MED437
KING SAUD UNIVERSITY

Revised By
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ANATOMY
Team 437

Anatomy of the Nose and Olfactory Nerve

Lecture (12)

- Important
- Doctors Notes
- Notes/Extra explanation

{وَمَنْ يَتَوَكَّلْ عَلَى اللَّهِ فَهُوَ حَسْبُهُ}

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هذا العمل مبني بشكل أساسي على عمل دفعة ٤٣٦ مع المراجعة
والتدقيق وإضافة الملاحظات ولا يغني عن المصدر الأساسي للمذاكرة

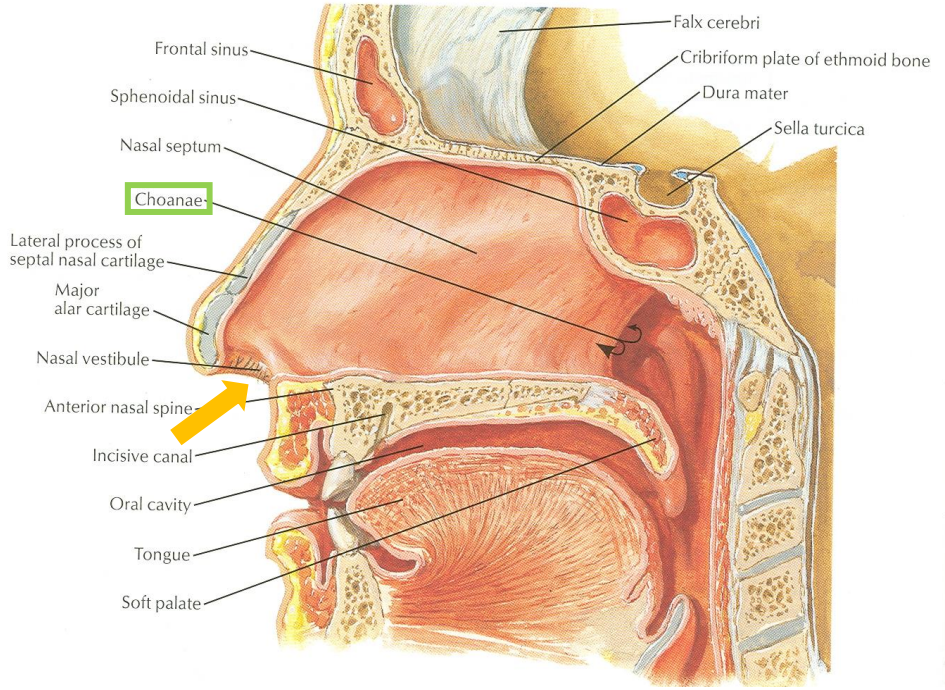
Objectives

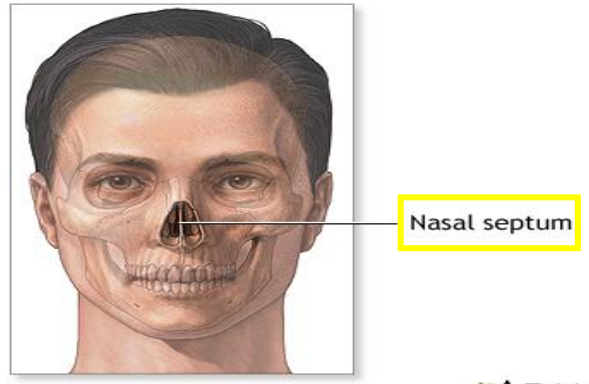
At the end of the lecture, students should be able to:

- ✓ Describe the structures forming the walls of the nasal cavity.
- ✓ List the main structures draining into the lateral wall of the nasal cavity.
- ✓ Differentiate between the respiratory and olfactory regions of the nasal cavity.
- ✓ List the main sensory and blood supply of the nose.
- ✓ Describe the olfactory pathway.

Nasal Cavity

- The external (anterior) nares or nostrils lead to the nasal cavity.
- Formed above by bony skeleton, and below by plates of hyaline cartilage.
- It is a large air filled space above and behind the nose in the middle of the face.
- It extends (begins) from nostrils anteriorly to the choanae posteriorly.
- Each cavity is the continuation of one of the two nostrils.
- It communicates with the nasopharynx posteriorly.
- Divided into right and left parts by the **nasal septum** (medial wall).
- Each part has:
  1. Roof
  2. Floor
  3. Lateral and
  4. Medial walls.





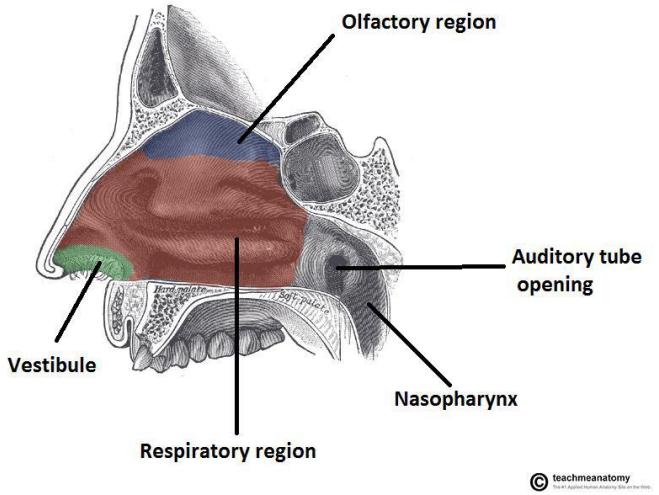
Extra

ADAM.

The Nose

*Only in Boys slides

- Functions:
  - -Olfaction (smell)
  - -Respiration (breathing)
  - -Warming inspired air (submucous venous plexues)
  - -Filtration of dust
  - -Humidification of the inspired air (mucous)
  - -Reception of secretions from the paranasal sinuses and nasolacrimal duct



- Divisions:

1-Vestibule region:

- It is the area surrounding the external opening to the nasal cavity.
- Lined by modified skin, provided with hairs, and sebaceous glands, to filter the incoming air.
- exocrine glands in the skin that secrete an oily or waxy matter called sebum to lubricate and waterproof the skin and hair.

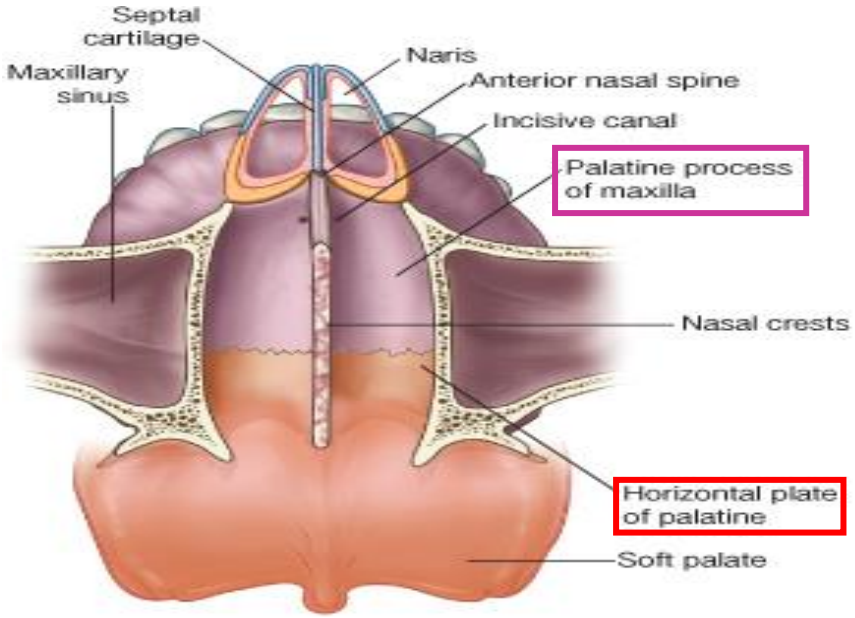
2-Respiratory region:

- The largest region.
- Lined with mucous that is continuous with that of Nasal Sinuses, Lacrimal sac, Conjunctiva, and Nasopharynx.

3-Olfactory region:

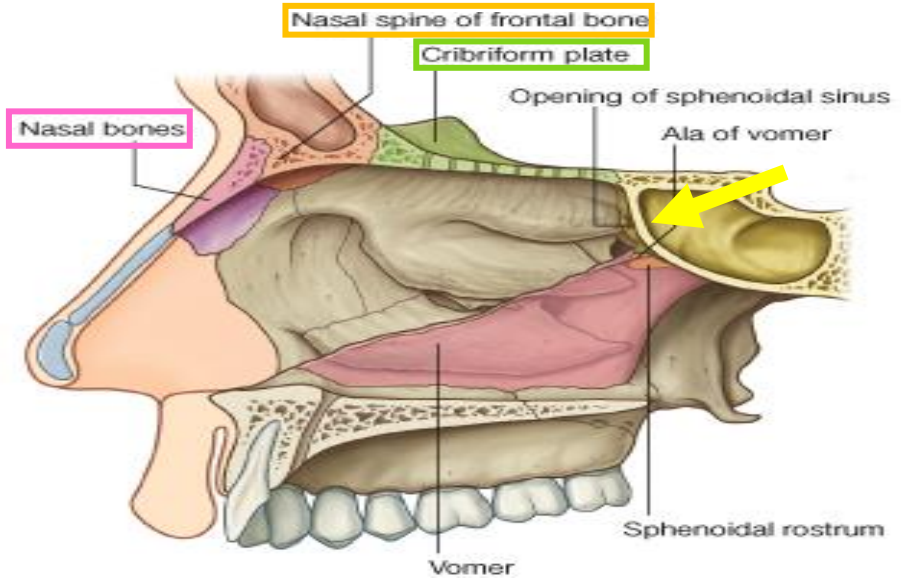
- Located at the apex of the nasal cavity.
- It is lined by olfactory cells with olfactory receptors.

Nasal Cavity



1. Floor

- Formed by:
  - Nasal (upper) surface of the hard (bony) palate:
  - Palatine process of maxilla (anteriorly)
  - Horizontal plate of the palatine bone (posterior)y



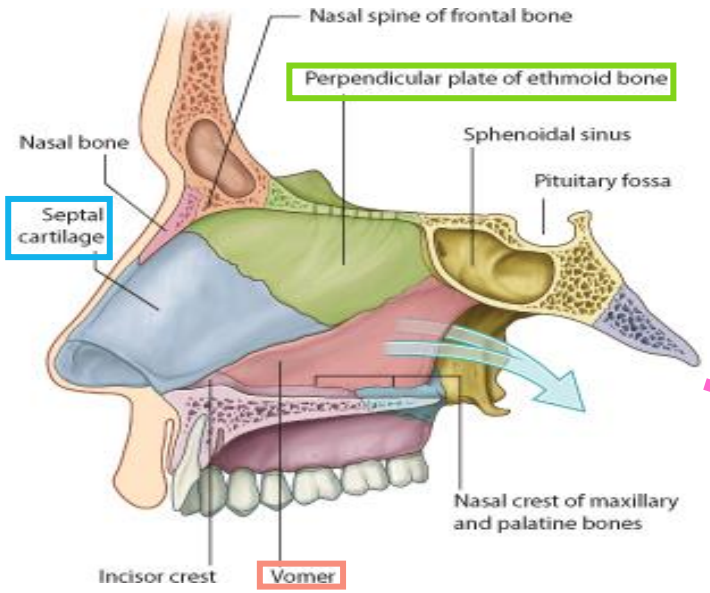
2. Roof (narrow, sloping)

- Formed by:
  - Body of sphenoid (posteriorly)
  - Cribriform plate of ethmoid (in the middle)
  - Frontal, and nasal bones (Anteriorly)

Nasal Cavity

3. Medial Wall

- The nasal septum :
  - Vertical or perpendicular plate of ethmoid.(superior)
  - Septal cartilage.(most anterior)
  - Vomer.(inferior)



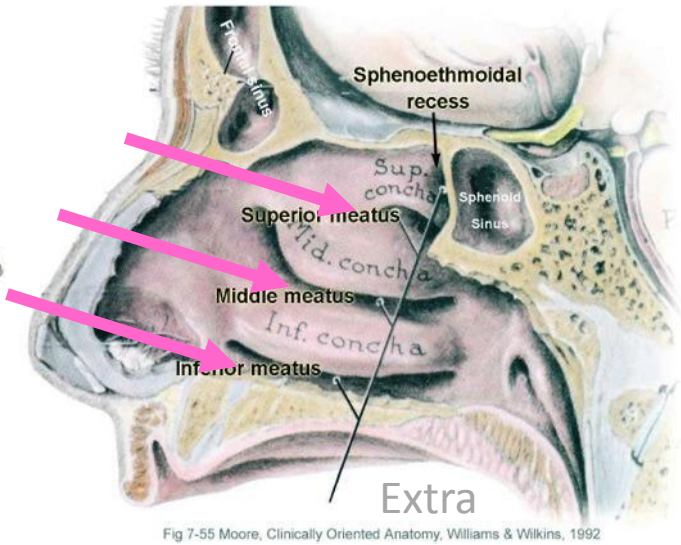
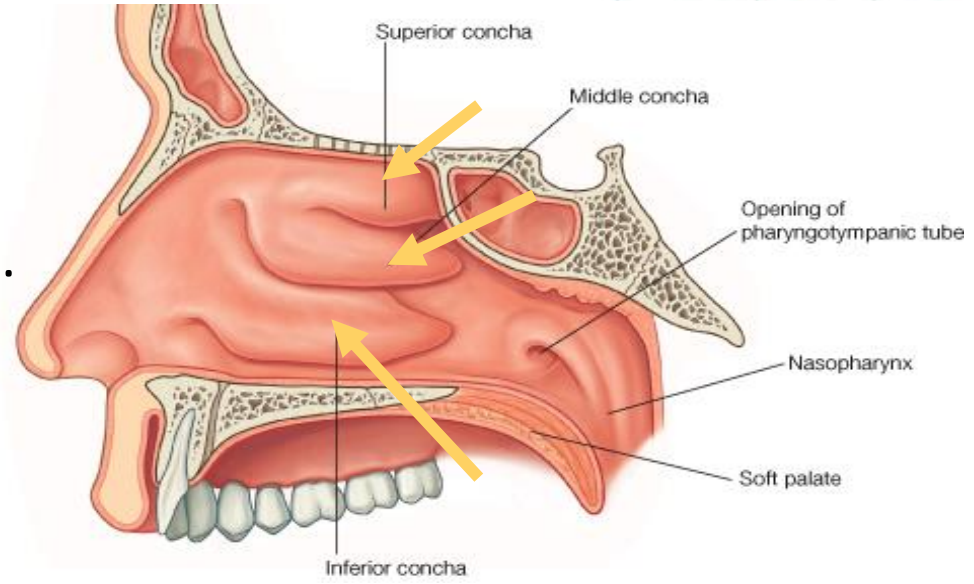


Fig 7-55 Moore, Clinically Oriented Anatomy, Williams & Wilkins, 1992

4. Lateral Wall

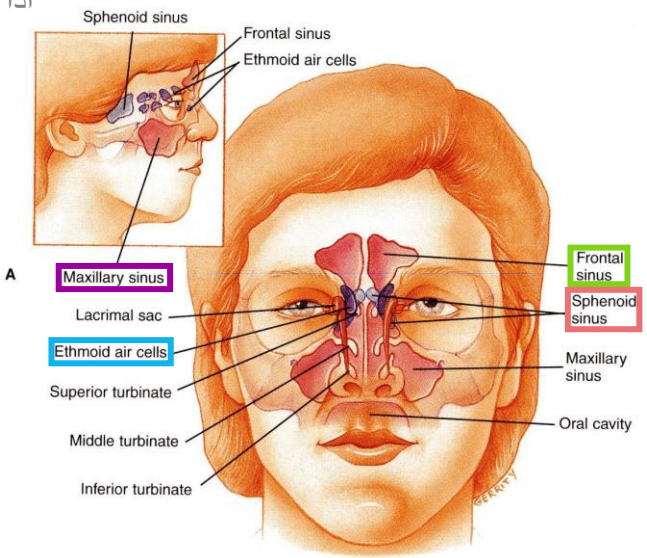
- Marked by Three projections (Nasal **Conchae**):
  - Superior, middle, and inferior(biggest)
- The space below each concha is called **Meatus**.
  - Superior, middle, and inferior meatus.
- The space (fossa) above the superior concha is the **Sphenoethmoidal recess**.

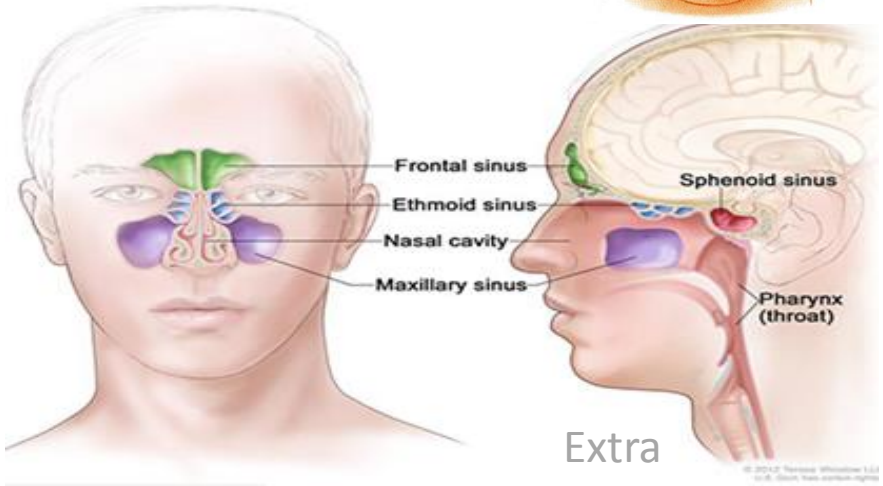


اذا صار فيه obstruction يتجمع ال secretion داخل ال sinuses ويسبب صداع وتغيير بالصوت

Nasal Cavity
Paranasal Sinuses

- They are **cavities** that are named according to the bones within which the sinuses located:
  - Maxilla
  - Frontal bone
  - Sphenoid bone
  - Ethmoid bone divided into anterior, middle, and posterior
- They are:
  - Lined with respiratory epithelium (ciliated pseudostratified columnar epithelium)**(mucoperiosteal).**
  - Group of four paired air-filled spaces
  - Communicate with the nasal cavity.
  - Open in the lateral wall of the nasal cavity
- Functions:
  - Lighten the skull weight
  - Amplify the sound as we speak.
  - Resonance of voice.
  - Drainage secretion into the lateral wall





Extra

- Provides a buffer against facial trauma.
- Insulating sensitive structures like dental roots and eyes from rapid temperature change in the nasal cavity.
- Humidifying and heating of inhaled air because of slow air turnover in this region.

*Only in Boys slides

Nasal Cavity
Nasal conchae

- Projecting out of the lateral walls of the nasal cavity are curved shelves of bone.
- They project into the nasal cavity, creating four pathways for the air to flow.

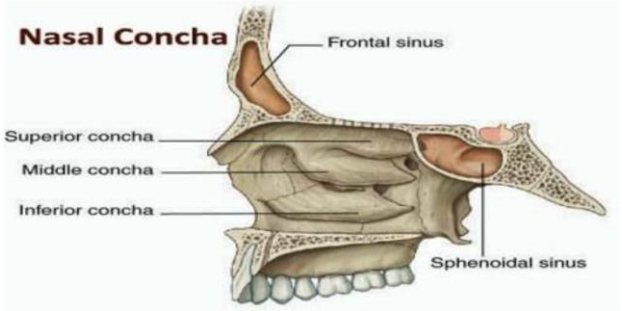
These pathways are called meatuses:

-**Inferior meatus**: lies between the inferior concha and floor of the nasal cavity.

-**Middle meatus**: lies between the inferior and middle concha.

-**Superior meatus**: lies between the middle and superior concha.

-**Spheno-ethmoidal recess**: lies superiorly and posteriorly to the superior concha.

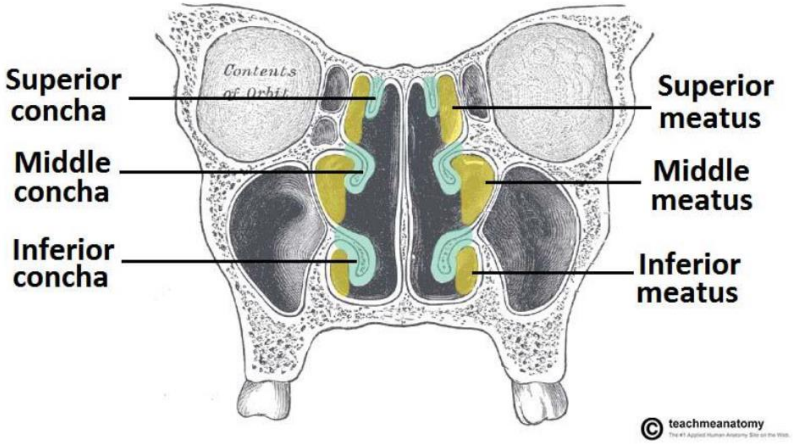


- The function of the conchae is to increase the surface

area of the nasal cavity to increase the amount of inspired air that can come into contact with the cavity walls.

- They also disrupt the fast flow of the air, making it slow;

So that the air spends longer in the nasal cavity, so that it can be humidified.

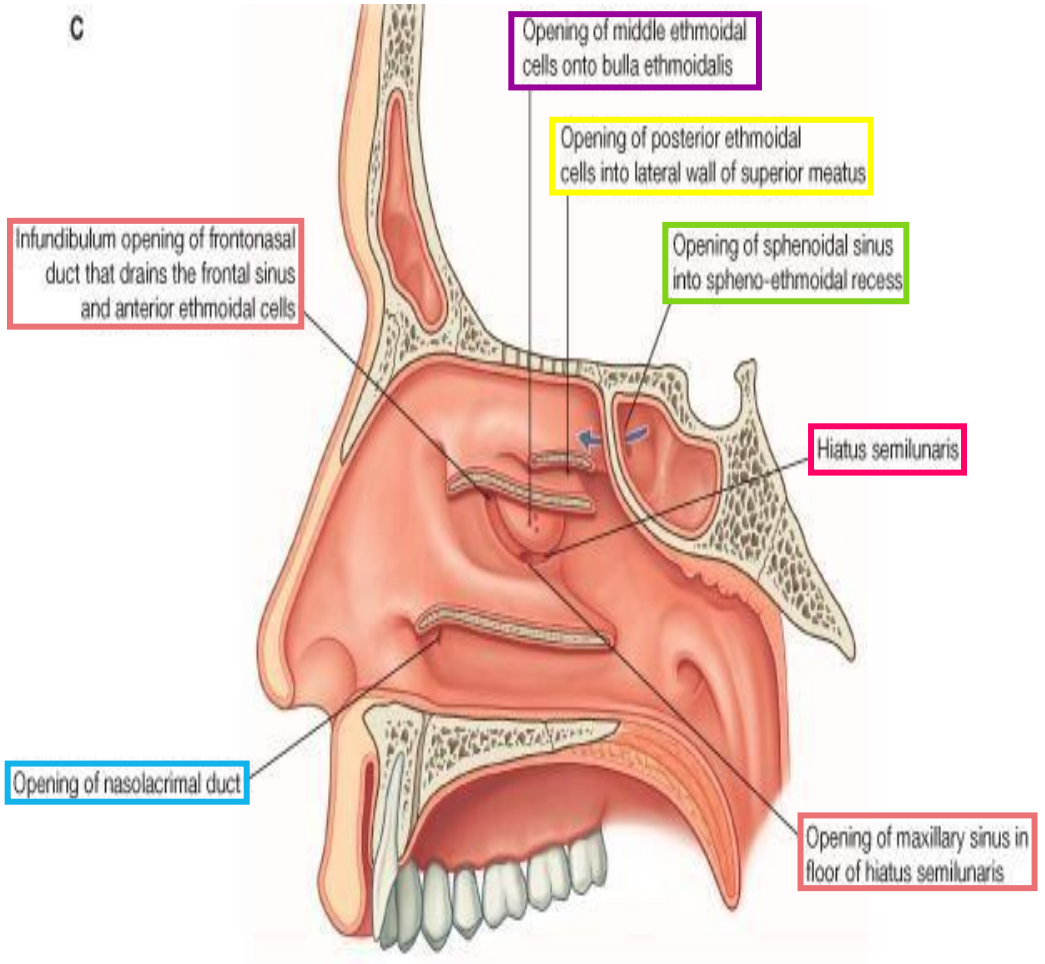


Nasal Cavity
Sinuses Opening in Lateral Wall

Spheno-ethmoidal recess	receives the opening of **sphenoidal air sinus**
Superior meatus	receives the opening of **posterior ethmoidal sinus.**
Middle meatus	receives the openings of (1) **maxillary,** (2) **frontal, &** (3) **anterior ,** (4) **middle ethmoidal sinuses.** contains bulla ethmoidalis*, hiatus semilunaris**, Infundibulum***
Inferior meatus	receives the opening of **nasolacrimal duct**. اذا الدموع زادة عن حاجة العين تروح هنا

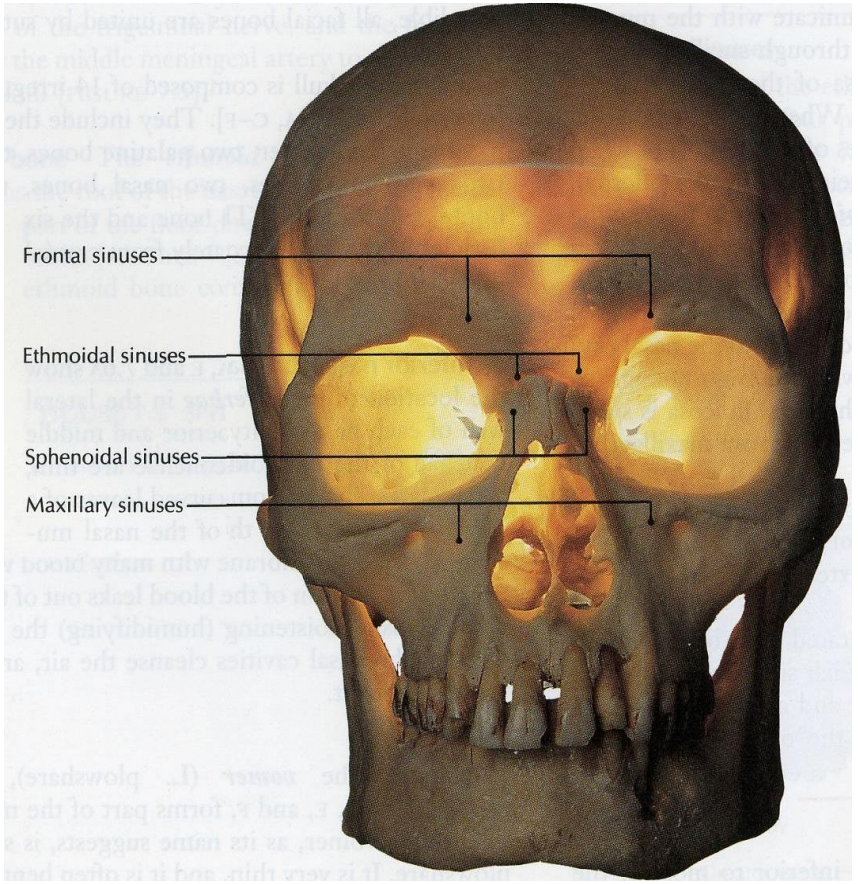
N.B: all sinuses open into the middle meatus EXCEPT:
Sphenoidal sinus : in sphenoethmoidal recess.
Posterior ethmoidal sinus : in superior meatus.

*Receives opening of (4)
**Receives opening of (1)
*** Receives opening of (2) and (3)



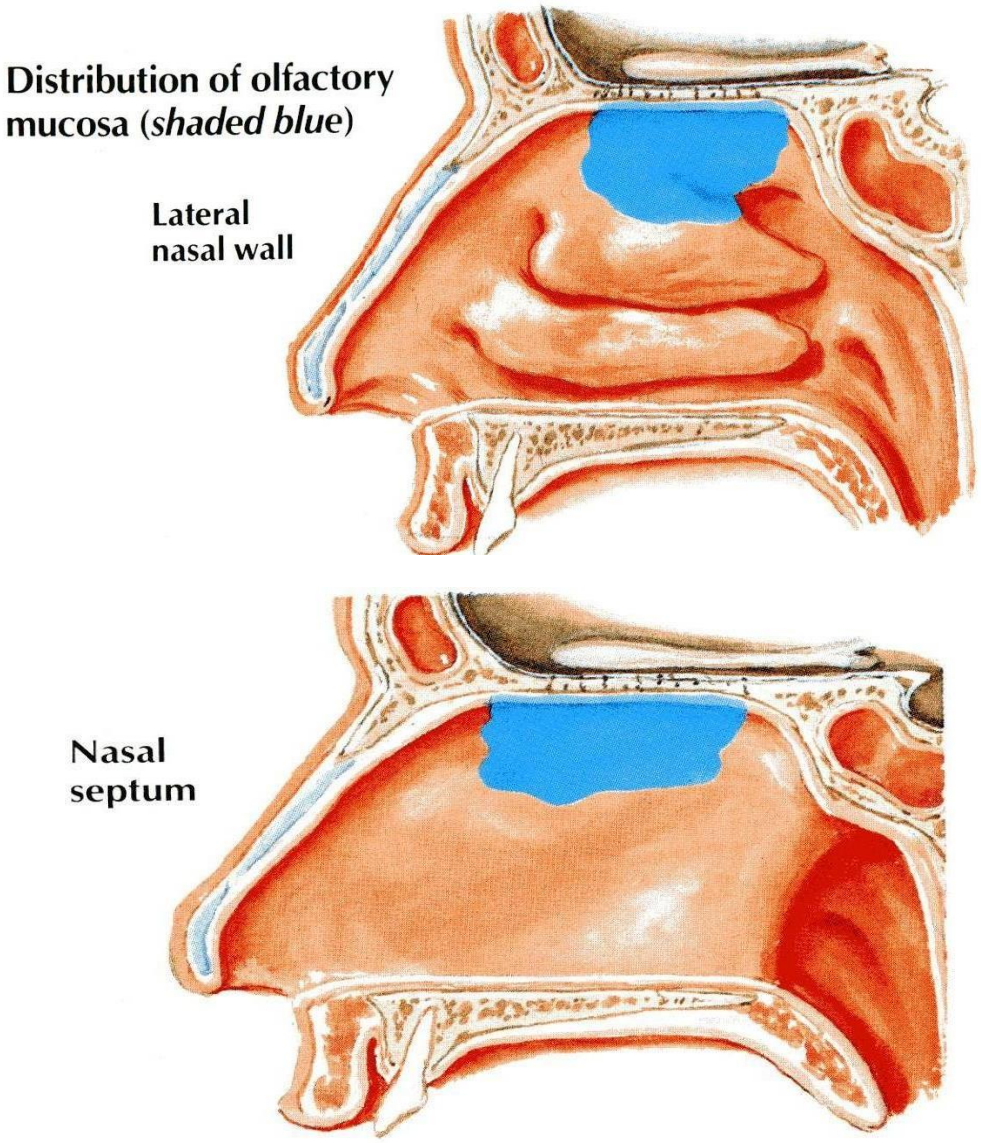
Nasal Cavity
Mucosa

- The mucosa or mucous membrane is a type of tissue that lines the nasal cavity, and it is usually moist tissues that are bathed by secretions such as in the nose.
- The mucosal lining of these (paranasal) sinuses is continuous with that in the nose and the throat.
- So infection in this area tends to migrate into the sinuses causing sinusitis.
- When the sinuses are obstructed they cause headaches.
- The nose has 2 functions: respiration and smell, so accordingly there are two types of mucosa in the nasal cavity:
    1. Respiratory mucosa
    2. Olfactory mucosa



Nasal Cavity
Olfactory Mucosa

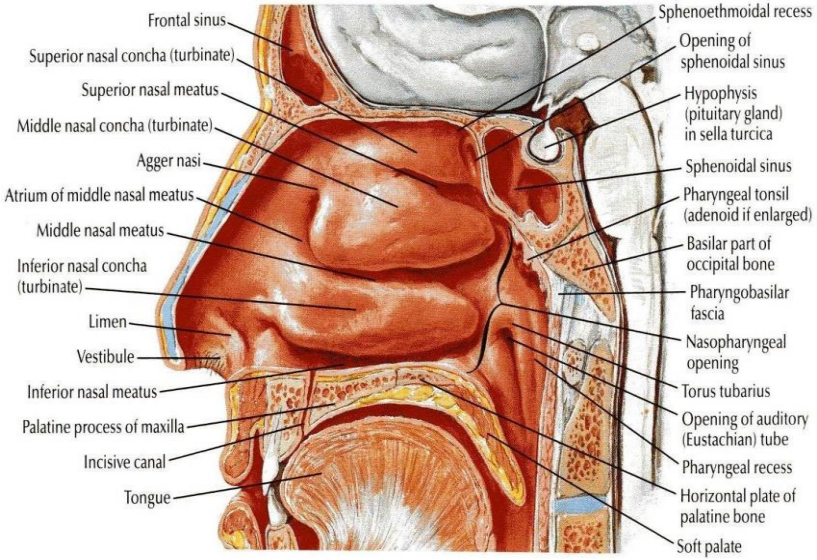
- It is made up by olfactory epithelium.
- It is delicate and contains olfactory nerve cells.
- It is present in the **upper part** of nasal cavity:
  - **Roof**
  - On the **lateral wall**, it lines the upper surface of the superior concha and the sphenoethmoidal recess.
  - On the **medial wall**, it lines the superior part of the nasal septum.

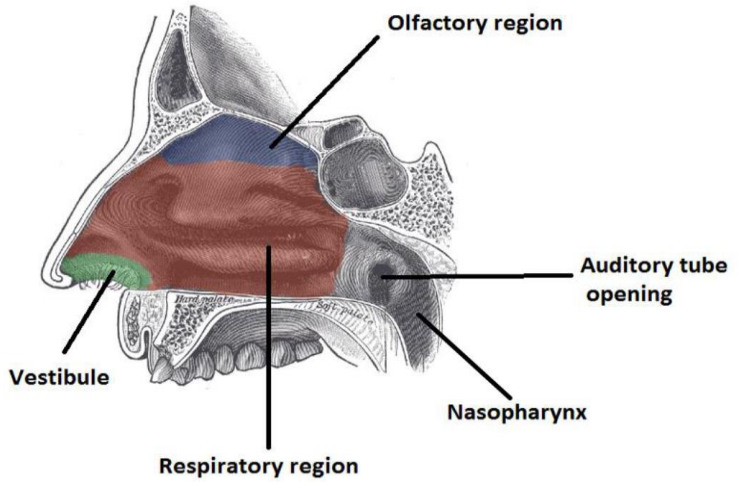


Nasal Cavity
Respiratory Mucosa

- It is thick, ciliated, highly vascular and contains **mucous glands** & **goblet cells**
- It lines the **lower part** of the nasal cavity (from skin of vestibule* to the superior concha).
- It functions to moisten, clean and warm the inspired air.
  - The air is moistened by the secretion of numerous serous glands.
  - It is cleaned by the removal of the dust particles by the ciliary action of the columnar ciliated epithelium that covers the mucosa.
  - The air is warmed by a submucous venous plexus.
- The vestibule is lined by skin.

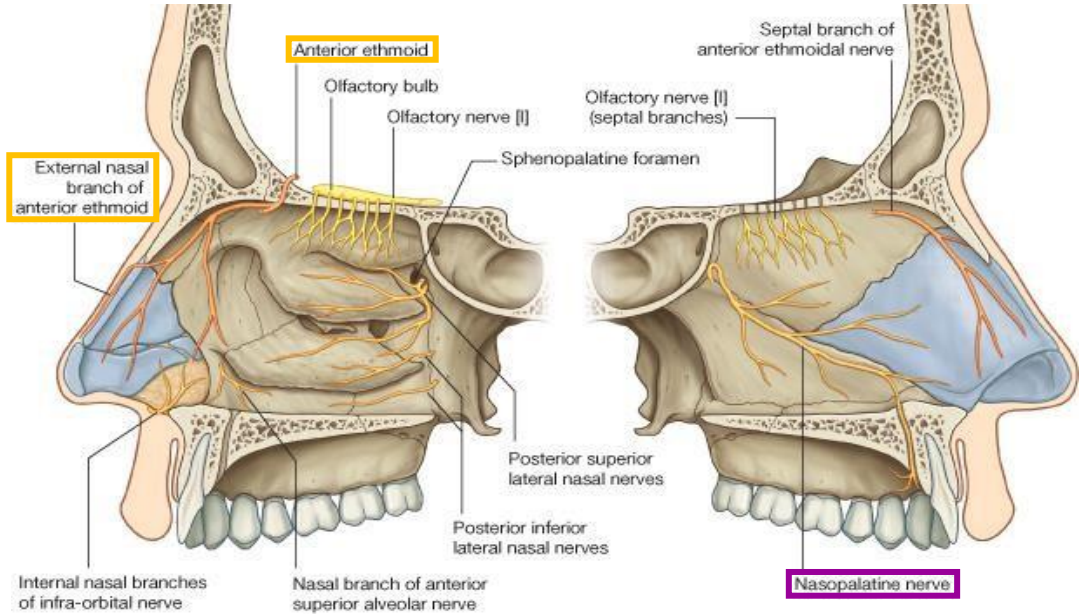
Vestibule: it is the only part of the nasal cavity which is lined by skin (also contains hair)

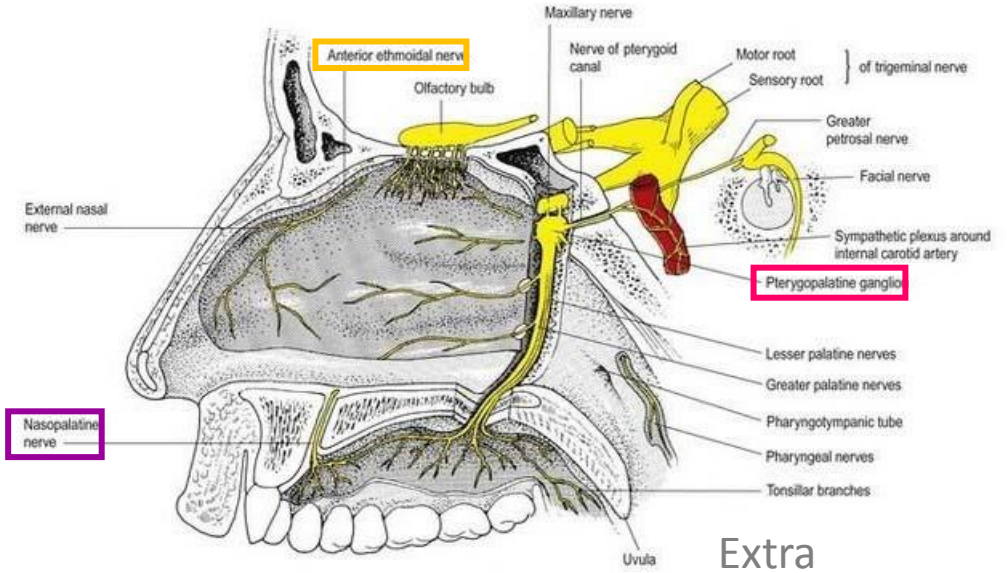




Nasal Cavity
Nerve Supply

- Innervation to the external skin of the nose is supplied by the trigeminal nerve.
- The nerves of General Sensation are derived from the **Ophthalmic** & **Maxillary** divisions of trigeminal nerve.
- The anterior part is supplied by: **Anterior Ethmoidal** branch of nasociliary(another name is external nasal) nerve. **(the septum and lateral wall)**
- The posterior part is supplied by branches of the **pterygopalatine ganglion***:
  1- **Nasopalatine (the septum and lateral wall)**
  2- **Nasal**
  3- **Palatine**





Extra

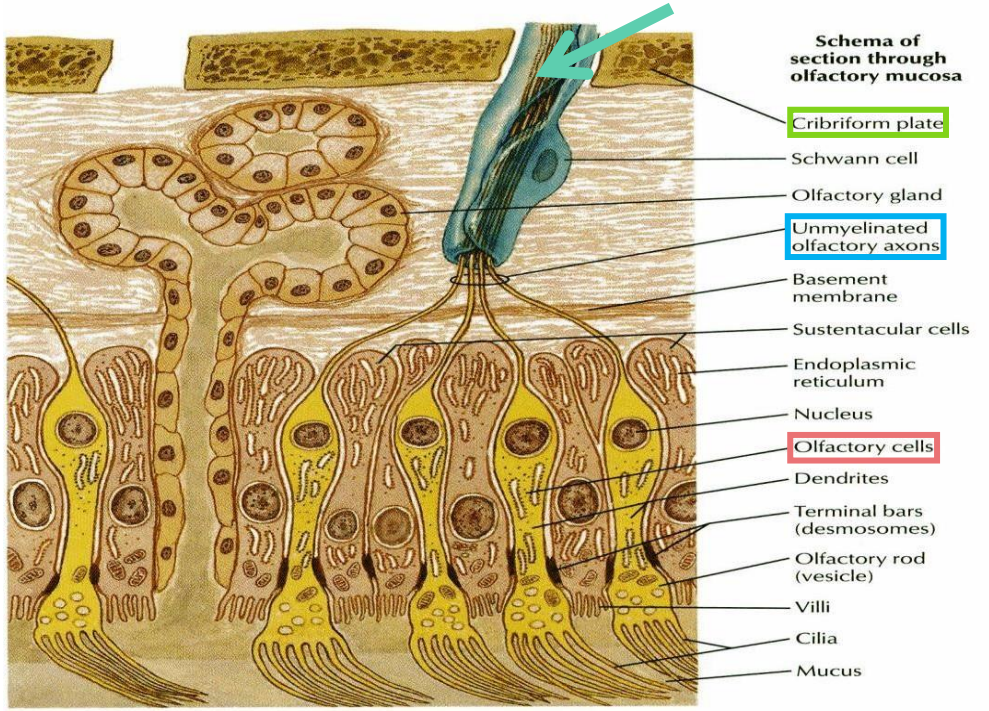
* The sensory root of the pterygopalatine ganglion is from the maxillary nerve.

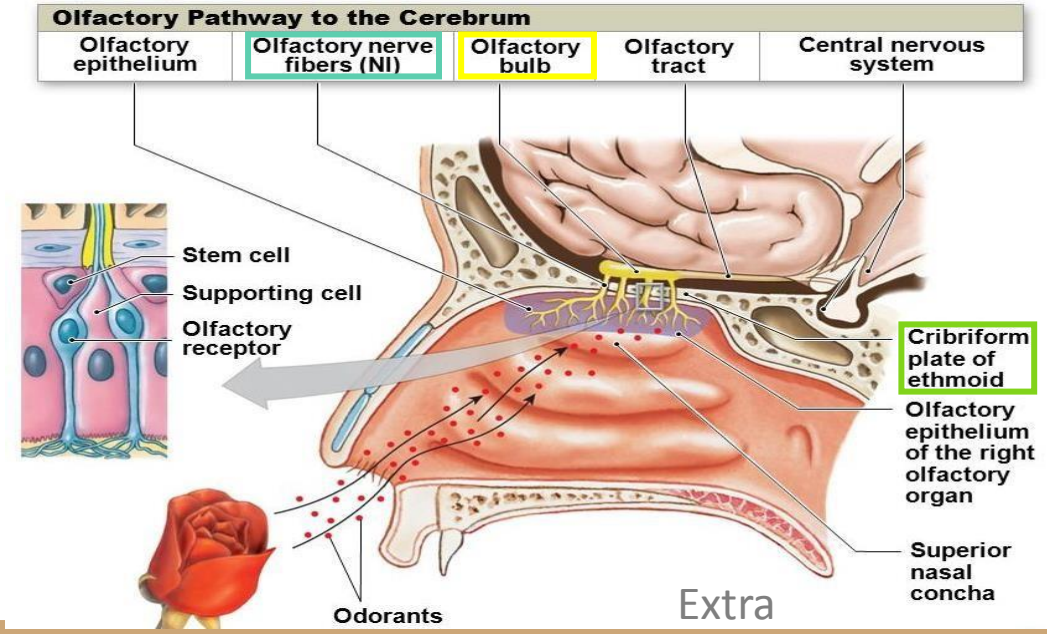
Nasal Cavity
Nerve Supply

- The nerve of special sensation is the **olfactory nerve.**
- It gives the ability of the nose to smell. This is carried out by the olfactory nerves (Cr. I)
- Olfactory pathway:

1st neuron:

- Olfactory receptors are specialized, **ciliated nerve cells** that lie in the olfactory epithelium.
- The axons of these bipolar cells 12-20 fibers form the true olfactory nerve fibers.
- Which passes through the cribriform plate of ethmoid.
- They join the **olfactory bulb**





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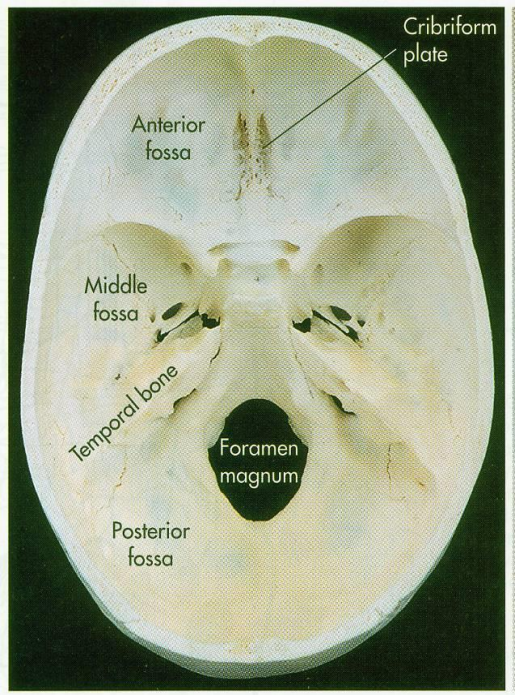
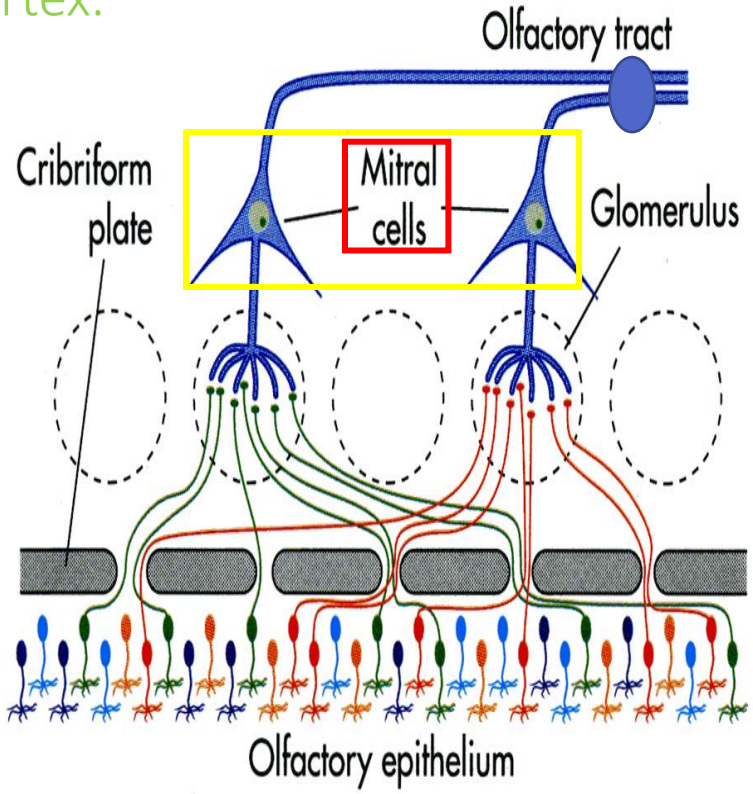
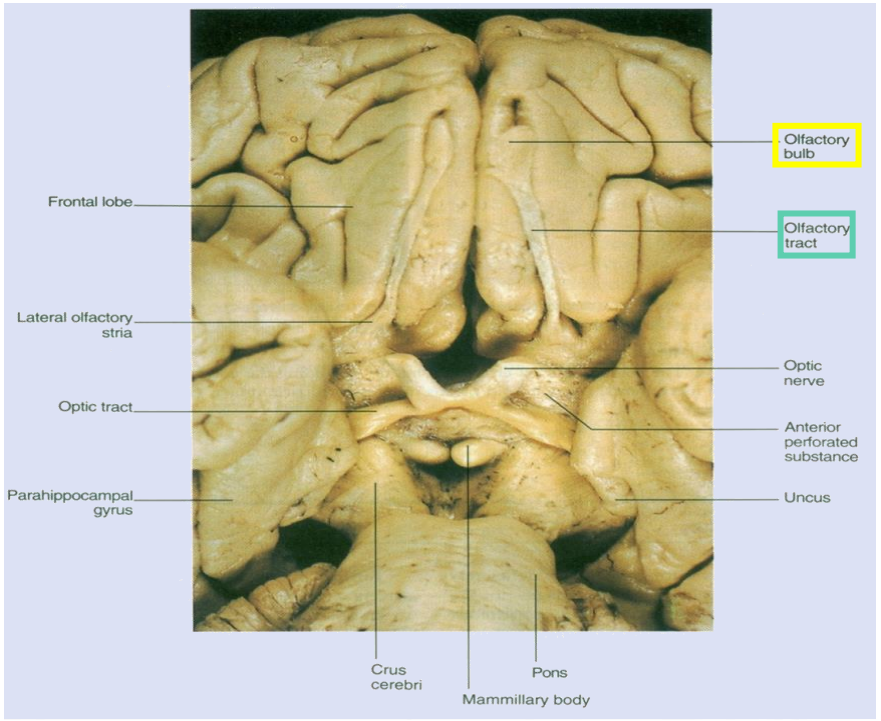
Nasal Cavity
Nerve Supply

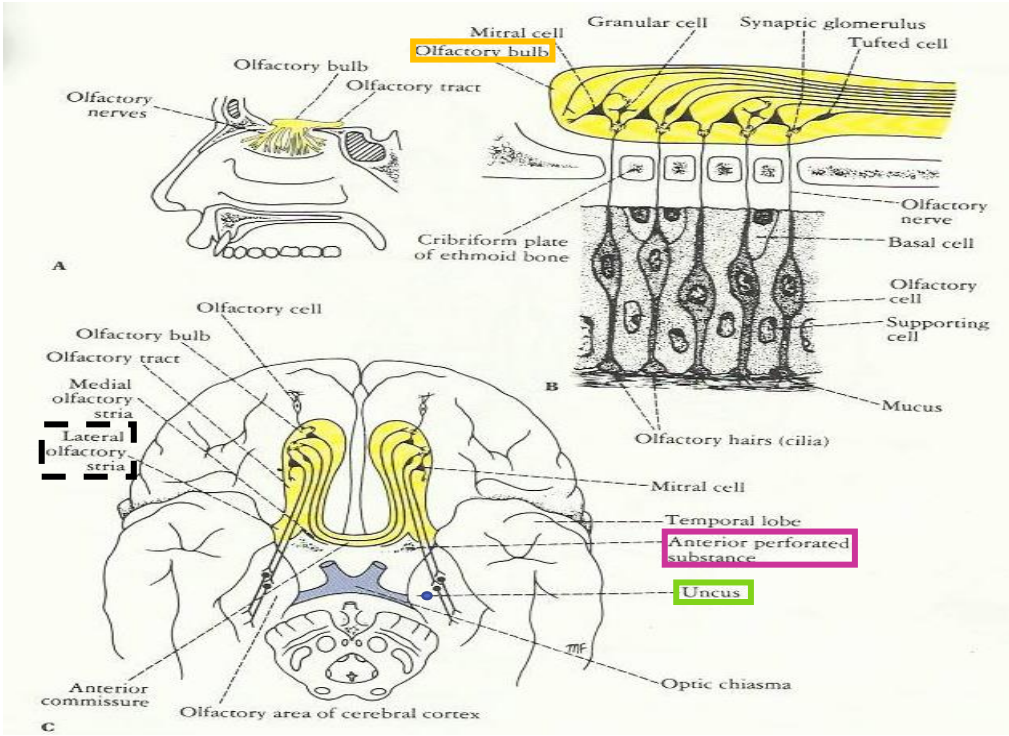
Preliminary processing of olfactory information is within the **olfactory bulb,** which contains interneurons and large Mitral cells(2nd order neuron) **;** axons from the latter leave the bulb to form the **olfactory tract**. (smell is the only sense that does not go to the thalamus) from 2nd neuron to cerebral cortex.







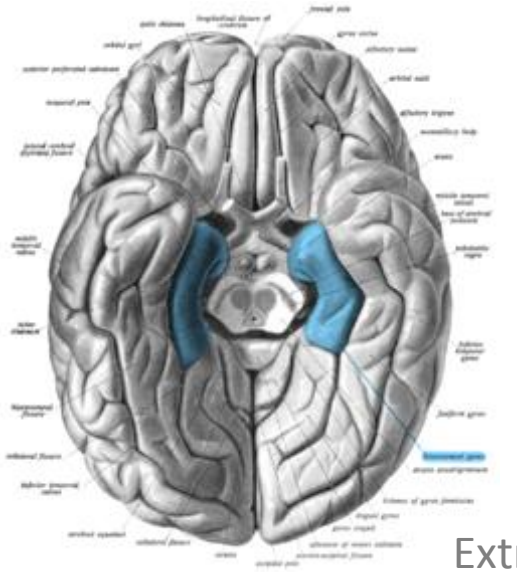
Nasal Cavity
Nerve Supply



2nd neuron:

- It is formed by the **Mitral cells of olfactory bulb.**
- The axons of these cells form the olfactory tract.
- tract divides into 2 roots (lateral and medial) at the **anterior perforated substance:**

1- Lateral root:(direct to area in the same side)
Carries olfactory fibers to end in cortex of the **Uncus** & adjacent part of **Hippocampal gyrus (center of smell).**



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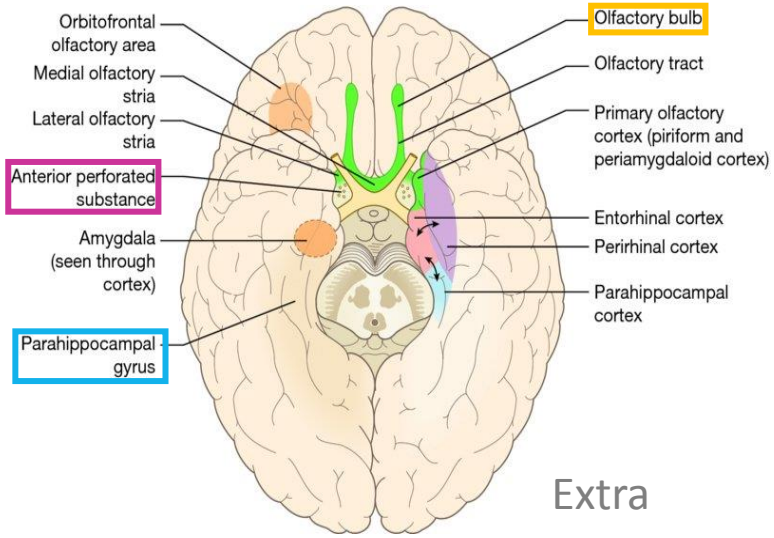


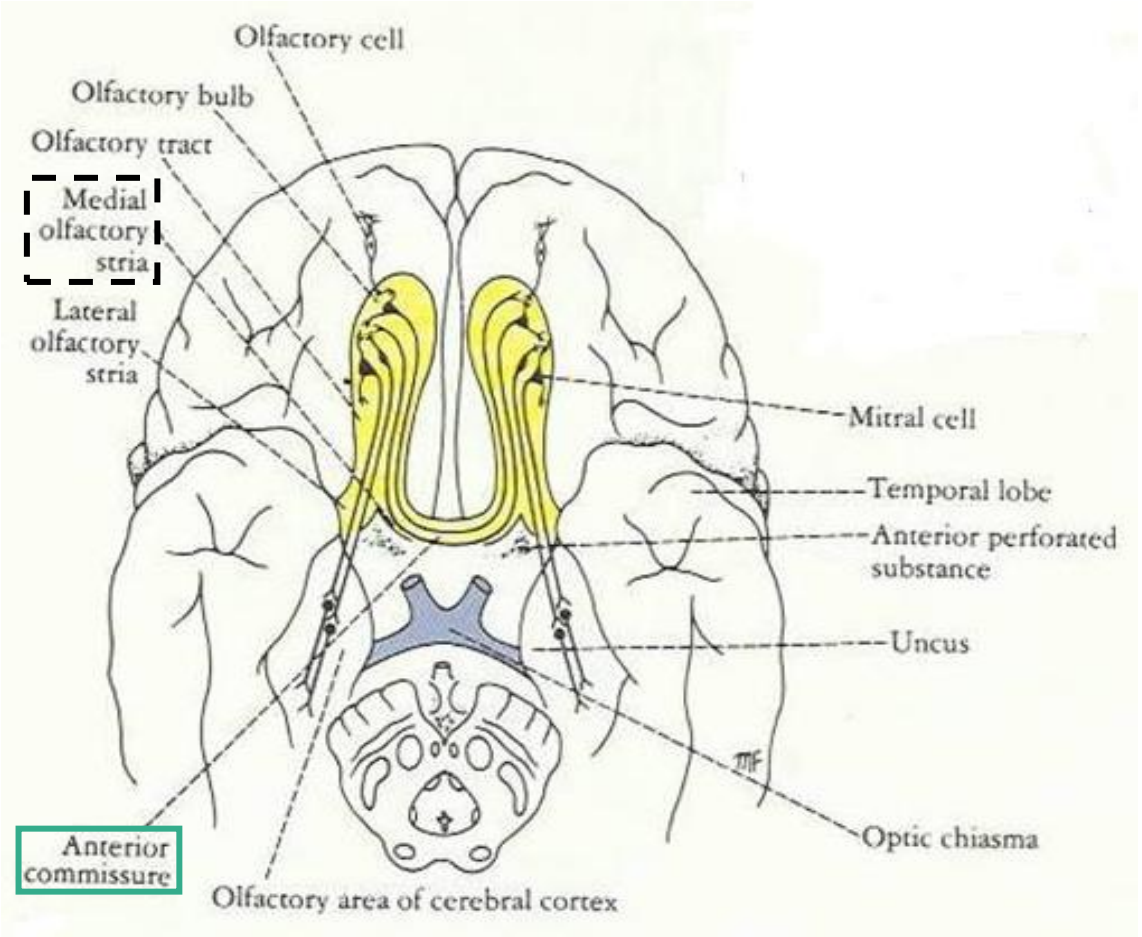
Extra

Nasal Cavity
Nerve Supply

2- Medial root:(direct to area in the opposite side)

- crosses midline through anterior commissure and joins the uncrossed lateral root of opposite side.
- It connects olfactory centers of 2 cerebral hemispheres.
- So each olfactory center receives smell sensation from both halves of nasal cavity.

NB. Olfactory pathway is the only sensory pathway which reaches the cerebral cortex without passing through the Thalamus.



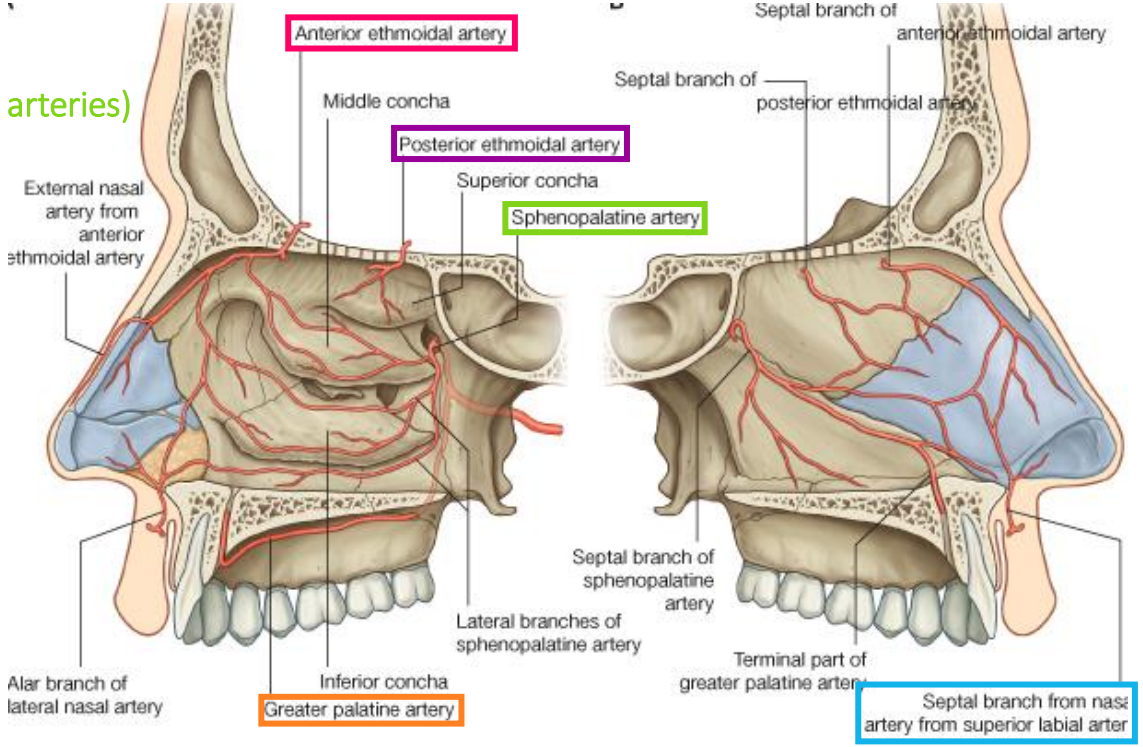
*Note: The lateral root goes to the same side while the medial root crosses to the opposite side.

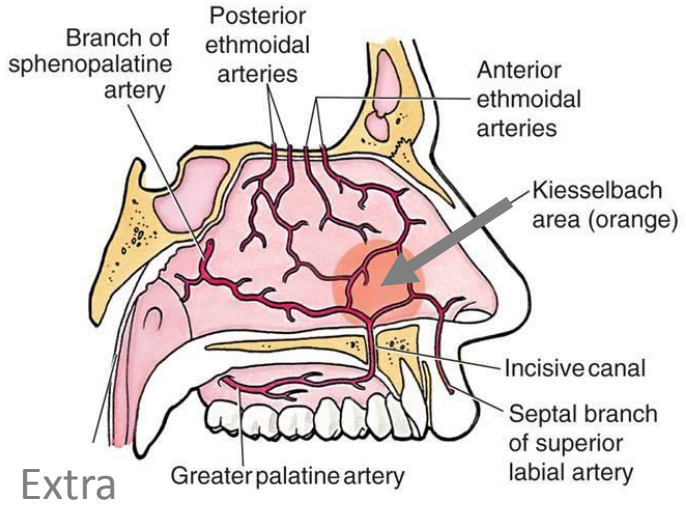
Nasal Cavity
Arterial Supply (from both external and internal carotid arteries)

1. Sphenopalatine artery (branch of maxillary). (external carotid)
2. Anterior and Posterior Ethmoidal (branch of ophthalmic). (internal carotid)
3. Superior labial (branch of facial).(external carotid)
4. Greater palatine artery (Branch of maxillary)
5. Lateral nasal artery (Branch of facial)

❑ Applied anatomy :
The most common site for **epistaxis** (nosebleed) is at the anterior & inferior part of nasal septum (Little's area) because of the rich arterial anastomosis

Remember:
Nerve supply → nasopalatine
Arterial supply → sphenopalatine





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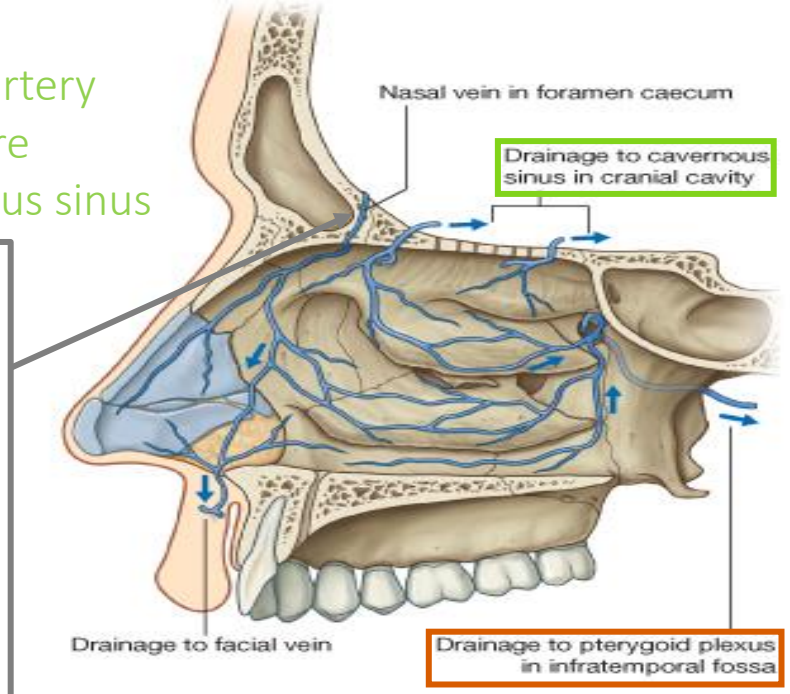
Nasal Cavity

- Venous Drainage
  - **Venous plexus** in the submucosa formed by veins accompanying the arteries
  - They drain into **cavernous sinus(Facial vein)*** & **pterygoid venous plexus.**

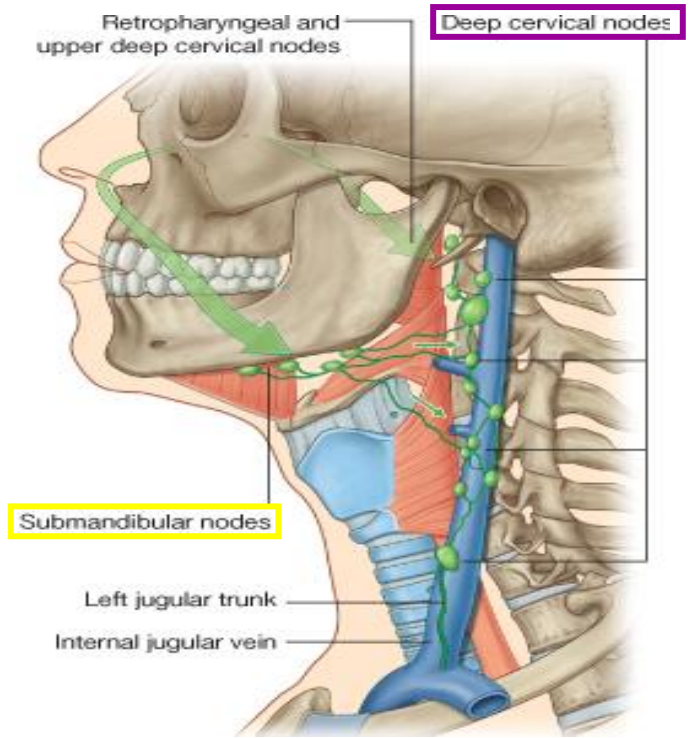
*The internal carotid artery and abducens nerve are present in the cavernous sinus

The emissary vein directly opens into the cavernous sinus. The vein is special because it is valve-less, so blood can pass in 2 directions



- Blood passes according to pressure
- Can transmit infection from nasal cavity to cavernous sinus

- Lymphatic Drainage
  - To **Submandibular**
  - **Upper deep cervical nodes**.



Clinical significances

*Only in Boys slides

- NOSEBLEED:
  - It is common case due to rich blood supply of the node.
  - Most likely occur in anterior third of nasal cavity.
  -Cause could be local due to trauma or systemic due to hypertension.

- DISEASES OF THE NASAL CAVITY INCLUDE:
  - Viral
  - Bacterial
  - Fungal infections
  - Nasal cavity tumours
  - Inflammations of the nasal mucosa

- Inflammation:

▪ The paranasal sinuses are joined to the nasal cavity via small orifices called ostia. These become blocked easily by allergic inflammation, or by swelling in the nasal lining that occurs with a cold. If this happens, normal drainage of mucus within the sinuses is disrupted, and sinusitis may occur.

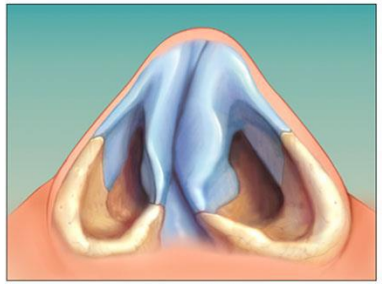
▪ Because the maxillary posterior teeth are close to the maxillary sinus, this can also cause clinical problems if any disease processes are present, such as an infection in any of these teeth.

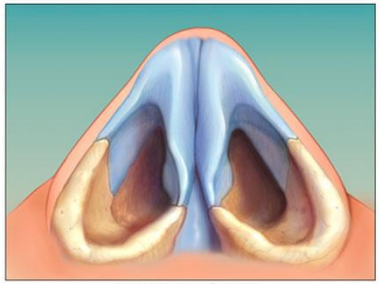
Clinical significances

*Only in Boys slides

- **Deviated Septum:**

▪ Occurs when the thin wall (nasal septum) between the nasal passages is displaced to one side.
▪ In many people, the nasal septum is displaced or deviated making one nasal passage smaller.
▪ When a deviated septum is severe, it can block one side of the nose and reduce airflow, causing difficulty breathing.
▪ Nasal obstruction can occur from a deviated nasal septum, from swelling of the tissues lining the nose, or from both.
▪ Treatment of nasal obstruction may include medications to reduce the swelling or nasal dilators that help open the nasal passages.
▪ To correct a deviated septum, surgery is necessary.


Deviated nasal septum


Straightened nasal septum

- **Cancer:**

▪ Malignancies of the paranasal sinuses comprise approximately 0.2%of all malignancies.
▪ About 80% of these malignancies arise in the maxillary sinus.
▪ They most often occur in the age group between 40 and 70 years.
▪ Carcinomas are more frequent than sarcomas.
▪ Tumours of the sphenoid and frontal sinuses are extremely rare.

Summary

Anatomy of the Nose and Olfactory Nerve

Arterial Supply

- Sphenopalatine artery .
- Anterior and Posterior Ethmoidal (branch of ophthalmic).
- Superior labial (branch of facial).
-artersail anastomosism

Nerve Supply

General Sensation

from the anterior part Ophthalmic & posterior part Maxillary divisions of trigeminal nerve.
anterior it's supplied by: Anterior Ethmoidal nerve.
posterior is supplied by branches of the pterygopalatine ganglion
1- Nasopalatine, 2- Nasal 3- Palatine

special sensation

olfactory nerve

Olfactory pathway:
1st neurone:
The axons form the true olfactory nerve fibers, Which passes through the cribriform plate of ethmoid and join the olfactory bulb

2nd neuronelt :is formed by the Mitral cells of olfactory bulb.
-The axons of these cells form the olfactory tract.
-Each tract divides into 2 roots (lateral and medial) at the anterior perforated substance:

lateral :end in cortex of the Uncus & adjacent part of Hippocampal gyrus (center of smell. To the same side

medial : crosses midline through anterior commissure and joins the uncrossed lateral root of opposite side.
It connects olfactory centers of 2 cerebral hemispheres

Mucosa

Olfactory Mucosa

. delicate and contains olfactory nerve cells.
It is present in the upper part of nasal cavity:
-Roof
- lateral wall, - -
medial wall,

Respiratory Mucosa

-thick, ciliated and highly vascular. -contains mucous glands & goblet cells
- lines the lower part of the nasal cavity (from vestibule to the superior concha).
- functions; to moisten, clean and warm the inspired air.

Nasal Cavity

floor

formed by :nasal surface of the hard palate:-
-Palatine process of maxilla, anteriorly.
-Horizontal plate of the palatine bone, posteriorly

Roof

Formed by:
-Body of sphenoid, posteriorly.
-Cribriform plate of ethmoid, in the middle.
- Frontal, and nasal bones, Anteriorly

Lateral wall

Marked by :
- Superior, middle, and inferior between them is the Meatus.
-Superior, middle, and inferior meatus.
- Sphenoethmoidal recess.

medial wall

The nasal septum :
-Vertical plate of ethmoid.
-Septal cartilage.
-Vomer.

Paranasal Sinuses

Spheno-ethmoidal recess >sphenoidal air sinus

Superior meatus >posterior ethmoidal sinus

Middle meatus >(1) maxillary, (2) frontal, & (3) anterior , (4) middle ethmoidal sinuses

Inferior meatus >nasolacrimal duct.

Lymphatic Drainage

To Submandibular & Upper deep cervical nodes

Venous Drainage

Venous plexus >drain into cavernous sinus (in it is the carotid artery and the nerve 6) & pterygoid venous plexus.

MCQs

(1) Anterior nasal floor is composed of?

A) Horizontal plate of the palatine bone
B) Palatine process of maxilla
C) Vomer
D) Inferior meats

(2) Paranasal Sinuses are lined with?

A) serous membrane
B) Cutaneous membrane
C) Mucoperiosteum
D) Non of them

(3) Which sinus doesn't open into the middle meatus?

A) Maxillary
B) Sphenoidal sinus
C) Frontal
D) Middle ethmoidal

(4) Olfactory Mucosa in nasal cavity is present in?

A) Upper part
B) Lower part
C) Right part
D) Left part

(5) Posterior part of nasal cavity is innervated by all of the following except?

A) Anterior Ethmoidal
B) Nasopalatine
C) Pterygopalatine ganglion
D) Palatine

(6) Which root of 2nd neuron (mitral cells) joins the opposite side?

A) Medial root
B) Lateral root
C) Upper root
D) Lower root

(7) First order neurons are present in?

A) Olfactory epithelium
B) Olfactory bulb
C) Olfactory tract
D) Non of them

(8) What is the most common site for epistaxis (nosebleed)?

A) Anterior & inferior part of nasal septum
B) Posterior part of nasal septum
C) Floor of nasal cavity
D) Lateral wall of nasal cavity

(9) ?

A)
B)
C)
D)

(10) ?

A)
B)
C)
D)

Answers

(1) B
(2) C
(3) B
(4) A
(5) A
(6) A
(7) .
(8) A
(9) .
(10) .

SAQ

(1) What are the functions of the paranasal sinuses?

1. Lighten the skull weight
2. amplify the sound as we speak

(2) Describe how respiratory mucosa moisten, clean, and warm)?

1. The air is moistened by the secretion of numerous serous glands.
2. It is cleaned by the removal of the dust particles by the ciliary action of the columnar ciliated epithelium
3. that covers the mucosa. The air is warmed by a submucous venous plexus.

(3) Mention the innervation of nasal cavity?

1. The anterior part is supplied by **Anterior Ethmoidal** nerve (a branch of the ophthalmic nerve).
2. The posterior part is supplied by branches of **pterygopalatine** ganglion (a branch of maxillary nerve): Nasopalatine, Nasal, and Palatine.
3. Both ophthalmic and maxillary are branches of trigeminal nerve.

Good luck
Special thank for team436 ❤

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