



Respiratory system

Nose, nasal cavity & paranasal
sinuses

By

Dr. Mohamed Fathi

Assistant professor of Anatomy Department
Faculty of medicine

By the end of this lecture you must know:

- **Divisions and different parts of respiratory system.**
- **Anatomy of nose and Para nasal sinuses which includes:**
 - 1-External nose and its nerve supply**
 - 2-Nasal cavity boundaries and contents of its lateral wall.**
 - 3-Blood supply and lymphatic drainage of the nose.**
 - 4- Development of the nose and para nasal sinuses.**
 - 5- Anatomy of Para nasal sinuses, drainage and clinical importance**
 - 6-Histology of the nose and paranasal sinuses**

The Respiratory System is divided into 2 parts:

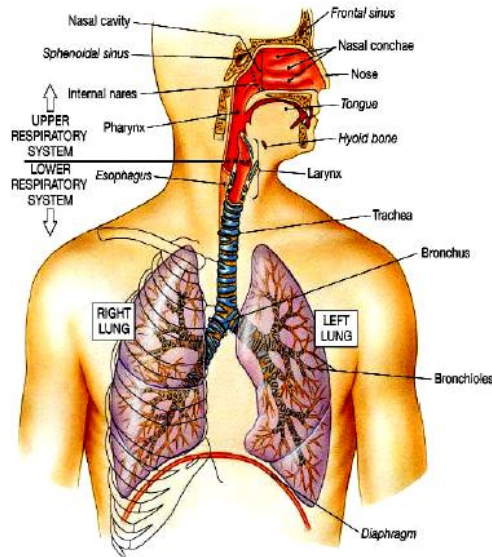


Figure 13.1: Conducting portion of the respiratory system

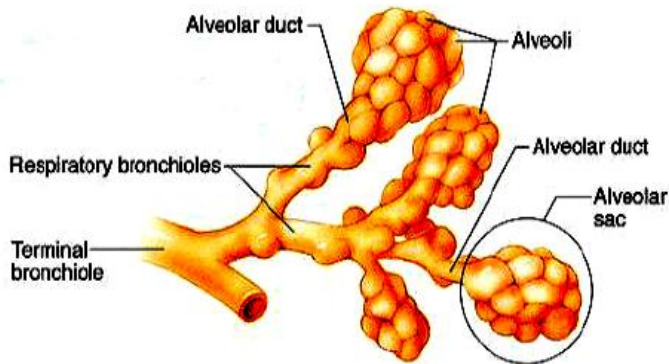


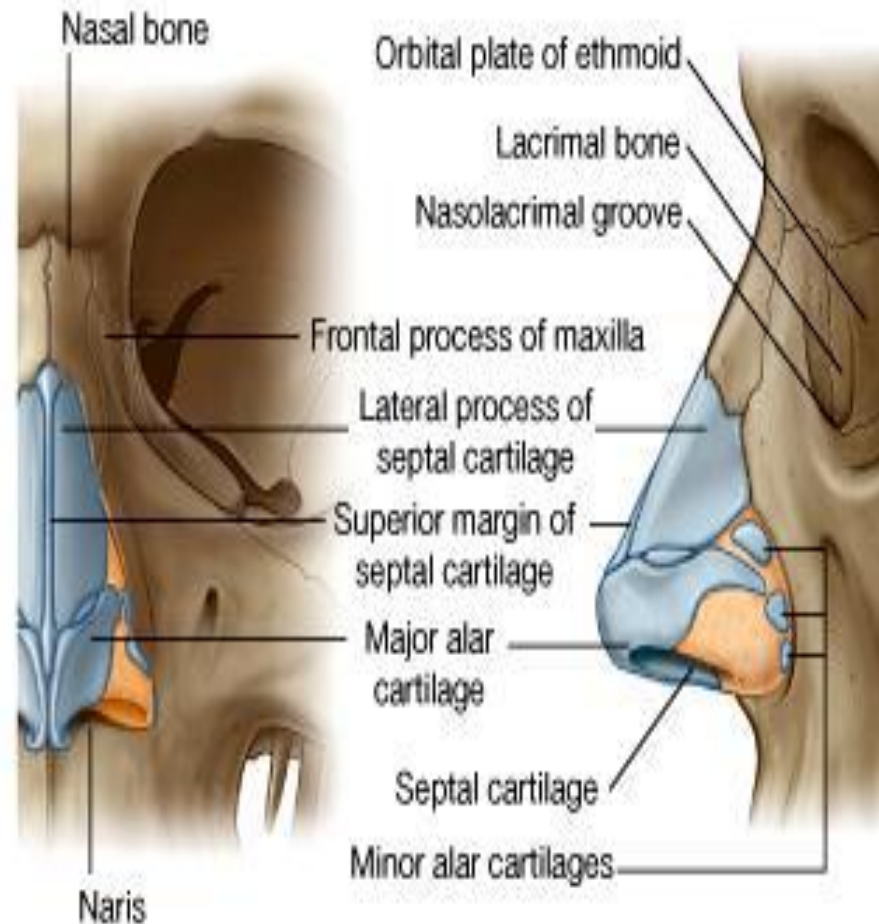
Figure 13.2: Respiratory portion of the respiratory system

Conducting part	Respiratory part
<p>-Nose (nasal cavity & Nasal sinuses.</p> <p>-Nasopharynx, larynx, trachea</p> <p>-Bronchial tree:</p> <p>Extra pulmonary bronchus</p> <p>Intrapulmonary bronchus</p> <p>-Bronchioles:</p> <p>Preterminal bronchioles</p> <p>Terminal bronchioles</p>	<p>Gas exchange take place</p> <p>-Respiratory bronchioles</p> <p>-Alveolar bronchioles</p> <p>-Alveolar ducts</p> <p>-Alveolar sacs</p> <p>-Alveoli</p>

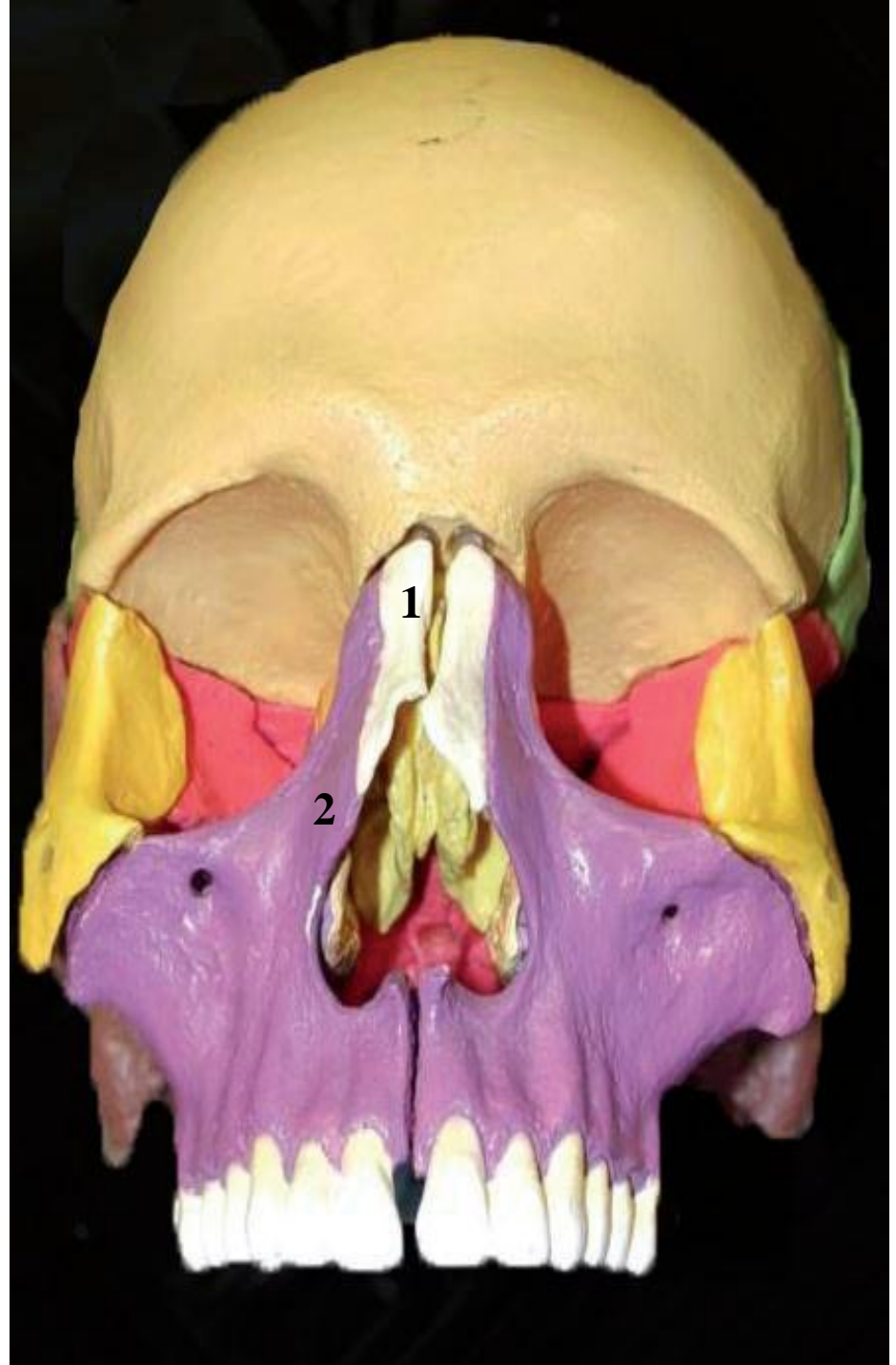
Nose

1) The external nose:

- It has bridge, tip, nostrils (anterior opening of nose) and ala of nose which bounds the nostril laterally.
- Skin of external nose is supplied by **external nasal, infra- trochlear & infra-orbital nerves.**



- Its skeletal framework is formed by bones; **nasal bones** + **frontal processes of maxilla**



Nasal Cavity

The nasal cavity: is the posterior wide part of the nose; divided into 2 halves by nasal septum, which making the two nasal cavities.

- Each half has a roof, floor, lateral and medial wall.

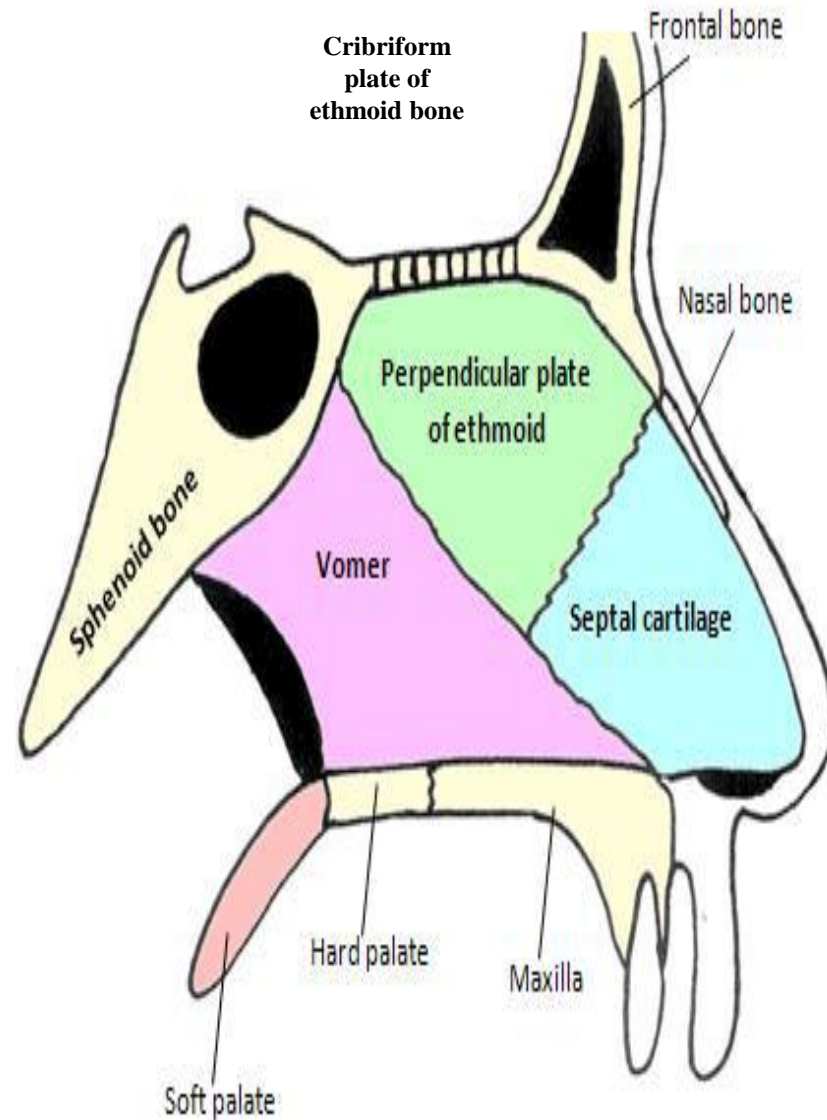
Boundaries

1-The Roof (sloping):

*It is formed of 3 parts:

- a. The cribriform plate of ethmoid form middle part.
- b. Nasal bone & nasal process of frontal bone form anterior sloping part.
- c. Body of sphenoid forms the posterior sloping part.

2- Floor: hard palate.



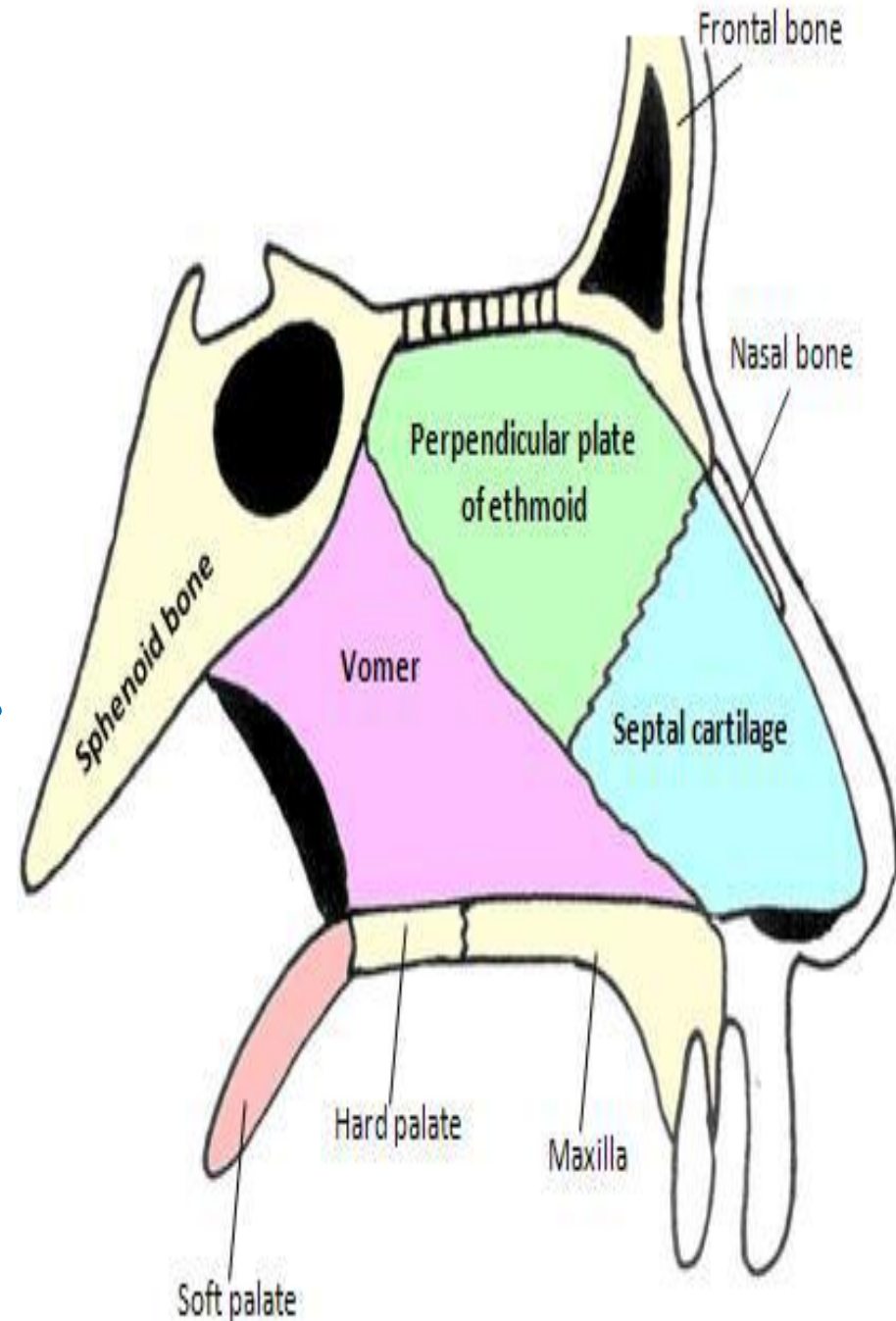
3-The Medial wall (nasal septum):

a. Bony element:

**-Vomer bone
(posterior).**

**- Perpendicular plate of
ethmoid bone (above).**

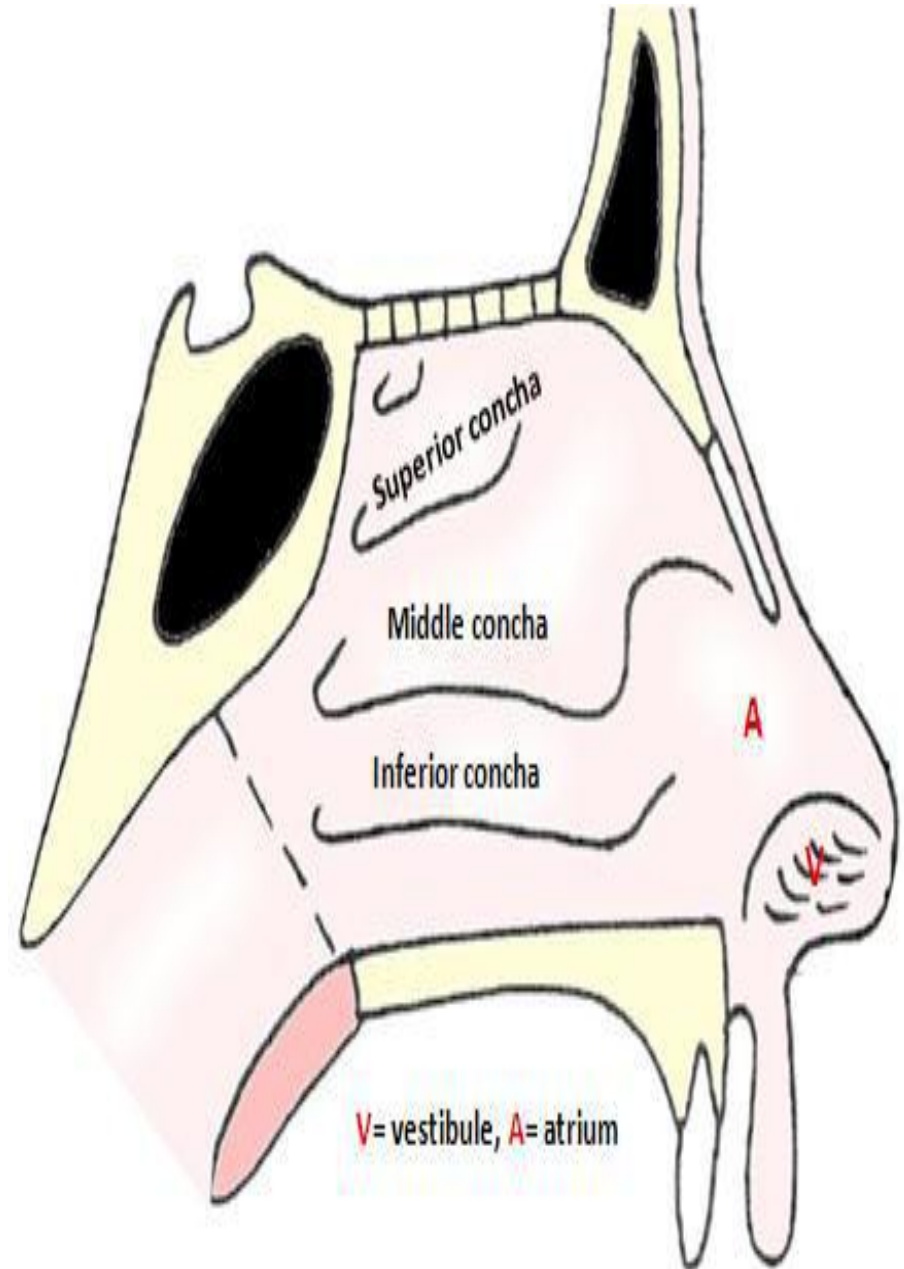
**b. Cartilaginous
element: septal
cartilage (anterior).**



4-The Lateral wall:

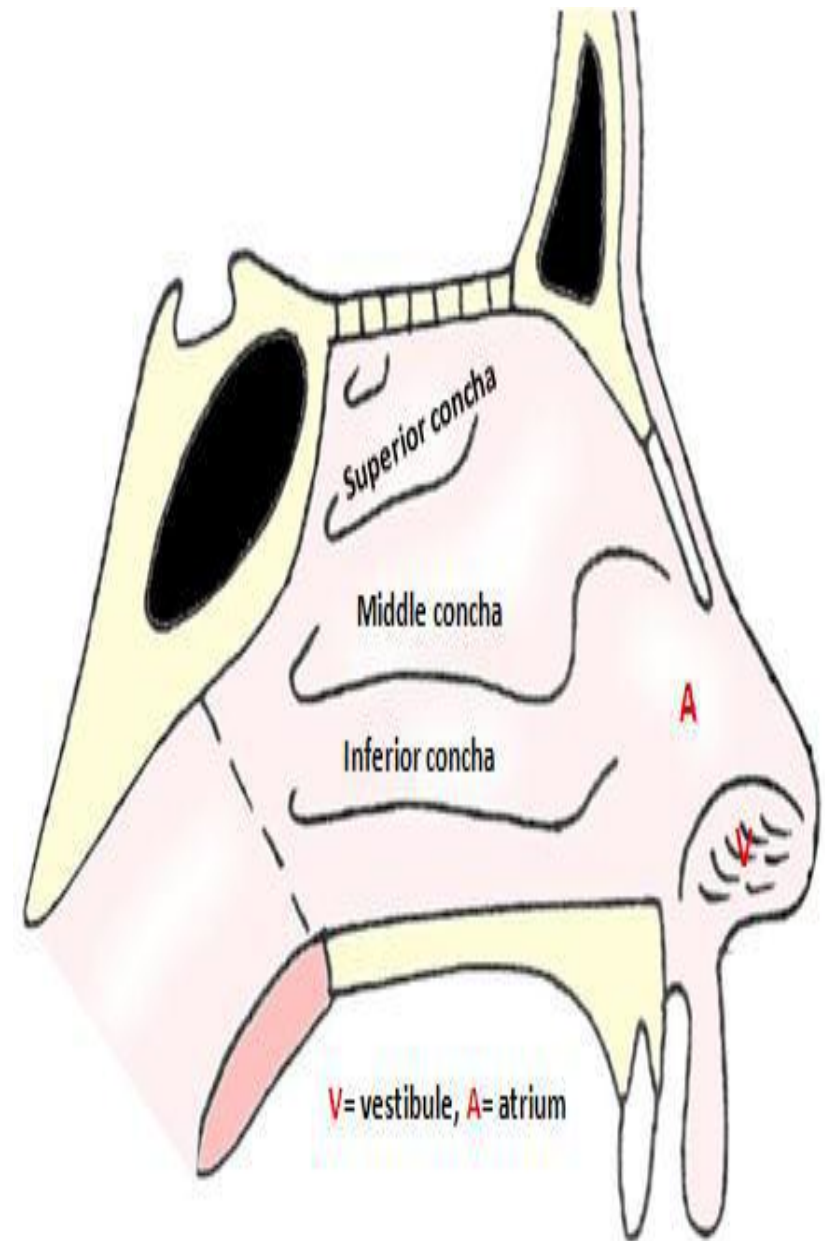
Bones forming :

- **Superior:** Nasal aspect of ethmoid bone above.
- **inferior:**
- (a) Nasal aspect of maxilla
- (b) Perpendicular plate of palatine bone behind.

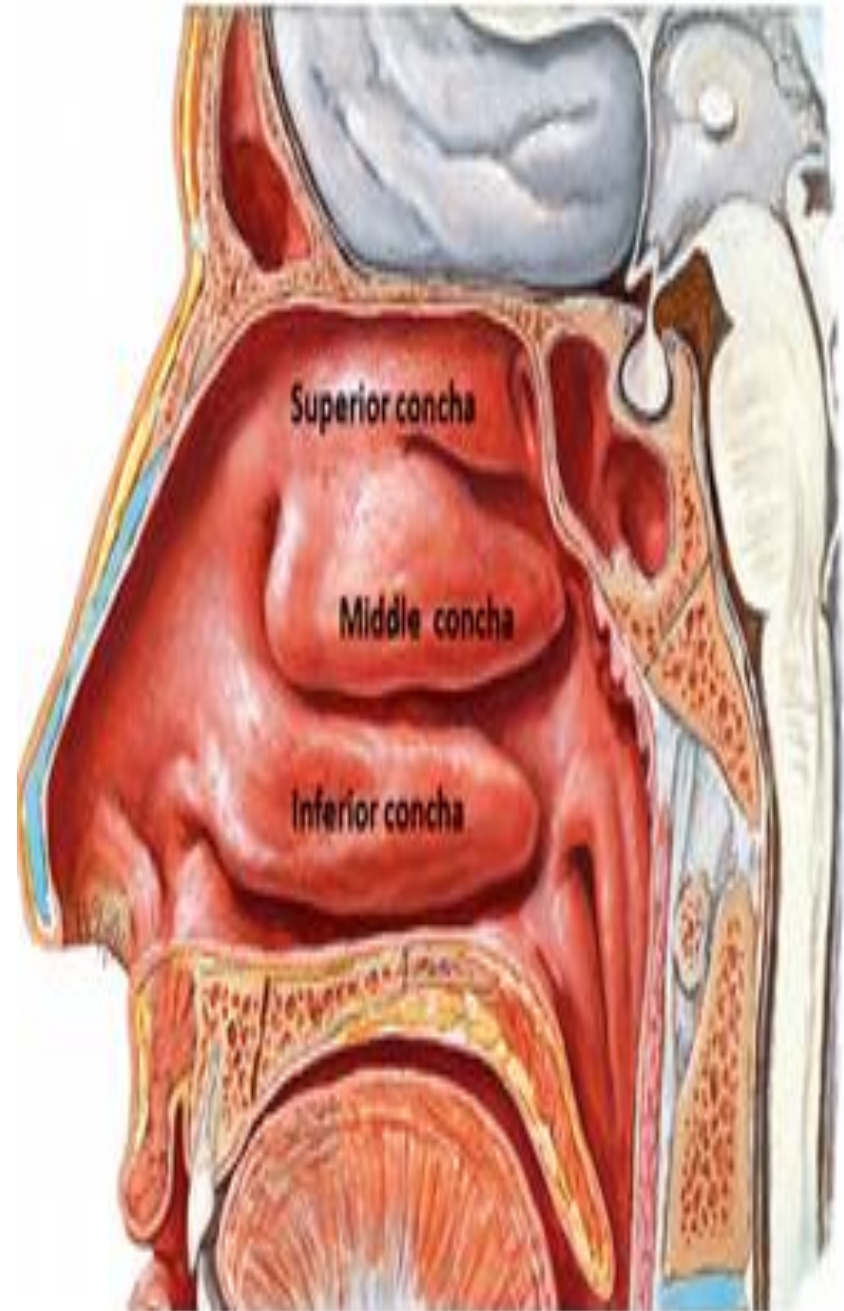


The lateral wall is divided into 3 parts:

- a. Small anterior hollow part called “**vestibule**”, covered by skin and contains hair.
- b. Middle hollowed part called “**atrium** of the middle meatus”.
- c. Posterior part containing the conchae & meatuses.

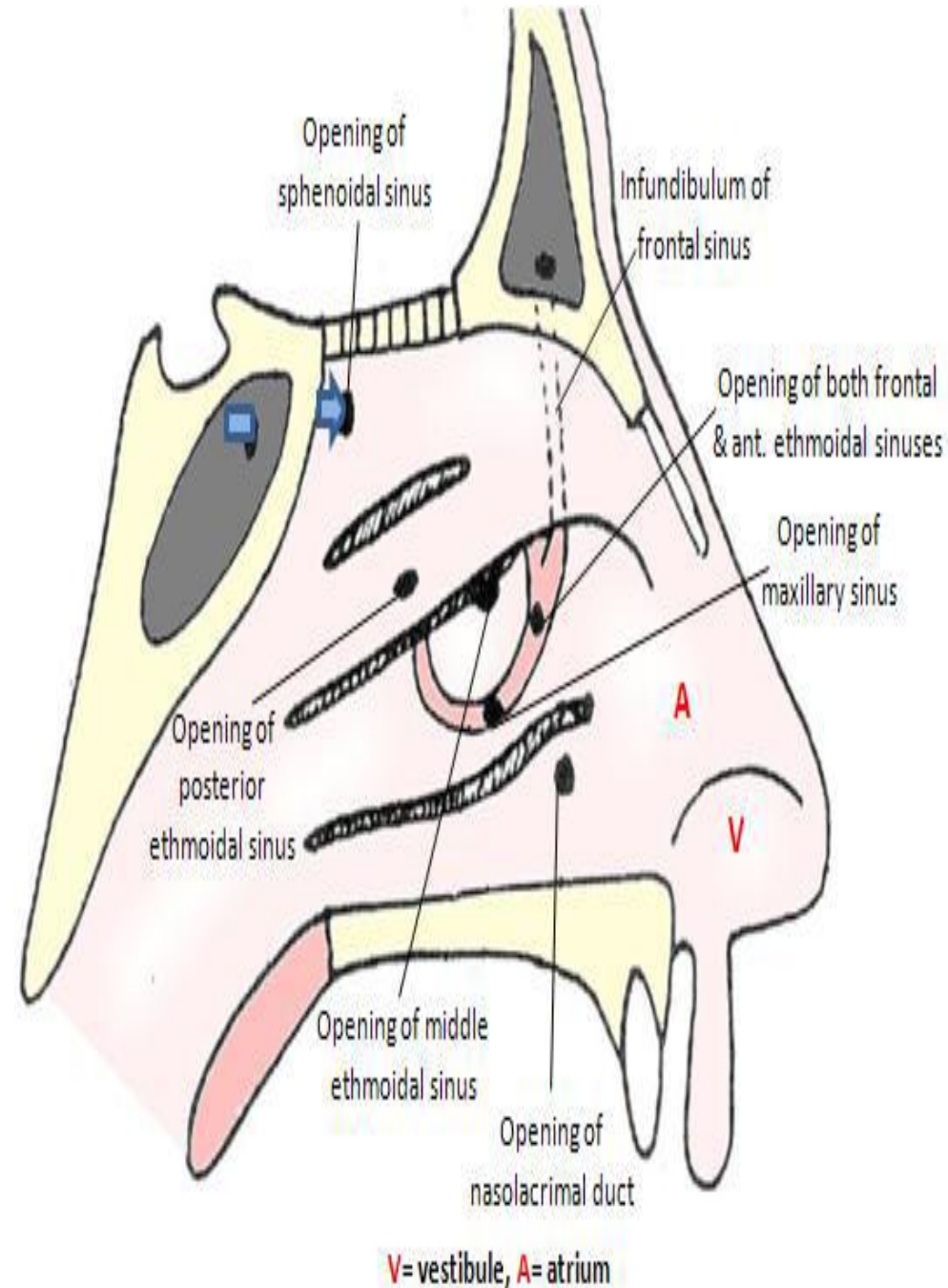


- **Nasal conchae:**
- (superior, middle & inferior):
- Shelf-like bony projections directed downward and medially.
- - The superior & middle conchae project from the ethmoidal bone while the inferior one is a separate bone
- Superior concha is **the smallest** while the inferior concha is the **largest**.

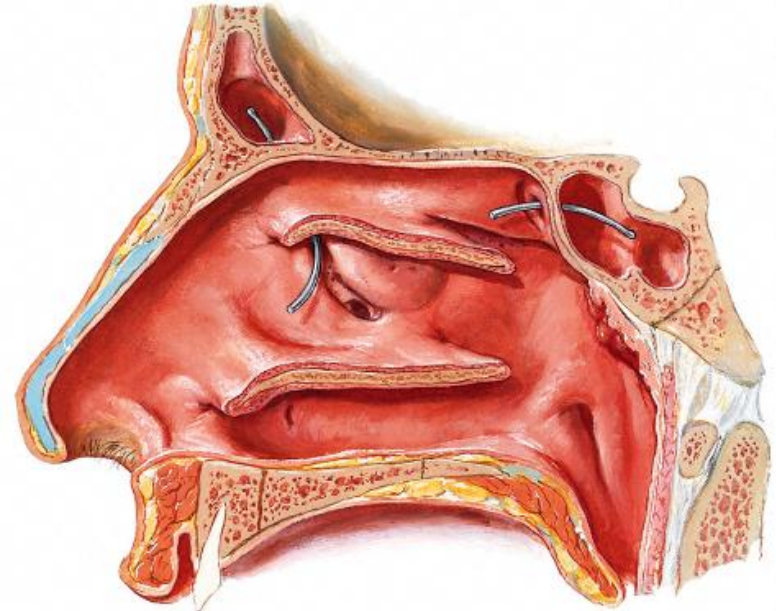
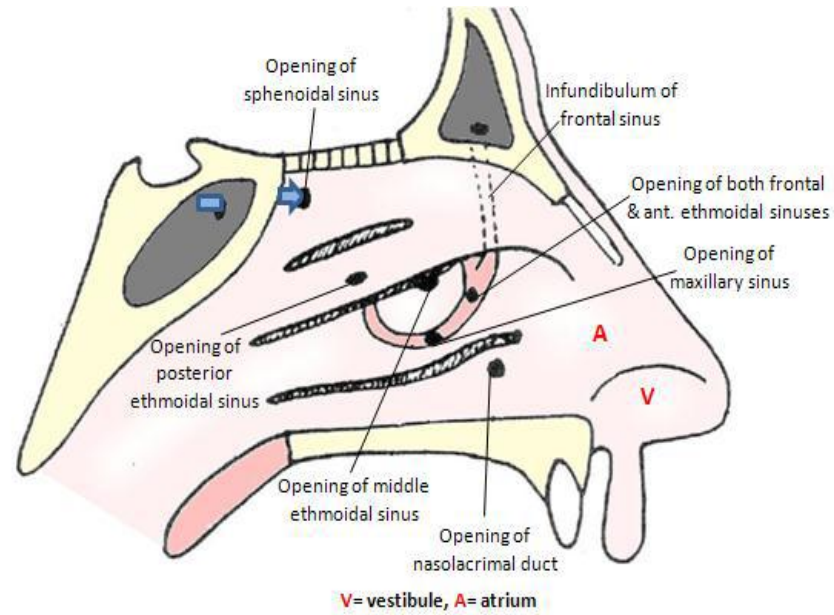


Nasal meatuses:

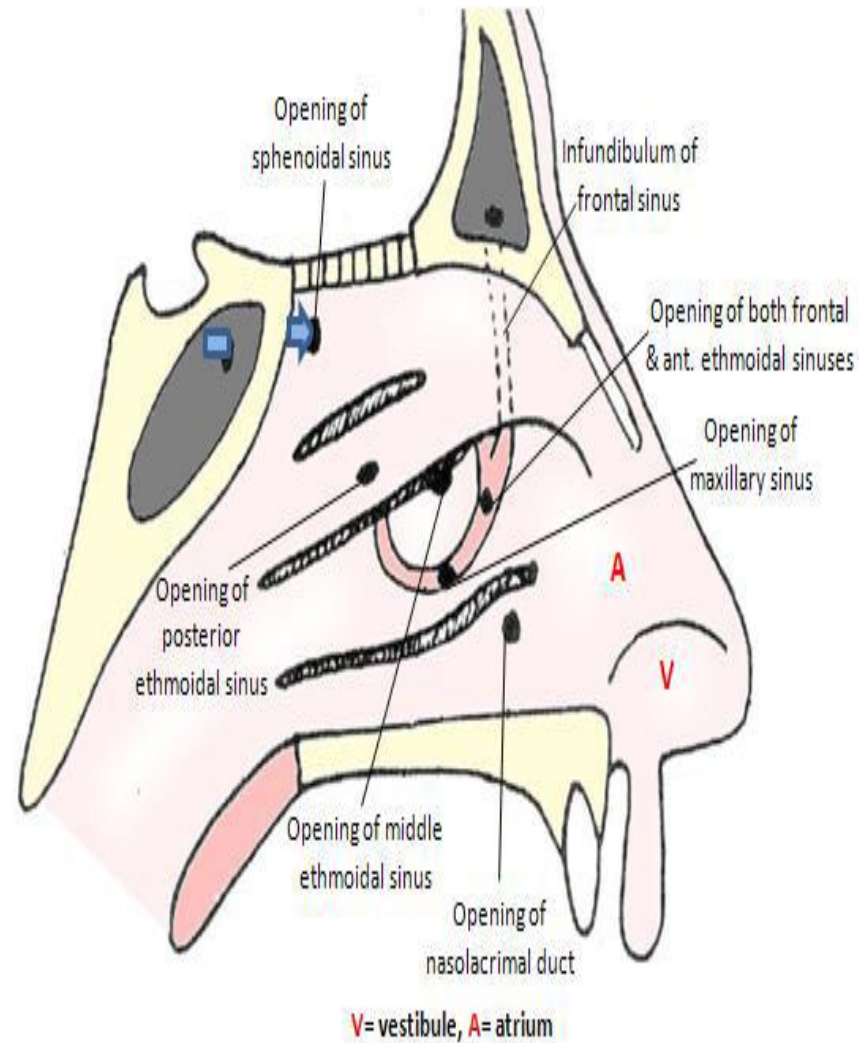
- Are passages beneath the conchae.
- **The superior meatus** : the shortest and shallowest one, receiving the opening of the **posterior ethmoidal sinuses**.



- **II- The middle meatus:**
has 3 features:
- **1. *Bulla ethmoidalis:*** rounded elevation produced by the **middle ethmoidal sinus (open on it).**
- **2. *Hiatus semi-lunaris:*** deep semicircular groove below the bulla, has: - **Anterior end**, receives the opening of the **frontal air sinus & anterior ethmoidal air sinus.** - **Posterior end**, receives the opening the **maxillary air sinus.**
- **3. *Infundibulum:*** short passage at the anterior end of the hiatus.

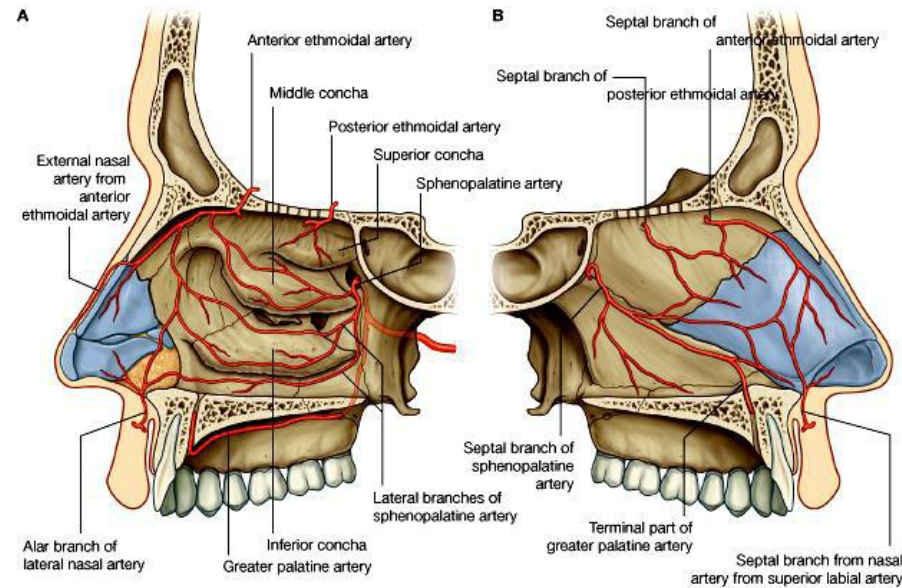


- **III- Inferior meatus:** the largest one, receives opening of **naso-lacrimal duct**
- **IV- Spheno-ethmoidal recess:** triangular fossa above superior concha, receiving the opening of **sphenoidal air sinus**.



Blood supply of the nose

part	Arterial supply
1-Antero-superior	Ant. & post. ethmoidal as
2-postero-superior	Sphenopalatine a
3-Antero-inferior	Facial a, Gr. palatine a, Ant. sup.alv.a
4- postero-inferior	Greater palatine a



***Venous drainage of the nose:**

***a. Anterior part* into the facial vein.**

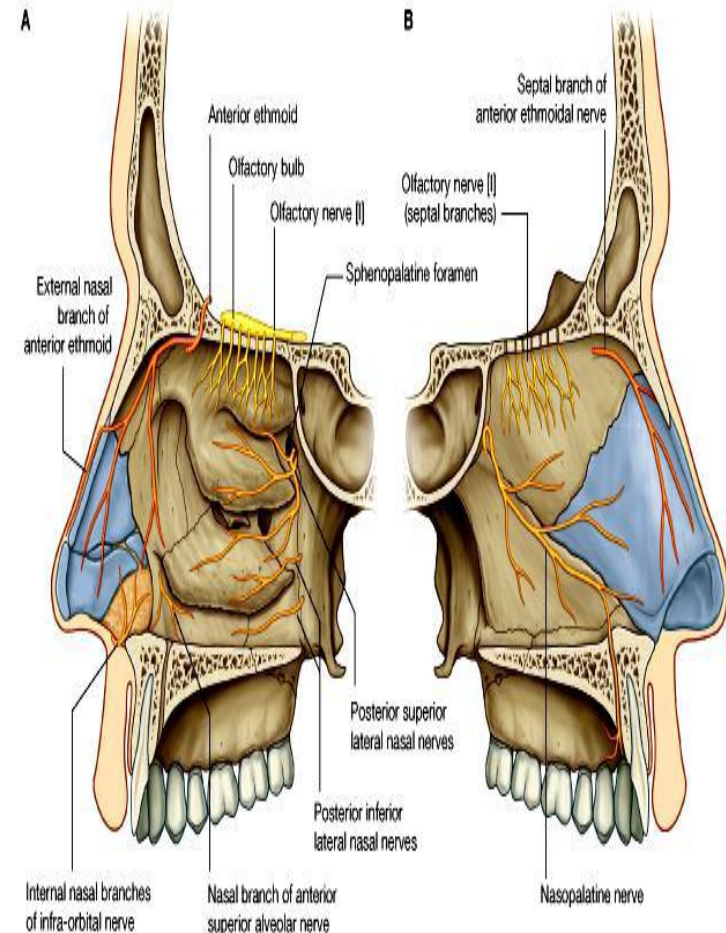
***b. Posterior part* into the pharyngeal plexus.**

***c. Middle part* into the pterygoid venous plexus.**

*Nerve supply of the nose

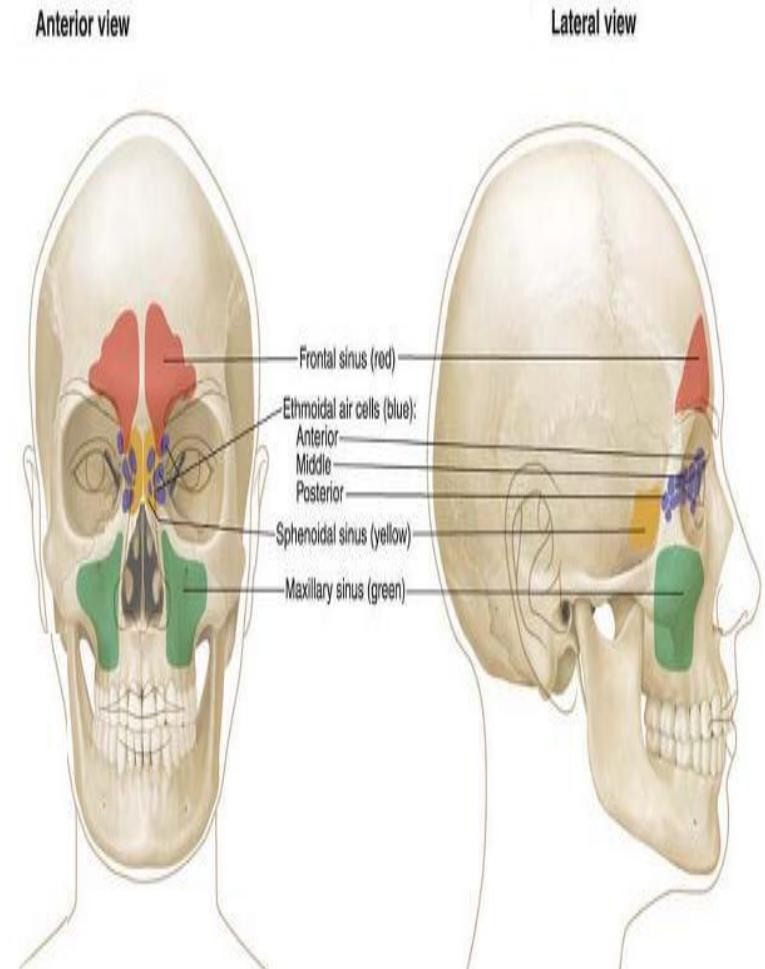
A)- General sensation: (from trigeminal n 5th cranial n)

B)-Special sensation :
(olfactory n. 1st cranial n).

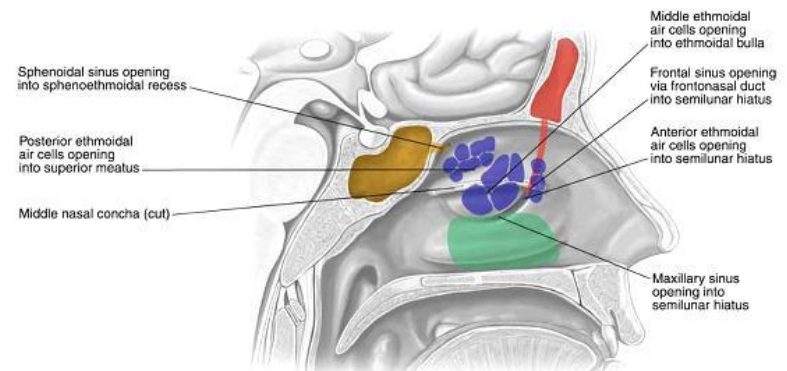
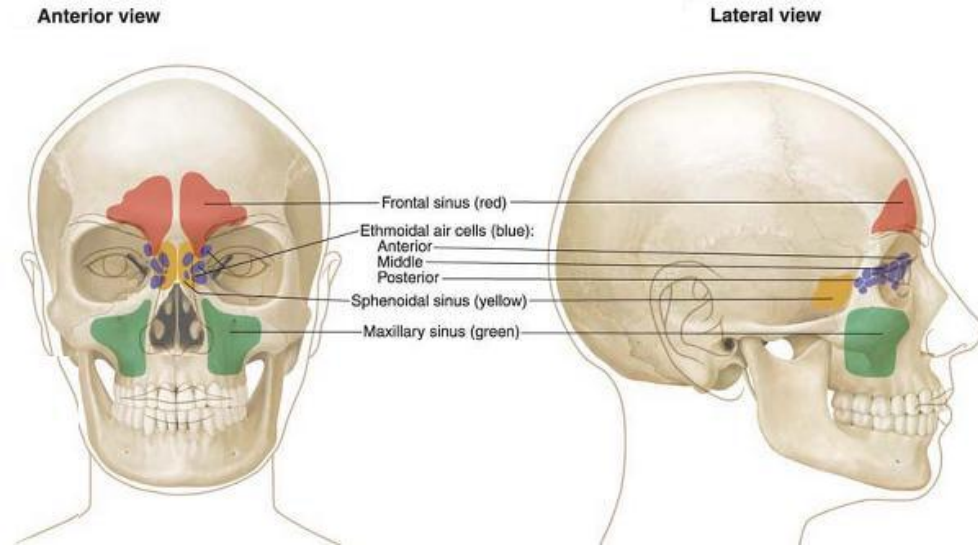


Parnasal Air Sinuses

- **Definition:** spaces inside the skull filled by air.
- **4 sinuses** on each side (**frontal**, **maxillary**, **sphenoidal** & **ethmoidal**), they open into the lateral wall of nose.
- **Function:** lighten the skull weight & add resonance to the voice.
- They are either absent or rudimentary at birth but increase in size until adolescence they become fully developed after eruption of permanent teeth.



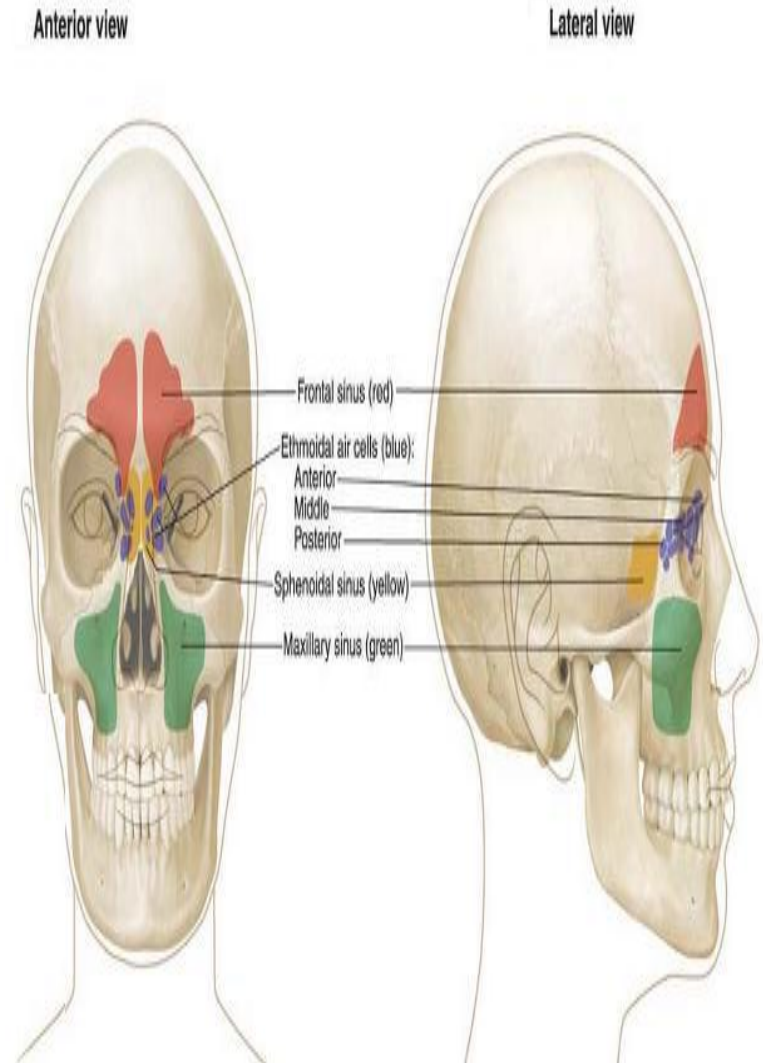
- They are divided into 2 groups:
- **Anterior group:** frontal, maxillary, anterior & middle ethmoidal (all open in the middle meatus).
- **Posterior group:**
 - *Sphenoidal opens in spheno-ethmoidal recess.
 - *Posterior ethmoidal opens in superior meatus.



1-Maxillary Air Sinus

- **Site:** body of the maxilla.
- **Shape:** pyramidal in shape:
- **The base** is the lateral wall of the nose
- **The apex** extends to zygomatic process of maxilla or even the zygomatic bone.
- **The roof** is the floor of the orbit.
- **The floor** is the maxilla's alveolar process
- **The sinus** opens into the hiatus semilunaris by one or two openings.

***Nerve supply:** infraorbital and superior alveolar nerves. Pain from an infected sinus can be referred to the teeth (upper jaw).



Clinical importance

- **The maxillary air sinus is commonly infected (maxillary sinusitis) because:**

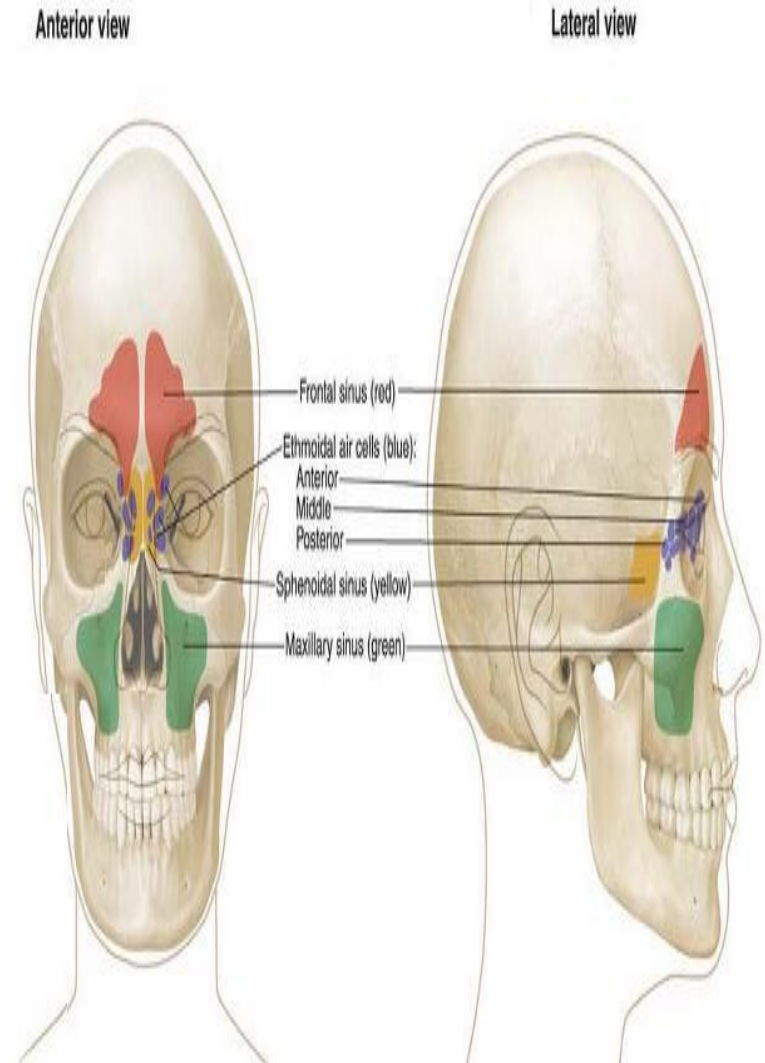
1-Its drainage is difficult (its drainage orifice lies near the roof)

2-Discharge from an infected frontal or anterior ethmoidal air sinus can pass to the sinus.

3-It is closely related to teeth so spread of infection from tooth to the sinus can occur.

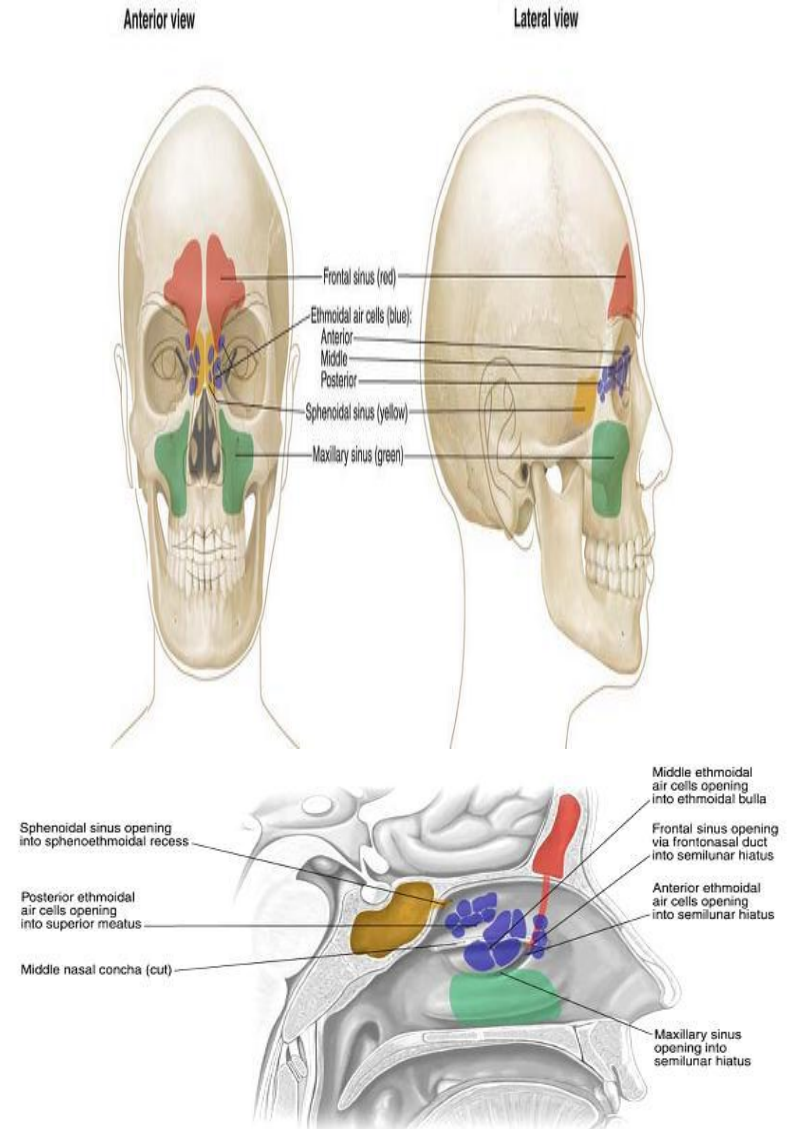
2-Frontal Air Sinuses

- -The two sinuses in frontal bone are usually unequal in size. -Each drains into the **middle meatus of the nose by the infundibulum**, in the anterior part of the hiatus semilunaris.
- ***Nerve supply:** Supraorbital nerve.
- **Clinical importance:** pain from an infected sinus can be referred to the forehead Infection of frontal air sinus can spread to frontal lobe of brain.

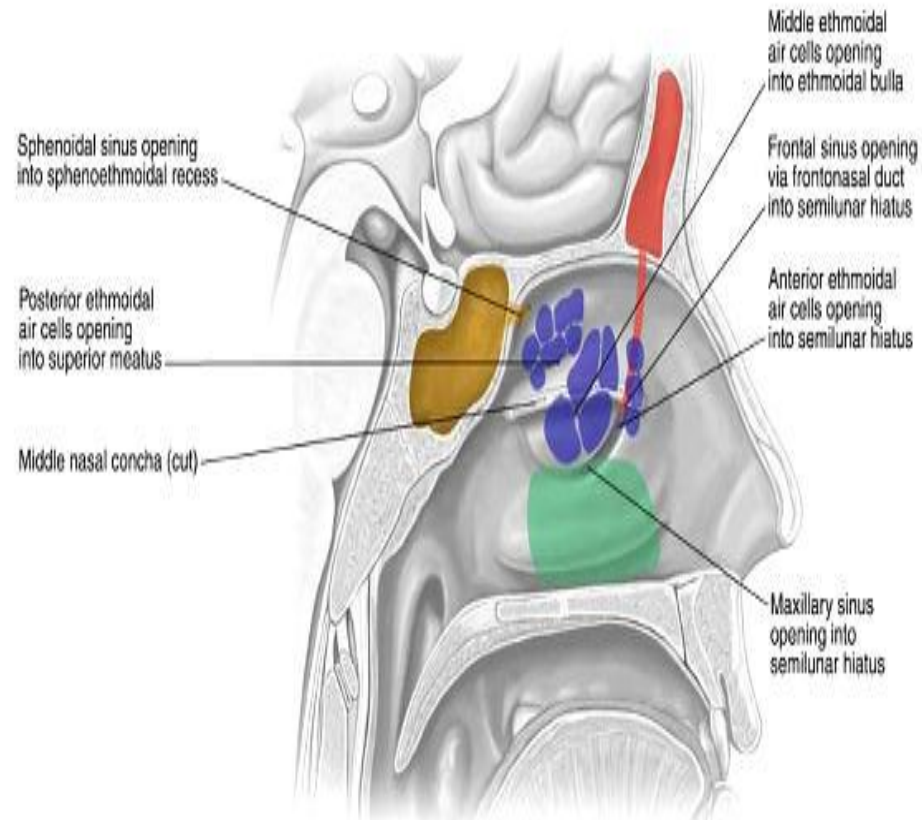


3-Ethmoidal Air Sinuses

- -They are present in the ethmoid bone arranged into: anterior, middle and posterior ethmoidal air sinuses. They lie between the nasal cavity and orbit. Infection in these sinuses can spread to the orbit.



- **a) Anterior ethmoidal sinuses:** drain into infundibulum at anterior end of hiatus semilunaris of middle meatus.
- **b) Middle ethmoidal sinuses:** drain by an opening on top of bulla ethmoidalis.
- **c) Posterior ethmoidal sinuses:** drain into superior meatus.
- ***Nerve supply:** They are supplied by anterior and posterior ethmoidal nerves.

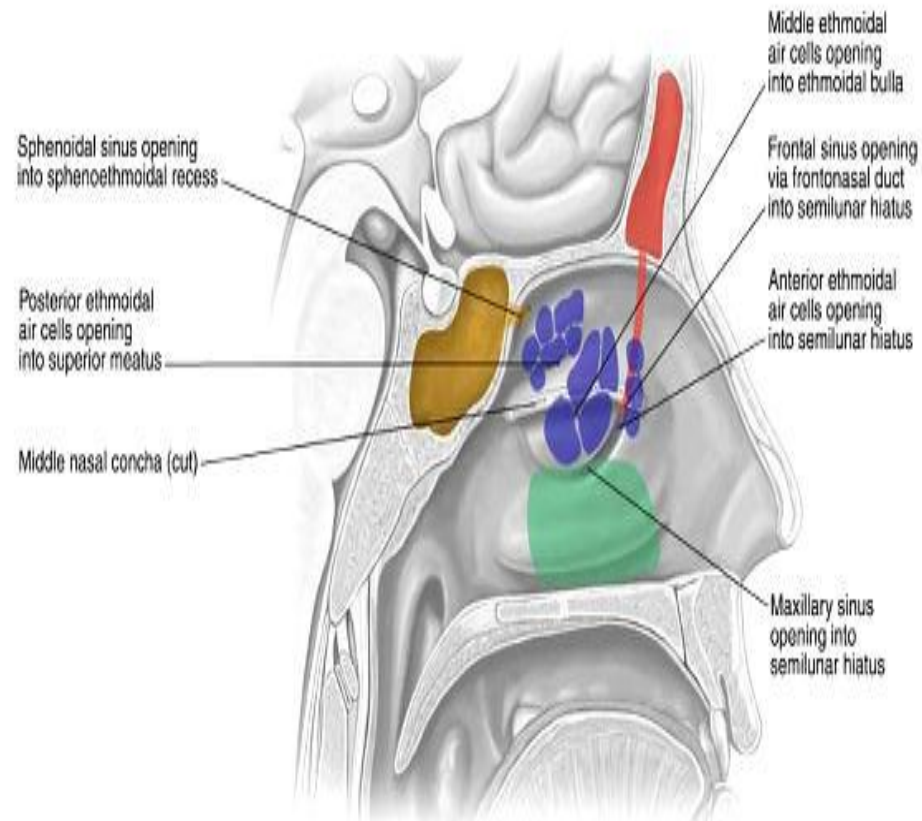


4-Sphenoidal Air Sinuses

- They are two right and left separated by a septum inside body of sphenoid. They drain into **spheno-ethmoidal recess**.

**Nerve supply:* Posterior ethmoidal nerve.

- *Clinical importance:* The sphenoidal air sinuses are related superiorly to pituitary gland & optic chiasma and laterally to cavernous venous sinus & its contents.



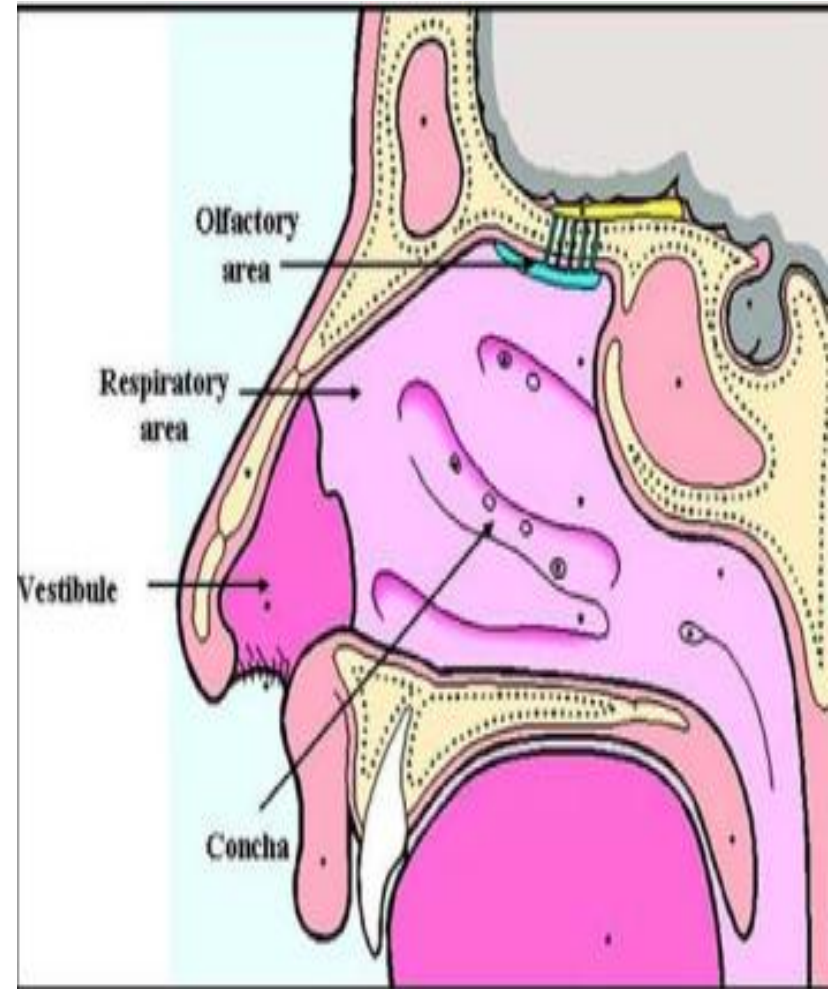
Histology of the nasal cavity

It is divided into 2 parts:

[1] Anterior part of nasal cavity (vestibule): It is the dilated anterior part of the nasal cavity. It is lined with modified skin formed of:

1. Epidermis: lined by Stratified squamous keratinized epithelium with short stiff hairs (vibrissae) for filtration of the inspired air.

2. Dermis: contains sweat and sebaceous glands.



[2] Posterior part of nasal cavity : Its lateral wall contains 3 projections called conchae (superior, middle and inferior). It is divided into 2 areas, respiratory and olfactory areas.

I. Respiratory area: It is lined by mucous membrane; which is formed of:

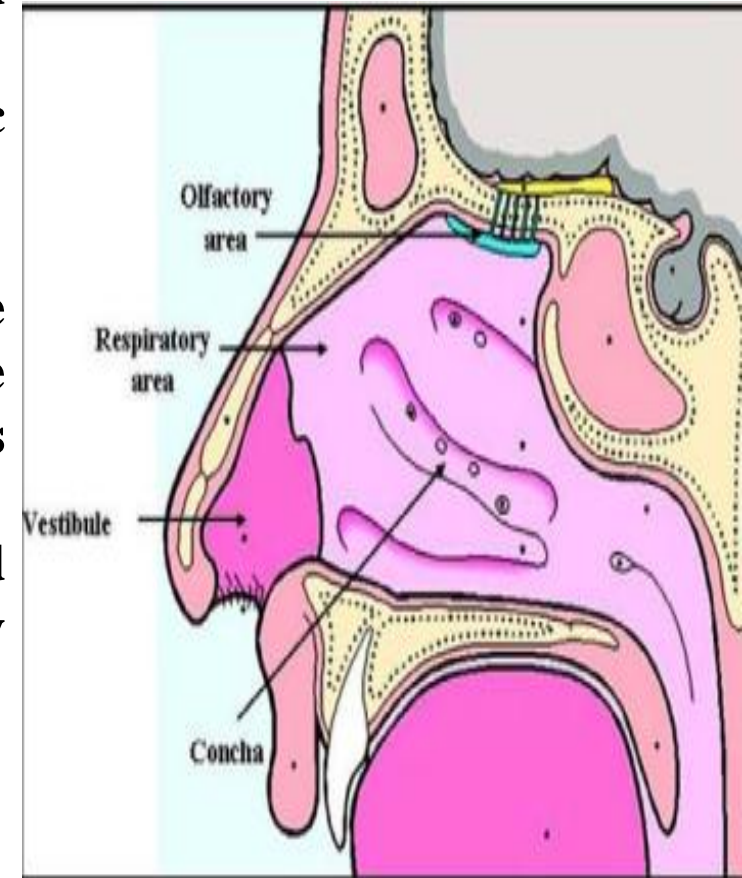
(a) Respiratory epithelium; Pseudo-stratified columnar ciliated with goblet cells.

(b) Lamina propria: which is a dense fibroelastic connective tissue characterized by:

1- It is highly vascularized

2- It contains muco-serous glands to moisten the air and make a film of mucoid fluid on the surface to trap any minute foreign particles that is removed by the action of cilia.

3- It is rich with lymphocytes, macrophages and plasma cells (have immune function against any FBs)



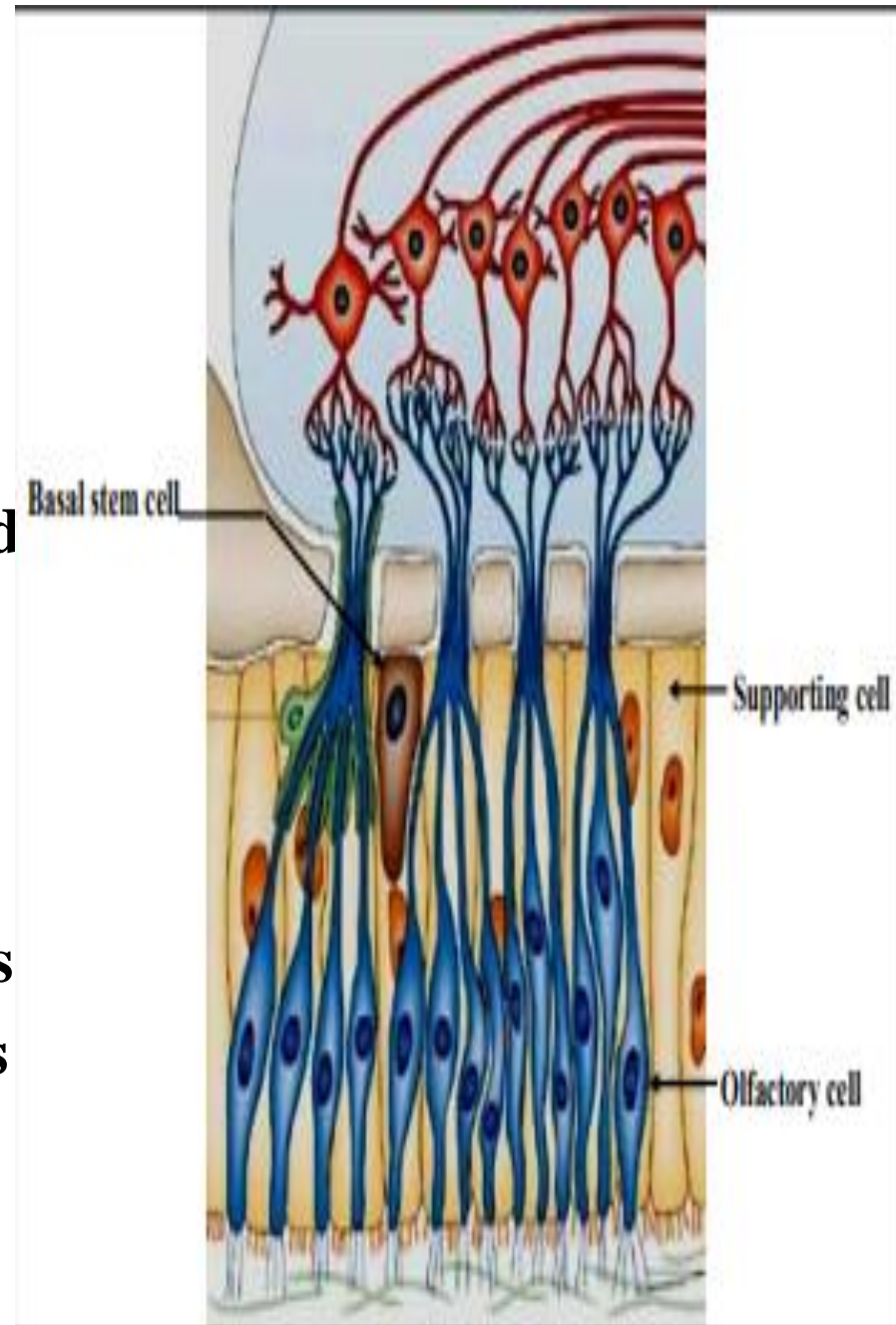
II. Olfactory area : present at the roof of the nasal cavity and extends on upper parts of its medial and lateral walls.

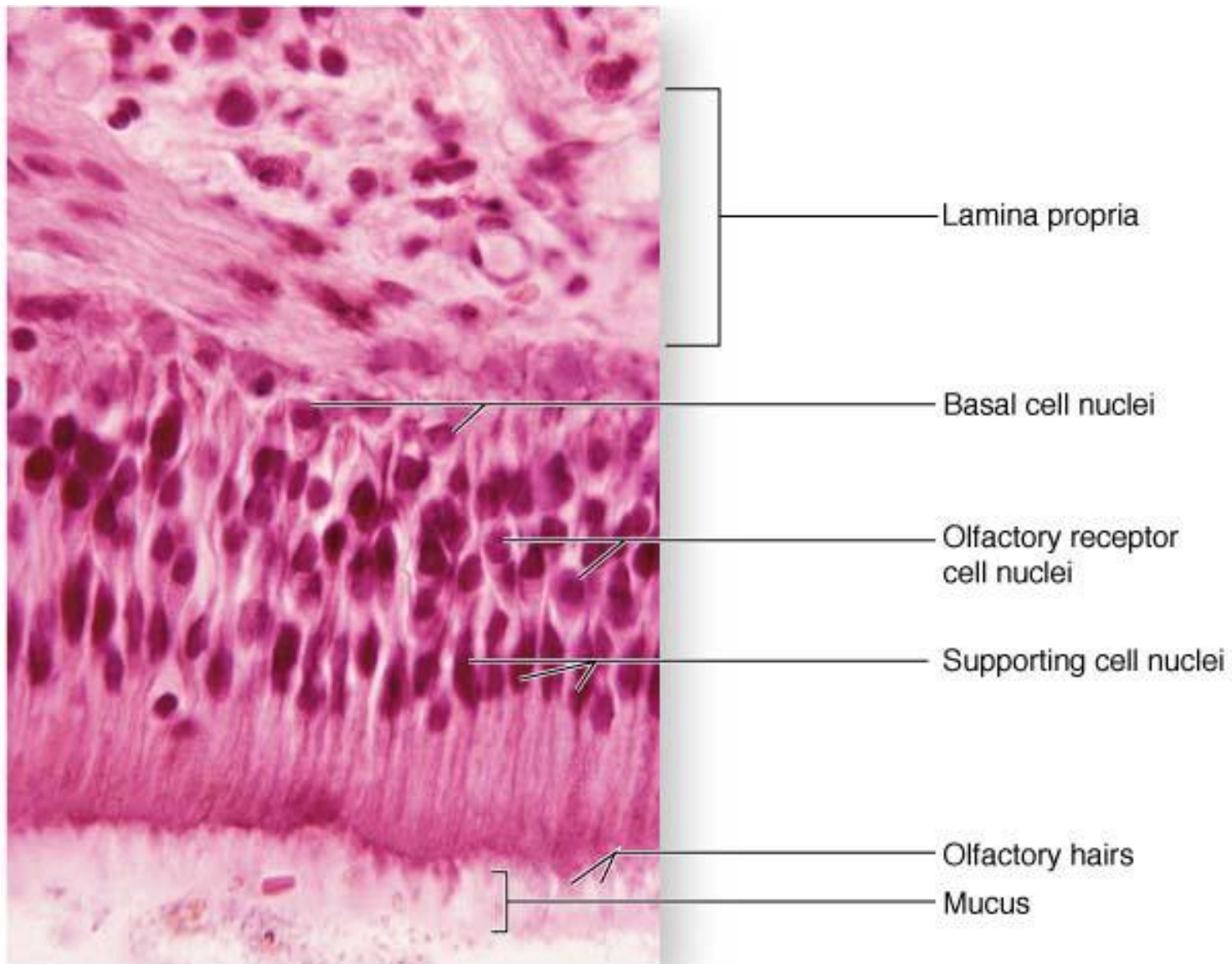
- **Lining:** lined by olfactory mucosa (organ of smell) which includes olfactory epithelium and thick lamina propria

- **Olfactory epithelium:**

Thick pseudo stratified epithelium formed of three types of cells:

- Sustentacular (supporting) cells**
- Olfactory (chemoreceptor) cells**
- Basal (stem) cells**





b

Source: Mescher AL: *Junqueira's Basic Histology: Text and Atlas, 12th Edition*: <http://www.accessmedicine.com>

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OLFACTORY EPITHELIUM

↳ PSEUDOSTRATIFIED CILIATED
COLUMNAR CELLS

↳ olfactory, sustentacular, & basal cells

↳ lined with **OLFACTORY RECEPTORS**





Thank You
Thank You
Thank You!!!!