

# **ANATOMY OF NOSE**

## **AND**

### **PARANASAL**

### **SINUSES**



# ANATOMY OF NOSE

## *EXTERNAL NOSE*

- External nose is shaped like a pyramid with its root up and base directed downwards.
- Consists of osteocartilagenous framework covered by muscle and skin.

# ANATOMY OF NOSE

## *EXTERNAL NOSE*

- **Osteocartilagenous framework:**

Upper 1/3<sup>rd</sup> - bony

Lower 2/3<sup>rd</sup> – cartilagenous

- **Bony framework**

- a) Nasal bones
- b) Nasal processes of frontal bone
- c) Frontal processes of maxilla

# ANATOMY OF NOSE

## *EXTERNAL NOSE*

- Cartilagenous framework
  - a) Upper lateral cartilages
  - b) Lower lateral cartilages (alar cartilages)
  - c) Lesser cartilages (sesamoid cartilages)
  - d) Septal cartilage

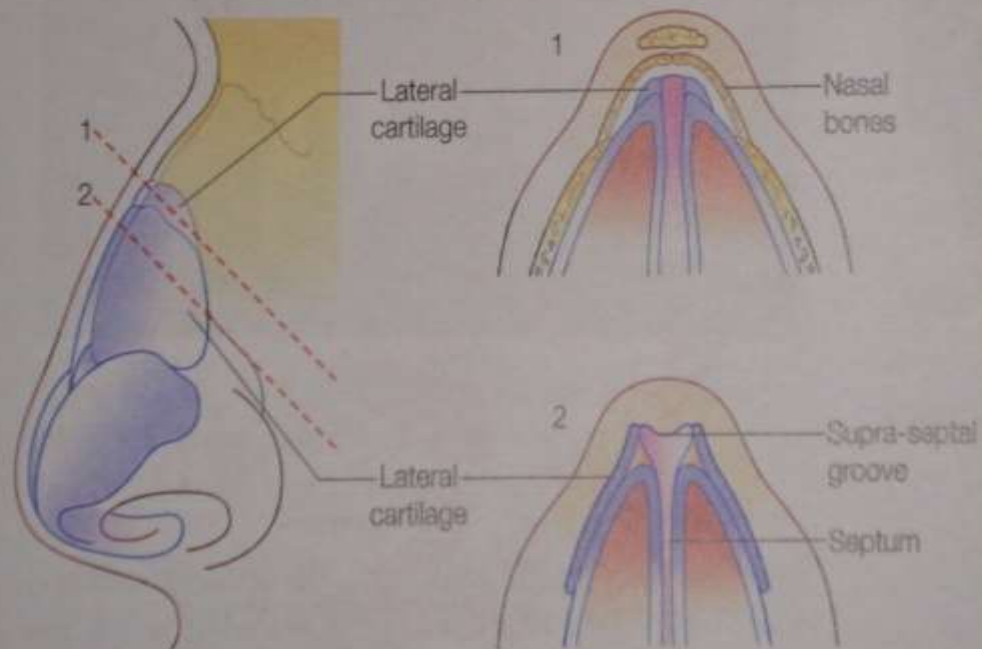
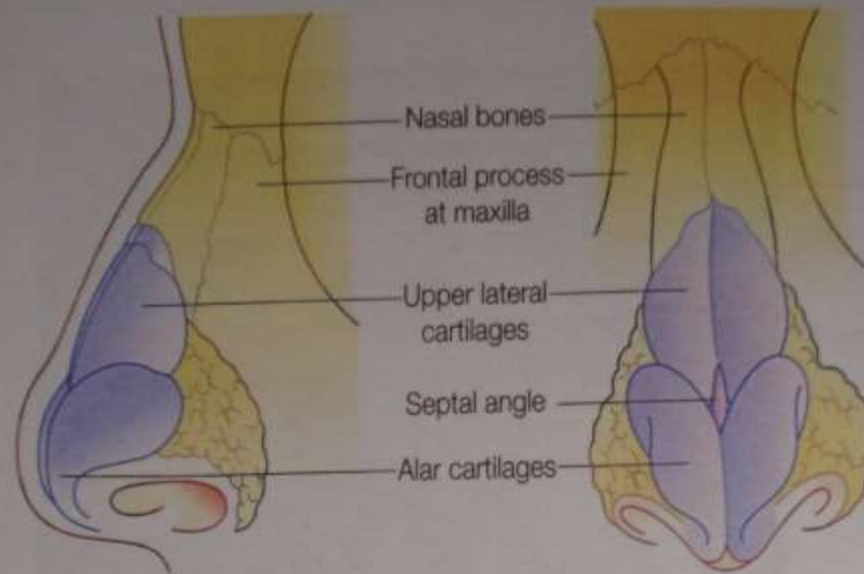
Clinical significance: **limen nasi** (nasal valve) is the narrowest area in the upper airway

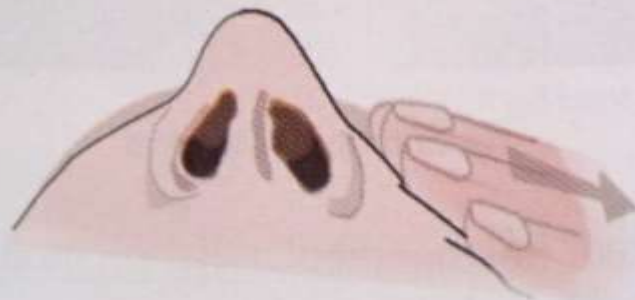


# ANATOMY OF NOSE

## *EXTERNAL NOSE*

- *Nasal valve*: Formed by lower edge of upper lateral cartilages, the anterior end of inferior turbinate and adjacent nasal septum.
- *Cottle's test*: used in nasal obstruction due to abnormality of nasal valve.





27.6 Cottle test: On pulling the cheek away from the  
line, the nasal valve opens, increasing the airflow  
on that side of the nasal cavity.

# ANATOMY OF NOSE

## *EXTERNAL NOSE*

### ■ Nasal musculature:

- a) Procerus
- b) Nasalis (transverse and alar part)
- c) Levator labii superioris alaeque nasi
- d) Anterior and posterior dilator naris
- e) Depressor septi

Nasal skin: skin over nasal bone and upper lateral cartilage is thin and freely mobile while that on alar cartilages is thick and adherent and contains sebaceous glands



# ANATOMY OF NOSE

## *EXTERNAL NOSE*

- Blood supply: facial and ophthalmic arteries and veins
- Lymphatic drainage: preauricular and submandibular lymph nodes

# ANATOMY OF NOSE

## *INTERNAL NOSE*

- It is divided into right and left nasal cavities by nasal septum.
- Each nasal cavity consists of
  - a) Skin lined portion-vestibule (contains sebaceous glands, hair follicles, vibrissae)
  - b) Mucosa lined portion-nasal cavity proper

# ANATOMY OF NOSE

## *INTERNAL NOSE*

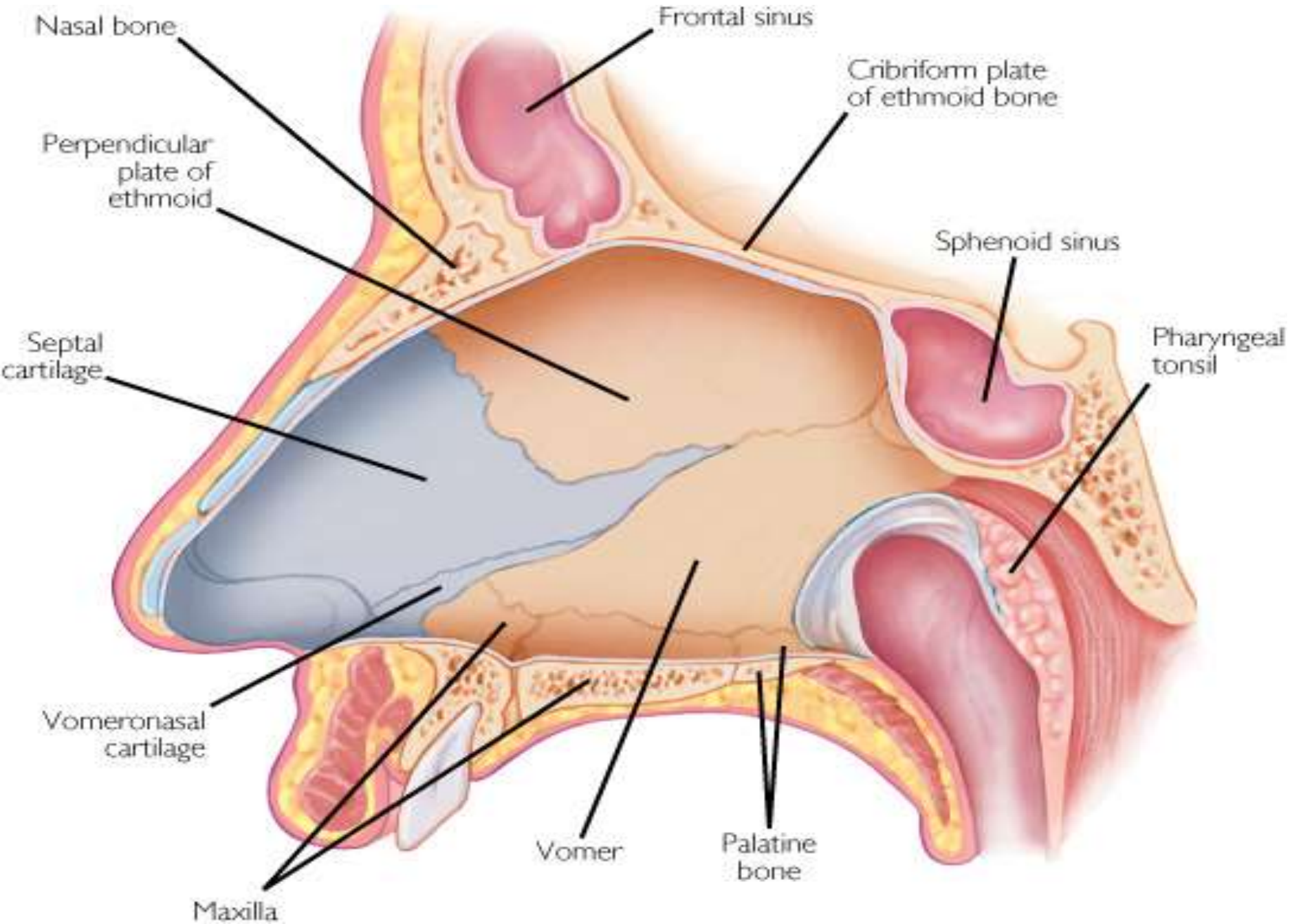
- Nasal cavity proper: bounded by lateral wall, medial wall, roof and a floor.
- Floor: Formed by
  - a) Palatine process of maxilla (anterior 3/4<sup>th</sup>)
  - b) Horizontal process of palatine bone (posterior 1/4<sup>th</sup>)

# ANATOMY OF NOSE

## *INTERNAL NOSE*

- Roof: formed by
  - a) Anterior sloping part by nasal bones
  - b) Posterior sloping part by body of sphenoid
  - c) Middle horizontal part by cribriform plate of ethmoid through which olfactory nerves enter the nasal cavity





# ANATOMY OF NOSE

## *INTERNAL NOSE*

- Nasal septum consists of three parts
  - a) Columellar septum
  - b) Membranous septum (lies between columella and caudal border of septal cartilage)
  - c) Septum proper: consists of osteocartilagenous framework covered with nasal mucous membrane

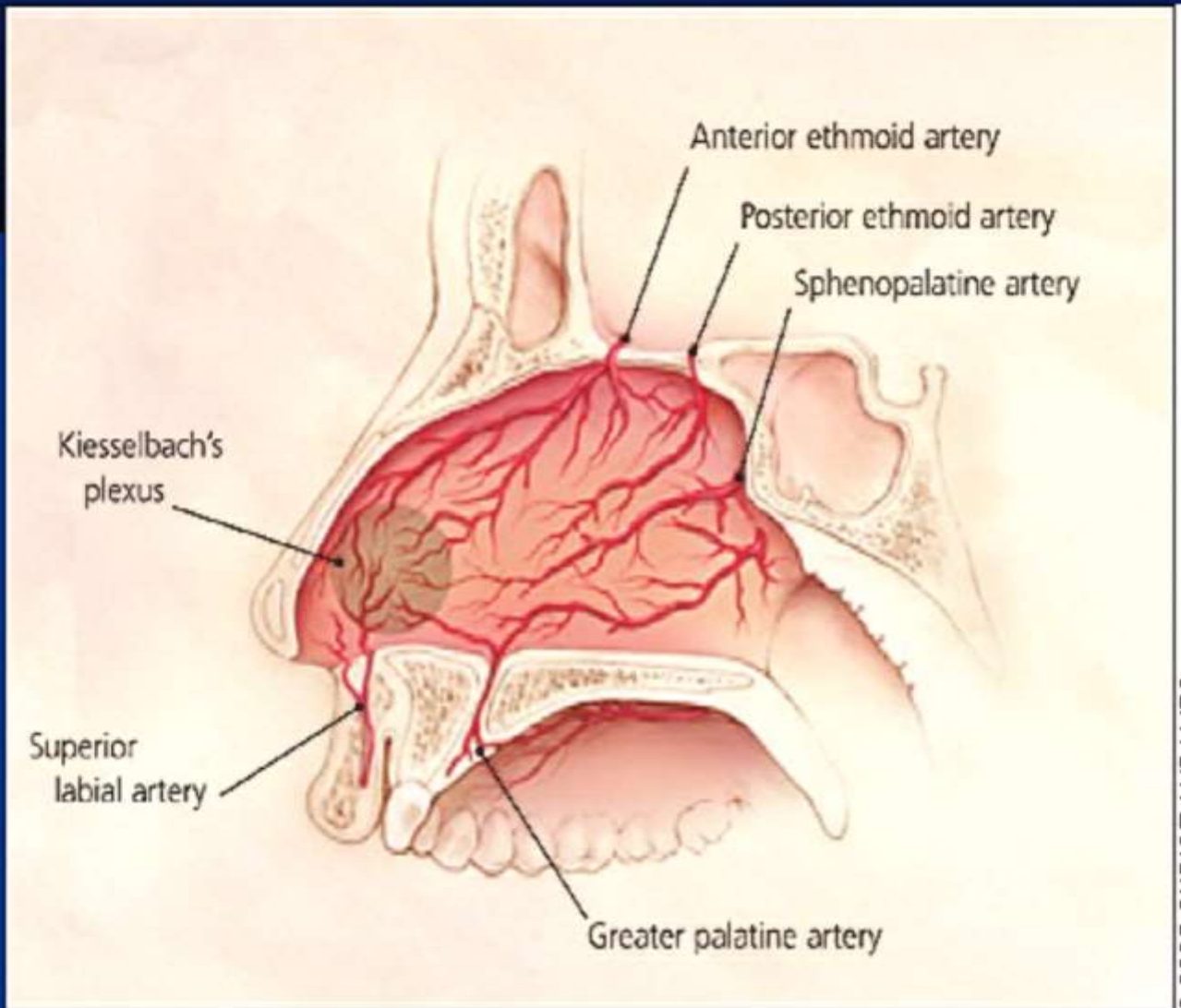
# ANATOMY OF NOSE

## *INTERNAL NOSE*

- Septum proper: principal constituents
  - a) Perpendicular plate of ethmoid postero-superiorly
  - b) Vomer infero-posteriorly
  - c) Septal cartilage (quadrilateral cartilage)
- These articulate with following bones to complete the septum
  - a) Superiorly-frontal bone, nasal bone, rostrum of sphenoid.
  - b) Inferiorly anterior nasal spine of maxilla, nasal crest of maxilla and palatine bones



# BLOOD SUPPLY-NASAL SEPTUM

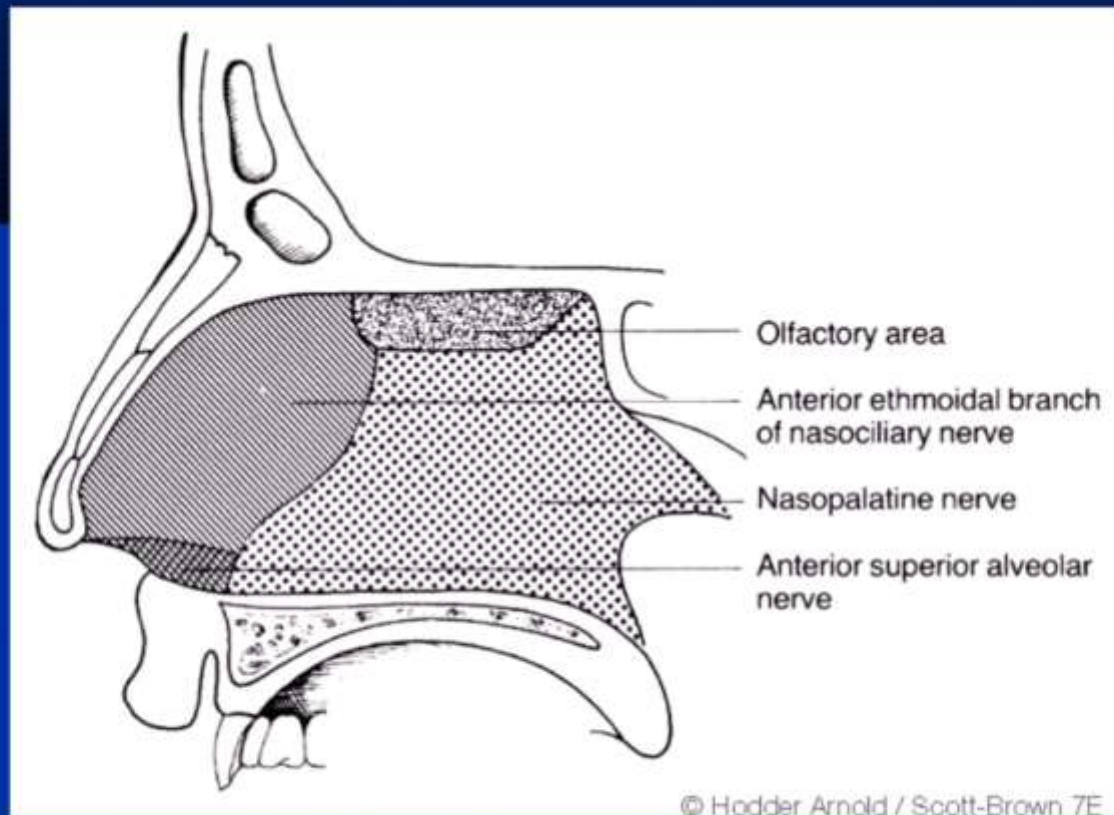




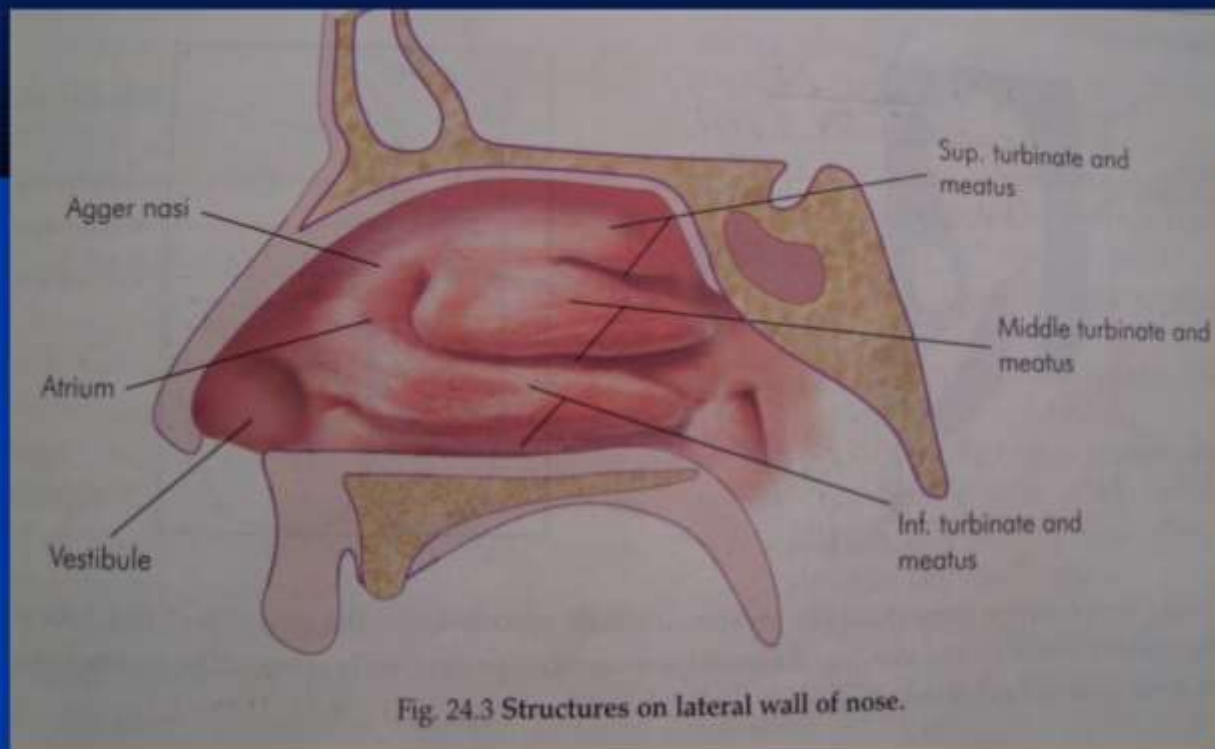
# BLOOD SUPPLY-NASAL SEPTUM

- Little's area: Situated in the antero-inferior part of nasal septum just above the vestibule. Four arteries-anterior ethmoidal, septal branch of superior labial, septal branch of sphenopalatine and greater palatine anastomose here to form Kiesselbach's plexus.

# NERVE SUPPLY-NASAL SEPTUM



# ANATOMY-LATERAL WALL OF NASAL CAVITY



# ANATOMY-LATERAL WALL OF NASAL CAVITY

- Lateral wall is formed by
  - a) Ascending process of maxilla
  - b) Nasal bone
  - c) Ethmoid
  - d) Medial part of maxilla
  - e) Inferior turbinate
  - f) Perpendicular plate of palatine bone
  - g) Medial pterygoid plate



# ANATOMY-LATERAL WALL OF NASAL CAVITY

- Lateral wall is marked by three bony projections called *turbinates* or *conchae*-*superior* (part of *ethmoid*), *middle* (part of *ethmoid*), *inferior* (separate bone).
- sometimes a fourth turbinate concha suprema may also be present.
- Below and lateral to each turbinate is a corresponding meatus

# ANATOMY-LATERAL WALL OF NASAL CAVITY

- Inferior meatus- nasolacrimal duct opens in its anterior part.
- Middle meatus- consists of bulla ethmoidalis, hiatus semilunaris, infundibulum. Frontal, maxillary and anterior ethmoidal sinuses open into middle meatus.
- Superior meatus- posterior ethmoidal sinuses open into it.
- Sphenoethmoidal recess- triangular fossa above the superior meatus. Sphenoidal sinus opens into it.

Infundibulum opening of frontonasal duct that drains the frontal sinus and anterior ethmoid cells

Opening of middle ethmoidal cells onto bulla ethmoidalis

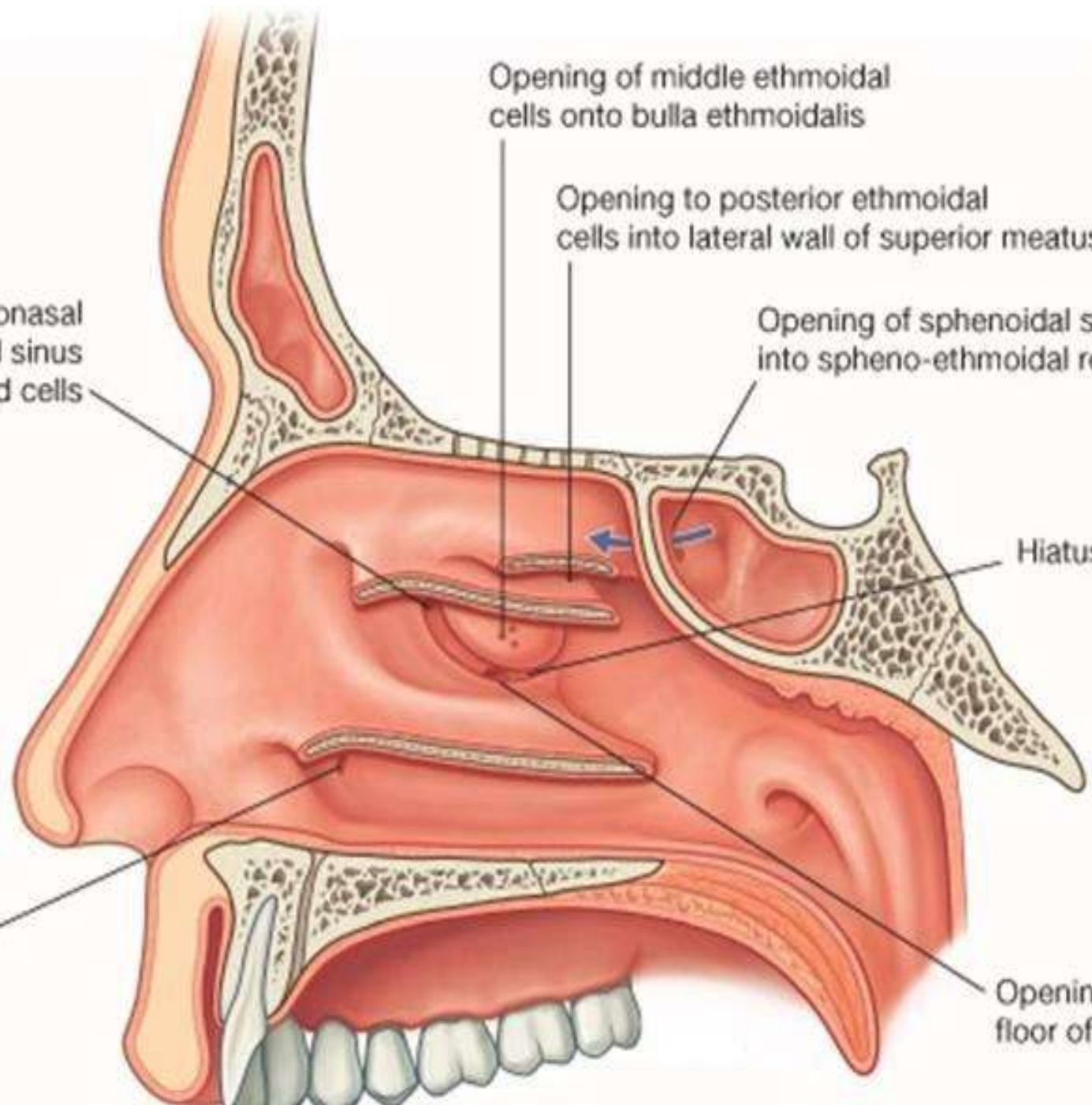
Opening to posterior ethmoidal cells into lateral wall of superior meatus

Opening of sphenoidal sinus into spheno-ethmoidal recess

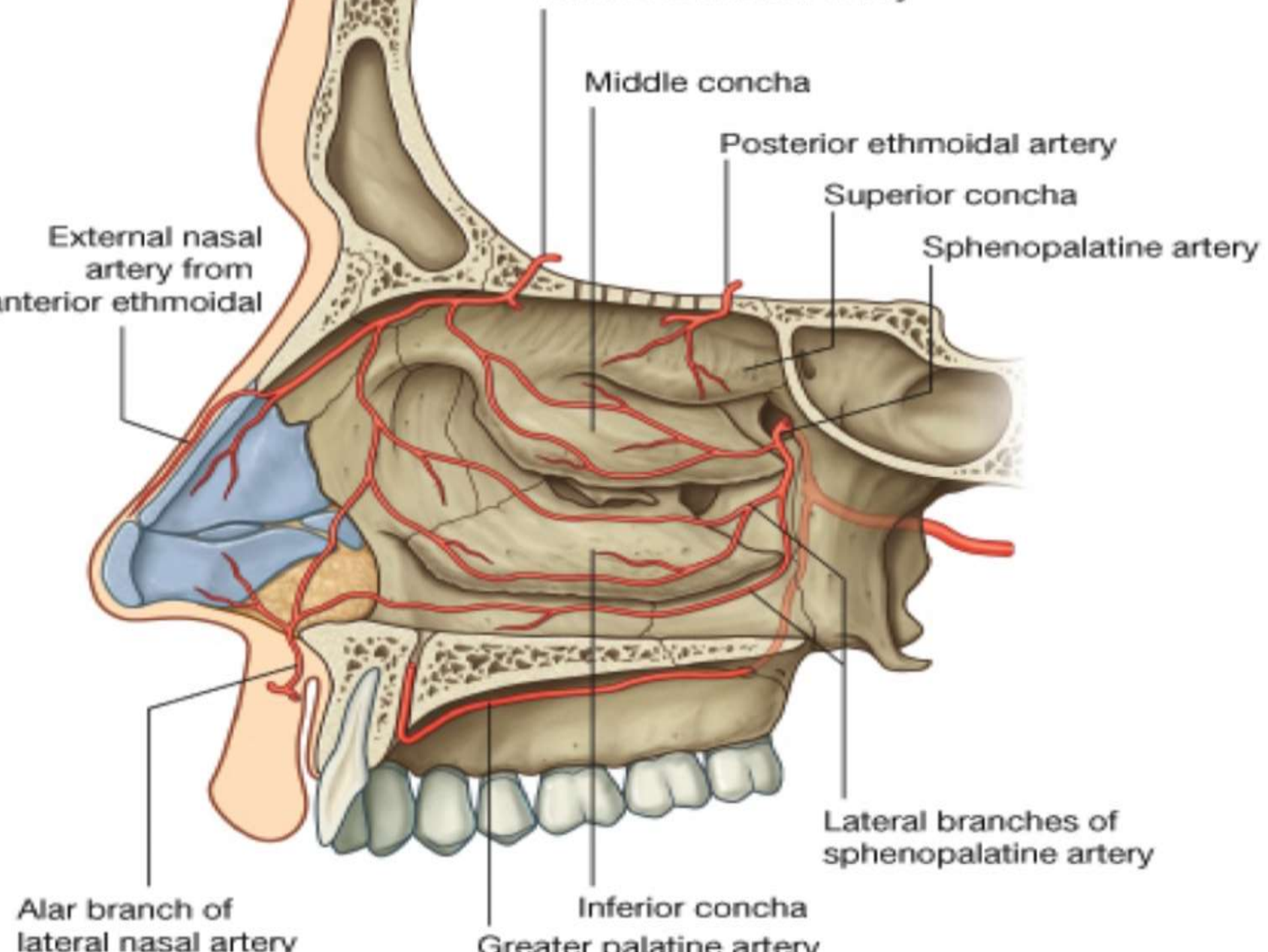
Hiatus

Opening of nasolacrimal duct

Opening floor of

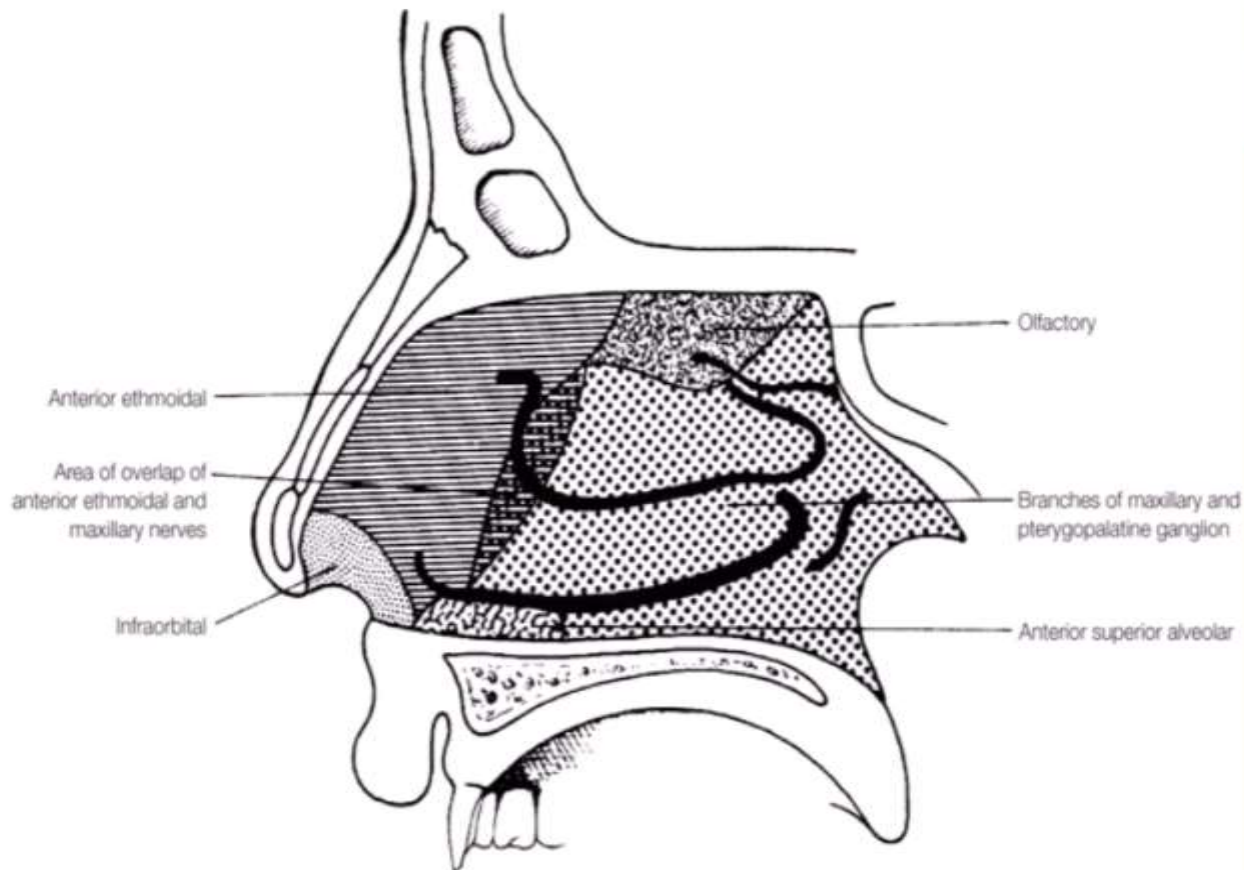








# NERVE SUPPLY-LATERAL WALL OF NASAL CAVITY



# AUTONOMIC NERVE SUPPLY- NASAL CAVITY

- Sympathetic supply- superior cervical sympathetic ganglion -> internal carotid plexus -> vidian nerve -> sphenopalatine ganglion.
- Parasympathetic supply- facial nerve -> greater superficial petrosal nerve -> vidian nerve -> sphenopalatine ganglion.
- Nasal branches from sphenopalatine ganglion supply the nasal cavity.

# SENSORY NERVE SUPPLY- NASAL CAVITY

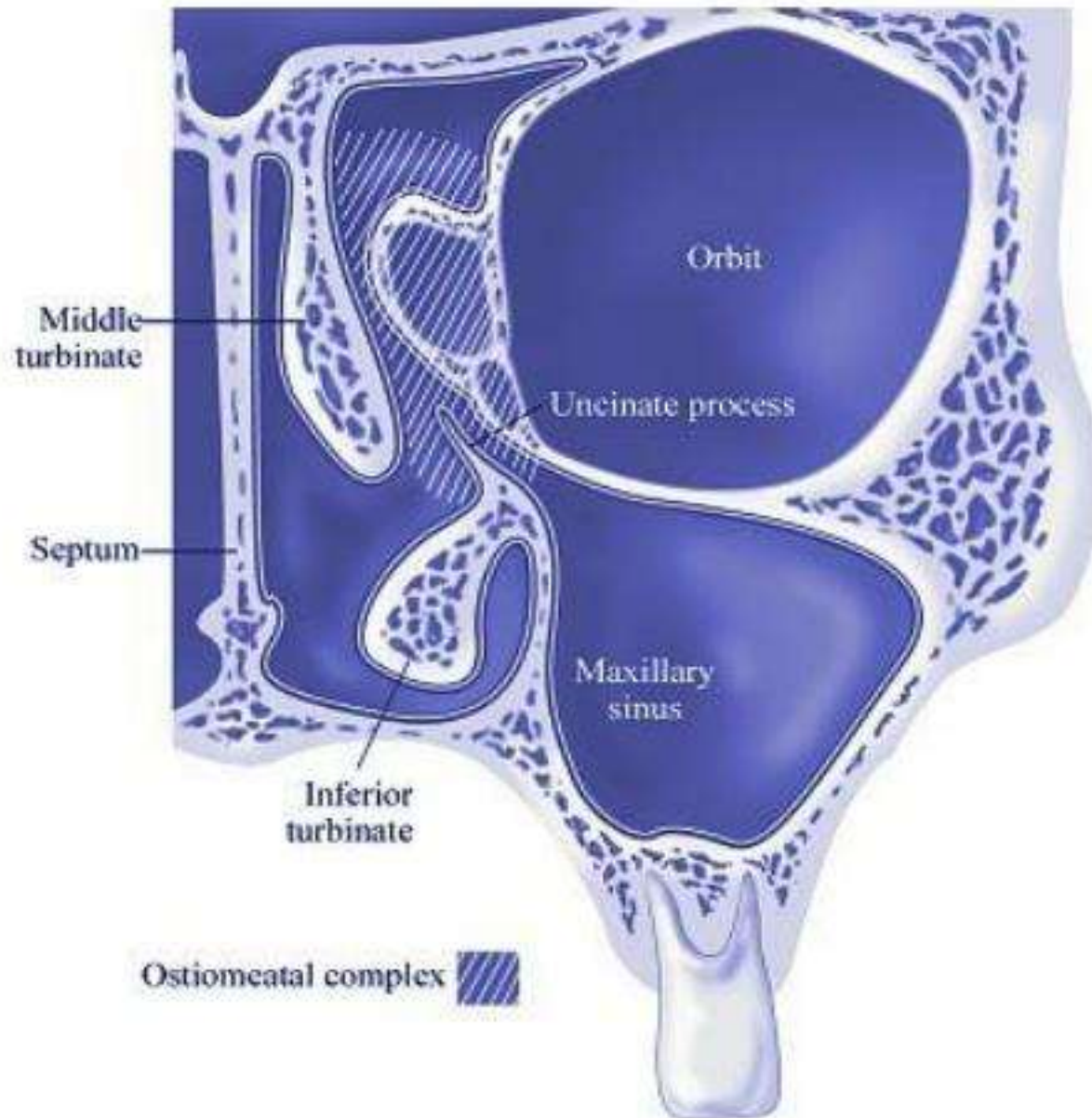
- Trigeminal nerve carries the common sensation via ophthalmic and maxillary divisions.
- Special sensory (smell) carried via olfactory nerves.

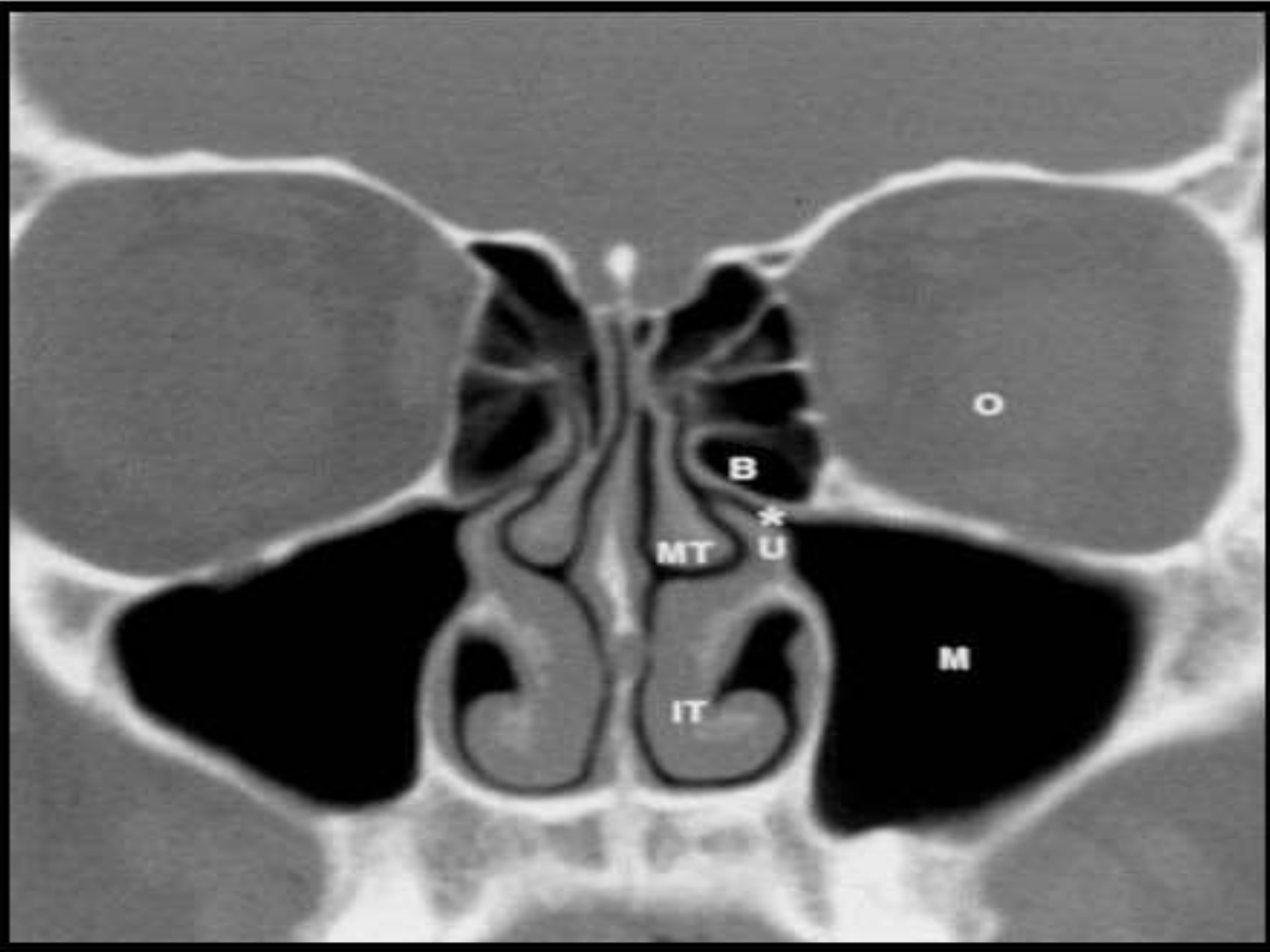
# LYMPHATIC DRAINAGE-NASAL CAVITY

- Upper deep cervical nodes drain the nasal cavity directly or via the retropharyngeal nodes.



## Slide 21 - Ostiomeatal complex





# OSTEOMEATAL COMPLEX

- The middle meatus is the space below and lateral to the middle turbinate, and is often functionally referred to as the osteomeatal complex. It contains the drainage pathways for the anterior ethmoids, the maxillary and the frontal sinuses.
- The middle meatus is the area that is most commonly involved in the pathophysiology of chronic rhinosinusitis.

# OSTEOMEATAL COMPLEX- RELATED STRUCTURES

- Bulla ethmoidalis- The ethmoid bulla is one of the most constant and largest of the anterior ethmoid air cells. It is located within the middle meatus directly posterior to the uncinate process and anterior to the basal lamella of the middle turbinate.
- Hiatus semilunaris- hiatus semilunaris is a crescent shaped gap between the posterior free margin of the uncinate process and the anterior wall of the ethmoid bulla, through this passage the middle meatus communicates with the ethmoid infundibulum .



# OSTEOMEATAL COMPLEX- RELATED STRUCTURES

- Ethmoidal infundibulum - Ethmoidal infundibulum is the funnel-shaped passage through which the secretions from various anterior ethmoid cells, the maxillary sinus, and, in some cases, the frontal sinus are transported or channeled into the middle meatus.
- Uncinate process- floor and medial wall of infundibulum is formed by the uncinate process of the ethmoid. This structure is nearly sagittally oriented, nearly paralleling the ethmoidal bulla. It is approximately 3 to 4 mm wide and 1.5 to 2 cm in length.

# APPLIED ANATOMY

- Dangerous area of face- The lower part of external nose and the upper lip. Infection may spread to cavernous sinus through inferior ophthalmic vein via anterior facial vein which have no valves
- Dangerous area of nose- olfactory area Infection may spread into meninges along the pia and arachnoid sheath of olfactory nerves. This area is also connected to superior sagittal sinus and cavernous sinus by venous channels

# PARANASAL SINUSES- ANATOMY

- These are air filled spaces in certain bones of skull and are in direct communication with nasal cavity through their ostia. They are four on each side divided as
  - a) Anterior group- maxillary, frontal, anterior ethmoidal
  - b) Posterior group- posterior ethmoid, sphenoid



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# Maxillary sinus

## (Antrum of Highmore)

- Largest of the paranasal sinuses
- Pyramidal in shape with base towards lateral wall of nose and apex directed into zygomatic process
- Capacity- 10-20 ML
- boundaries-
  - a) Medial wall- lies between the sinus and nasal cavity
  - b) Posterior wall- related to pterygopalatine and infratemporal fossae
  - c) Anterior wall- related to soft tissue of cheek
  - d) Roof- formed by floor of orbit
  - e) Floor- formed by alveolar process and palate



# FRONTAL SINUS

- Situated in between inner and outer table of frontal bone
- Pyramidal in shape with apex upwards and base is formed by the floor
- Capacity- 5-10 ML
- Boundaries
  - a) Anterior wall-outer table of frontal bone
  - b) Posterior wall- inner table of frontal bone separates the sinus from cranial cavity
  - c) Floor- formed by thin bone separating sinus from orbit
  - d) Medial wall- forms the septum between two frontal sinuses

# ETHMOIDAL SINUSES

- Thin walled air cavities in the lateral masses of ethmoid bone.
- Clinically divided into anterior and posterior group
- *Ethmoidal labyrinth has following relations*
  - a) Roof- anterior cranial fossa lateral to cribriform plate
  - b) Lateral wall- orbit, optic nerve, nasolacrimal duct separated by thin bone called lamina papyracea
  - c) Inferior- maxillary sinus
  - d) Posteriorly- sphenoid sinus
  - e) Medially- superior and middle turbinate

# SPHENOID SINUS

- There are two sphenoidal sinuses in the sphenoid bone divided unequally by a thin bony septum
- Relations-
  - a) Laterally- cavernous sinus containing 3,4,5,6<sup>th</sup> cranial nerves, internal carotid artery, optic nerve
  - b) Superiorly- pituitary gland, optic chiasma, olfactory bulb, frontal lobe
  - c) Inferiorly- nasopharynx and vidian nerve
  - d) Posteriorly- brainstem, Basilar artery

# PHYSIOLOGY OF NOSE

## ■ FUNCTIONS OF NOSE

- a) Respiration
- b) Air conditioning
- c) Protection of lower airway
- d) Vocal resonance
- e) Nasal reflex functions
- f) olfaction



# PHYSIOLOGY OF NOSE

- **Respiration**- during quite inspiration air passes through middle part of nose between turbinate and nasal septum very little air passes through inferior meatus or olfactory area
- During expiration friction offered at limen nasi converts it into eddies under middle and inferior turbinate and this ventilates the sinuses
- **Nasal cycle**: nasal mucosa undergoes rhythmic cyclical congestion and decongestion thus controlling the air flow

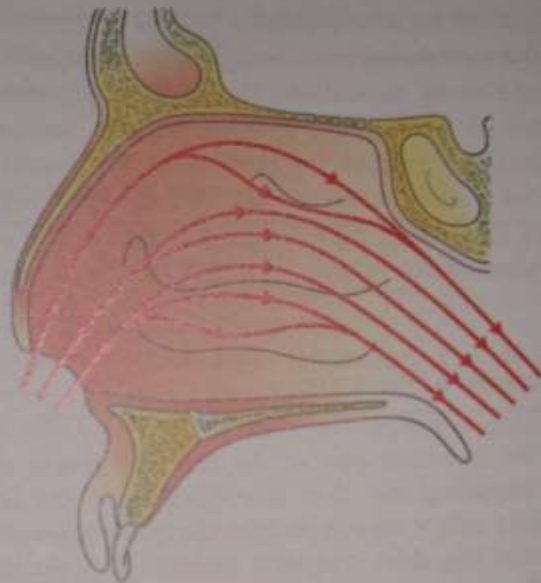


Figure 106.1 The direction of inspiratory airflow.

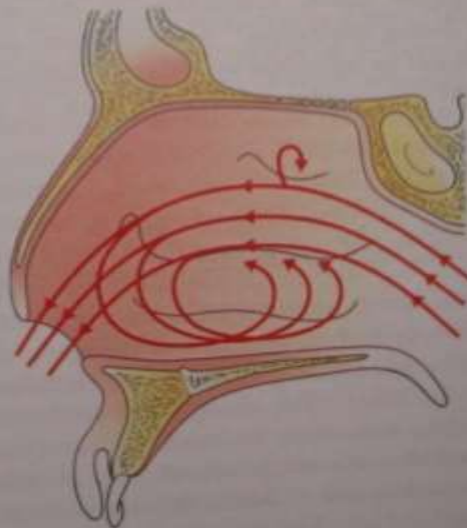


Figure 106.2 The direction of expiratory airflow.

# PHYSIOLOGY OF NOSE

- *Air conditioning*- it filters and purifies the inspired air and adjusts its temperature and humidity before it passes on to lungs
- a) *Filtration and purification* – nasal vibrissae can filter particles up to 3 microns while nasal mucus traps particles of 0.5-0.3 microns
- b) *Temperature control*- nasal mucus membrane in the region of middle and inferior turbinate is highly vascular with cavernous venous spaces which control the blood flow and maintains the temperature
- c) *Humidification*- nasal mucus membrane adjust the relative humidity of inspired air to 75% or more. It has significant effect on gas exchange in lower airway



# PHYSIOLOGY OF NOSE

## ■ Protection of lower airway

- a) Mucociliary mechanism- nasal mucosa is rich in goblet cells, mucous and serous secretory glands. Their secretions form a mucous blanket floating on top of cilia which is constantly beating to carry it like a 'conveyer belt'
  - Inspired bacteria, viruses and dust particles are entrapped on the viscous mucous blanket and carried to nasopharynx to be swallowed
  - Cilia beats 10-20 times/second at room temperature
  - The movement of mucous is maintained in a single direction because of rapid "effective stroke" and slow "recovery stroke"



# Mucociliary mechanism

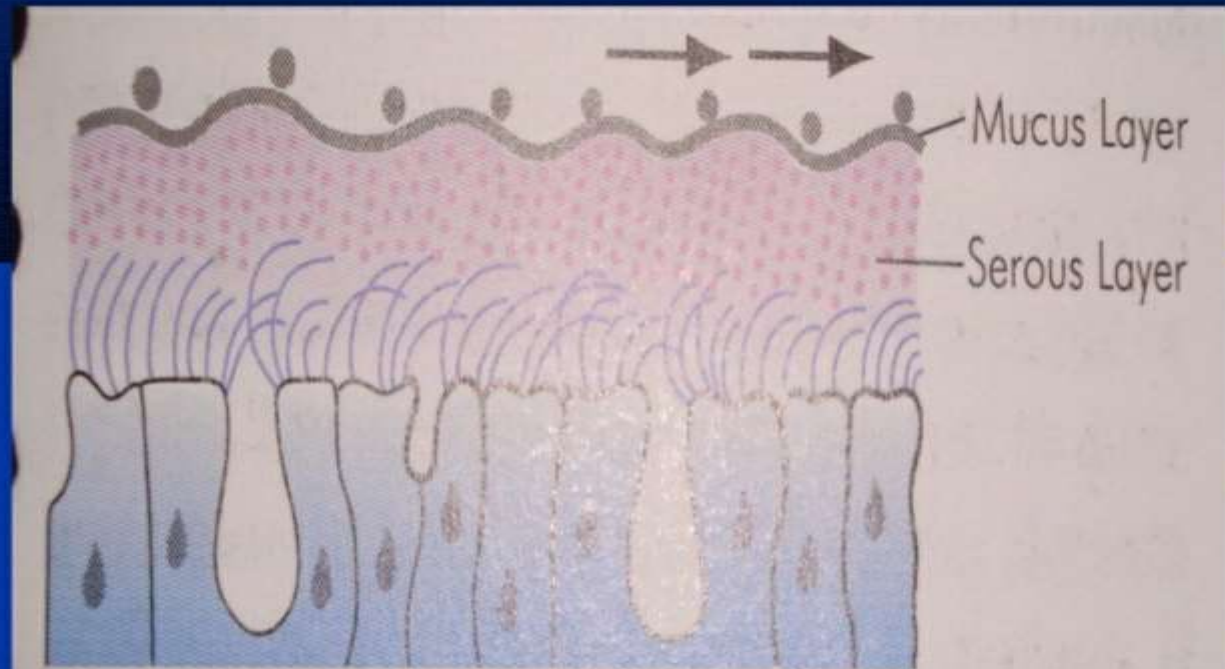


Fig. 25.2 "Conveyor belt" mechanism of mucus blanket to entrap and carry organisms and dust particles.

# PHYSIOLOGY OF NOSE

## b) Enzymes and immunoglobulins

nasal secretions contain immunoglobulins IgA and IgE, interferons and enzyme muramidase (lysozyme)

## c) Sneezing- it is a protective reflex induced by foreign particles which irritate nasal mucosa

# PHYSIOLOGY OF NOSE

- *Vocal resonance*

Nose forms a resonating chamber for certain consonants. In phonating nasal consonants (m/n/ng) sound passes through the nasopharyngeal isthmus and is emitted through the nose

# PHYSIOLOGY OF NOSE

## ■ Nasal reflexes

1. Smell of palatable food causes reflex secretion of saliva and gastric juice
2. Irritation of nasal mucosa causes sneezing
3. Nasal function is closely related to pulmonary function through naso-bronchial and naso-pulmonary reflexes



# PHYSIOLOGY OF NOSE

- *Olfaction*

Plays a critical role in enjoying the taste of food. When nose is blocked food tastes bland and unpalatable

- *Olfactory pathway*

Olfactory area of nose -> olfactory nerves -> mitral cells of olfactory bulb -> olfactory tract-> prepiriform cortex and amygdaloid nucleus

# PHYSIOLOGY OF PARANASAL SINUSES

## ■ PROBABLE FUNCTIONS ARE

1. Air conditioning of inspired air by providing large surface area over which air is humidified and warmed
2. To provide resonance to voice
3. To act as thermal insulators to protect delicate structures in orbit and cranium
4. To lighten the skull bones



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