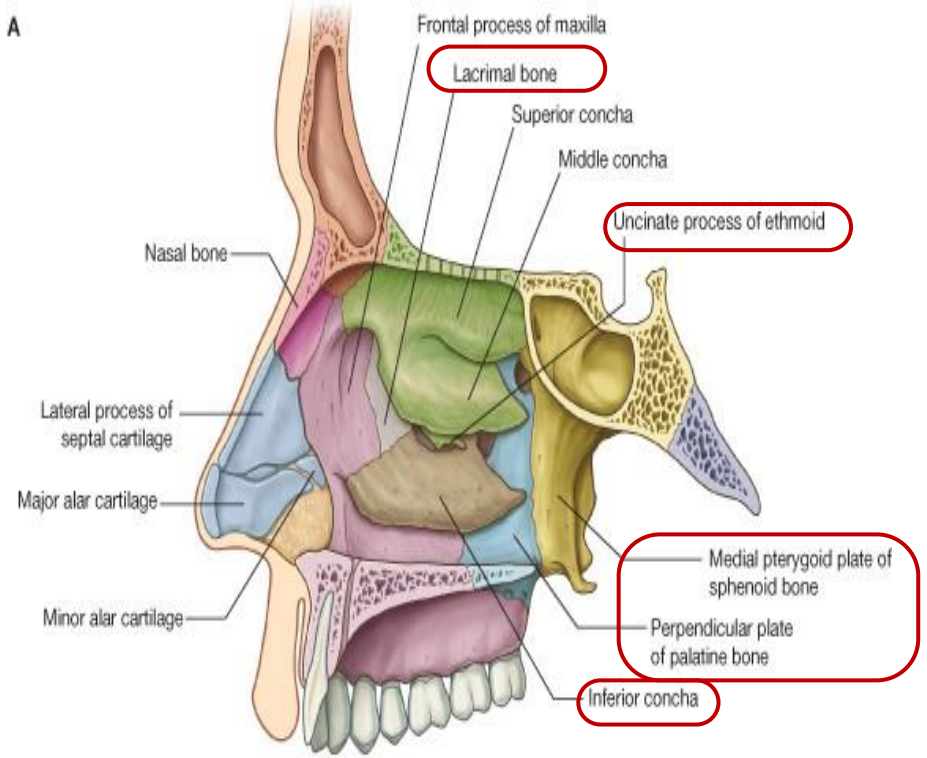
Dr.'s figure:

9- Anatomy of the Nasal Cavity
Lateral wall

- Complex and formed by bone, cartilage, and soft tissues.

- **Bony support :**

- ✓ **Ethmoidal labyrinth** and **uncinate process**
- ✓ Perpendicular plate of the **palatine bone**
- ✓ Medial plate of the **pterygoid process**
- ✓ Medial surfaces of the **lacrimal bones and maxillae**
- ✓ **Inferior concha**



Dr.'s figure:

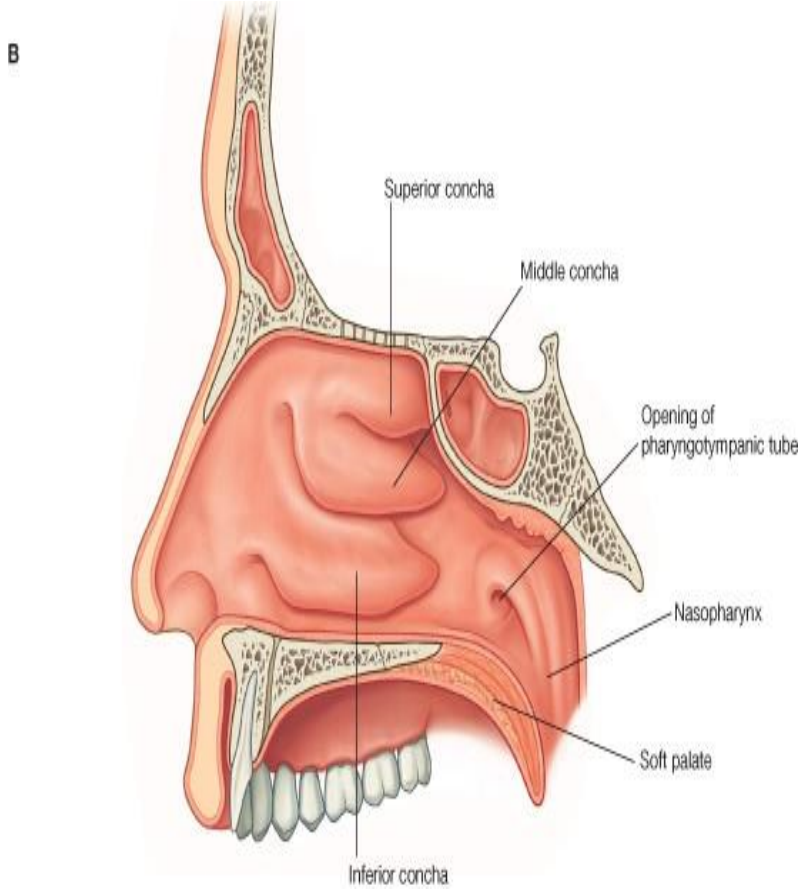
10- Anatomy of the Nasal Cavity
Mucosa

- Lined with **Respiratory Mucous Membrane, pseudostratified ciliated columnar epithelium.**

- **Except :**

1. **The vestibule** is lined with **modified skin and has coarse hairs (keratinized stratified squamous epithelium)**

2. **Above the superior concha** (in the roof) is lined with **olfactory** mucous membrane and contains **nerve endings** of the bipolar cells.



Dr.'s figure:

10- Anatomy of the Nasal Cavity
Mucosa

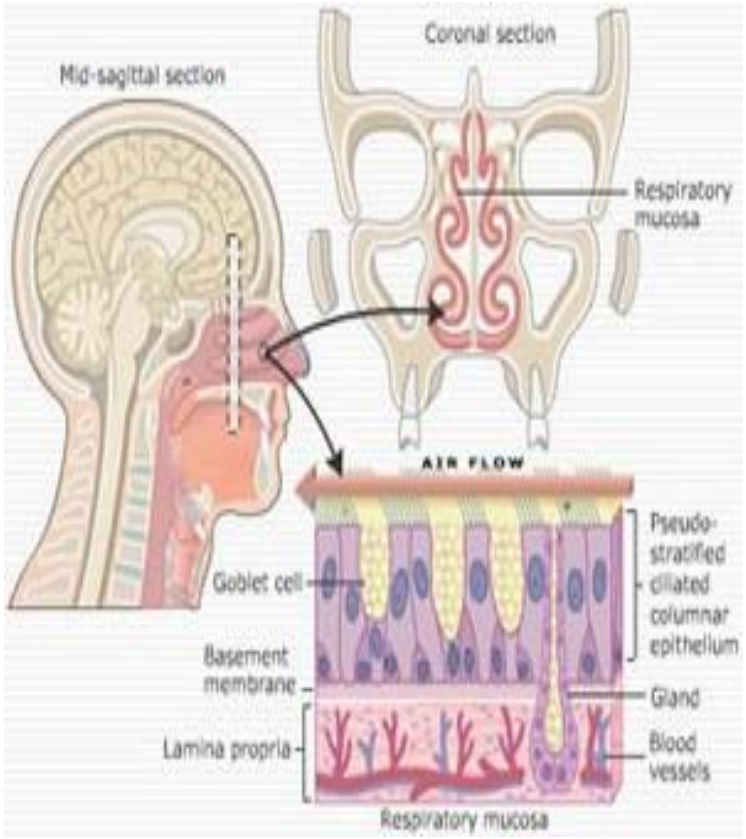
➢ Function of the mucosa

✓ **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.

- During **inflammation or infection**, this plexus becomes congested, leading to nasal obstruction; therefore, decongestant drugs are used to reduce congestion.

✓ **Mucous traps foreign particles** and organisms in the inspired air.



Dr.'s figure:

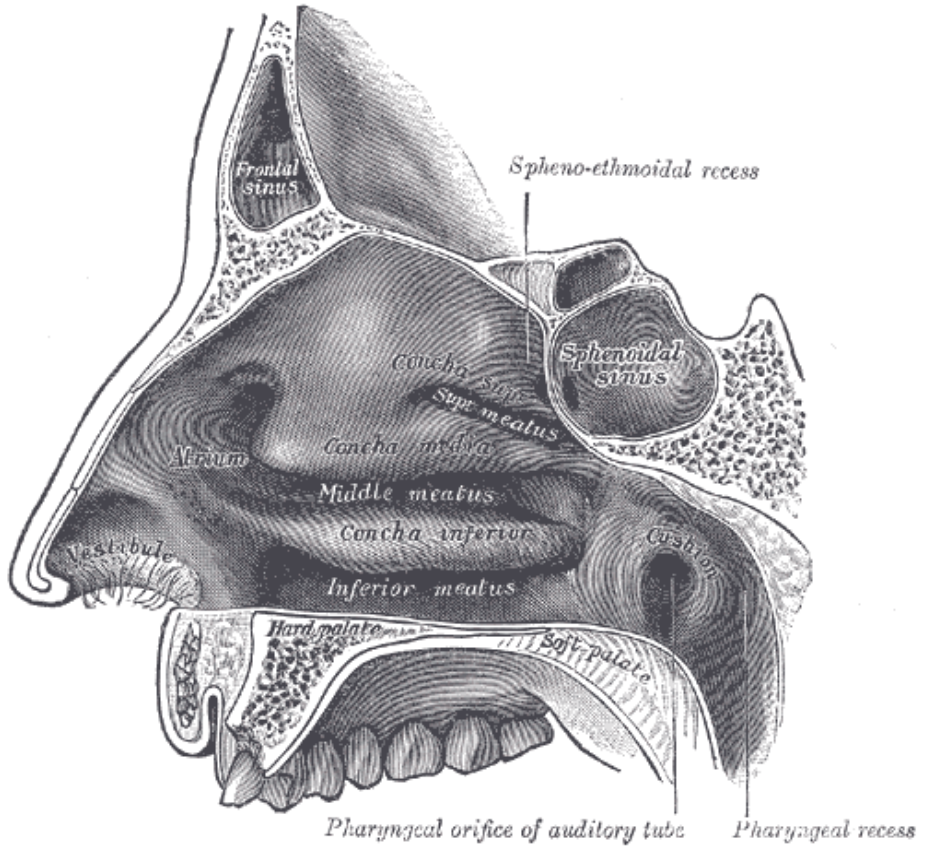
11- Anatomy of the Nasal Cavity – Lateral wall
Nasal Conchae & Meatuses

- The **nasal conchae** (inferior, middle, and superior) is a bony projection from the **lateral wall** that is covered by mucosa, its main function is to increase the surface area of the lateral wall.

- beneath each concha lies a corresponding **nasal meatus** (inferior, middle, and superior meatus).

- The nasal meatuses receive the openings of the **paranasal ducts.**

- The **middle** meatus is the most important drainage area for the paranasal sinuses.



Highly recommended video

11- Anatomy of the Nasal Cavity – Lateral wall
Nasal Conchae & Meatuses

➢ Ethmoidal Bulla

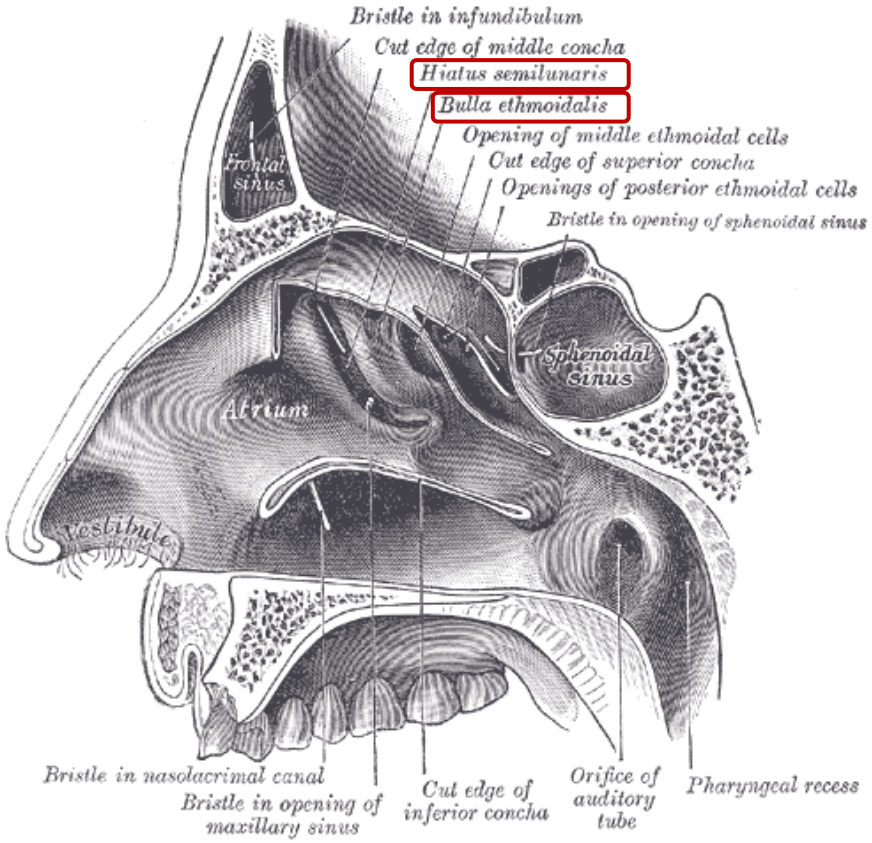
- The ethmoidal bulla is a rounded elevation found in the **middle meatus.**
- The **middle ethmoidal sinuses** open onto the surface of the ethmoidal bulla.

➢ Hiatus Semilunaris

- **Inferior** to the ethmoidal bulla lies a curved groove called the hiatus semilunaris.
- The hiatus semilunaris receives:

✓ **Anterior** ethmoidal air cells

✓ Maxillary sinus (opens **posteriorly** into the hiatus)



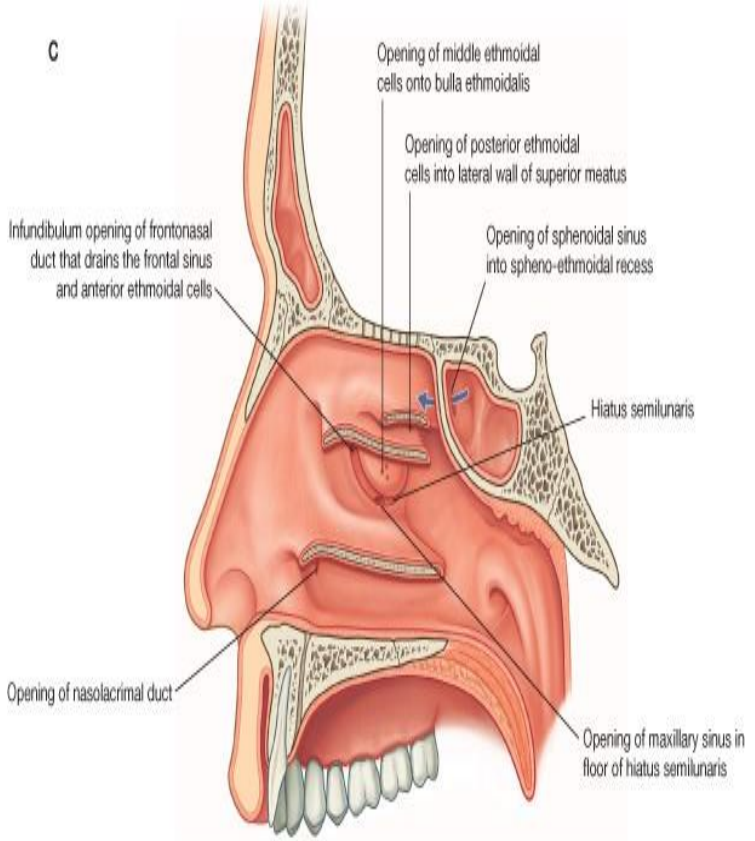
Highly recommended video

11- Anatomy of the Nasal Cavity – Lateral wall
Nasal Conchae & Meatuses

➢ Frontal Infundibulum

- The frontal sinus drains via the **frontonasal duct,** which opens into the **ethmoidal infundibulum** of **middle meatus**.
- The infundibulum is an **anterosuperior** continuation of the **hiatus semilunaris.**

✓ *Note:* The ethmoidal infundibulum does not represent a single common opening for the frontal sinus and the anterior ethmoidal cells, each structure has its own opening.

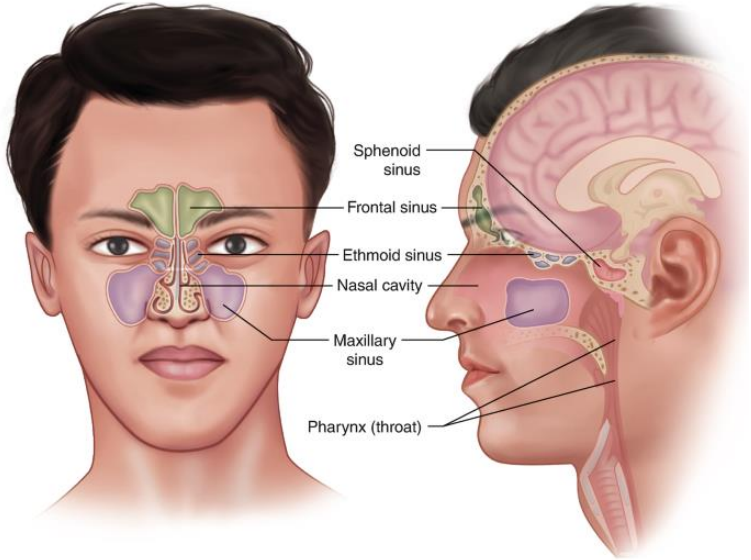


Dr.'s figure:

Highly recommended video

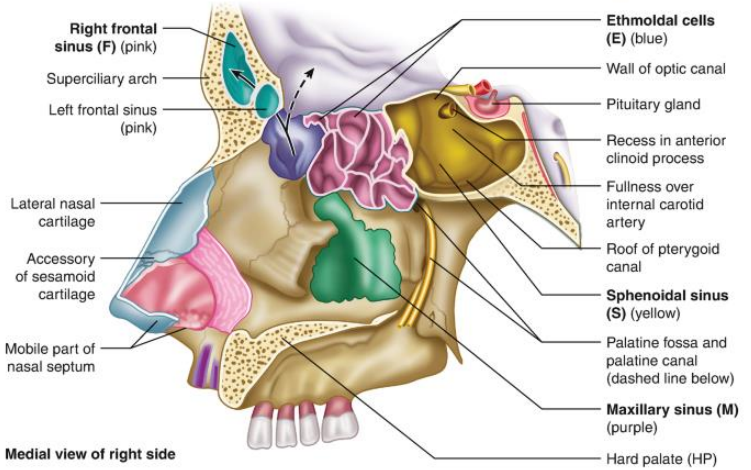
12- Anatomy of the Nasal Cavity – Lateral wall Paranasal Sinuses

- The nasolacrimal duct and most of the paranasal sinuses are lined by a thin mucosa and open into the lateral wall of the nasal cavity:



1. Maxillary sinus

- Middle meatus through hiatus semilunaris.
- The maxillary sinus is the largest paranasal sinus and has a pyramidal shape.
- Its duct (ostium) opens **superiorly**, which results in poor natural drainage.
- Because of this upward position, drainage requires the head to be positioned below the sinus to facilitate emptying, which is not physiologically convenient.
- **Intervated by infraorbital nerve.**

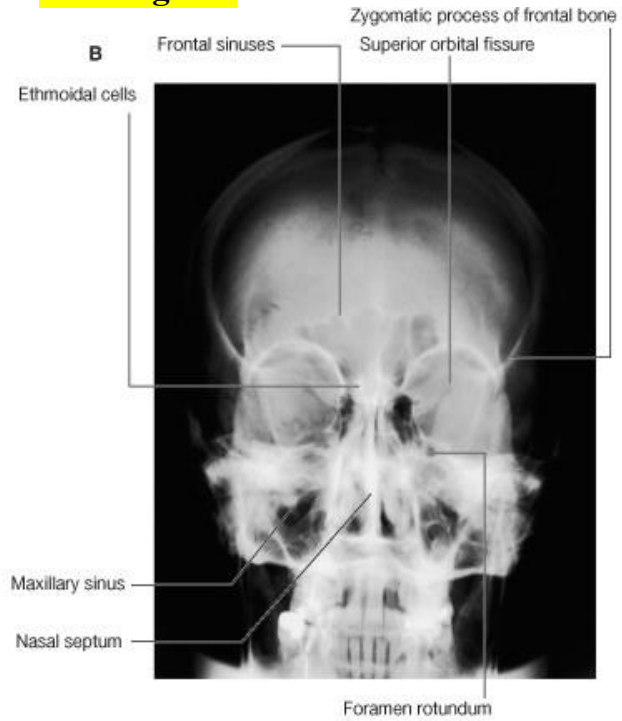


12- Anatomy of the Nasal Cavity – Lateral wall
Paranasal Sinuses

➢ Relations of the Maxillary Sinus

Border / Wall	Relation / Structure
Superior (Roof)	Orbit
Inferior (Floor)	Roots of the upper molars
Posterior (Back wall)	Infratemporal region / infratemporal fossa
Medial (Medial wall)	Lower part of the nasal cavity

Dr.'s figure:



➢ Related to CLINICAL :

- Poor drainage can lead to cranial infections and pus accumulation, which may form a fistula into the oral cavity and sinusitis.
- Extraction of the upper third molars, which are closely related to the sinus floor, can accidentally create a communication (oroantral fistula), allowing pus to enter the oral cavity, causing bad taste and odor.

12- Anatomy of the Nasal Cavity – Lateral wall Paranasal Sinuses

2. Frontal sinuses

- Middle meatus via infundibulum and frontonasal duct.
- **Innervated by branches of the supra-orbital nerve** from the ophthalmic nerve.

3. Sphenoidal sinuses

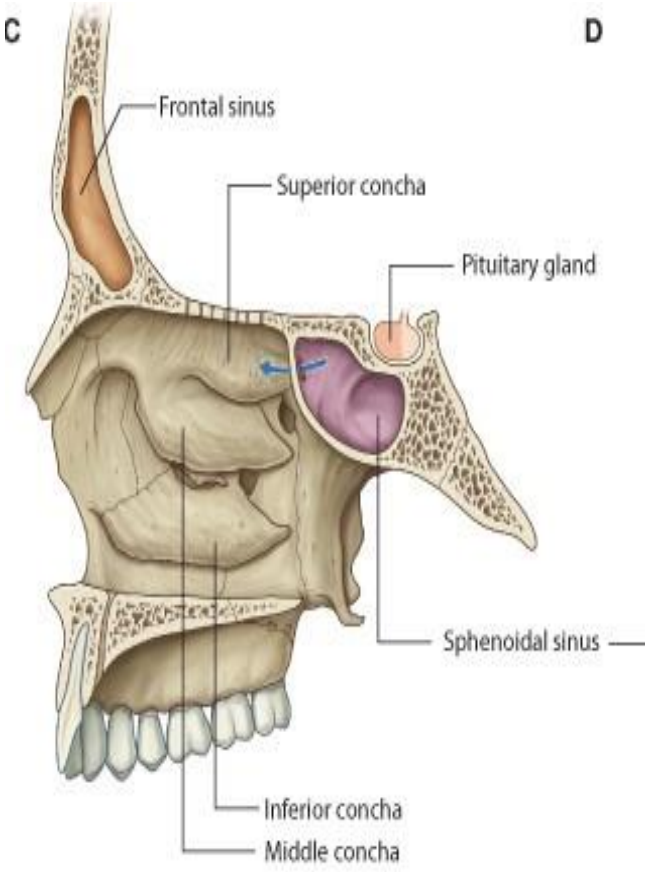
- The sphenoid sinuses are located within the body of the sphenoid bone.
- Their opening is into the sphenoethmoidal recess.
- Relations:

✓ **Superior:** Sella turcica, which contains the pituitary gland.

- Tumors of the pituitary may invade the sphenoid sinuses, detectable on X-ray.

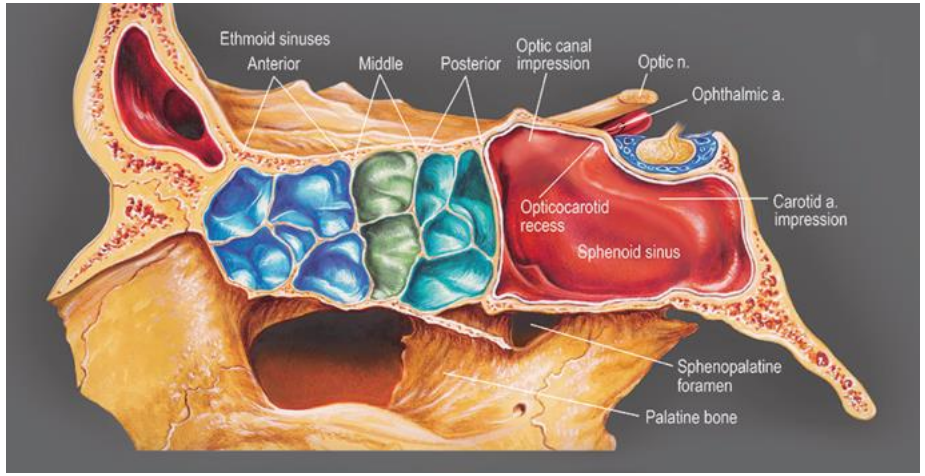
✓ **Lateral:** Cavernous sinuses.

✓ **Innerveted by Posterior ethmoidal branch of the ophthalmic nerve (V1) & Maxillary nerve (V2) via the orbital branches**



Dr.'s figure:

12- Anatomy of the Nasal Cavity – Lateral wall
Paranasal Sinuses



4. Ethmoidal sinuses

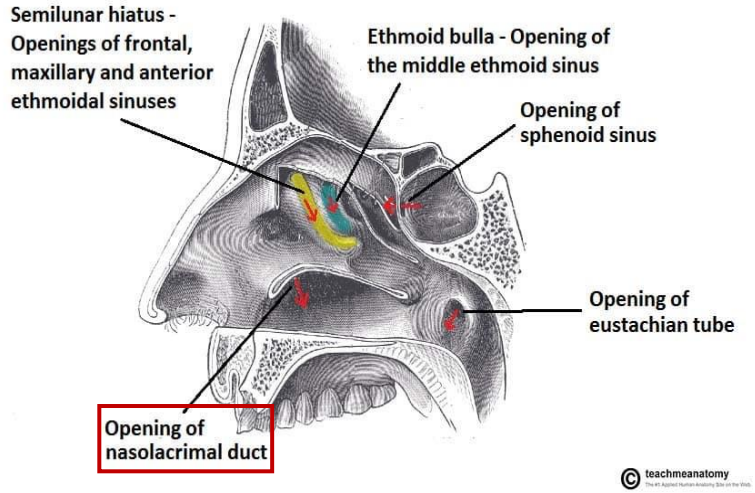
The ethmoidal sinuses consist of very small air cells, usually one or two per sinus, each lined by a very thin mucosa:

✓ **Anterior** group

- **Hiatus semilunaris**

✓ **Middle** group

- Middle meatus on or above bulla ethmoidalis



✓ **Posterior** group

- Superior meatus

✓ **Nasolacrimal duct** opens onto the **lateral** wall of the **inferior nasal meatus.**

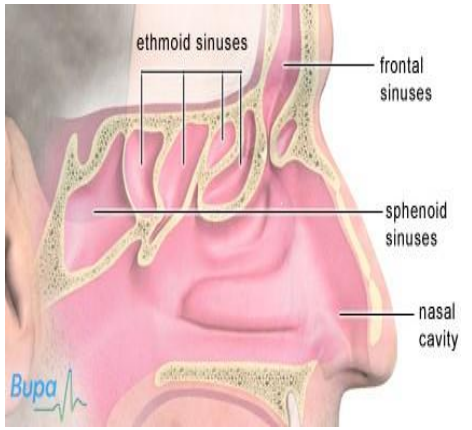
➢ **Iinnervated by the anterior and posterior ethmoidal branches.**

12- Anatomy of the Nasal Cavity – Lateral wall
Paranasal Sinuses

- ✓ The functions of the paranasal sinuses include **resonance of the voice**, **reduction of the weight of the skull**, and **protection** of the skull.

- ✓ At birth, the paranasal sinuses are **rudimentary**, They **increase in size with facial growth** and attain their **largest size in adults.**

Dr.'s figure:



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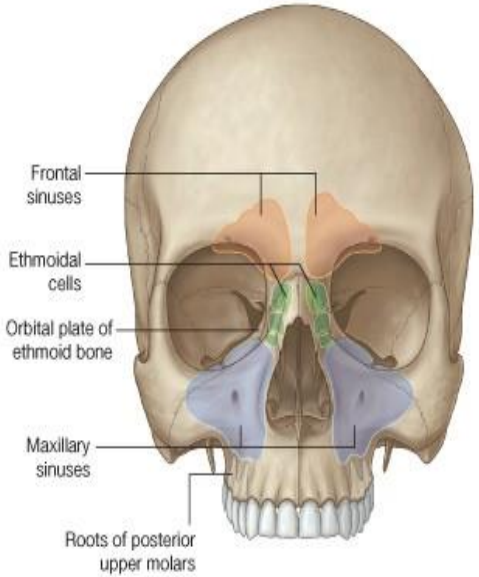
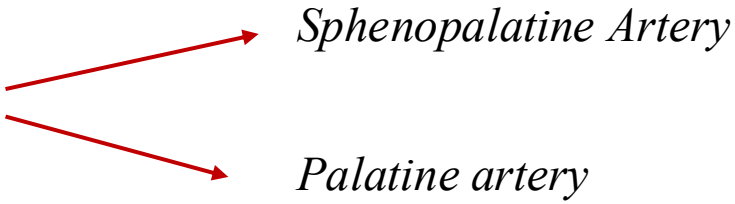


Dr.'s figure:

13- Blood Supply of the Nose

- When discussing the blood supply of the nose, it is useful to divide the nose into two main regions: Lateral wall & Septum (medial wall)

- **Maxillary artery** is the major contributor, It travels in the **pterygopalatine fossa**, which contains: Maxillary artery, Maxillary vein, Maxillary ganglion.



- **Sphenopalatine Artery (Main Branch of Maxillary Artery)** Enters the nasal cavity through the **sphenopalatine foramen** (**medial** wall of pterygopalatine fossa).

• Branches:

Posterior lateral nasal branches

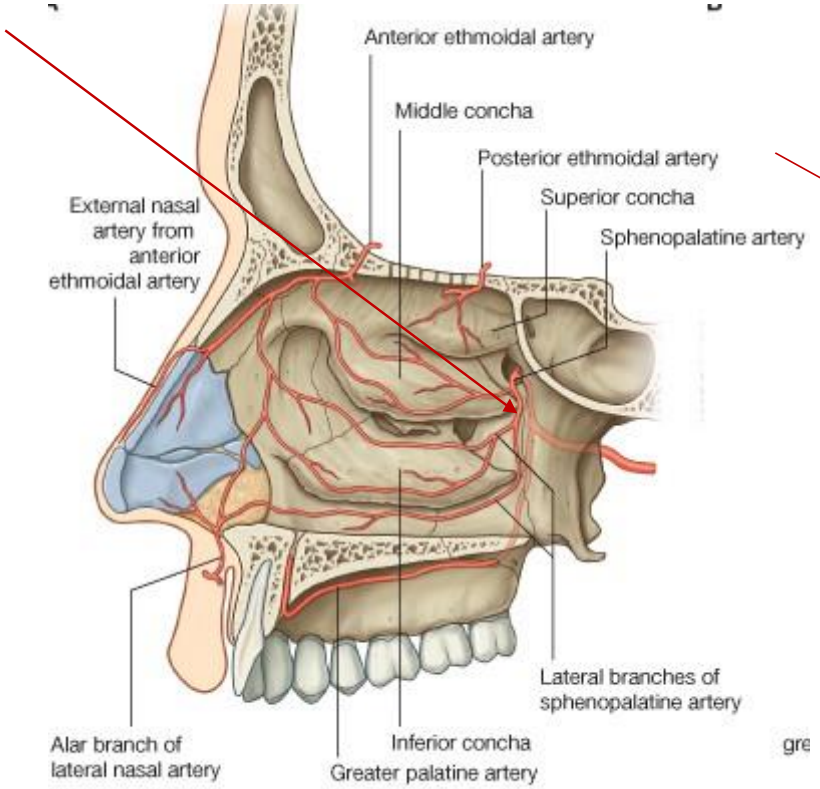
✓ **Short sphenopalatine artery** → supplies **upper lateral** wall (upper lateral quadrant)

Posterior septal branches

✓ **Long sphenopalatine artery** → supplies **nasal septum** (medial wall)

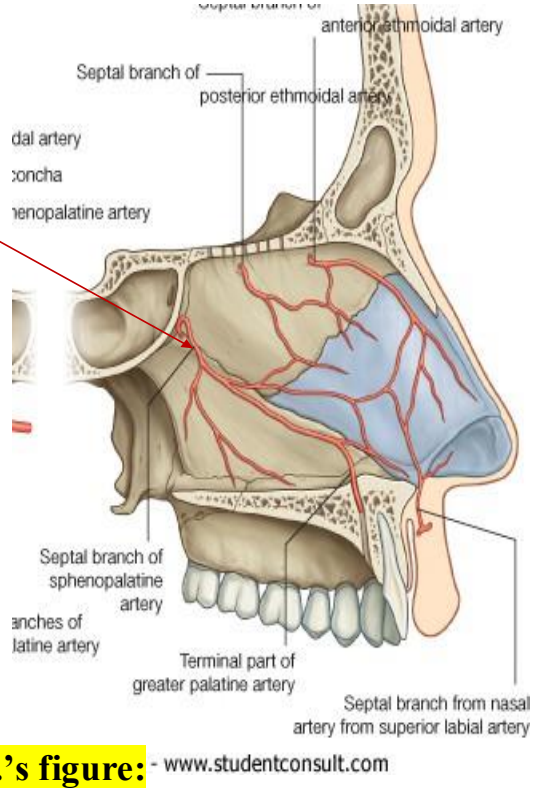
• Clinical relevance: main source of epistaxis (nosebleeds) *slide 38*

13- Blood Supply of the Nose



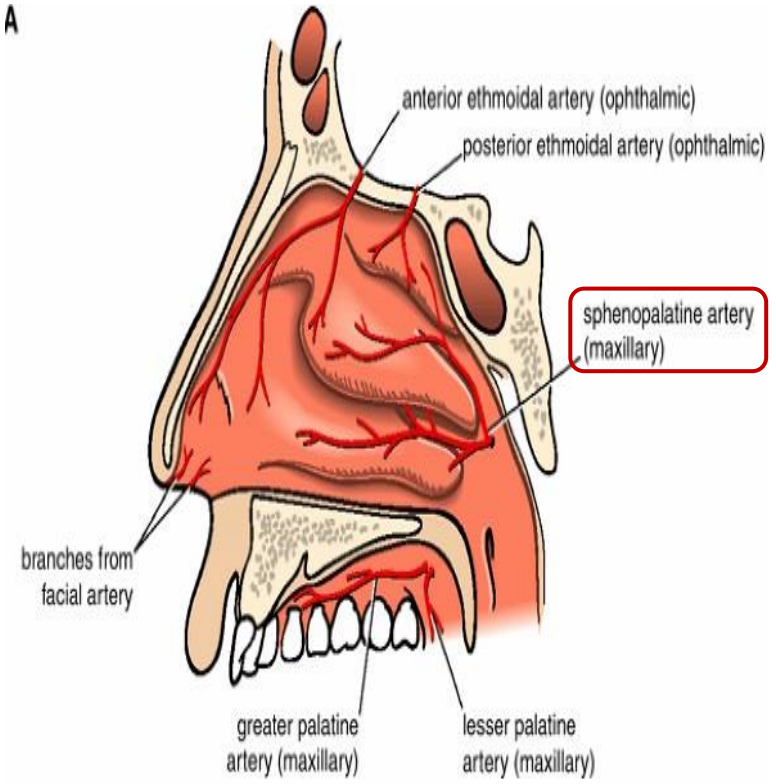
Dr.'s figure:

Short sphenopalatine artery



Dr.'s figure: - www.studentconsult.com

Long sphenopalatine artery



Dr.'s figure:

13- Blood Supply of the Nose

➢ **Palatine artery** is a branch of the maxillary artery, It passes through the palatine canal toward the oral cavity.

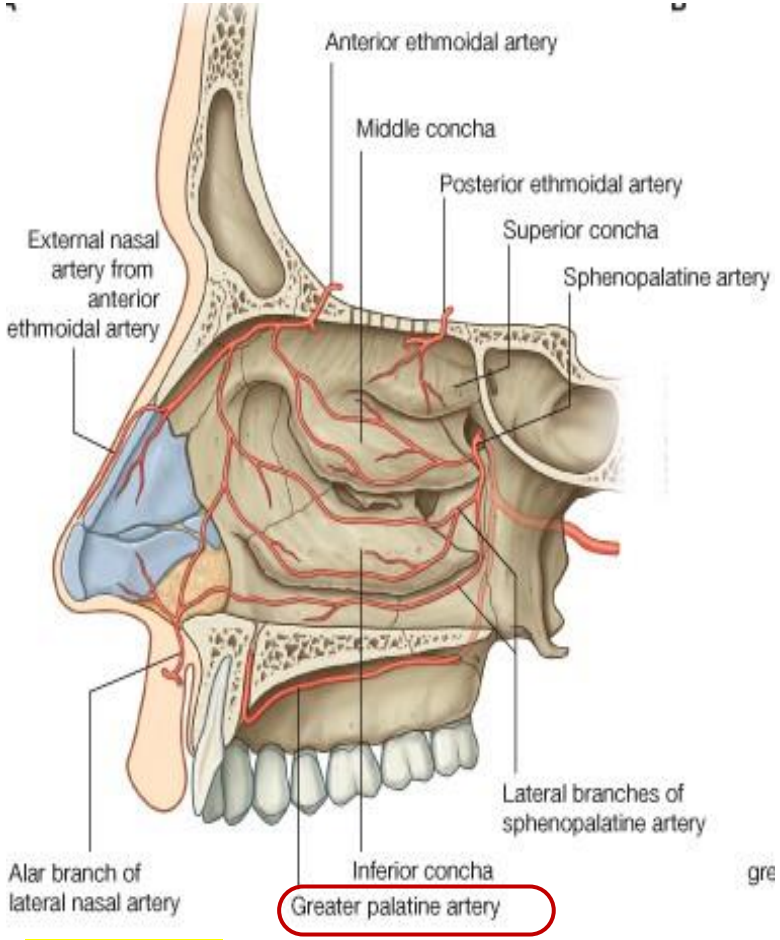
- Divides into two branches:

✓ **Greater palatine artery**

- Supplies the hard palate.
- Continues superiorly to the nasal cavity via the *incisive foramen*.
- Supplies the anterior inferior part of the lateral wall of the nose.

✓ **Lesser palatine artery**

- Supplies the soft palate.



Dr.'s figure:

13- Blood Supply of the Nose

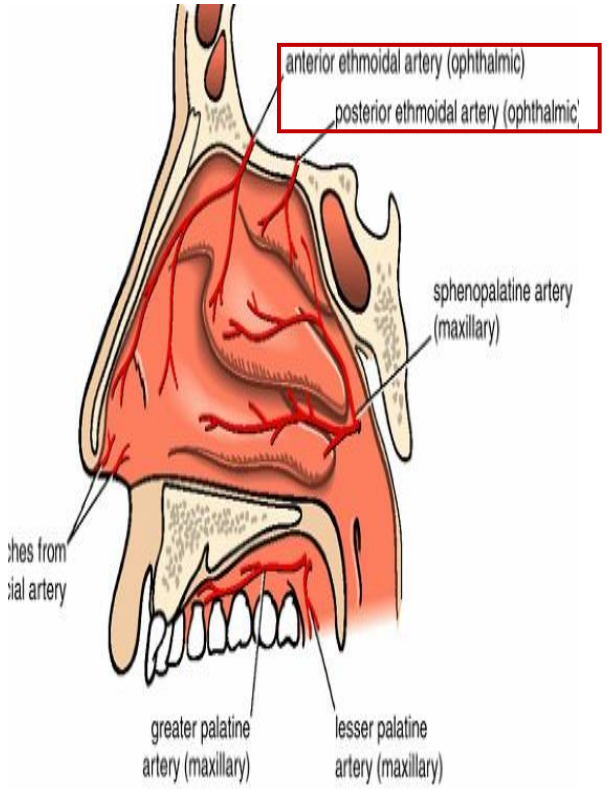
➢ **Ethmoidal arteries** are branches of the **ophthalmic artery** (from the internal carotid artery).

✓ **Anterior Ethmoidal Artery**

- Originates from the ophthalmic artery in the anterior cranial fossa.
- Passes through the *anterior ethmoidal foramen* into the nasal cavity.
- Supplies:
  - Anterior superior part of the nasal septum (medial wall)
  - Anterior superior part of the lateral wall
- Terminates as the external nasal artery, supplying the external nose.

✓ **Posterior Ethmoidal Artery**

- Passes through the *posterior ethmoidal foramen.*
- Supplies: Posterior superior parts of the septum and lateral wall.

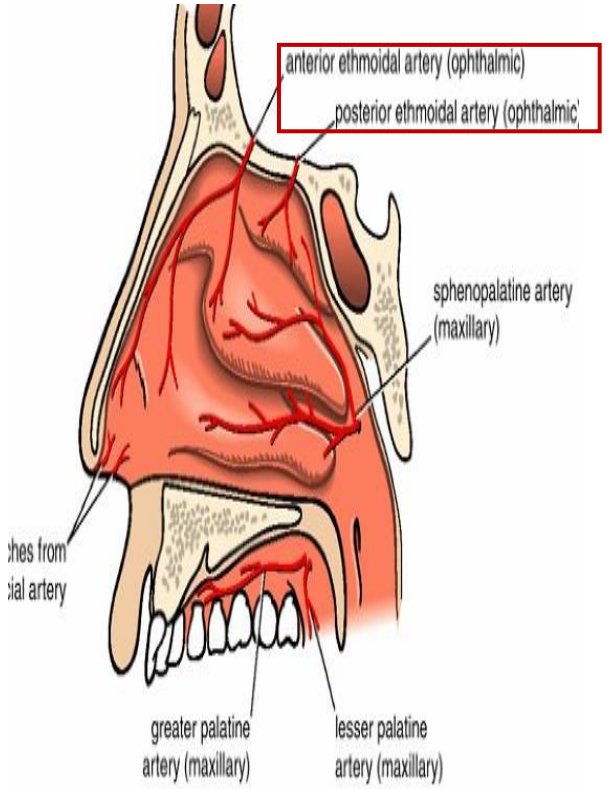


Dr.'s figure:

13- Blood Supply of the Nose

- **The superior labial artery**, which is a branch of the **facial artery**, supplies the upper lip and the anterior part of the nasal septum, This artery is one of the main contributors to anterior epistaxis.

- The **infraorbital artery**, a branch of the maxillary artery, gives **lateral nasal branches** that supply the external nose, in addition to palpebral branches to the lower eyelid and superior labial branches to the upper lip.



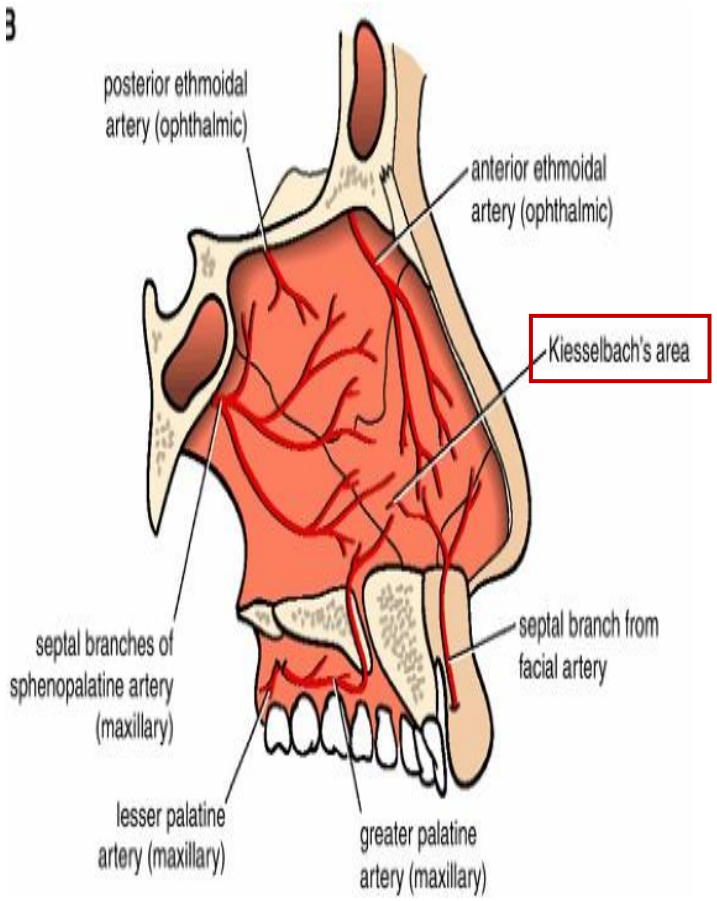
Dr.'s figure:

14- Epistaxis

➢ Related to CLINICAL :

- Epistaxis, or bleeding through the nose, occurs in an area of vascular anastomosis on the nasal septum known as **Kiesselbach's area,** this anastomotic region is located between the **upper two-thirds** and the **lower one-third** of the septum, making it particularly prone to bleeding.

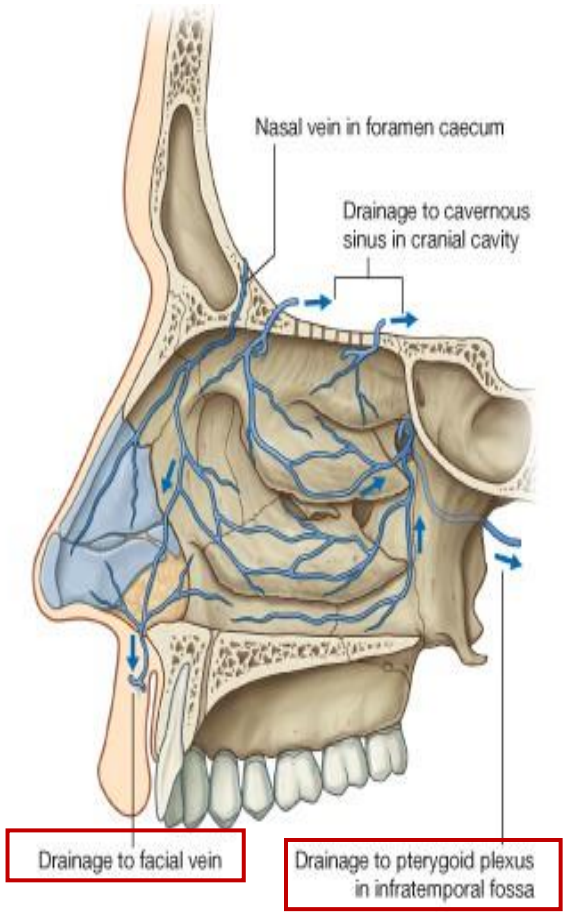
- The main arteries contributing to Kiesselbach's area include the **long sphenopalatine artery**, the **superior labial artery.**



Dr.'s figure:

15- Venous Drainage

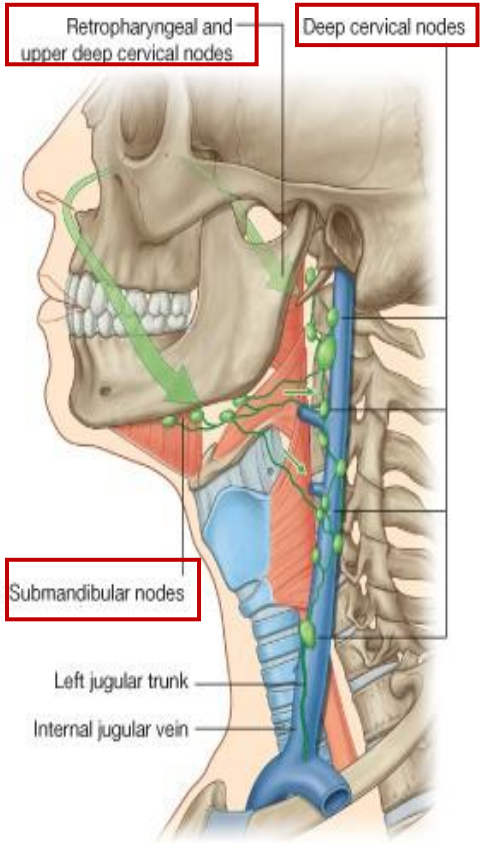
Region / Wall	Vein	Origin / Pathway	Drainage
Anterior part	**Facial vein**	-	Joins the common facial vein → internal jugular vein
Posterior / superior part	**Pterygoid venous plexus**	Located near lateral pterygoid muscles	Drains into maxillary vein → passes through parotid gland



Dr.'s figure:

16- Lymphatic Drainage

- The **anterior** part of the nasal cavity drains into the **submandibular lymph nodes**.
- The **superior & posterior** part drains into the **retropharyngeal lymph nodes** or directly to the **deep cervical lymph nodes.**
- **Ultimately, all lymph from the nasal cavity eventually drains into the deep cervical lymph nodes.**



Dr.'s figure:

17- Innervation

➢ **Sensory Innervation**

✓ **Ophthalmic nerve (V1)**

✓ Gives rise to the anterior and posterior ethmoidal nerves.

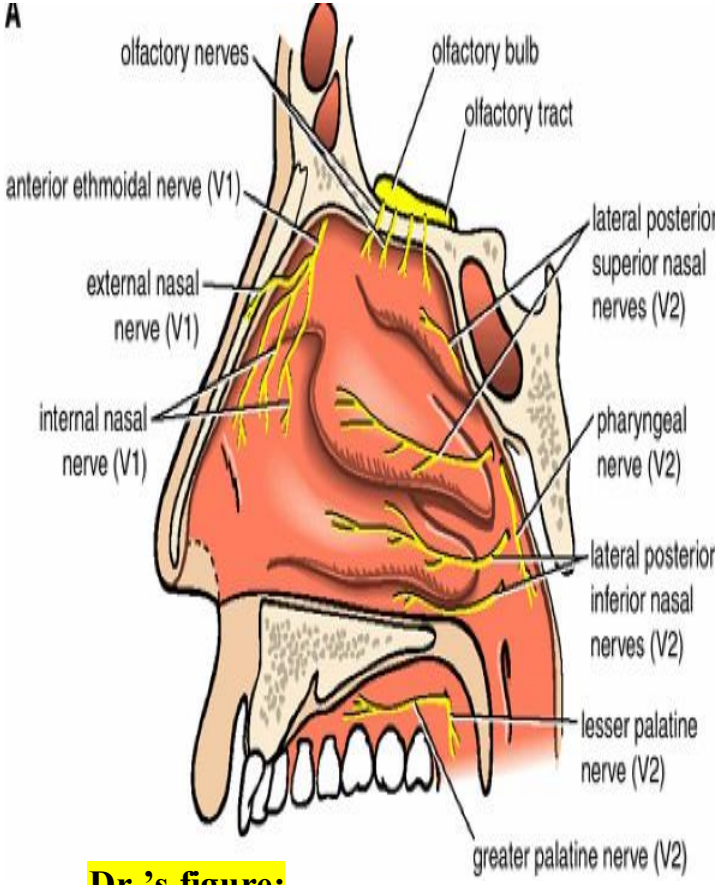
✓ **Maxillary nerve (V2)**

- Gives rise to the long sphenopalatine (nasopalatine) nerve, and the greater and lesser palatine nerves.

➢ **For Olfaction**

✓ **Olfactory nerve (I)** Provides sensory fibers from the roof of the nasal cavity.

- Originates from bipolar cells in the olfactory region.
- Passes as filaments through the cribriform plate to reach the olfactory epithelium.

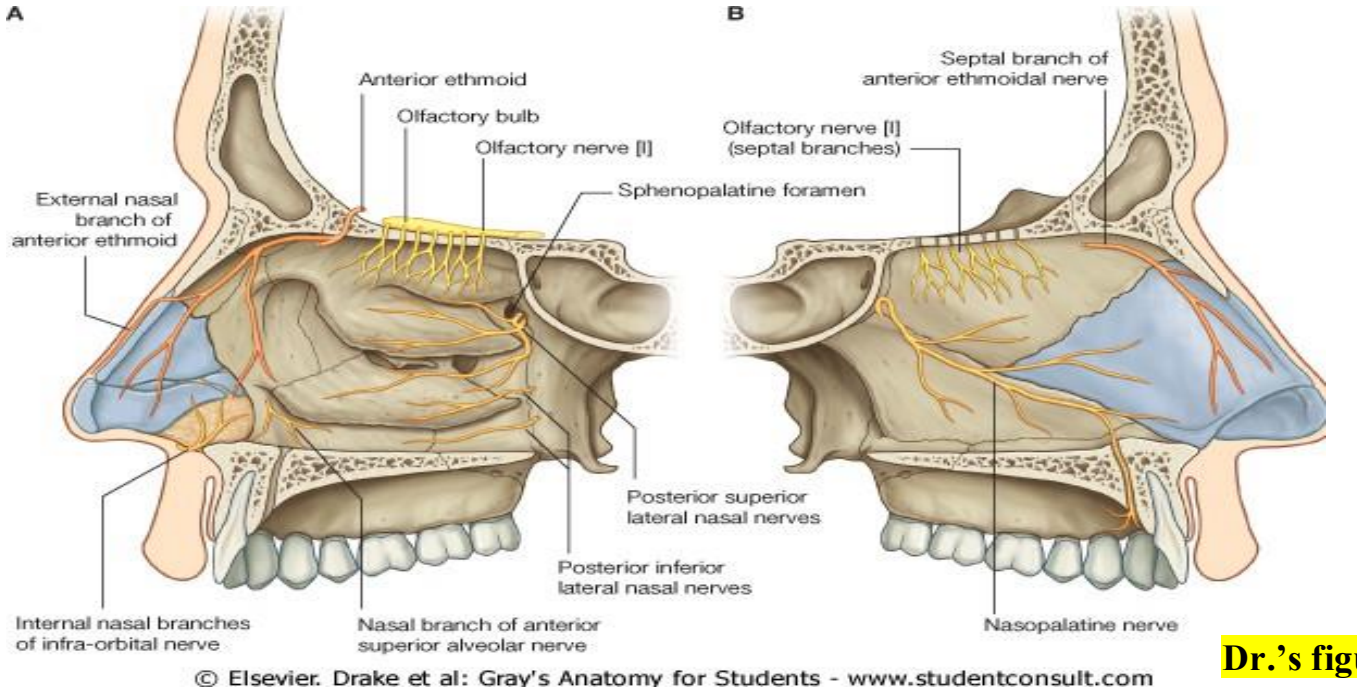


Dr.'s figure:

17- Innervation

➢ Parasympathetic fibers

- Parasympathetic secretomotor fibers supplying the nasal glands originate from the **facial nerve (V11)** pass through the greater petrosal nerve to the pterygopalatine ganglion, and then reach the glands to stimulate secretion.



Dr.'s figure:

ANATOMY
QUIZ
LECTURE 1

External Resources

رسالة من الفريق العلمي

فوّض لِمن وسعت ألطافه أمماً ،
نِعم الوكيل ونعم العون والمدد ..

For any feedback, scan the code or click on

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1	24 -	- -	Adding info (During Information or...) A new slide related to the blood supply was added, and indicative markers were added
V1 → V2	11 23 **31**	- - Infundibulum and into middle meatus	Adding info (**facial artery** (branch of the **external** carotid artery) **modified skin** = **(keratinized stratified squamous epithelium)** **Hiatus semilunaris**