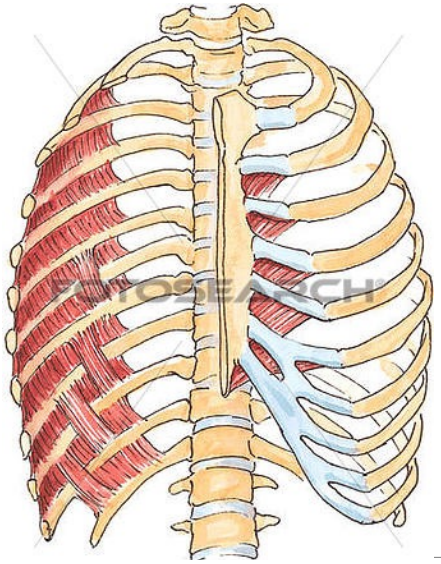
Jordan University
Faculty Of Medicine



# Thorax

DR. AHMED SALMAN

Associate professor of anatomy & embryology

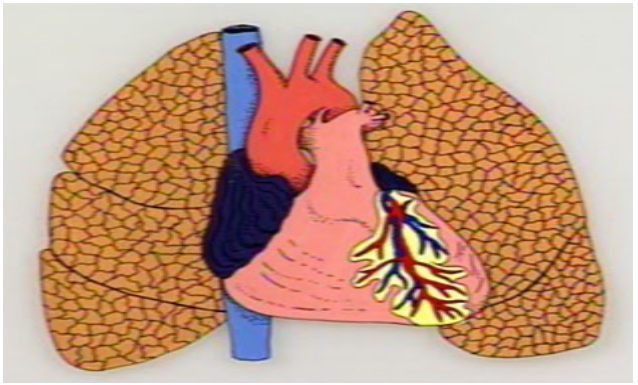
# THORAX

Is the part of the trunk extending between the root of the neck & abdomen

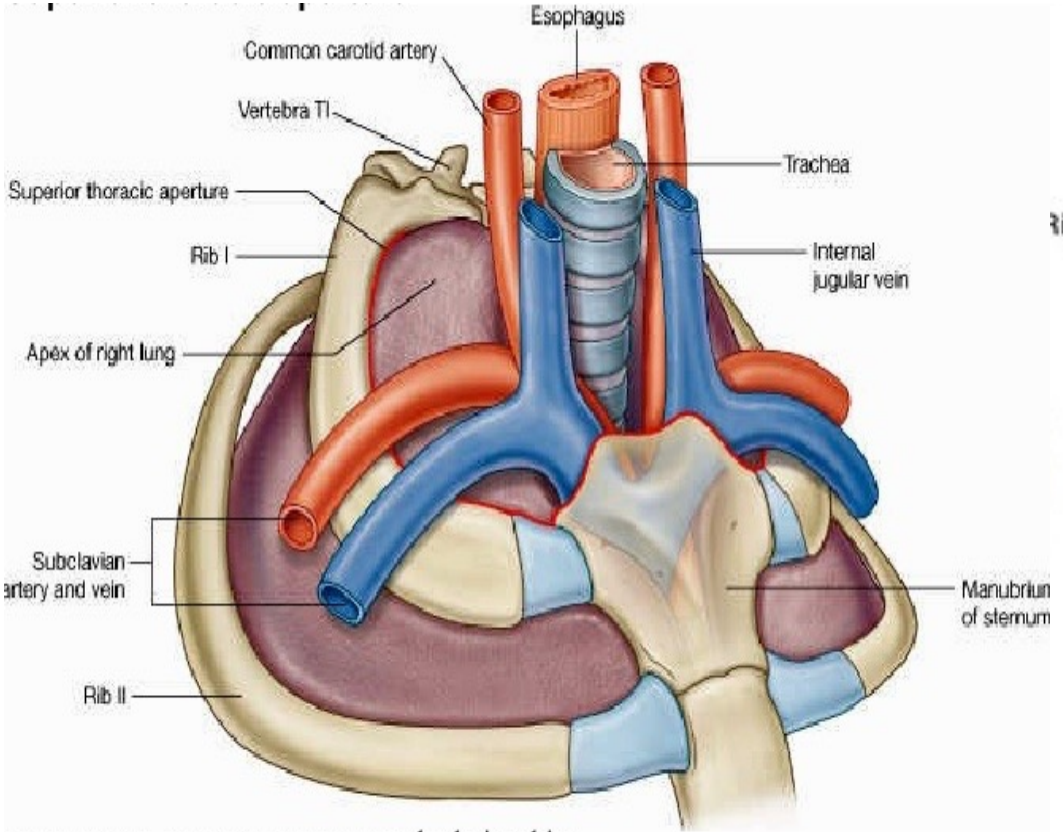
# Thorax

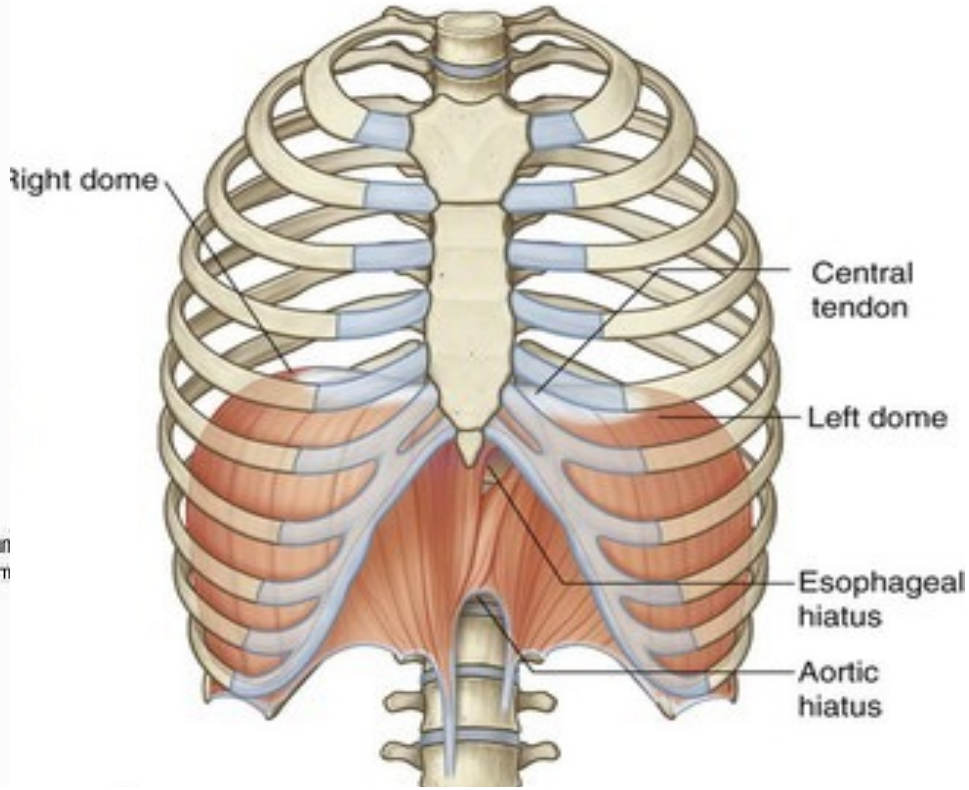

## Thoracic Wall

## Thoracic Cavity



# Openings of the Thorax



# Openings of the Thorax

## Thoracic outlet

It is an opening between  chest cavity and the root of the neck .

**Boundaries :**

Anteriorly:  superior border of the manubrium sterni
Posteriorly : first thoracic vertebra
Laterally : medial borders of the first ribs and their costal cartilages

**Structure passing :**

Esophagus , trachea and many vessels and nerves.

## Inferior thoracic aperture

- The thoracic cavity communicates with the abdomen through a large opening.
- **Boundaries :**

Anteriorly : xiphisternal joint
Posteriorly : 12th thoracic vertebra
Laterally : costal margin

**Structure passing :**

esophagus and many large vessels and nerves, through diaphragm foramina

# Intercostal muscles

Are arranged in tree layers :

**1-External intercostal muscle**

- Its fibres are directed downward and forward
- It extends from the inferior border of the rib above to the superior border of the rib below .

**2-Internal intercostal muscle**

Its fibres are directed downward and backward

It extends from the subcostal groove of the rib above to the upper border of the rib below

Responsible for Expiration

**3-Innermost intercostal muscle**

**4-Subcostal muscle**

**5-Transverseus thoracis muscles**

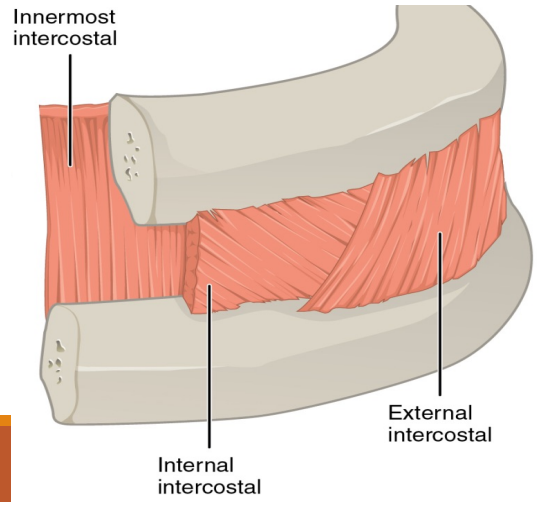
**Nerve Supply**

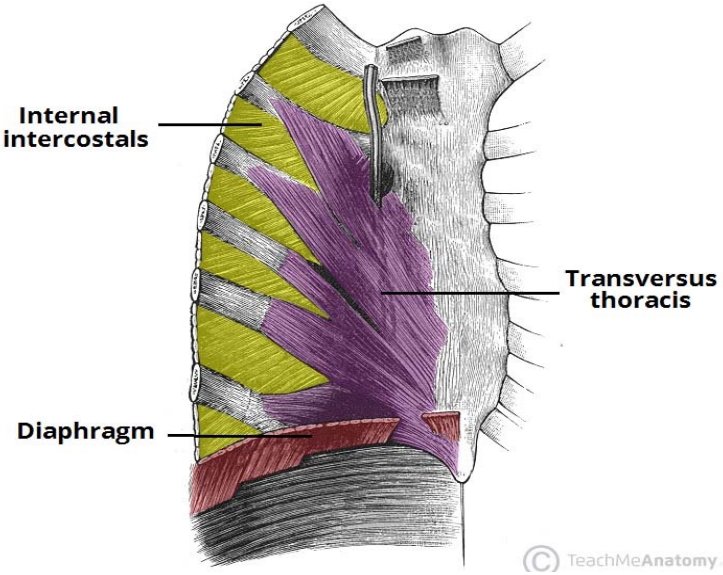
Intercostal nerves

**Action :**

Respiration

Strengthen the intercostal spaces

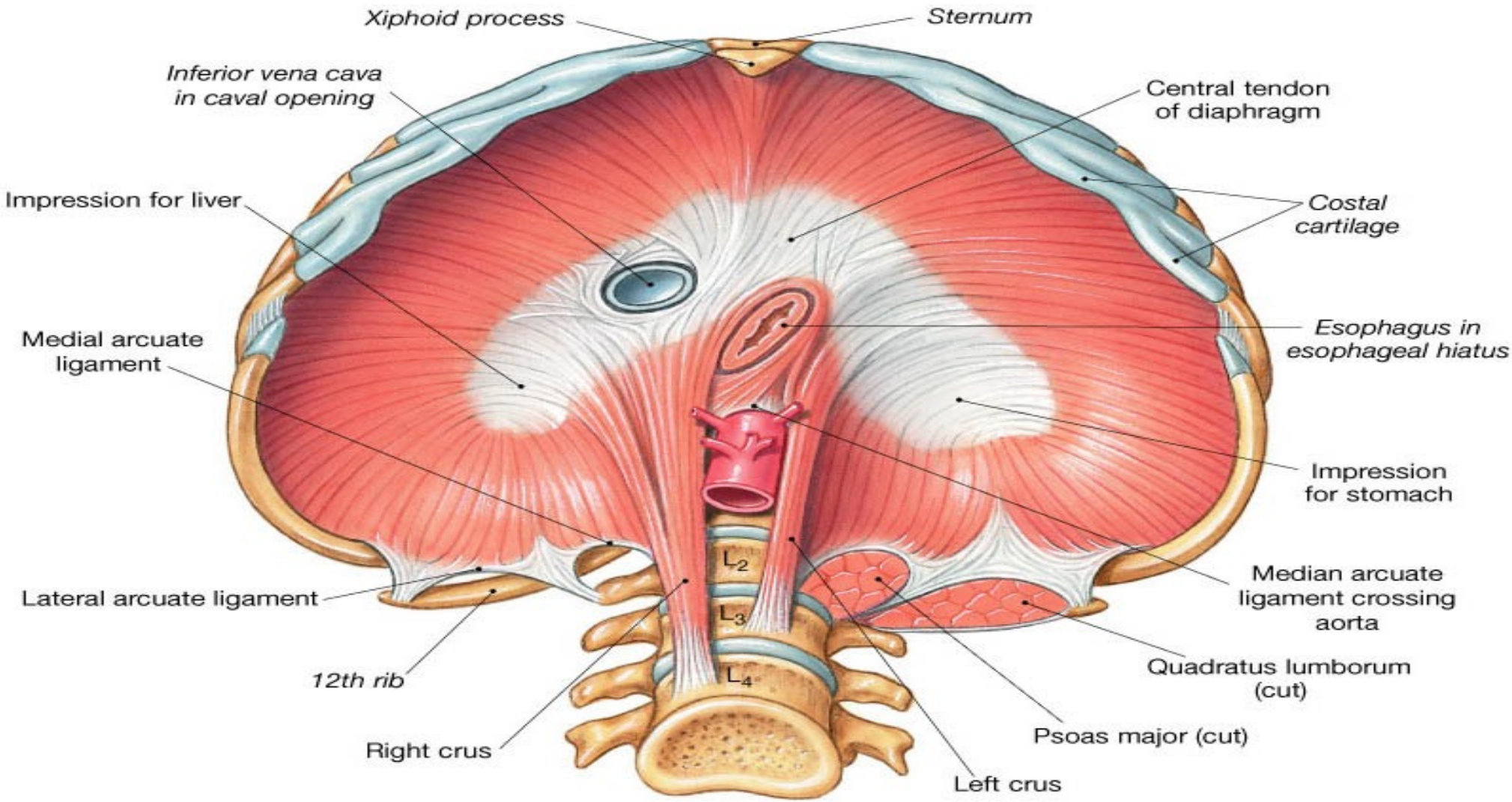


# Diaphragm

It is a thin muscular and tendinous septum that separates the chest cavity above from the abdominal cavity below.

**Nerve Supply :** Motor nerve supply: The right and left phrenic nerves (C3, 4, 5).




**(a) Inferior view**

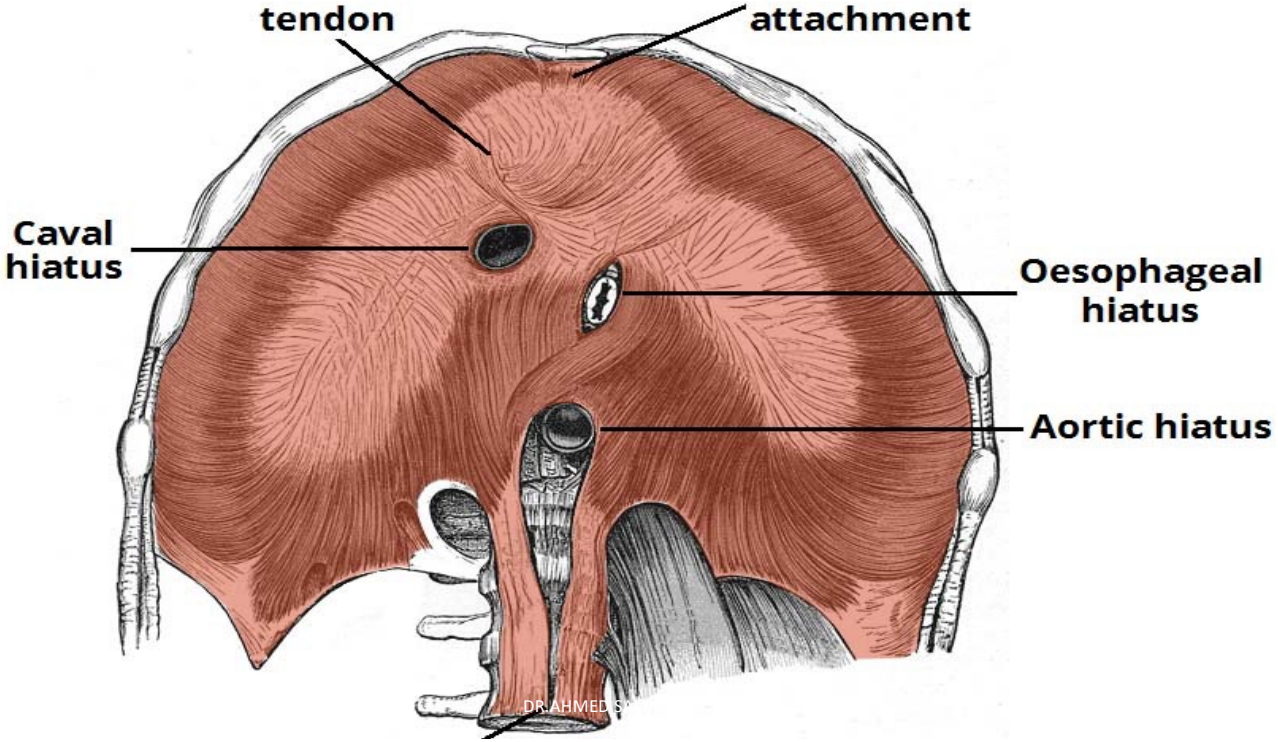
## Function of the diaphragm

1. **Respiration**
2. **Muscle of abdominal straining:** The contraction of the diaphragm is raising the intra-abdominal pressure
3. **Weight-lifting muscle**:

**4- Thoracoabdominal pump:** Pump for blood and lymph

## Opening of the diaphragm :

| Opening | Level | Structures passing through it |
|---|---|---|
| **Vena Caval** | 8th thoracic vertebra | It transmits the inferior vena cava and terminal branches of the right phrenic nerve. |
| **Oesophageal (Oesophagus)opening** | 10th thoracic vertebra | oesophagus, the right and left vagus nerves |
| **Aortic** | 12th thoracic vertebra | aorta, the thoracic duct, and the azygos vein. |

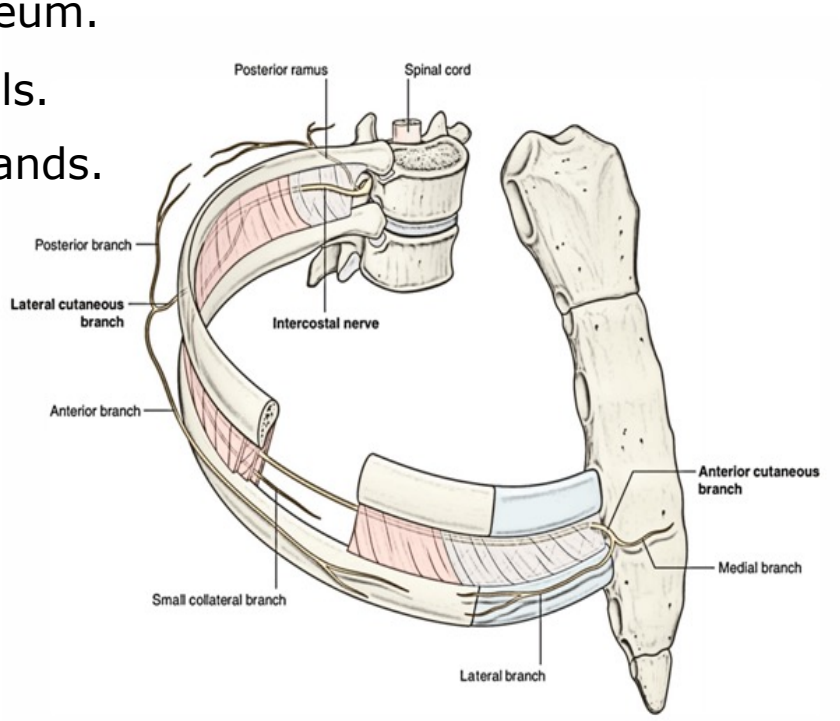


# Intercostal nerves

- ❑ It is a ventral ramus of thoracic nerves
- ❑ There are 11 nerves on each side
- ❑ The last one called subcostal nerve

## Function of intercostal nerves

- ✓ Sensory : skin – parietal layer of pleura and peritoneum.
- ✓ Motor: muscles of anterior thoracic & abdominal walls.
- ✓ Postganglionic sympathetic: blood vessels, sweat glands.



# Blood supply of thoracic wall

## Anterior wall

9 on each side.

2 in each space.

Upper 6 from **internal thoracic artery**.

7,8,9 from **musculophrenic artery**

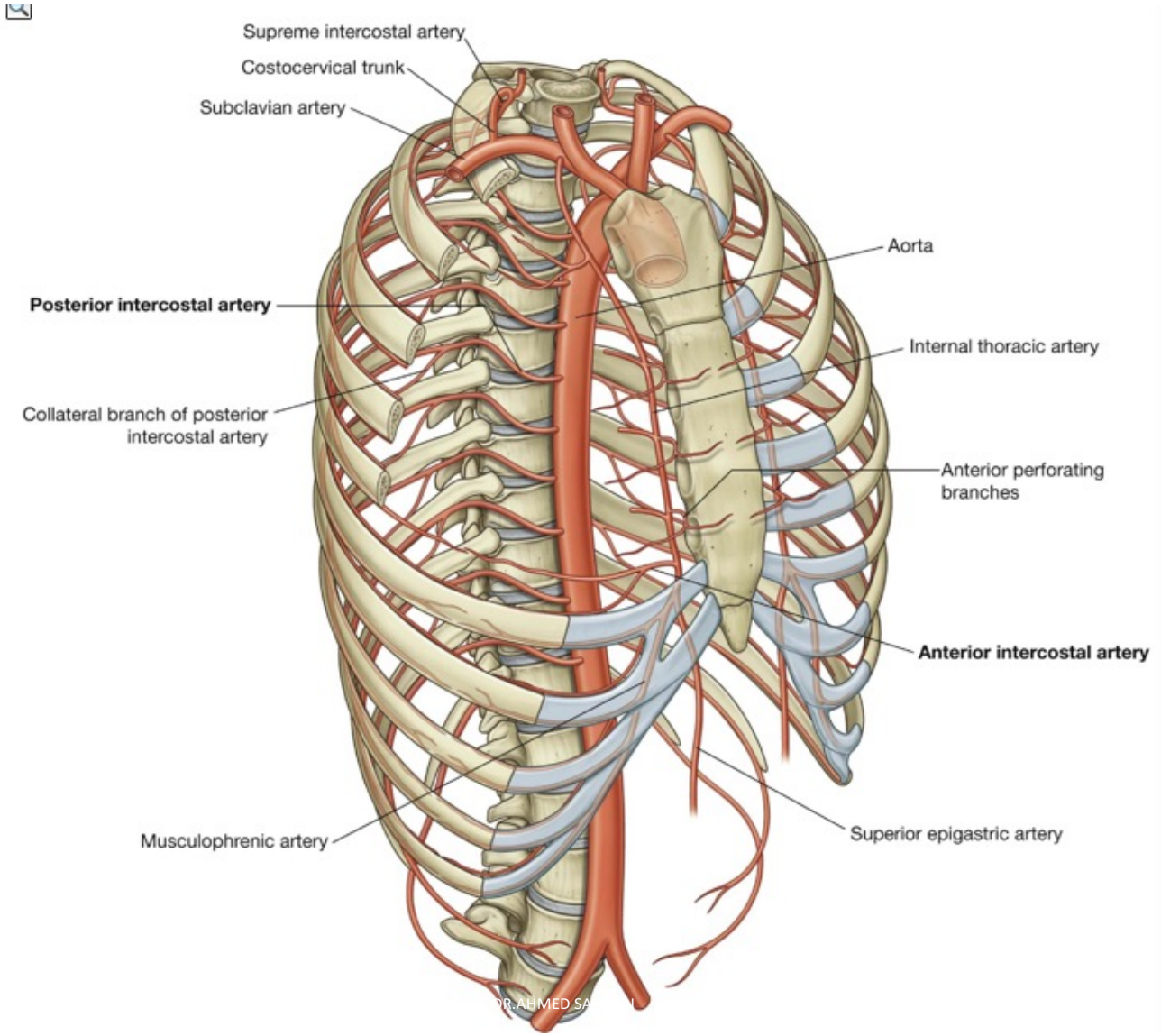
## Posterior wall

11 on each side.

One in each space.

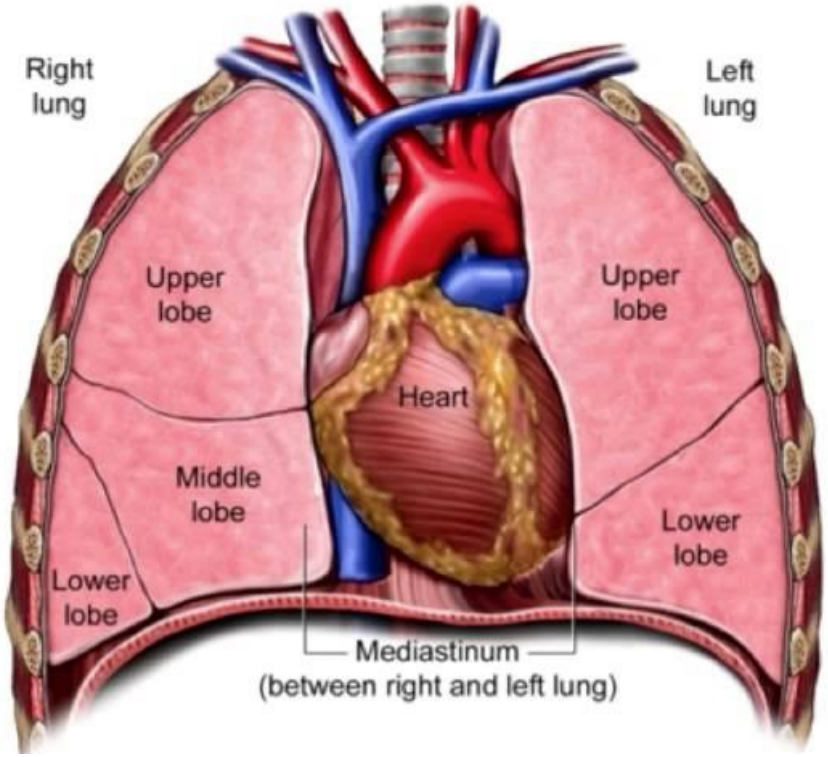
$1^{st}$ ,$2^{nd}$ from superior intercostal artery.

3 -11 from descending thoracic aorta.


Supreme intercostal artery
Costocervical trunk
Subclavian artery
Aorta
Posterior intercostal artery
Internal thoracic artery
Collateral branch of posterior intercostal artery
Anterior perforating branches
Anterior intercostal artery
Musculophrenic artery
Superior epigastric artery

# Thoracic cavity

- It bounded by thoracic cage ,diaphragm.
- It contains two pleural cavities containing lungs  and mediastinum



# Mediastinum

It is the septum between the two pleural cavities.

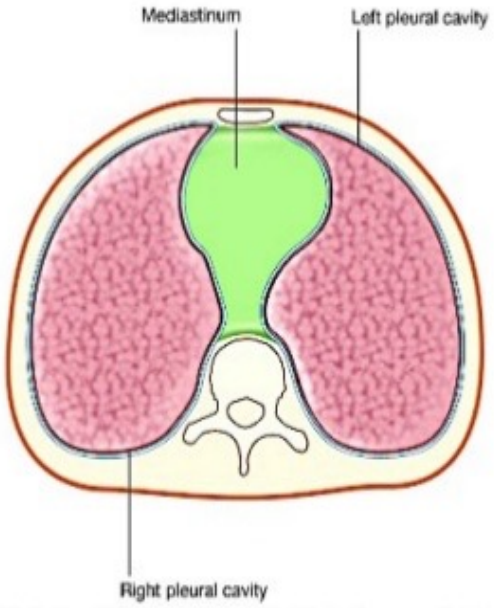
**Boundaries** :

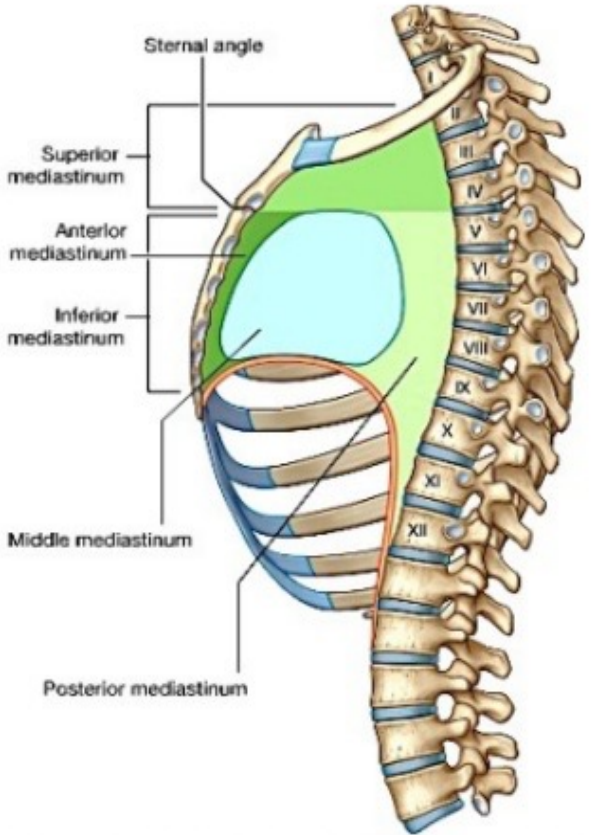
Superior: Thoracic outlet

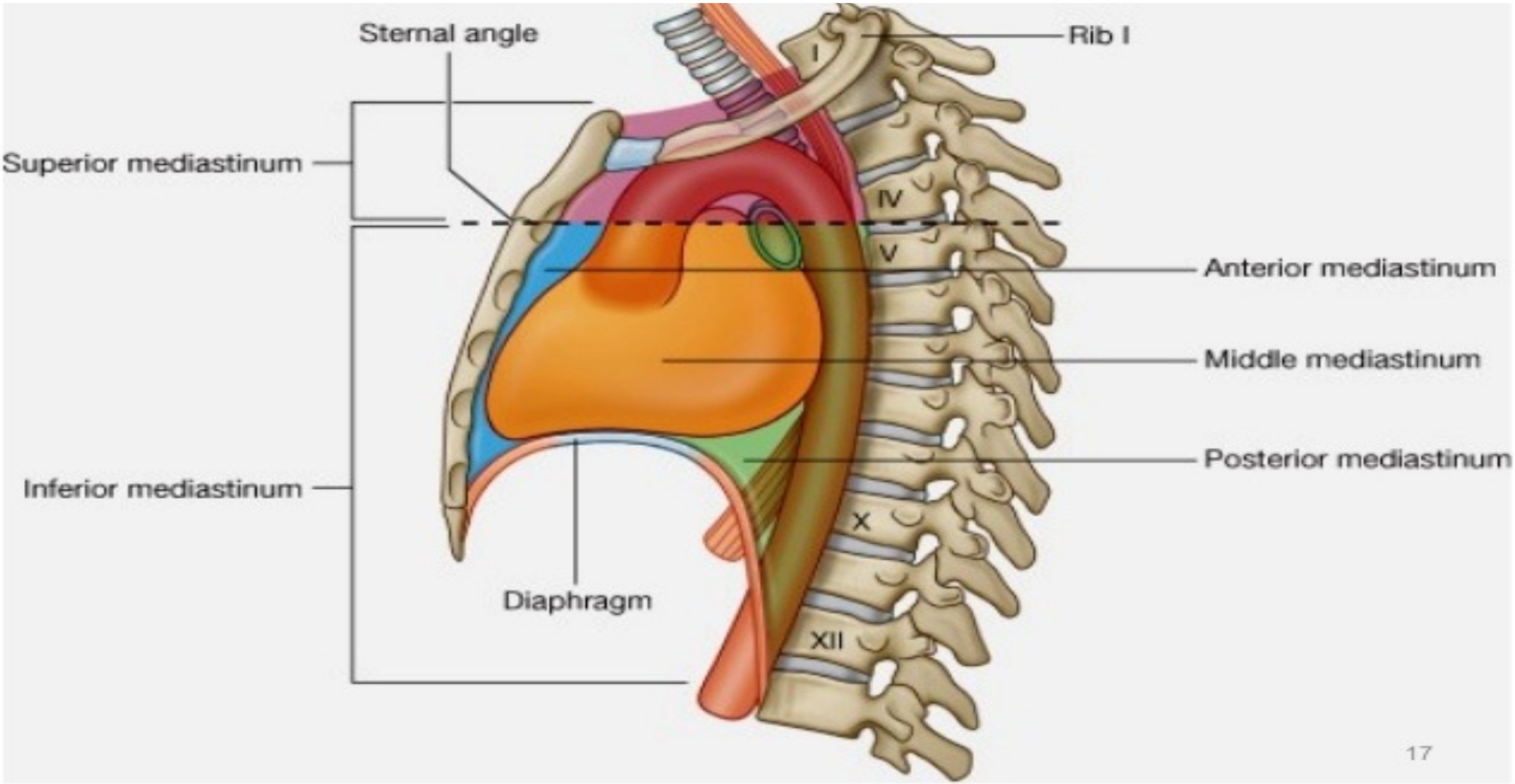
Inferior: Diaphragm

Anterior: Sternum

Posterior: Vertebral column



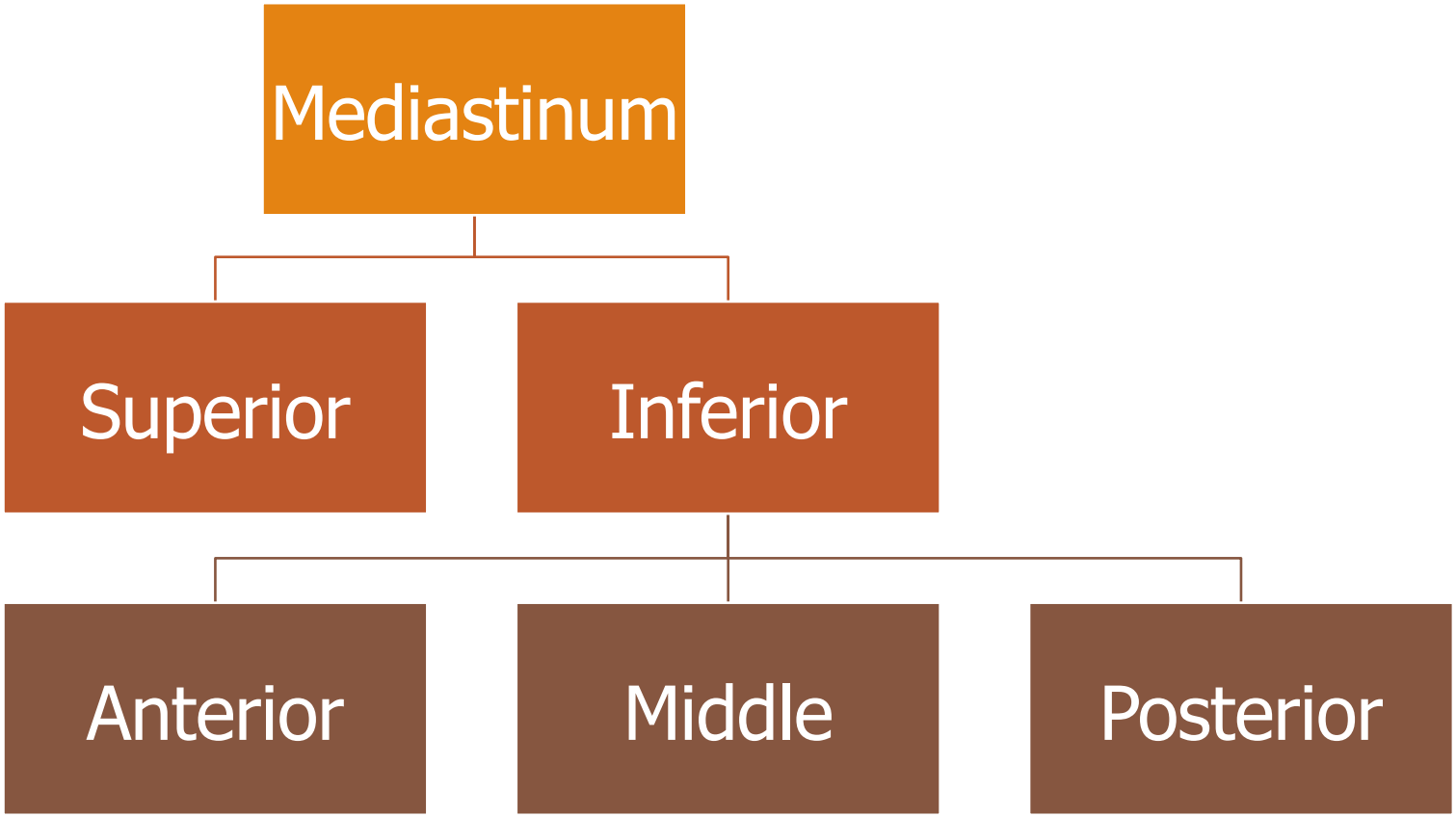

Sternal angle
Rib I
Superior mediastinum
I
IV
V
Anterior mediastinum
Middle mediastinum
Posterior mediastinum
Inferior mediastinum
X
Diaphragm
XII
17

# Subdivisions:

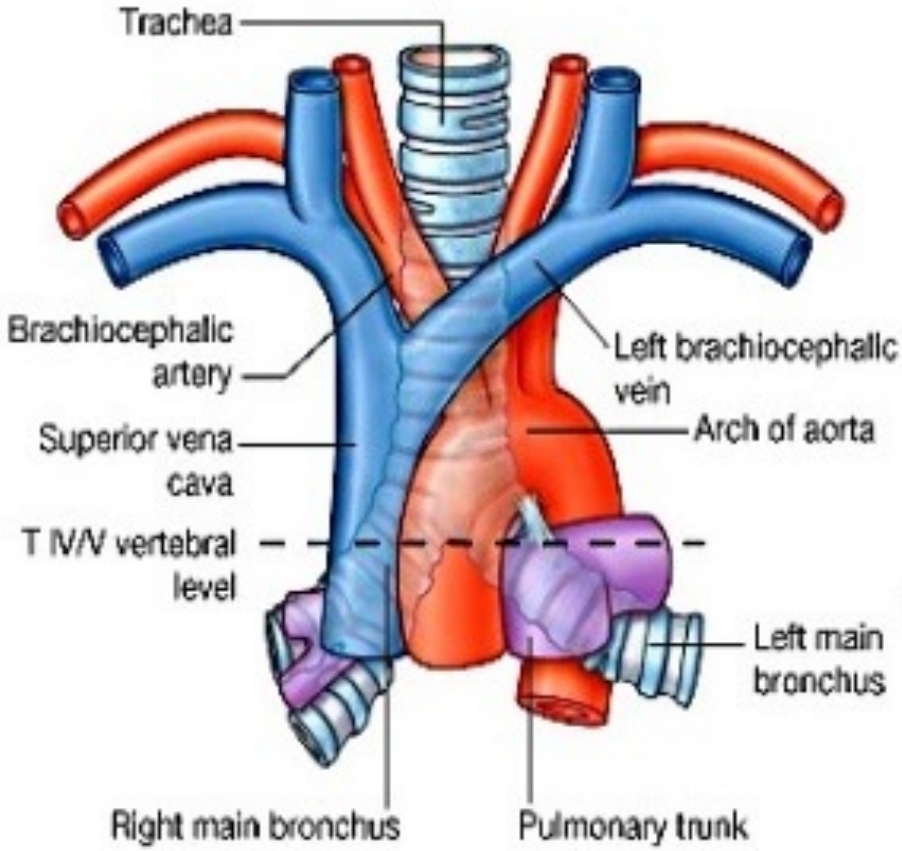
## Division :

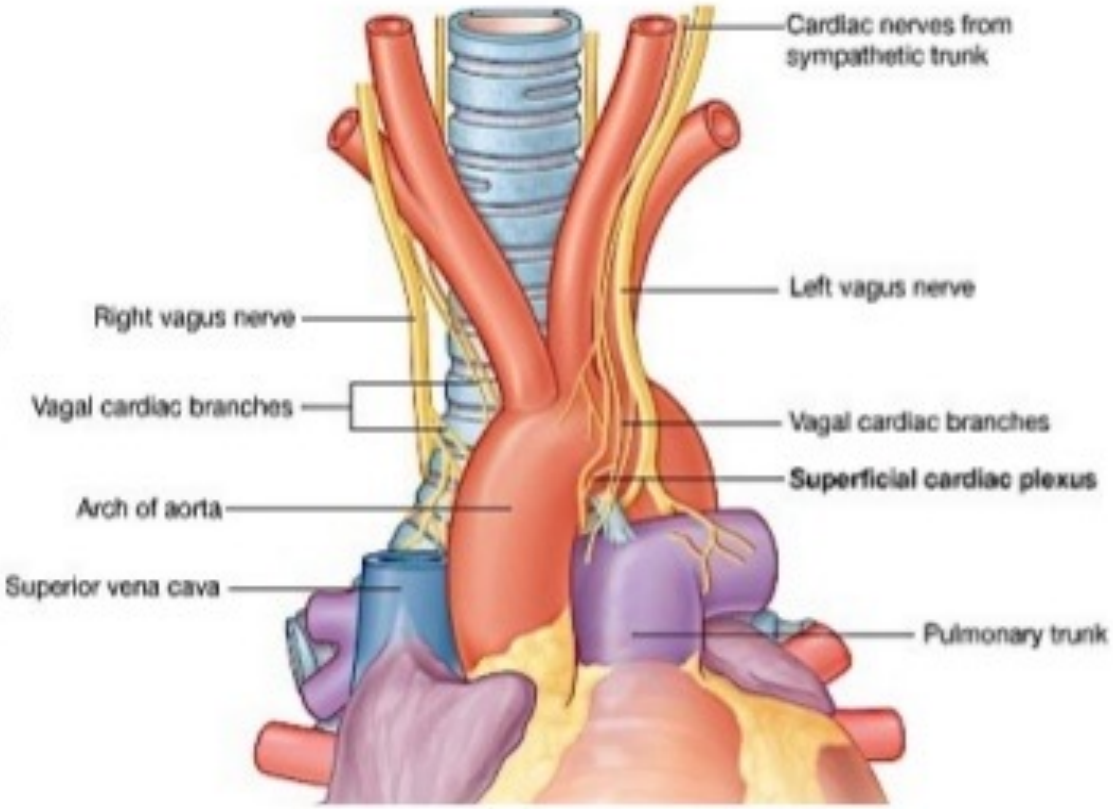
An imaginary line from sternal angle to lower border of 4th thoracic vertebra divide mediastinum into :

- ✓ Superior mediastinum above the line and inferior mediastinum below the line.
- ✓ Inferior mediastinum divided into :
- Middle mediastinum contains heart and pericardium
- Anterior mediastinum in front middle mediastinum
- Posterior mediastinum behind middle mediastinum


Mediastinum
Superior
Inferior
Anterior
Middle
Posterior

# Superior Mediastinum - contents



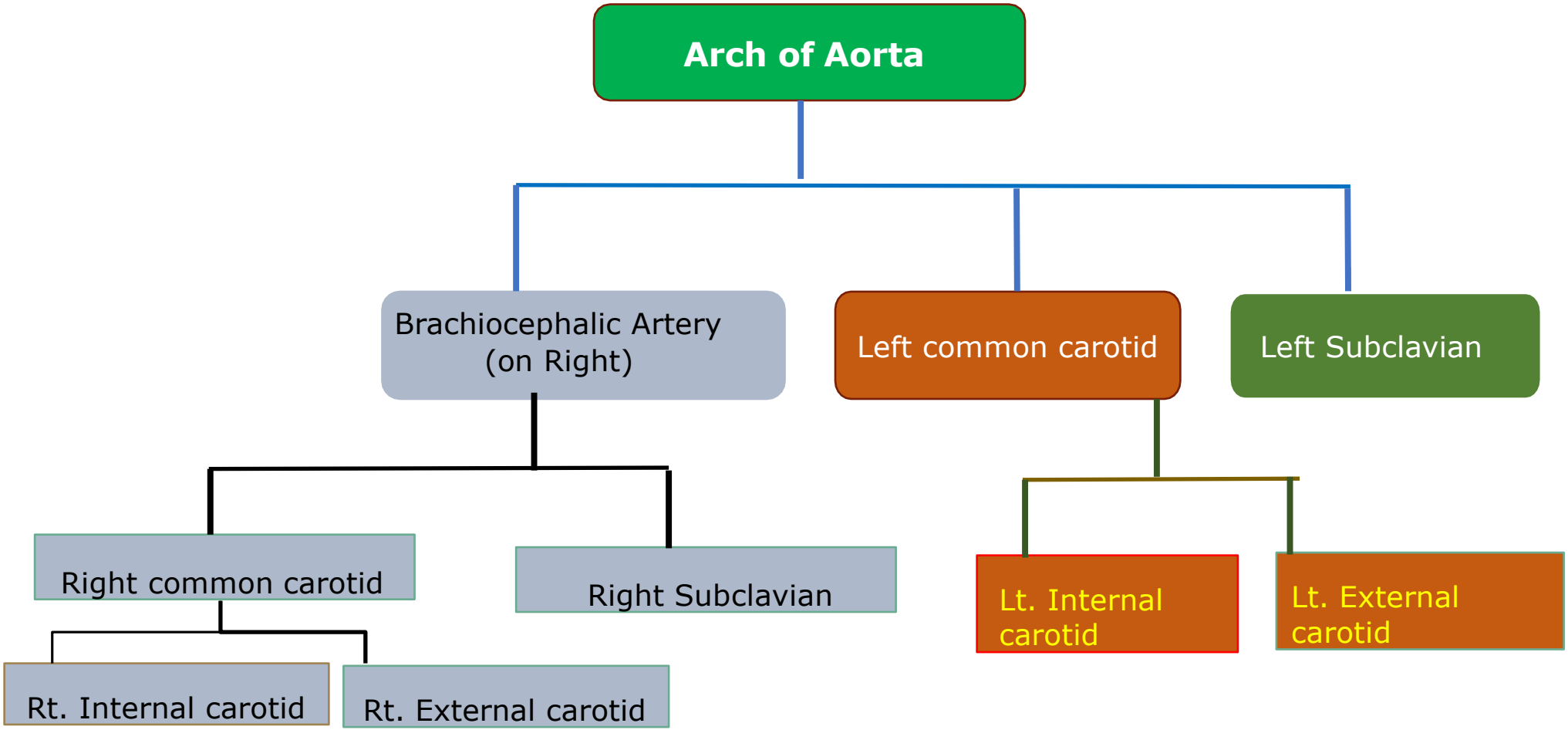
**Vein of the head and the neck :** internal jugular vein

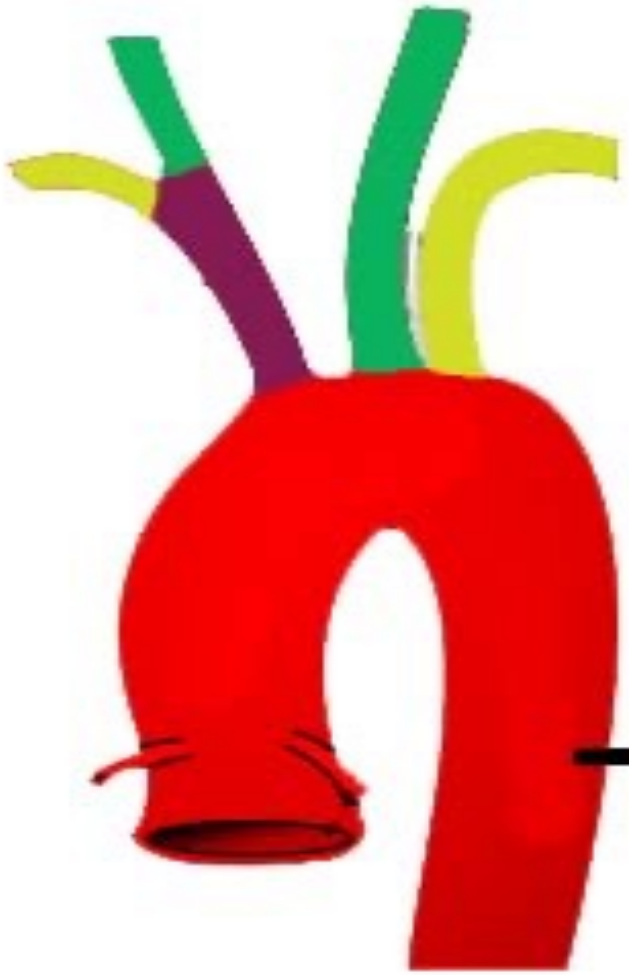
**Vein of the upper limb :** subclavian vein

**Right internal jugular vein joins right subclavian vein** to form right brachiocephalic vein

**Left  internal jugular vein joins left subclavian vein** to form left brachiocephalic vein

**Right brachiocephalic vein jioins left brachiocephalic vein** to form superior vena cava


Arch of Aorta
Brachiocephalic Artery (on Right)
Left common carotid
Left Subclavian
Right common carotid
Right Subclavian
Lt. Internal carotid
Lt. External carotid
Rt. Internal carotid
Rt. External carotid



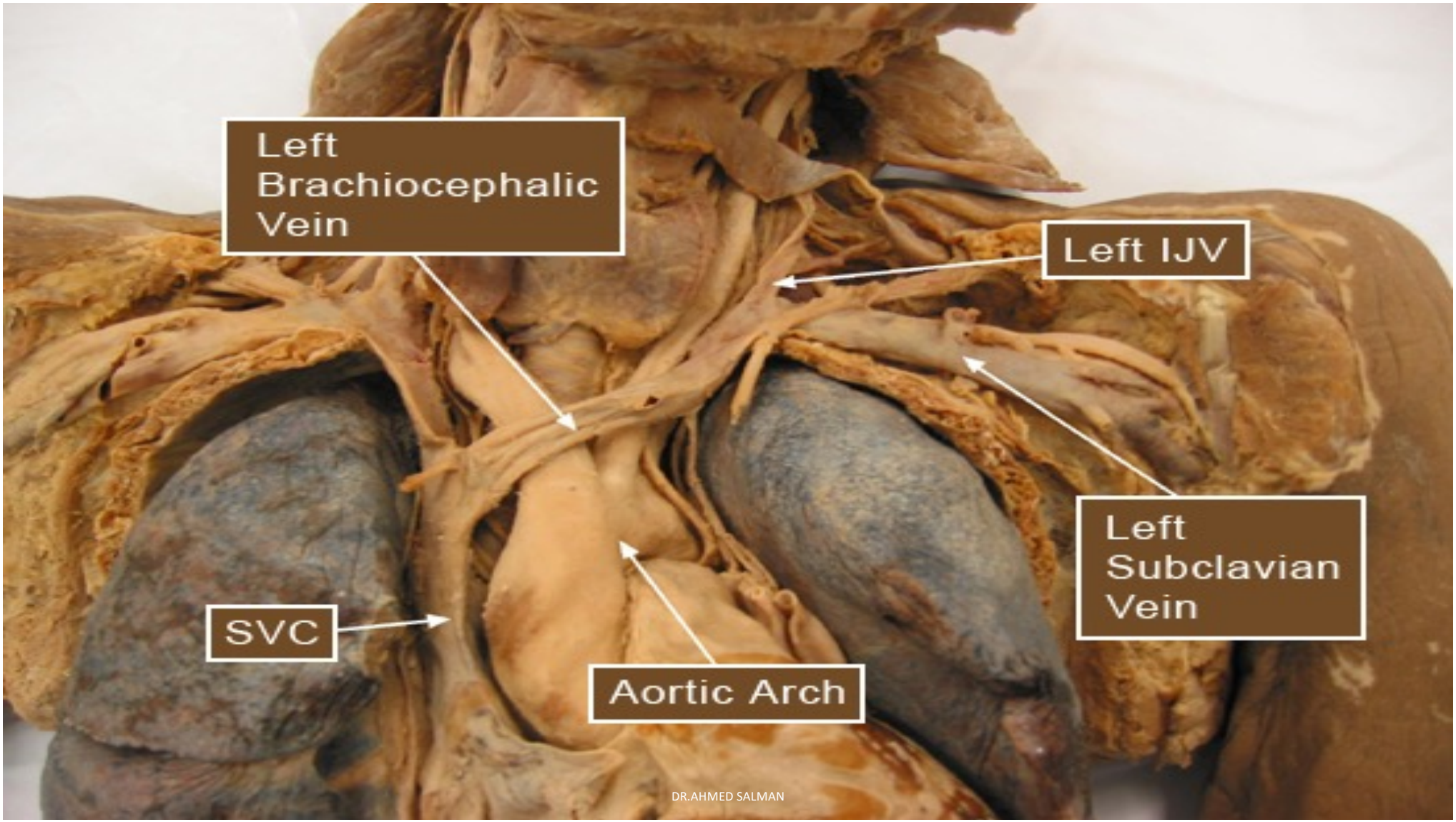
Arch of aorta

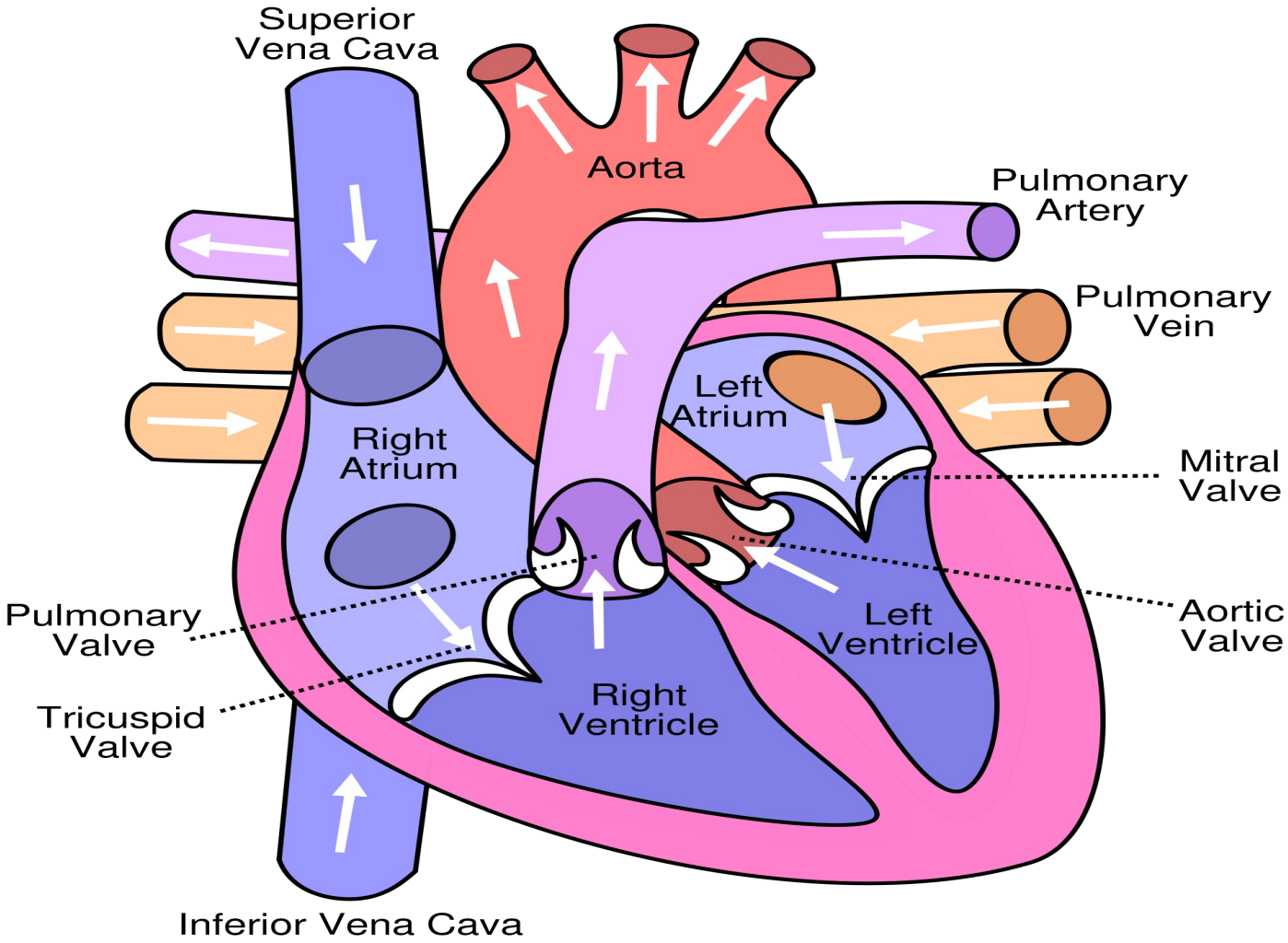
Subclavian arteries

Common carotid arteries

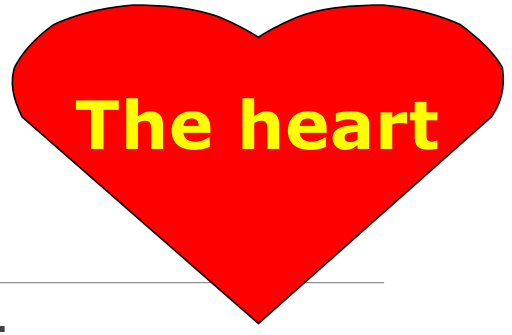
Brachiocephalic trunk

Descending aorta


Left
Brachiocephalic
Vein
Left IJV
Left
Subclavian
Vein
SVC
Aortic Arch


Superior
Vena Cava
Aorta
Pulmonary
Artery
Pulmonary
Vein
Left
Atrium
Right
Atrium
Mitral
Valve
Pulmonary
Valve
Aortic
Valve
Left
Ventricle
Tricuspid
Valve
Right
Ventricle
Inferior Vena Cava

# Heart

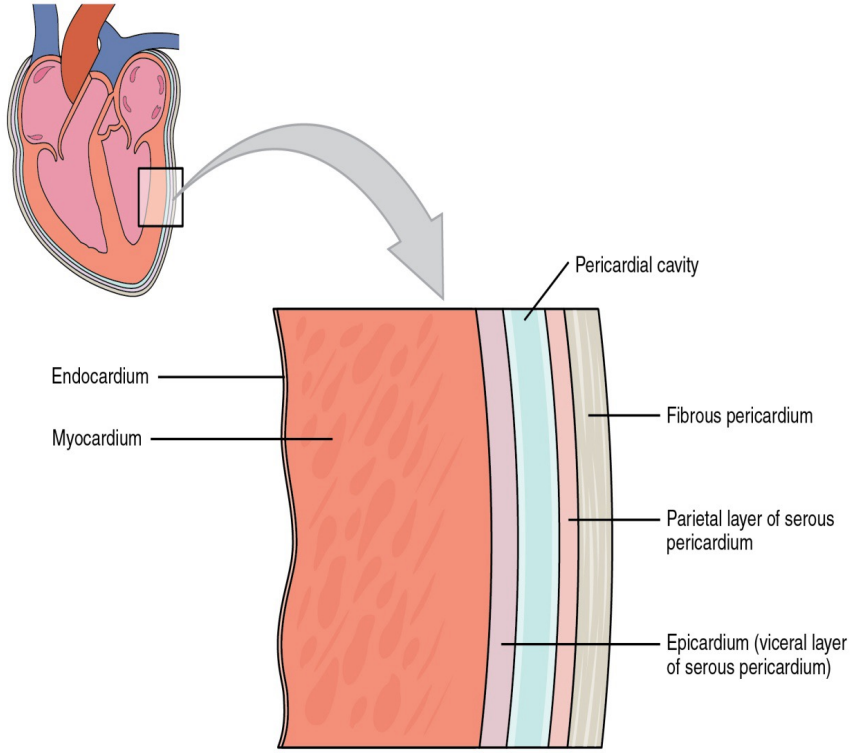


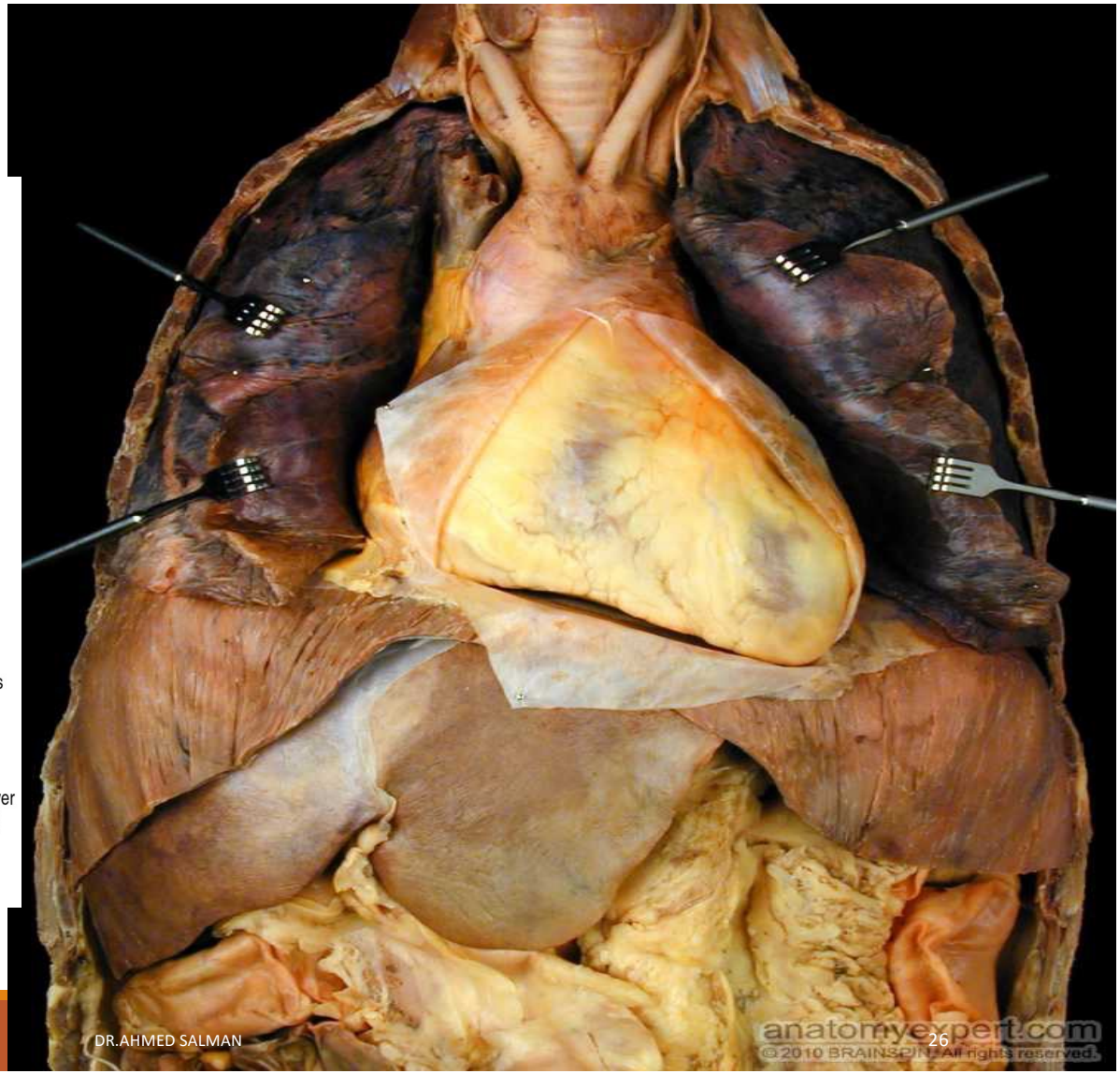

- Muscular pump that propels blood to various parts of the body.
- Lies within the pericardium in the middle mediastinum.
- 1/3 of the heart lies to the right & 2/3 to the left of the median plane.
- The walls of the heart are composed of three layers from outside :

1- Epicardium

2- Myocardium which is the cardiac muscle

3- Endocardium


Pericardial cavity
Endocardium
Myocardium
Fibrous pericardium
Parietal layer of serous pericardium
Epicardium (viceral layer of serous pericardium)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# Pericardium

➢The pericardium is a fibroserous sac surrounding the heart and the roots of the great vessels.

Its function is to :-

1-Restrict excessive movements of the heart.

2-Serve as a lubricated container in which the different parts of the heart can contract.

# Pericardium

**Fibrous Pericardium**

-It is outer sac of pericardium.

- It is firmly attached to the diaphragm.

**Serous Pericardium**

It is thin transparent double layered sac that lies within the fibrous pericardium.

**The pericardial cavity**

It is the space between the 2 layers of serous pericardium.

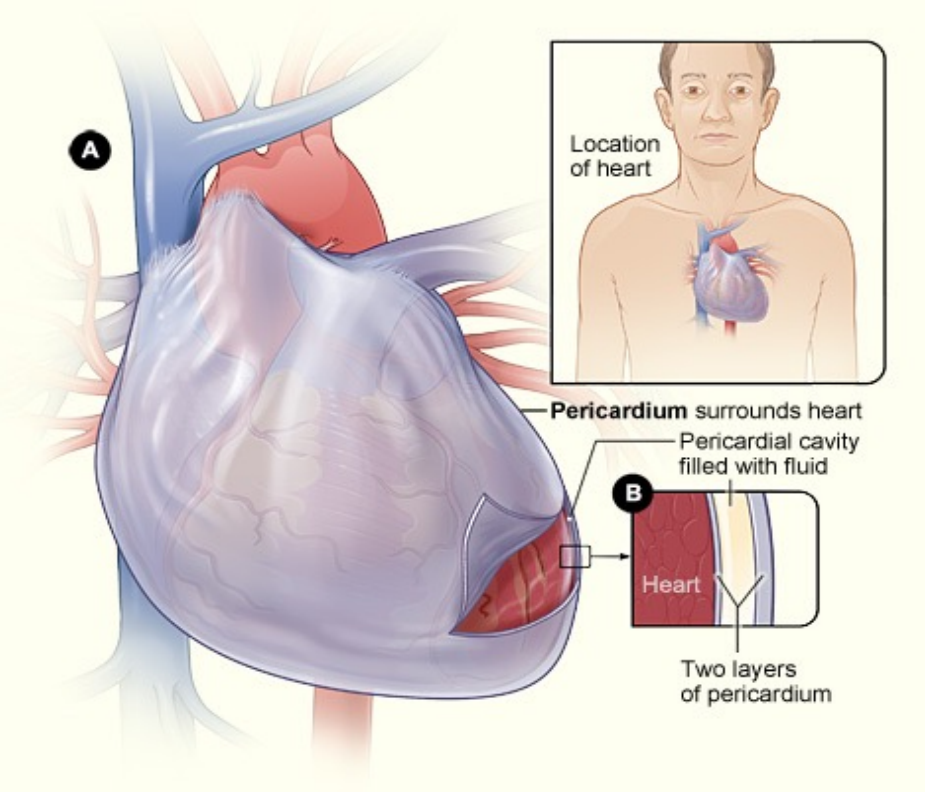
Contains a thin film of fluid that acts as a lubricant for movements of the heart

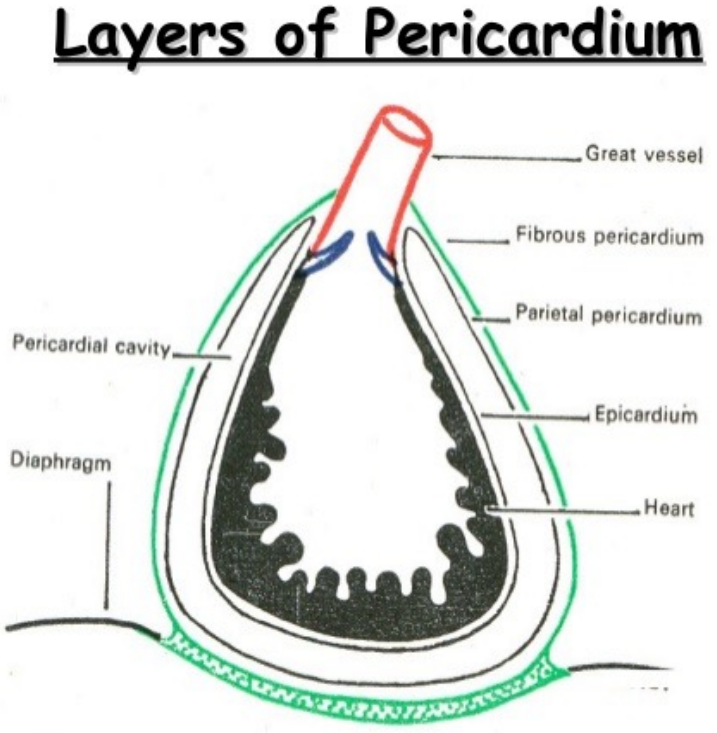
**Parietal**

lines the inner surface of the fibrous pericardium

**Visceral**

Adheres to the heart and forms its outer covering


A
Location of heart
Pericardium surrounds heart
Pericardial cavity filled with fluid
B
Heart
Two layers of pericardium


Layers of Pericardium
Great vessel
Fibrous pericardium
Parietal pericardium
Pericardial cavity
Epicardium
Diaphragm
Heart

# Cardiac tamponade

When fluid in the pericardium (the sac around the heart) builds up, resulting in compression of the heart

# External morphology of the heart

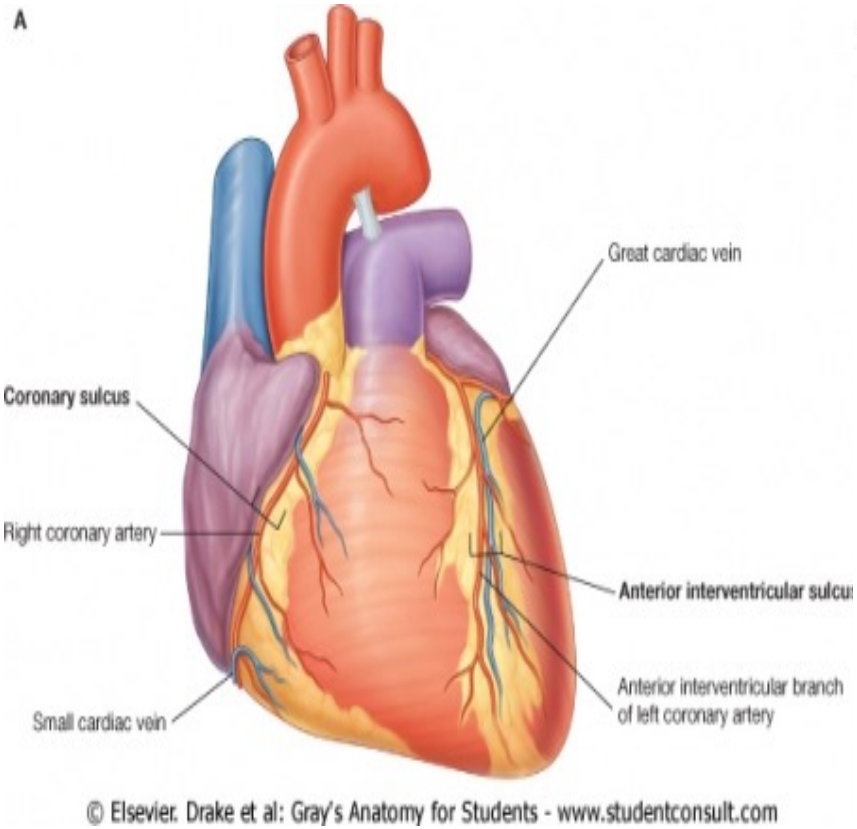
**Base :** Located posteriorly , it is formed mainly by the left atrium

**Apex:** Formed by the left ventricle.

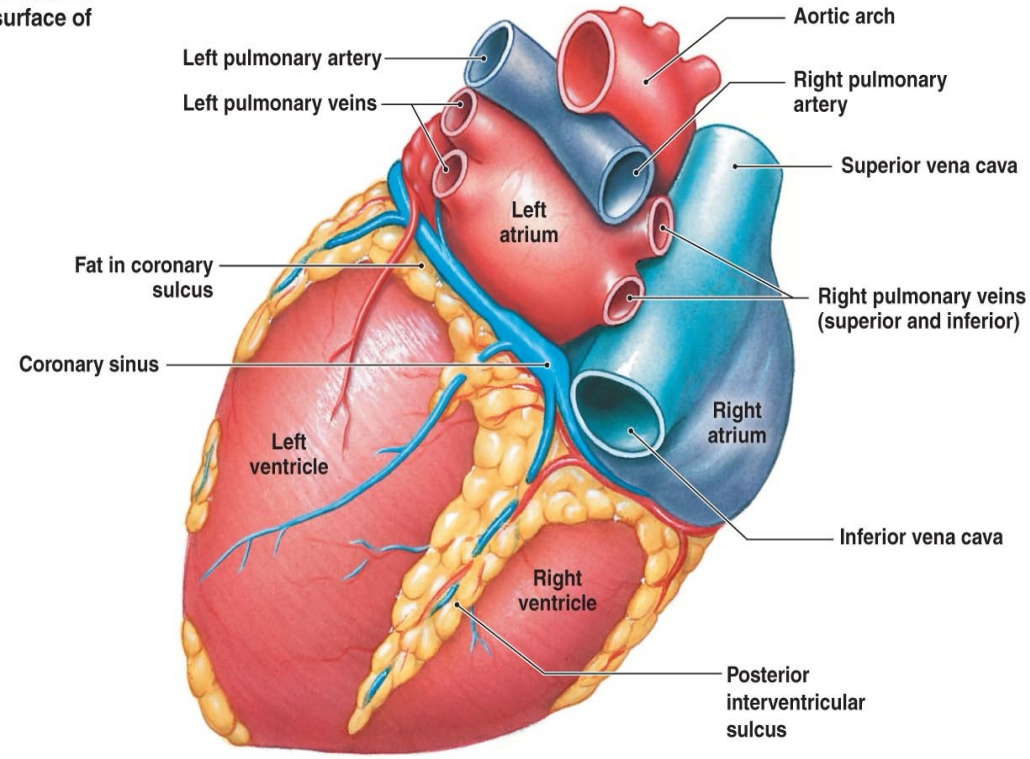
It lies at the fifth left intercostal space, 3.5 inch (9 cm) from the midline.

**Two surfaces** ( anterior or sternocostal and  inferior or diaphragmatic).

**Four borders :**




A diagrammatic view of the posterior surface of the heart



# Borders of the Heart

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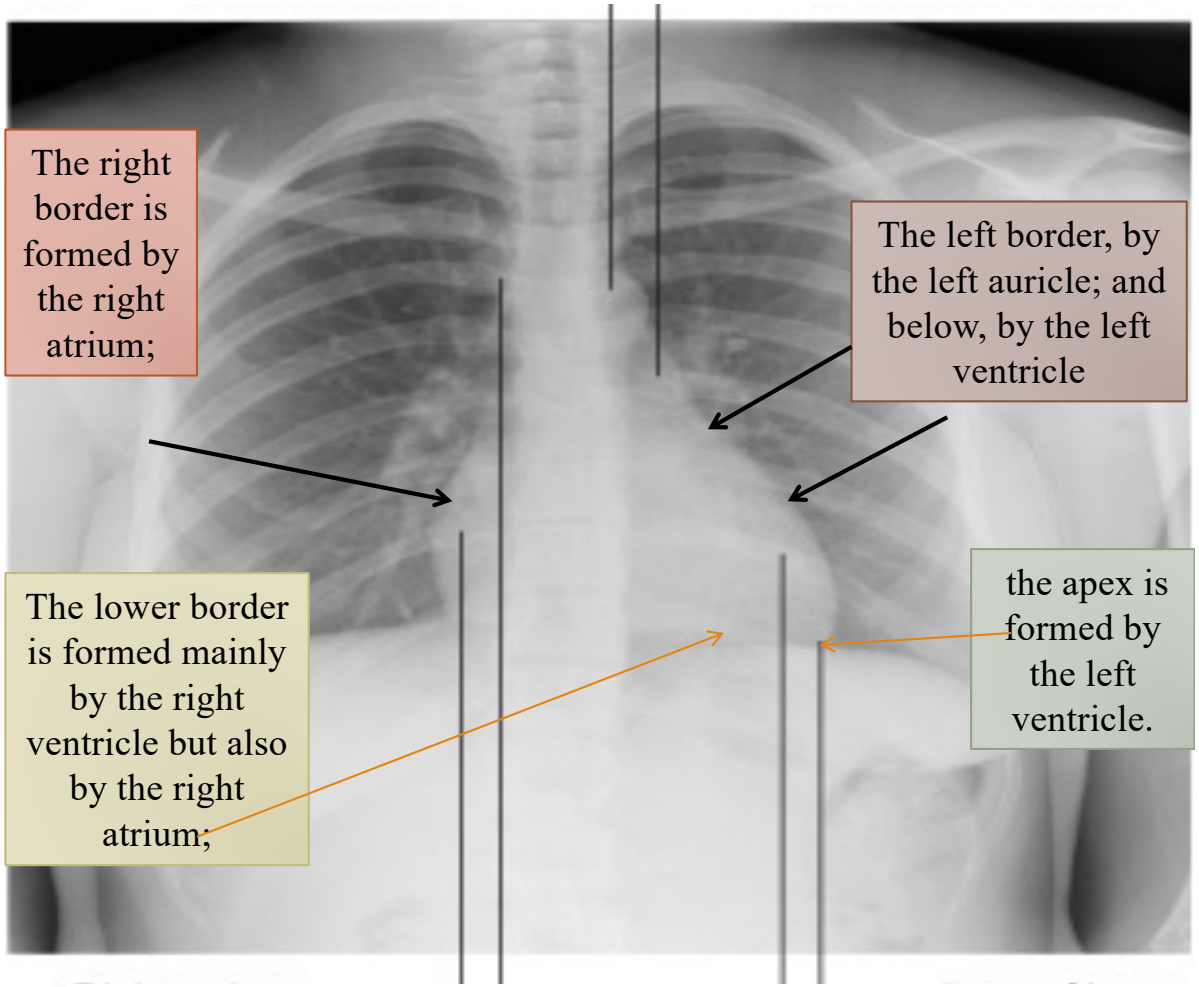
**These borders are important to recognize when examining a radiograph of the heart.**




**Dr.Amjad Shatart**

# Heart Chambers

The Heart composed of 4 chambers :-

Receiving chambers (Atria )
Right Atrium
Left Atrium

Discharging chambers (Ventricles)
Right Ventricles
Left Ventricles

# Heart Chambers

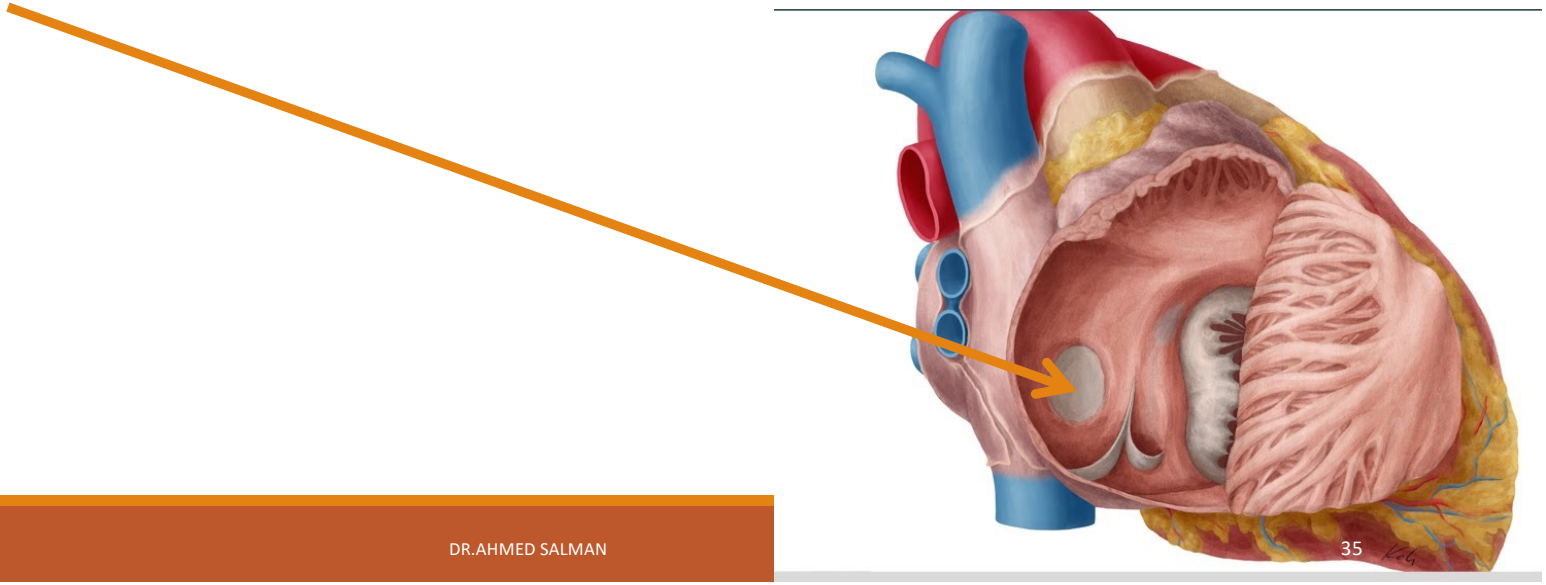
The heart has four chambers two atria and two ventricles

1-Right atrium : It has

-**S**mooth po**s**terior part and Rough anterior part .

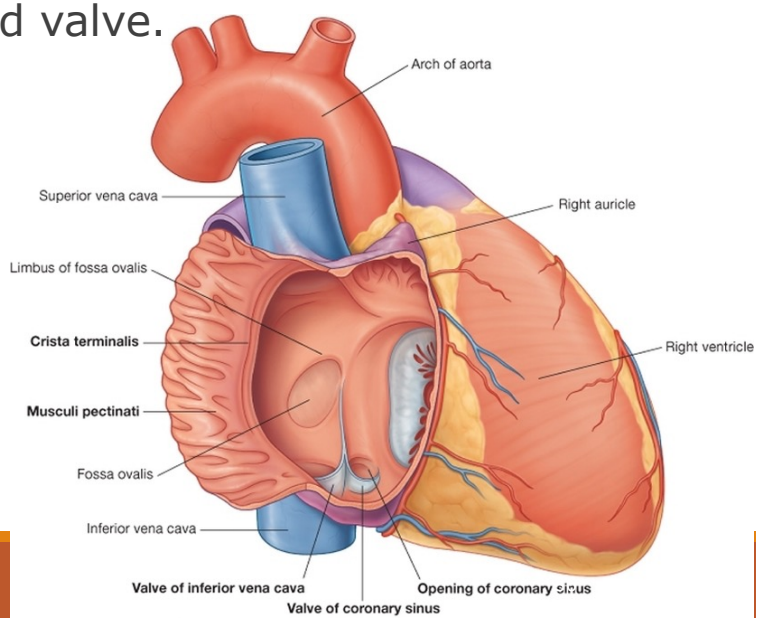
Septal wall : which separates the right atrium from the left atrium

it contains fossa ovalis which was the site of the foramen ovale in the fetus.



# Openings into the right atrium:

- S.V.C. : It returns the blood to the heart from the upper half of the body.
- I.V.C. : It returns the blood to the heart from the lower half of the body.
- The coronary sinus : it drains most of the blood from the heart.
- Right atrioventricular orifice which is guarded by Tricuspid valve.

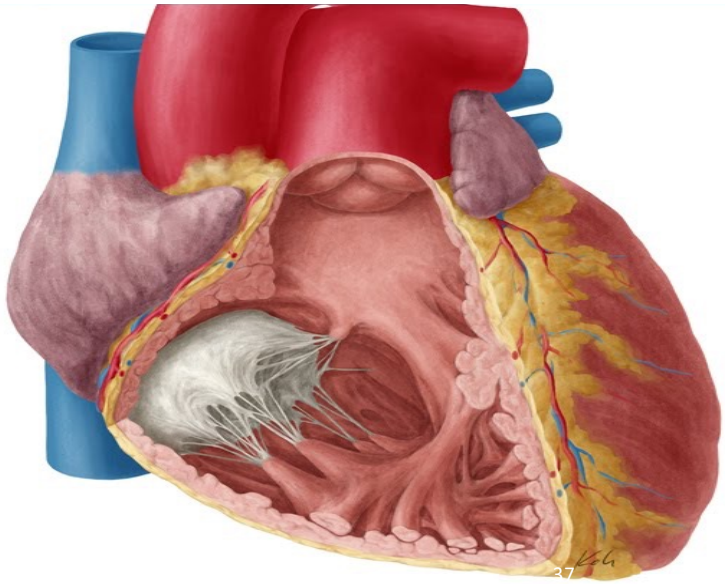


# Right ventricle

It has

- Smooth outflow part called infundibulum leads into the pulmonary artery .
- Rough inflow part ,
- **Communication of Right ventricle**

With Right atrium and pulmonary artery

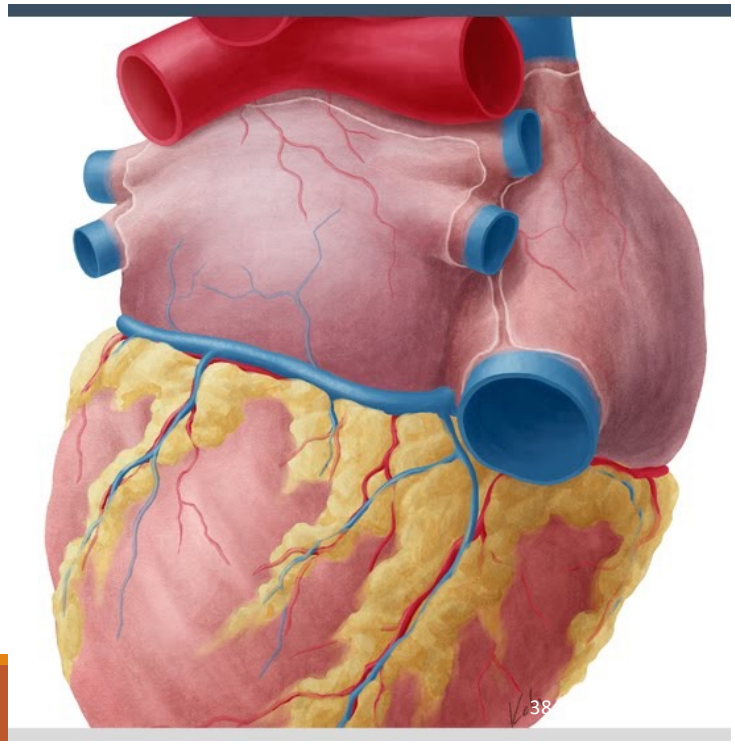


# Left atrium

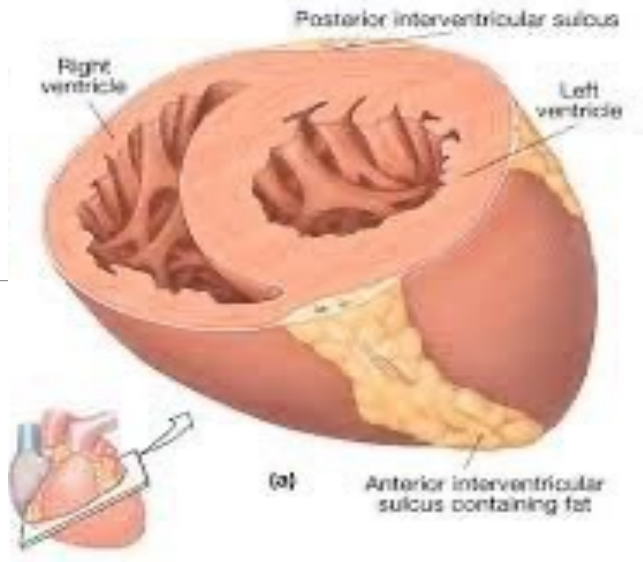
## Opening of the left atrium

1-The four pulmonary veins

2-The left atrioventricular orifice is guarded by mitral valve



# Left ventricle




The thickness of its wall is 3:1 that of the left ventricle

It has :-

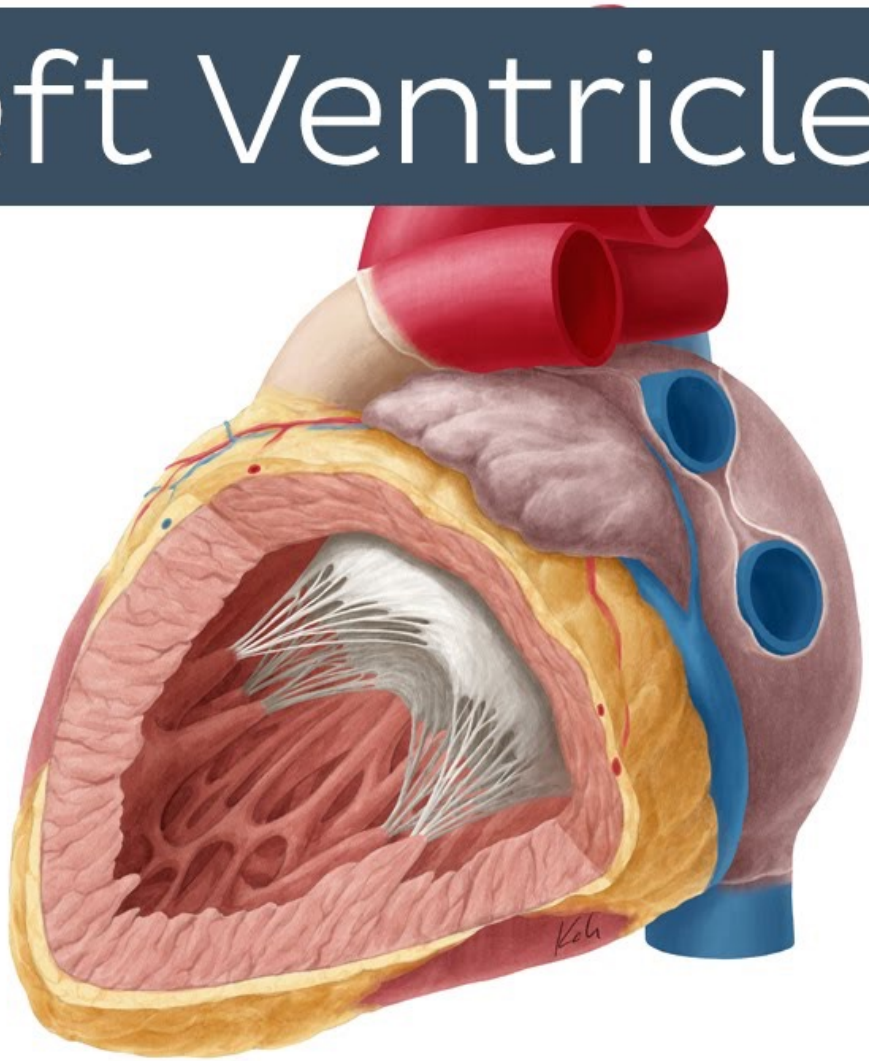
Rough Inflow rough part:

Outflow smooth part or the vestibule: leads into the ascending aorta.

**Communication of Right ventricle**

Left Atrium and Aorta

# Left Ventricle



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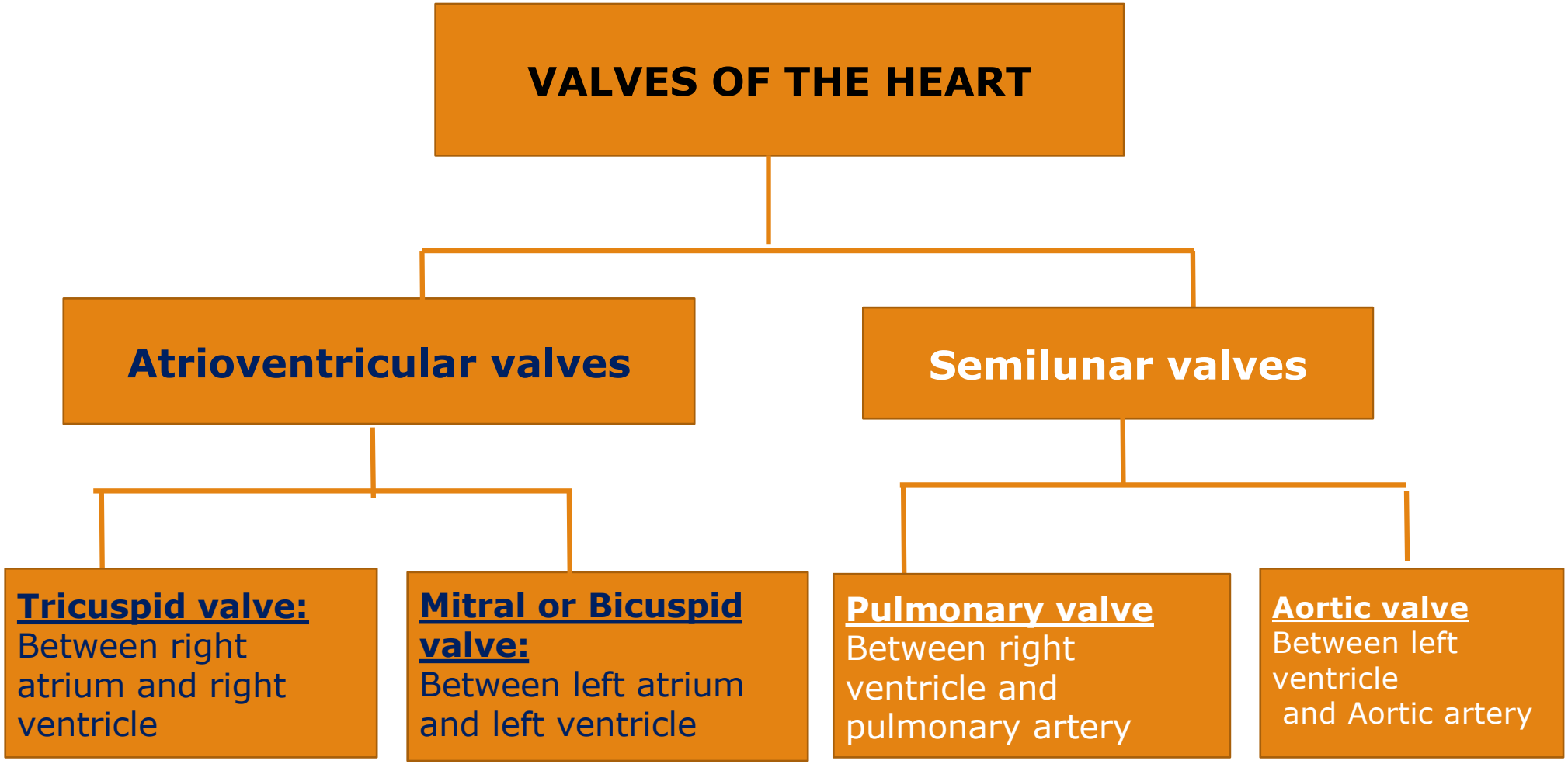
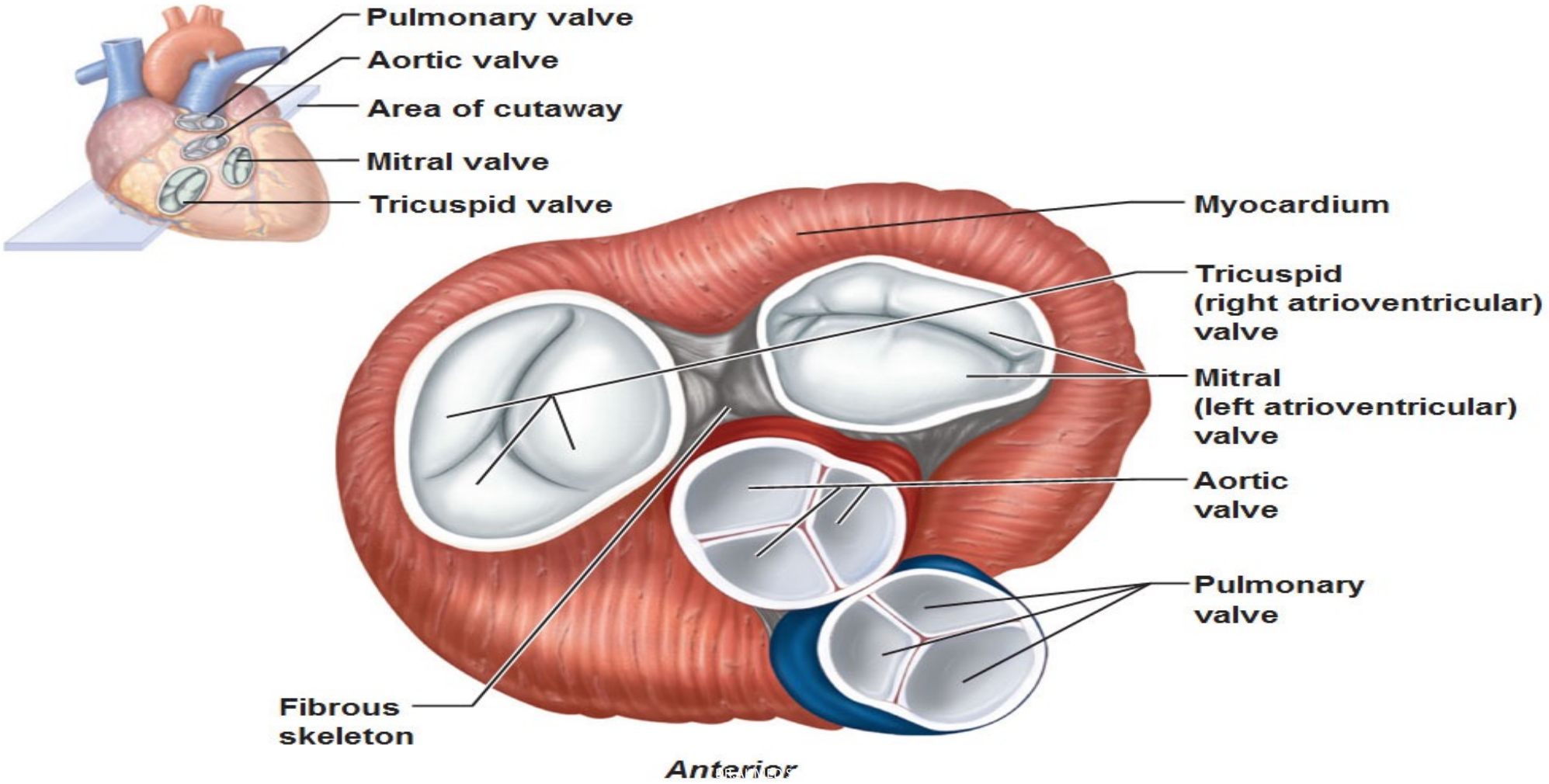

VALVES OF THE HEART
Atrioventricular valves
Semilunar valves
Tricuspid valve:
Between right atrium and right ventricle
Mitral or Bicuspid valve:
Between left atrium and left ventricle
Pulmonary valve
Between right ventricle and pulmonary artery
Aortic valve
Between left ventricle and Aortic artery

# Heart Valves and the Fibrous Skeleton (dense CT)



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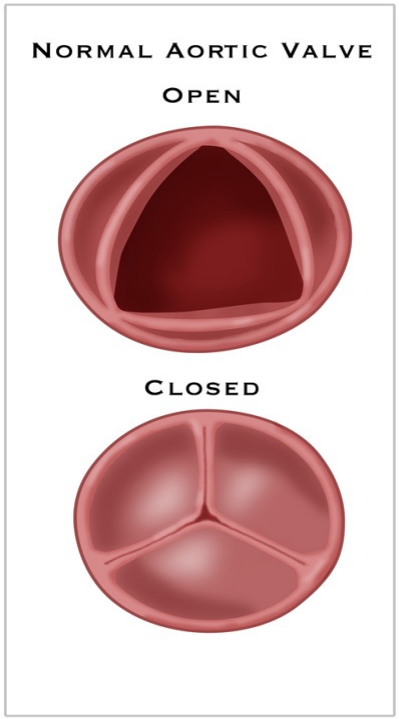
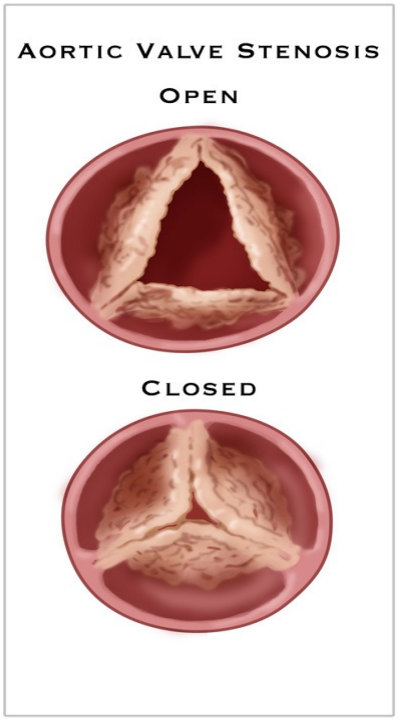
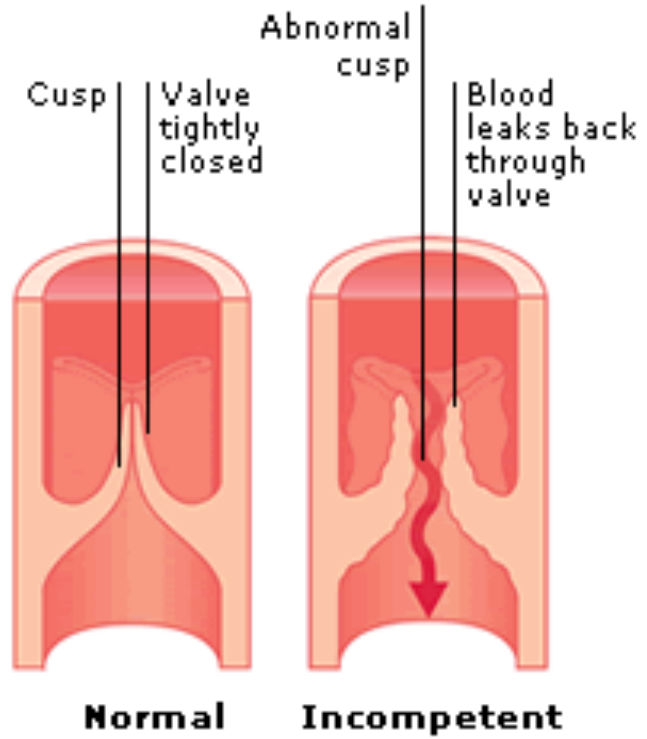
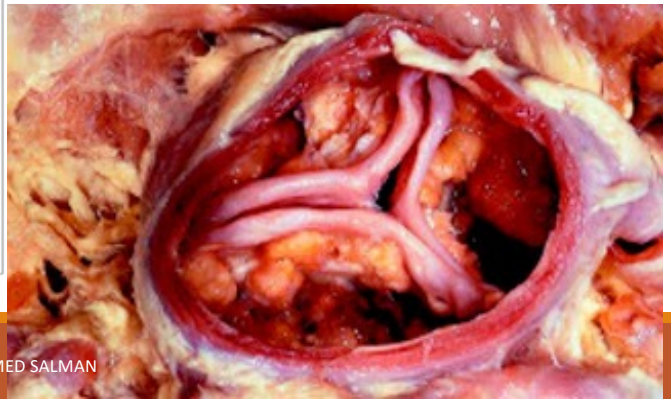
## Clinical Anatomy

Incompetent valve leads to regurgitation of blood
Stenosis of the valve leads to heart over load

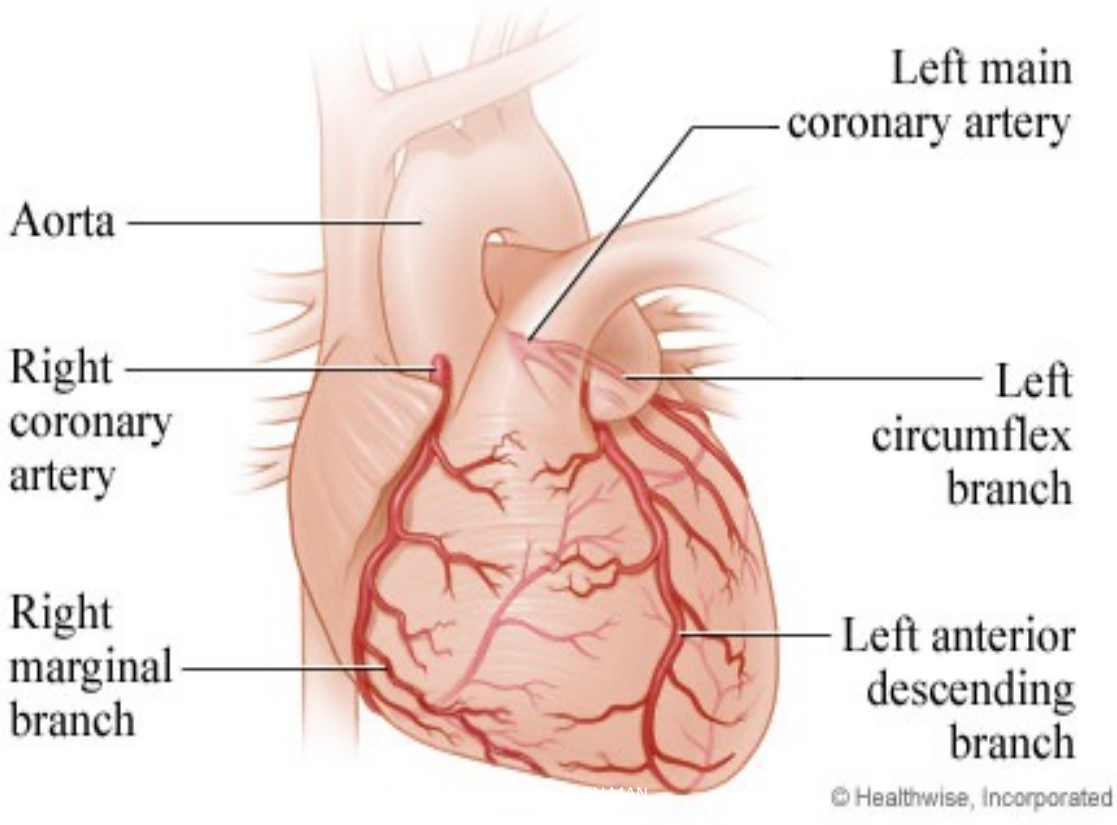


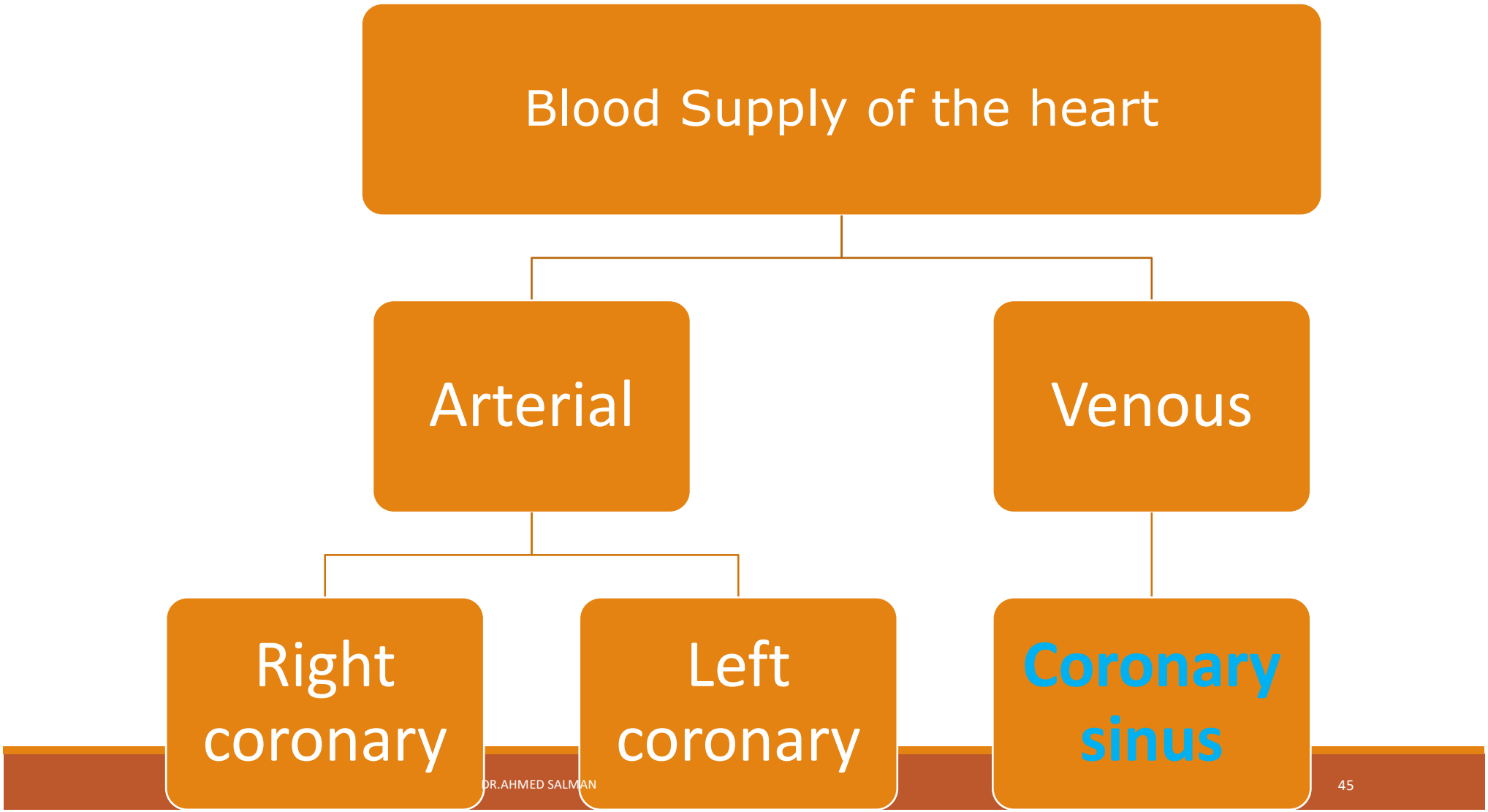



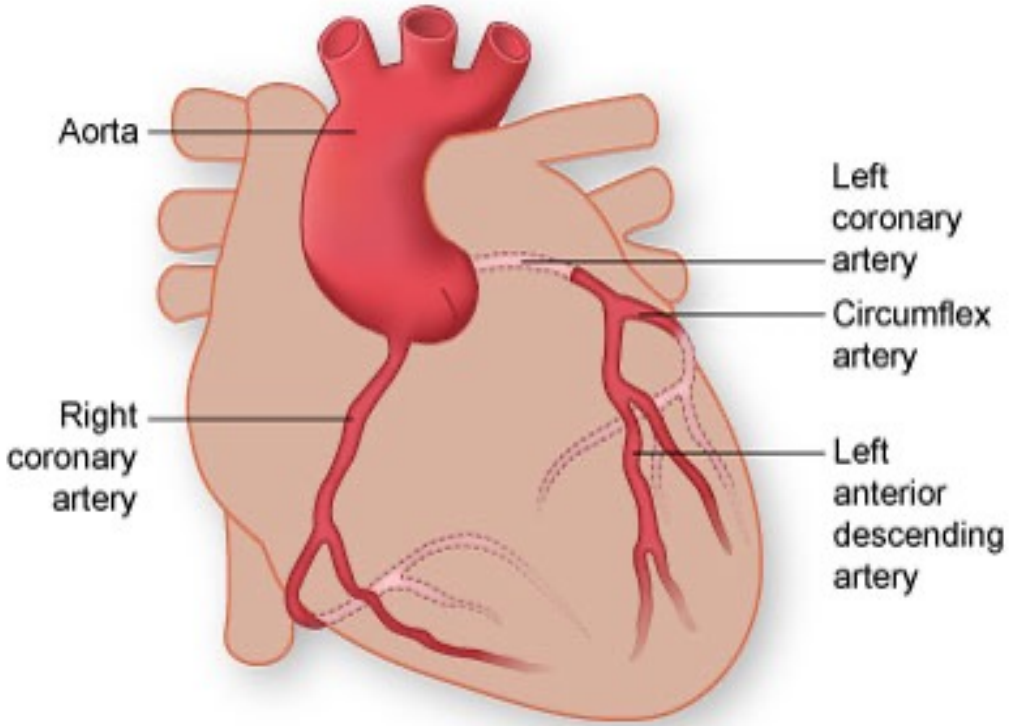



# Blood Supply of heart



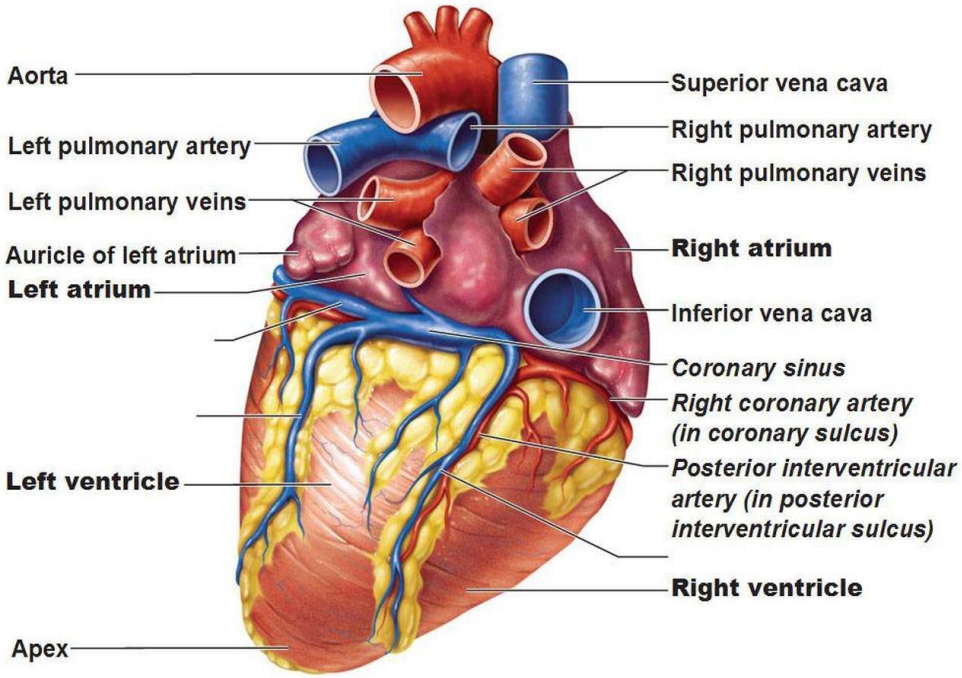

Blood Supply of the heart
Arterial
Venous
Right coronary
Left coronary
Coronary sinus

| Right coronary | Left coronary |
| --- | --- |
| Arises from **the anterior** aortic sinus of the ascending aorta | Arises from the **posterior** aortic sinus of the ascending aorta |
| Important branches :<br>1-Posterior interventricular artery<br>2- SA node branch | Important branches :<br>it gives<br>1-Anterior interventricular artery<br>2-Circumflex |



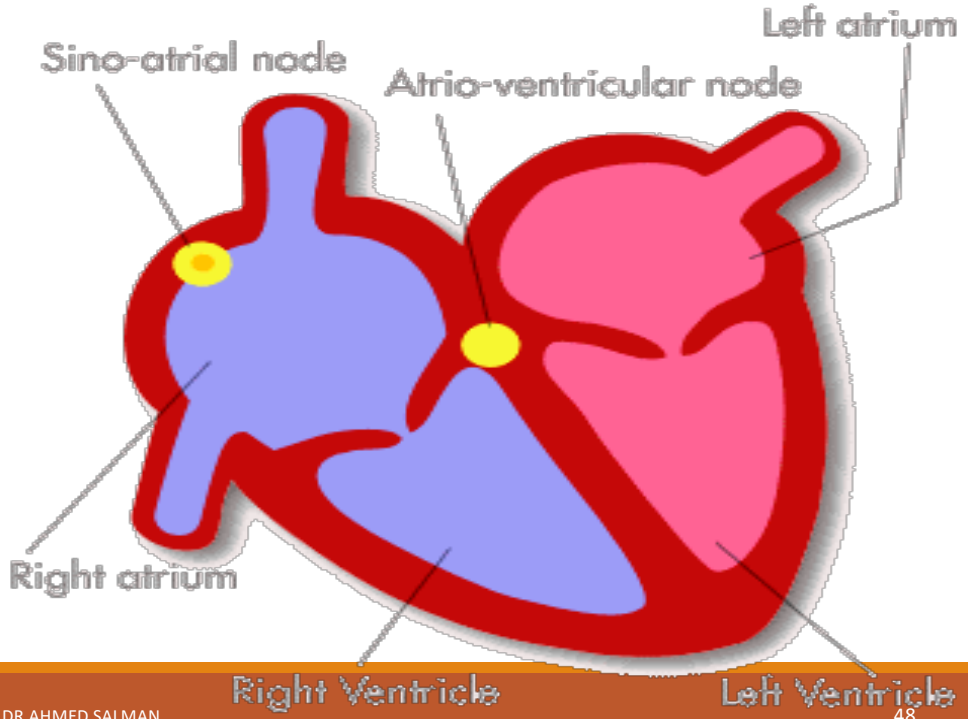

**Inferior View of the Heart** ("Inferior" because this surface lies on diaphragm)

**surface shown rests on the diaphragm.**



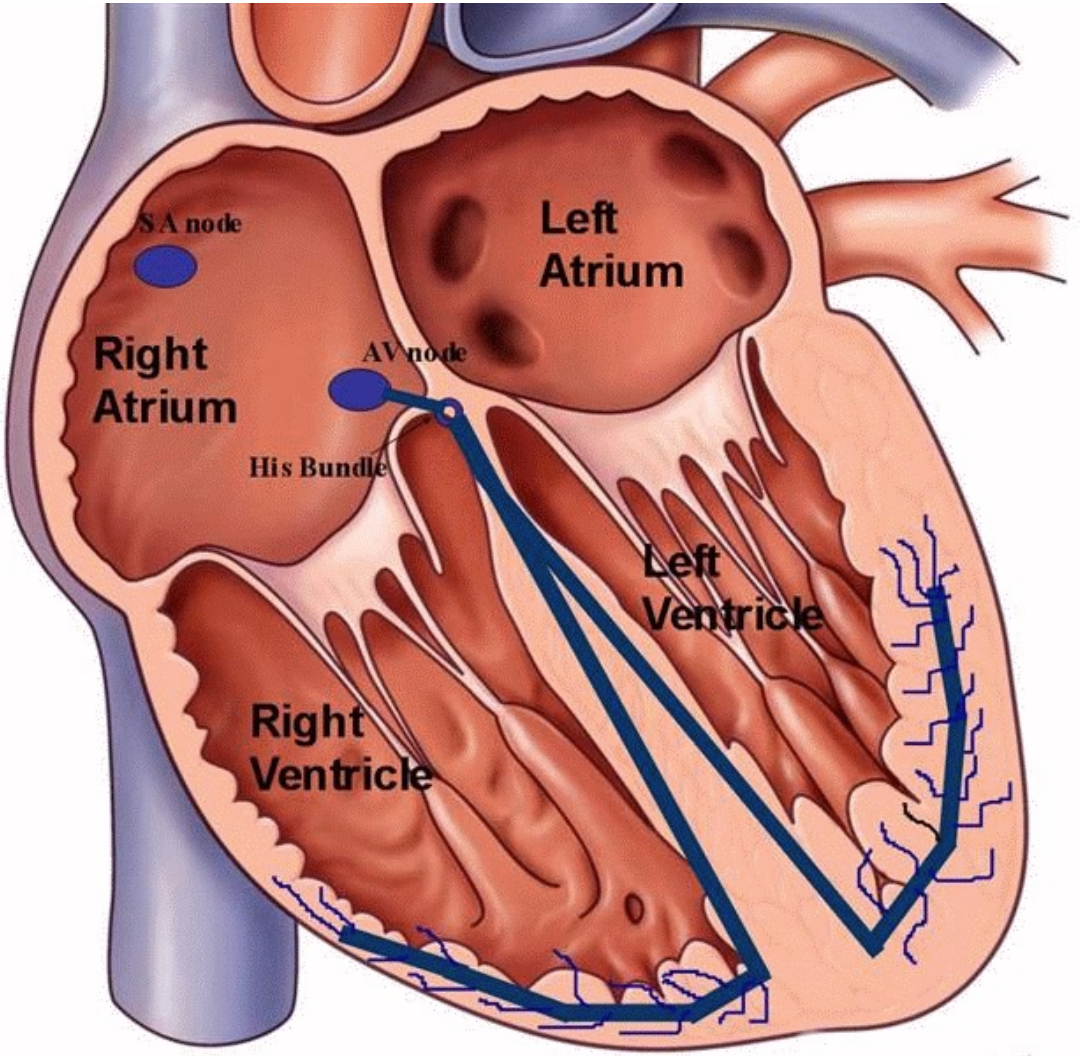
# Conducting system of the heart

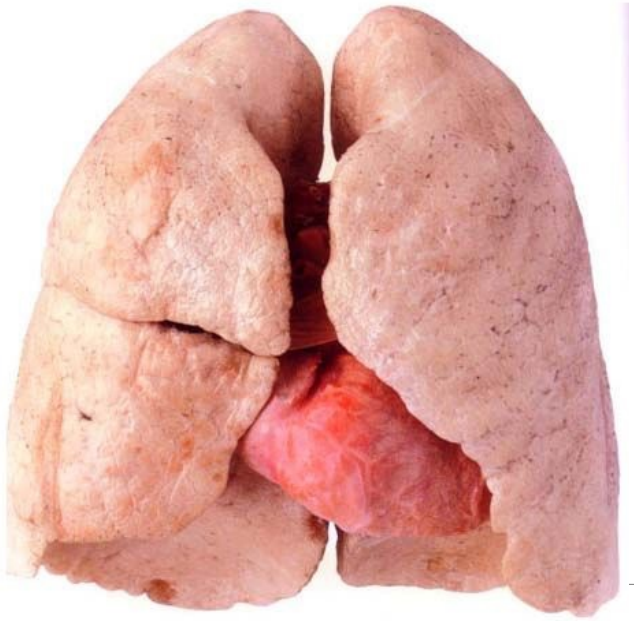
- Responsible for initiation and conduction of cardiac impulses.



**Parts of Conducting system of the he**

- Sinoatrial node ( SA node).
- Atrioventricular node ( AV node).
- Atrioventricular bundle ( bundle of His)
- The right branch of AV bundle.
- The left branch of AV bundle.
- The Purkinje fibers.



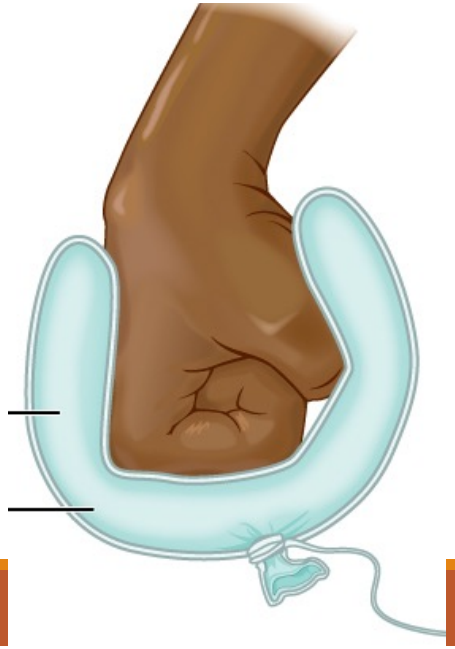


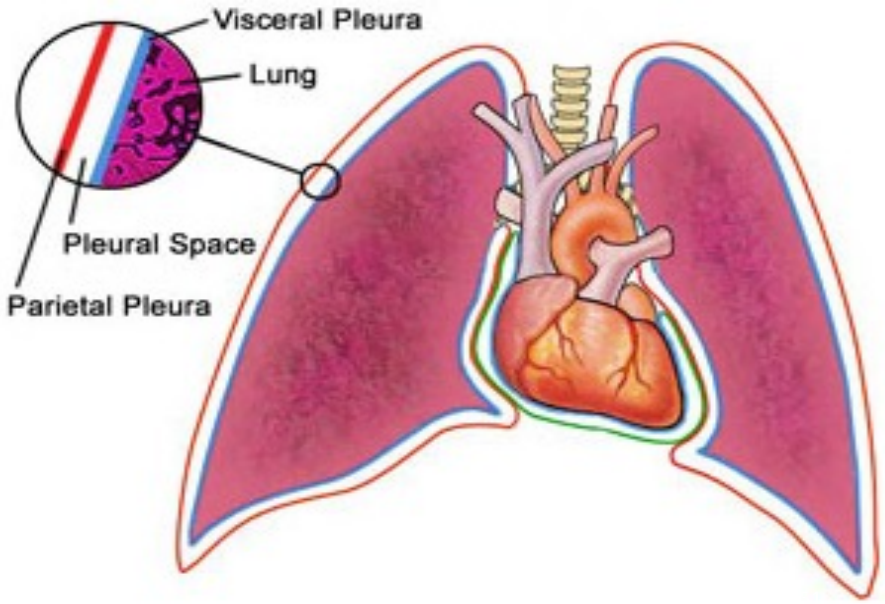
# Lungs and Pleura

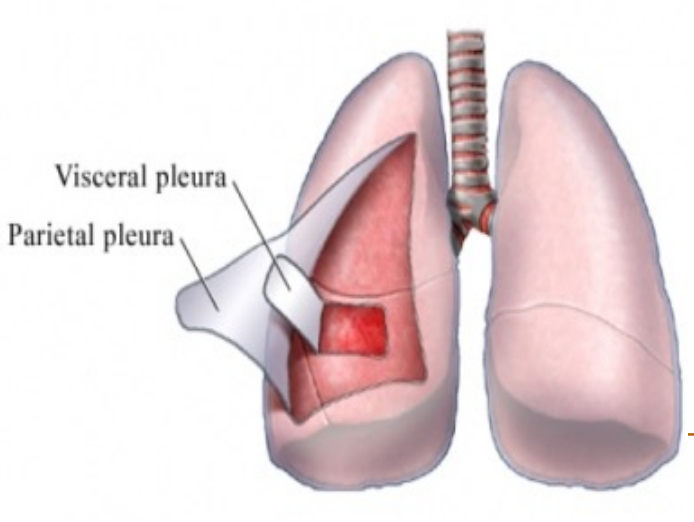
# Pleura

It is a serous sac invaginated from its medial side by the lungs.

Two pleural sacs are separated from each other by the mediastinum.








# The pleura

## *Visceral layer*

*covers the outer surfaces of the lungs and extends into the interlobar fissures*

## *Parietal layer*

*Lines the thoracic wall, covers the diaphragm and lateral aspect of the mediastinum*

## *Pleural cavity*

*Contains the pleural fluid, permits the two layers to move on each other with the minimum of friction*

# Nerve supply of pleura

| Parietal Pleura | Visceral Pleura |
|---|---|
| Supplied by somatic nerves (Intercostal nerves) | Supplied by visceral nerves ( autonomic ) |
| It is sensitive to pain, temperature, touch, and pressure | It is sensitive ***to stretch*** |

## The pleural cavity may be distended by one of the following:

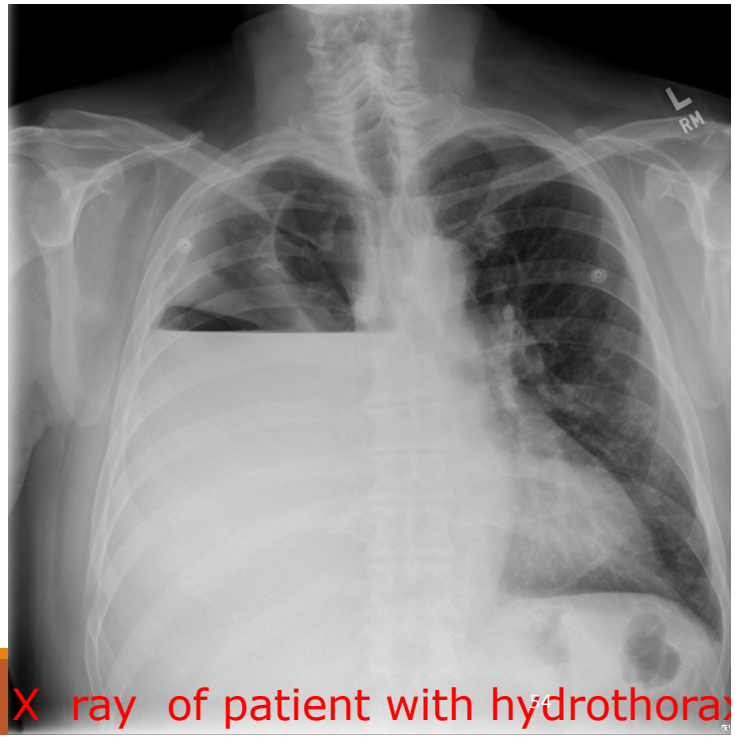
Fluid ---------- Pleural effusion {hydrothorax}.

Air ---------- Pneumothorax .

Blood ---------- Haemothorax.

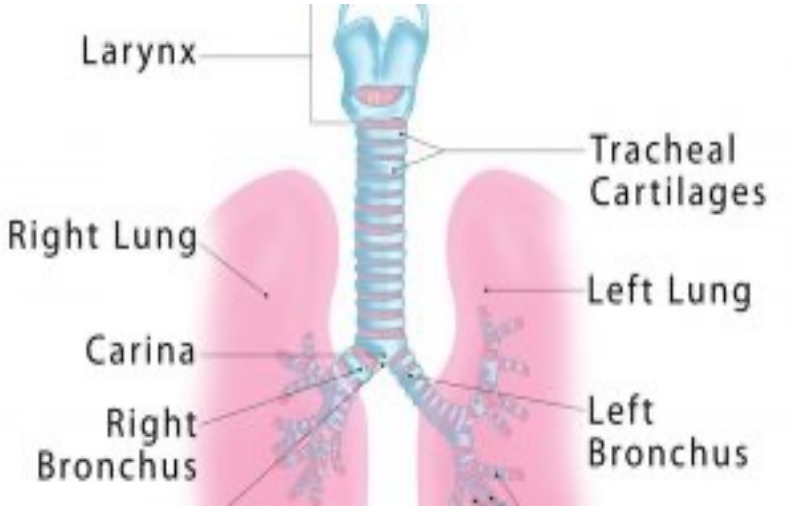
Pus ---------- pyothorax.

Lymph ---------- Chylothorax.




X ray of patient with hydrothorax

# Trachea



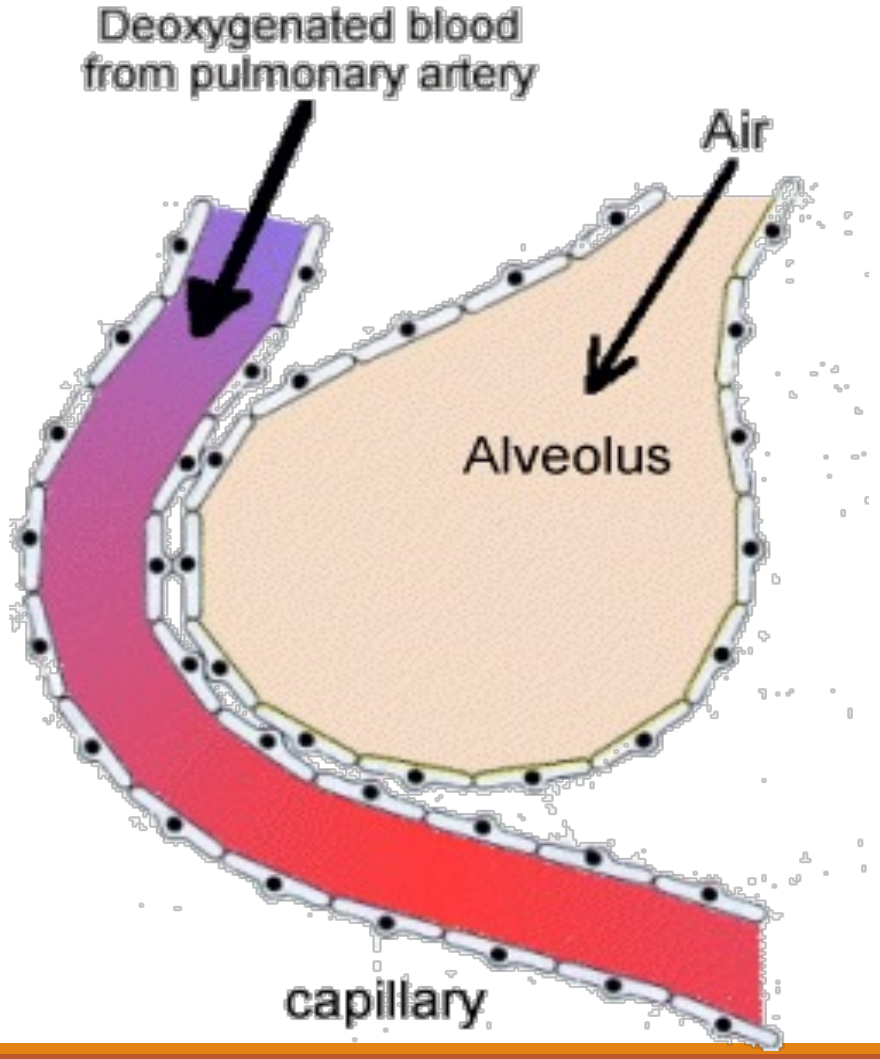

It is cartilaginous and membranous tube conducting air from larynx to the lungs

Beginning : At the level 6th cervical vertebra

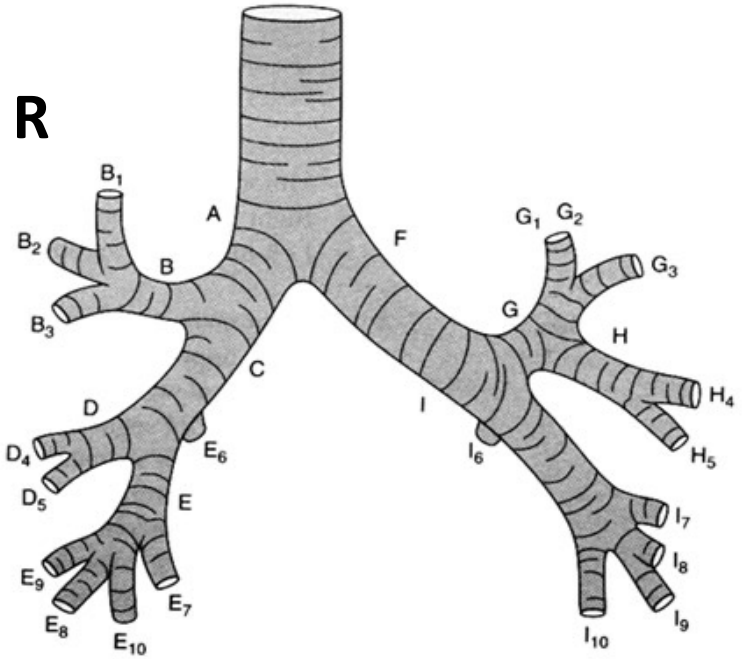
End : At the level of the sternal angle (opposite the disc between the fourth and fifth thoracic vertebrae).

The trachea is divided into right and left principal (main) bronchi

The trachea is kept patent by the presence of U-shaped bars (rings) of hyaline cartilage

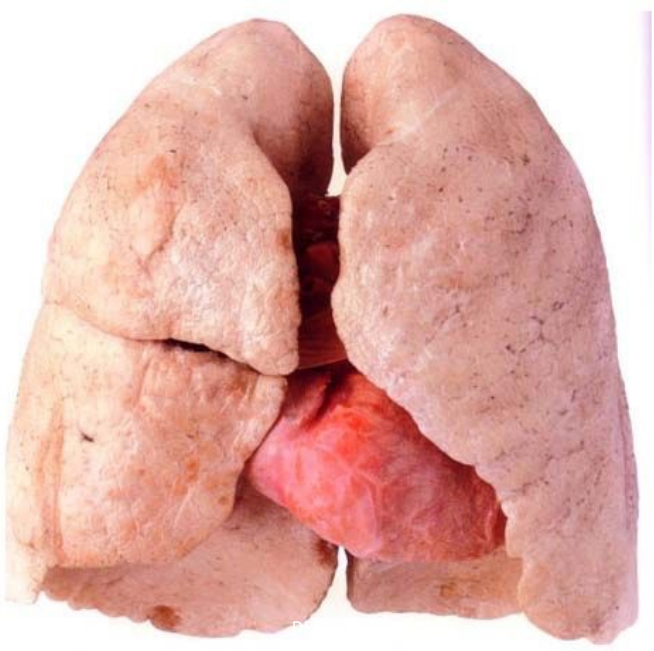

Deoxygenated blood
from pulmonary artery
Air
Alveolus
capillary

| Right principal bronchus | Left principal bronchus |
|---|---|
| Shorter | Longer |
| wider | Narrower |
| more vertical | More horizontal |
| Inhalation of foreign bodies into the lower respiratory tract is common, especially in children | Less common |

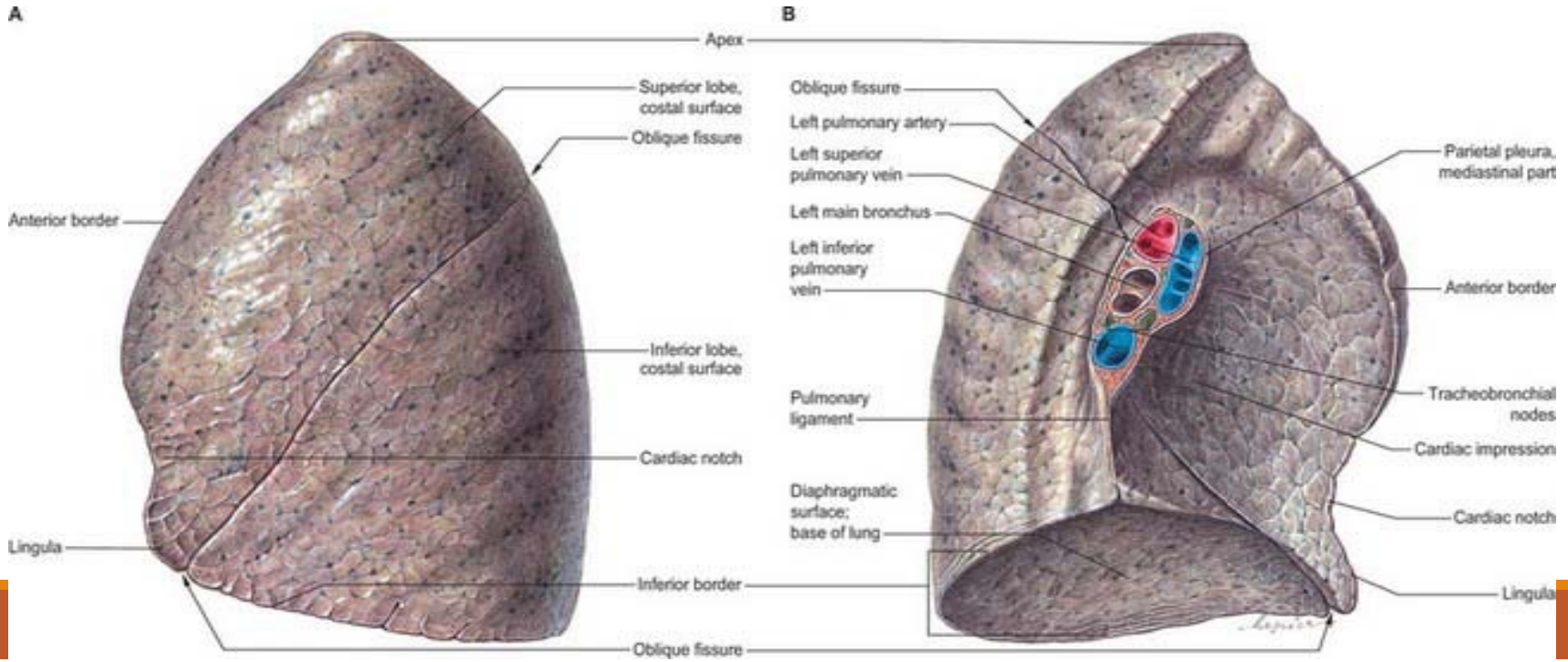


# Lungs

It is the essential organs of respiration.
Each lung is conical, covered with visceral pleura
Each has an apex, base, 3 borders {anterior, posterior & inferior} and 2 surfaces (costal & medial).



**Apex :** is blunt and projects upward into the neck for about (2.5 cm) above the clavicle
**Base :** is a concave and related to the diaphragm
**Costal Surface :**is convex related to ribs and costal cartilages
**Mediastinal surface :** is concave is related to mediastinum and contains the hilum
**Anterior border :** is thin and overlaps the heart .It has cardiac notch on the left side
**Posterior border** : is thick and lies beside the vertebral column

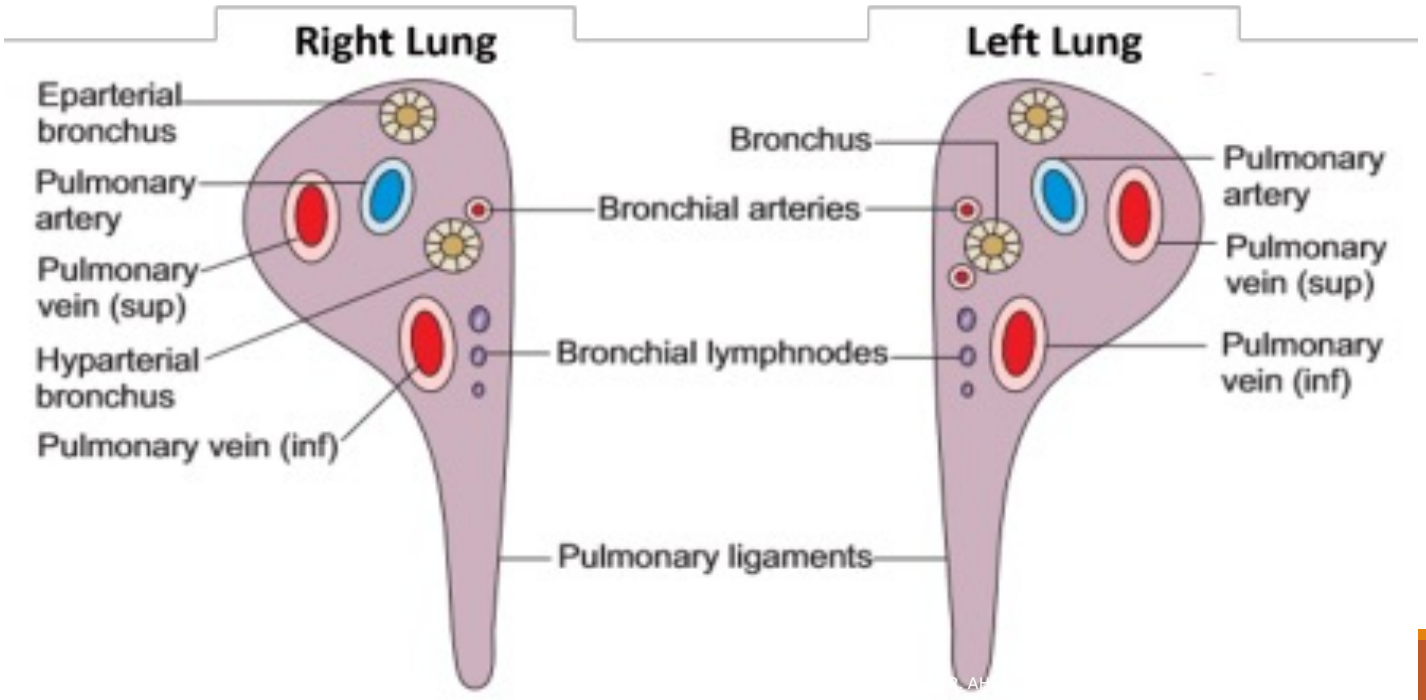


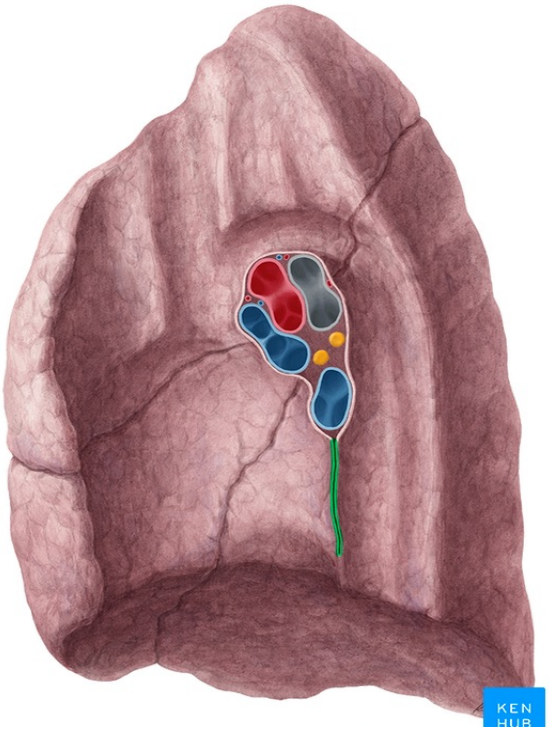
## Hilum

It is the group of structures that enter or leave the lung through the hilum

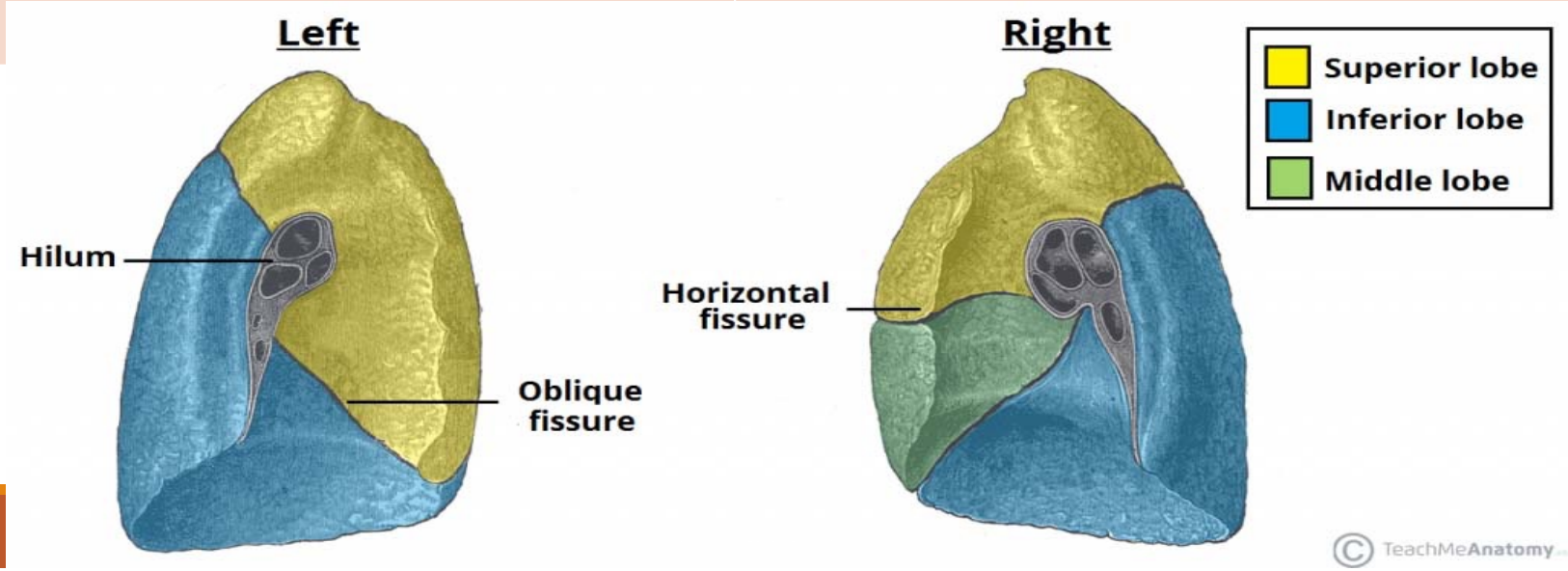
**Contents :**

- ✓Bronchus
- ✓Pulmonary artery
- ✓Superior pulmonary vein
- ✓Inferior pulmonary vein
- ✓Vessels ,nerves and lymphatics



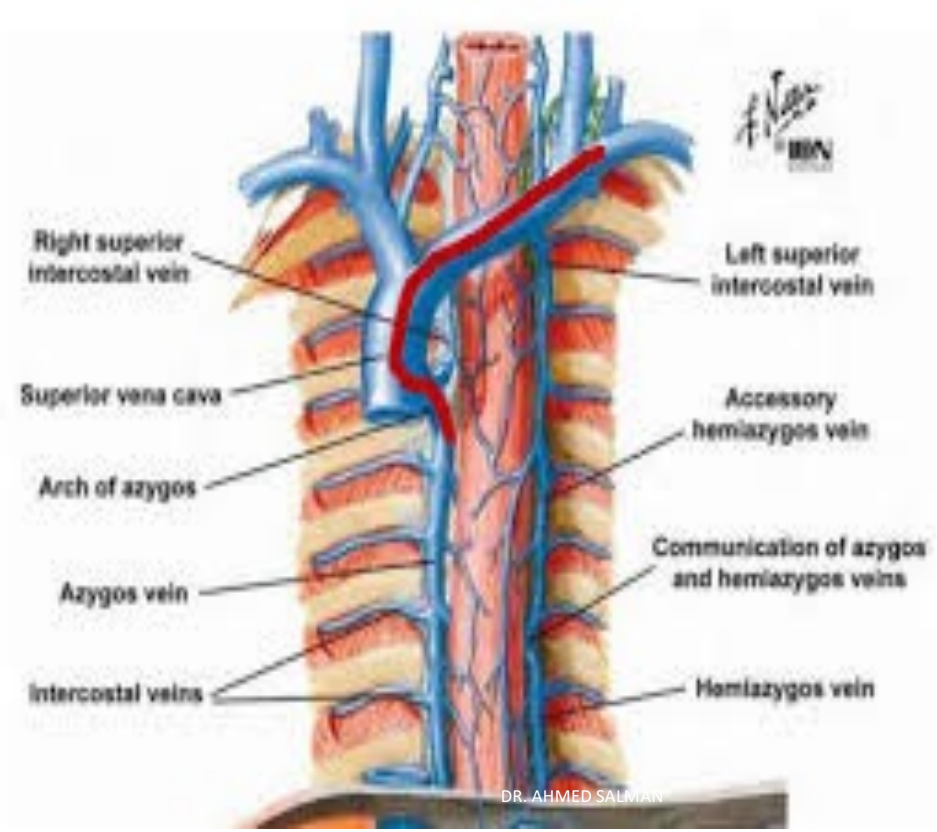



| Difference between right and left lung | |
|---|---|
| **Right lung** | **left lung** |
| Larger | Smaller |
| Has two fissures oblique and horizontal fissures | Has oblique fissures only |
| Has three lobes ,upper , middle and lower lobes | Has two lobes ,upper and lower lobes |
| Shorter | Taller |



## Blood Supply of the Lungs

The bronchi, the connective tissue of the lung, and the visceral pleura receive their blood supply from **the bronchial arteries,** which are branches of the descending aorta.
The **bronchial veins** drain into the azygos and hemiazygos veins.

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