



# REVISION OF RESPIRATORY MODULE

**Dr Fekry Shata**

Department of human Anatomy and Embryology  
Faculty of Medicine  
Mansoura National University, Egypt

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# Anatomy of the nose & paranasal sinuses

Department of human Anatomy and Embryology  
Faculty of Medicine  
Mansoura National University, Egypt

By  
Dr. Fekry Shata





# Boundaries of The Nasal Cavity

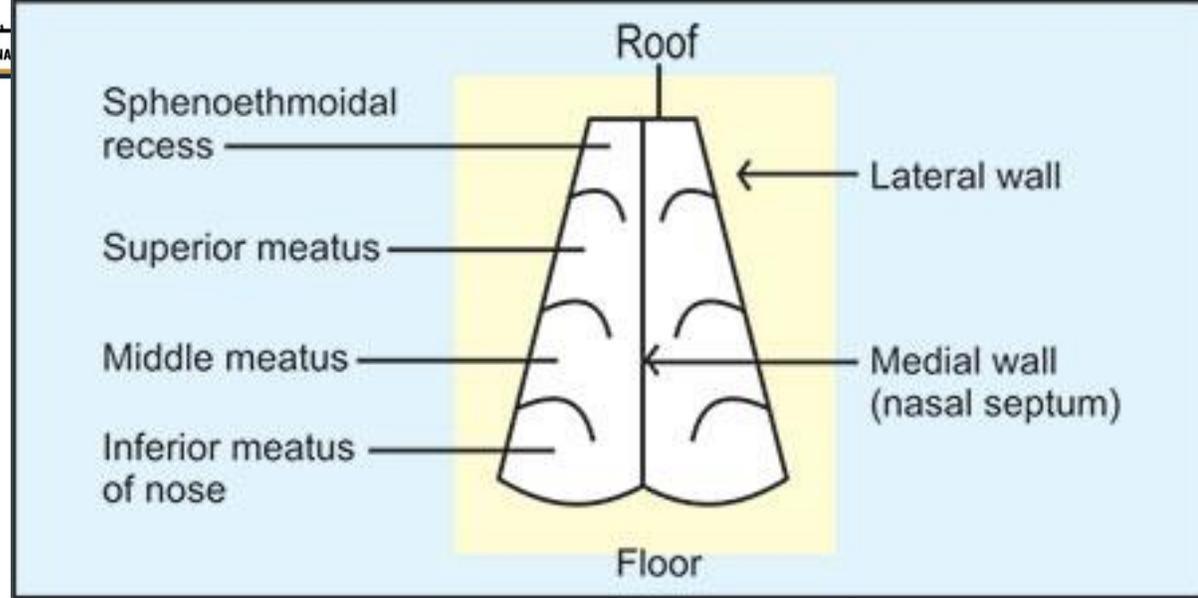


# Walls of the Nasal Cavity

- Each half of the nasal cavity has a floor, a roof, a lateral wall, and a medial or septal wall.

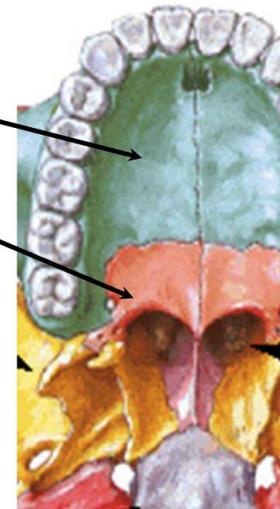
## Floor

1. Palatine process of the **maxilla**
2. Horizontal plate of the **palatine bone**.



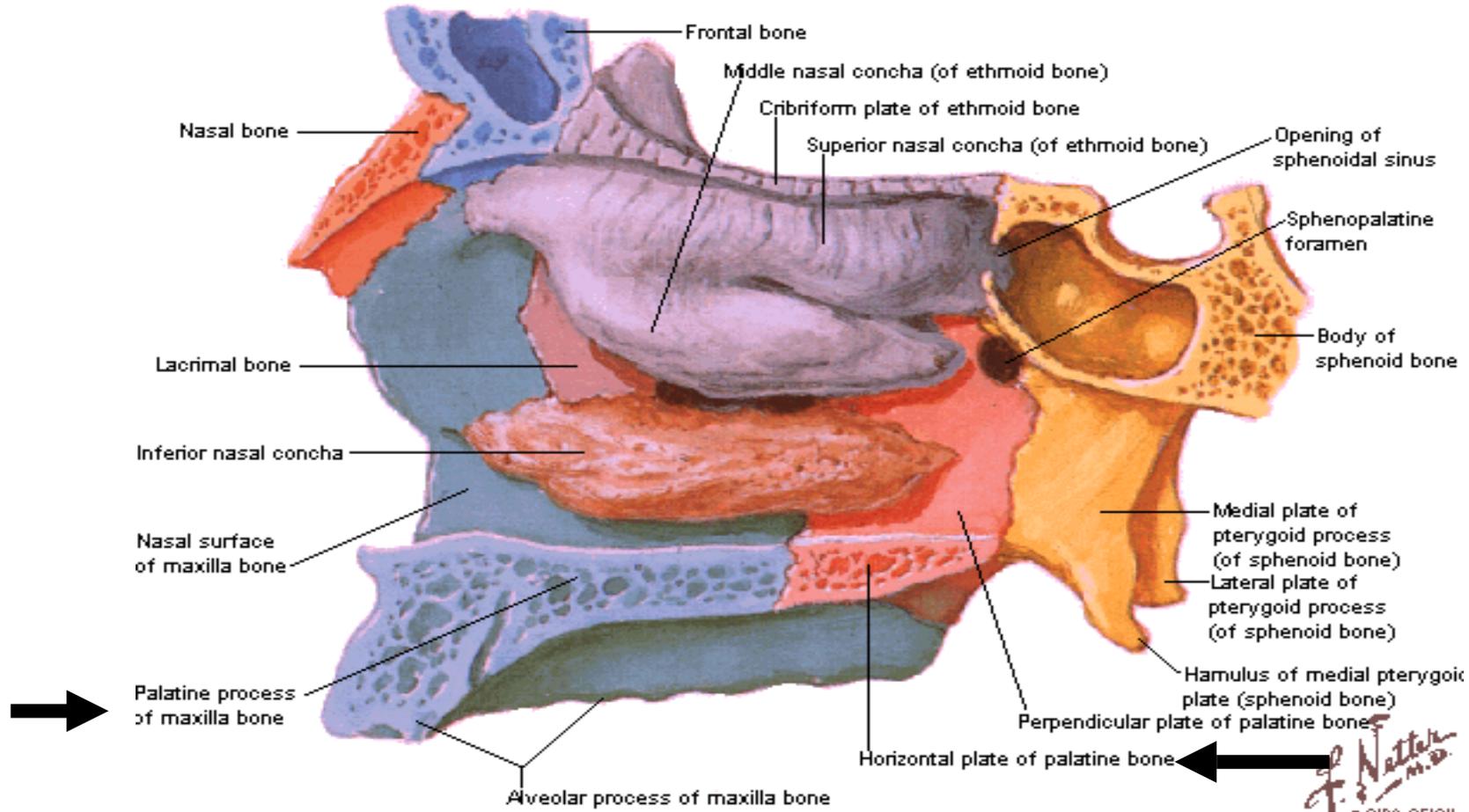
## The Floor

- **Palatine process maxilla**
  - **Horizontal plate palatine bone**
- (the superior surface of the hard palate)



# Floor

## Skull - Nasal Conchae Exposed Sagittal Section



# Roof

- The roof is narrow and is formed

## Anteriorly:

- Nasal bone
- Frontal bones

## Middle:

Cribriform plate of the ethmoid

## Posteriorly:

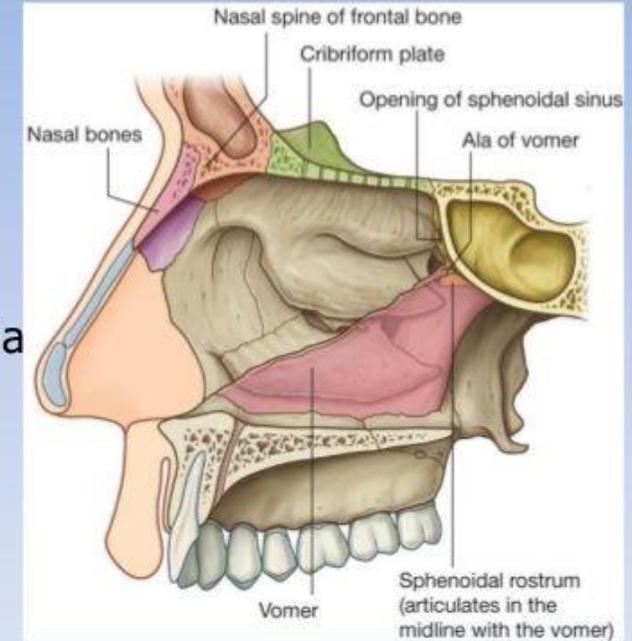
Body of the sphenoid.

MCQ

## Roof:

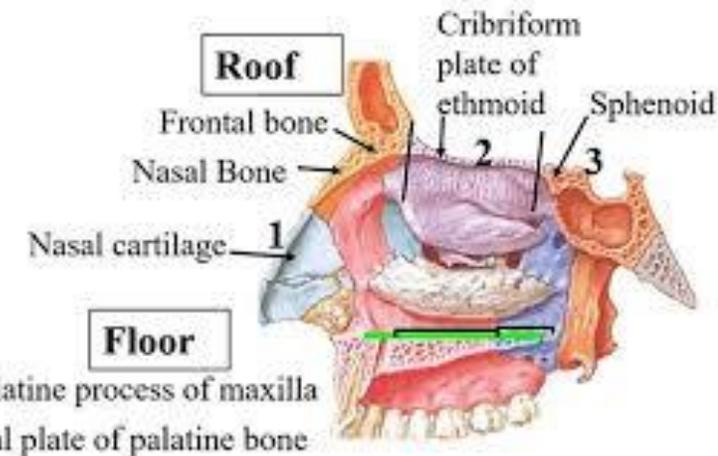
### Formed by:

- Body of sphenoid.
- Cribriform plate of ethmoid bone.
- Frontal bone.
- Nasal bone & cartila
- vomer.



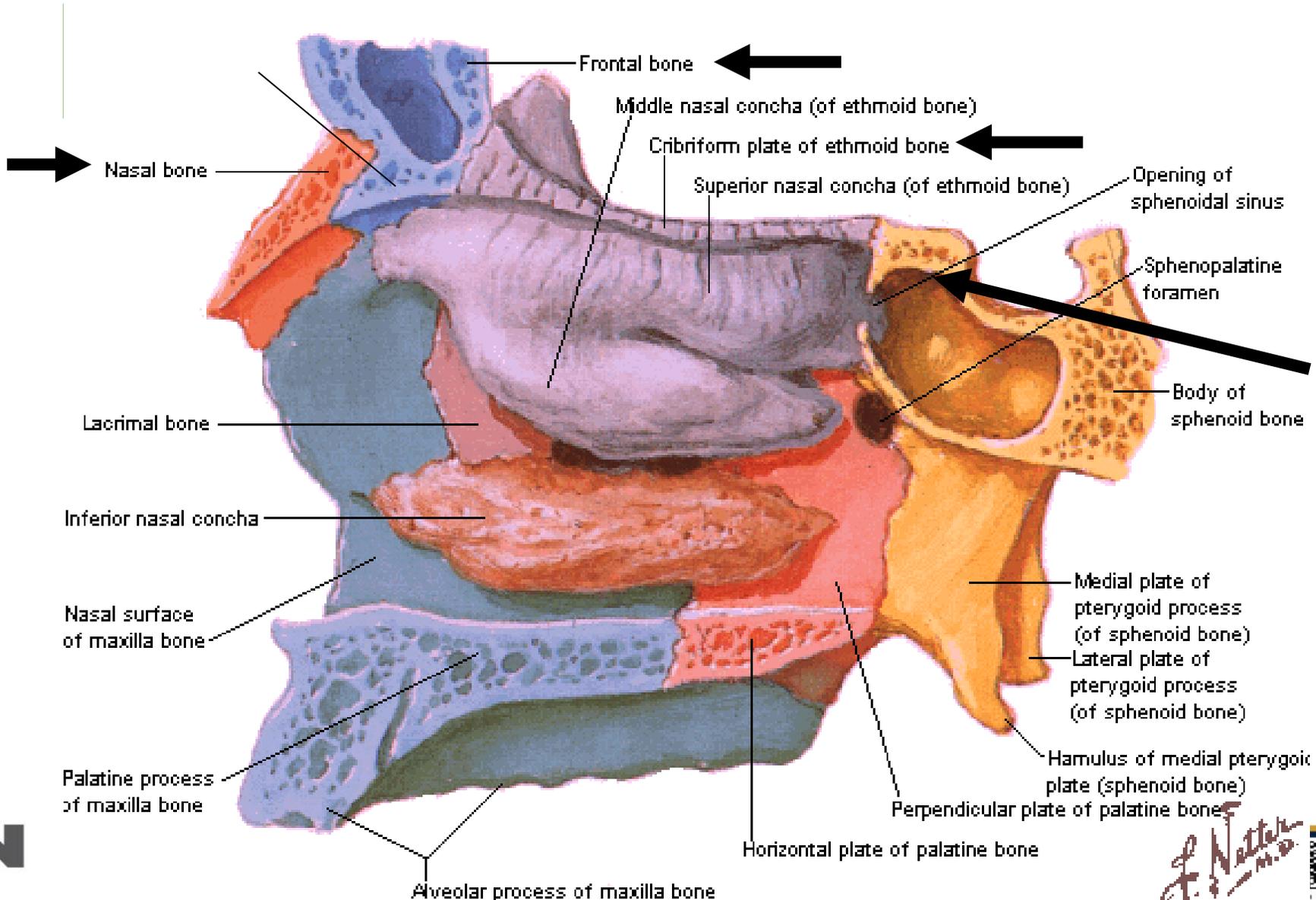
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# Roof

## Skull - Nasal Conchae Exposed Sagittal Section



## Medial Wall

- The medial wall is formed by the **nasal septum** which is formed by the

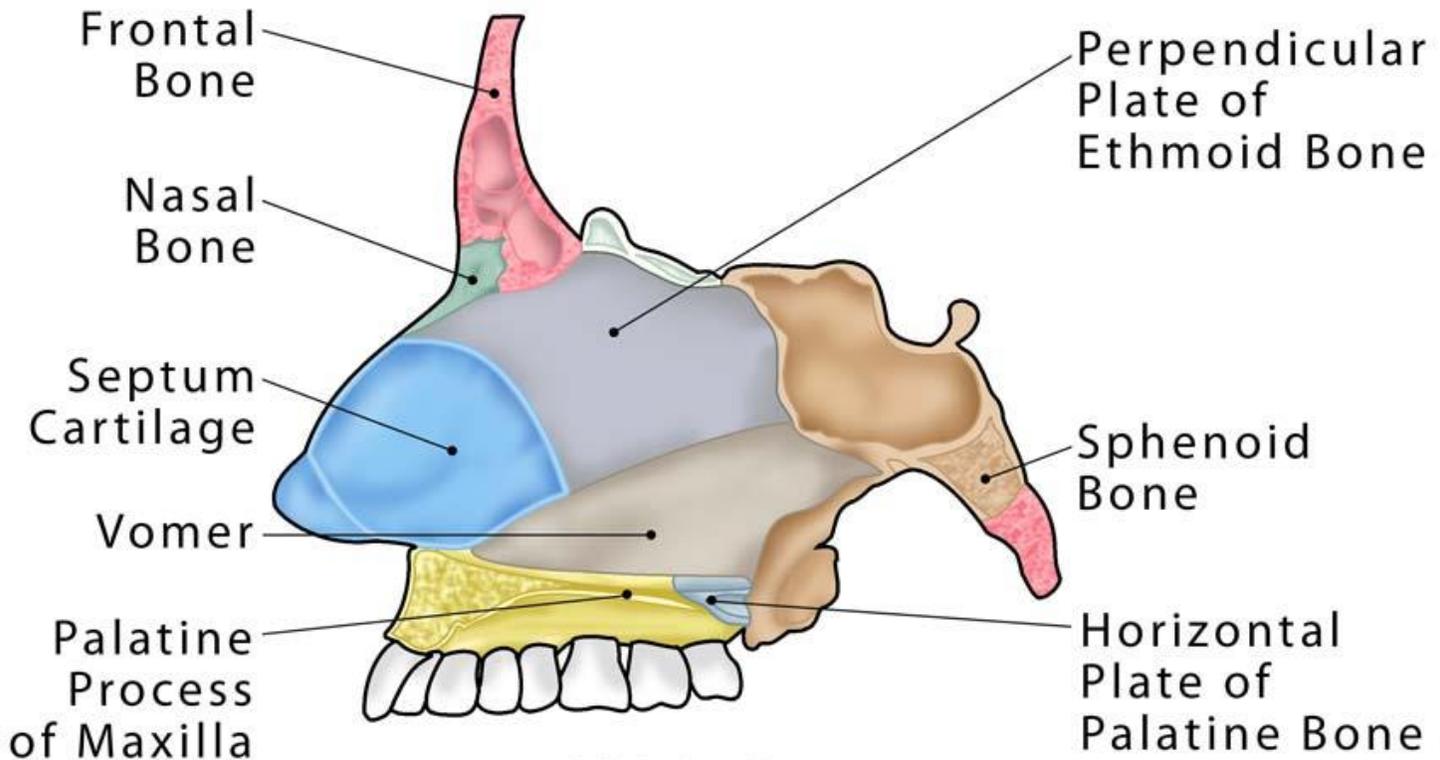
1. **Vertical plate of the ethmoid**

2. **Vomer**

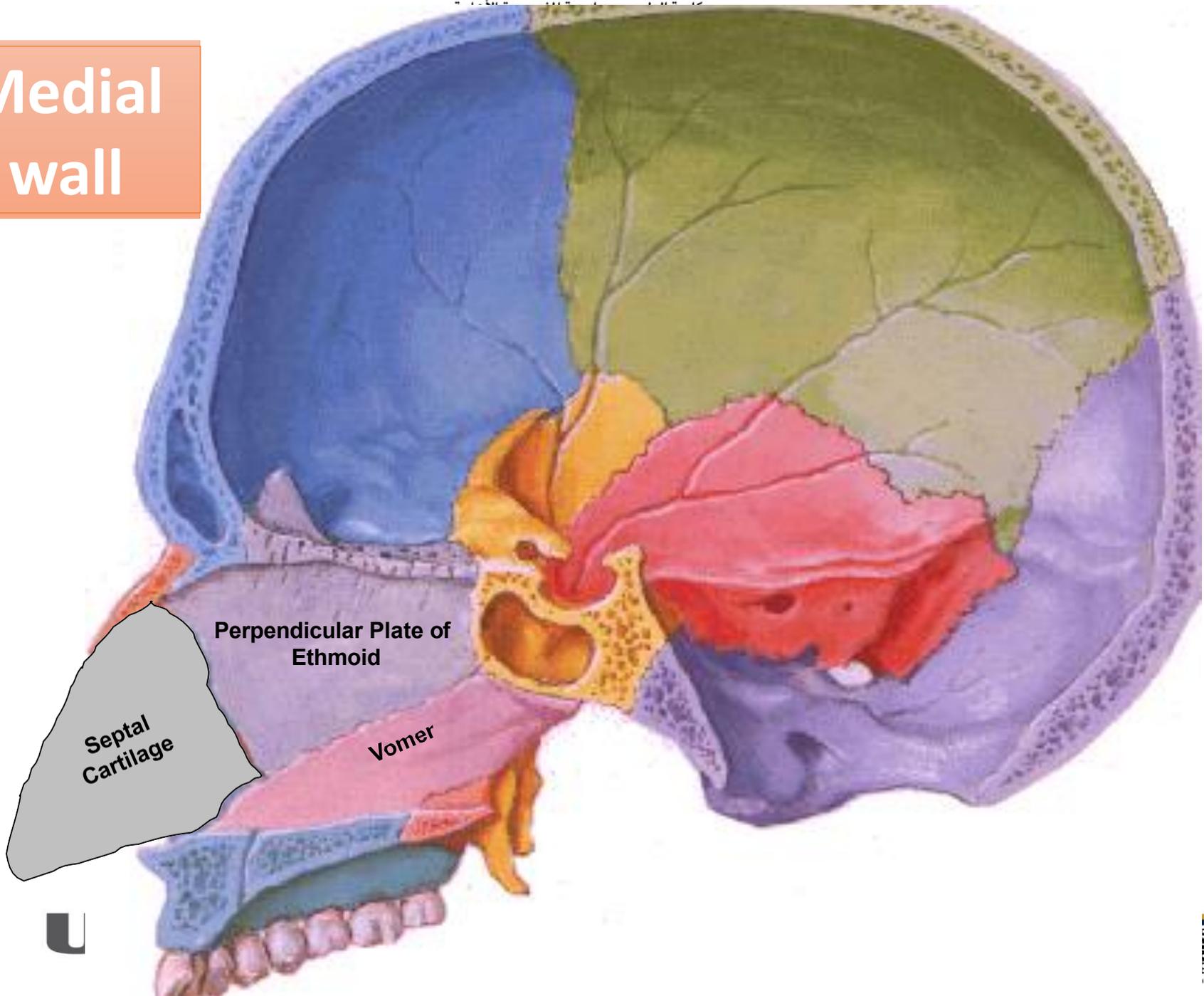
3. **Septal cartilage**

MCQ

## Bones Forming the Walls of Nasal Cavity

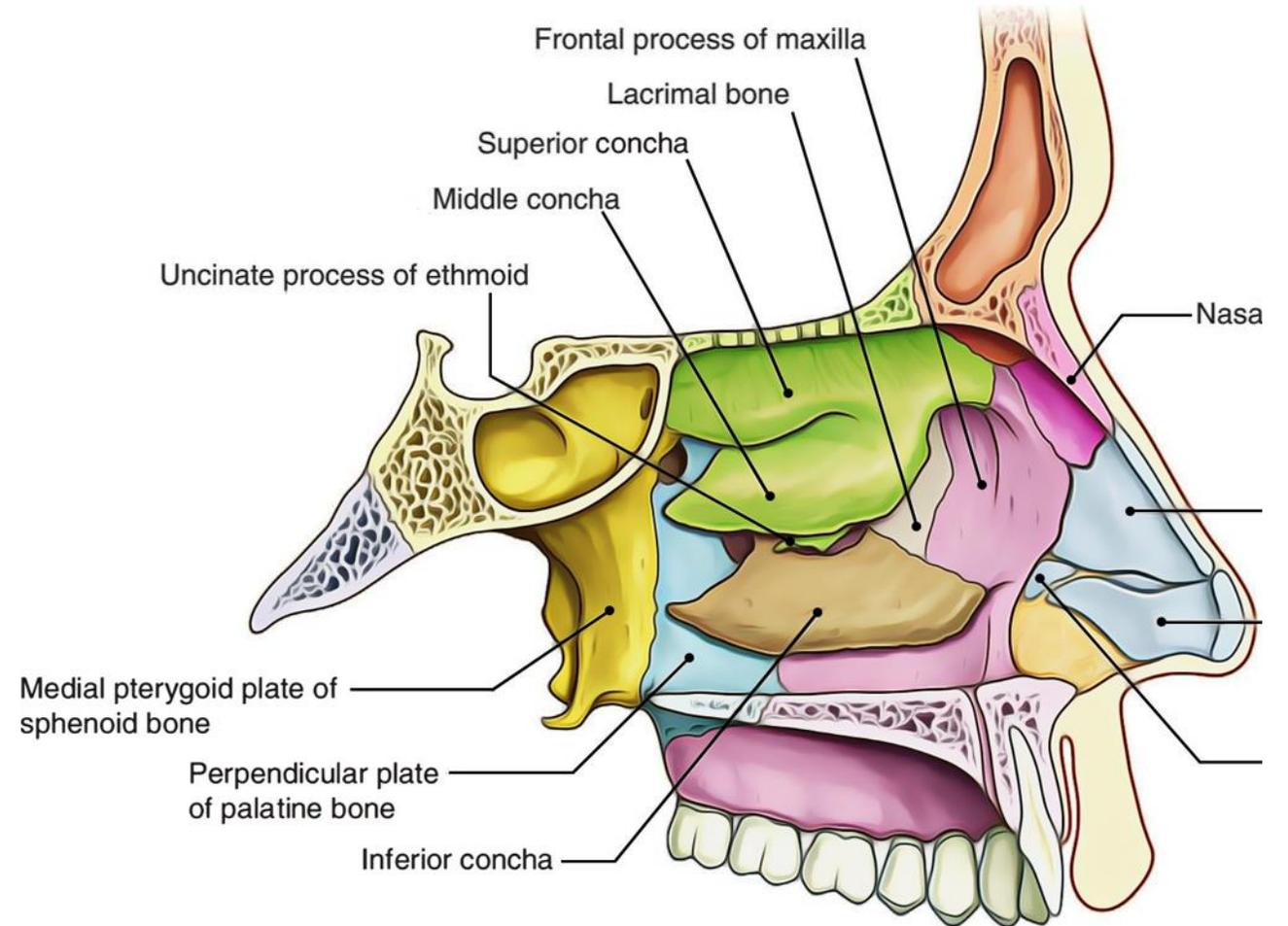


# Medial wall

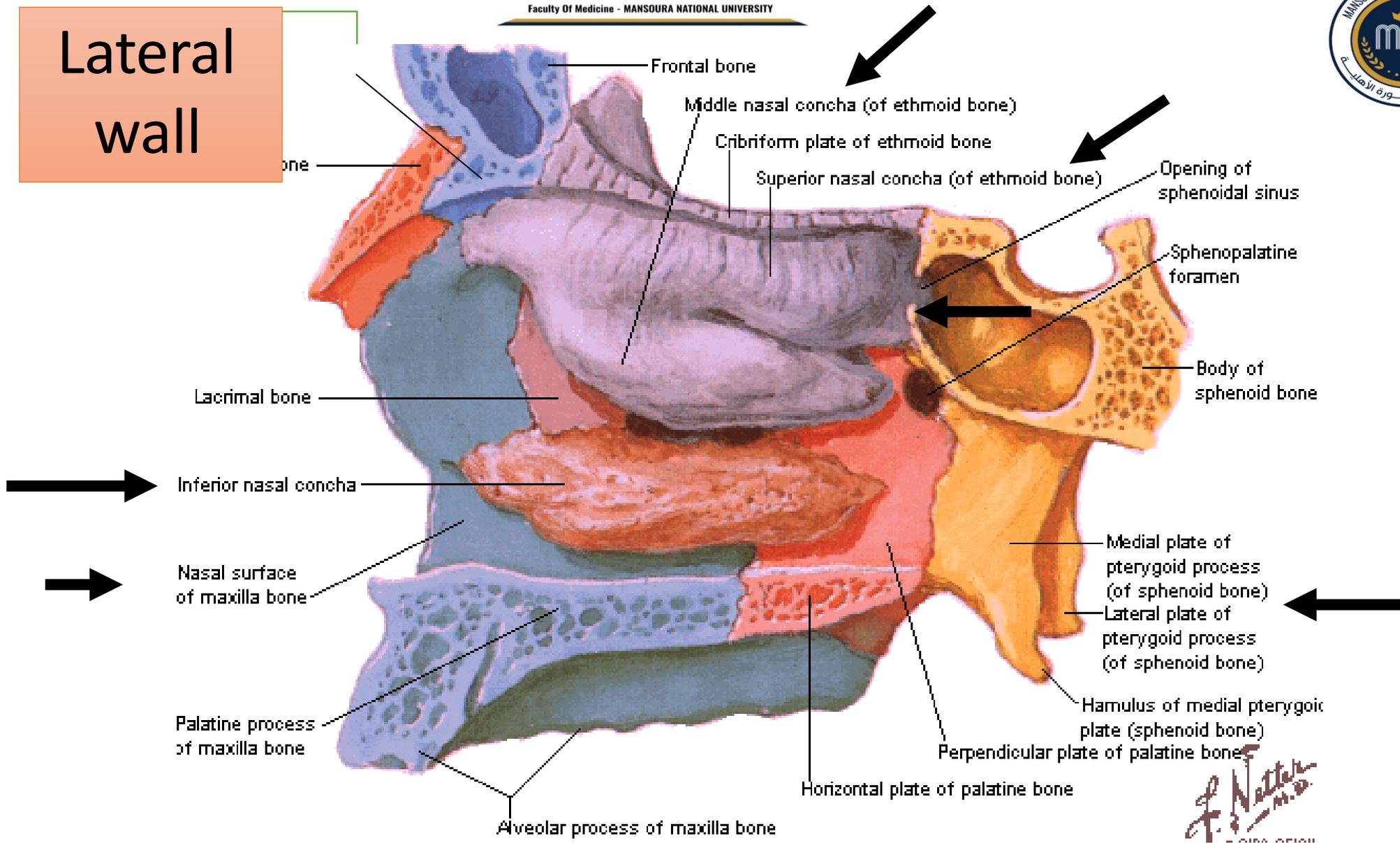


# Lateral wall

- The lateral wall has three projections of bone called the
- Superior nasal conchae** SAQ
  - Middle nasal conchae**
  - Inferior nasal conchae.**
- The space below each concha is called a **meatus (superior, middle inferior)**.
  - Sphenoethmoidal Recess** is a small area above the superior concha.



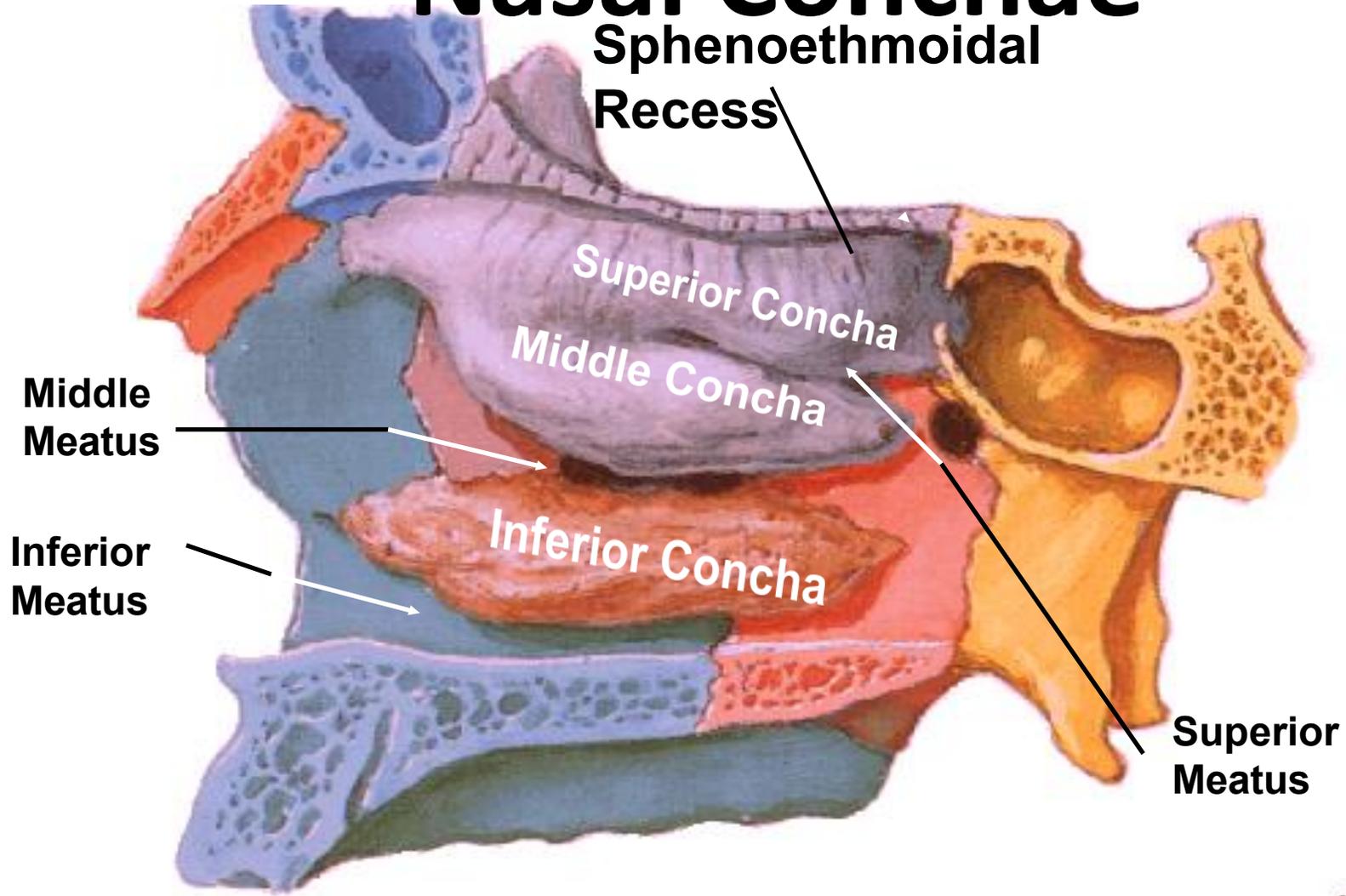
# Lateral wall



*F. Nattah*  
M.D.

# Nasal Conchae

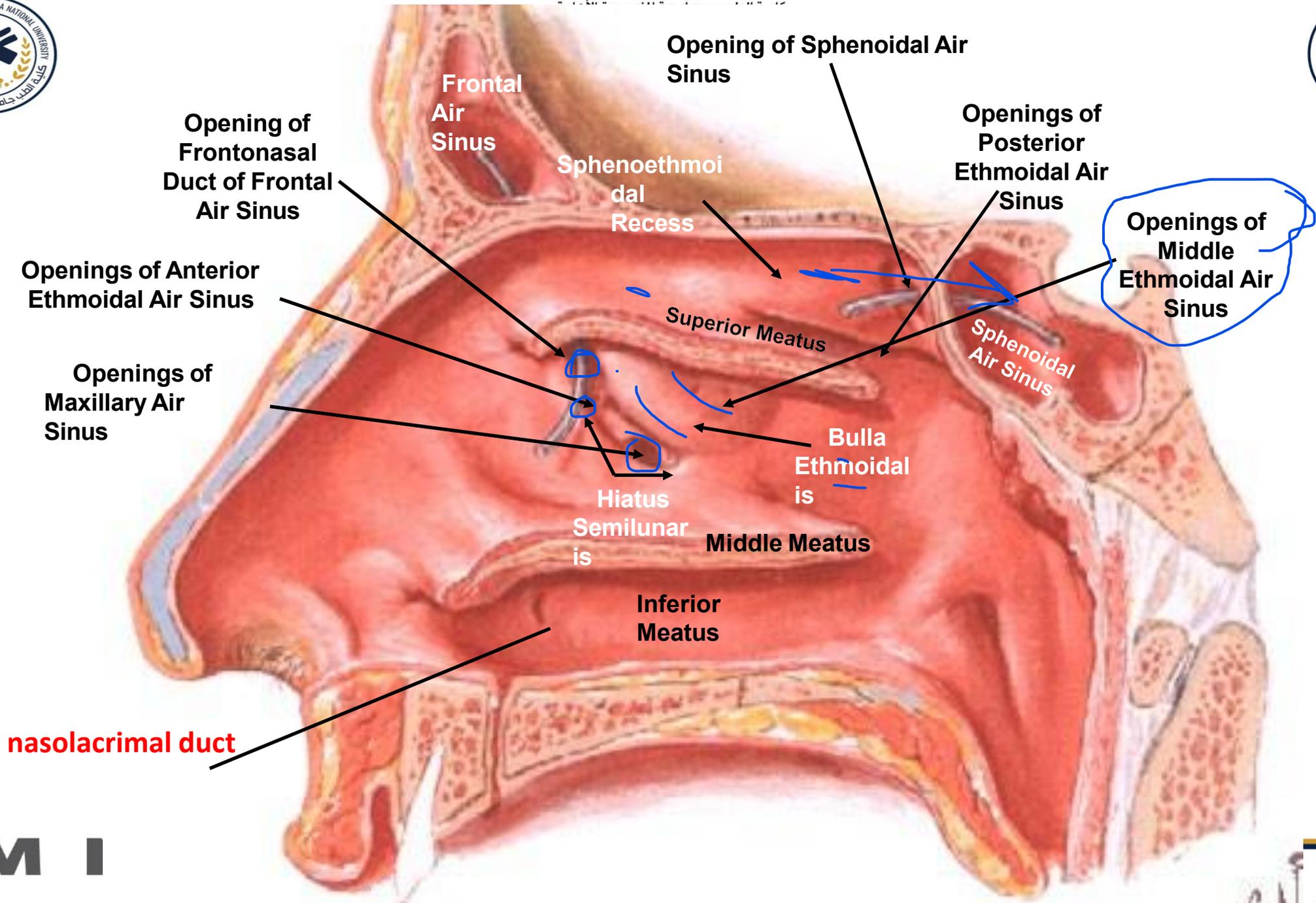
Sphenoethmoidal  
Recess





# Openings in the lateral walls of The Nose





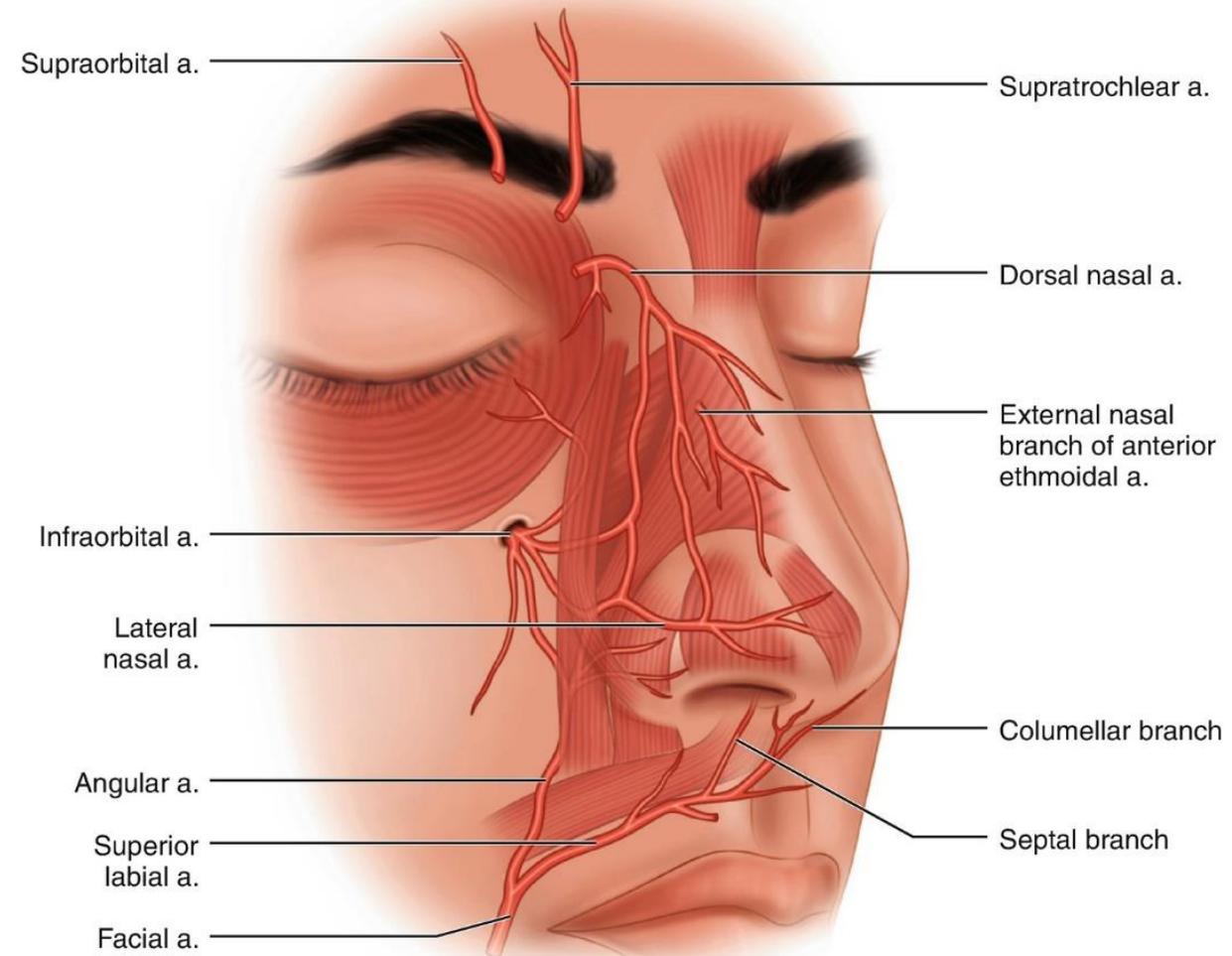
# • Blood Supply of the External Nose

1. Ophthalmic

SAQ

2. Maxillary

3. Facial artery.





# Nerve Supply of the Nasal Cavities



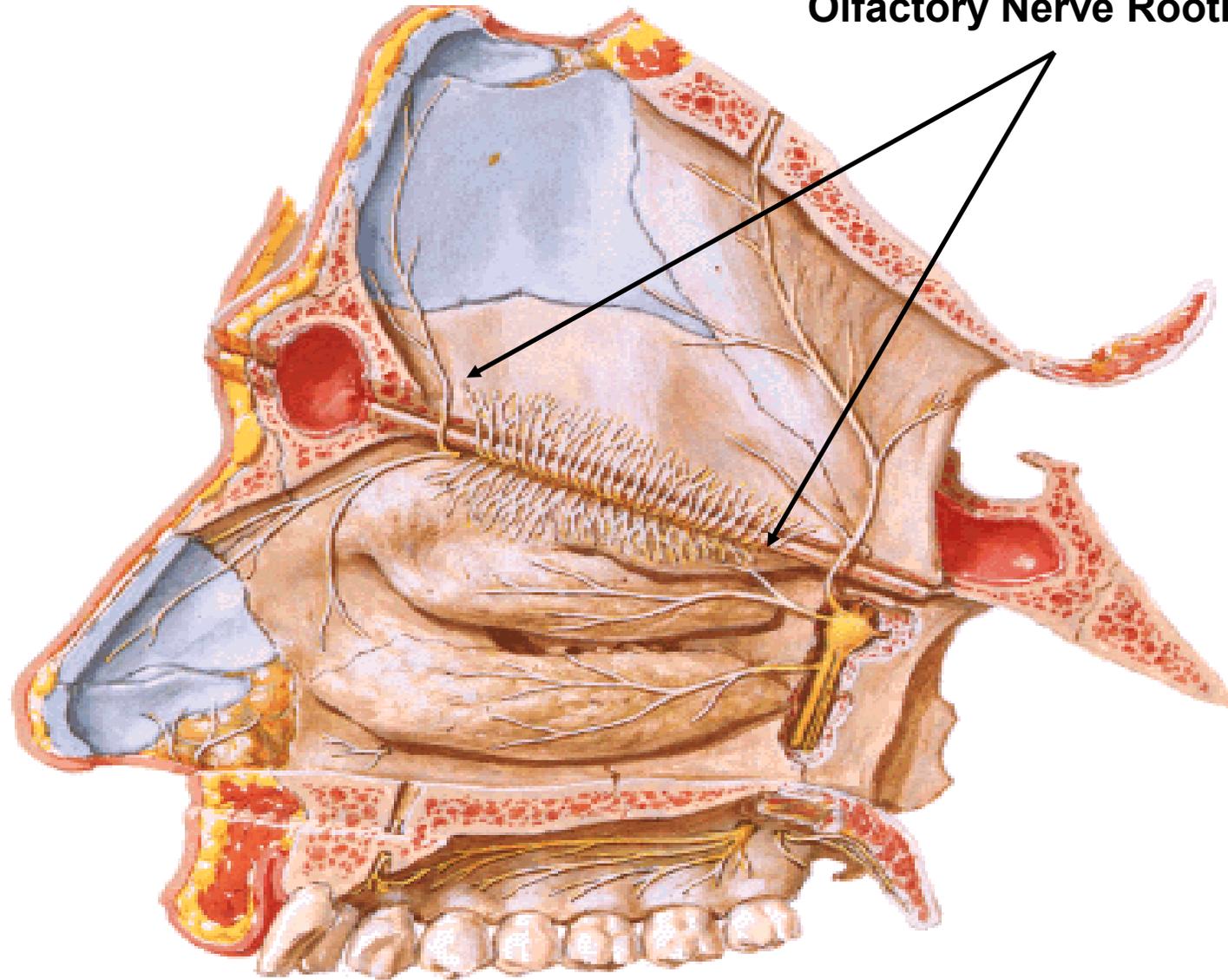


# A- Special Nerve Supply of The Nasal Cavities

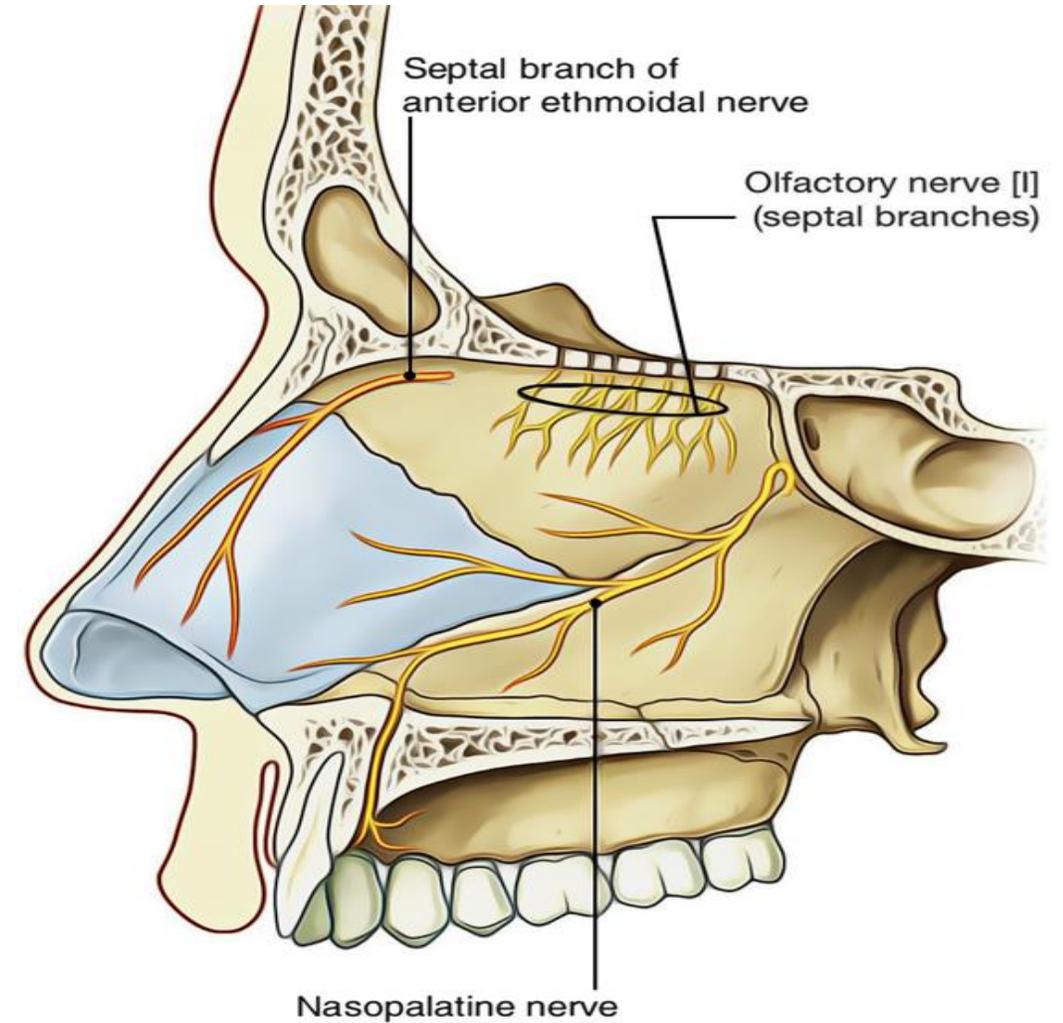
## Olfactory nerve



## Olfactory Nerve Rootlets



# B- General Nerve Supply of The Nasal Cavities



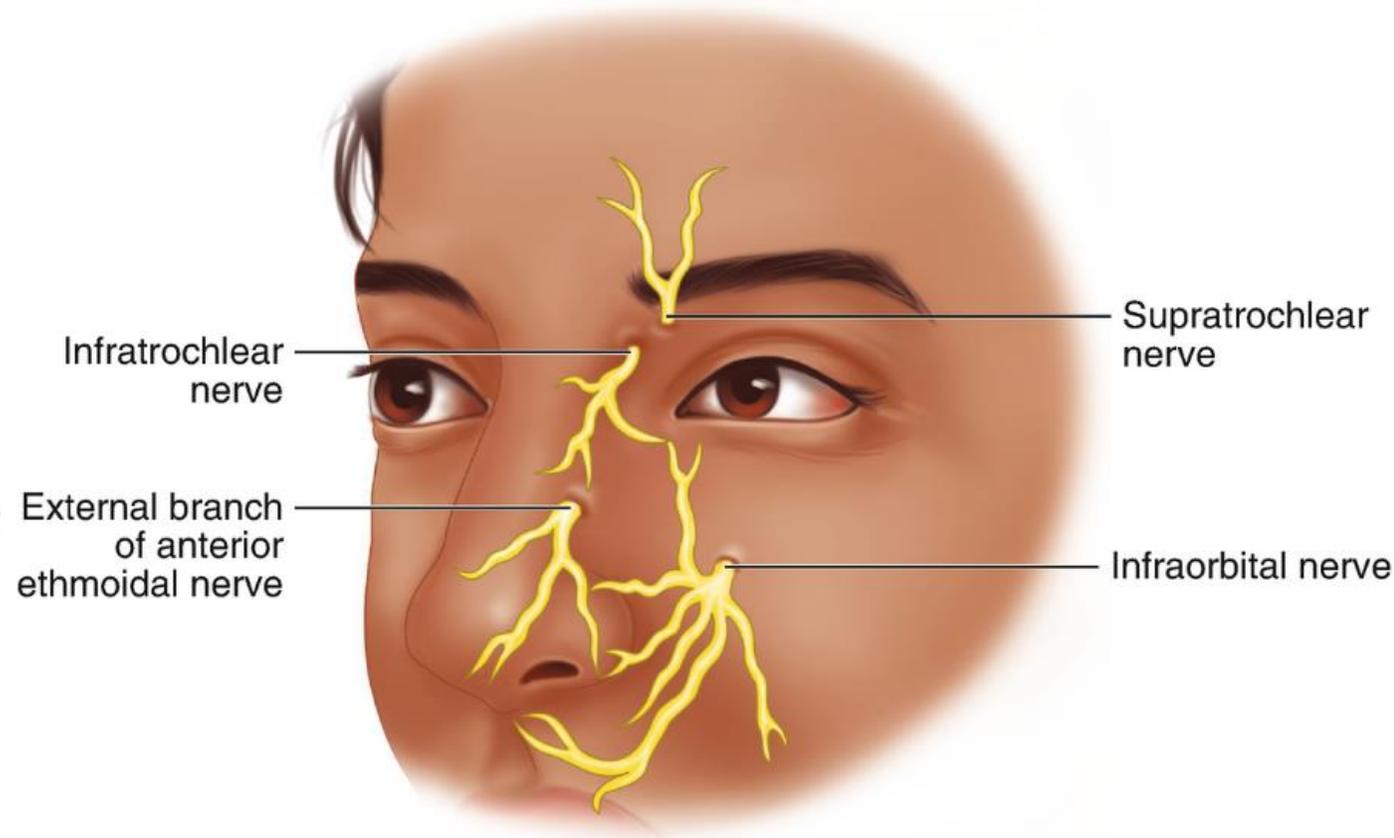
# Nerve Supply of the External Nose

## 1. Ophthalmic nerve (CN V)

- **Infratrochlear**
- **external nasal** branches of the

## 2. Maxillary nerve (CN V).

- **infraorbital**



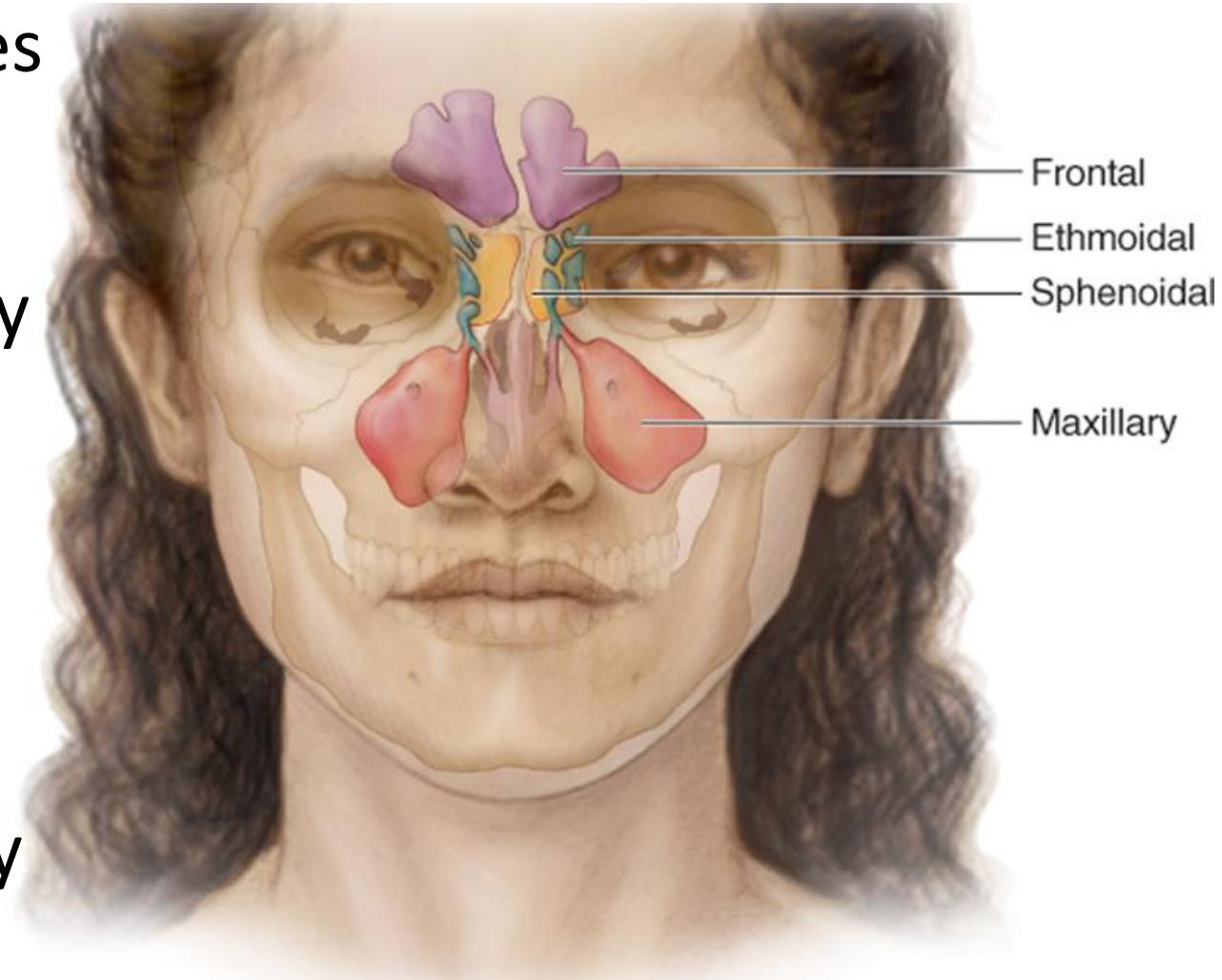


# Paranasal Sinuses



# Paranasal Sinuses

- Paired air spaces In four skull bones
  1. Decrease skull bone weight
  2. Resonance of voice
- Named for the bones in which they are housed.
  1. Frontal
  2. Ethmoidal
  3. Sphenoidal
  4. Maxillary
- Communicate with the nasal cavity by ducts.



SAQ

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

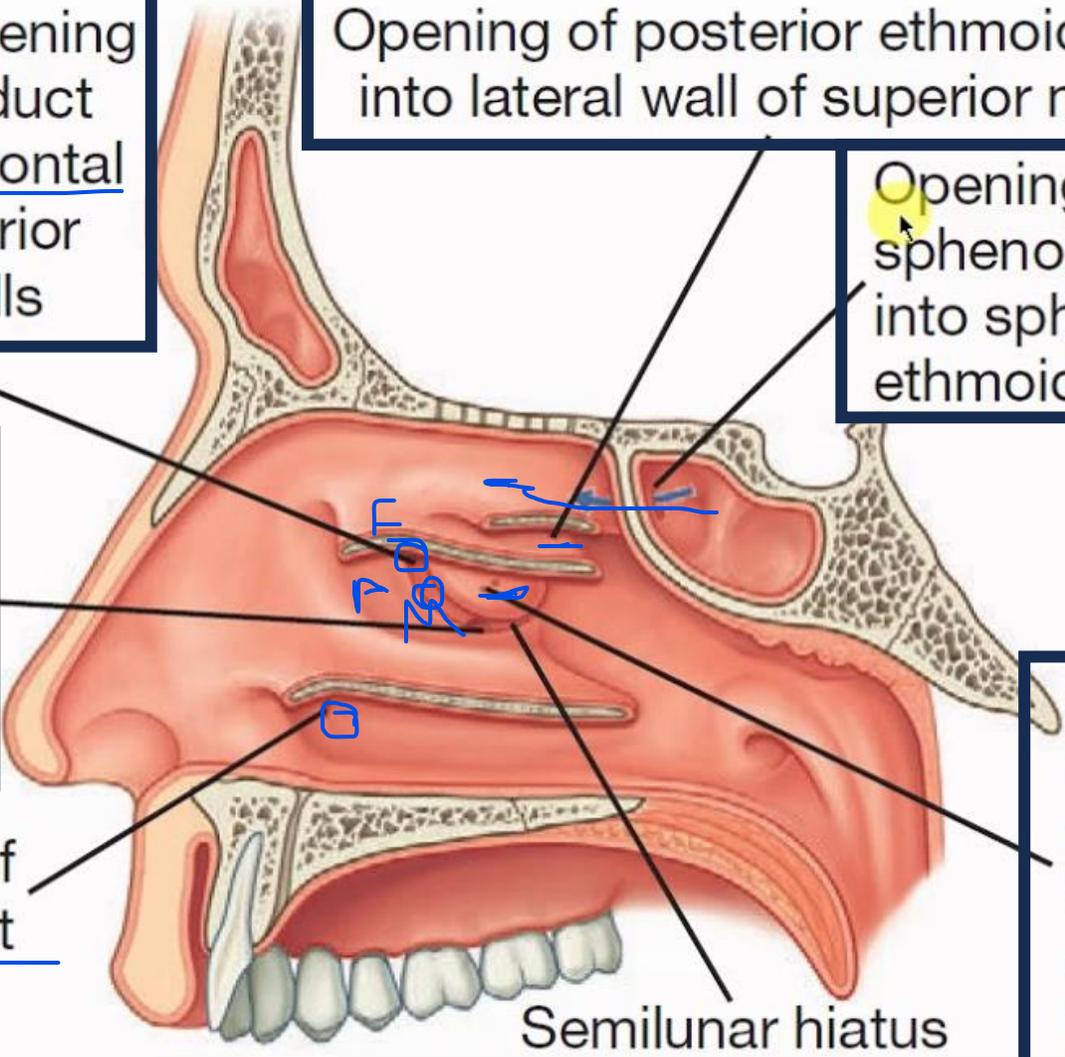
Opening of posterior ethmoidal cells into lateral wall of superior meatus

Opening of sphenoidal sinus into sphenoidal recess

Opening of maxillary sinus in floor of semilunar hiatus

Opening of nasolacrimal duct

Opening of middle ethmoidal cells onto ethmoidal bulla



C

Semilunar hiatus



# Pharynx

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# Pharynx

It is a tube **15 cm** long formed of arrangement of muscles and fascia.

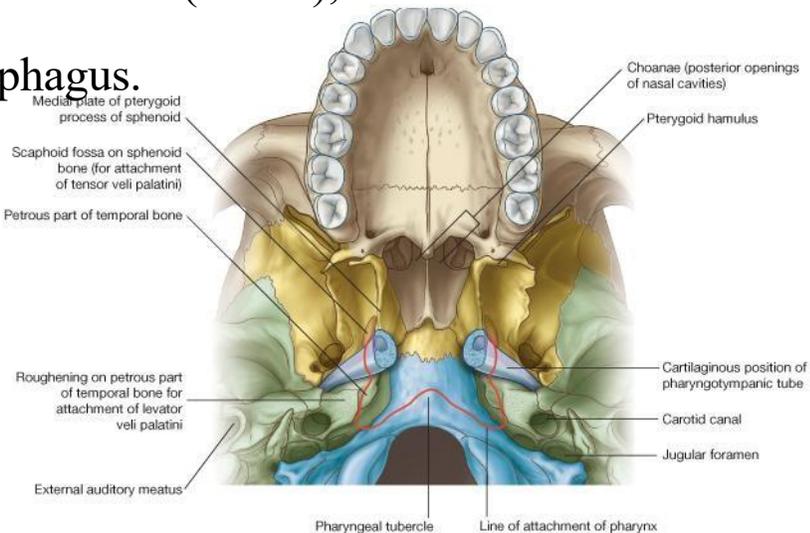
## Extent

- It extends from the base of the skull (above).
- To the level of **the lower border 6<sup>th</sup> cervical vertebra** (below), where it becomes continuous with the

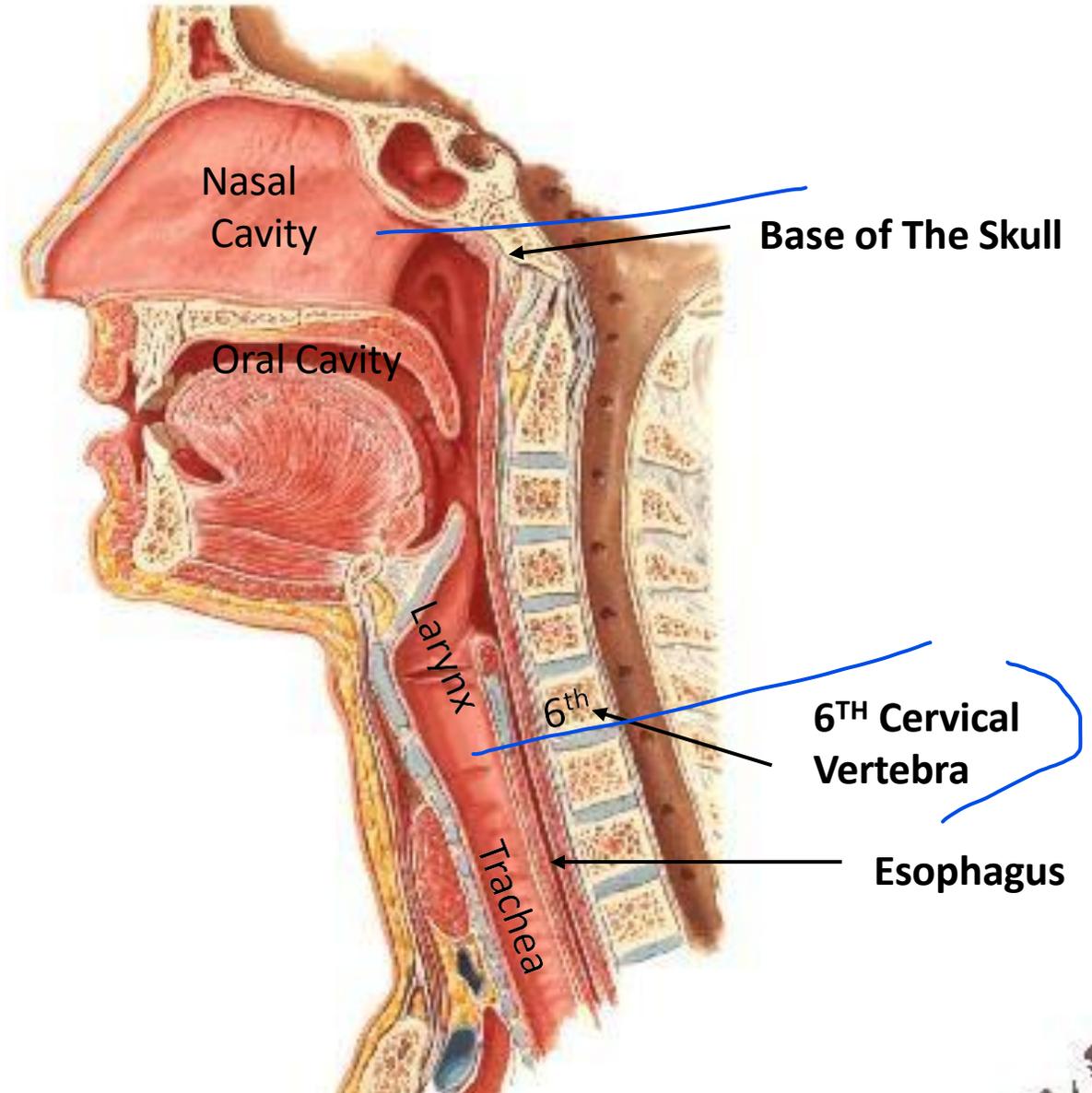
**MCQ**

**vertebra** (below), where it becomes continuous with the

esophagus.



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Figure 8.187 Line of attachment of the pharynx to the base of the skull.



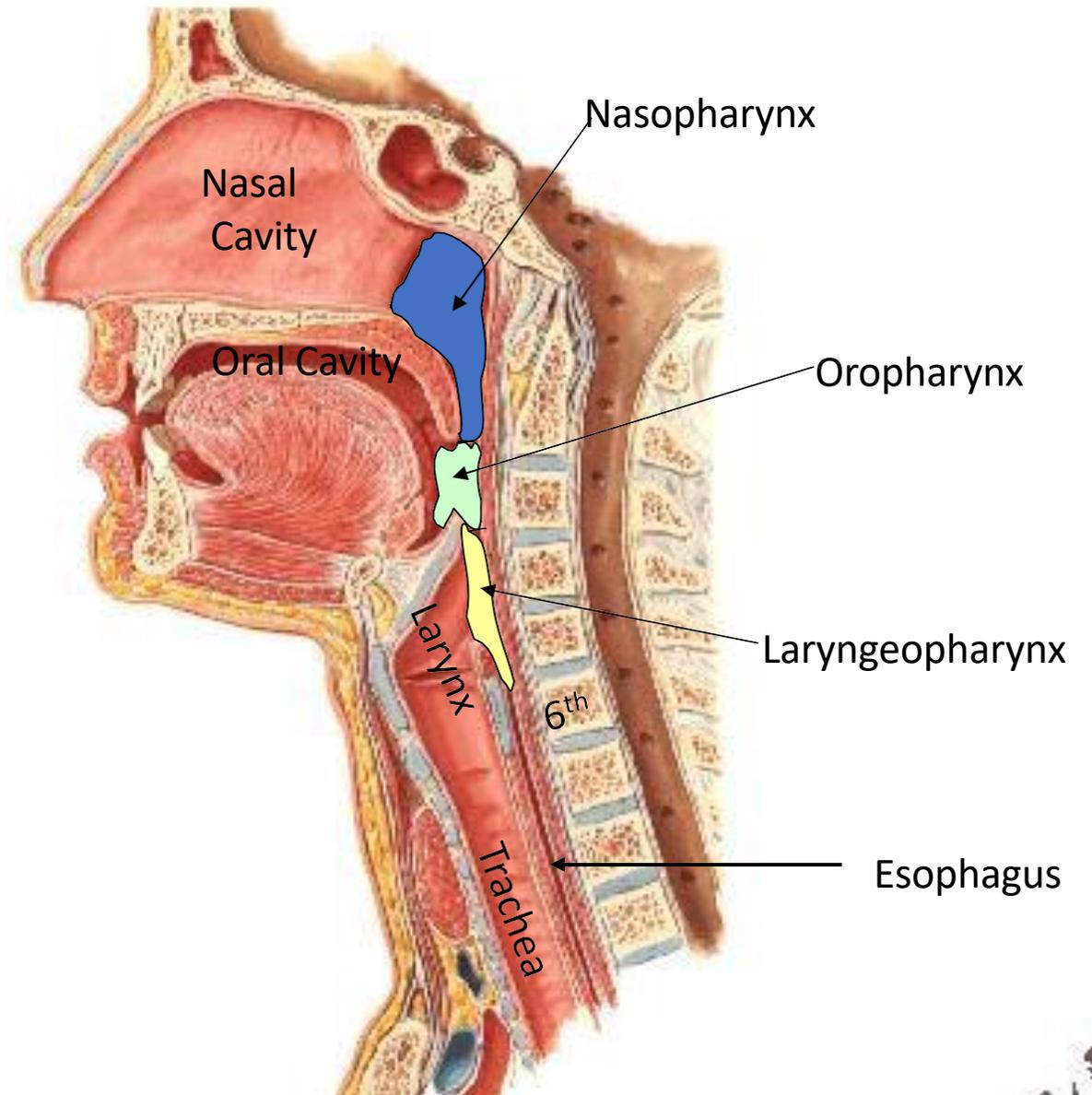
# Divisions of the Pharynx

## Parts

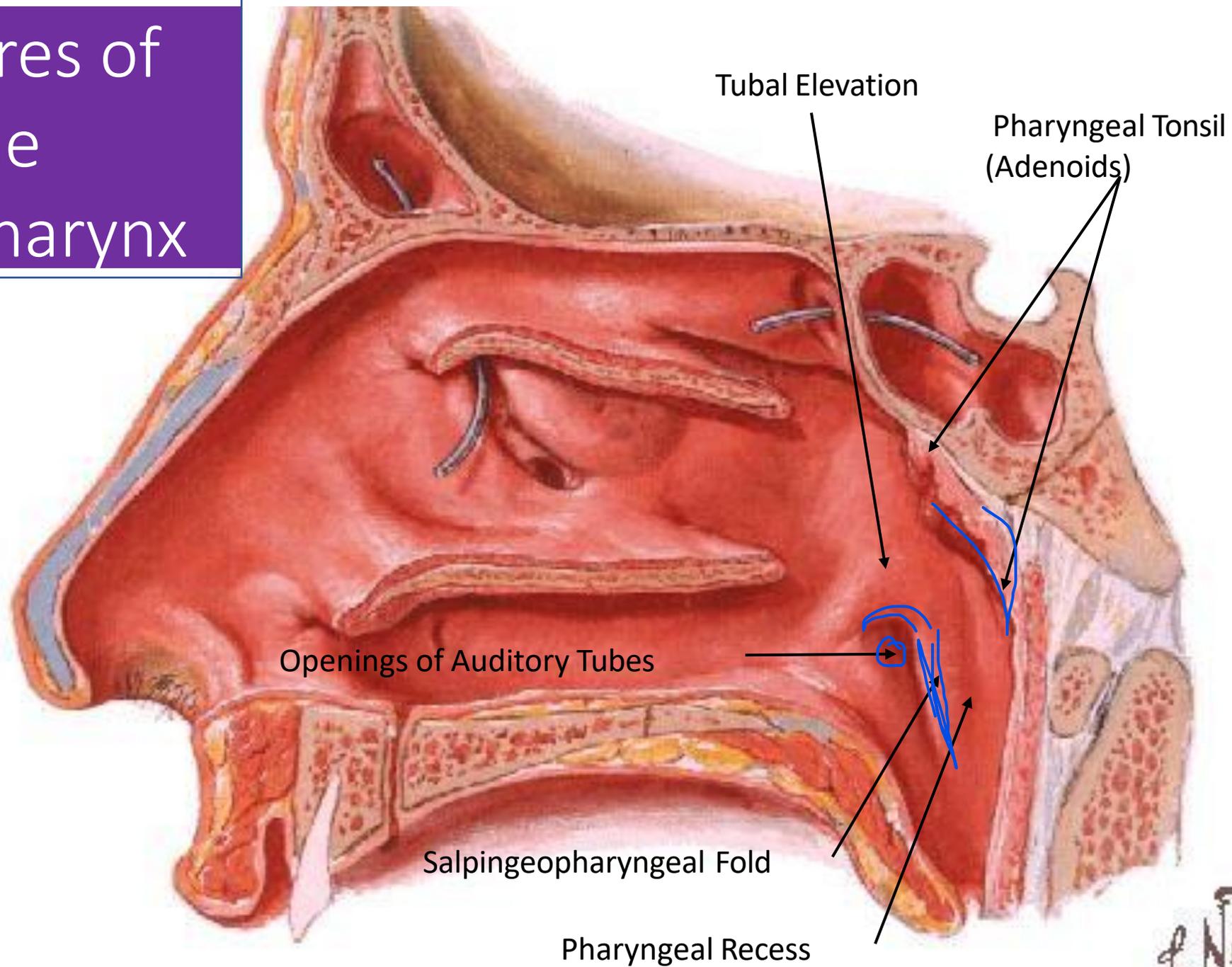
The pharynx is divided into 3 parts.

- **Nasopharynx** → behind the nasal cavity.
- **Oropharynx** → behind the oral cavity.
- **Laryngopharynx** → behind the laryngeal cavity.

SAQ



# Features of the Nasopharynx



F. Natter  
M.D.



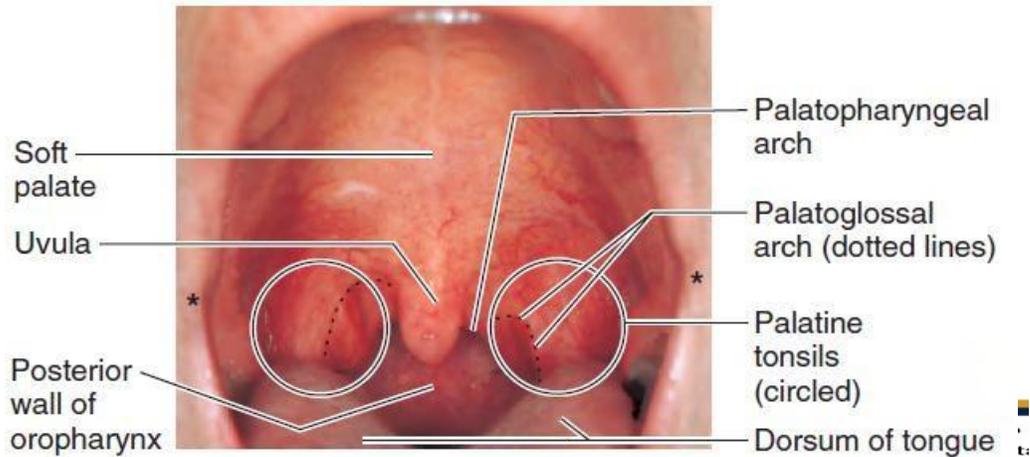
## *Features:*

- **Opening of the auditory tube** → one on each side communicate it with the tympanic cavity.
- **Tubal elevation** → bound the opening of the auditory tube from above and behind.
- **Salpingopharyngeal fold** → extends from the auditory tube (contains **salpingopharyngeus muscle**).
- **Pharyngeal recess** → vertical groove behind the salpingopharyngeal fold.
- **Pharyngeal tonsil (adenoid)** → on the posterior wall.

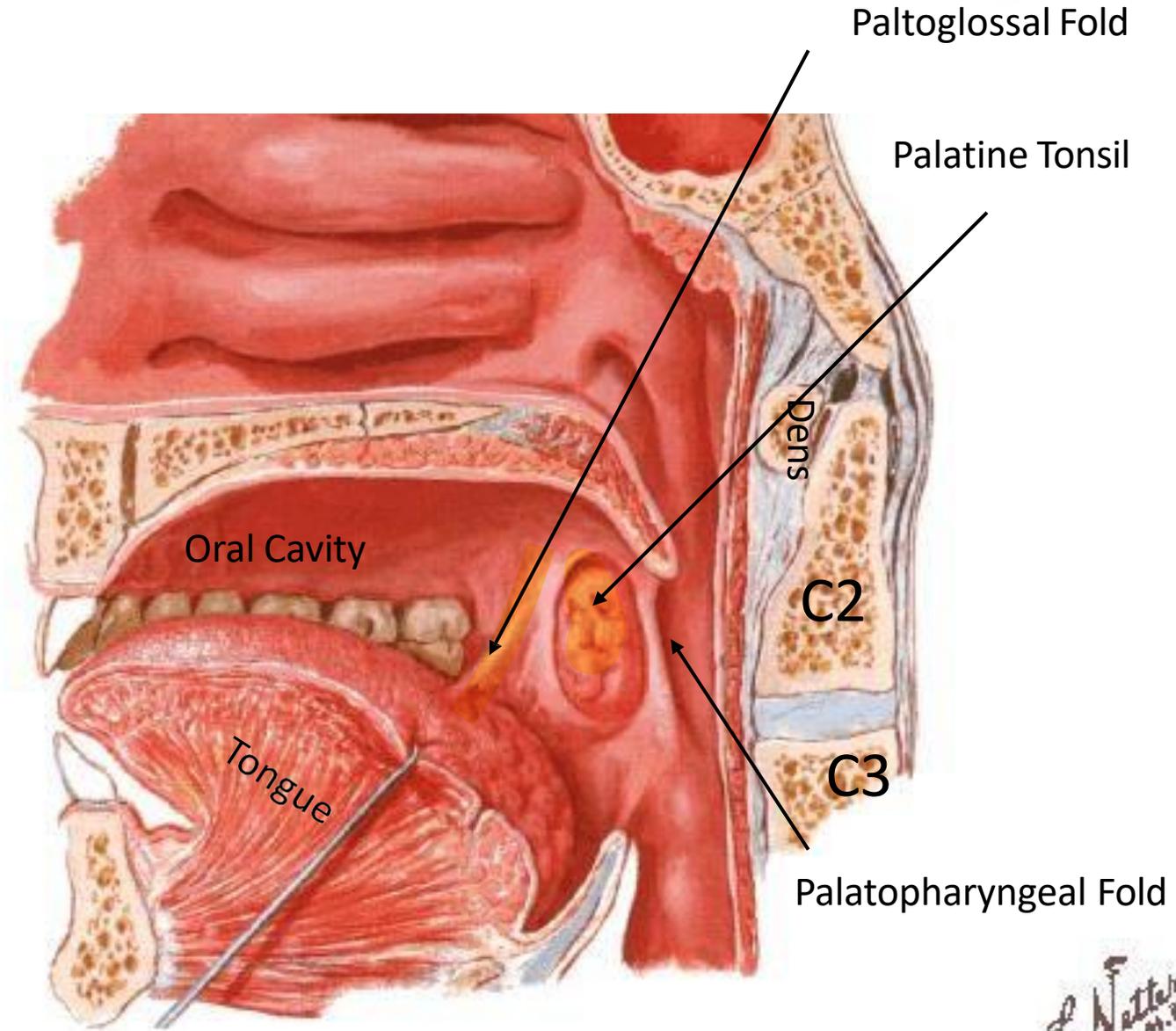
SAQ

## Features:

- **Palatine tonsil**
- **Tonsillar fossa** → between the palatoglossal fold anteriorly and the palatopharyngeal fold posteriorly.

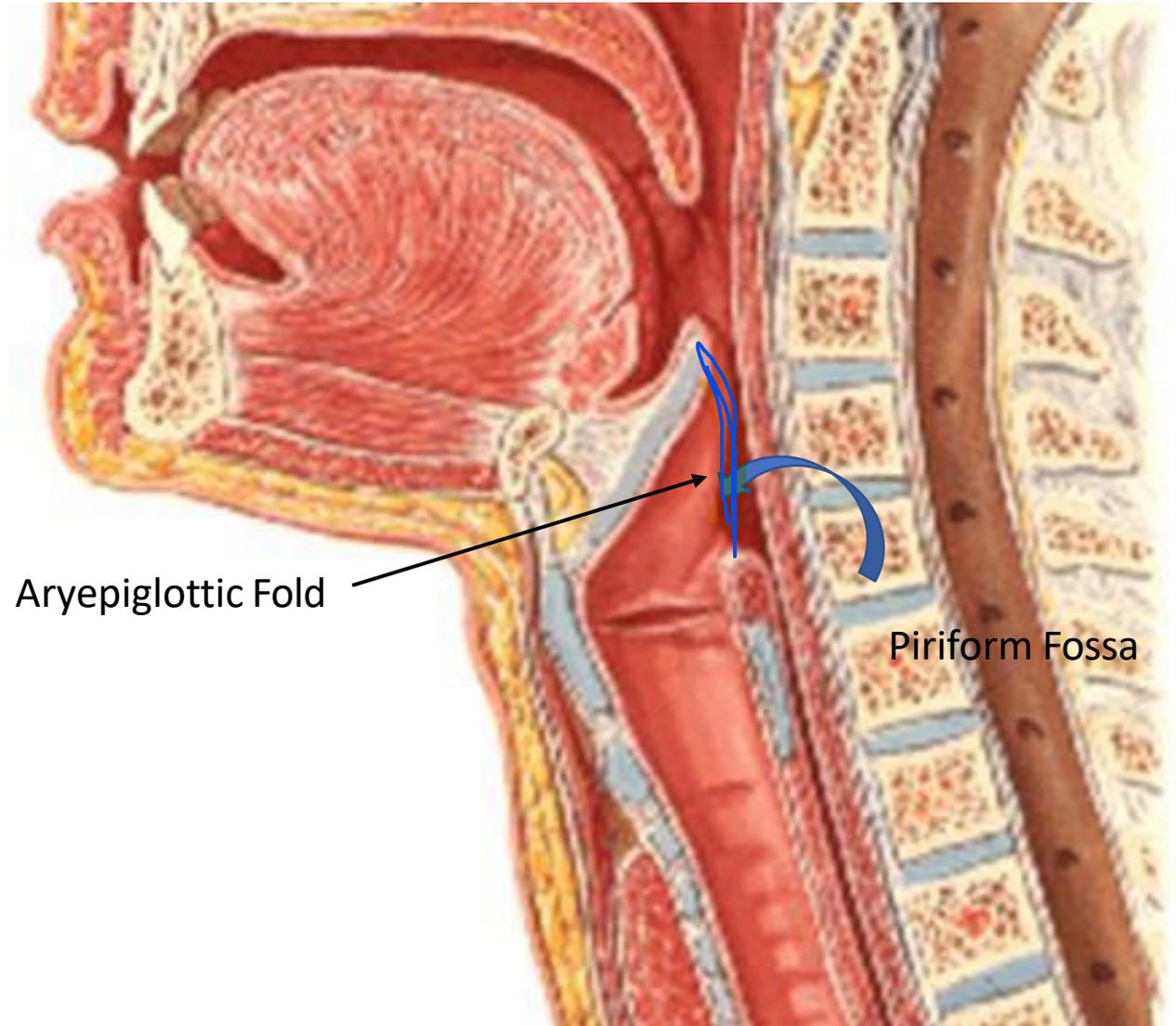


\*Fold overlying pterygomandibular raphe  
 Source: Moore - Clinically Oriented Anatomy (7th Edition)



**Features:** MCQ

- **Piriform fossa** → on the lateral wall, one on each side of the inlet of the larynx. This fossa is the site of impaction of foreign bodies.  
The internal laryngeal nerve lies at its floor.
- **Aryepiglottic fold** → forms the medial wall of the piriform fossa.



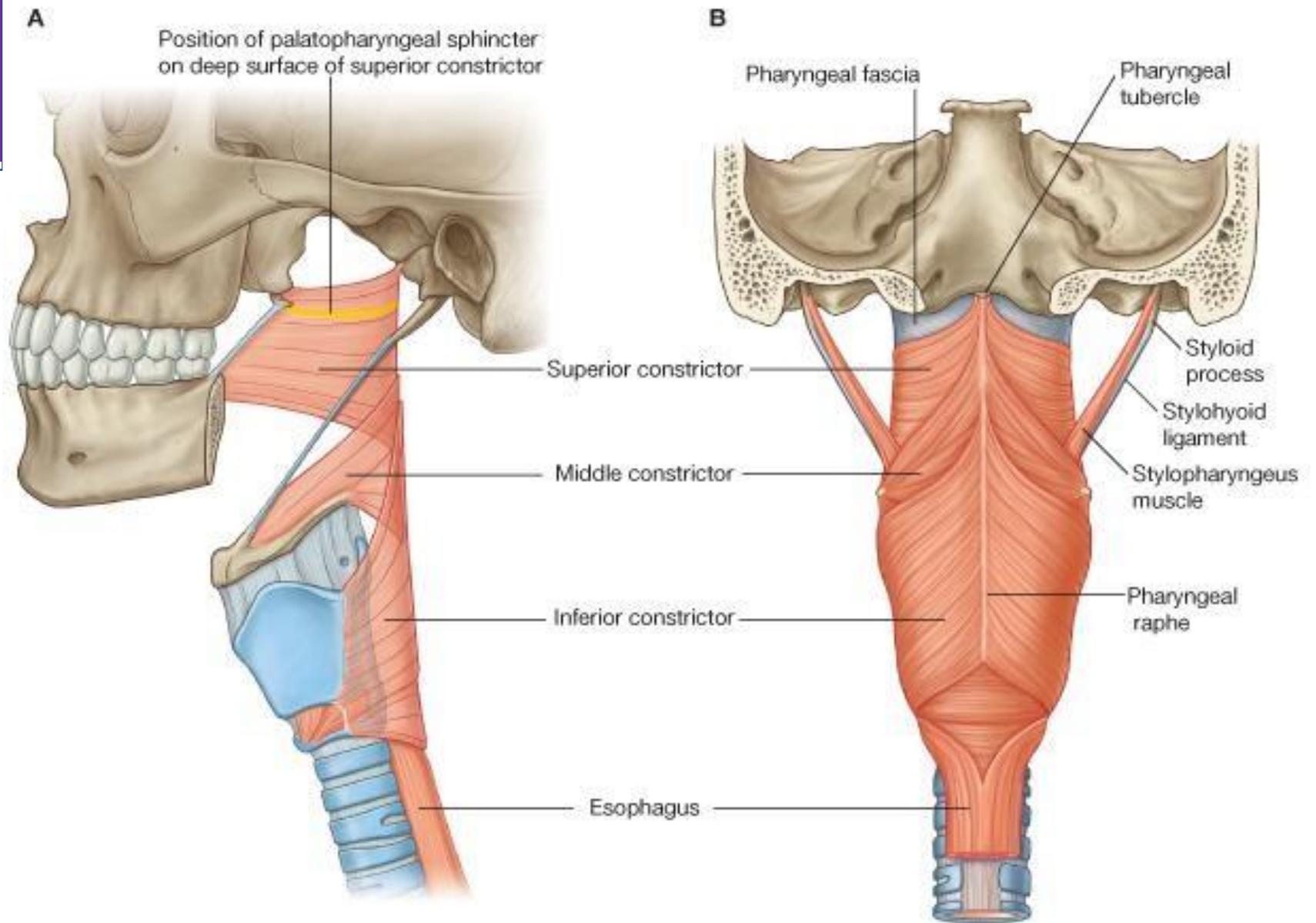
# Muscles of the pharynx

## External muscles of the pharynx

- Superior constrictor muscle
- Middle constrictor muscle
- Inferior constrictor muscle

## Internal muscles of the pharynx

- Stylopharyngeus muscle
- Palatopharyngeus muscle
- Salpingopharyngeus muscle



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Figure 8.189 Constrictor muscles of the pharynx. A. Lateral view. B. Posterior view.

# Nerve Supply of The Pharynx

## SAQ

### Motor:

- All muscles of the pharynx supplied by the **pharyngeal plexus** (The cranial **accessory** nerve through the **vagus** nerve).
- Except **stylopharyngeus** supplied by **glossopharyngeal nerve**. **MCQ**

### Sensory:

- Nasopharynx: maxillary nerve.
- Oropharynx: glossopharyngeal nerve.
- Laryngopharynx: internal laryngeal branch of the vagus nerve.





# Anatomy of the Larynx and trachea

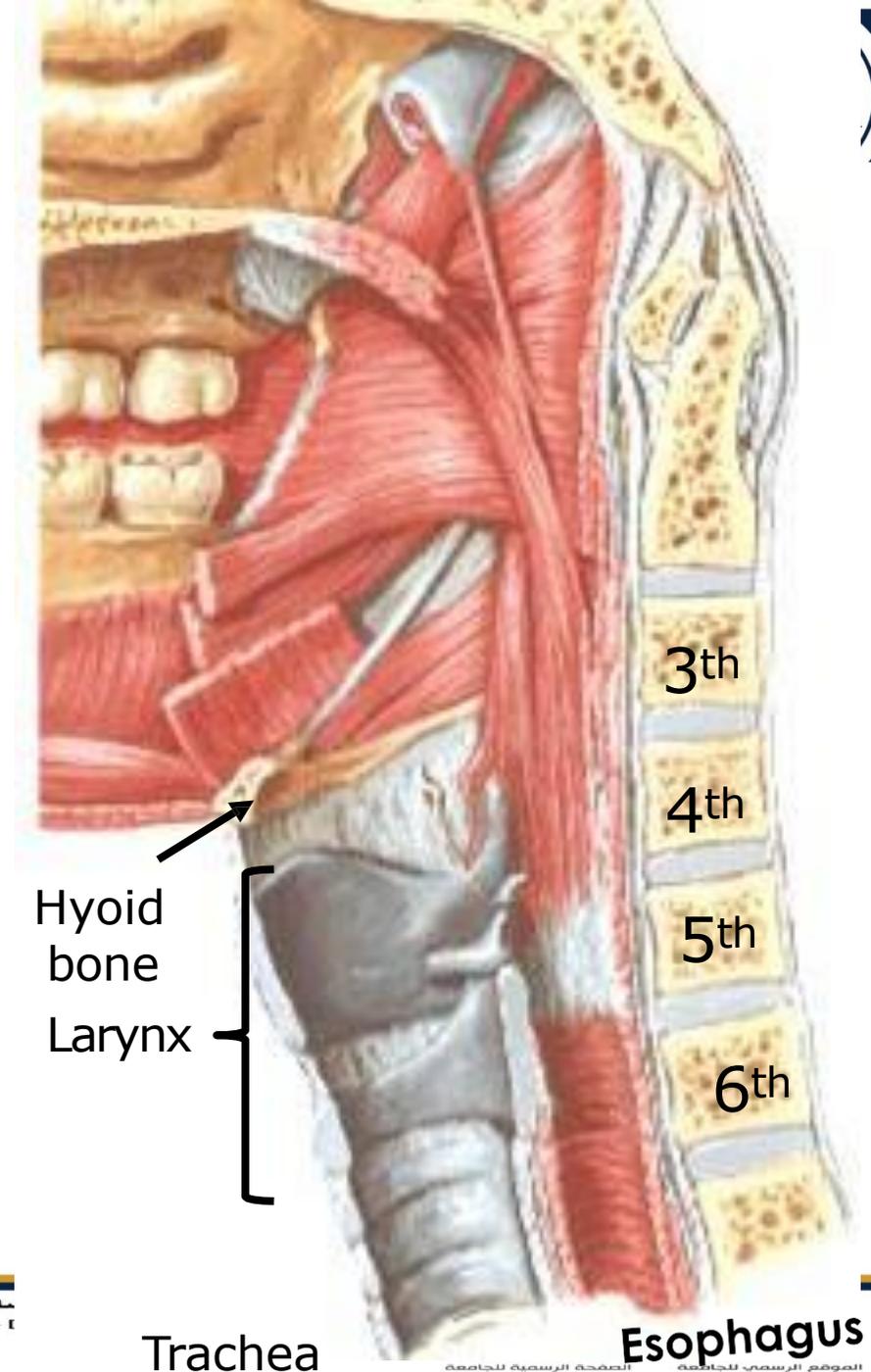
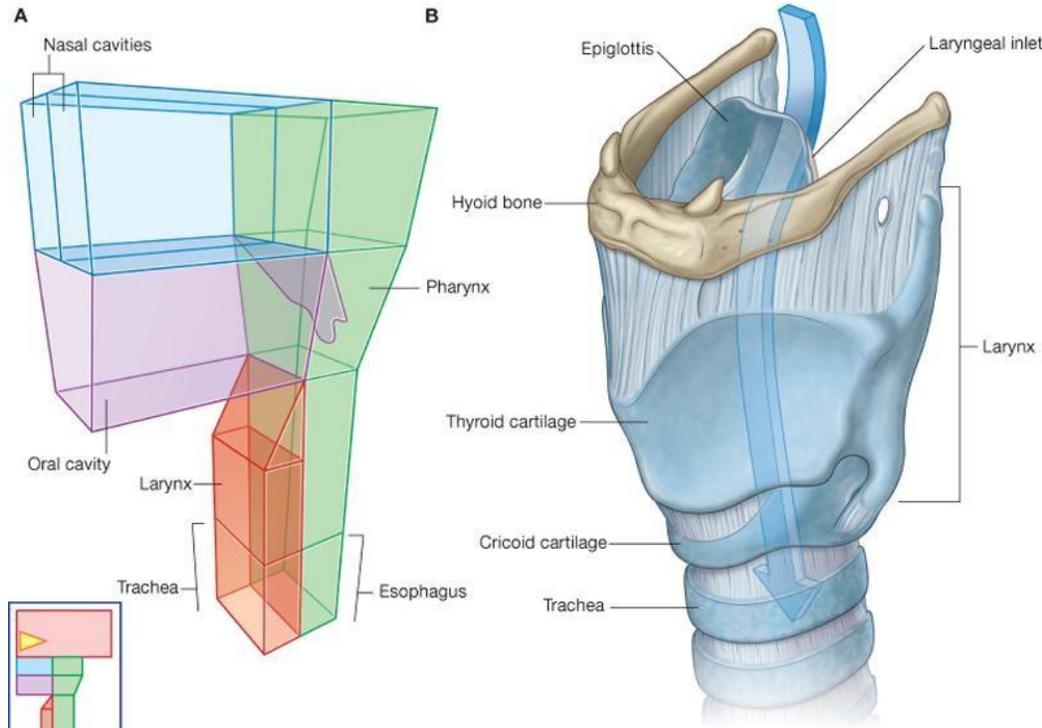
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## MCQ

- The larynx lies in front of the pharynx at the level of the **4th, 5th and 6th cervical vertebrae**.



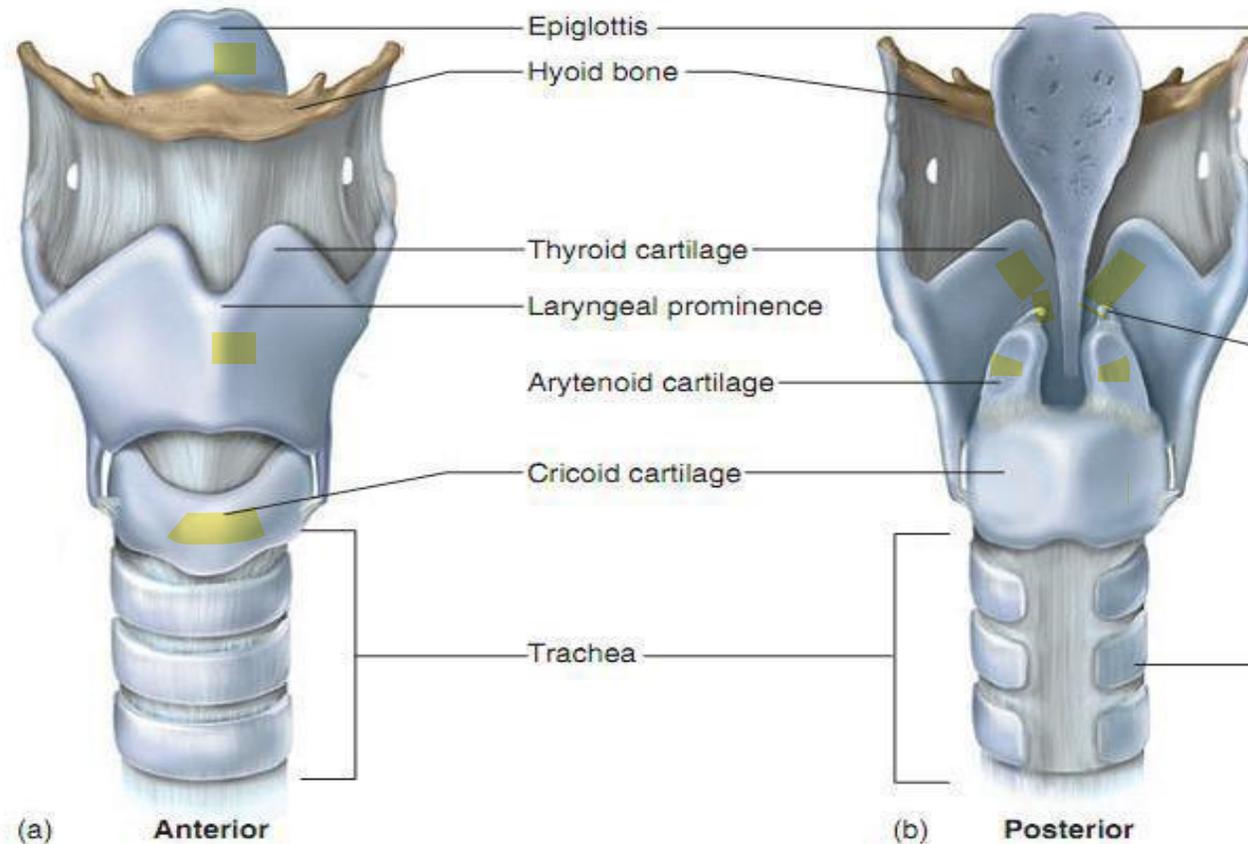
# Cartilages of the larynx

## SAQ

### Single:

3

- Epiglottis
- Thyroid cartilage
- cricoid cartilage



### Paired :

3

- Arytenoid
- Corniculate
- cuneiform.

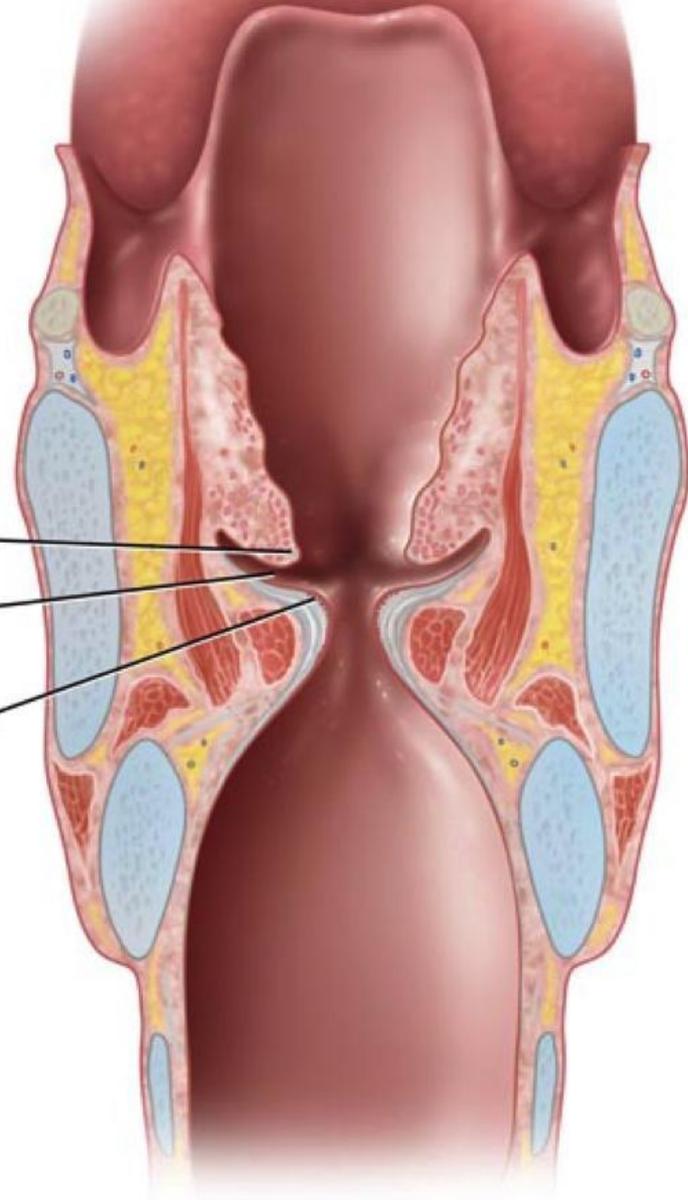
# Laryngeal Cavity

It extends from the upper border of the epiglottis above to the lower border of the cricoid cartilage below. It is divided into 3 parts

## 1- Vestibule:

between the laryngeal inlet and the vestibular folds.

Ventricular fold  
Laryngeal ventricle  
Vocal fold



Vestibule

Sinus

Infraglottic cavity

## 2- Sinus:

between the vestibular folds and the vocal folds.

The sinus continues upwards in the side wall of the larynx to form the saccule

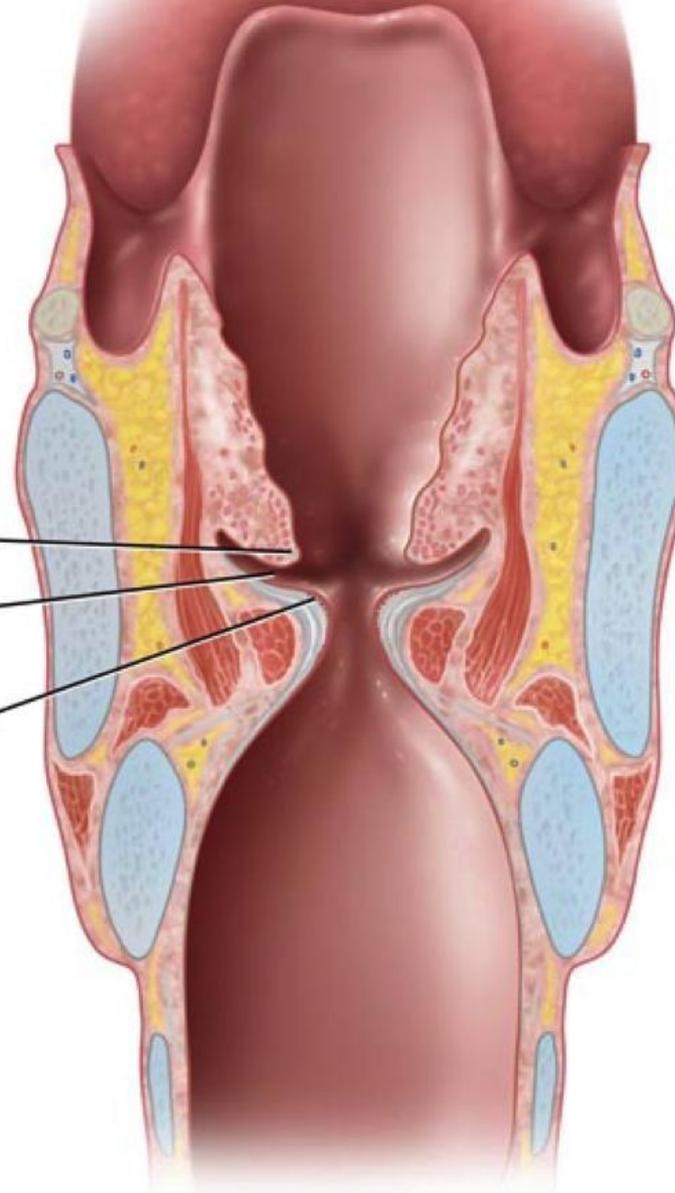
## 3- Infraglottic cavity:

between the vocal folds and the lower border of the cricoid cartilage.

Ventricular fold

Laryngeal  
ventricle

Vocal fold

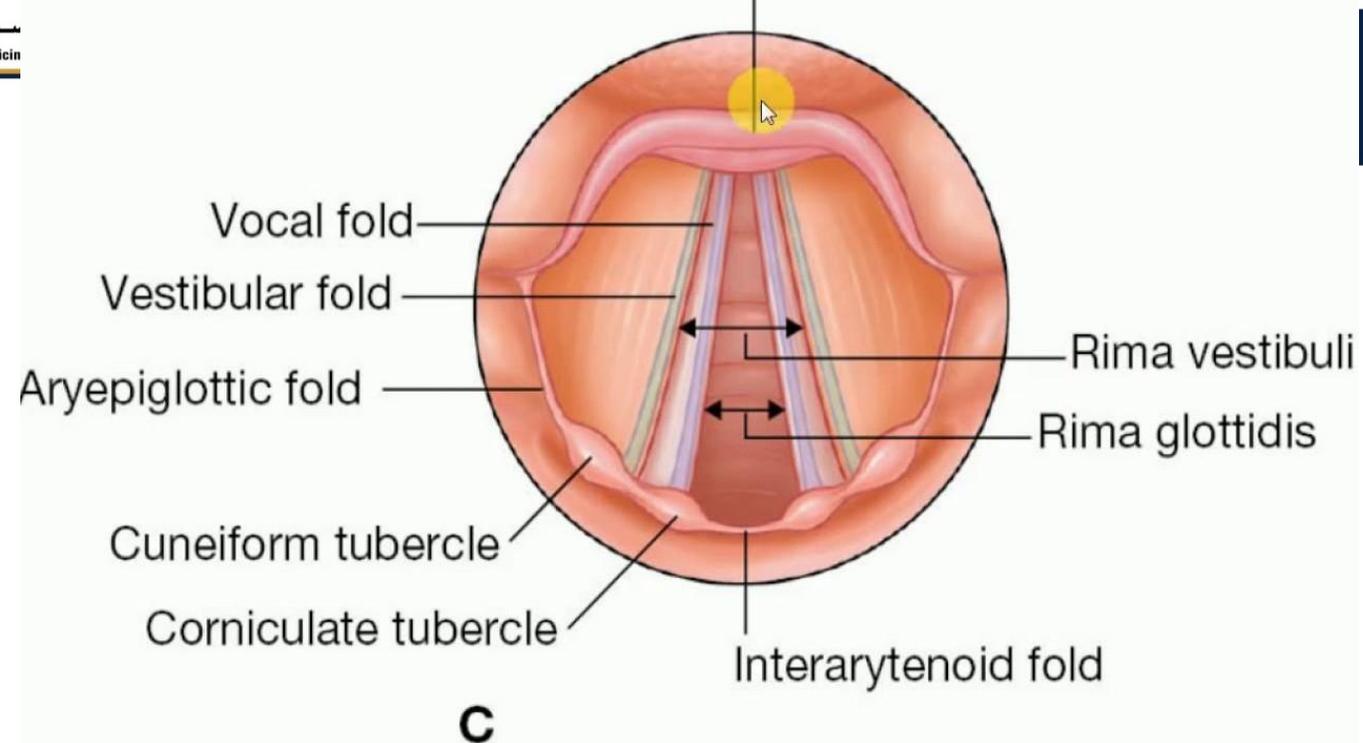


Vestibule

Sinus

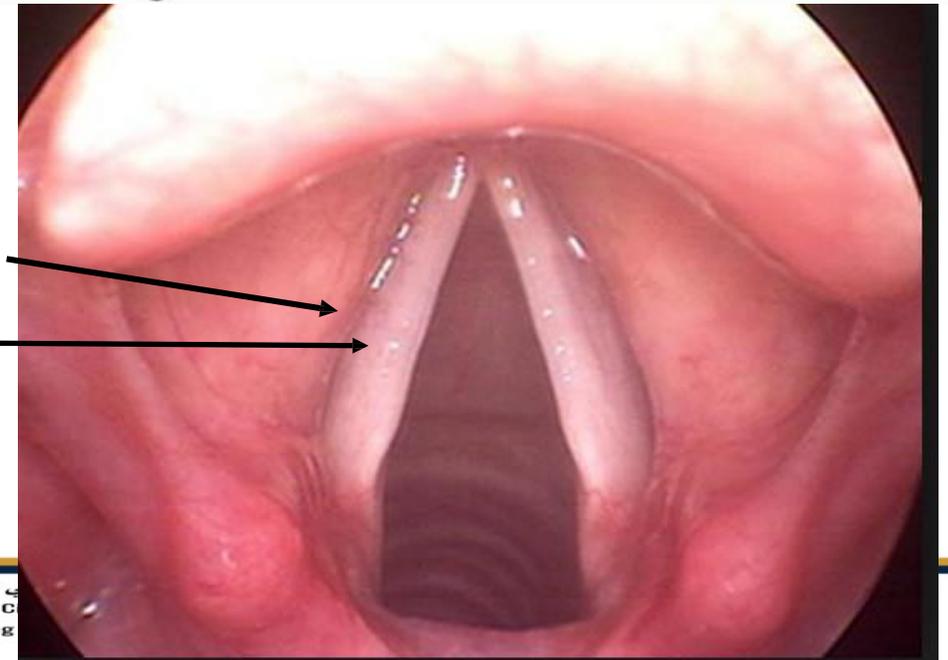
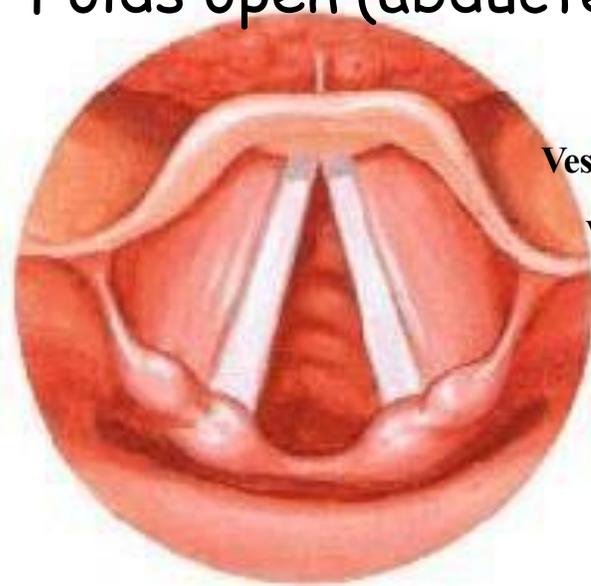
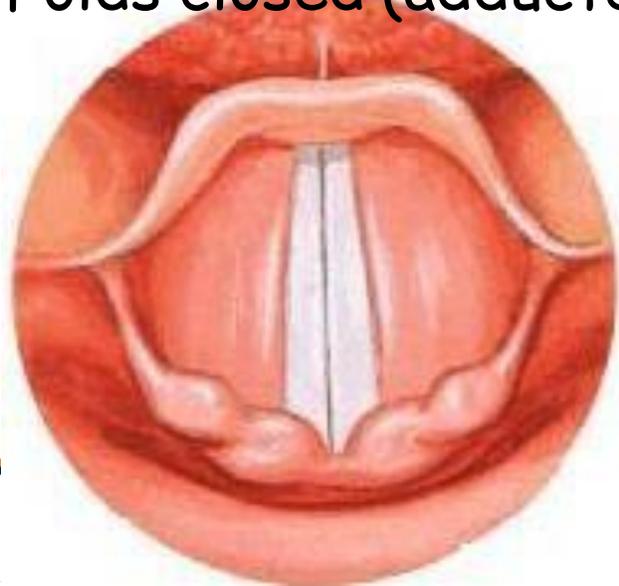
Infraglottic  
cavity

- The interval between the 2 vestibular folds is **called rima vestibuli**.
- The interval between the 2 vocal folds is called **rima glottidis**.



Vocal fold

Folds closed (adducted) Folds open (abducted)

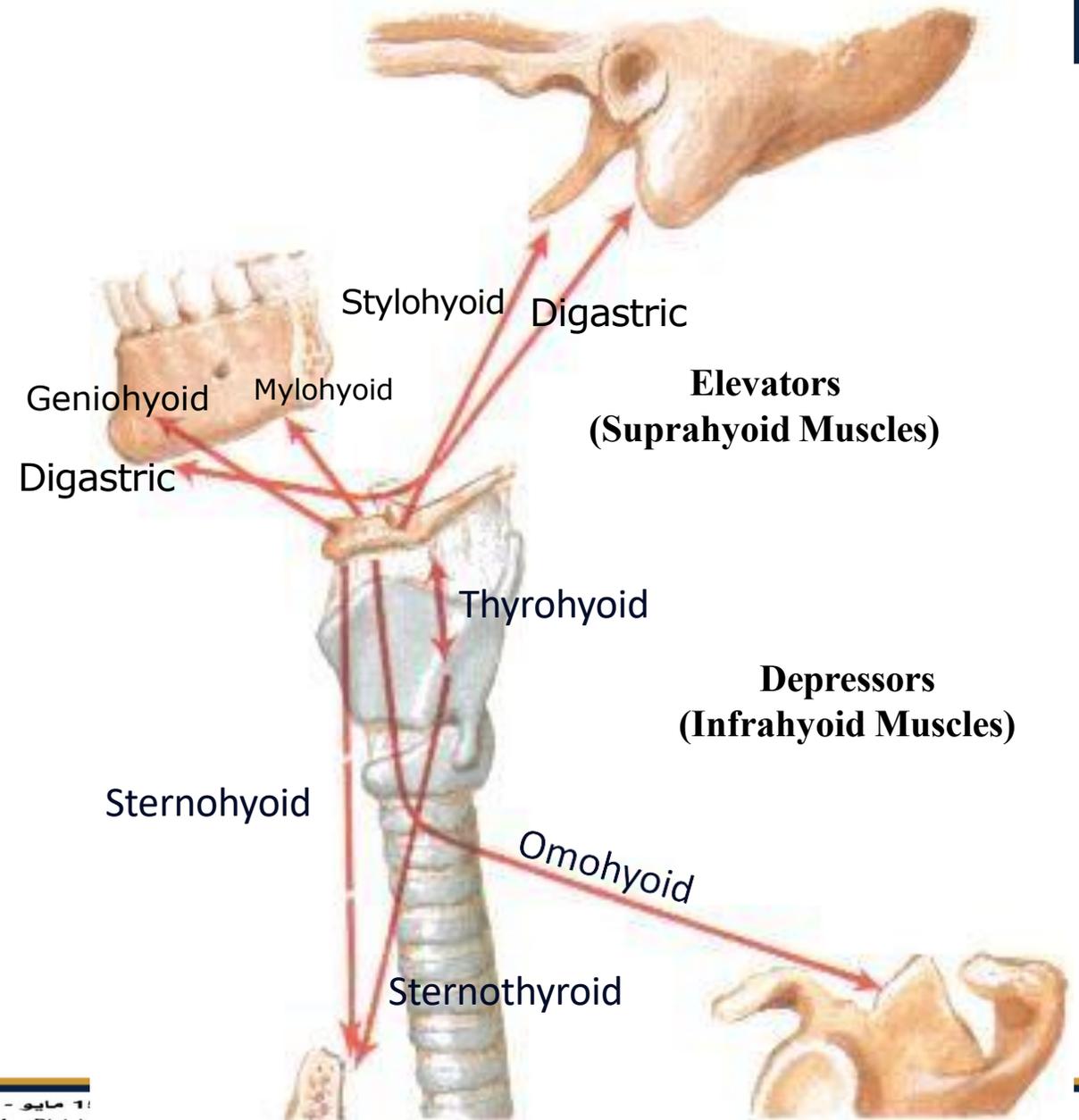


# Muscles of the Larynx

## A- Extrinsic Muscles of the Larynx

They move the larynx as a whole

- Elevators of the larynx: suprahyoid muscles.
- Depressors of the larynx: infrahyoid muscles.



## SAQ

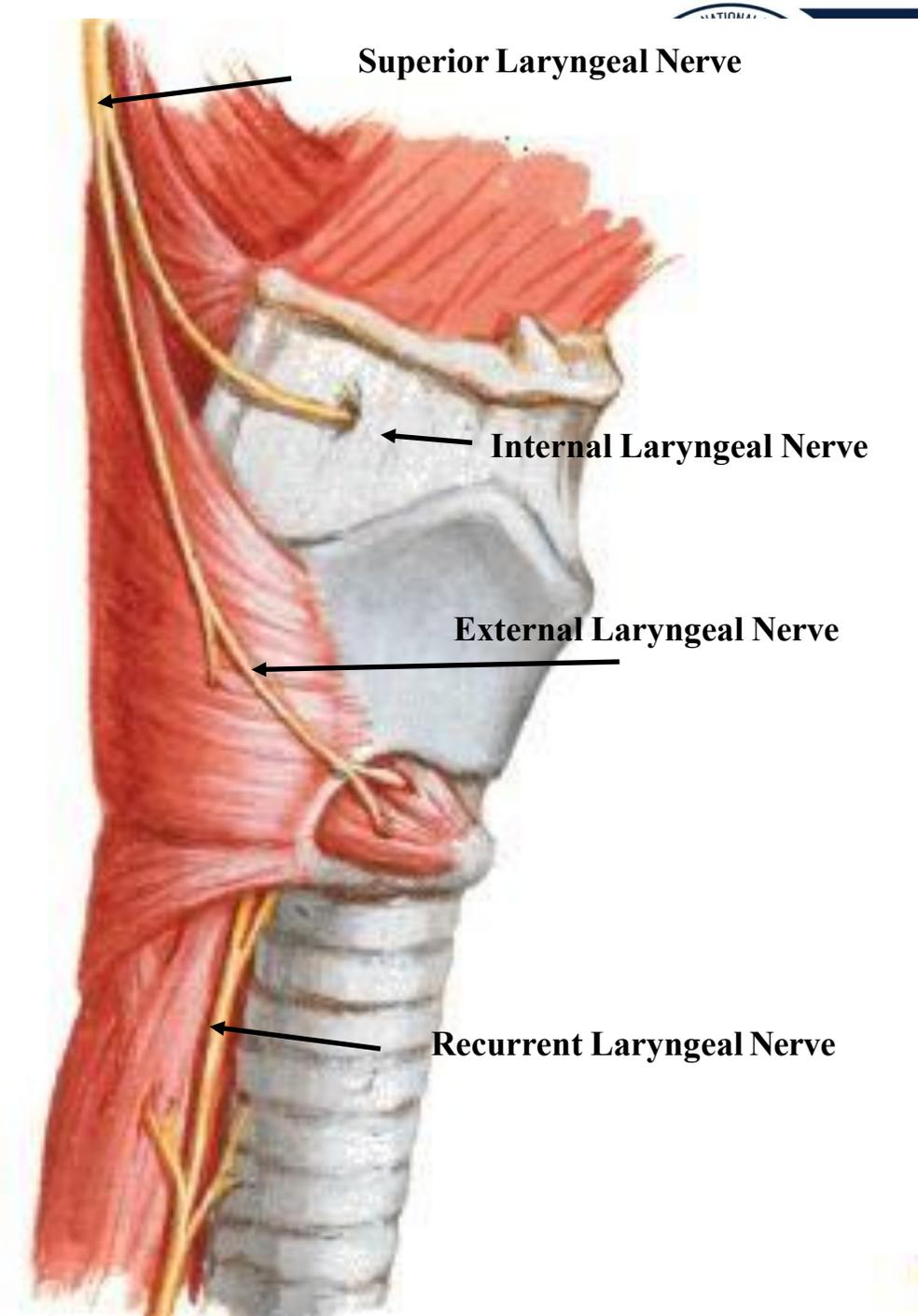
### Nerve supply of the larynx

#### 1- Motor:

- All intrinsic muscles of the larynx supplied by **RLN**
- Except the cricothyroid muscle supplied by **MCQ**
- **external laryngeal nerve.** **MCQ**

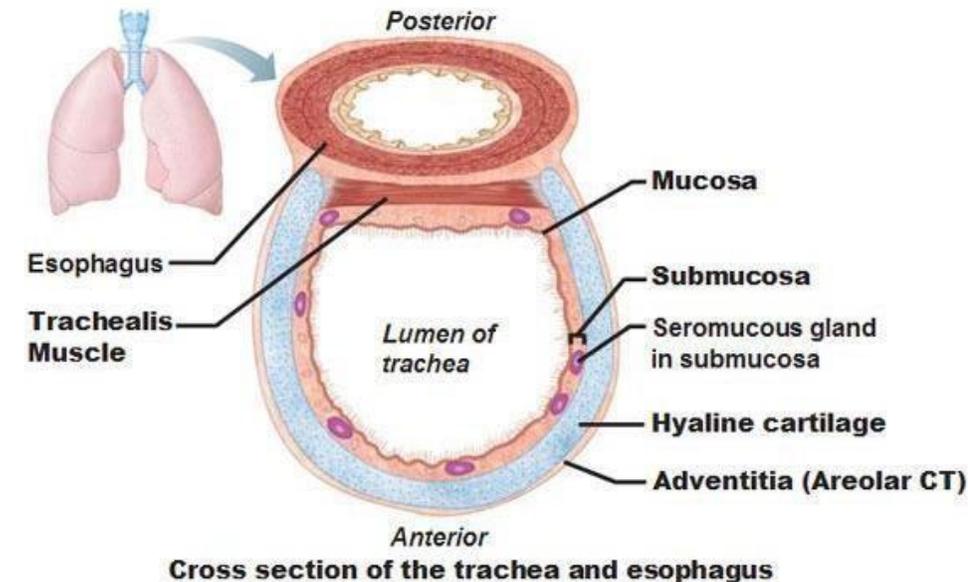
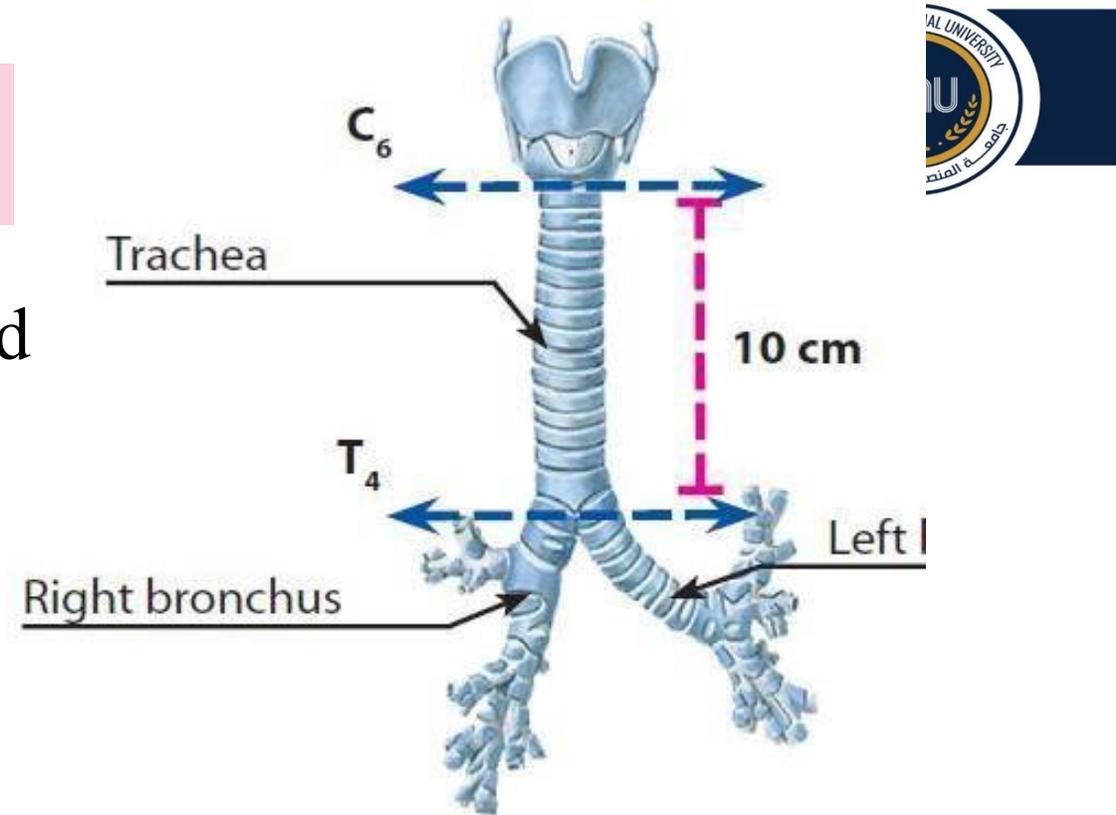
#### 2- Sensory:

- Above the level of the vocal fold supplied by the **internal laryngeal nerve.** **MCQ**
- Below the level of the vocal folds supplied by the **recurrent laryngeal nerve.** **RLN**



# Trachea

- Begins at lower border of cricoid cartilage and **C6 vertebrae**
- Ends in thorax: at level of **Sternal angle** (between T4 & T5)
- **15 cm long**, 2cm in diameter
- Formed of **incomplete rings** of cartilage (C shaped) completed posteriorly with trachealis muscle

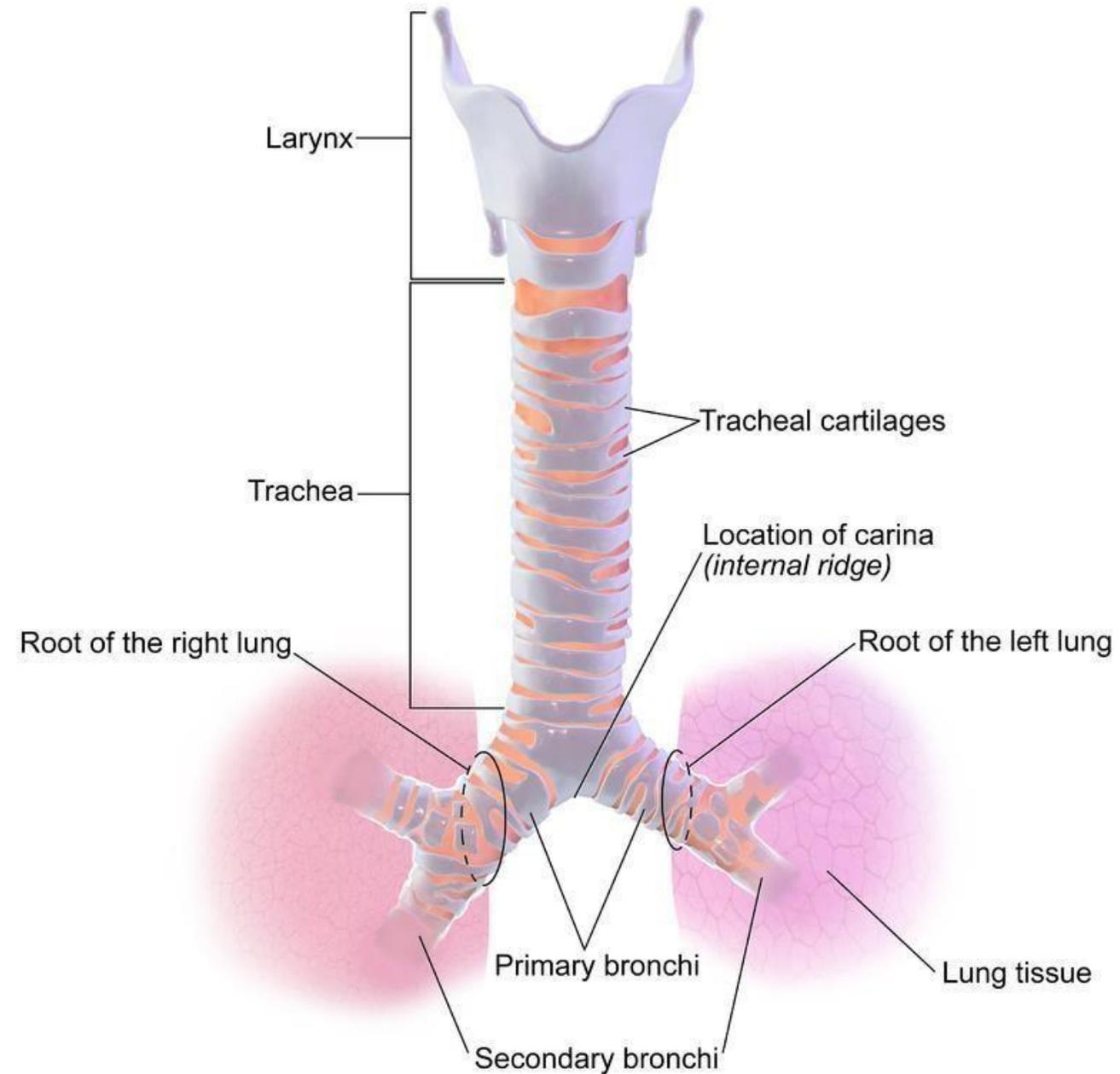


# Trachea

- Trachealis muscle replaces the cartilage posteriorly to allow the trachea to narrow.

This structure is vital for coughing, getting rid of secretions, foreign particles.

## Anatomy of the Trachea





# Thoracic Wall (Muscles & vessels)

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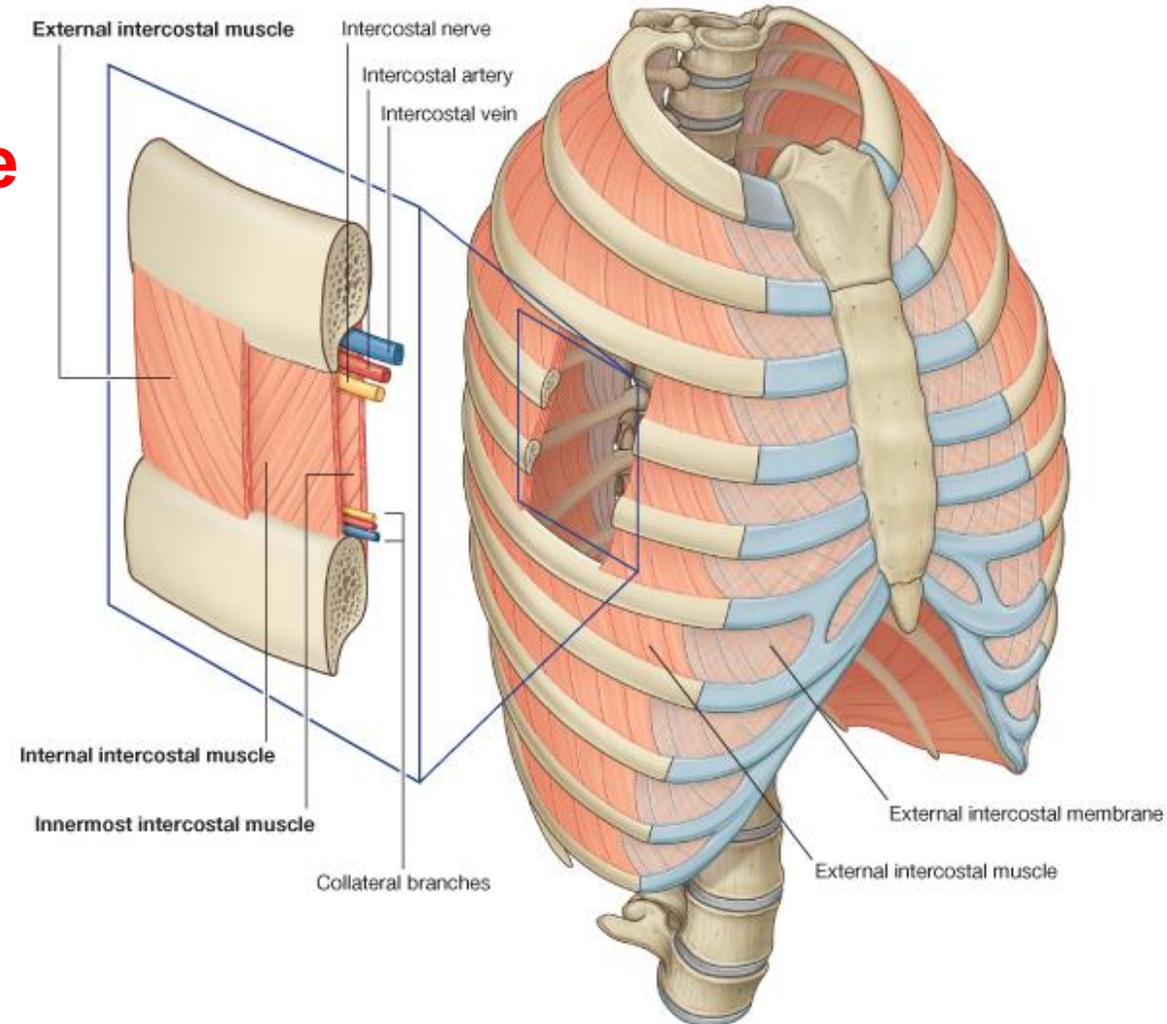
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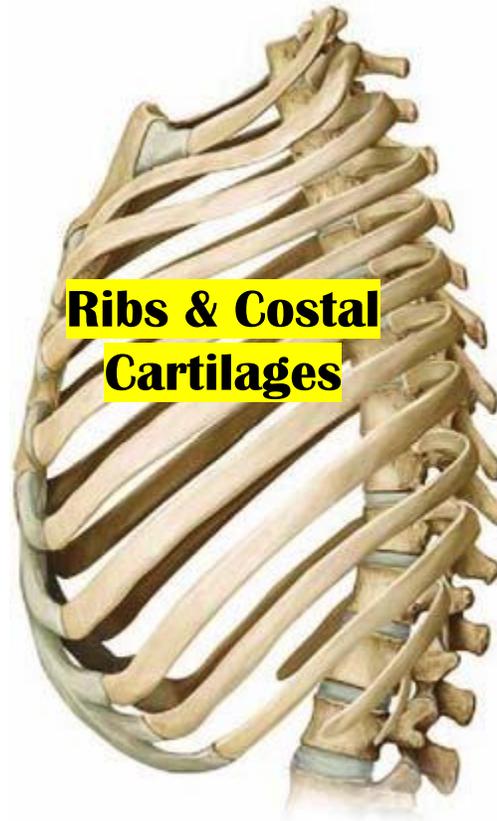
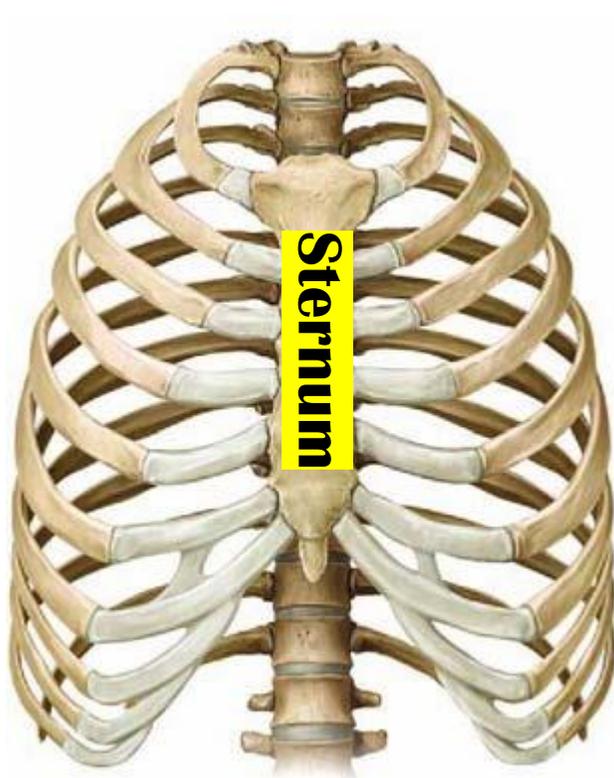
# Thoracic Wall

The Thoracic Wall is composed of:

- **Bones:** Forming the **thoracic cage**
- **Superiorly:** Thoracic **inlet**
- **Inferiorly:** Thoracic **Outlet**
- **Between the ribs:** 11 intercostal **spaces**
- **In the intercostal spaces:**
  1. **Intercostal muscles**
  2. **Intercostal nerves**
  3. **Intercostal arteries**
  4. **Intercostal veins**



# Skeleton of Thoracic Wall (thoracic cage)



Upper border of the body of the first thoracic vertebra

Inner border of the right first rib

Inner border of the left first

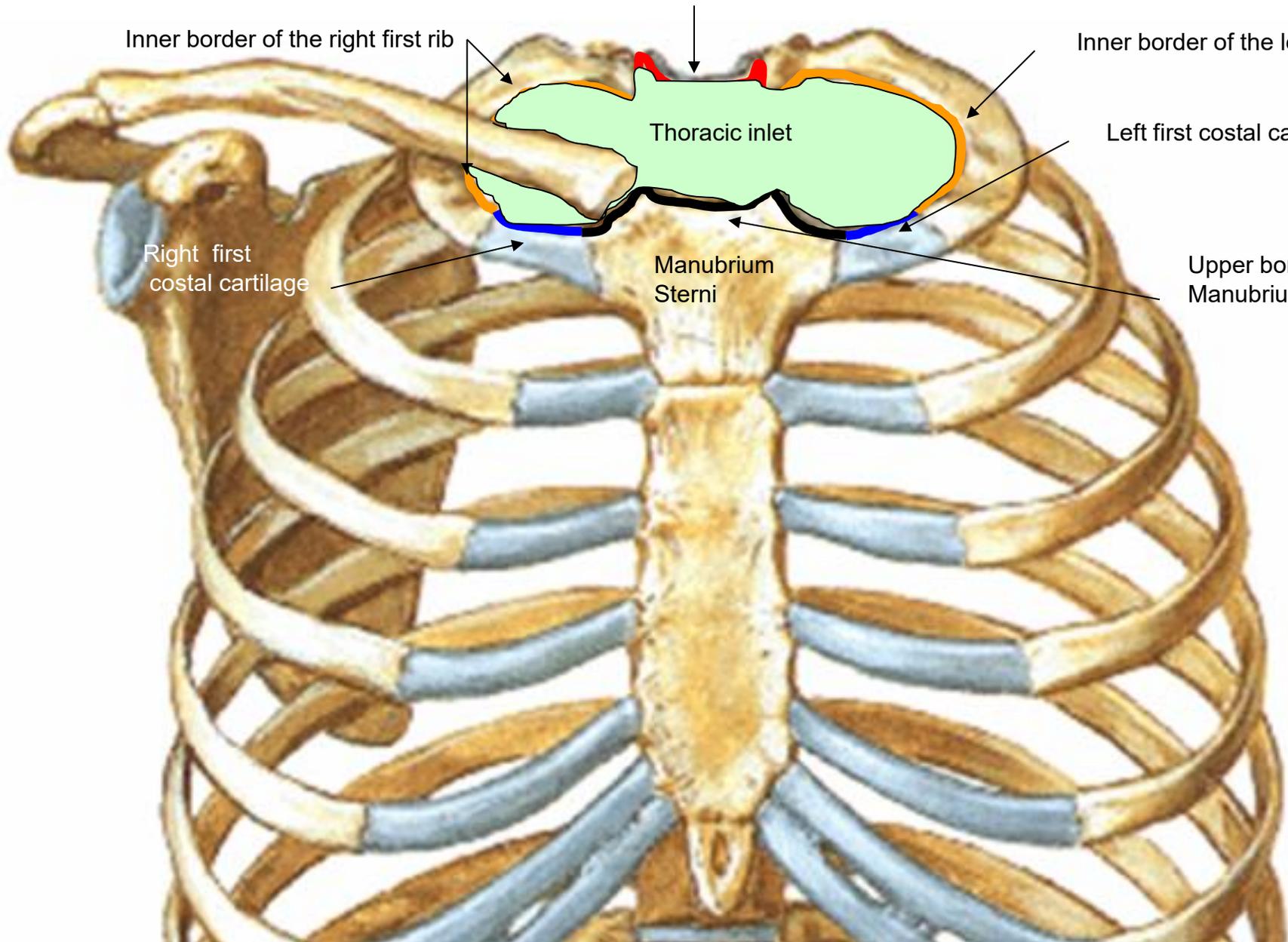
Thoracic inlet

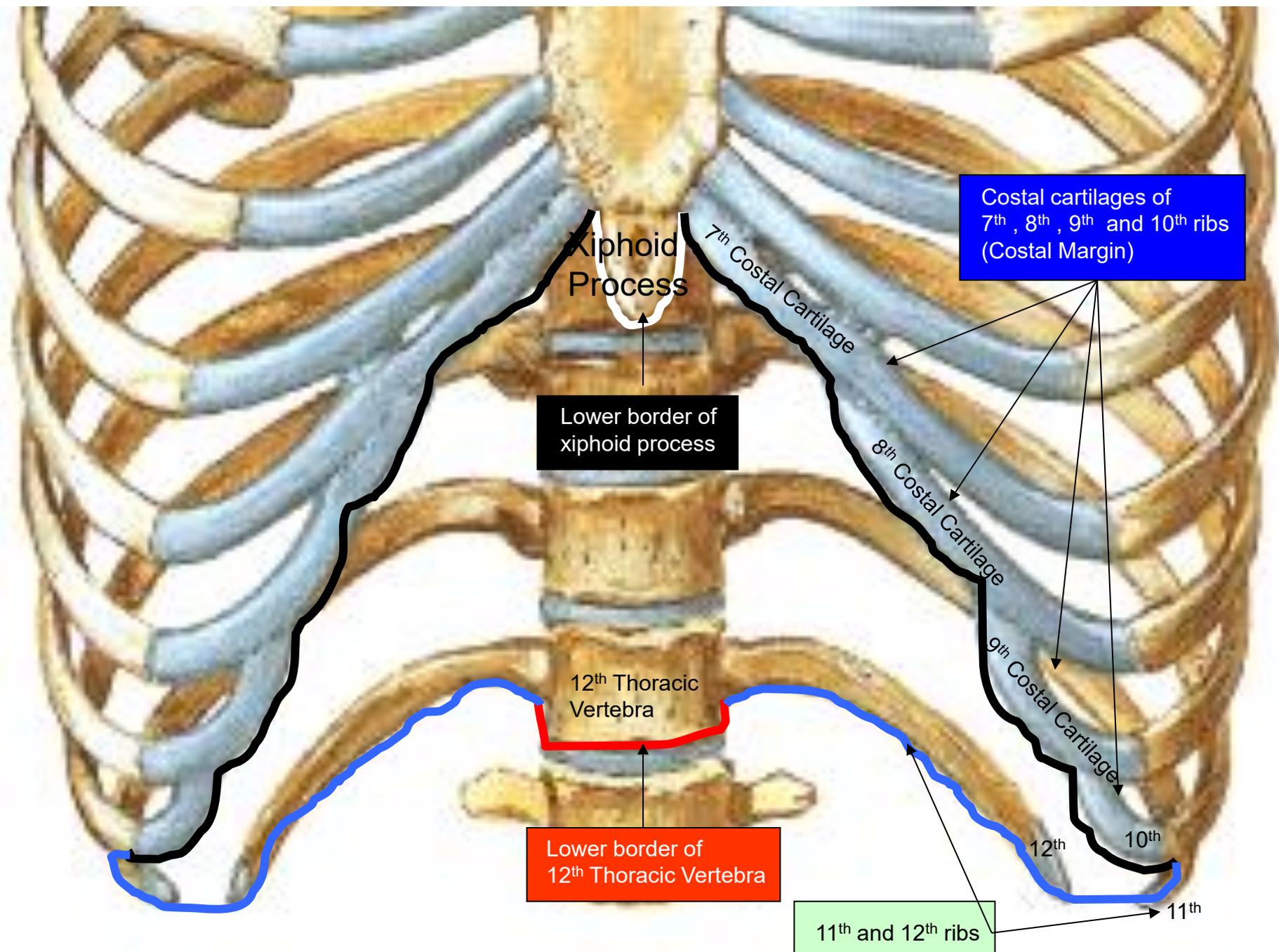
Left first costal cartilage

Right first costal cartilage

Manubrium Sterni

Upper border of Manubrium Sterni





Costal cartilages of 7<sup>th</sup>, 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> ribs (Costal Margin)

Xiphoid Process

Lower border of xiphoid process

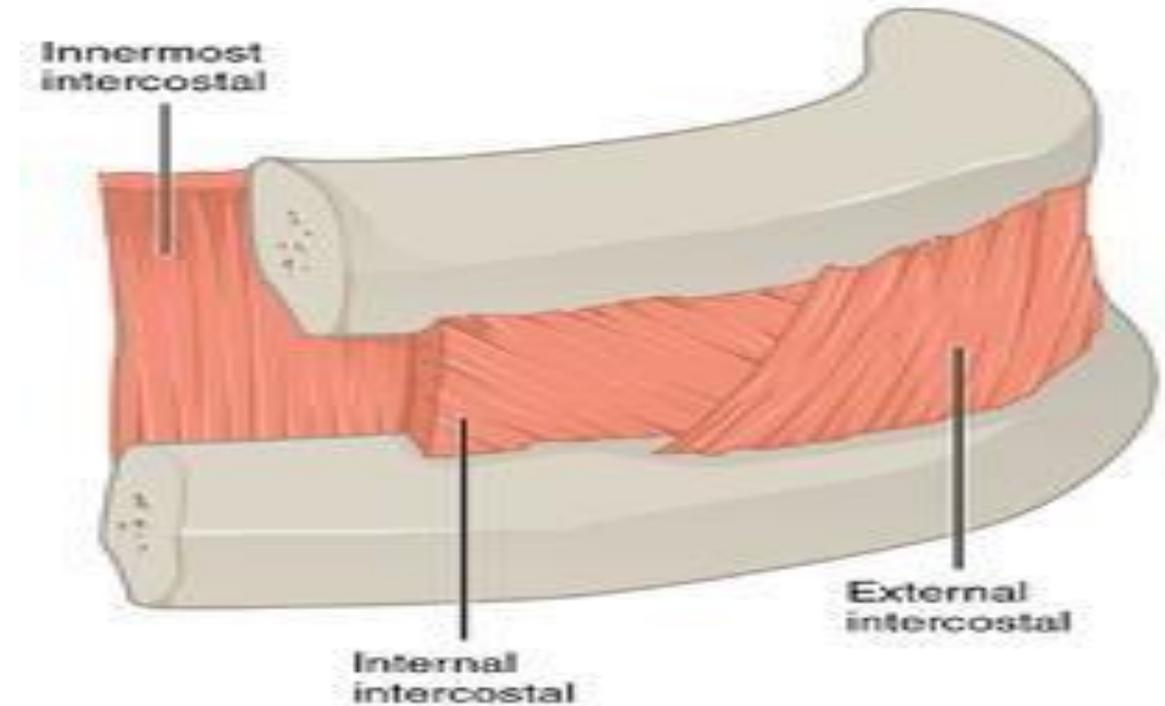
12<sup>th</sup> Thoracic Vertebra

Lower border of 12<sup>th</sup> Thoracic Vertebra

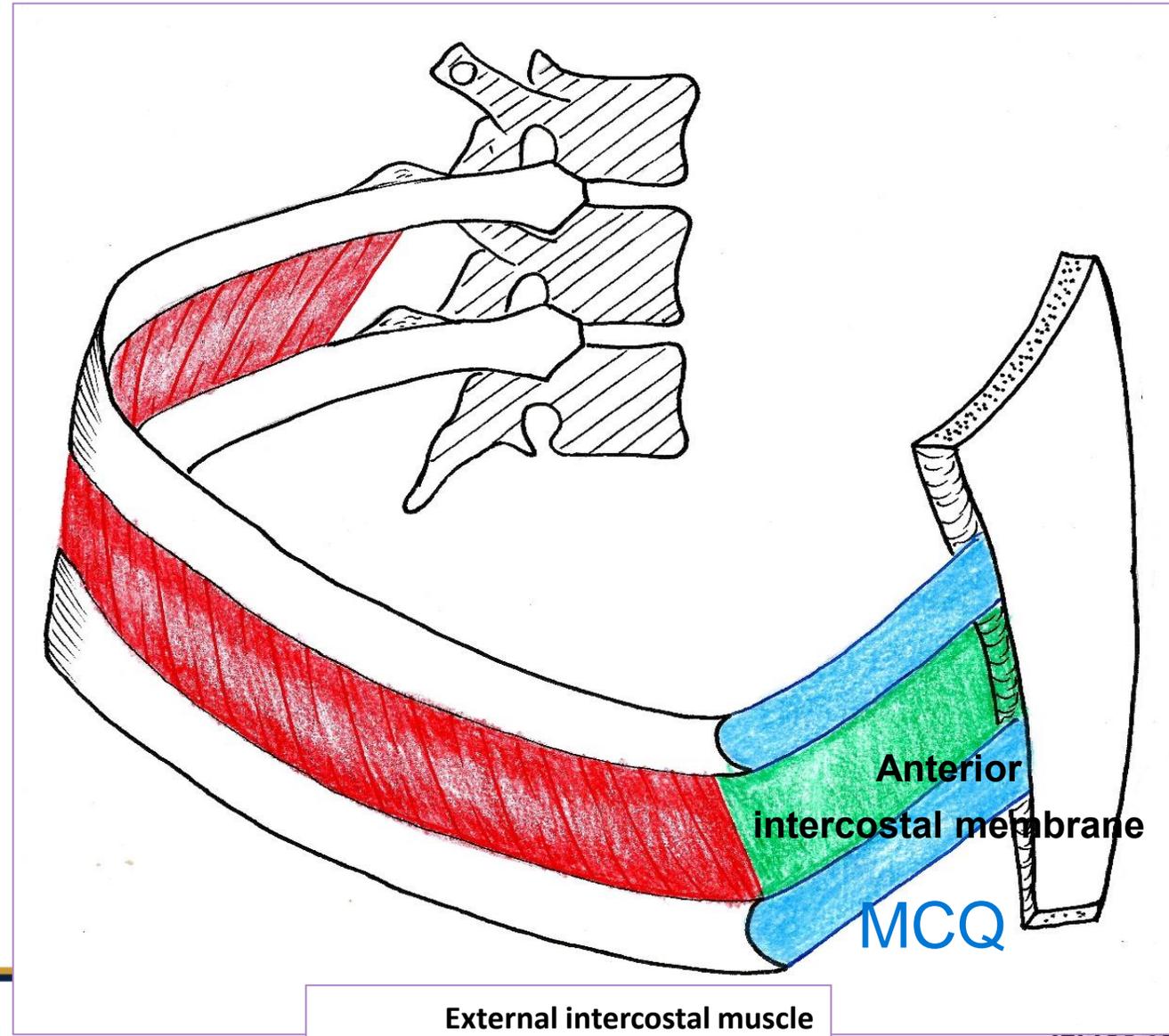
11<sup>th</sup> and 12<sup>th</sup> ribs



# Thoracic Wall (intercostal muscles)



# External Intercostal Muscle



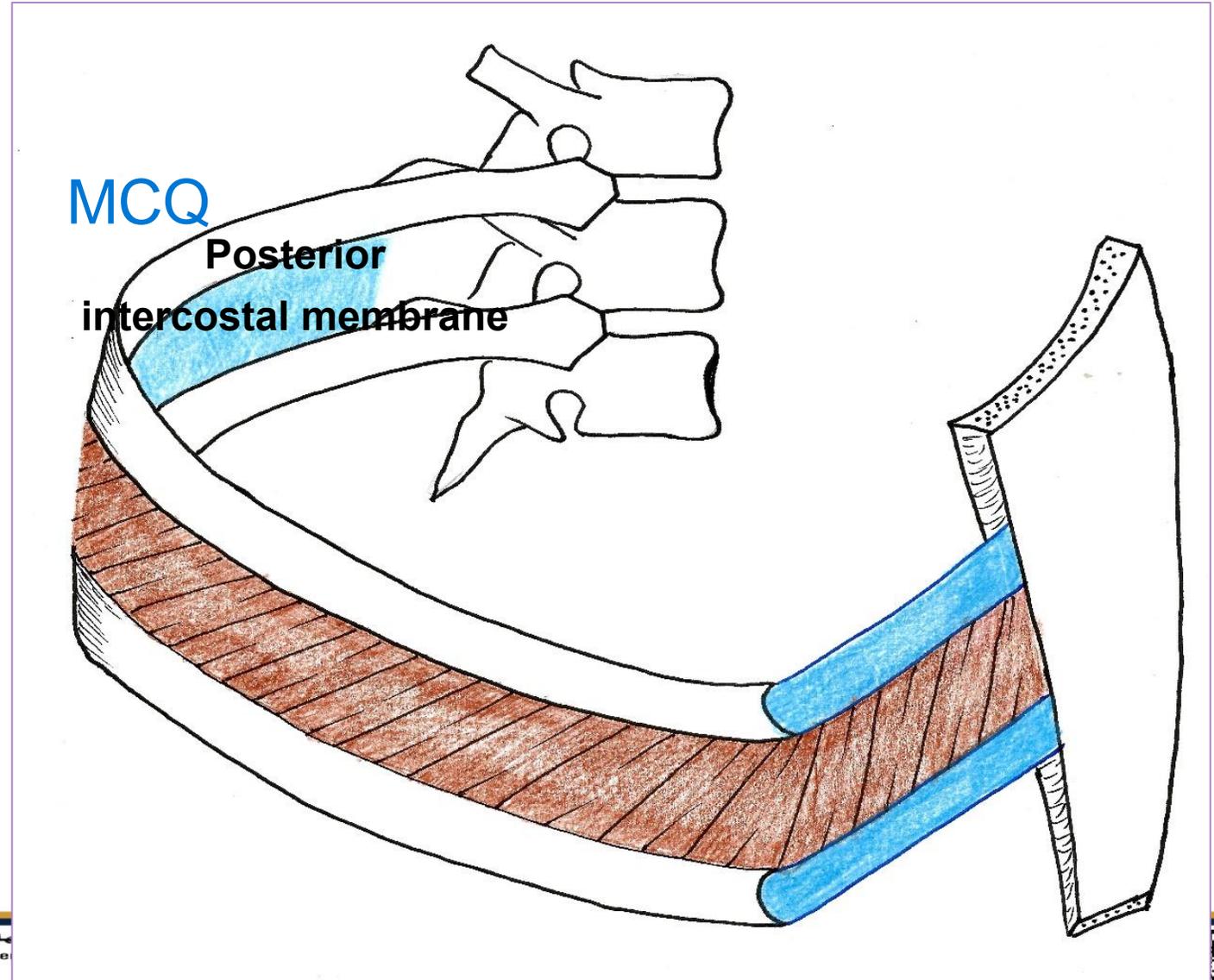
Anterior  
intercostal membrane

MCQ

External intercostal muscle



# Internal Intercostal Muscle



# Transversus thoracis

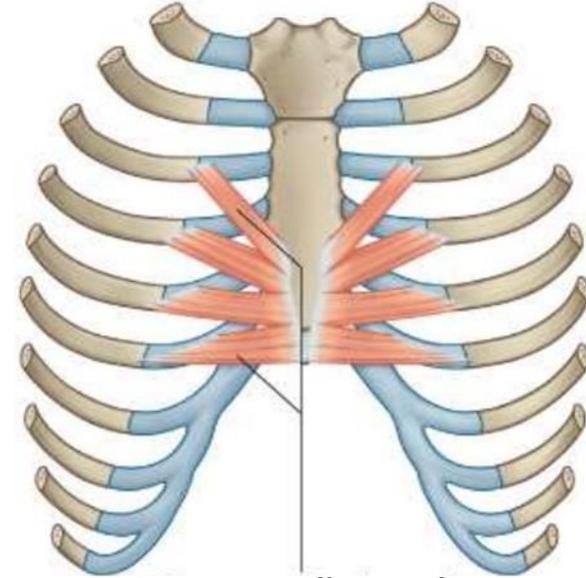
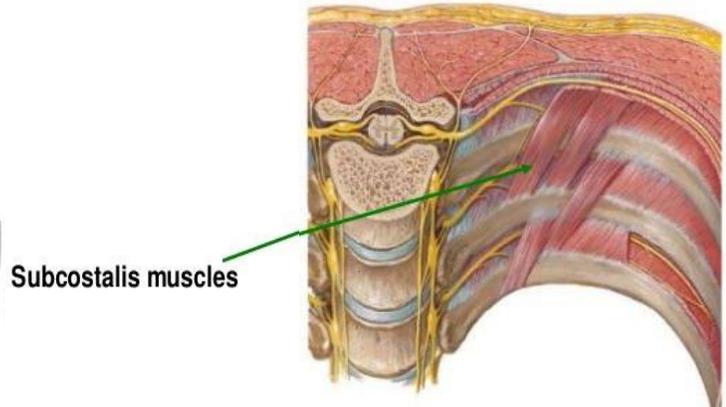
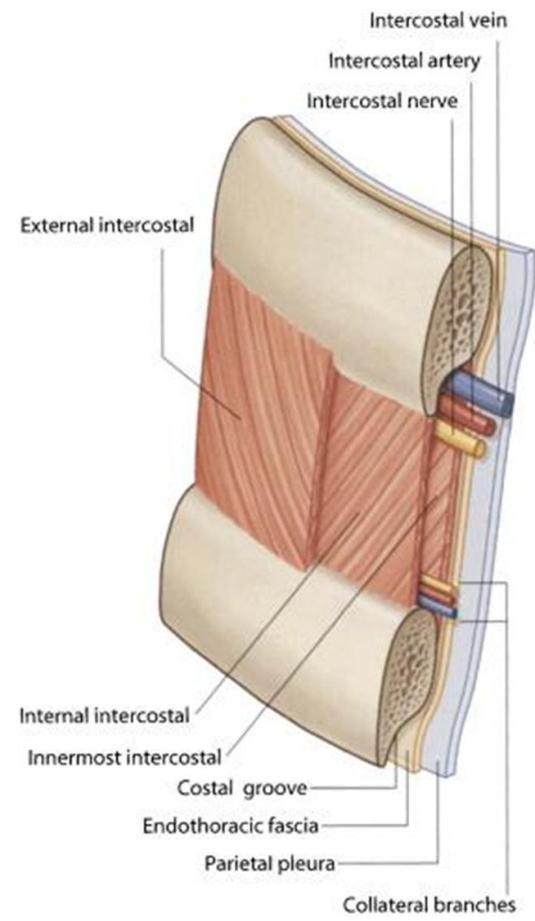
SAQ

It is subdivided into 3 parts:

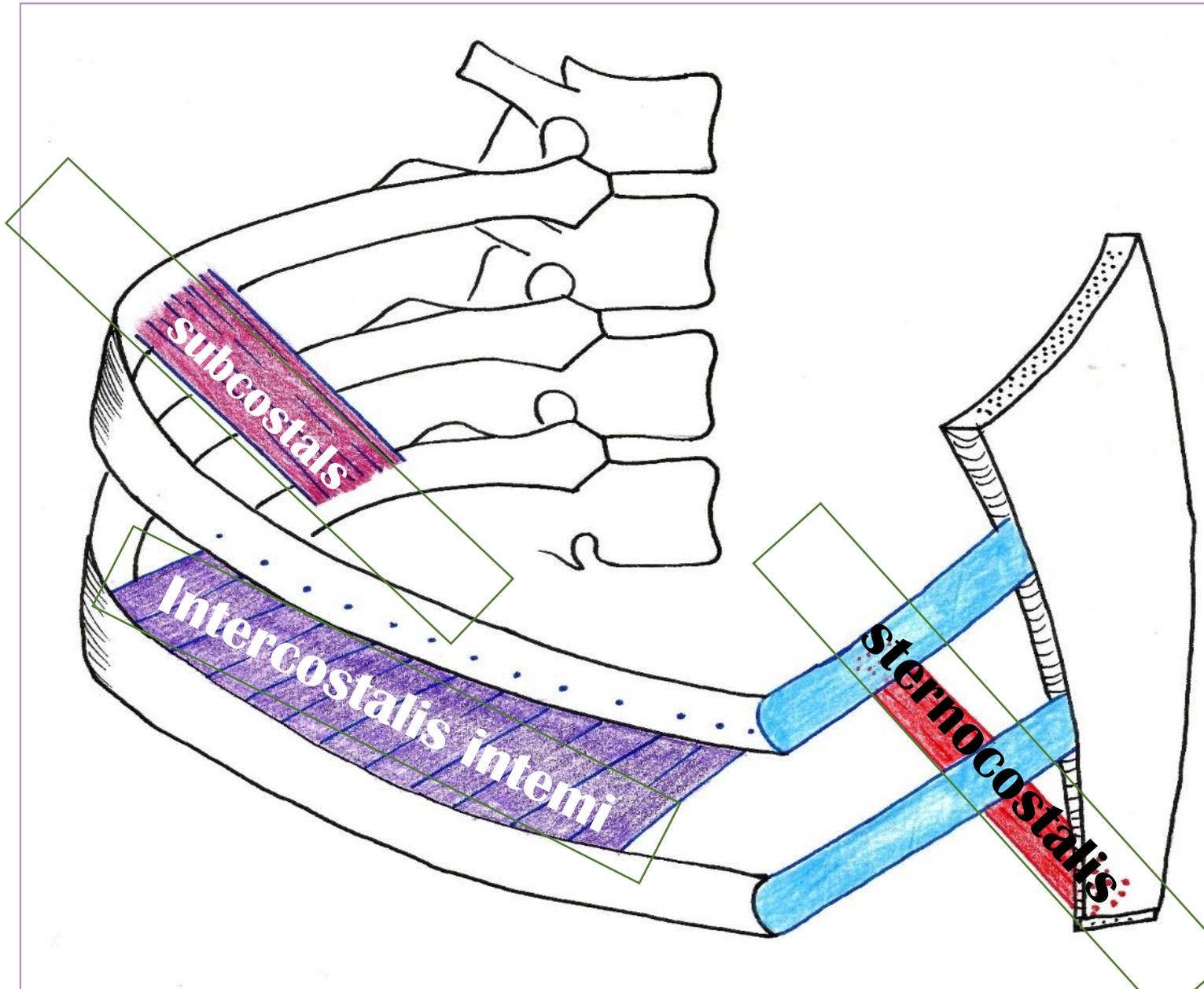
**A. Sternocostalis:** anteriorly  
(in the upper intercostal spaces).

**B. Subcostalis:** Posteriorly  
(in the lower intercostal spaces).

**C. Intercostalis intimi (innermost intercostal):** in the middle



# Transversus Thoracis muscles





# Intercostal Arteries



# Intercostal Arteries

Each space contains **one posterior** and **2 anterior** intercostal arteries.

## Anterior intercostal arteries

**Number:** **2 arteries** in each of the upper 9 spaces.

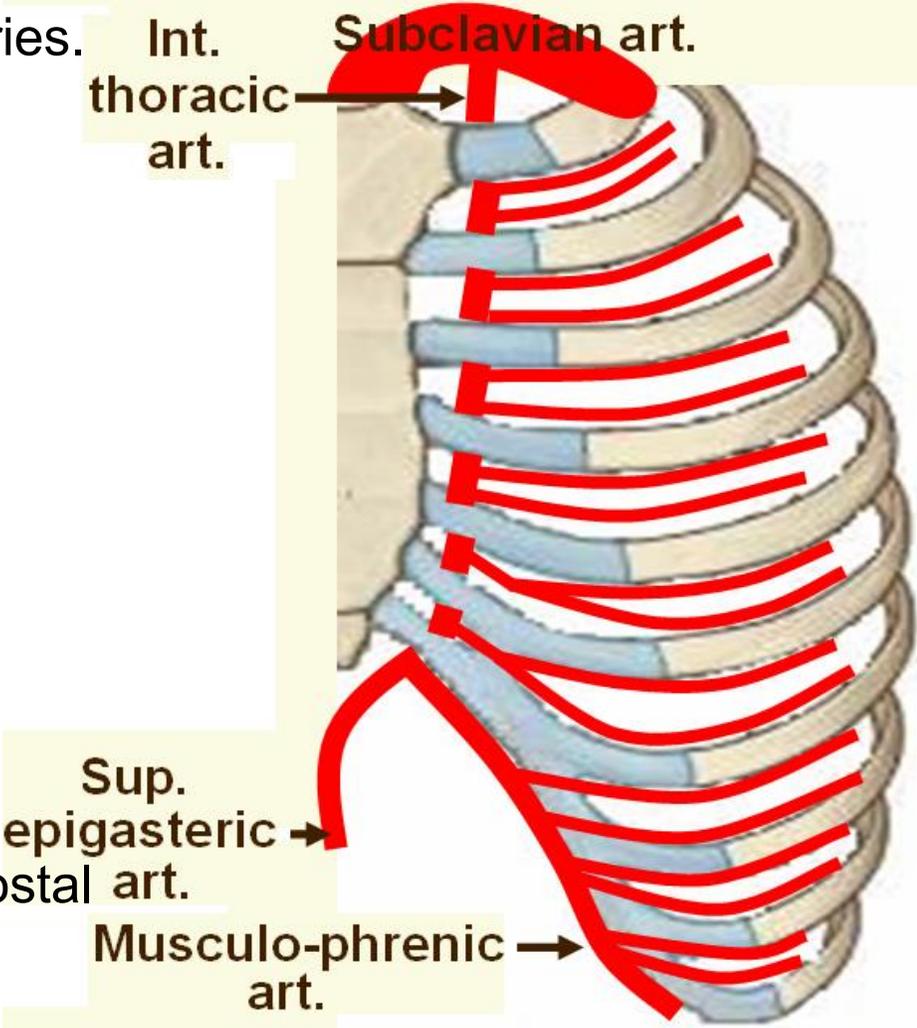
### Origin:

**The upper 6:** branches from the **internal thoracic artery**. MCQ

**The lower 3 (7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup>):** branches from the

MCQ  
**musculophrenic**

**Termination:** they anastomose with the posterior intercostal artery and its collateral branch.



# Intercostal Arteries

## Posterior intercostal arteries

**Number:** **one artery** in each of the 11 spaces.

**Origin:**

MCQ

**The 1<sup>st</sup> and 2<sup>nd</sup>:** from the **superior intercostal artery** (branch from the costo-cervical trunk, which is a branch from the 2<sup>nd</sup> part of subclavian).

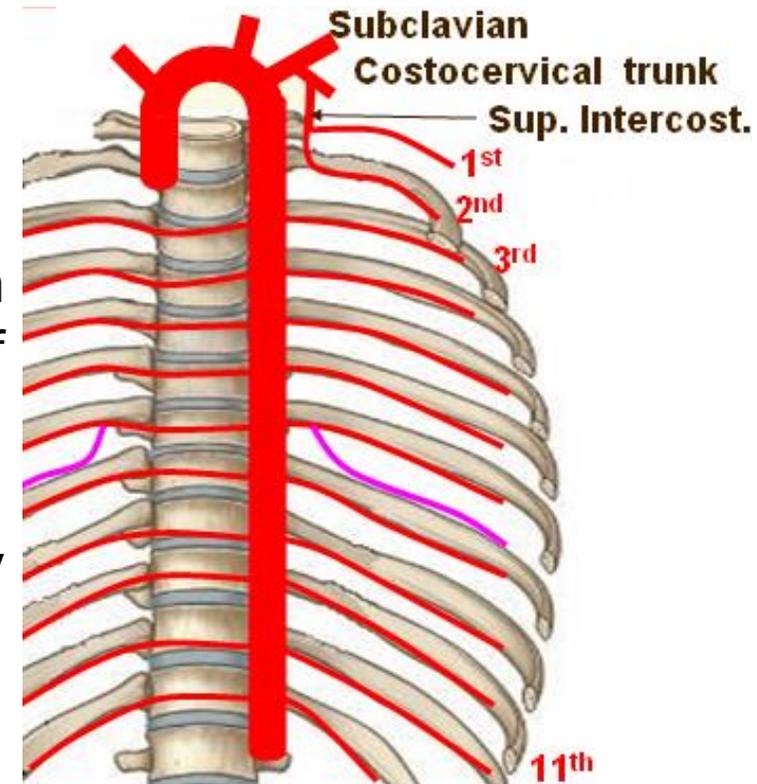
MCQ

**The 3<sup>rd</sup> - 11<sup>th</sup>:** from the **descending aorta**.

**Termination:** by anastomosis with the upper anterior intercostal artery in each space.

**Branches:**

- Dorsal branch:** supplies the spinal cord, muscles and skin of the back.
- Muscular branches:** to the intercostal muscles.
- Collateral branch:** passes on the upper border of the rib below to anastomose with the lower anterior intercostal artery in each space.



# Intercostal Veins

In each space there is **one posterior and 2 anterior** intercostal veins.

## Anterior intercostal veins

Number: 2 in each of the upper 9 spaces.

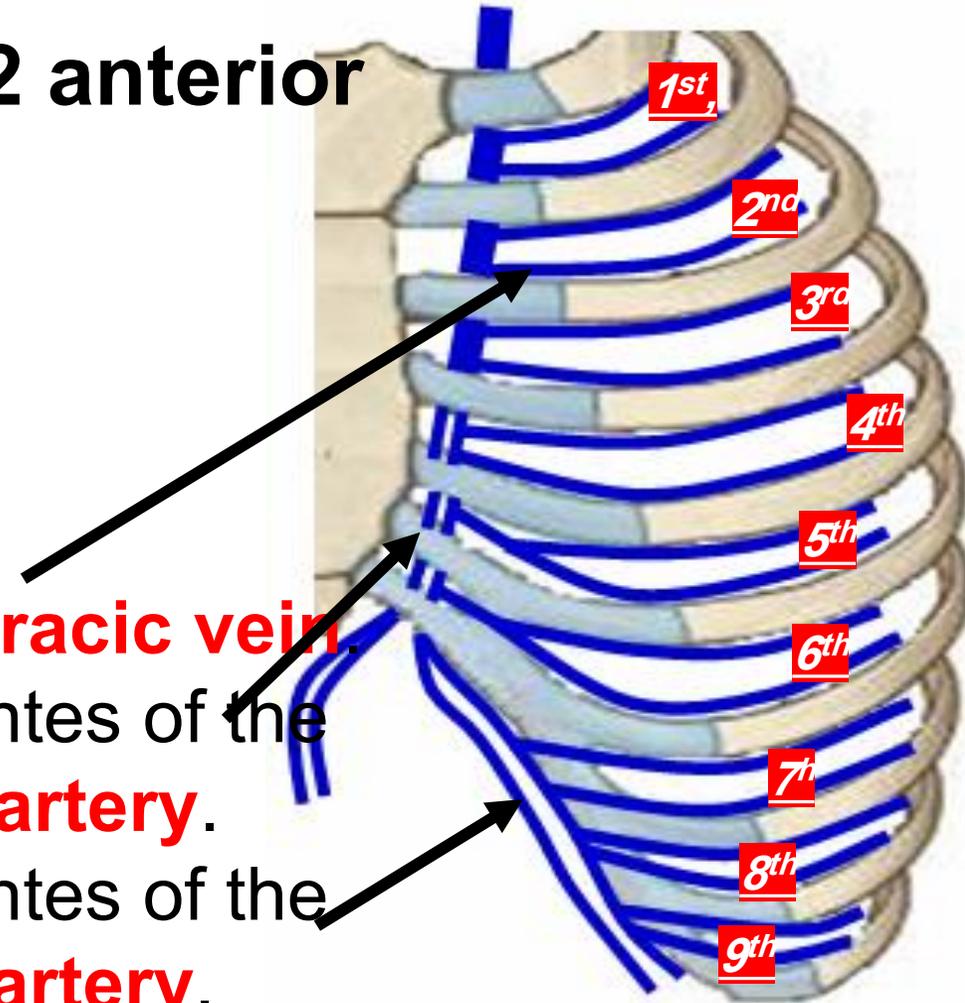
Course: pass with the corresponding arteries.

### Termination:

**The 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup>** end in the **internal thoracic vein**.

**The 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup>** end in the vena comitantes of the **internal thoracic artery**.

**The 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup>** end in the vena comitantes of the **musculophrenic artery**.

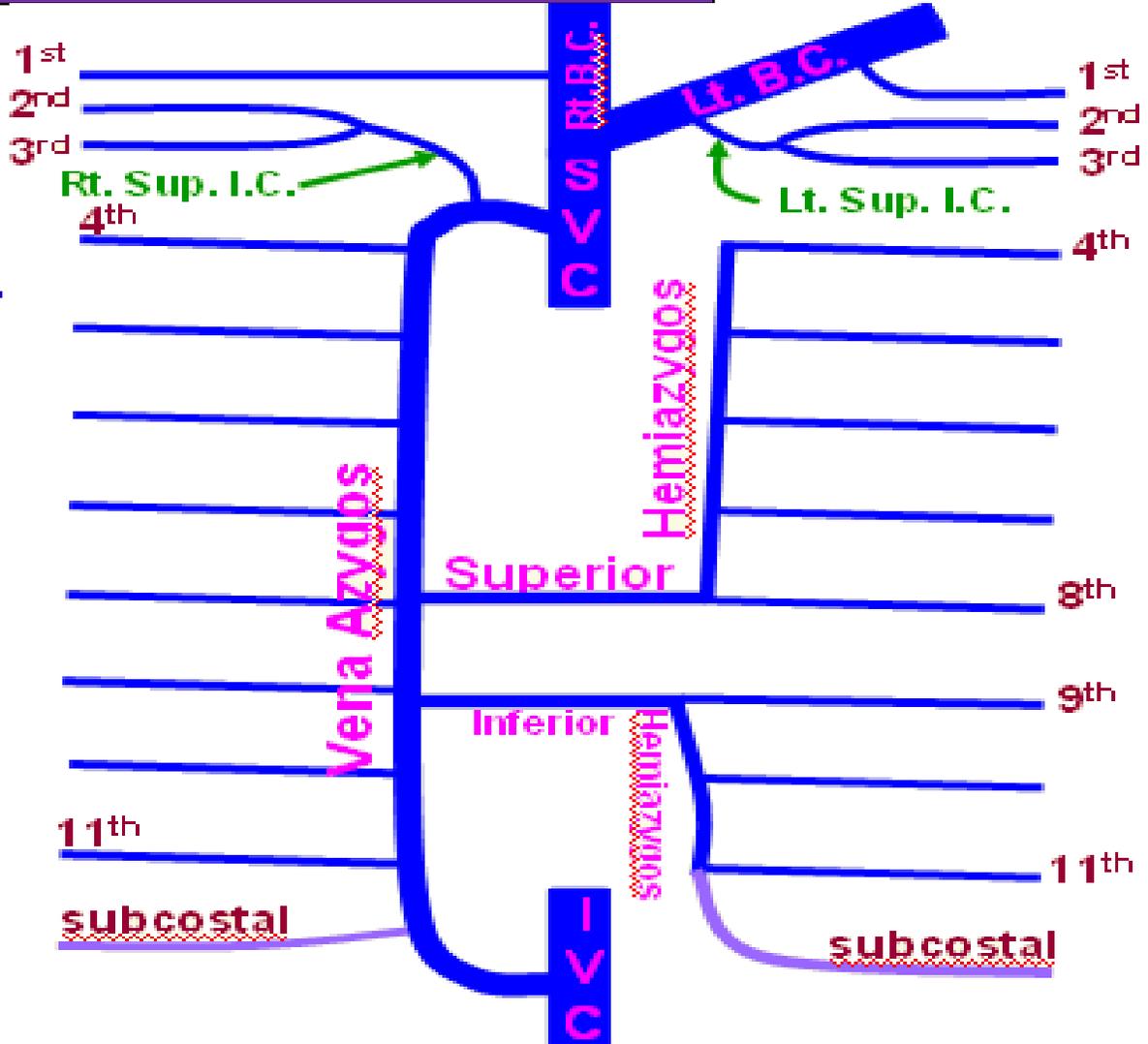


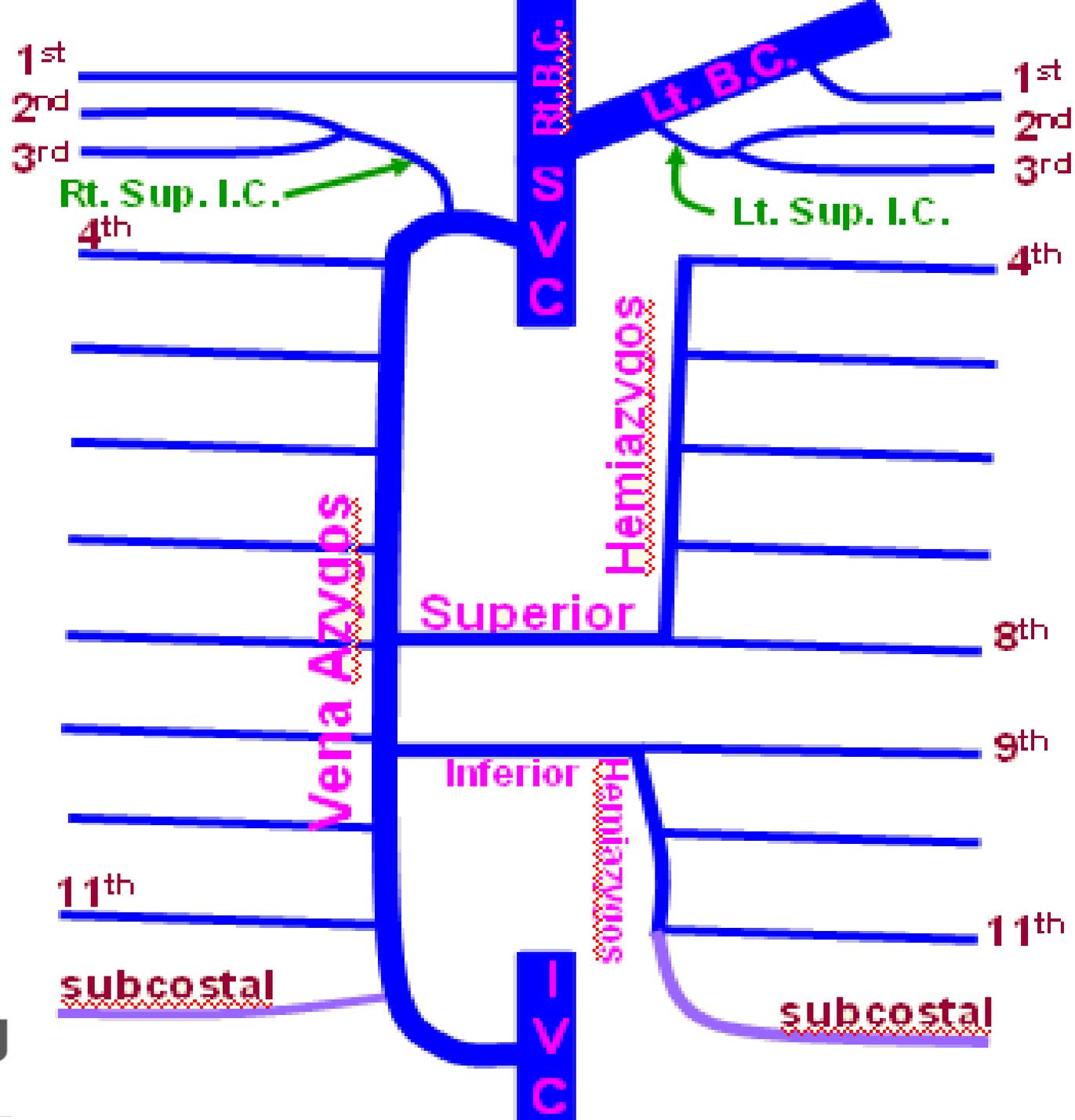
# Intercostal Veins

## Posterior intercostal veins

**Number:** 1 in each of the 11 spaces

**Course:** pass with the corresponding arteries.



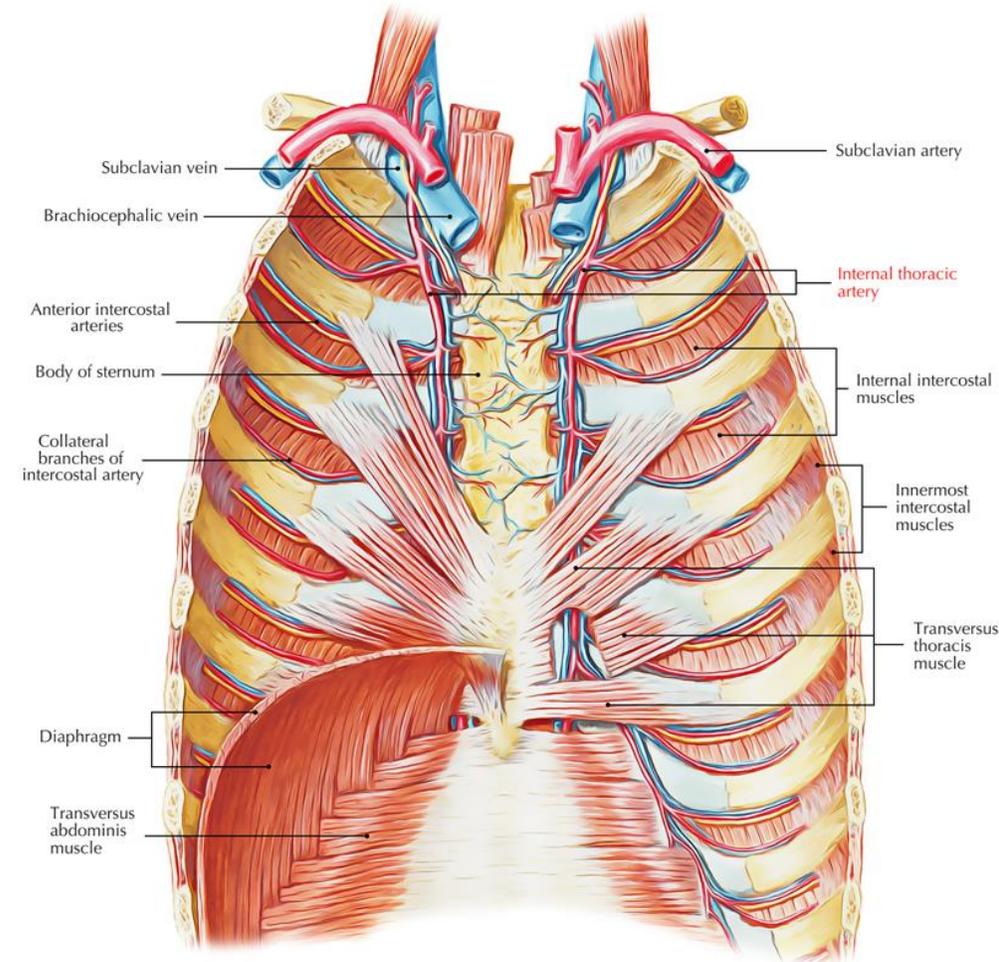


# Internal Thoracic Artery

**Origin:** from the **1<sup>st</sup> part of subclavian artery.**

**Course:** descends behind the clavicle and the medial ends of the upper 6<sup>th</sup> costal cartilages 1.5 cm lateral to the sternal margin.

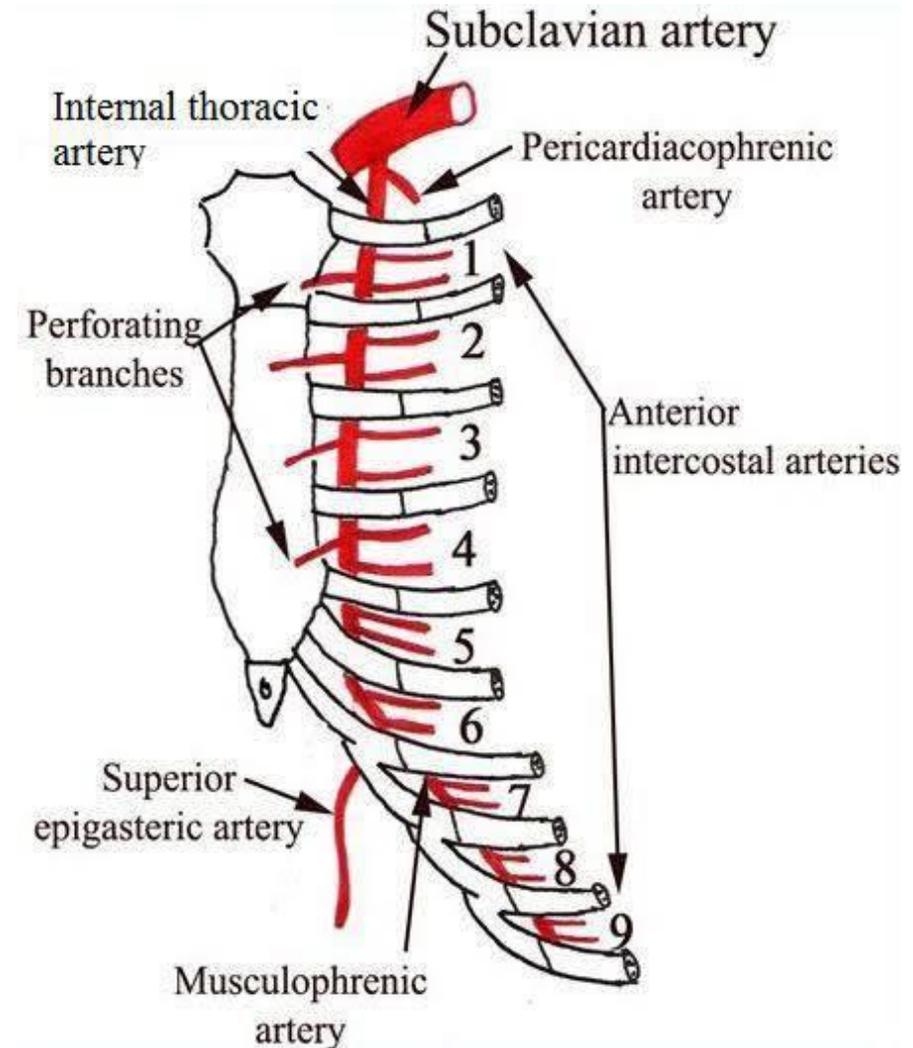
**Termination:** in the 6<sup>th</sup> intercostal space by dividing into **superior epigastric and musculophrenic arteries.**



# Internal Thoracic Artery

## Branches:

- 1) **Anterior intercostal arteries:** 2 in each of the upper 6 spaces.
- 2) **Pericardio-phrenic artery:**
  - Passes with the phrenic nerve.
  - Supplies the pleura, pericardium and diaphragm.
- 3) **Perforating arteries:**
  - Pass with the anterior cutaneous nerves.
  - The 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> supply the mammary gland.
- 4) **Musculophrenic artery:**
  - ✓ Course: passes along the costal margin.
  - ✓ Branches:
    - a) 2 anterior intercostal arteries in the 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> spaces.
    - b) Branches to the pleura, pericardium, diaphragm.
- 5) **Superior epigastric:**
  - ✓ Course: passes through the diaphragm to reach the rectus sheath.





# Intercostal nerves & Diaphragm

**Department of human Anatomy and Embryology  
Faculty of Medicine  
Mansoura National University, Egypt**

M N U



# Intercostal Nerves

**Definition:** they are the ventral rami of the thoracic spinal nerves.

**Number:** 11 nerves on each side.  
(The 12<sup>th</sup> is called Subcostal nerve)

**Types:**

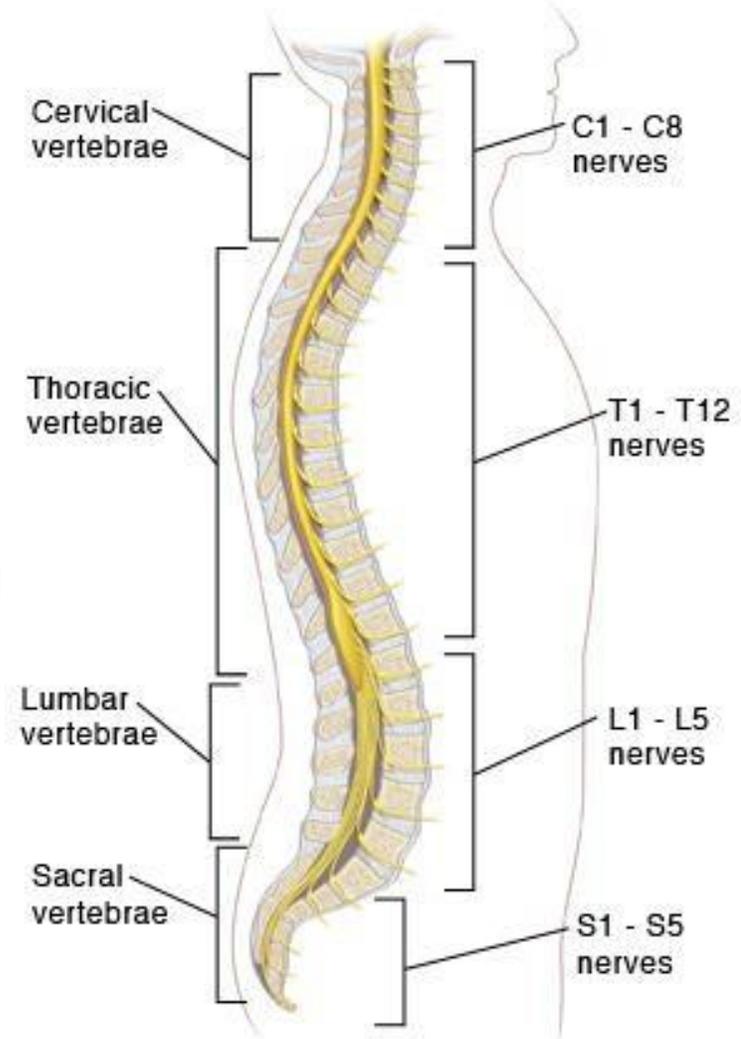
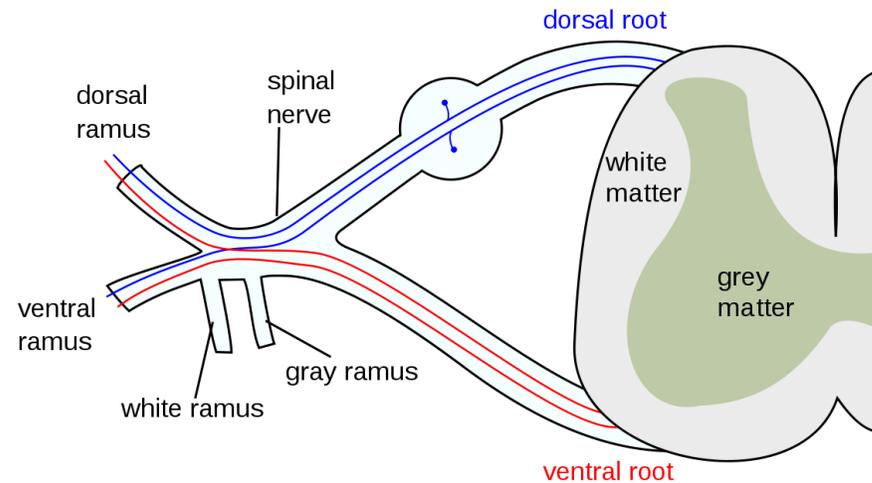
- Typical:** supply only the thoracic wall. They are the 3<sup>rd</sup> – 6<sup>th</sup> nerves.
- Atypical:** supply parts outside the thoracic wall.

They are the 1<sup>st</sup>, 2<sup>nd</sup>, 7<sup>th</sup> – 11<sup>th</sup>

- The 1<sup>st</sup> joins the brachial plexus and supplies the upper limb
- The 2<sup>nd</sup> has a lateral cutaneous branch called intercostobrachial, which supplies the skin of the axilla
- 7<sup>th</sup>-11<sup>th</sup> (thoraco-abdominal) & 12<sup>th</sup> (subcostal):

Supply the Anterior Abdominal wall

## MCQ



# Diaphragm

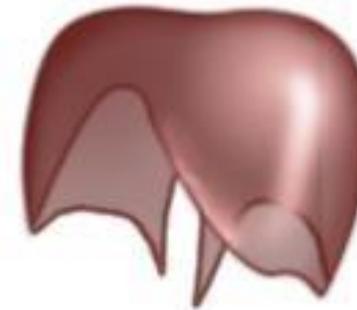
**Definition:** it is the musculofibrous partition which separates the thoracic cavity from the abdominal cavity.

**Origin:**

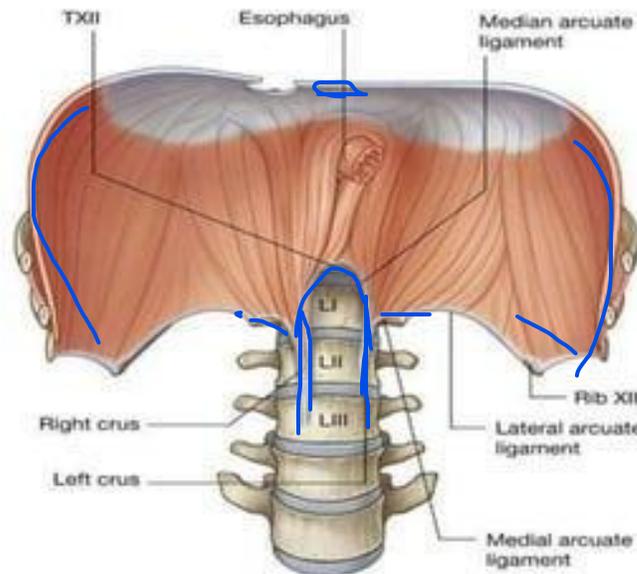
- **Sternal:** back of xiphoid process.
- **Costal:** inner surface of the lower 6 costal cartilages.
- **Vertebral:** 2 crura and 5 arcuate ligaments

2 crura: Right crus & Left crus  
5 Arcuate ligaments:

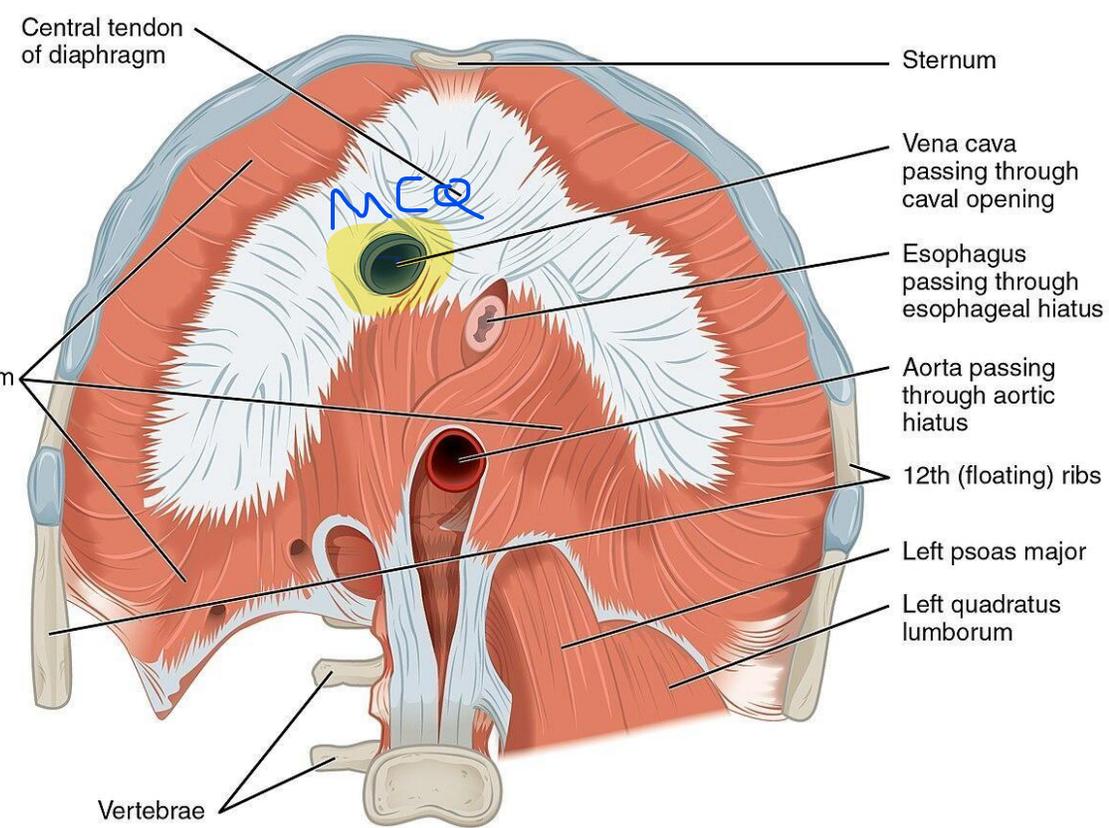
- Median Arcuate ligament.
- 2 Medial Arcuate ligaments.
- 2 Lateral Arcuate ligaments.



The diaphragm is shaped like a parachute



[https://www.google.com/eg/url?sa=i&url=https%3A%2F%2Fwww.slideshare.net%2Fslideshow%2FAnatomy-of-diaphragm%2F227000633&psig=AOvVaw0NgdDgqb1x\\_oq9iWVvYxGy&ust=1729565560900000&source=images&cd=vfe&opi=89978449&ved=OCBcQjhxqFwoTCID1q\\_u7nokDFQAAAAAdAAAAABAE](https://www.google.com/eg/url?sa=i&url=https%3A%2F%2Fwww.slideshare.net%2Fslideshow%2FAnatomy-of-diaphragm%2F227000633&psig=AOvVaw0NgdDgqb1x_oq9iWVvYxGy&ust=1729565560900000&source=images&cd=vfe&opi=89978449&ved=OCBcQjhxqFwoTCID1q_u7nokDFQAAAAAdAAAAABAE)



Diaphragm (inferior view)

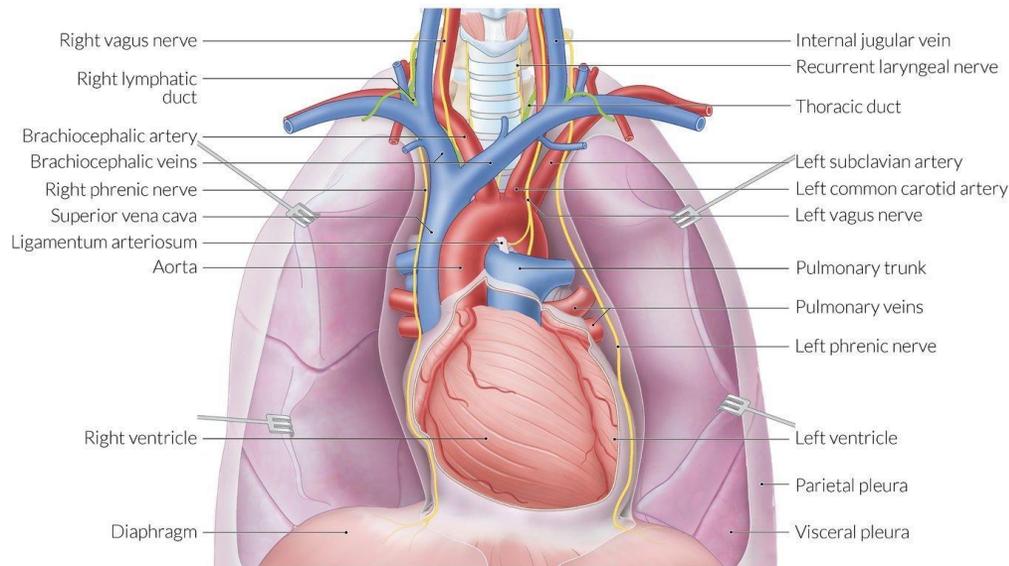
[https://en.wikipedia.org/wiki/Thoracic\\_diaphragm#/media/File:1113\\_The\\_Diaphragm.jpg](https://en.wikipedia.org/wiki/Thoracic_diaphragm#/media/File:1113_The_Diaphragm.jpg)

**Insertion:**

central tendon of diaphragm, which is U-shaped with its concavity directed backwards. It is formed of 3 lobes (leaflets).  
(central, the right copula & left copula)

**Nerve supply:** phrenic nerve and lower 6 thoracic nerves.

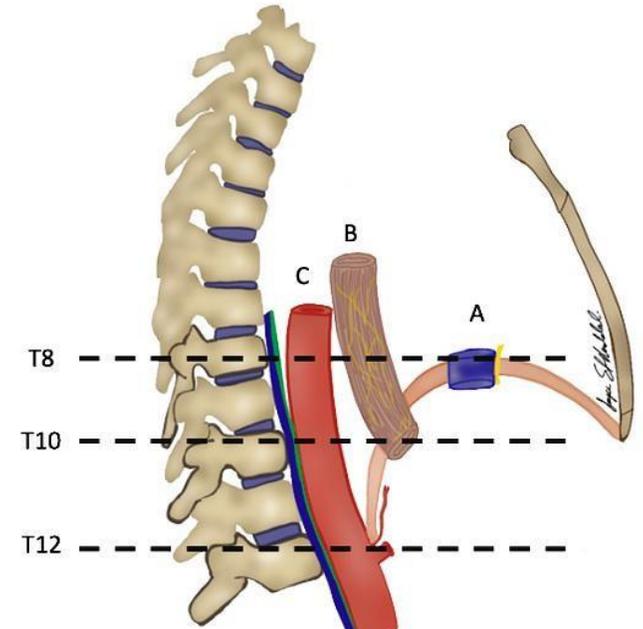
**Actions:** chief muscle of inspiration.



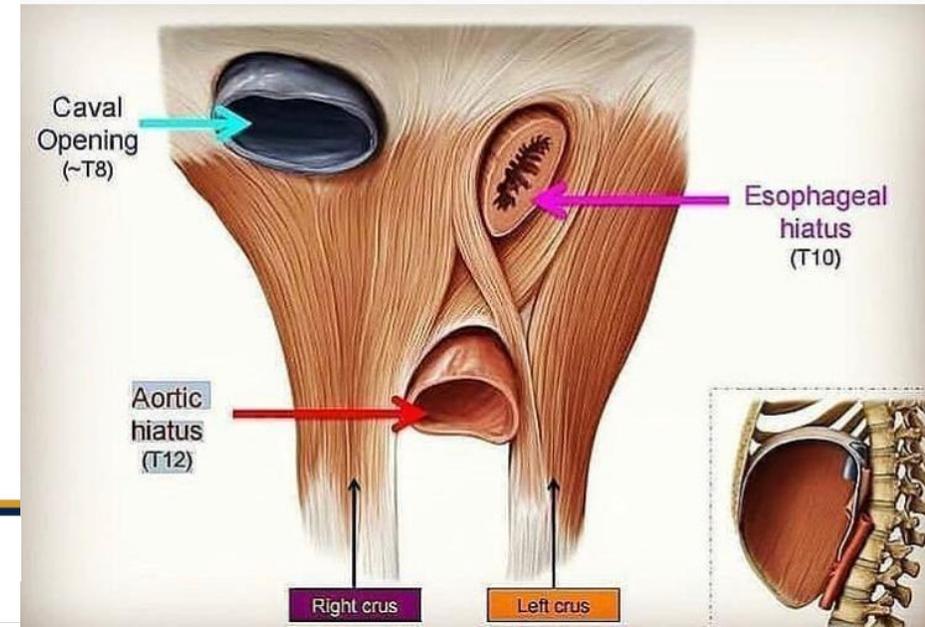
Openings:  
Major openings

SAQ

Opening	Level	Structures passing
Aortic orifice	- T12	- Abdominal aorta - Vena azygos - Thoracic duct
Oesophageal orifice	- T10	- Oesophagus - Vagi (gastric nerves) - Oesophageal vessels
Vena caval orifice	- T8	- IVC - Right phrenic nerve - Lymph vessels from the bare area of the liver



<https://www.google.com/eg/url?sa=i&url=https%3A%2Ffradiopaedia.org%2Fcases%2Fmajor-openings-of-the-diaphragm-lateral-view&psig=AOvVaw0z5wSQc9pql3Spjn3pNXh&ust=1729566651864000&source=images&cd=vfe&opi=89978449&ved=0CBcQjhxqFwoTCMDtkoLAnokDFQAAAAAdAAAAABAE>





# Anatomy of the Lung and Pleura

Department of human Anatomy and Embryology  
Faculty of Medicine  
Mansoura National University, Egypt

Edited by  
Dr. Fekry Shata





# PLEURA

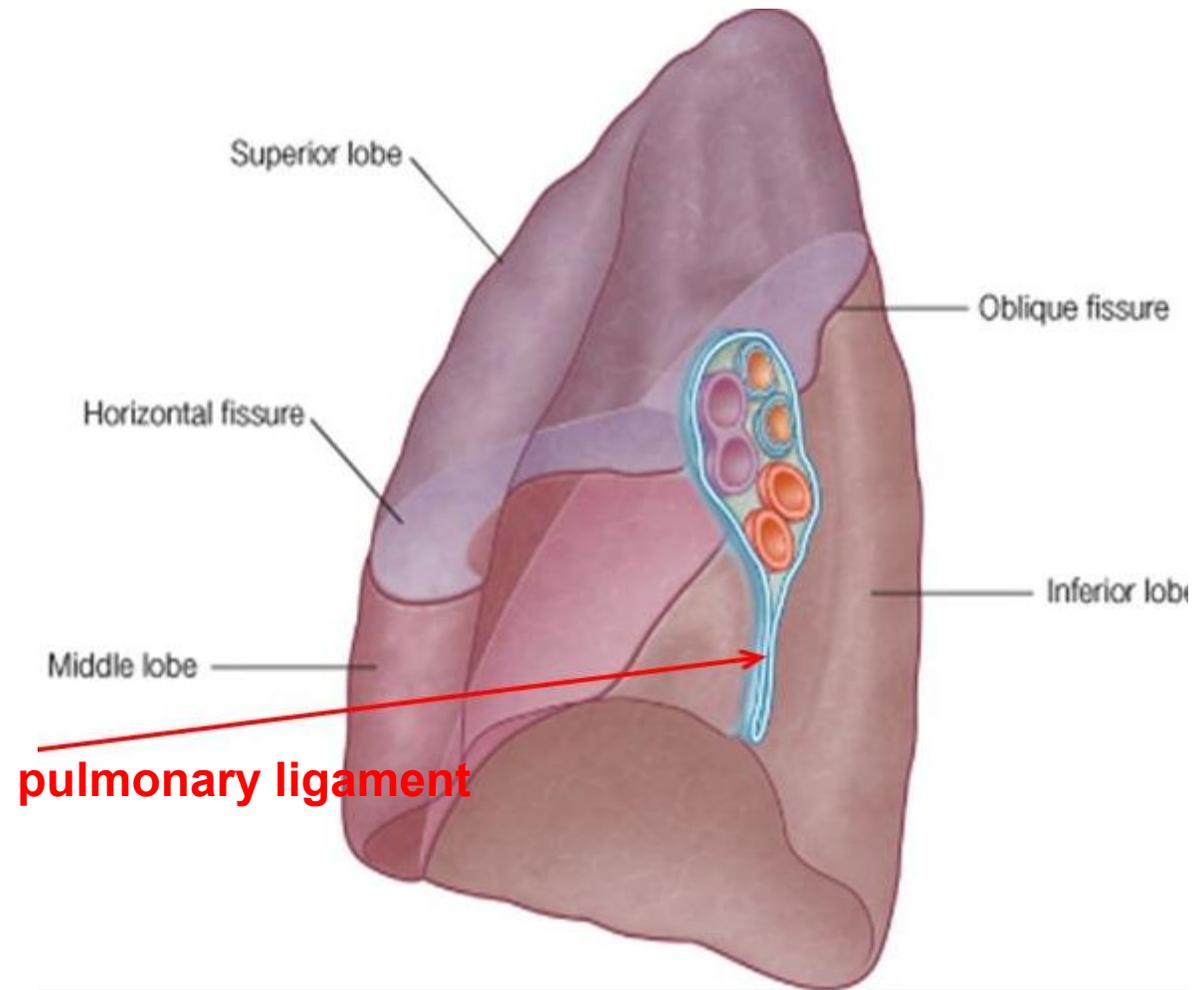


# Pleura

**Definition:** closed serous sac which covers the lung

## Layers:

- It is formed of 2 layers:
  - Outer layer:** called **parietal pleura**.
  - Inner layer:** called **visceral pleura**.
- The 2 layers are separated from each other by **pleural cavity** (which contains a very thin film of serous fluid).
- The 2 layers are continuous with each other around the root of the lung.
- **At the root of the lung, the parietal pleura extends downwards in a V-shaped manner forming **pulmonary ligament**.**



# Pleura

## Parietal pleura

It is the **outer layer** of the pleura, which lines the thoracic wall

**Parts:** it is divided into 4 parts:

### 1. Cervical pleura:

- covers the **apex of the lung**.
- It is covered by **supra-pleural membrane** (may be named **diaphragm of the thoracic inlet- Sibson`s Fascia**).

**2. Costal pleura:** lines the thoracic wall (sternum, ribs, costal cartilages and intercostal spaces).

**3. Diaphragmatic pleura:** covers the upper surface of the diaphragm.

**4. Mediastinal pleura:** covers the sides of the mediastinum.



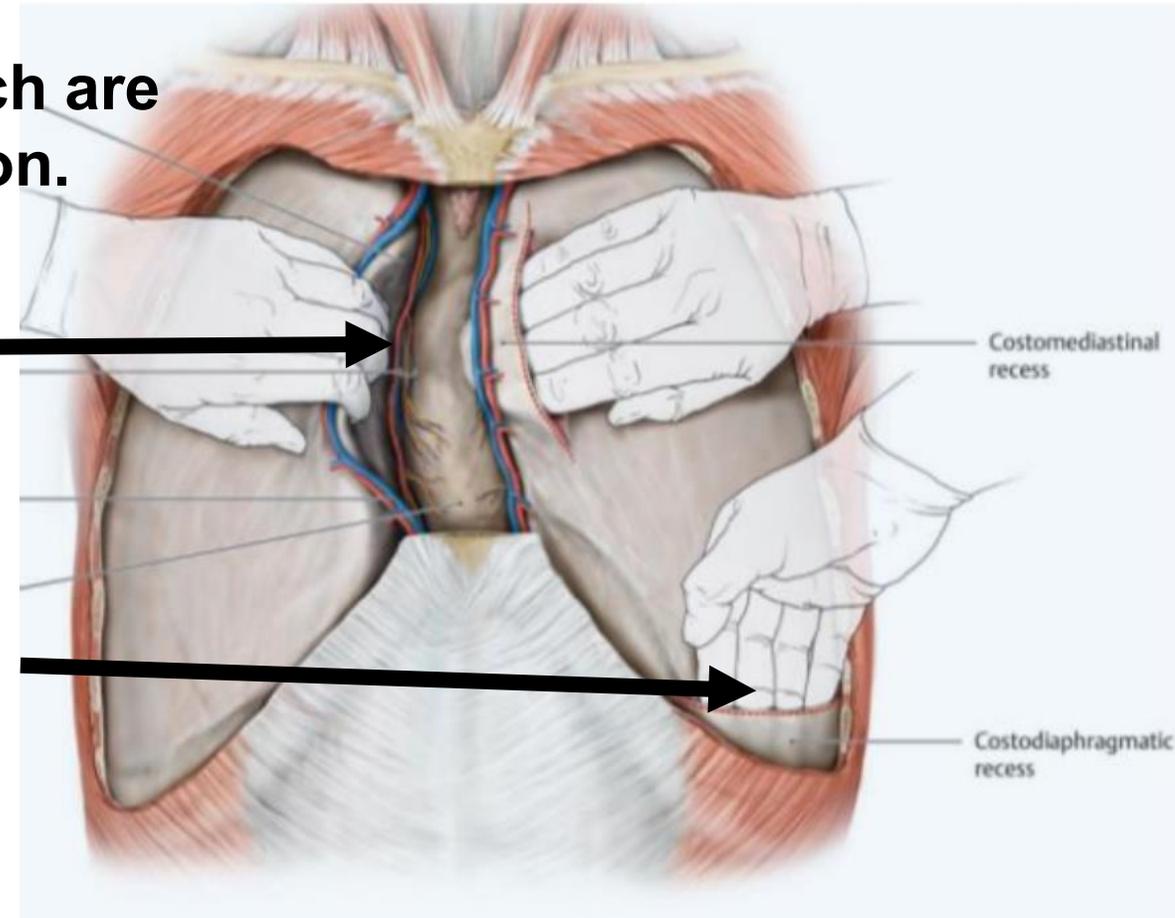
# Pleural Recesses

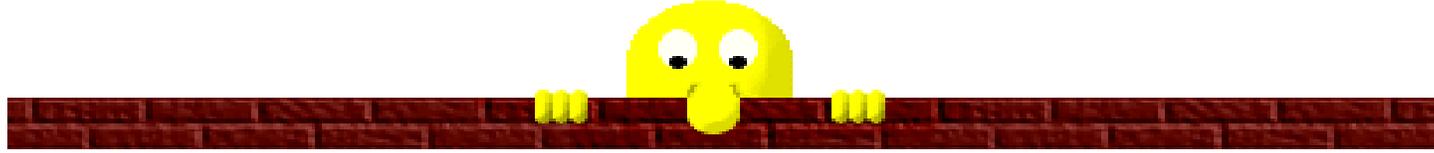
## Definition

Narrow extensions of the pleural cavity which are not occupied by lung except in full inspiration.

## Sites:

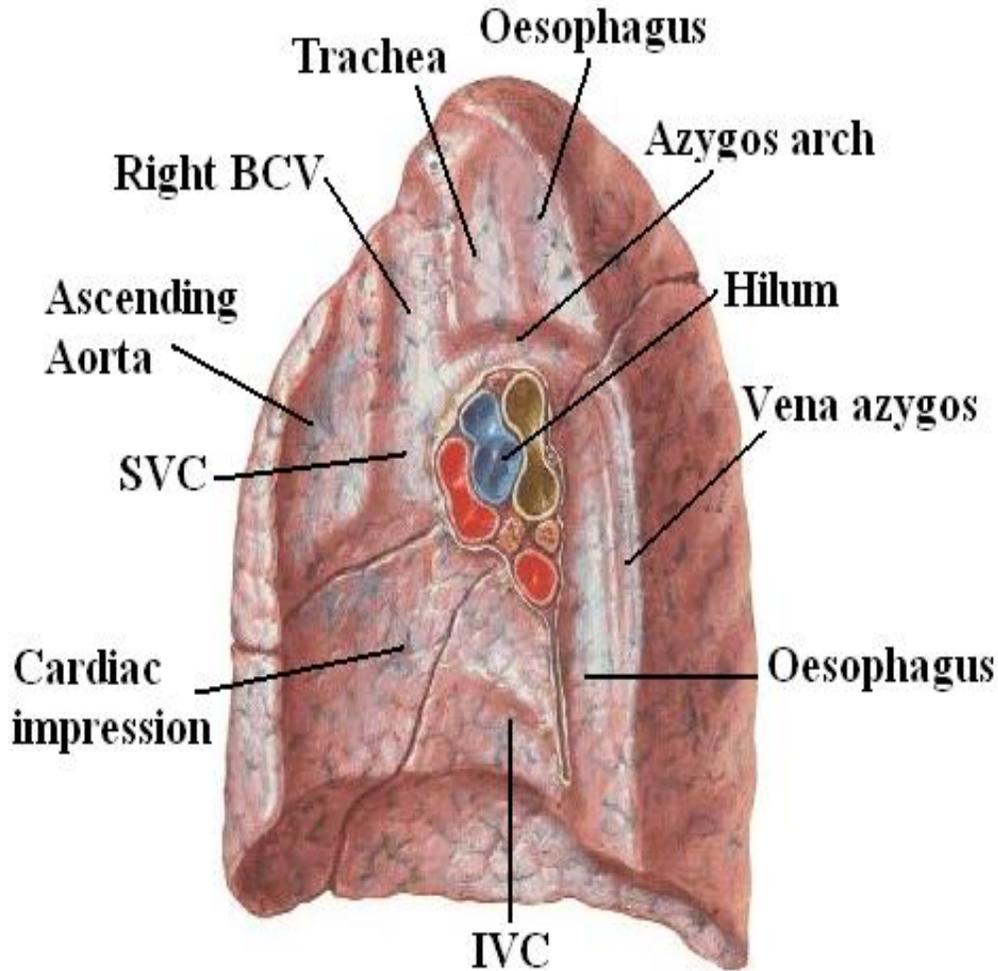
- **Costo-mediastinal recess:** along the **anterior margin** of the pleura between the costal and mediastinal pleura.
- **Costo-diaphragmatic recess:** along the **inferior margin** of the pleura between the costal and diaphragmatic pleura.



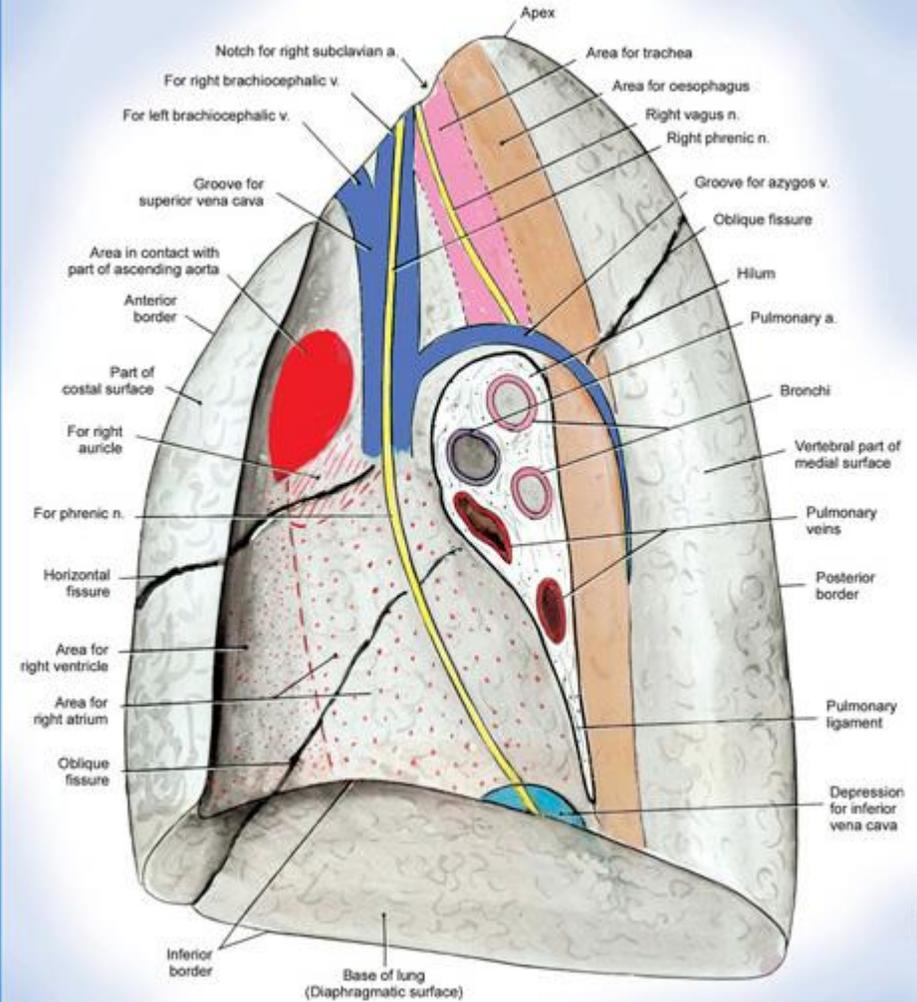


# LUNG

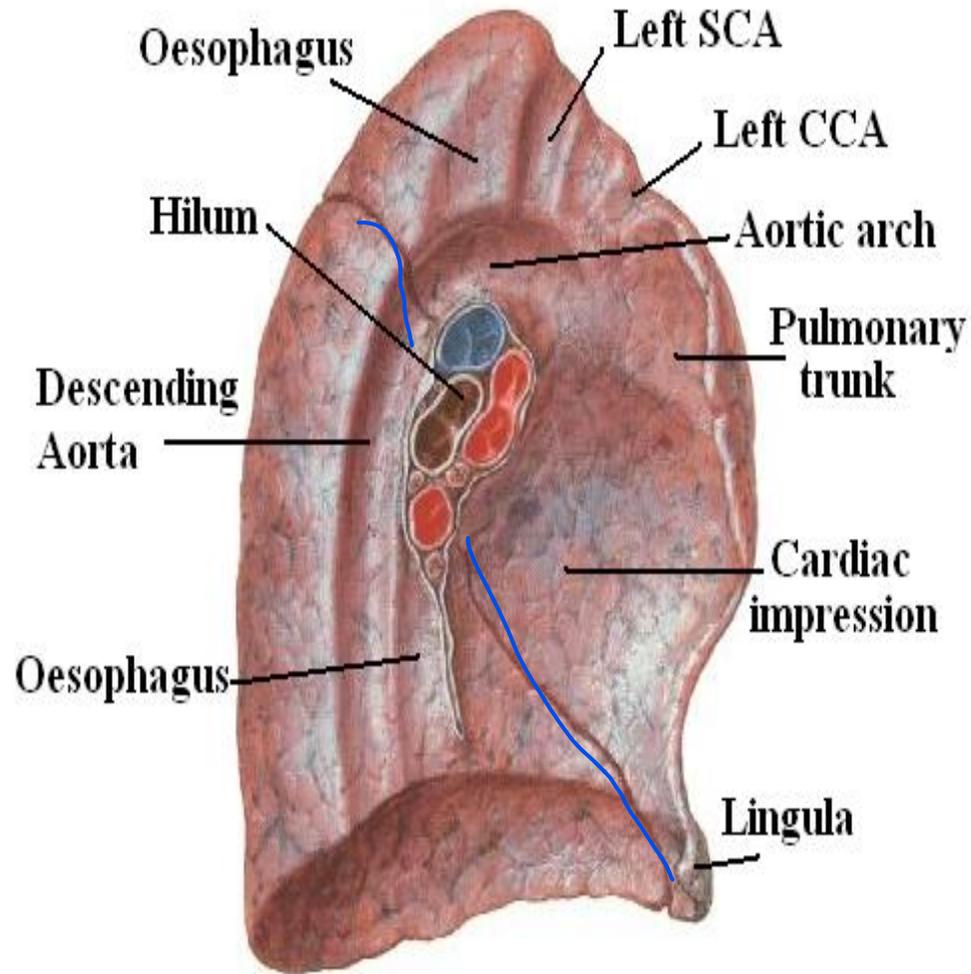
# Lung



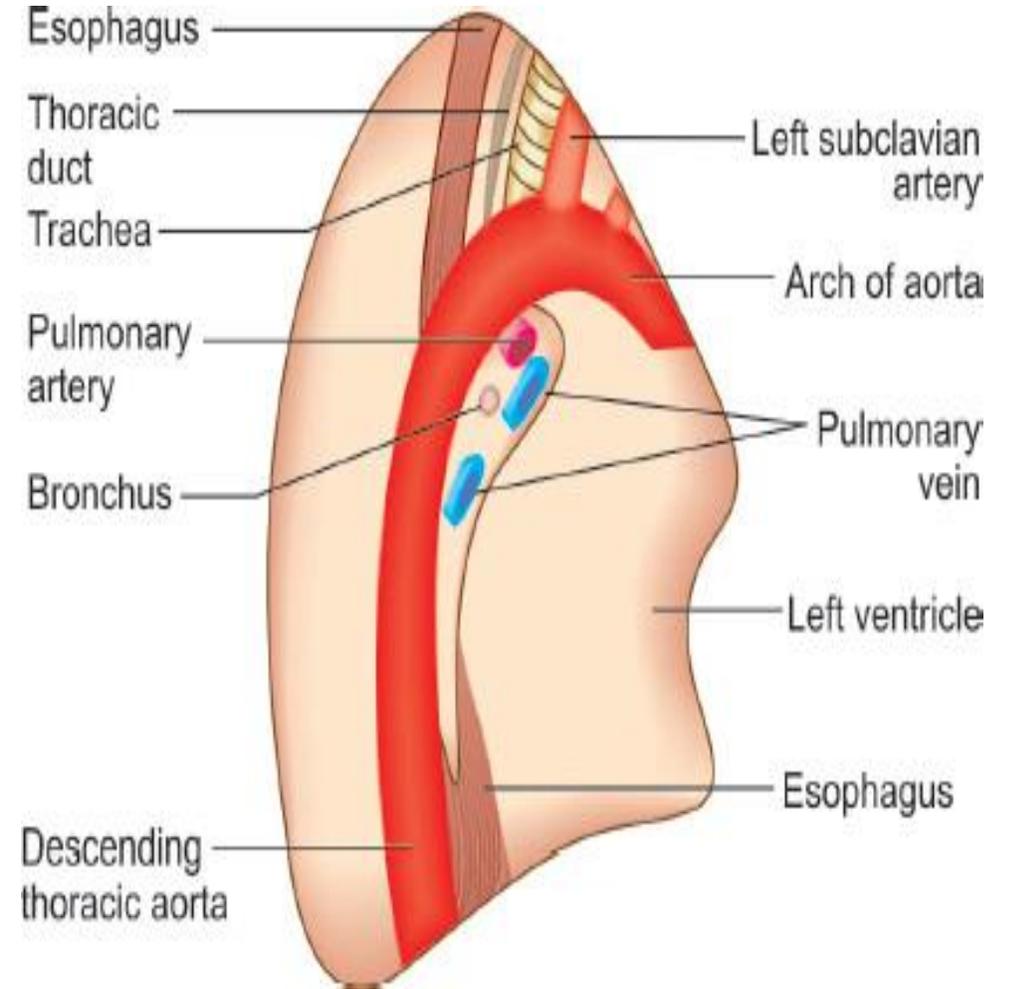
**Right lung**



# Lung



left lung



## oblique fissure

- ❖ Present on both lungs

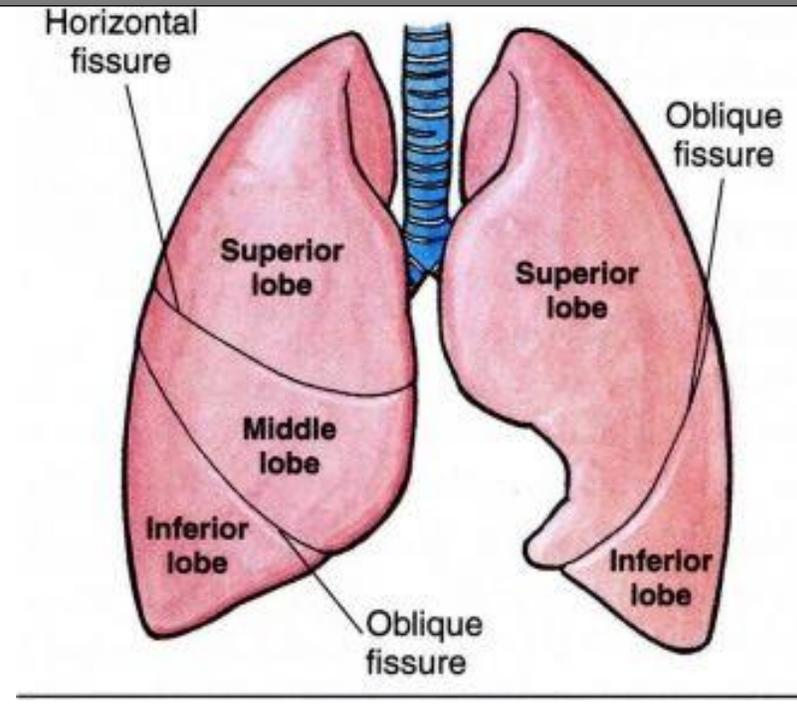
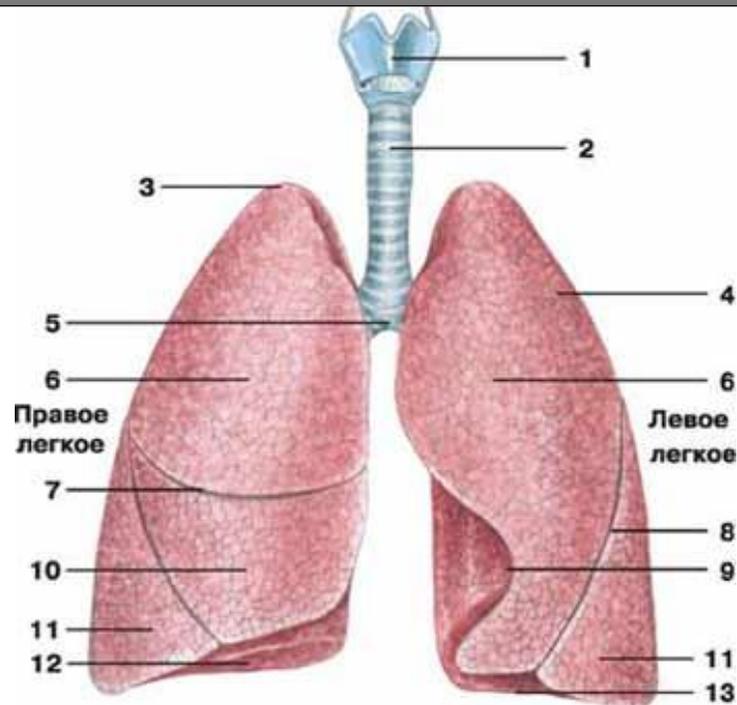
## Horizontal fissure

- ❖ In the right lung only.
- ❖ Opposite the 4<sup>th</sup> rib

## E) Fissures

## F) Lobes

- ❖ The right lung: 3 lobes: upper, middle and lower.
- ❖ The left lung: 2 lobes: upper and lower.



# Root of Lung

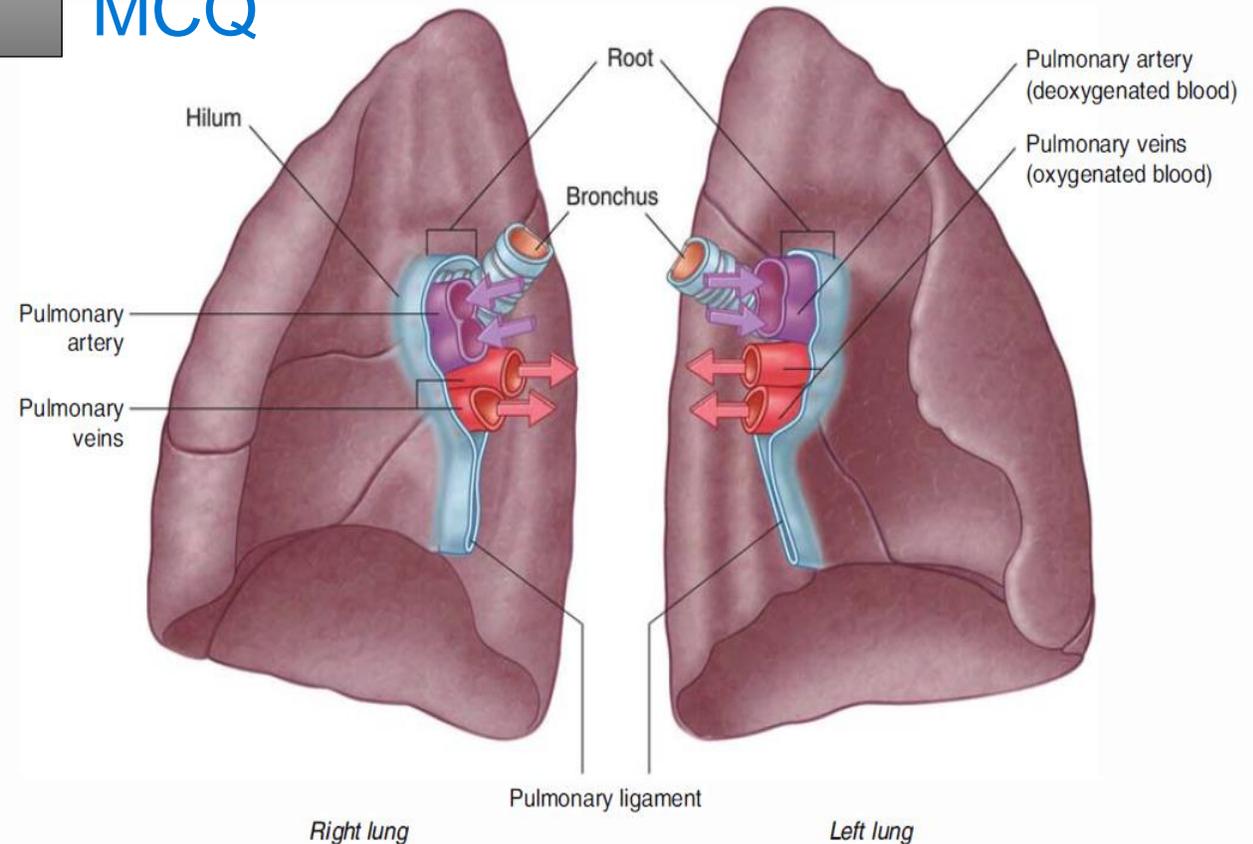
## Definition

❖ Structures which enter or leave the lung at its hilum

## Vertebral level

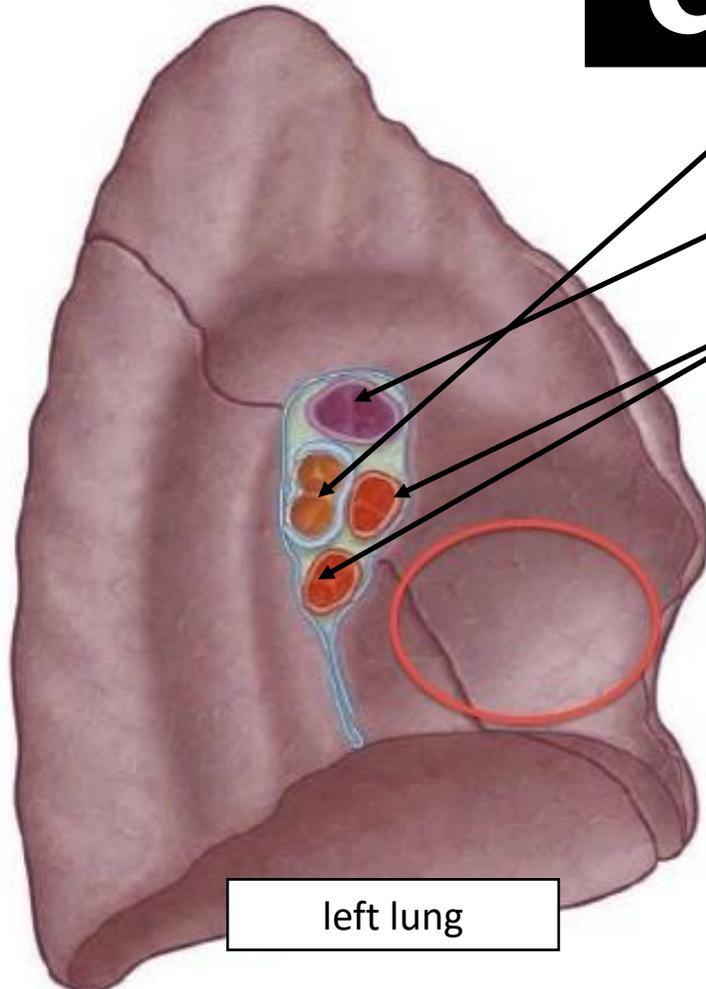
❖ T5 – T7

MCQ



# Root of Lung

## Contents



left lung

**Bronchus**

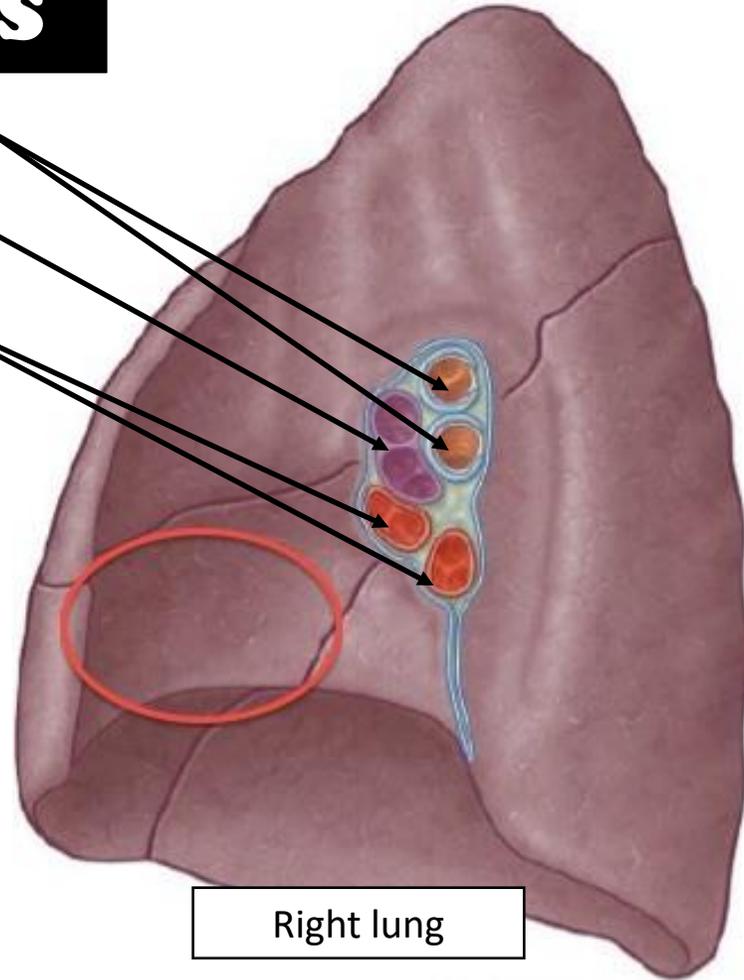
**Pulmonary artery**

**2 Pulmonary veins**

**Bronchial vessels**

**Broncho-pulmonary lymph nodes**

**Anterior & posterior pulmonary plexuses**



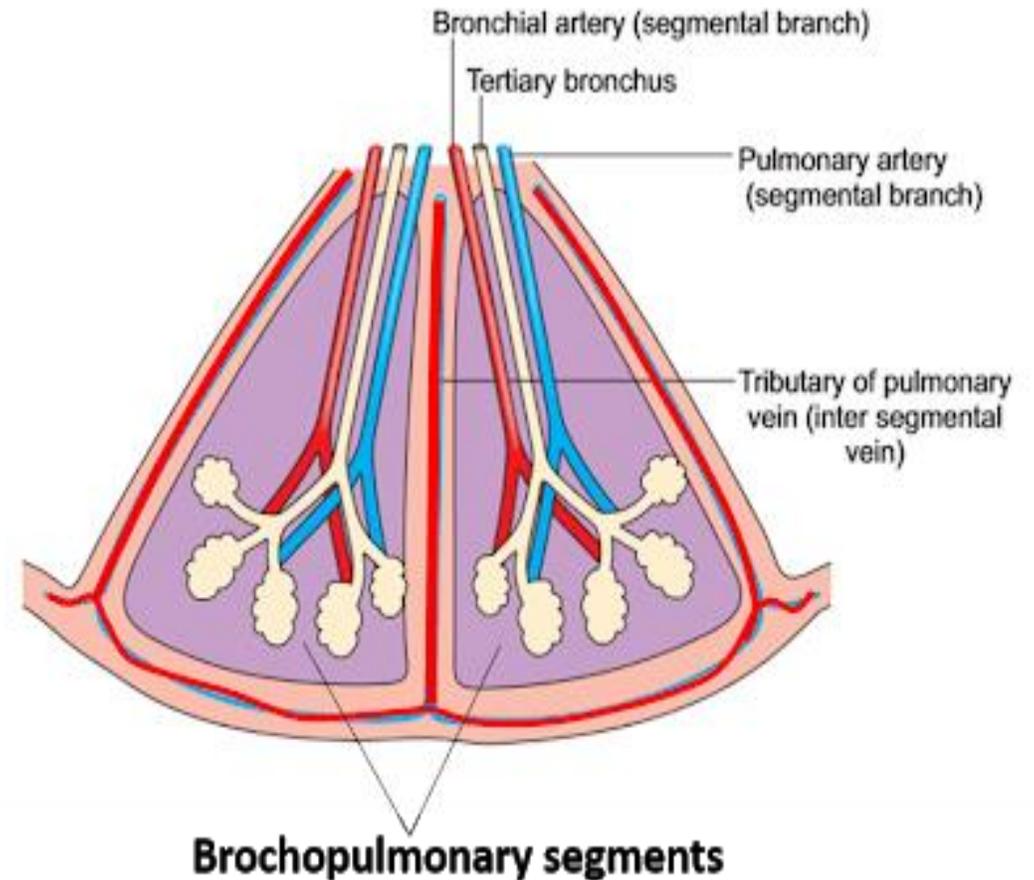
Right lung



# Broncho-pulmonary segments

- ❖ **Definition:** these are functional independent unit of lung tissue.
- ❖ **Structure:** each segment is formed of:
  - 1) Segmental bronchus.
  - 2) Segmental branch of pulmonary artery.
  - 3) Lymph vessel.

**The pulmonary vein runs in the inter-segmental plane. So, the broncho-pulmonary segment is not an anatomical segment.**



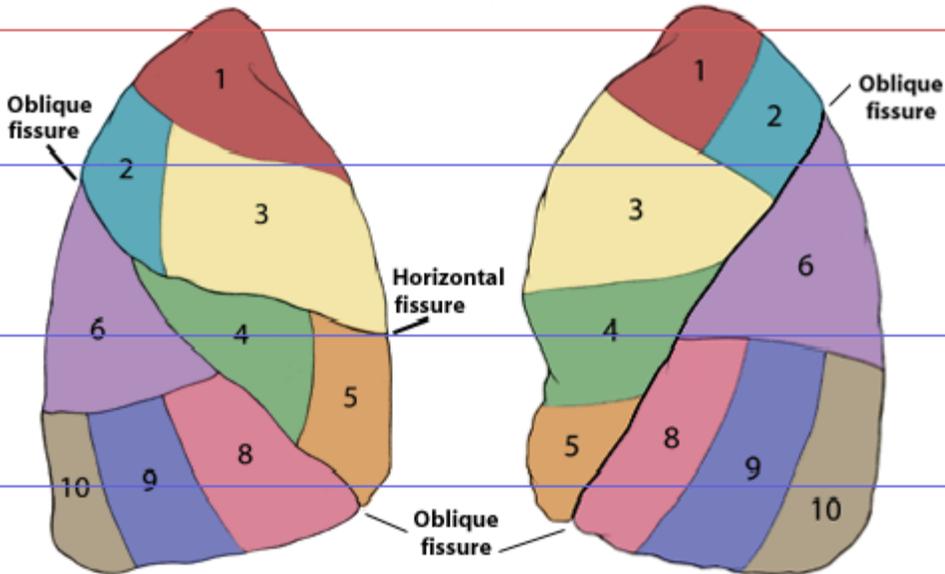
## Right lung (10)

- Upper lobe: **3 segments** (apical, posterior and anterior).
- Middle lobe: **2 segments** (medial and lateral).
- Lower lobe: **5 segments** (apical, medial basal, anterior basal, lateral basal and posterior basal).

## Left lung (8, 9 or 10)

- Upper lobe: **3 segments** (apical, posterior and anterior).
- Lingula: **2 segments** (superior lingular and inferior lingular).
- Lower lobe: **5 segments** (apical, anterior basal, lateral basal, posterior basal and medial basal).

However, the medial basal segment is usually absent.



# Lung

## Blood supply of lungs

### □ Pulmonary vessels:

- **Pulmonary artery:** carry venous blood from the heart to be oxygenated.
- **Pulmonary vein:** 2 in each lung. Carry oxygenated blood to the left atrium.

## Bronchial vessels

### Bronchial arteries

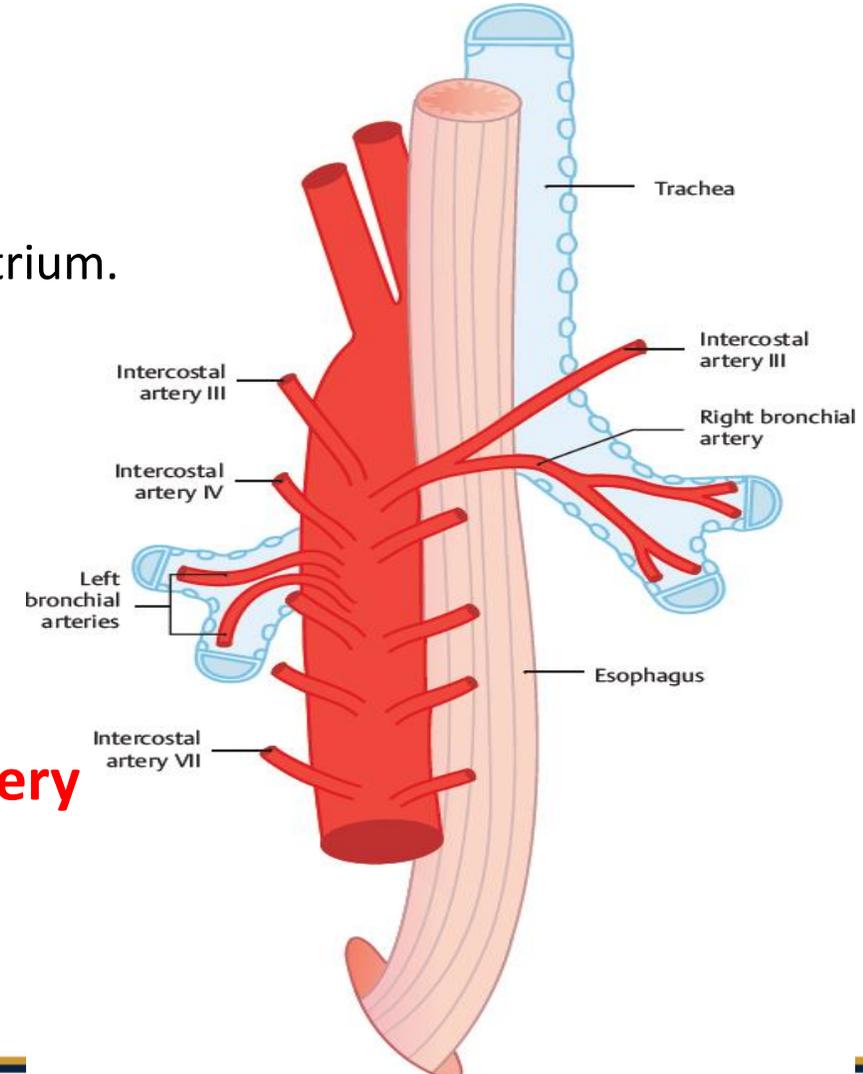
- carry oxygenated blood to the lungs.

Origin: **one artery in the right lung and 2 in the left lung.**

- **Left arteries arises from the descending aorta.**
- **Right artery arises from the upper left bronchial artery or the right 3<sup>rd</sup> posterior intercostal artery.**

Course: passes in the posterior wall of the bronchus.

Distribution: **supply the lung and visceral pleura.**



# Lung

## Blood supply of lungs: continued

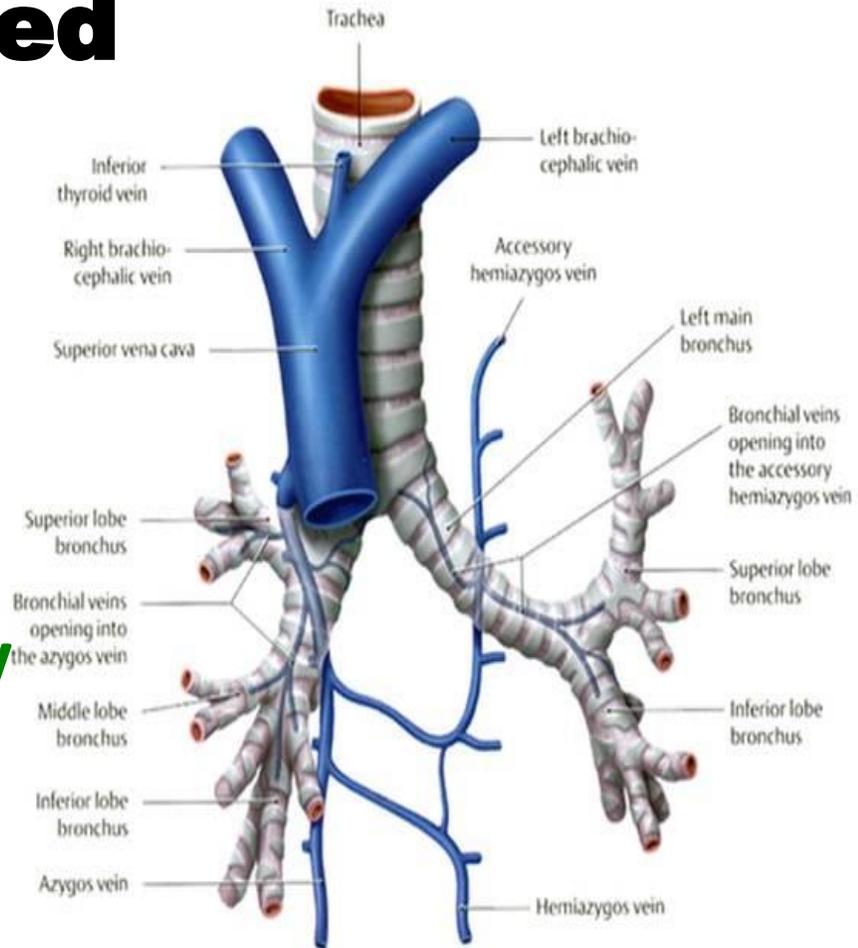
### Bronchial veins

end in Right side: **azygos vein.**

Left side: **superior hemi-azygos vein.**

## Lymph drainage of lungs

Lymphatics of the lung drain in the **pulmonary** and **bronchopulmonary** lymph nodes.



# Q: Compare between right & left lung

	<b>Right lung</b>	<b>Left lung</b>
<b>Size</b>	Larger	Smaller
<b>Length</b>	Shorter	Longer
<b>Lobes</b>	3 lobes (superior, middle & lower)	2 lobes (superior & lower)
<b>Fissures</b>	2 (oblique & horizontal)	One (oblique)
<b>Bronchus</b>	Divides before entering the hilum.	Divides after entering the hilum.
<b>Cardiac notch</b>	Absent	Present
<b>Base</b>	More concave	Less concave
<b>Bronchial artery</b>	One artery.	Two arteries.
<b>B.P. segments:</b>	10 segments.	8, 9 or 10 segments.



# Development of face & Palate

Department of human Anatomy and Embryology  
Faculty of Medicine  
Mansoura National University, Egypt

M N U

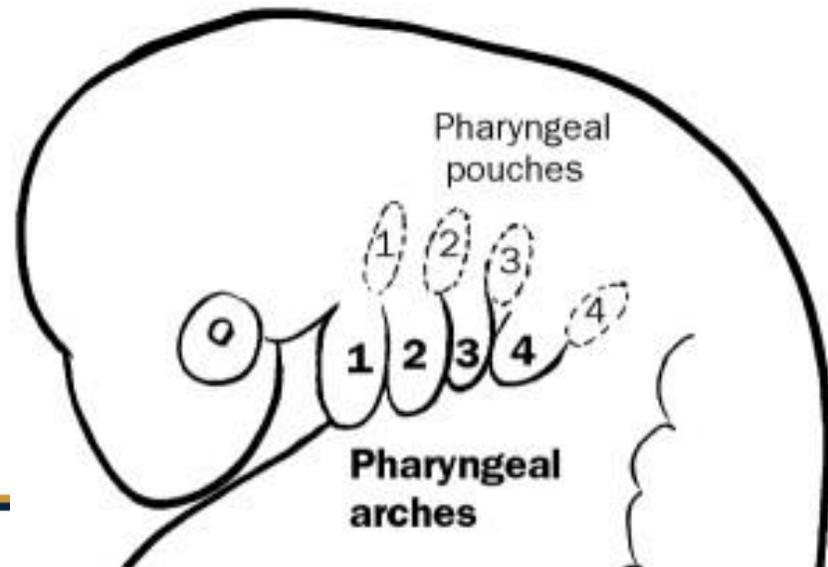
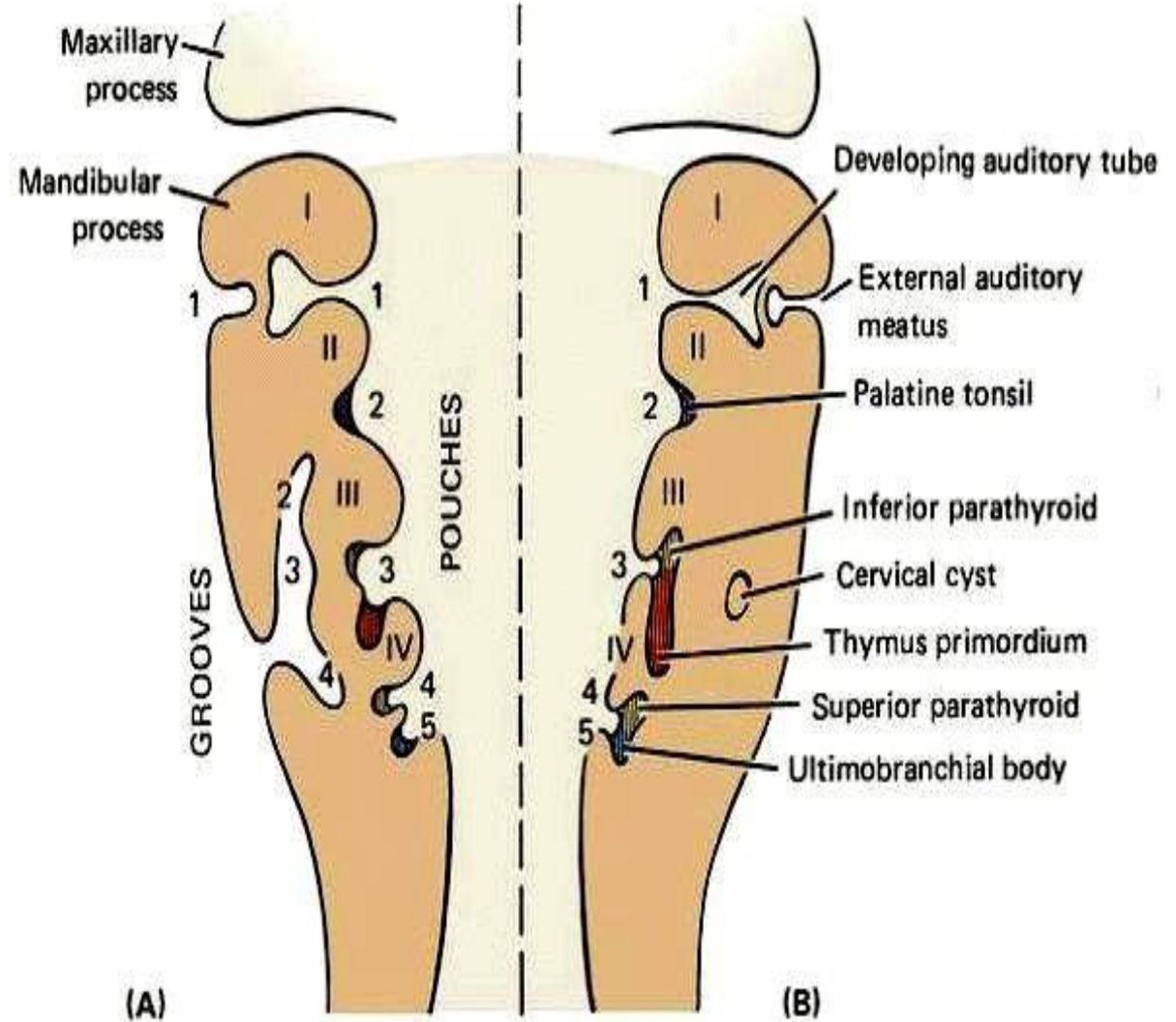


# Pharyngeal Apparatus

The *head & neck* region develops from the **pharyngeal apparatus**.

It is formed of:

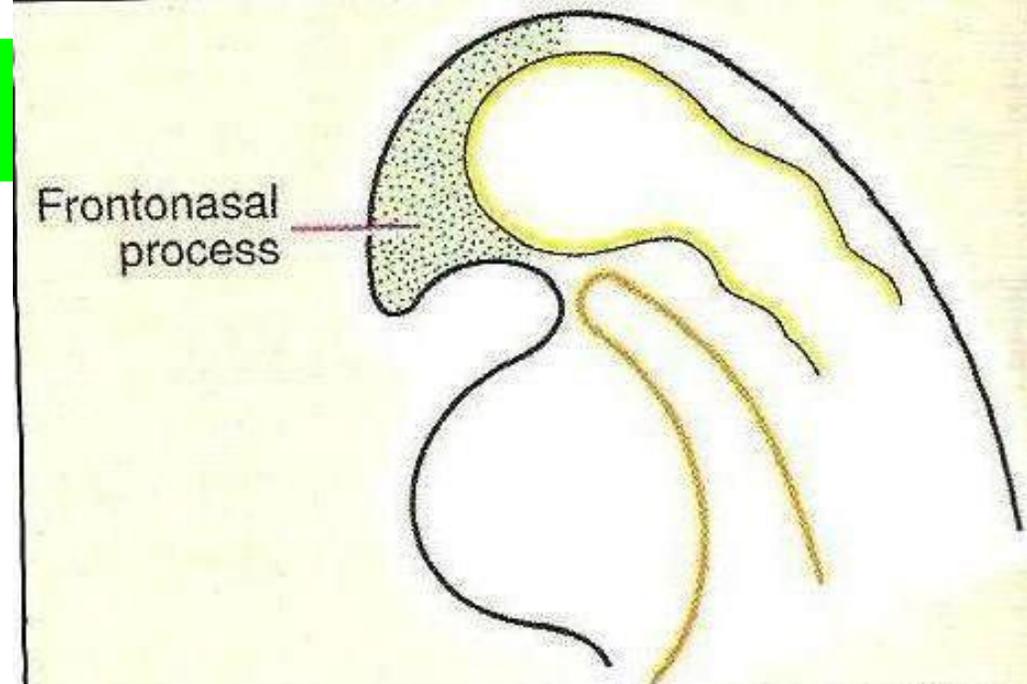
- 1 Pharyngeal **arches** (6 arches)
- 2 Pharyngeal **grooves or clefts** (externally).
- 4- Pharyngeal **pouches** (internally).



# Face development

Face is derived from the following structures that lie around the stomodaeum (4<sup>th</sup> week):

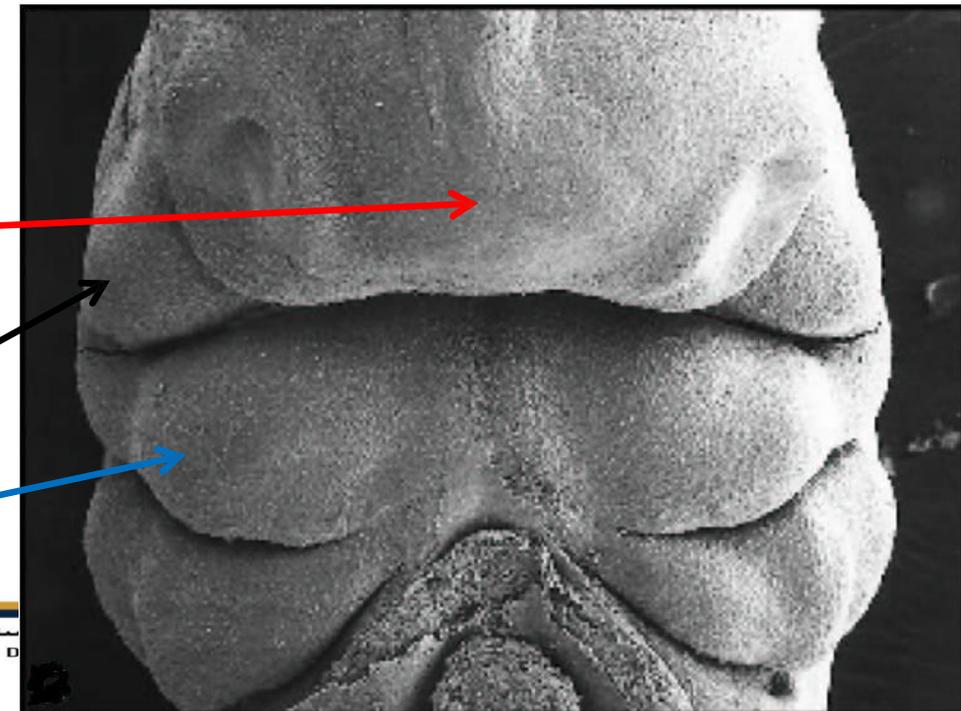
1. Frontonasal process (mesoderm)
2. 1<sup>st</sup> Pharyngeal (mandibular) arch of each side:
  - (a) Maxillary process (Dorsal part)
  - (b) Mandibular process (Ventral part)

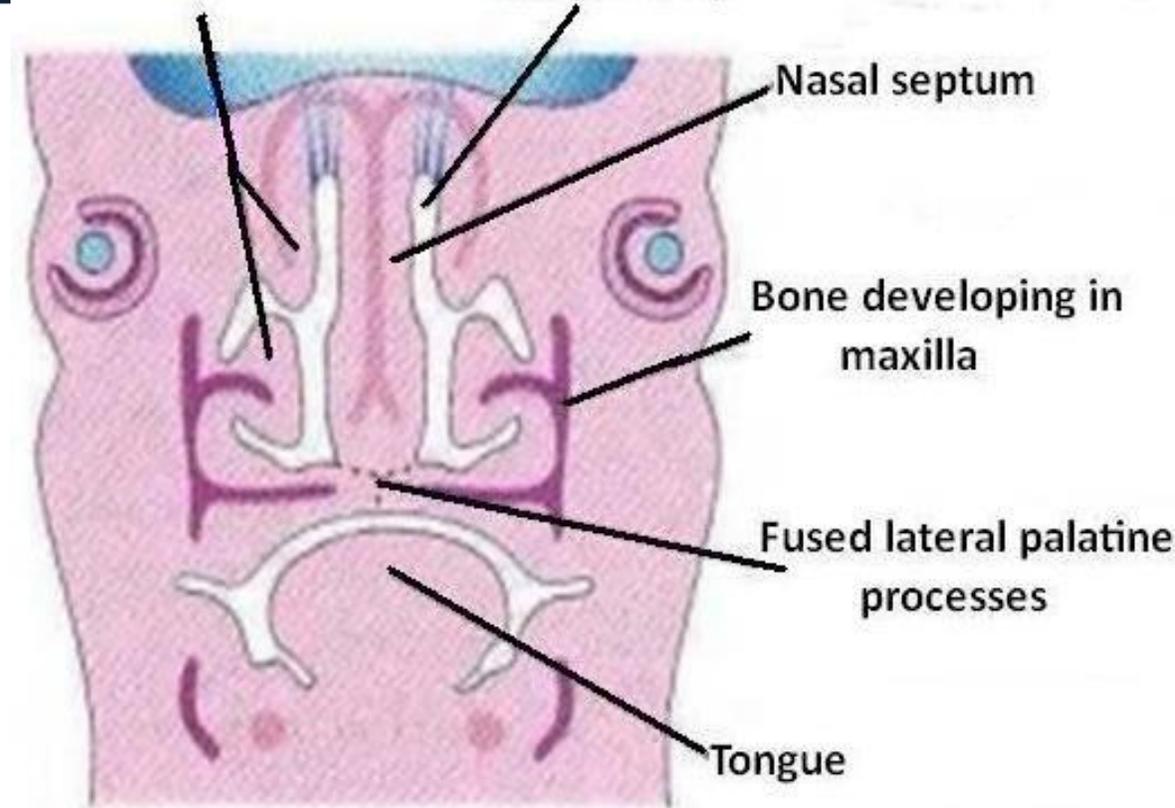


**1 Frontonasal prominence**

**2 Maxillary prominences**

**2 Mandibular prominences**

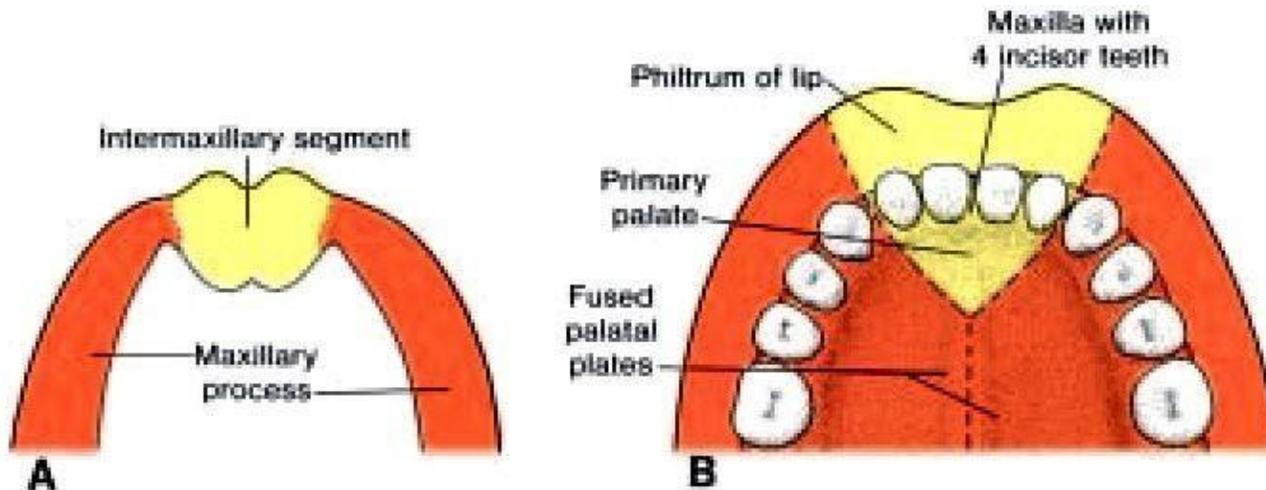




## Development of Palate

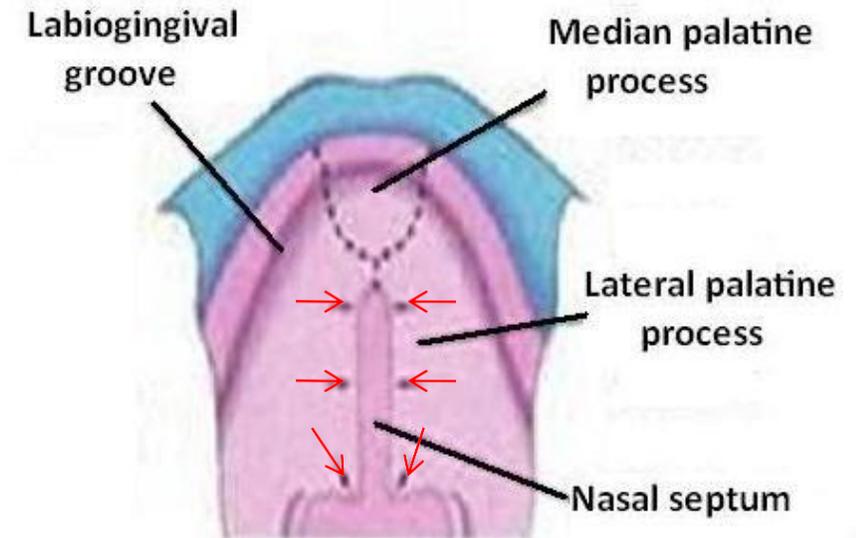
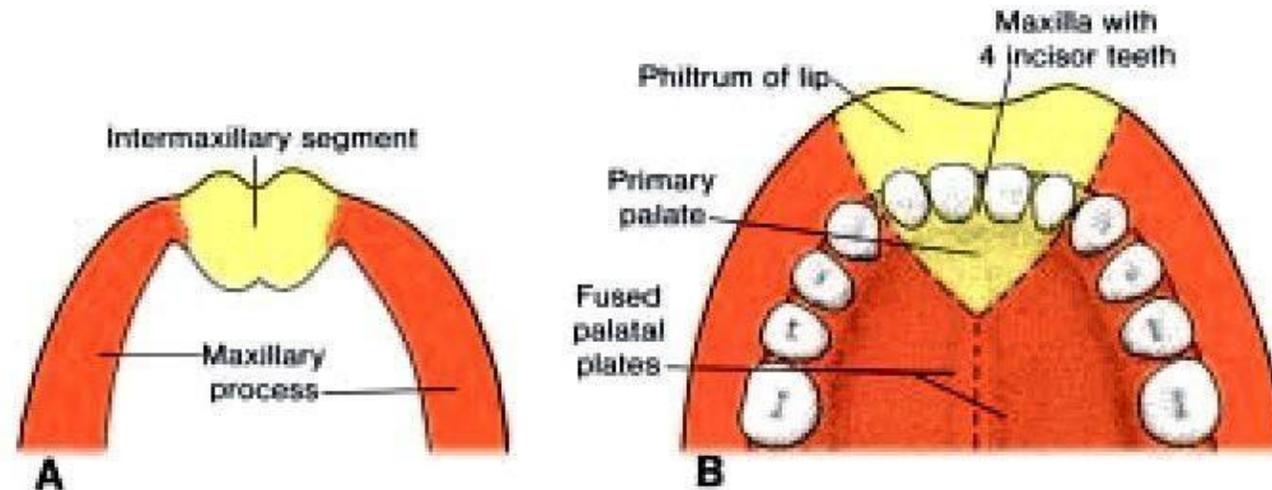
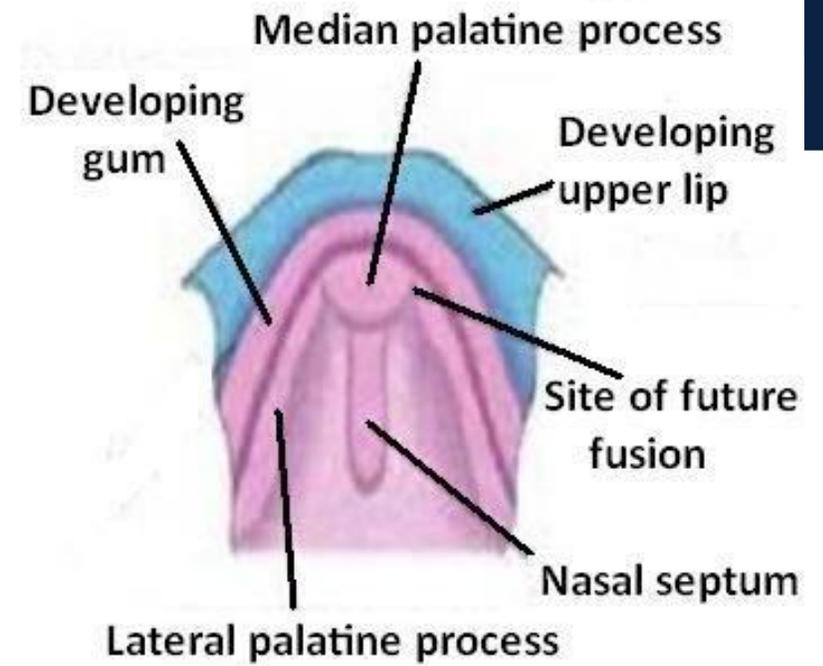
Begins at the end of the 5<sup>th</sup> week.

- The palate develops from two primordia:
  - The Primary palate
  - The Secondary palate



## The Primary Palate

- Begins to develop:
  - Early in the 6<sup>th</sup> week.
  - From the deep part of the intermaxillary segment, as median palatine process.
- Fuses with the developing secondary palate.



# Anomalies related to Face & Palate

SAQ

## Facial clefts

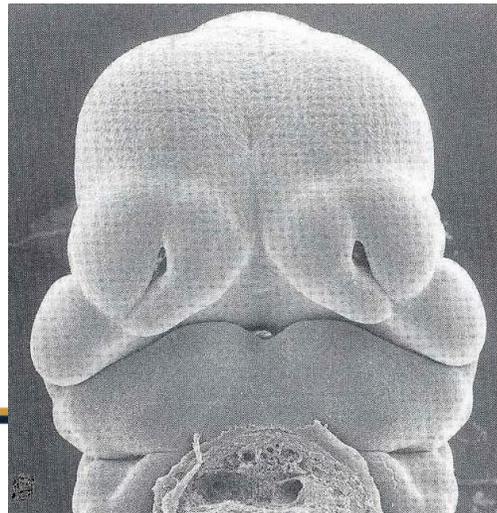
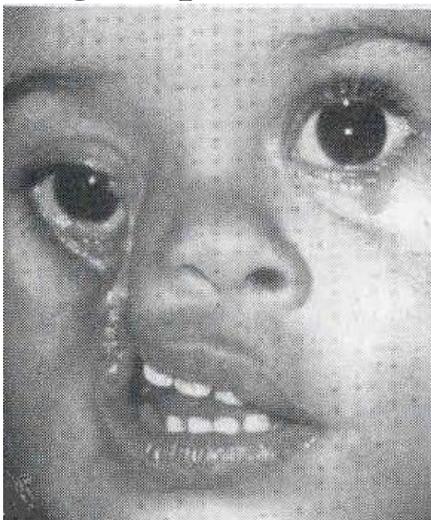
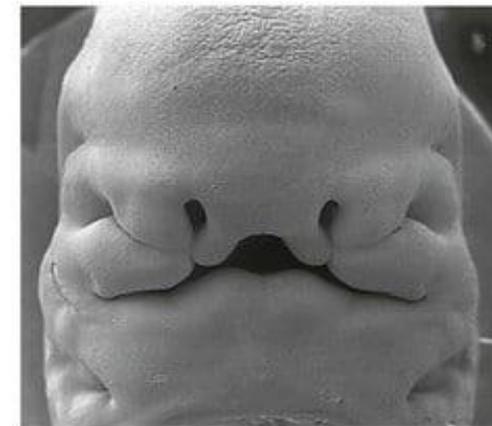
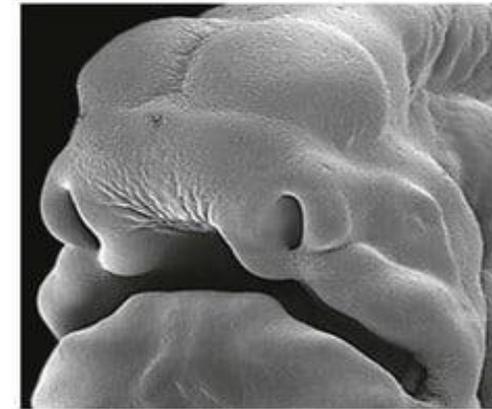
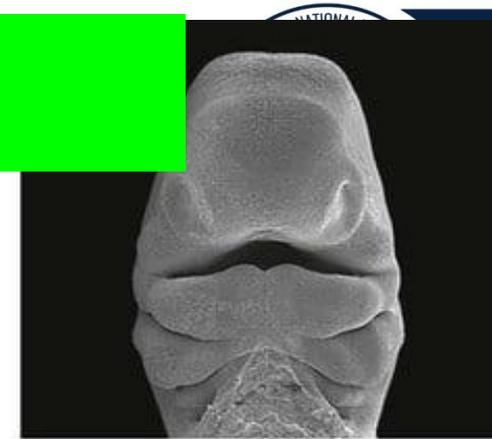
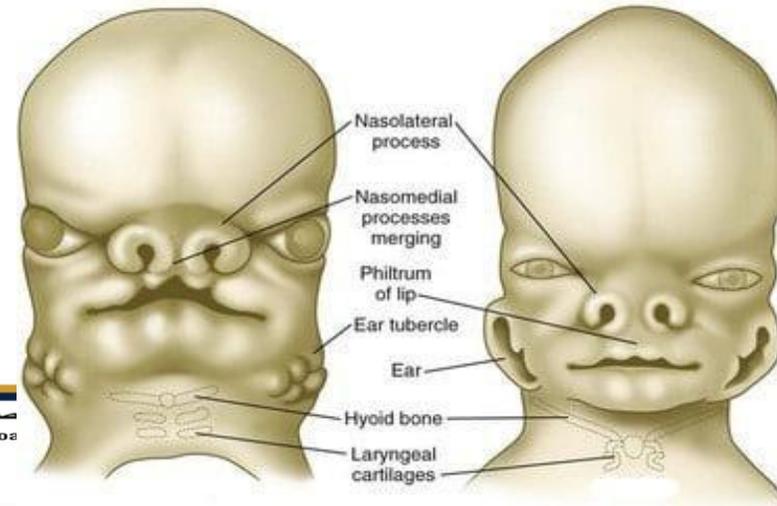
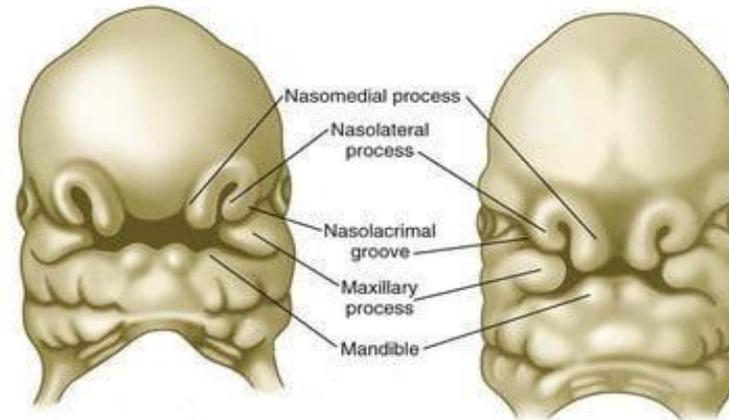
Failure of the embryonic facial prominences to fuse properly

May be unilateral or bilateral

May involve:

- Lips only: **Cleft lip**
- Palate only: **Cleft palate**
- Lip & palate: **Cleft lip & palate**
- Region of nasolacrimal groove: **Facial clefts**

Lead to difficulty in breathing feeding sucking swallowing & speech



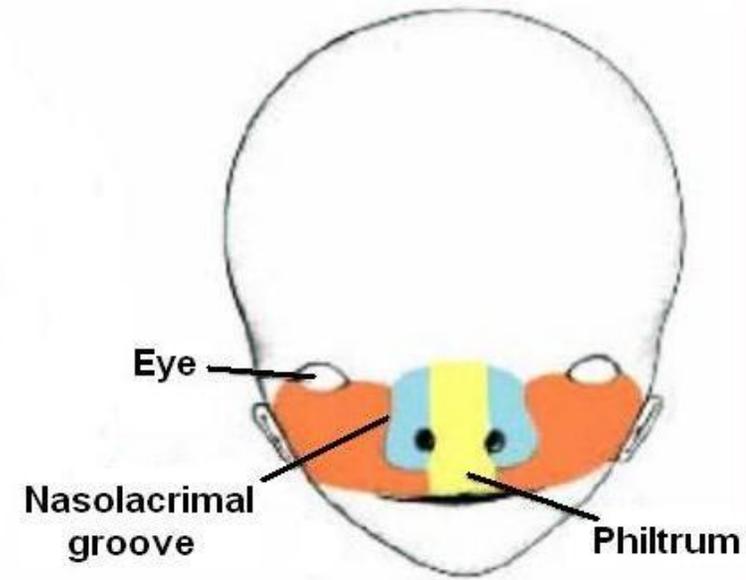
# Oblique facial cleft: results

from failure of the

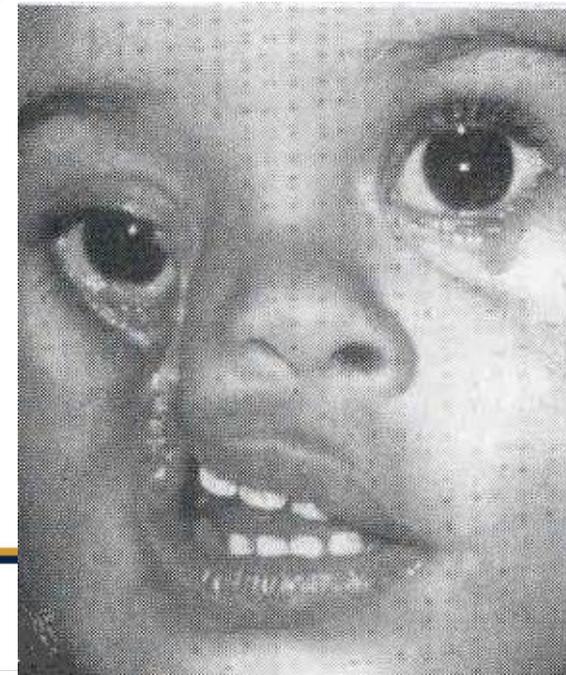
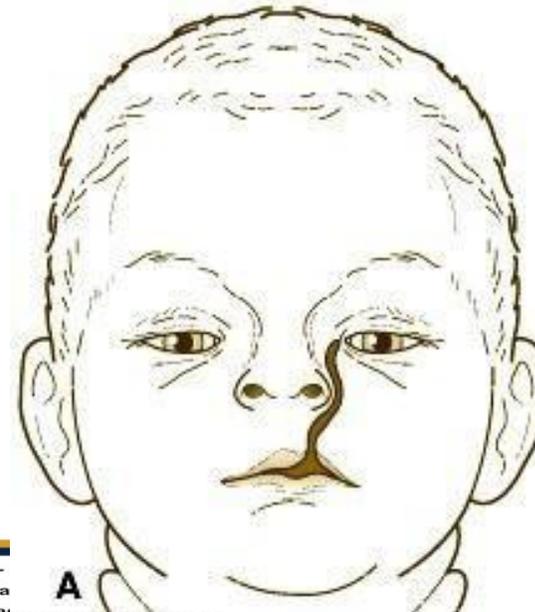
maxillary prominence to fuse

with the lateral nasal

prominence.



Oblique facial cleft



- **Median cleft upper lip (central hare lip):**

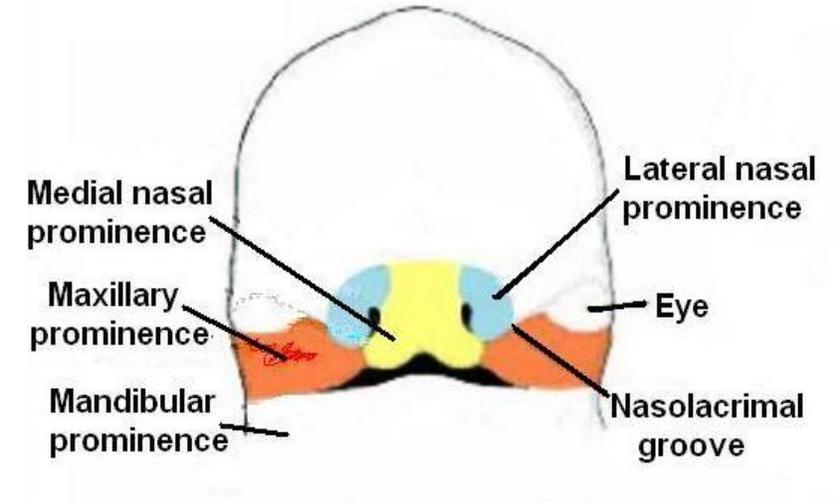
Results from failure of the medial nasal prominences to merge and form the intermaxillary segments .

- **Median cleft of the lower lip:**

Caused by failure of the two mandibular processes to fuse together completely.



Median Cleft lip

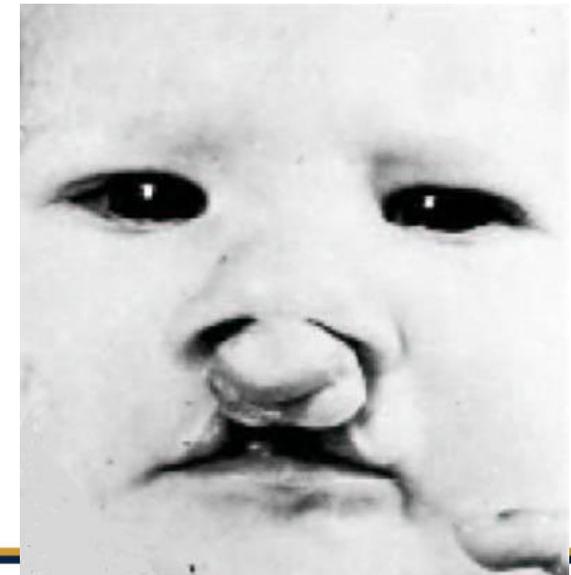


- **Unilateral cleft lip:** result from failure of the maxillary prominence to merge with the medial nasal prominence on the affected side.

- **Bilateral cleft lip:** results due to failure of maxillary prominences to meet and unite with the medial nasal prominences on both sides.

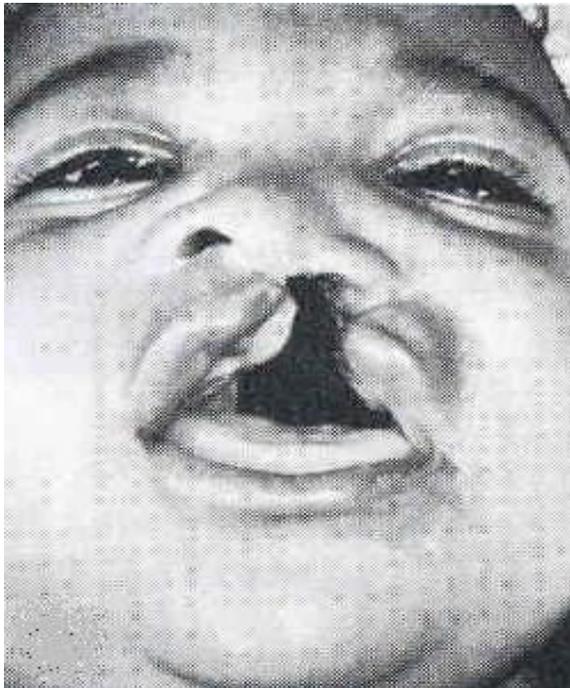


Unilateral cleft lip

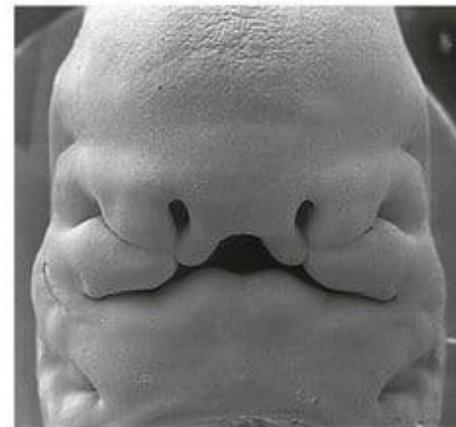
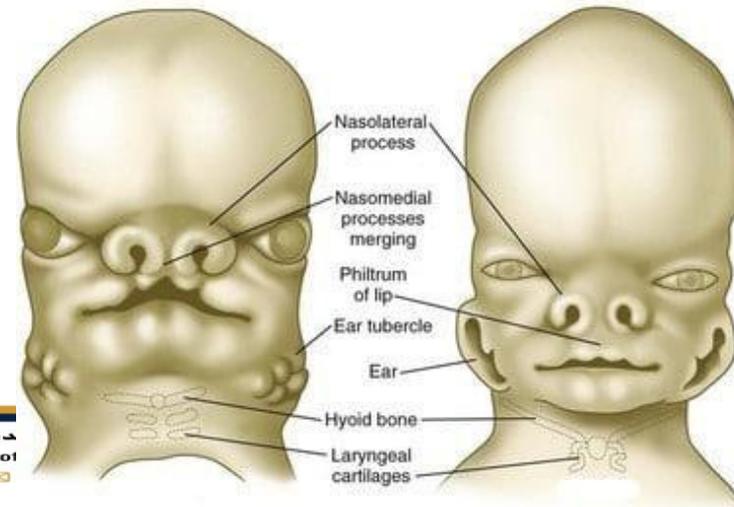
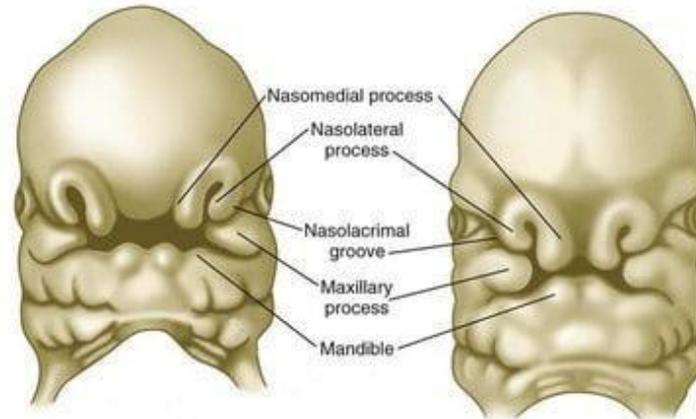
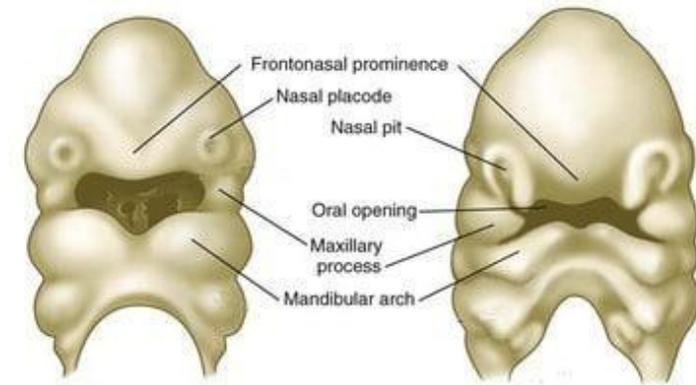


Bilateral cleft lip

**Cleft palate** leaves the nasal and oral cavities connected & results in nursing problem for the new born.



Cleft lip, cleft jaw & cleft palate





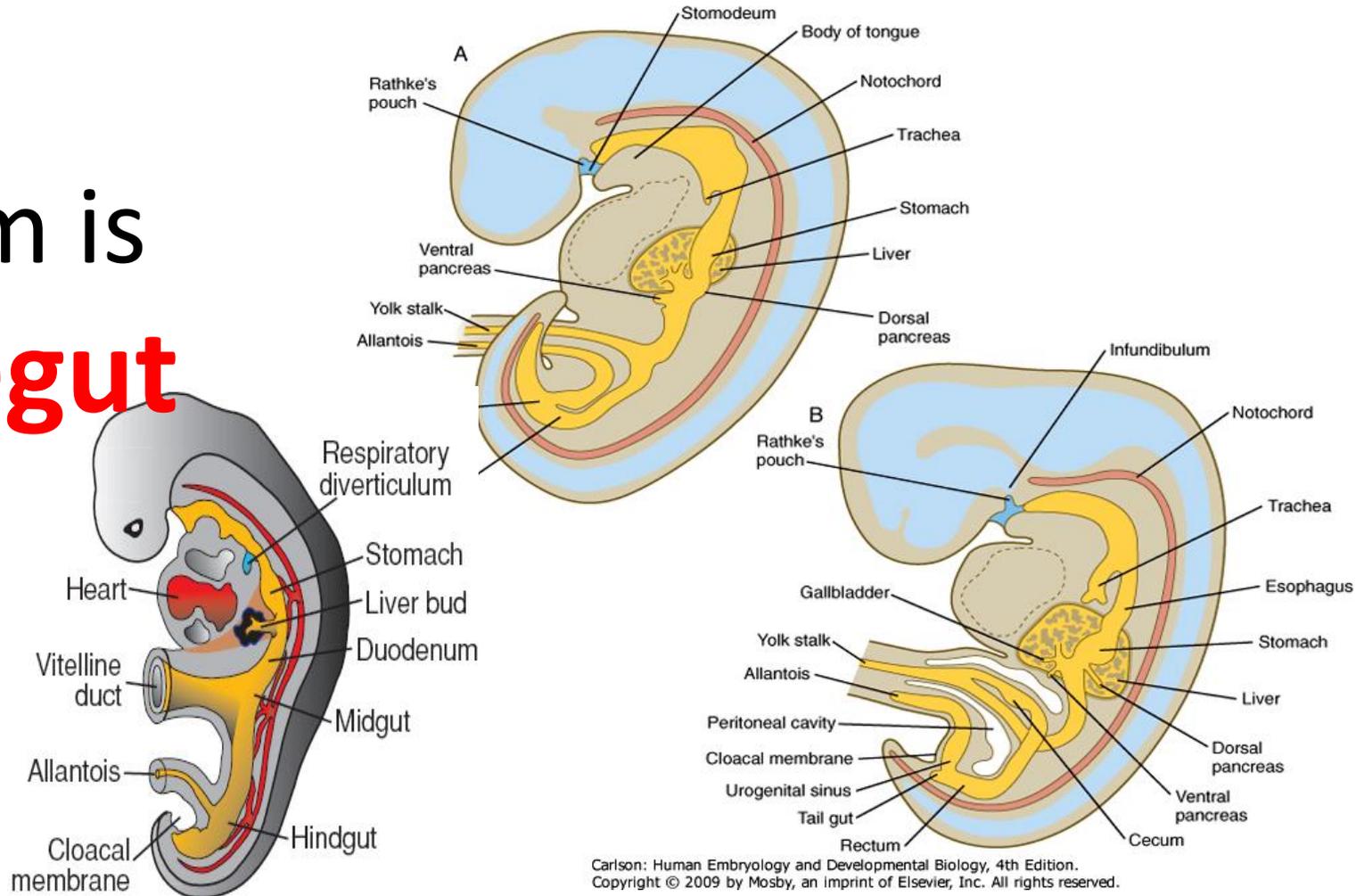
# Development of respiratory system

Department of human Anatomy and Embryology  
Faculty of Medicine  
Mansoura National University, Egypt

Edited by  
Dr. Fekry Shata



# Respiratory system is derived from **Foregut Endoderm**

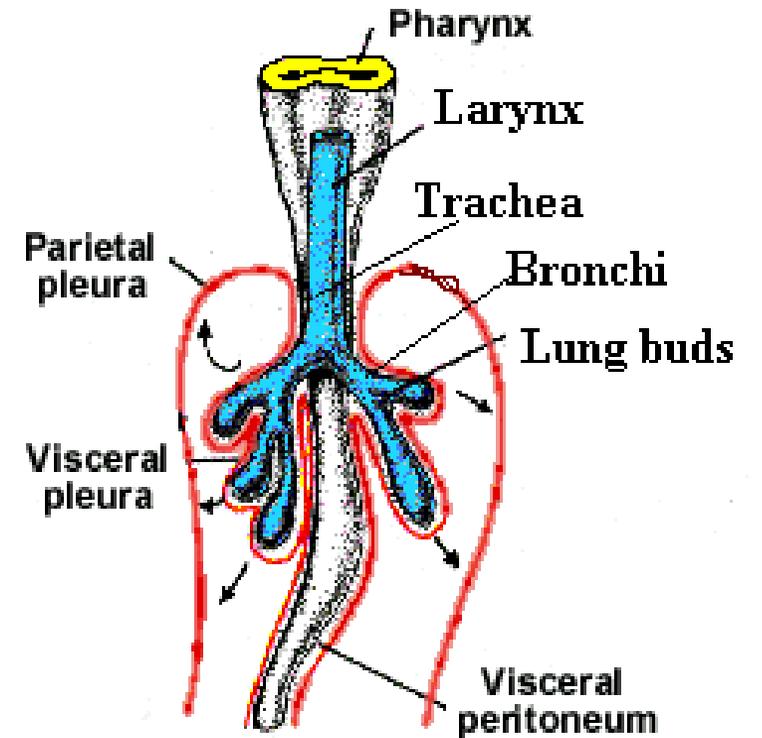


Carlson: Human Embryology and Developmental Biology, 4th Edition. Copyright © 2009 by Mosby, an imprint of Elsevier, Inc. All rights reserved.



## Derivatives of laryngo-tracheal tube

1. Larynx.
2. Trachea.
3. Bronchi.
4. Lung buds.





# Development of larynx



## SAQ

# Development of larynx

- **Epithelium:** from **cranial part of laryngo-tracheal tube.**
- **Cartilages & muscles:** from the **4<sup>th</sup> & 6<sup>th</sup> pharyngeal arches.**
- **Nerves:** from Vagus nerve
  - 1-**Superior laryngeal nerve:** for those developed from the 4<sup>th</sup> arch.
  - 2-**Recurrent laryngeal nerve:** for those developed from the 6<sup>th</sup> arch.

## MCQ





# Development of THE LUNG



# Development of the lung

From the **lung buds**.  
may **last for 8 years after birth**.

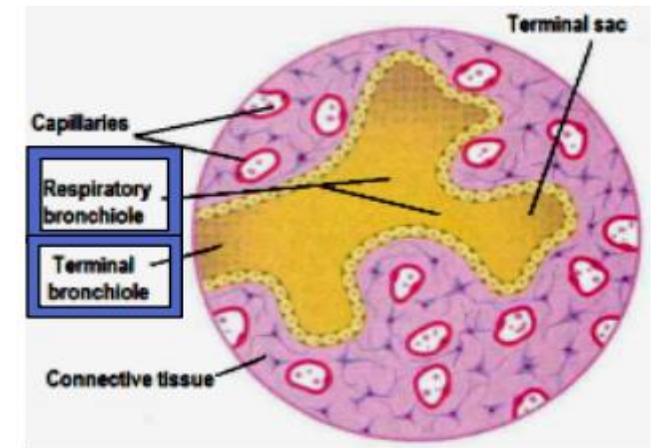
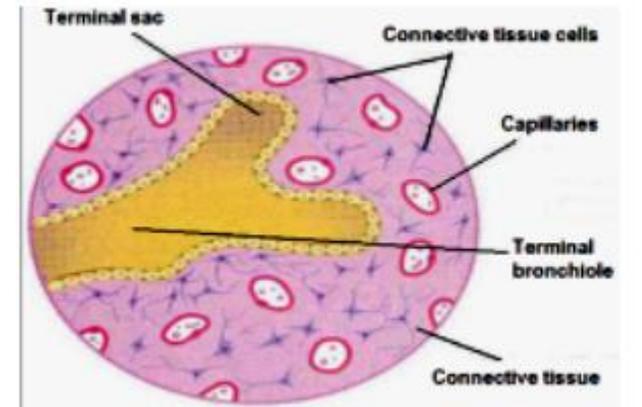
## ➤ Stages of lung maturation: (4 Stages).

### 1. Pseudoglandular stage : (1-4 month).

- Repeated divisions to form bronchi and terminal bronchioles.
- The lung resembles an exocrine gland, **respiration is NOT possible**

### 2. Canalicular stage : (4-6 month).

- Each terminal bronchiole divides into 2 respiratory bronchioles which divide into 4-6 alveolar ducts. **Respiration is possible at the end of this period**



# Development of respiratory system

## 3. Terminal stage : (6 month-Birth).

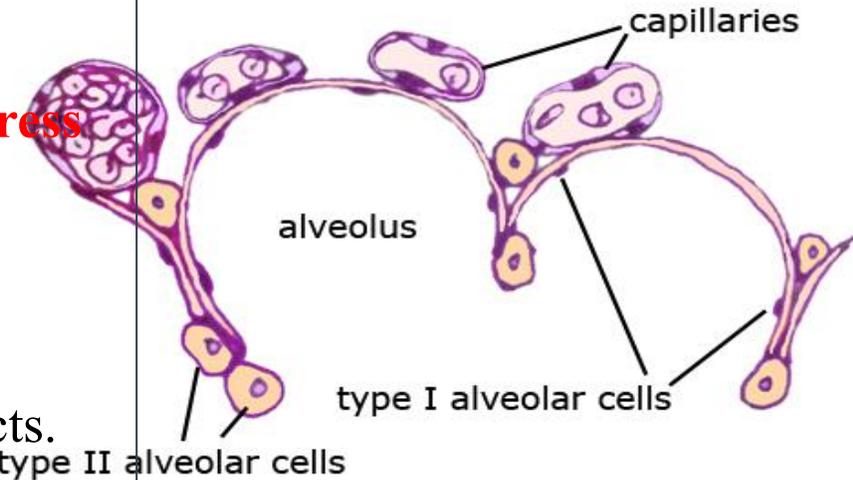
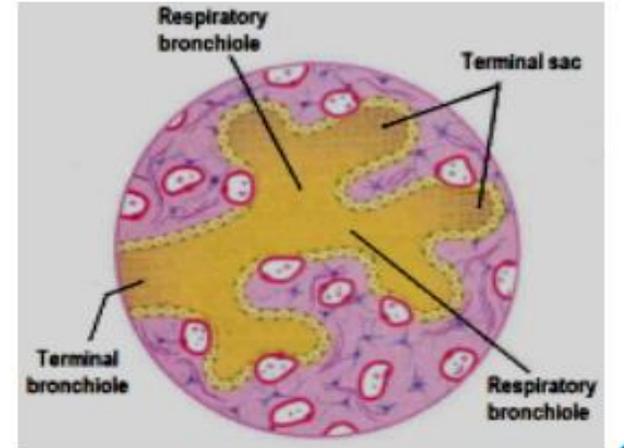
- Primitive alveoli (alveolar sac) are formed and capillaries establish close contact.

- **Surfactant** production begins by **20 weeks** and **increases** during the terminal stages of pregnancy.

- Fetuses born prematurely at 24-26 weeks may suffer from **respiratory distress** due to **surfactant deficiency** but **may survive** if given **intensive care**

## 4. Alveolar stage : (8 month-8years).

- Mature alveoli have well-developed epithelial endothelial (capillary) contacts.



# Development of respiratory system

## ➤ Alveoli have two types of cells:

- **Type I pneumocytes:** represent the main lining of the alveoli.
- **Type II pneumocytes:** **secrete pulmonary surfactant.**

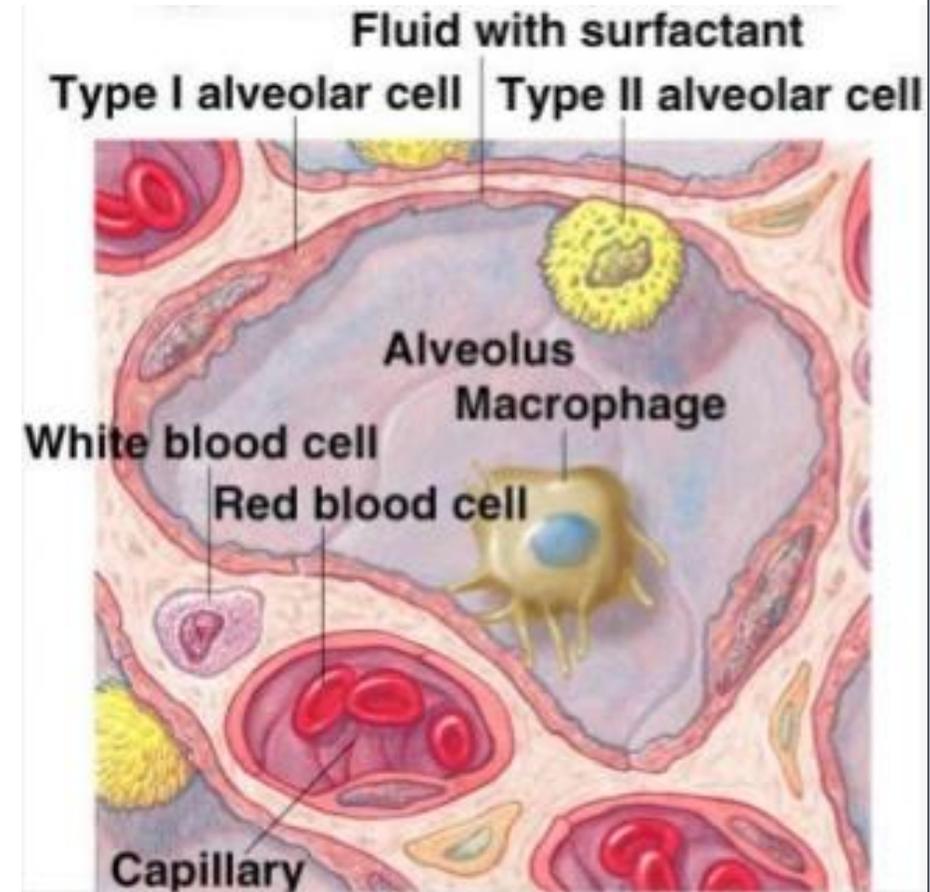
## ➤ **Surfactant production** begins at 20 - 22 weeks.

- At **26 – 28 weeks** sufficient amount of surfactant is present.

So, if the fetus is born at the end of terminal sac period he can survive

Women who expected to have preterm labor are given

**glucocorticoids** because it increases the production of surfactant.



# Congenital anomalies of respiratory system

## 1. Respiratory distress syndrome (hyaline membrane disease):

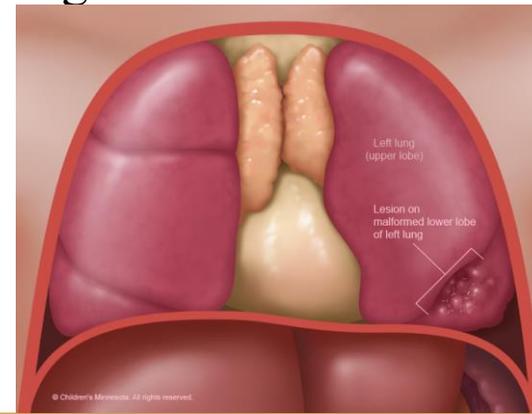
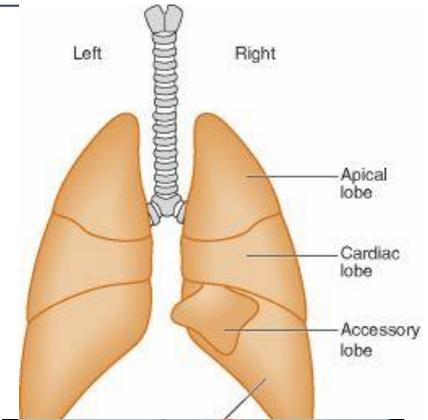
- **Cause:** decreased amount of surfactant.
- **Features:** failure of the alveoli to ventilate adequately.

## 2. Ectopic lung lobes:

- **Cause:** may be due to additional respiratory buds arising from the foregut.
- **Features:** the ectopic lung lobe may arise from the trachea or esophagus.

## 3. Congenital cysts of the lung:

- **Features:** dilatation of the terminal bronchiole with formation of multiple lung cysts.



# Congenital anomalies of respiratory system

## 4. Laryngomalacia:

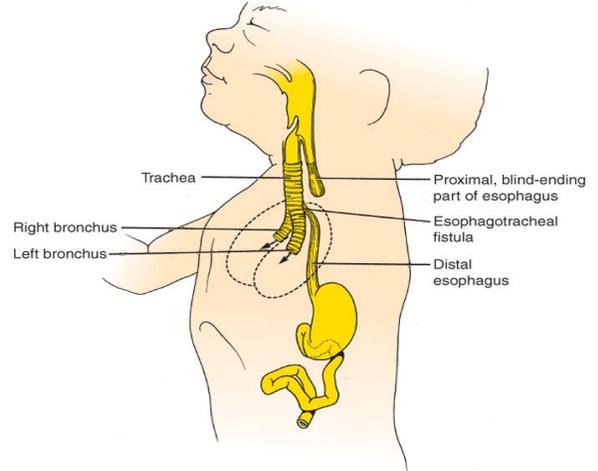
- **Cause:** soft immature cartilages of the larynx.
- **Features:** laryngeal cartilages collapse inwards during respiration.
- It is the most common cause of chronic stridor in infancy.

## 5. Tracheomalacia:

- **Features:** soft tracheal cartilages that collapse during respiration.

## 6. Esophageal atresia with or without trachea-esophageal fistula:

- **Cause:** incomplete development of tracheoesophageal septum.
- **Features:** many forms are present



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# Development of DIAPHRAGM



# Development of the diaphragm

➤ **Sources:** The diaphragm develops from **mesodermal** sources:

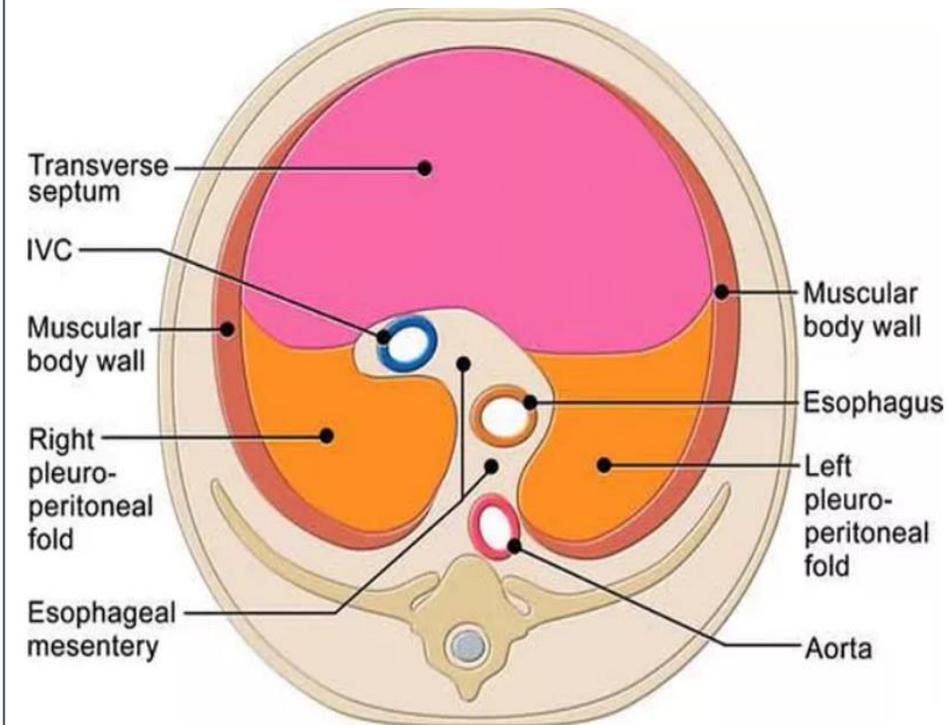
**1-Septum transversum:** forms the **central tendon**.

**2-Pleuroperitoneal membranes:** form the **posterolateral parts** of the diaphragm.

**3-Mesentery of the esophagus:** forms the **crura** of the diaphragm.

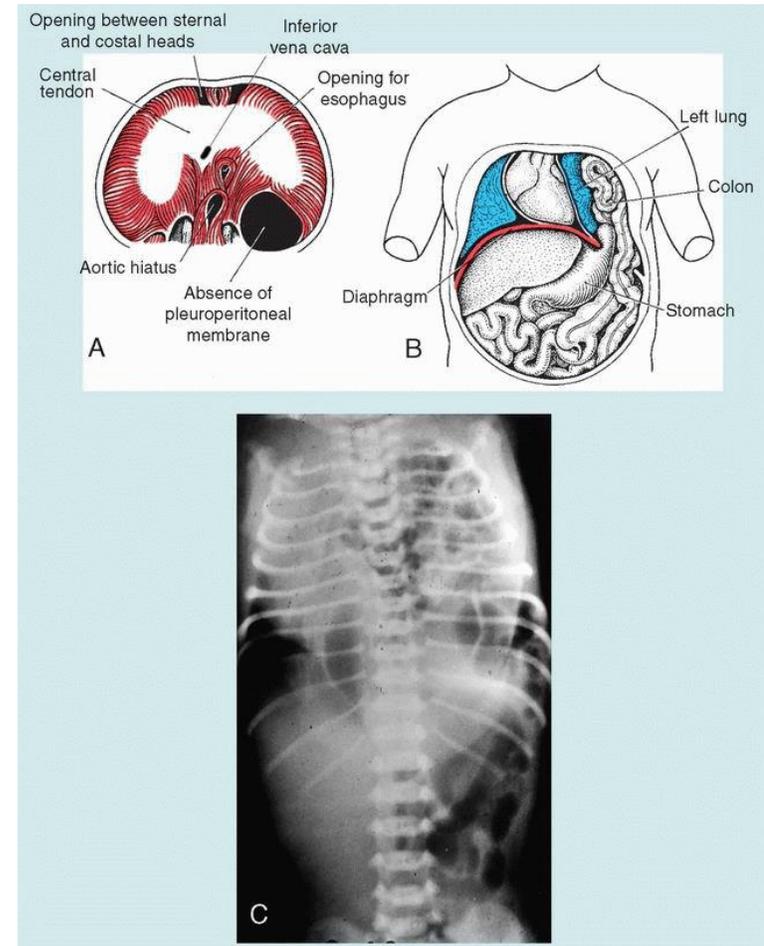
**4-Mesenchyme of the lateral and dorsal body walls:** form the **peripheral part** of the diaphragm.

**5-Myoblasts from the 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> cervical myotomes:** they migrate drawing the phrenic nerve with them.



# I. Congenital Diaphragmatic Hernias

- ❑ **Cause:** Defects in this process of separating the abdominal and thoracic cavities.
- ❑ **Feature:** abdominal contents herniate into pleural cavities and interfere with lung development.
- ❑ It is more common on the left side



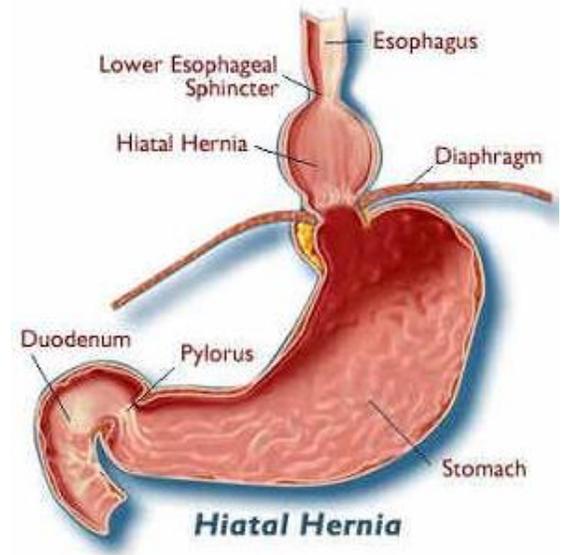
# Congenital anomalies of the diaphragm

## II-Parasternal (Retrosternal) hernia:

- **Cause:** failure of development of the anterior part of the mesenchyme of the lateral body wall.
- **Features:** herniation of the abdominal viscera through a small defect between the sternal and costal origins of the diaphragm.

## III-Congenital hiatal hernia:

- **Cause:** large sized esophageal orifice or congenital shortening of the esophagus.
- **Features:** the cardia and upper part of the stomach are herniated in the thorax.





# Quiz

**Bulla ethmoidalis is located in**

- A) Sphenoethmoidal recess**
- B) Superior meatus**
- C) Middle meatus**
- D) Inferior meatus**

**Answer: C**





# Quiz

**Bulla ethmoidalis is formed by**

- A) Sphenoethmoidal recess**
- B) Superior ethmoidal sinus**
- C) Middle ethmoidal sinus**
- D) posterior ethmoidal sinus**

**Answer: C**



# Quiz

**What is the origin of the 2<sup>nd</sup> posterior intercostal artery?**

- A) From the internal thoracic artery**
- B) From the musculophrenic artery**
- C) From the superior epigastric artery**
- D) From the superior intercostal artery**
- E) From the descending thoracic aorta**

**Answer: D**

# Quiz

Is the termination of posterior ethmoidal sinus

- A) Sphenoethmoidal recess
- B) Superior meatus
- C) Middle meatus
- D) Inferior meatus

**Answer: B**





# Quiz

**Is the termination of anterior ethmoidal sinus**

- A) Sphenoethmoidal recess**
- B) Superior meatus**
- C) Middle meatus**
- D) Inferior meatus**

**Answer: C**



# Quiz

**The anterior intercostal membrane is the continuation of what muscle?**

- A) External Intercostal muscle**
- B) Internal Intercostal muscle**
- C) Subcostalis**
- D) Sternocostalis**
- E) Innermost intercostal muscle**

**Answer: A**

# Quiz

**What is the termination of the 4<sup>th</sup> left posterior intercostal vein?**

- A) Into the azygos vein**
- B) Into the left brachiocephalic vein**
- C) Into the hemiazygos vein**
- D) Into the accessory hemiazygos vein**
- E) Into the left superior intercostal vein**

**Answer: D**

# Quiz

**During forced inspiration, anterior border of the lung extends into.....**

- A) Costo-diaphragmatic recess**
- B) costo-cervical recess.**
- C) costo-mediastinal recess.**
- D) costo-abdominal recess.**
- E) peritoneal recess.**

**Answer: C**





# Quiz

**Left bronchial arteries arise from.....**

- A) Descending thoracic Aorta.**
- B) ascending Aorta.**
- C) arch of Aorta.**
- D) left 3<sup>rd</sup> posterior intercostal artery.**
- E) right bronchial artery.**

**Answer: A**



# Quiz

- What is the origin of primary palate in embryo?  
A) Secondary palate.  
B) Tongue.  
C) Thoracic myotome.  
D) Intermaxillary segment.  
E) frontonasal process.
- Answer: D



# SAQ

## SUMMERIZE Nerve Supply of The Pharynx

### **Motor:**

- All muscles of the pharynx supplied by the pharyngeal plexus (The cranial accessory nerve through the vagus nerve).
- Except stylopharyngeus supplied by glossopharyngeal nerve.

### **Sensory:**

- Nasopharynx: maxillary nerve.
- Oropharynx: glossopharyngeal nerve.
- Laryngopharynx: internal laryngeal branch of the vagus nerve.

# SAQ

## DESCRIBE Nerve supply of the larynx

### 1- Motor:

- All intrinsic muscles of the larynx supplied by the **recurrent laryngeal nerve**.
- Except the cricothyroid muscle supplied by the **external laryngeal nerve**.

### 2- Sensory:

- Above the level of the vocal fold supplied by the **internal laryngeal nerve**.
- Below the level of the vocal folds supplied by the **recurrent laryngeal nerve**.

# SAQ

## Summarize congenital anomalies of the palate (any 2)

- **Median cleft upper lip (central hare lip):**

Results from failure of the medial nasal prominences to merge and form the intermaxillary segments .

- **Median cleft of the lower lip:**

Caused by failure of the two mandibular processes to fuse together completely.

- **Unilateral cleft lip:** result from failure of the maxillary prominence to merge with the medial nasal prominence on the affected side.
- **Bilateral cleft lip:** results due to failure of maxillary prominences to meet and unite with the medial nasal prominences on both sides.



# SAQ

## Summarize Congenital anomalies of respiratory system (any 2)

- 1. Respiratory distress syndrome (hyaline membrane disease):**
- 2. Ectopic lung lobes:**
- 3. Congenital cysts of the lung:**



## SAQ

# Mention termination of the following paranasal sinuses

- Named for the bones in which they are housed.
  1. Frontal = middle meatus
  2. Sphenoidal = Sphenoethmoidal recess
  3. Maxillary = middle meatus

# SAQ

## Summarize major openings of the diaphragm

Opening	Level	Structures passing
Aortic	- T12	<ul style="list-style-type: none"> <li>- Abdominal aorta</li> <li>- Vena azygos</li> <li>- Thoracic duct</li> </ul>
Oesophageal	- T10	<ul style="list-style-type: none"> <li>- Oesophagus</li> <li>- Vagi (gastric nerves)</li> <li>- Oesophageal vessels</li> </ul>
Vena caval	- T8	<ul style="list-style-type: none"> <li>- IVC</li> <li>- Right phrenic nerve</li> <li>- Lymph vessels from the bare area of the liver</li> </ul>

