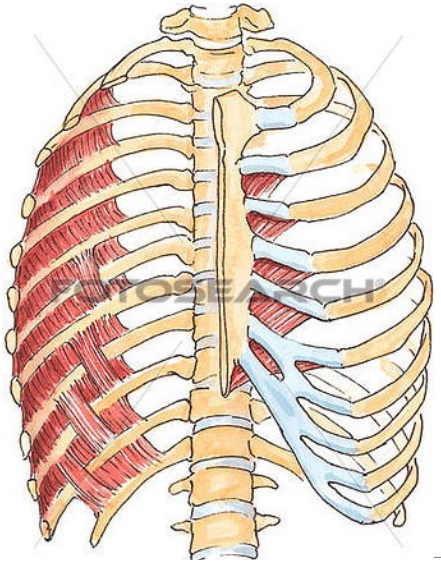
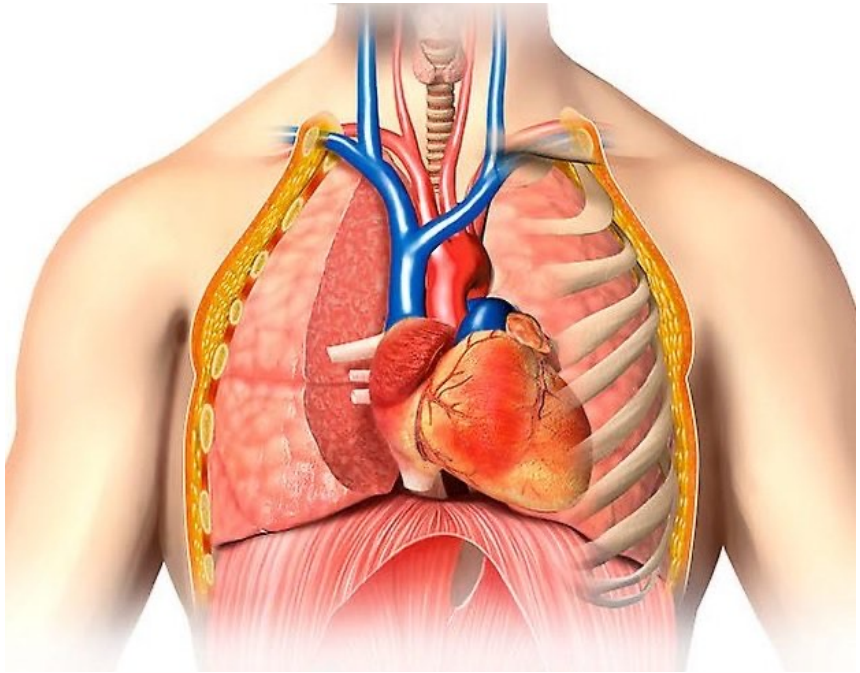
Jordan University
Faculty Of Medicine



Thorax

DR. AHMED SALMAN

Associate professor of anatomy & embryology



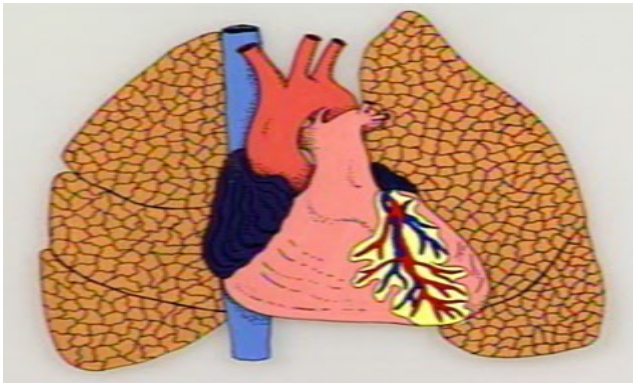
THORAX

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

Thorax

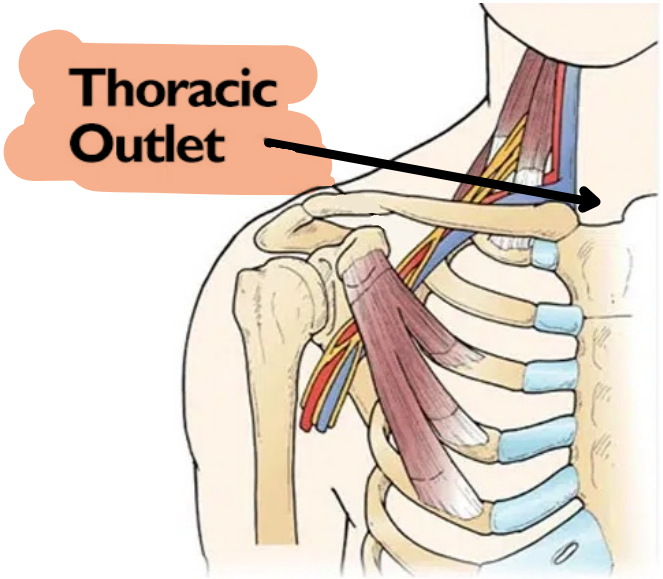
Thoracic Wall

Thoracic Cavity



The superior thoracic aperture, also known as the thoracic outlet, refers to the opening at the top of the thoracic cavity

Openings of the Thorax



Thoracic outlet

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

Boundaries :

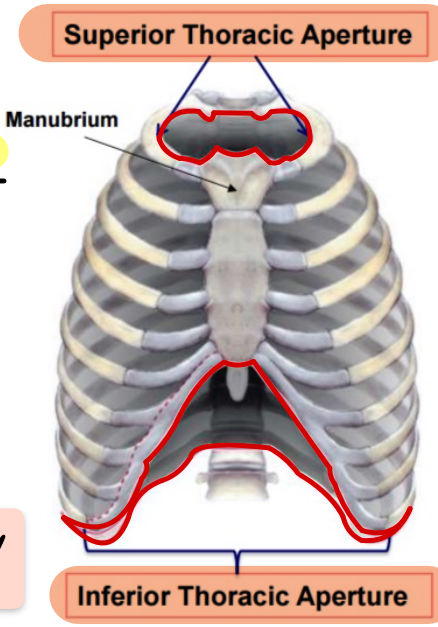
Anteriorly: superior border of the manubrium sterni

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

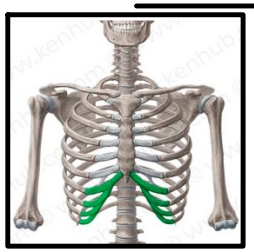
- The thoracic cavity communicates with the abdomen through a large opening

•Boundaries :

Anteriorly : xiphisternal joint

Posteriorly : 12th thoracic vertebra

Laterally : costal margin

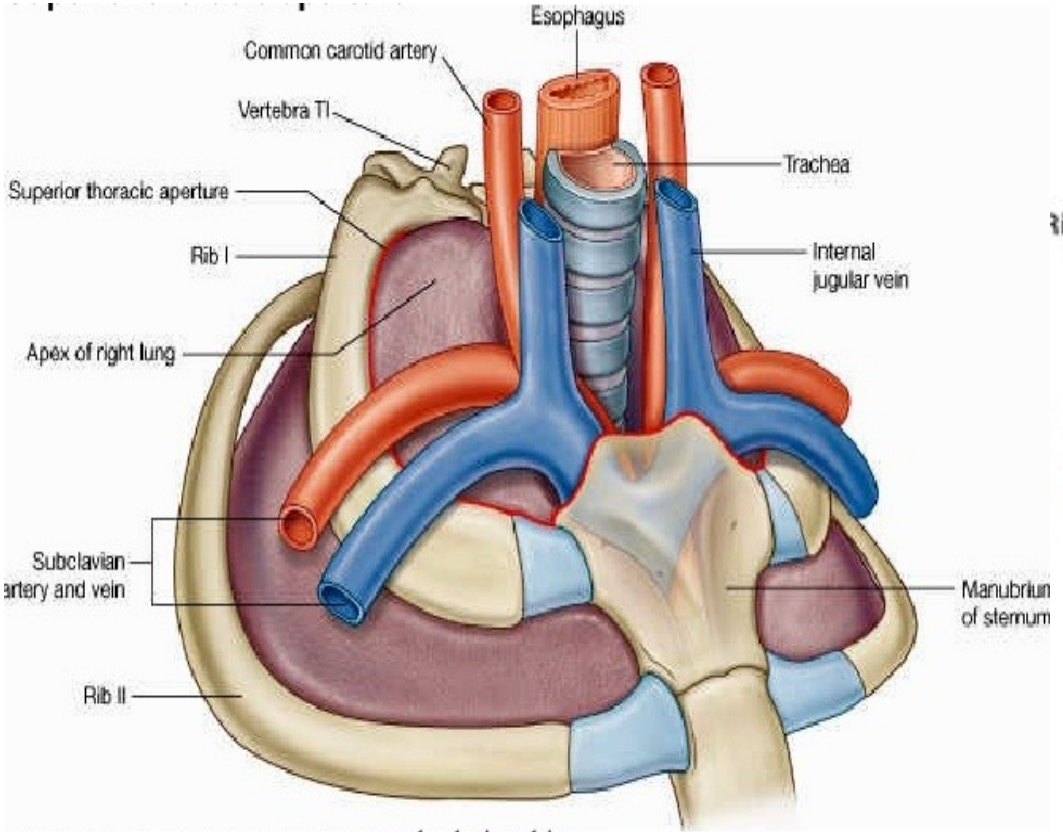


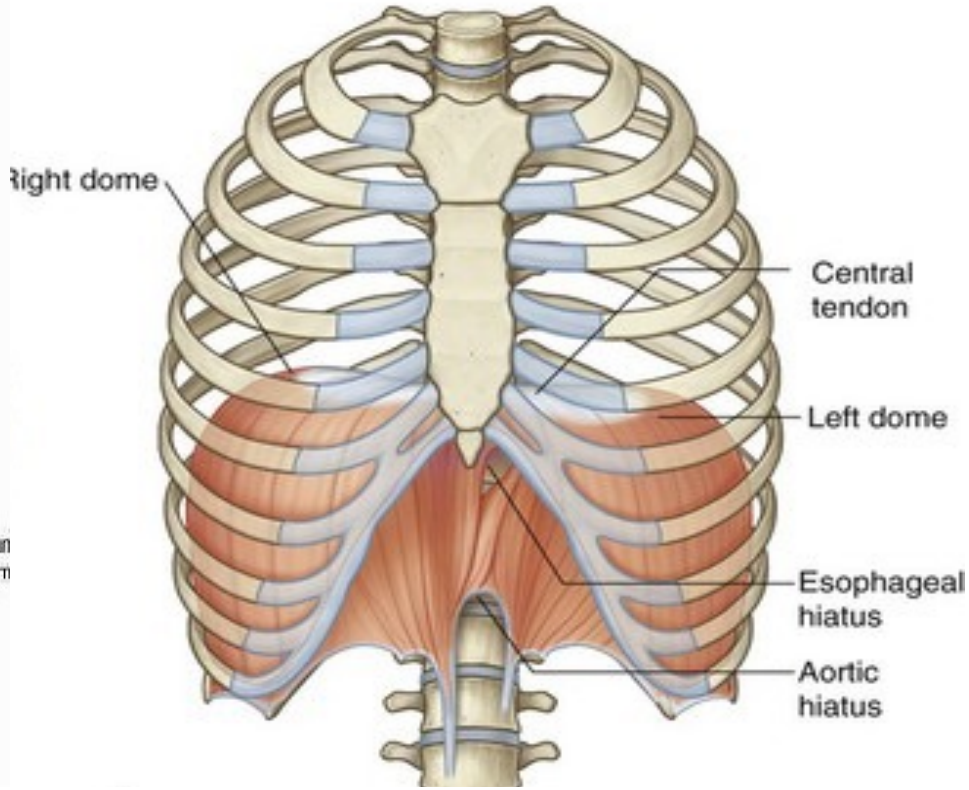
Structure passing :

(esophagus and many large vessels and nerves, through diaphragm foramina)

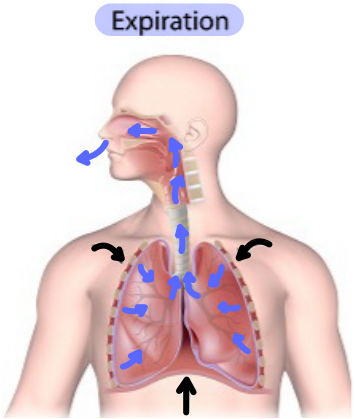
Why we would need trachea in the abdomen !!!

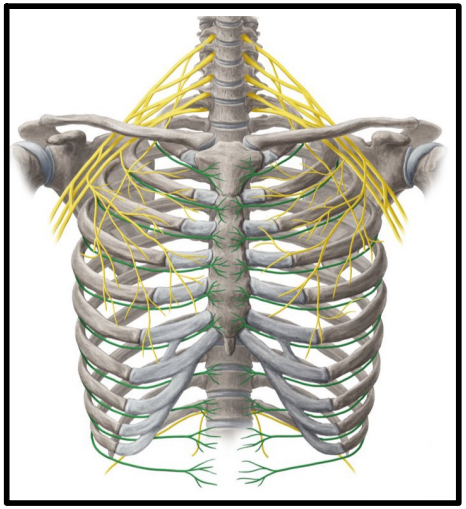
Openings of the Thorax





Intercostal muscles





Intercostal nerves

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

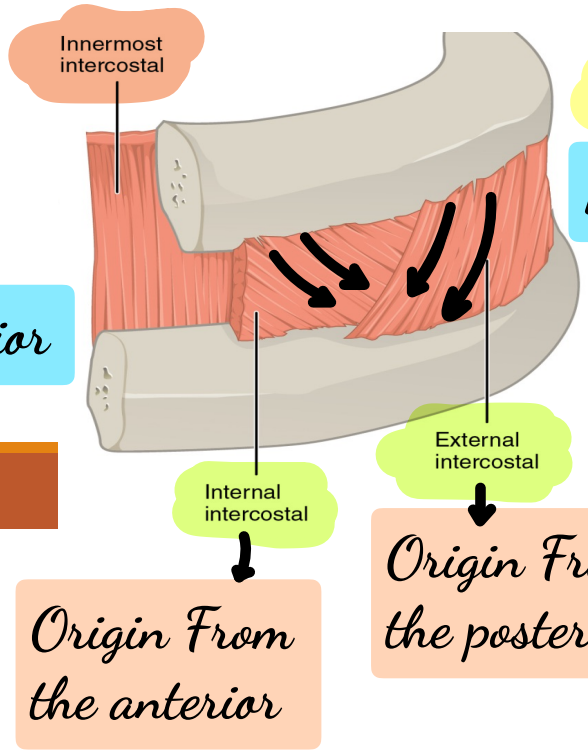
Action :

Respiration

Strengthen the intercostal spaces

Protection

Anterior

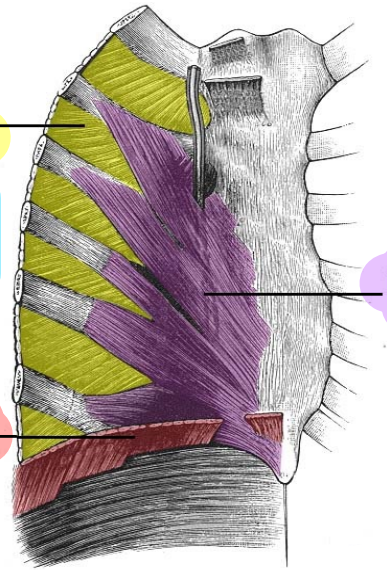


Origin From the anterior

Origin From the posterior

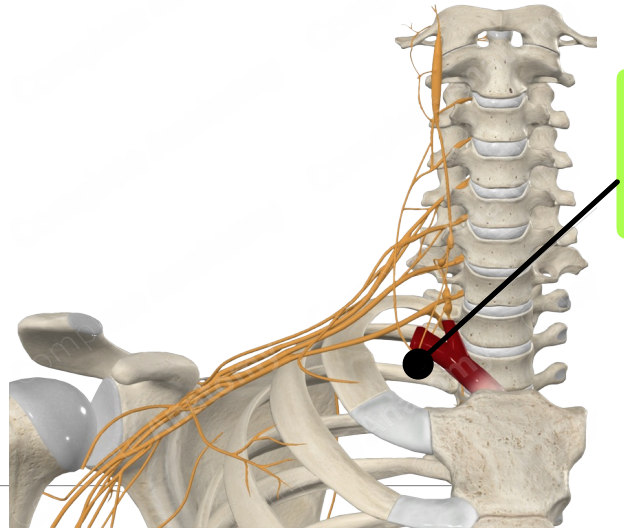
Internal intercostals

Posterior



Dom shaped

Diaphragm

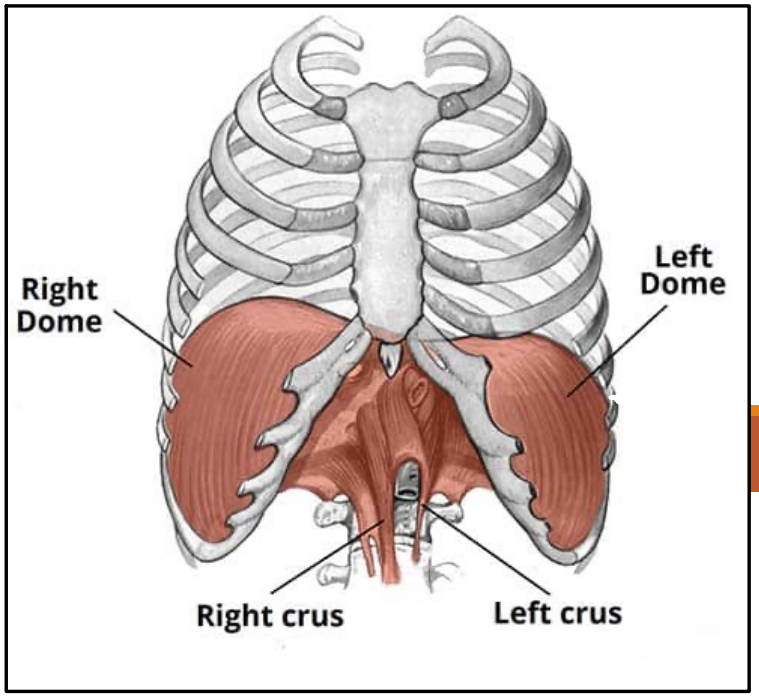


It is a thin muscular and tendinous septum that separates the chest cavity above from the abdominal cavity below.

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

Diaphragm Descend from the neck (cervical region) then lowering to the abdomen this is why it's nerve supply from C 3.4.5

Somatic nerve = voluntary movement
We can control our breath (we can hold our breath whenever we want)



Voice of Africa

Opening of the diaphragm :

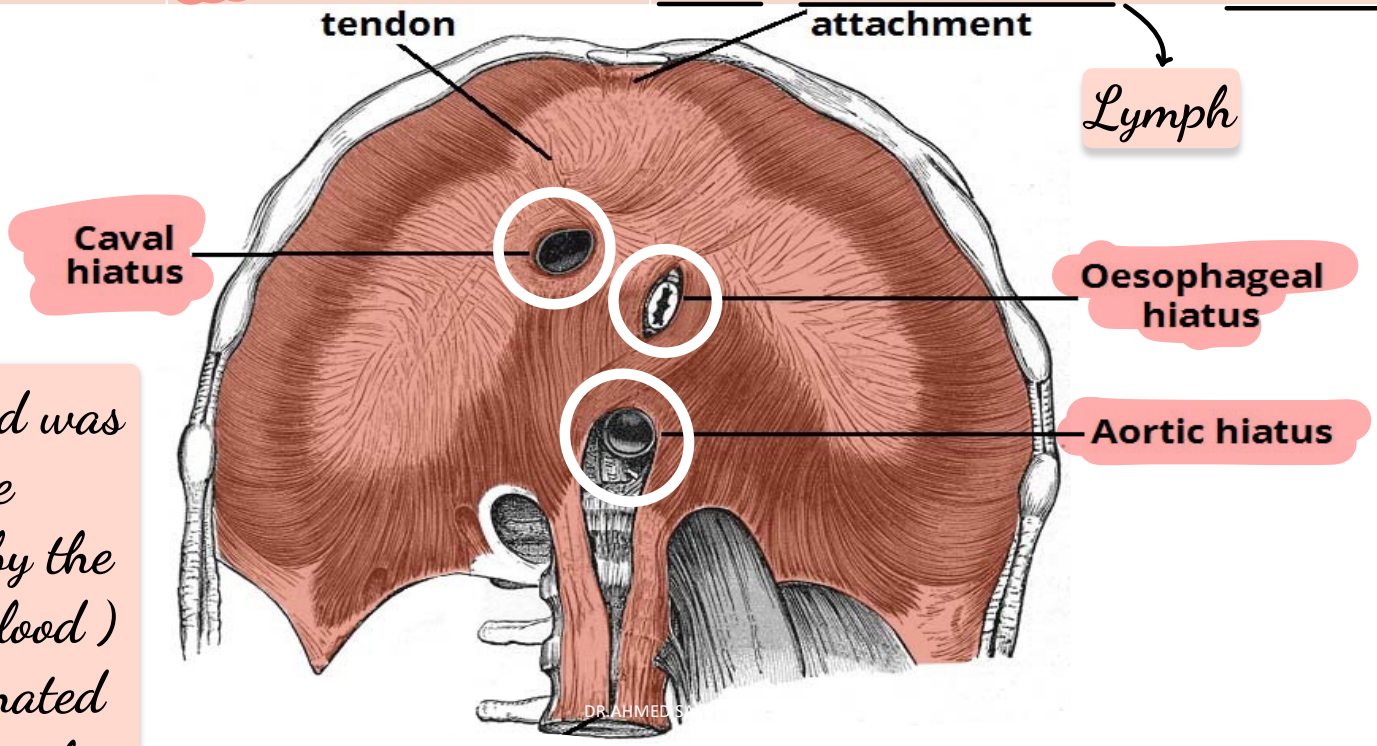
Opening	Level	Structures passing through it
Vena Caval	8th thoracic vertebra	It transmits the inferior vena cava and terminal branches of the right phrenic nerve.
Oesophageal (Oesophagus)opening	10th thoracic vertebra	oesophagus, the right and left vagus nerves
Aortic	12th thoracic vertebra	aorta, the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

Cranial nerve

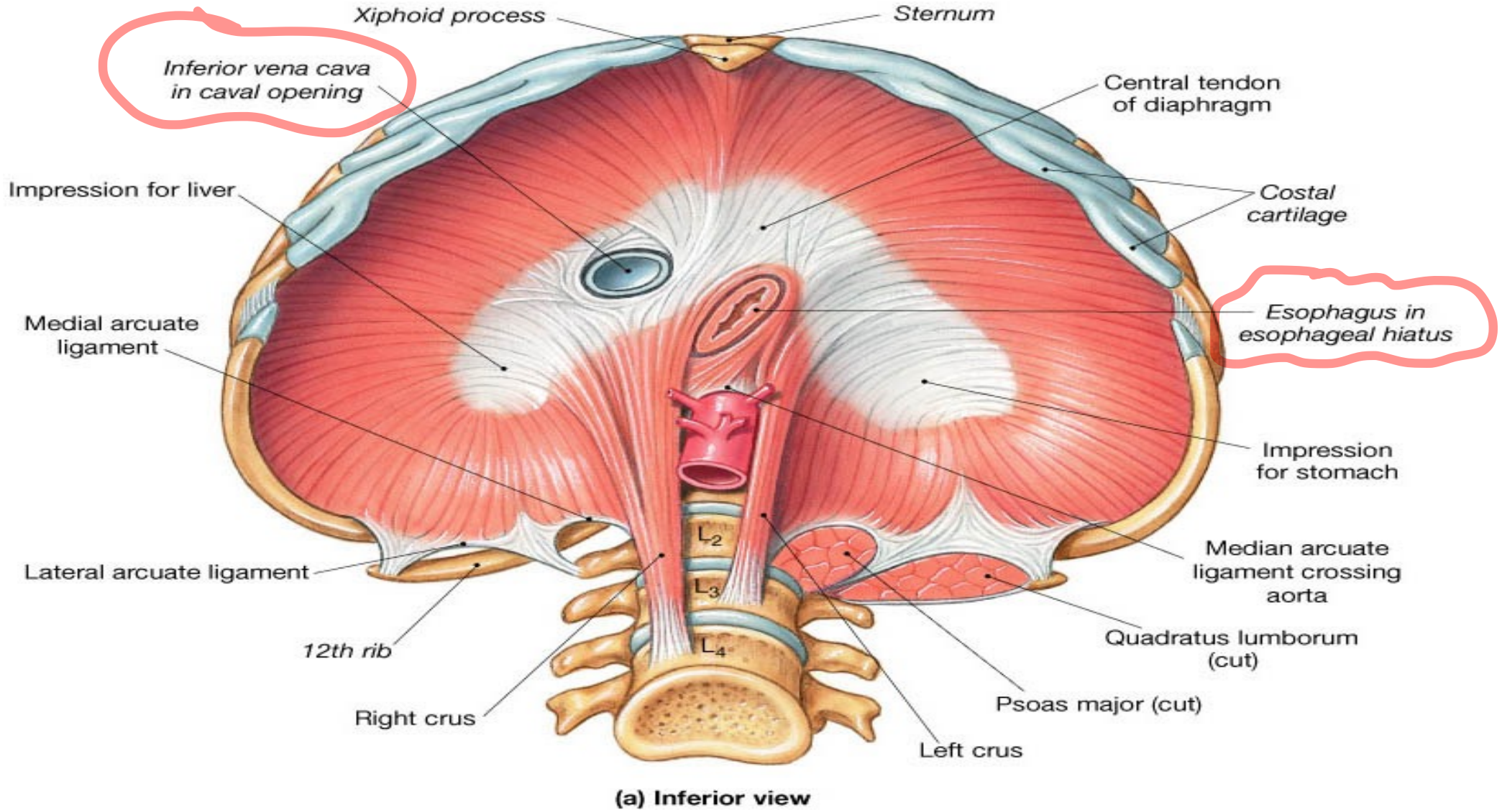
Middle

Lymph

Vein in the thoracic wall



Extra note : The blood was transferred from the heart to the tissue by the Aorta (oxygenated blood) then the (De-oxygenated blood) will go back to the vein (by helping of some lymph nodes)



(a) Inferior view

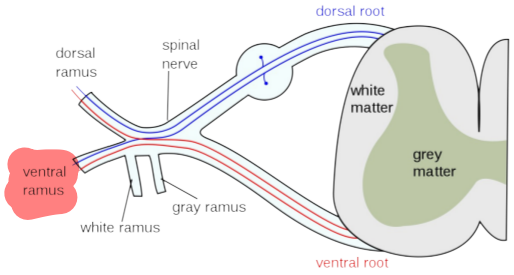
Function of the diaphragm

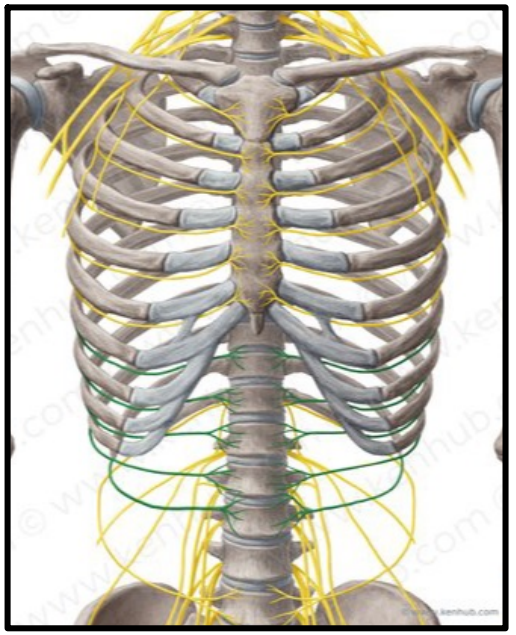
1. **Respiration**
2. **Muscle of abdominal straining:** The contraction of the diaphragm is raising the intra-abdominal pressure
3. **Weight-lifting muscle**:
4. **Thoracoabdominal pump:** Pump for blood and lymph

Pumping the blood from the lower limp To the abdomen & the thorax

Intercostal nerves

Mixed nerve





- It is a ventral ramus of thoracic nerves
- There are 11 nerves on each side

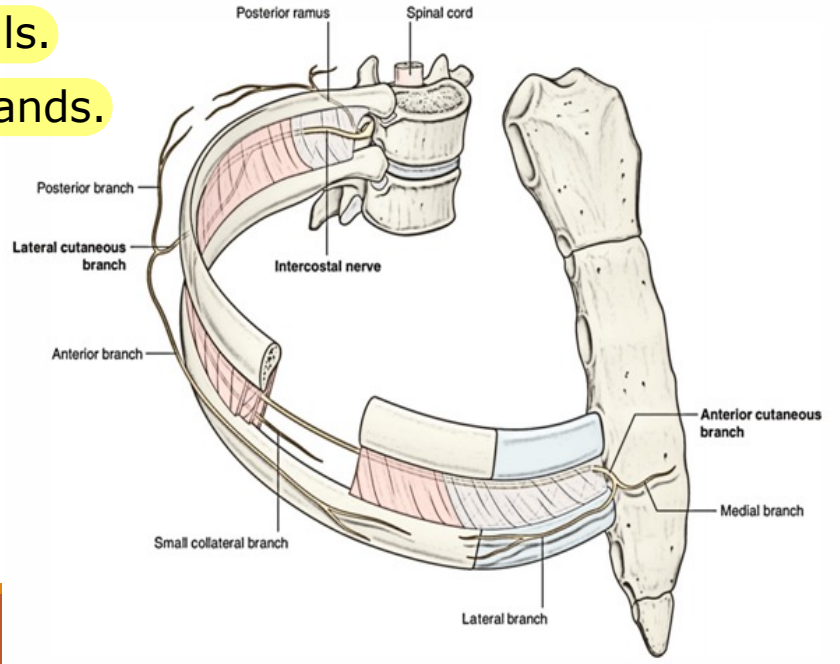
We have 11 intercostal space

- 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.

Sympathetic division: Come from the Thoracolumbar region



Arterial supply

Blood supply of thoracic wall

Means Arteries and veins

11 & 12 rib are floating anteriorly

Anterior wall

9 on each side.

2 in each space.

Upper 6 from **internal thoracic artery**.

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

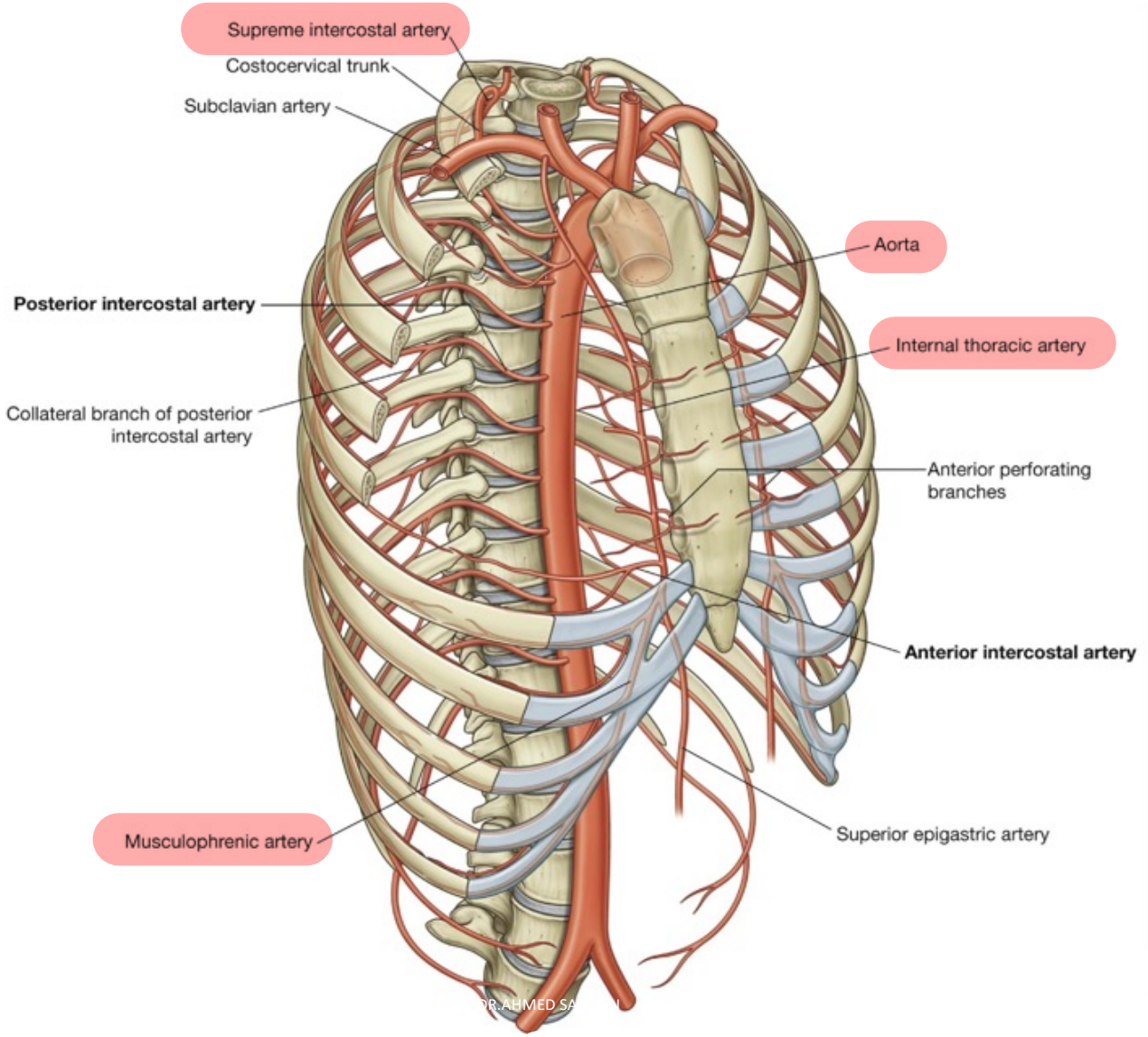
Posterior wall

11 on each side.

One in each space.

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

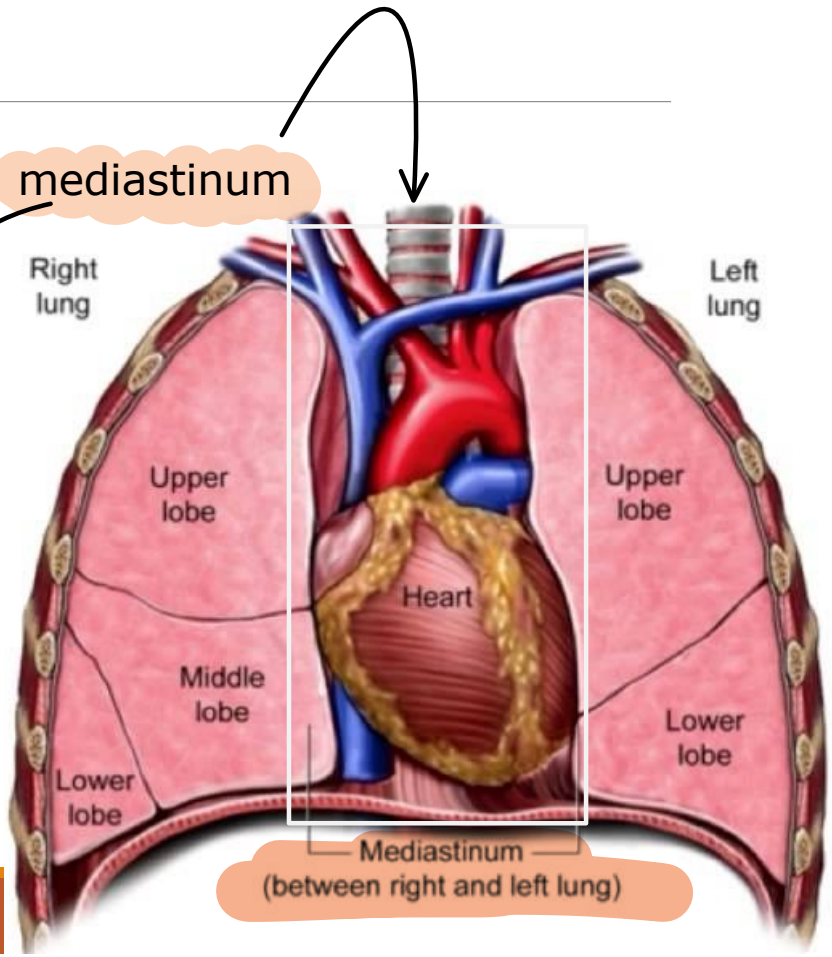
3 -11 from descending thoracic aorta.


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

Esophagus, Trakia heart vessels, nerves arteries



Mediastinum

It is the septum between the two pleural cavities.

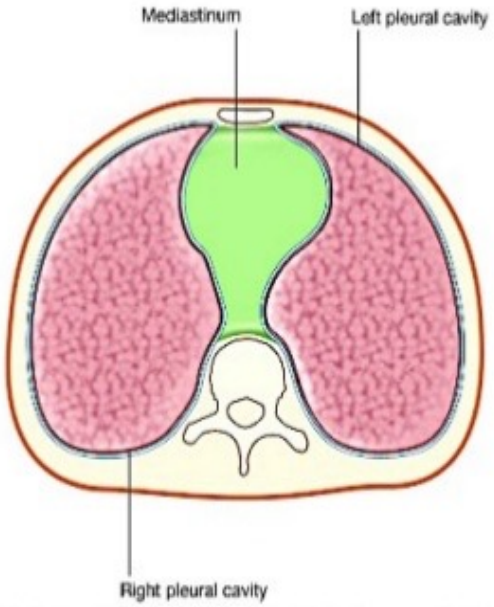
Boundaries :

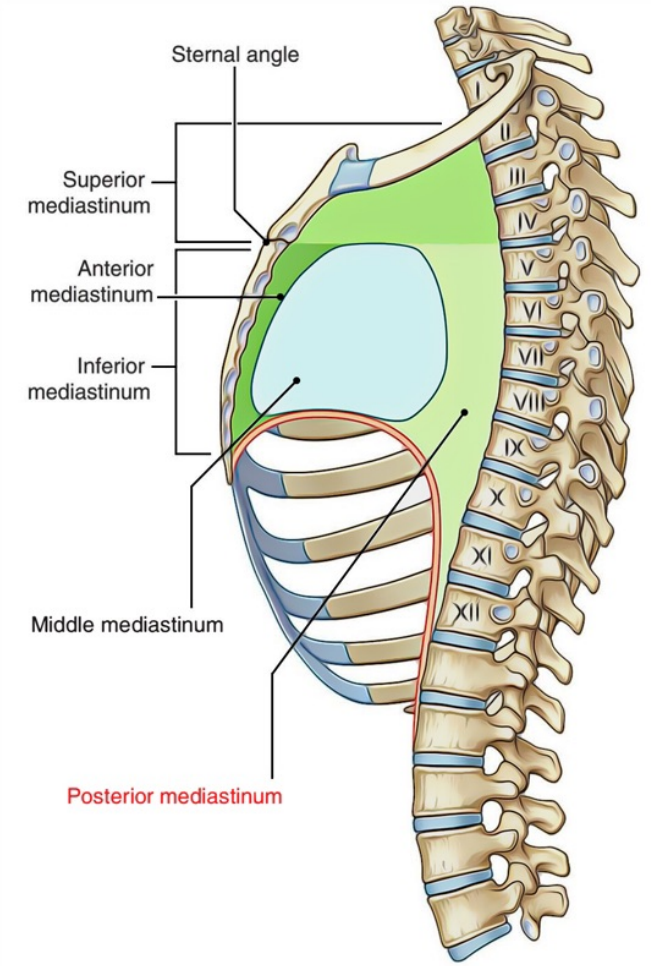
Superior: Thoracic outlet

Inferior: Diaphragm

Anterior: Sternum

Posterior: Vertebral column





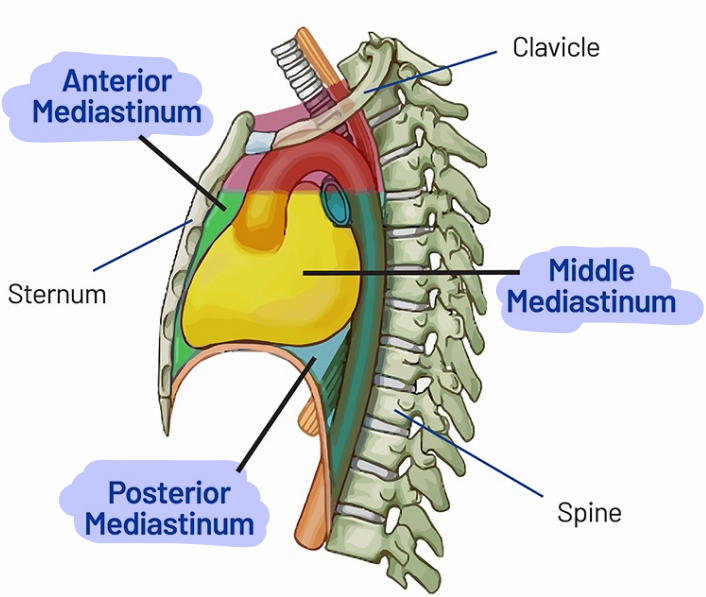
Subdivisions:

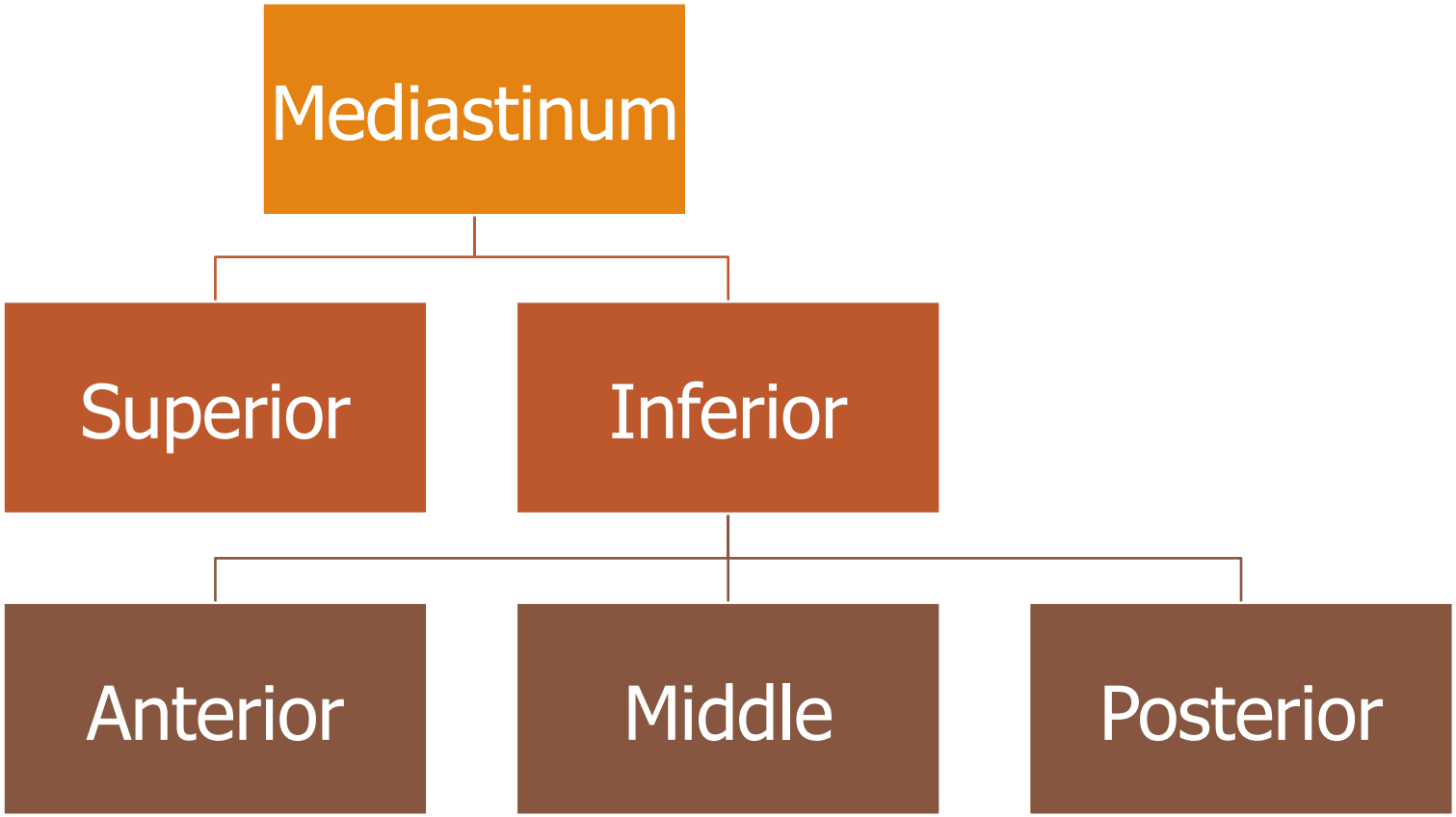
Division :

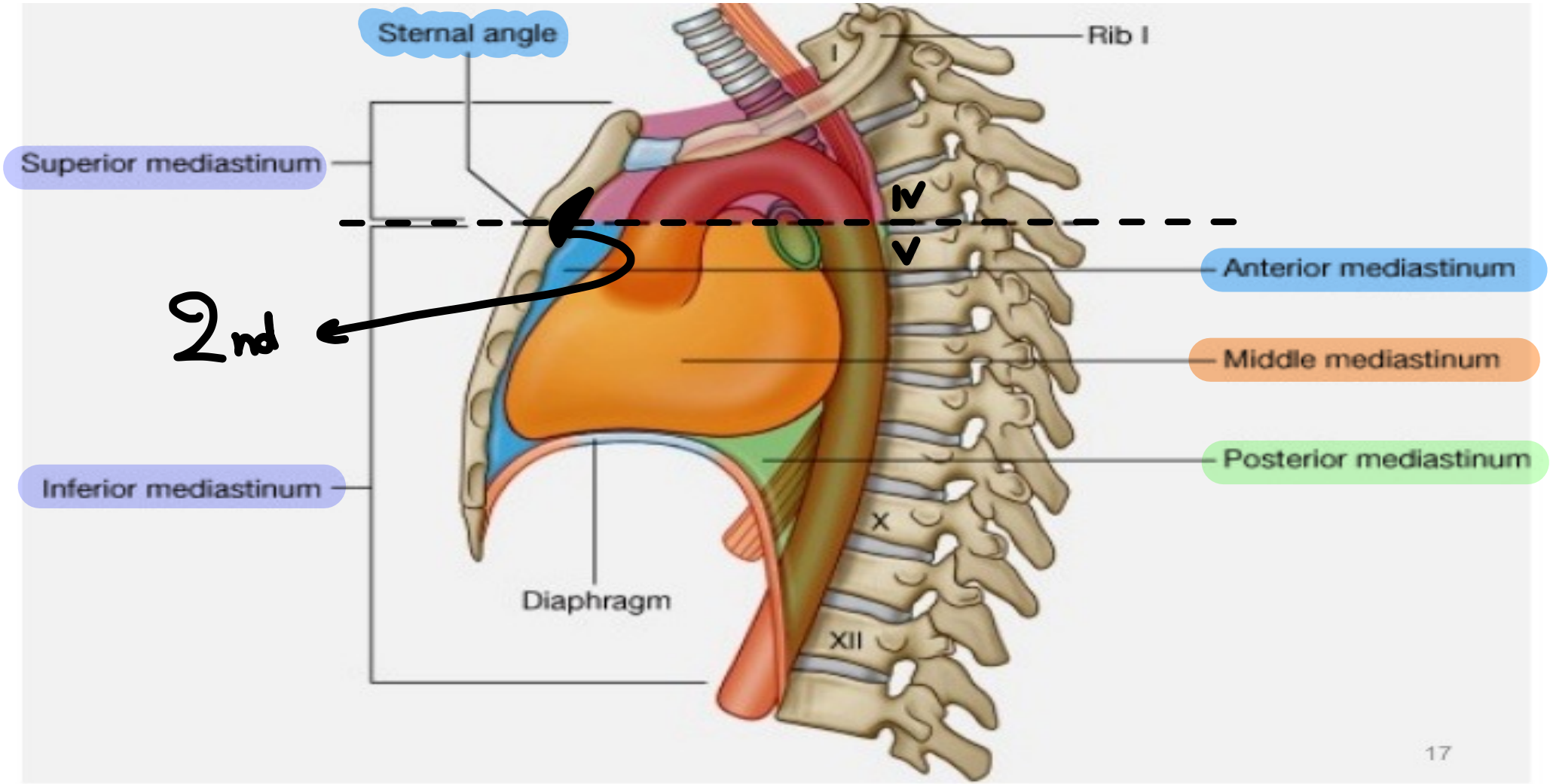
Because the vertebral column is curved

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

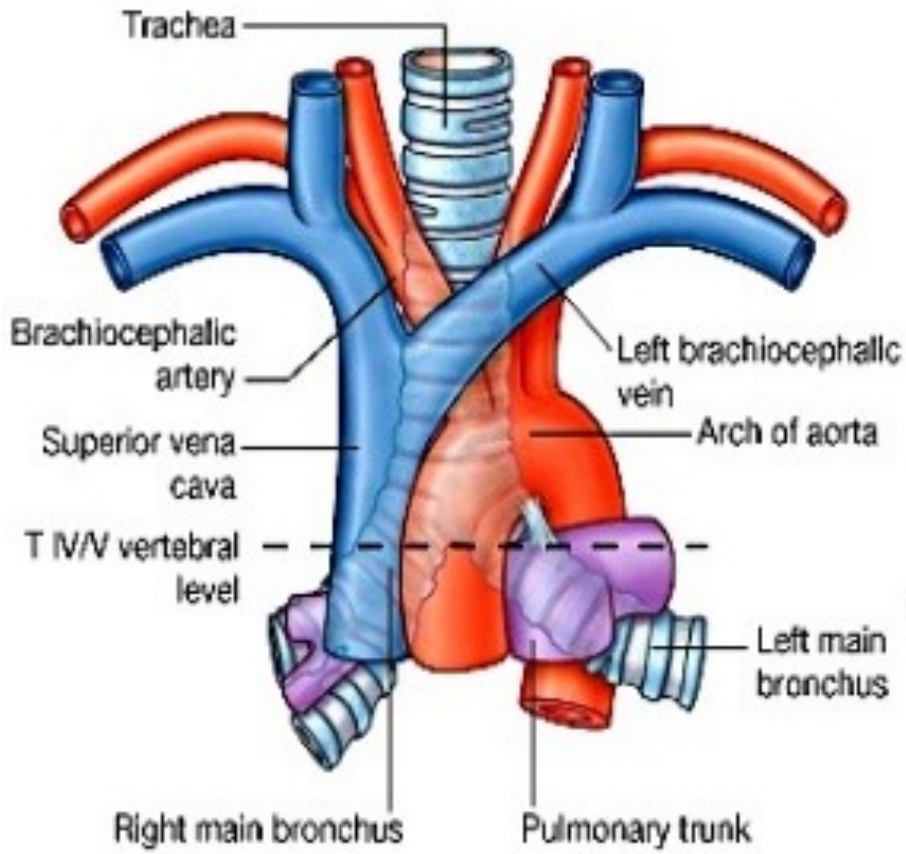
- ✓ Superior mediastinum above the line and inferior mediastinum below the line.
- ✓ Inferior mediastinum divided into :
  - Middle mediastinum contains heart and pericardium
  - Anterior mediastinum in front middle mediastinum
  - Posterior mediastinum behind middle mediastinum

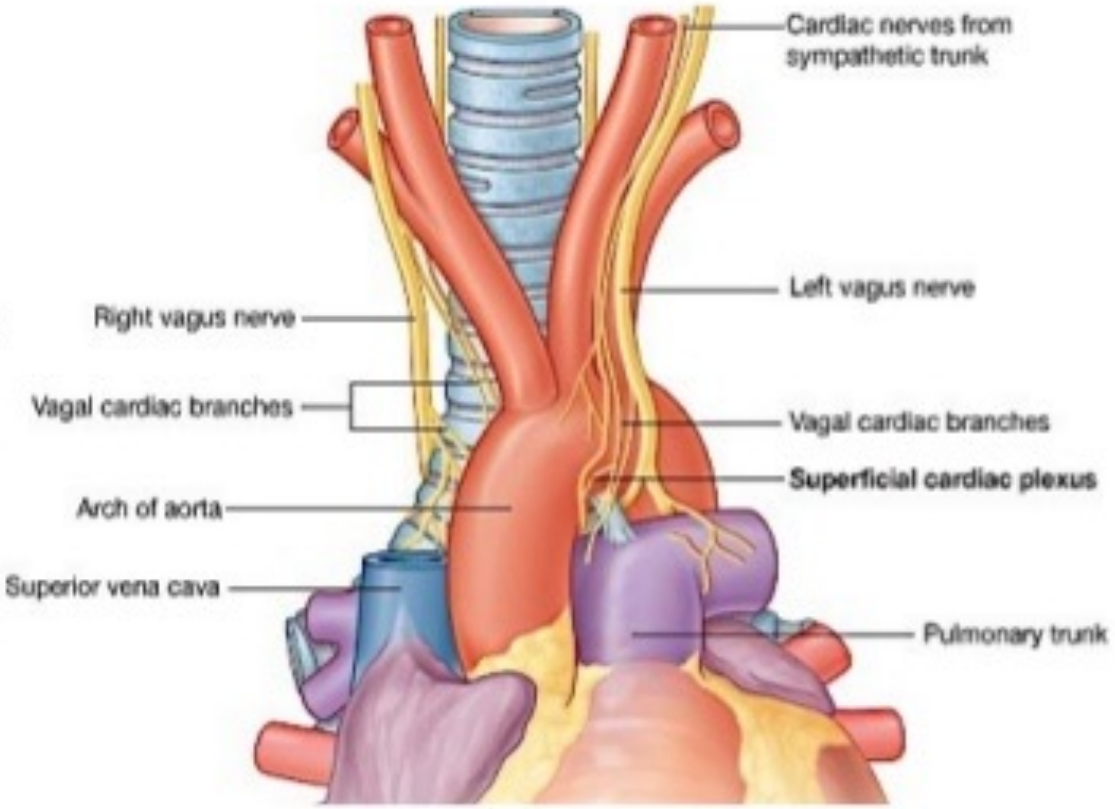



Mediastinum
Superior
Inferior
Anterior
Middle
Posterior

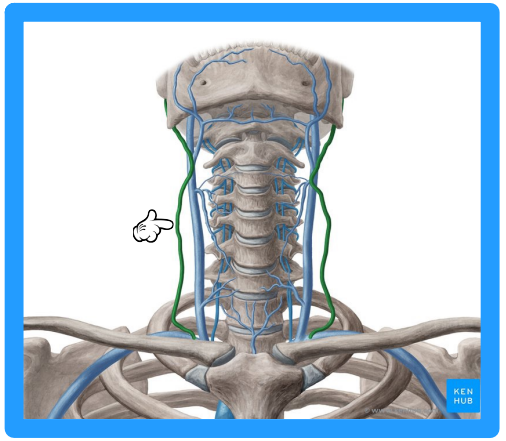

Sternal angle
Rib I
Superior mediastinum
IV
V
2nd
Anterior mediastinum
Middle mediastinum
Posterior mediastinum
Inferior mediastinum
X
Diaphragm
XII
17

Superior Mediastinum - contents





We also have external jugular nerve



Vein of the head and the neck : internal jugular vein

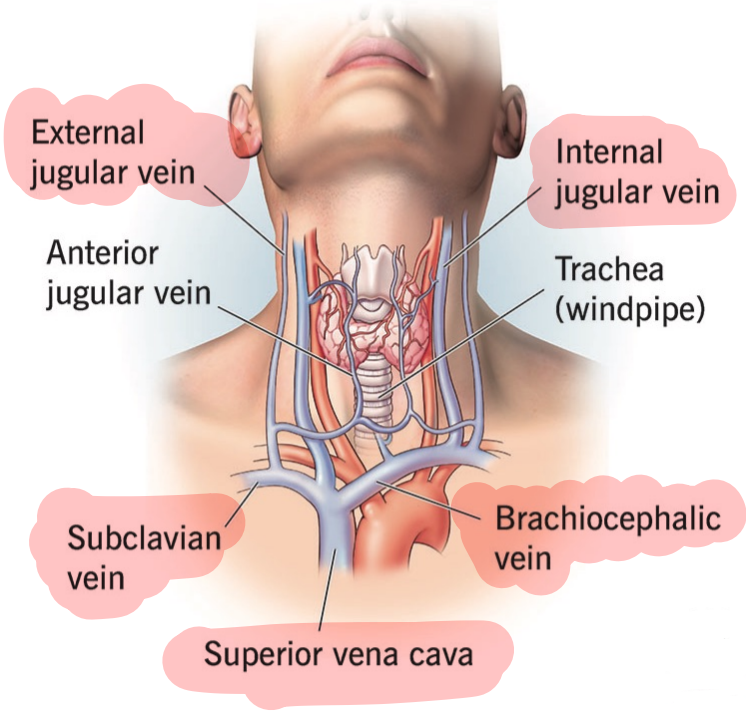
Vein of the upper limb : subclavian vein

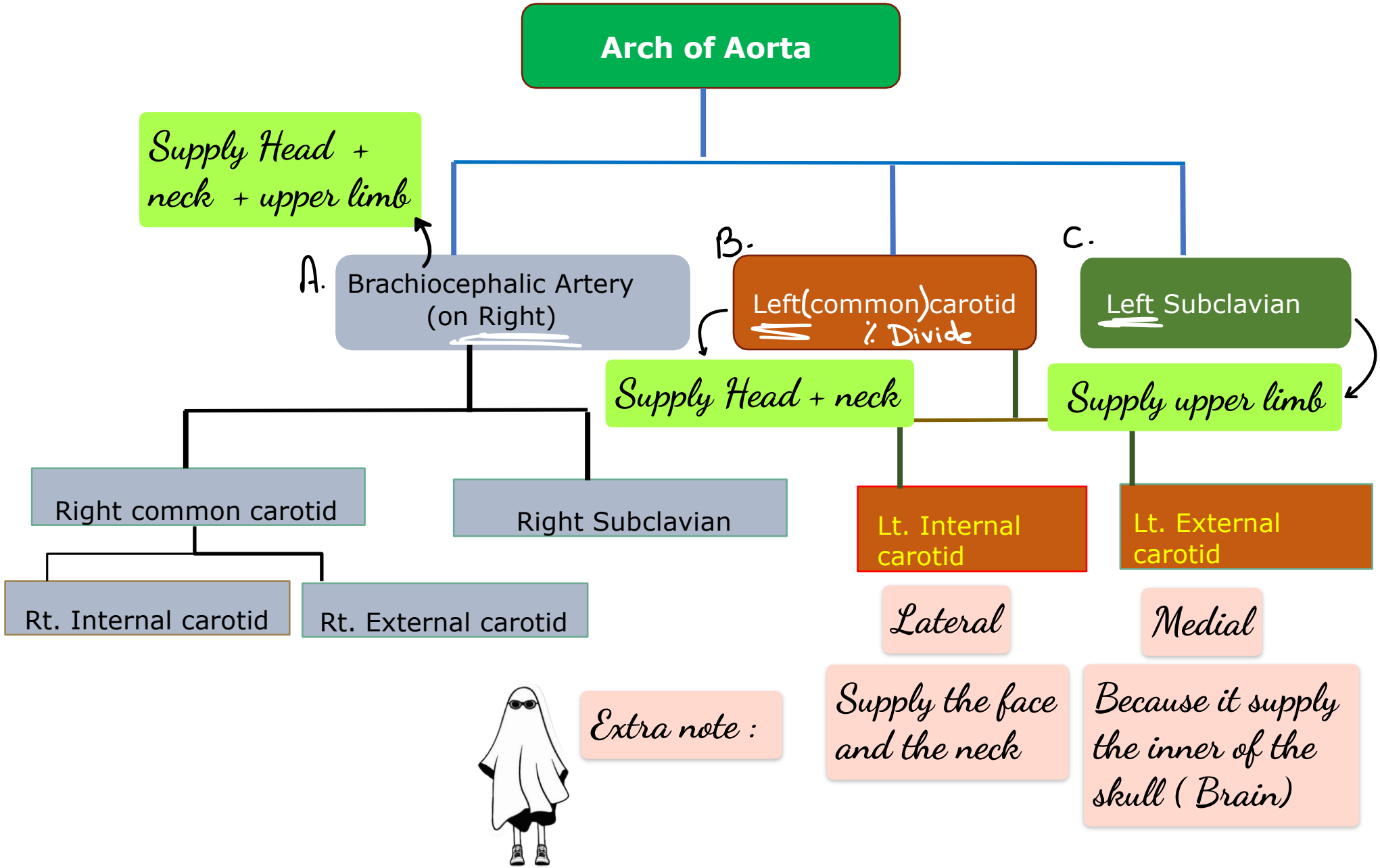
Right internal jugular vein joins right subclavian vein to form right brachiocephalic vein

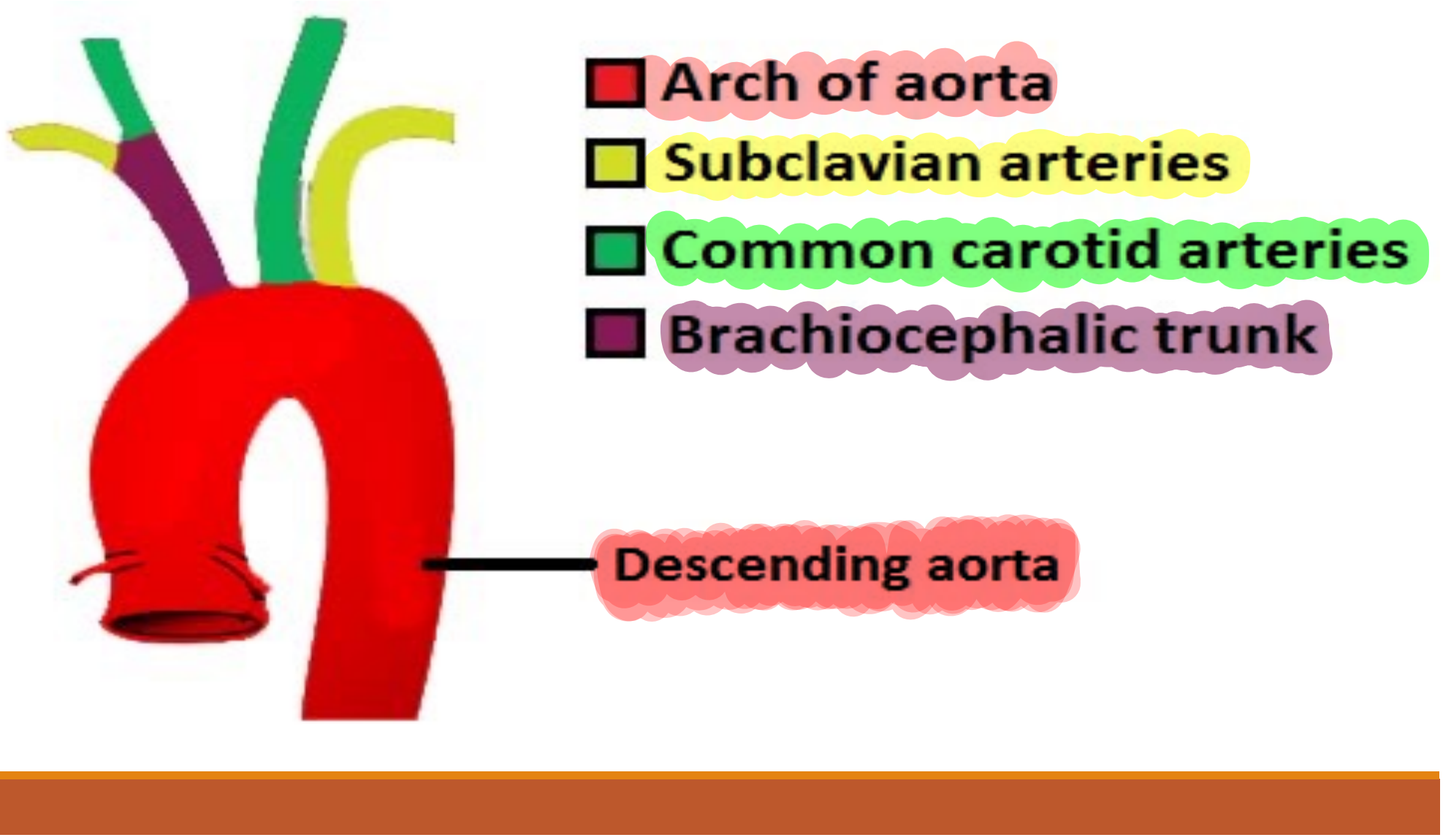
up → Superior

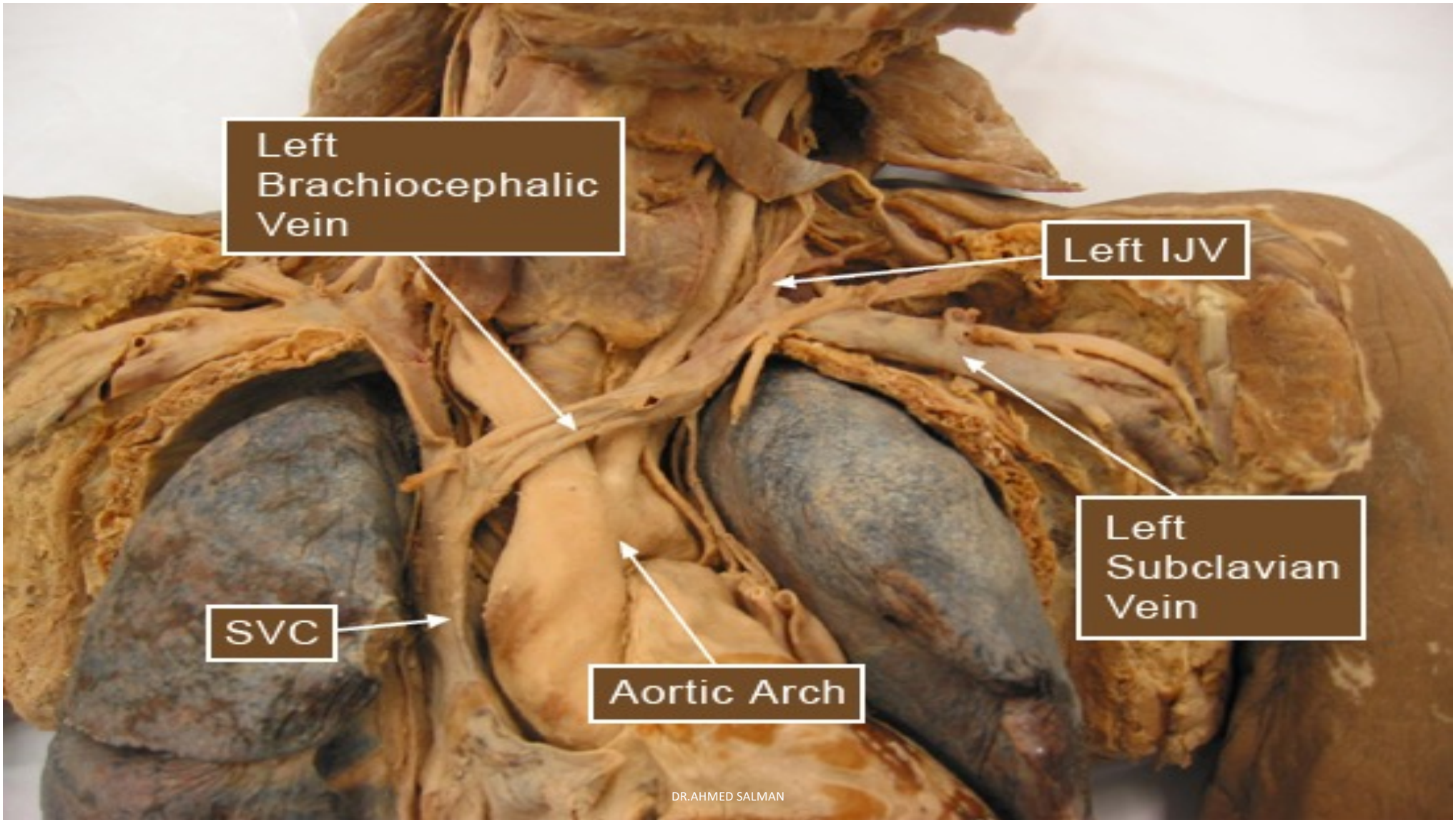
Left internal jugular vein joins left subclavian vein to form left brachiocephalic vein

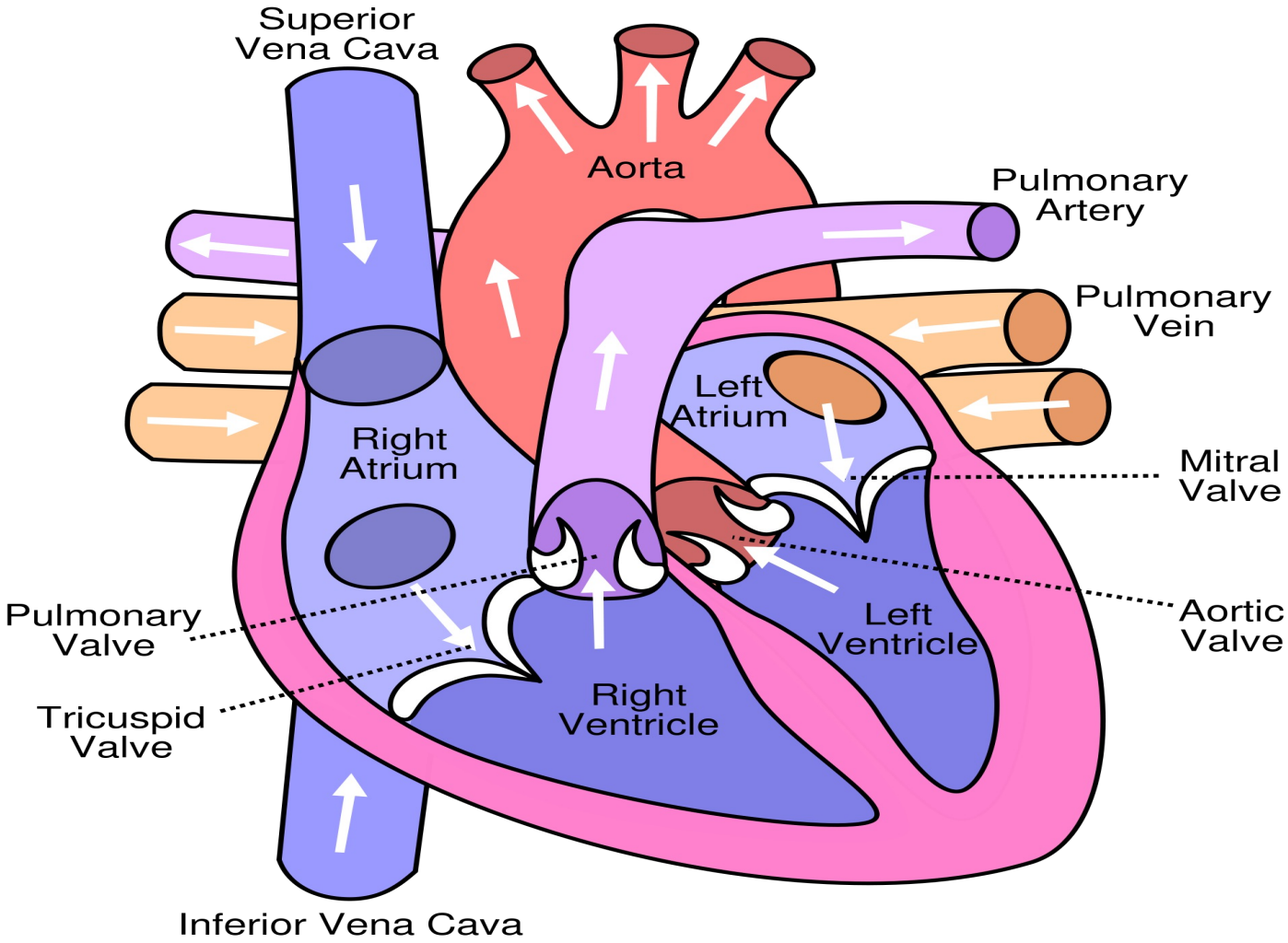
Right brachiocephalic vein jioins left brachiocephalic vein to form superior vena cava



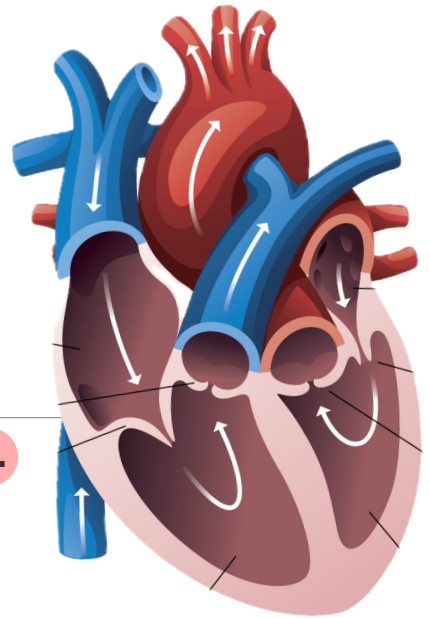

Arch of Aorta
Supply Head + neck + upper limb
A.
Brachiocephalic Artery (on Right)
B.
Left(common)carotid ∴ Divide
C.
Left Subclavian
Supply Head + neck
Supply upper limb
Right common carotid
Right Subclavian
Lt. Internal carotid
Lt. External carotid
Rt. Internal carotid
Rt. External carotid
Lateral
Medial
Supply the face and the neck
Because it supply the inner of the skull (Brain)
Extra note :


Arch of aorta
Subclavian arteries
Common carotid arteries
Brachiocephalic trunk
Descending aorta


Left
Brachiocephalic
Vein
Left IJV
Left
Subclavian
Vein
SVC
Aortic Arch

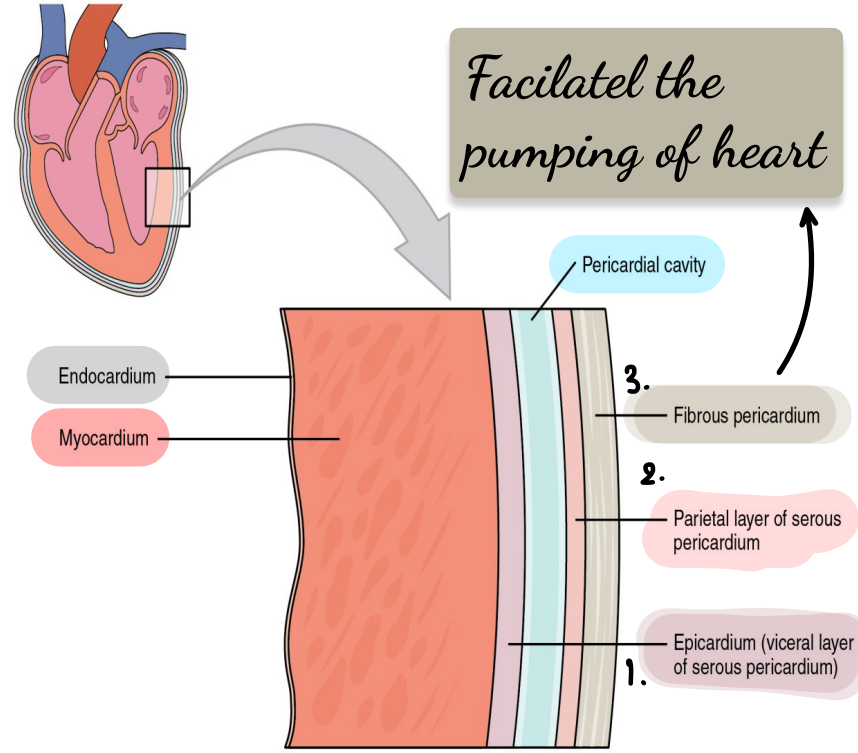

Superior
Vena Cava
Aorta
Pulmonary
Artery
Pulmonary
Vein
Left
Atrium
Right
Atrium
Mitral
Valve
Pulmonary
Valve
Aortic
Valve
Left
Ventricle
Tricuspid
Valve
Right
Ventricle
Inferior Vena Cava

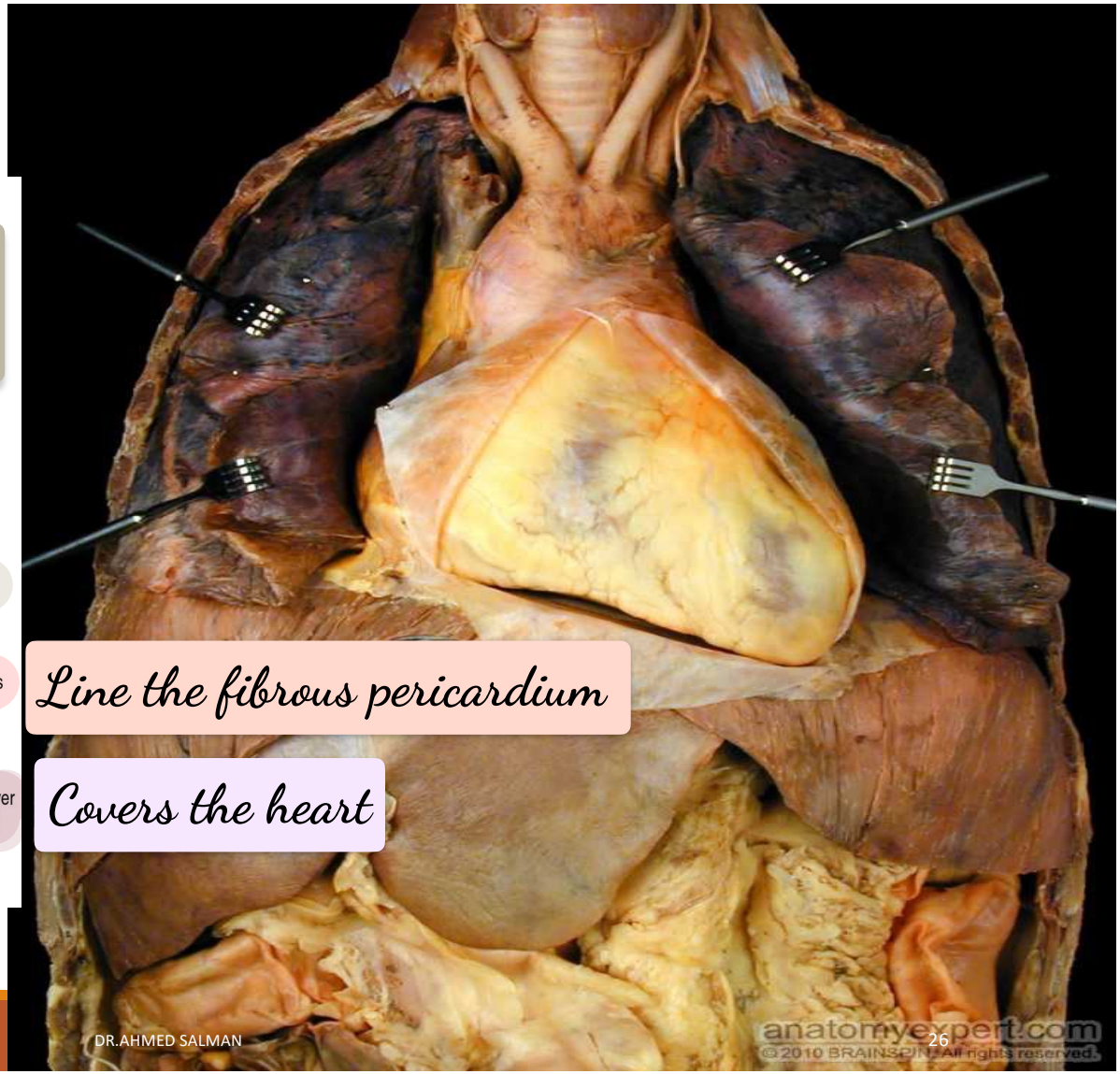
Heart



- 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


Facilatel the pumping of heart
Pericardial cavity
Endocardium
Myocardium
3.
Fibrous pericardium
2.
Parietal layer of serous pericardium
Epicardium (viceral layer of serous pericardium)
1.


Line the fibrous pericardium
Covers the heart
anatomyexpert.com
©2010 BRAINSPIN All rights reserved.

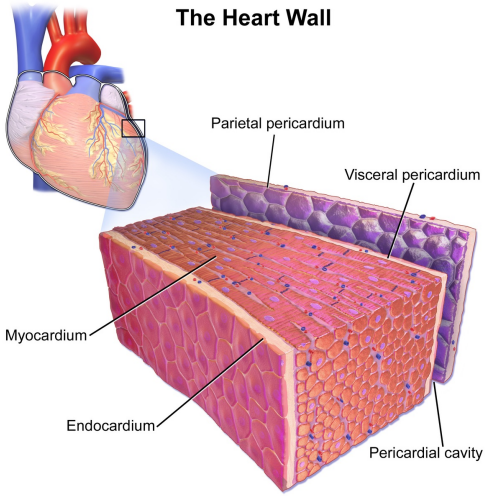
Pericardium

➢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.

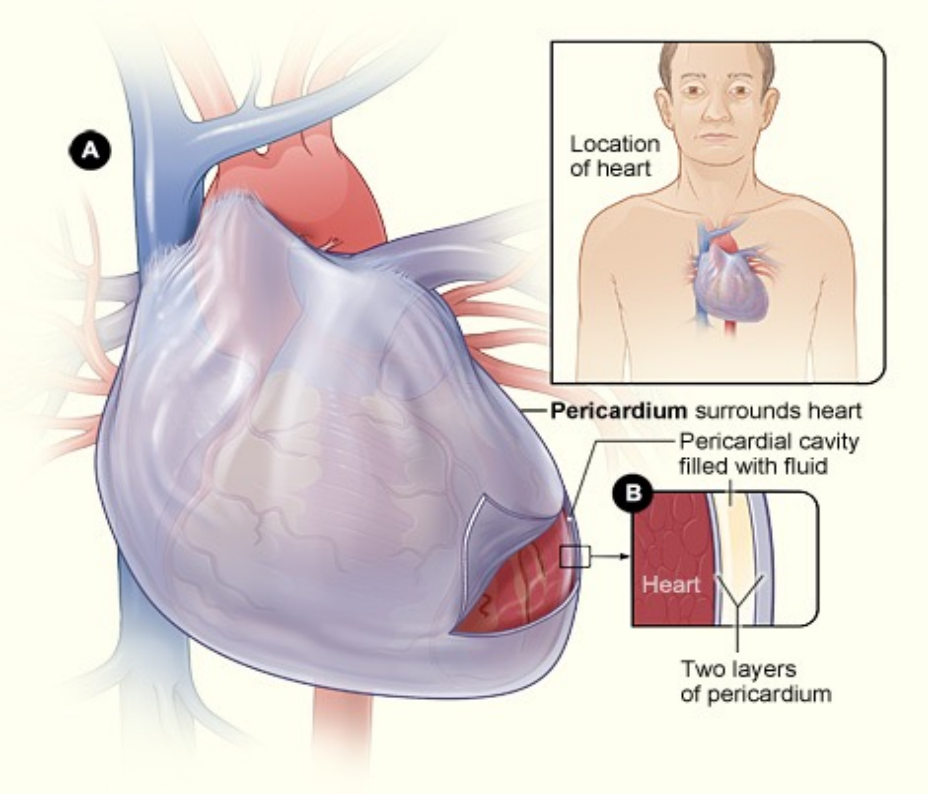
Contains a thin film of fluid that acts as a lubricant for movements of the heart

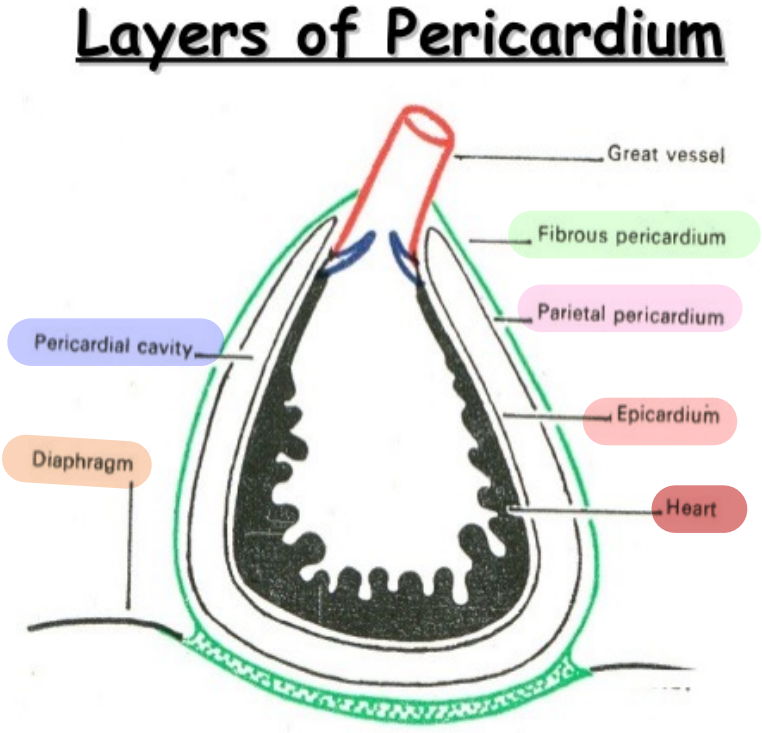
Parietal

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

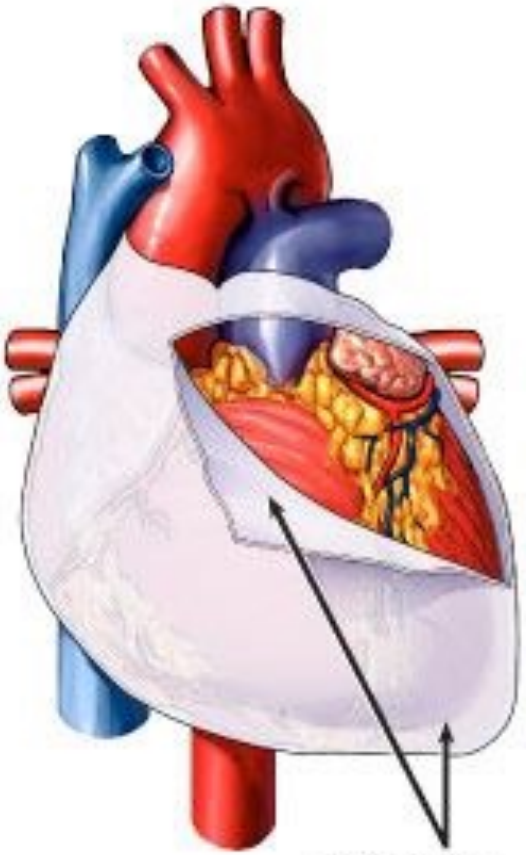

Layers of Pericardium
Great vessel
Fibrous pericardium
Parietal pericardium
Pericardial cavity
Epicardium
Diaphragm
Heart

Cardiac tamponade

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

Initial Condition

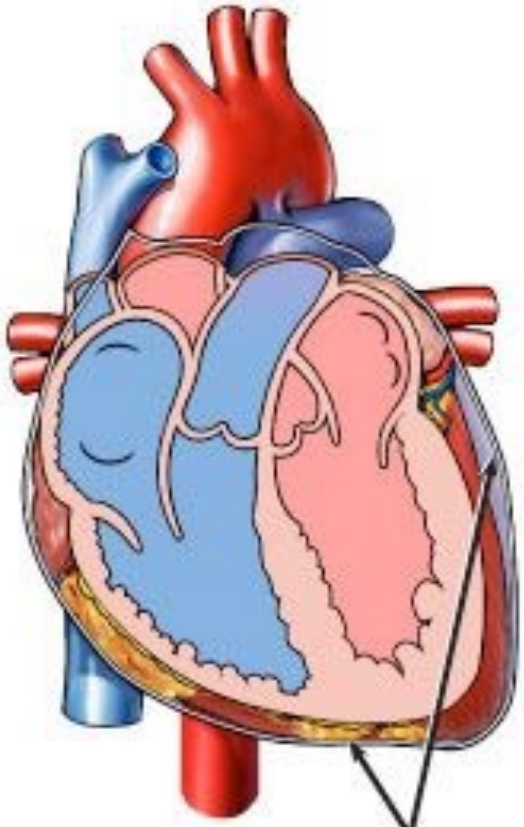
Anterior view



Pericardium covering the heart

Initial Condition

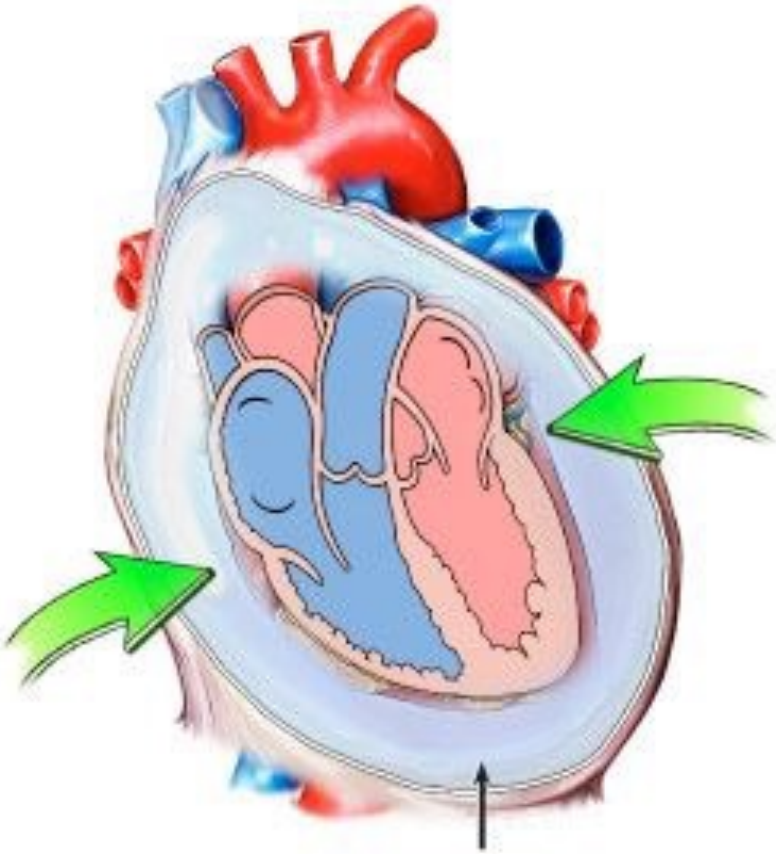
Anterior cut-away view



Cut edge of the pericardium surrounding the heart

Resulting Cardiac Tamponade

Anterior cut-away view



The pericardial sac fills with fluid causing severe compression of the heart

External morphology of the heart

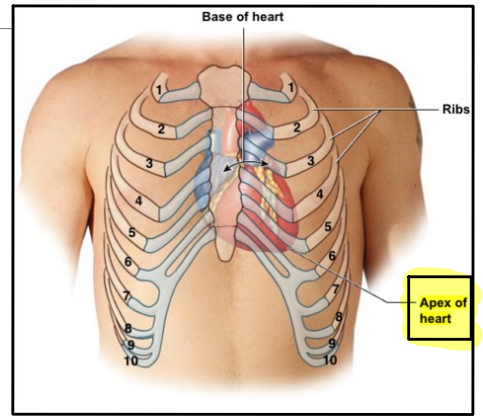
Base : Located posteriorly , it is formed mainly by the left atrium

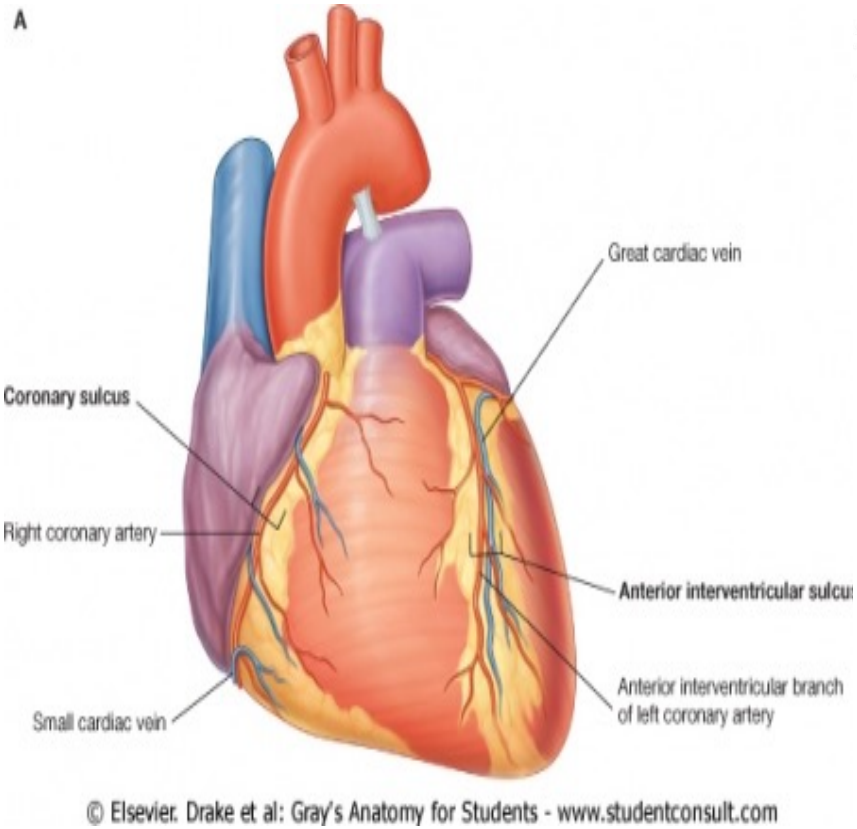
Apex: Formed by the left ventricle.

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

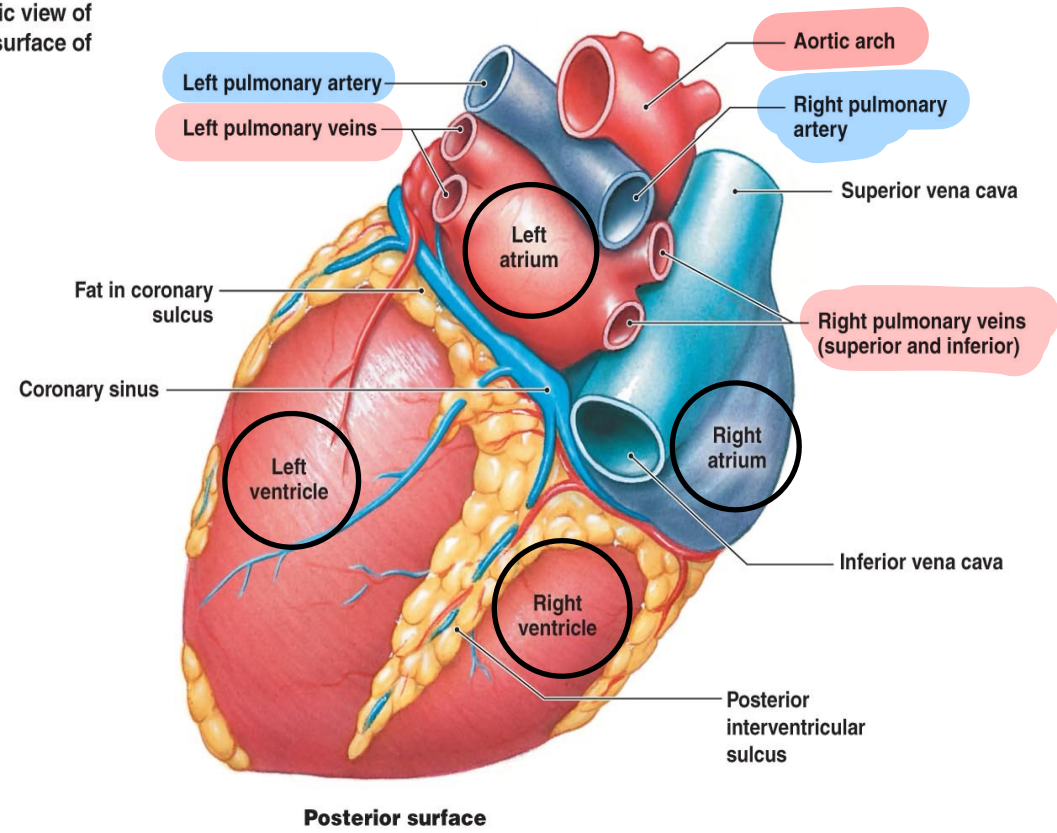
Two surfaces (anterior or sternocostal and inferior or diaphragmatic).

Four borders :





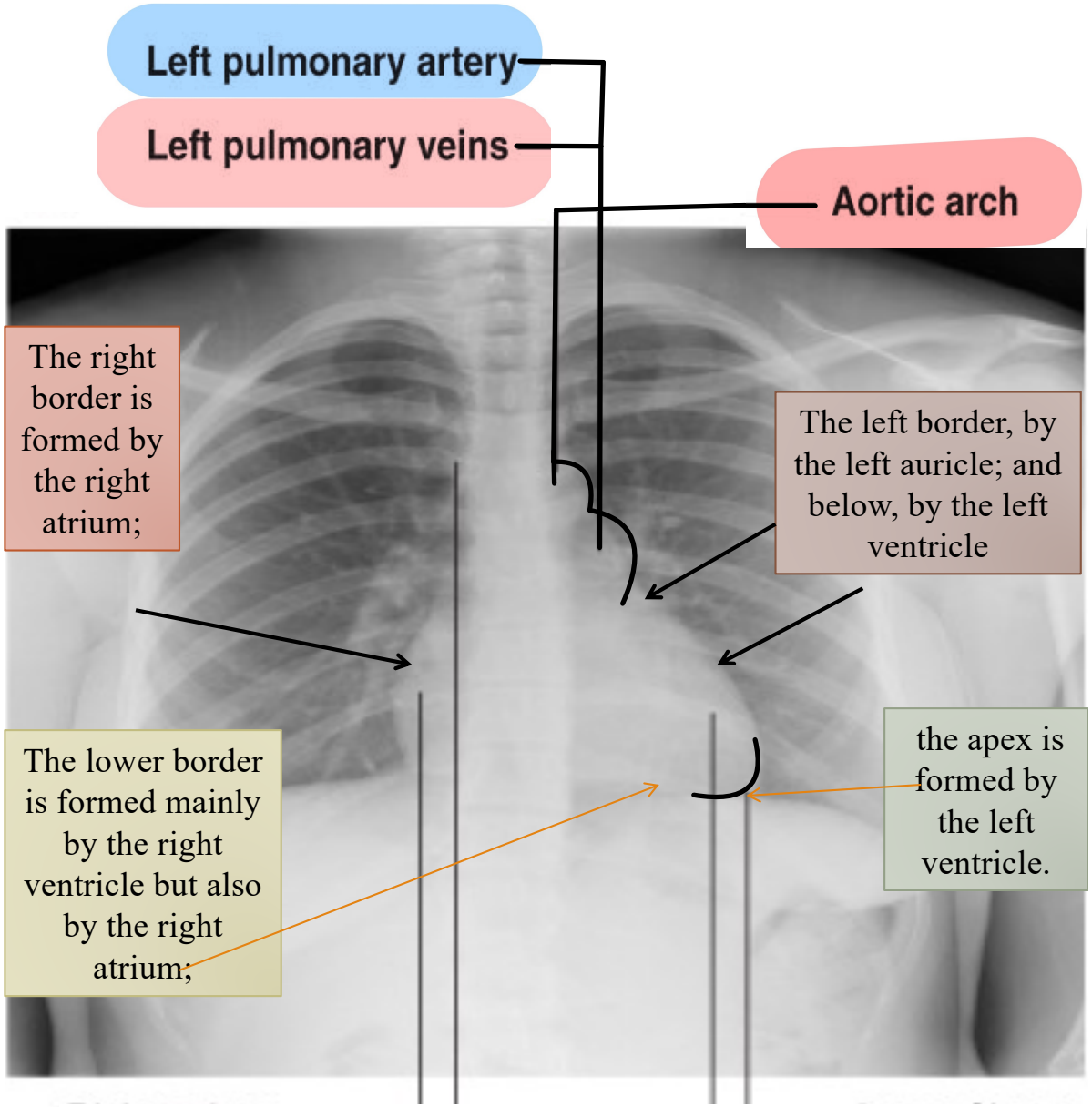
A diagrammatic view of the posterior surface of the heart



Borders of the Heart

REED ONLY

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



Dr.Amjad Shatart

Heart Chambers

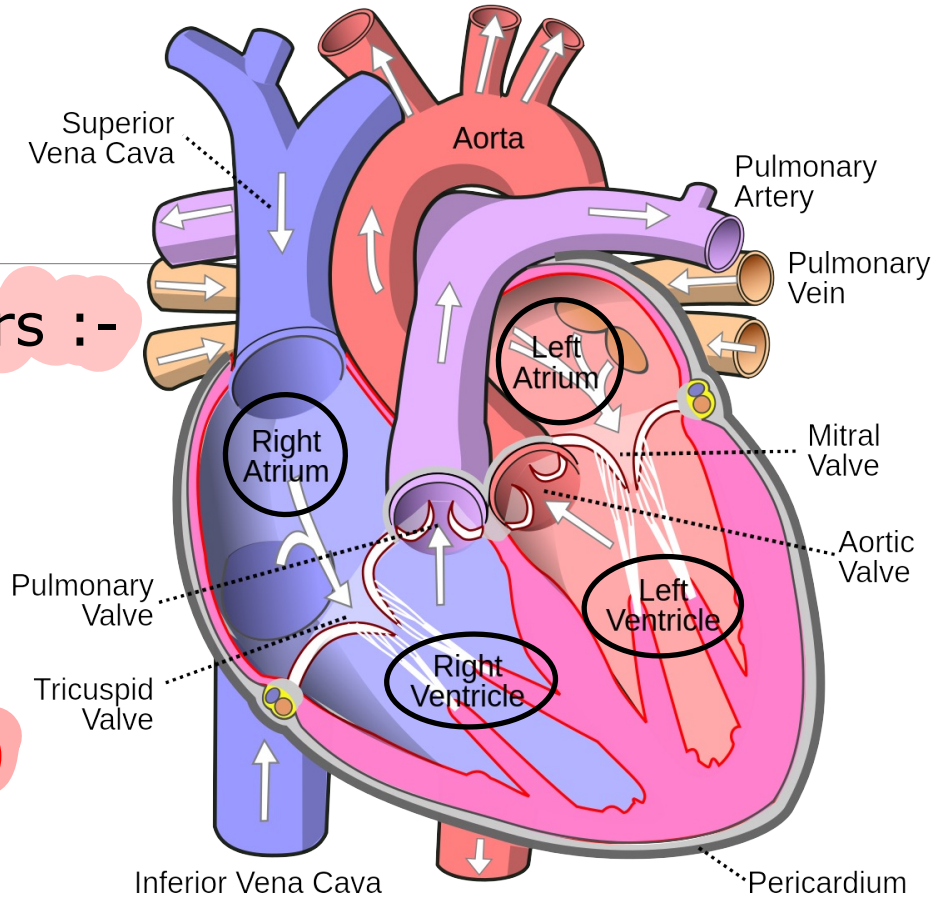
The Heart composed of 4 chambers :-

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

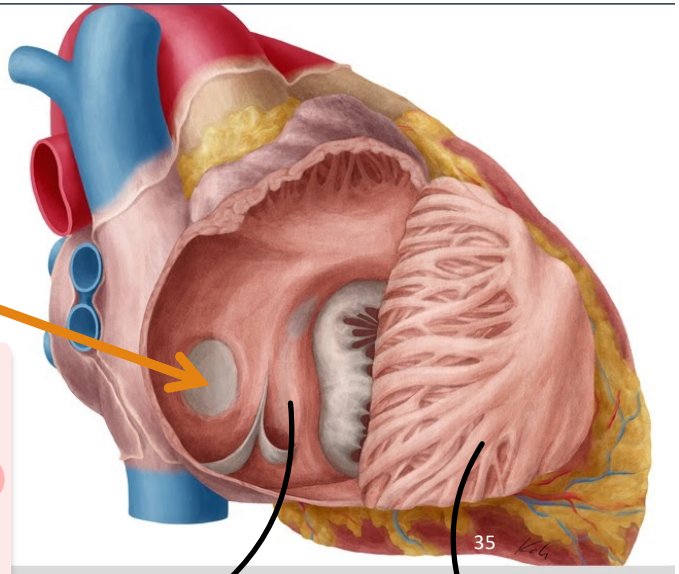
1-Right atrium : It has

-**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.

allows blood to cross the atrium during fetal development



After the delivery of the baby this foramen will close - if it doesn't that will lead on the defect between the right and left atrium or defect between the right and left ventricle

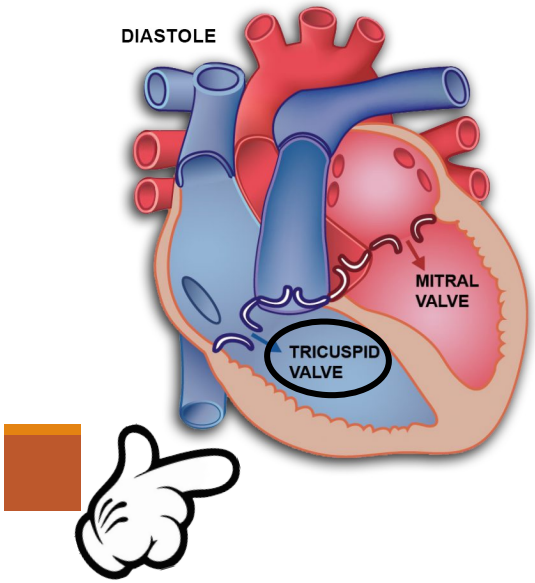
Posterior wall

Anterior wall

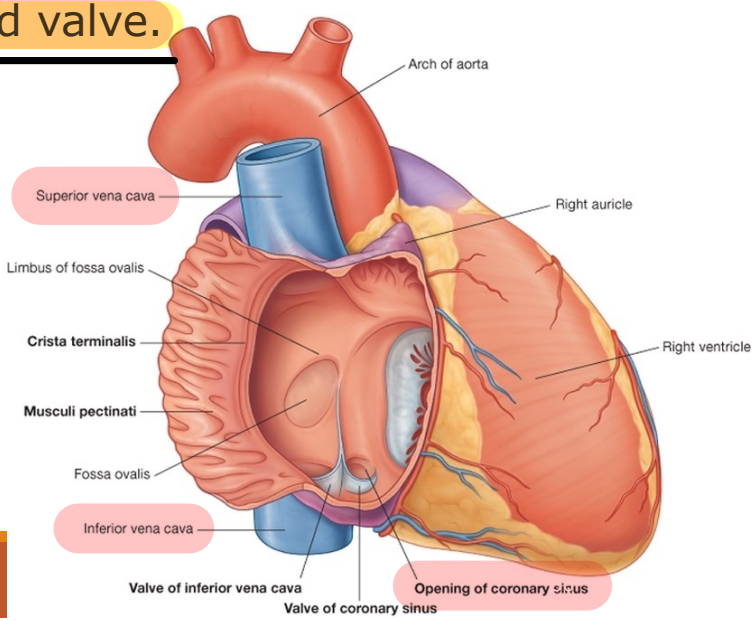
Openings into the right atrium:

The main function for it : is collection of the Venus blood from all the body

- 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.



To transfer the blood from the right atrium into the right ventricle



Right ventricle

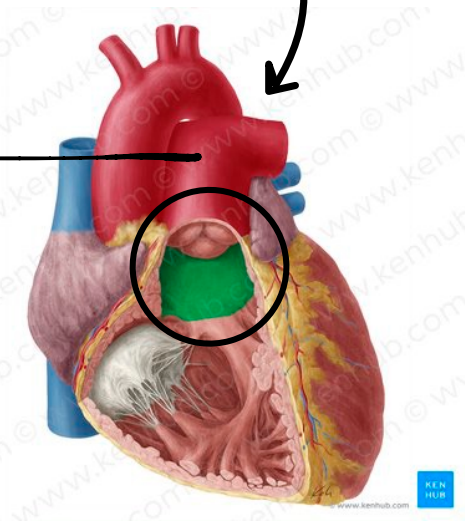
Receive Blood from the atrium and pumping it to the artery

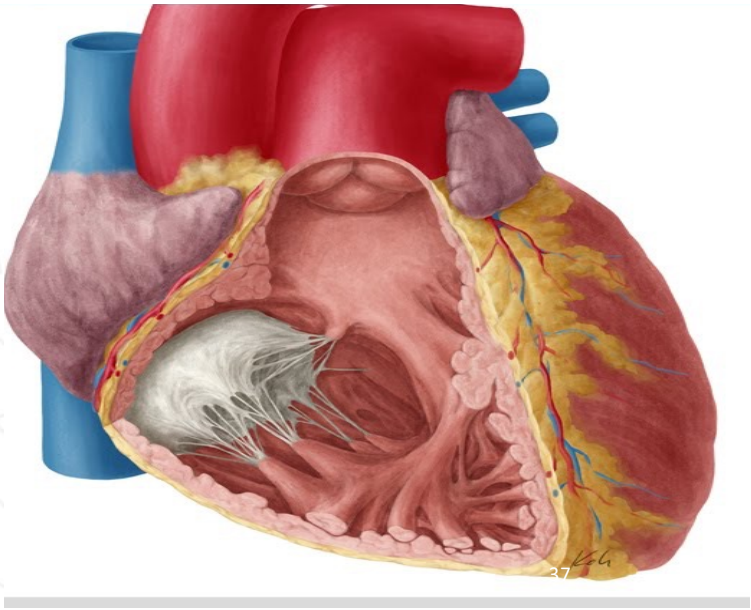
It has

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

With Right atrium and pulmonary artery

Pulmonary Artery





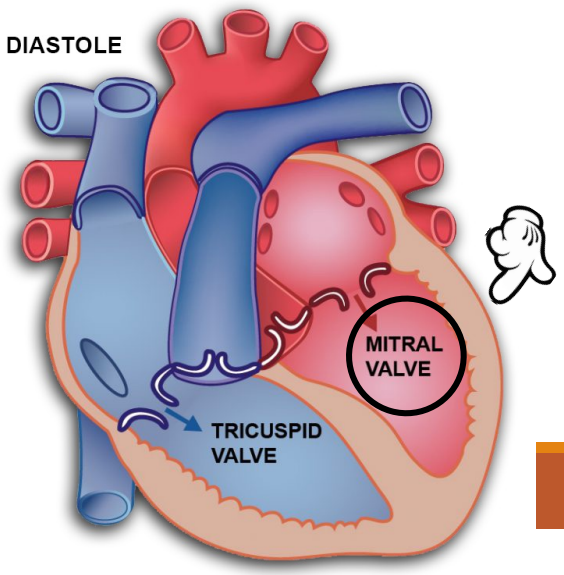
Left atrium

It's smooth (mainly)

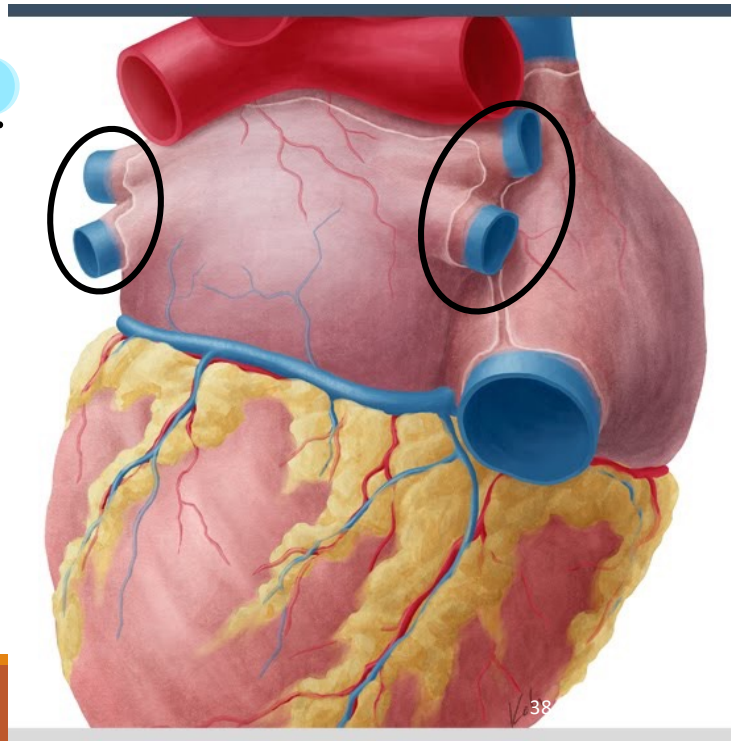
Opening of the left atrium

1-The four pulmonary veins

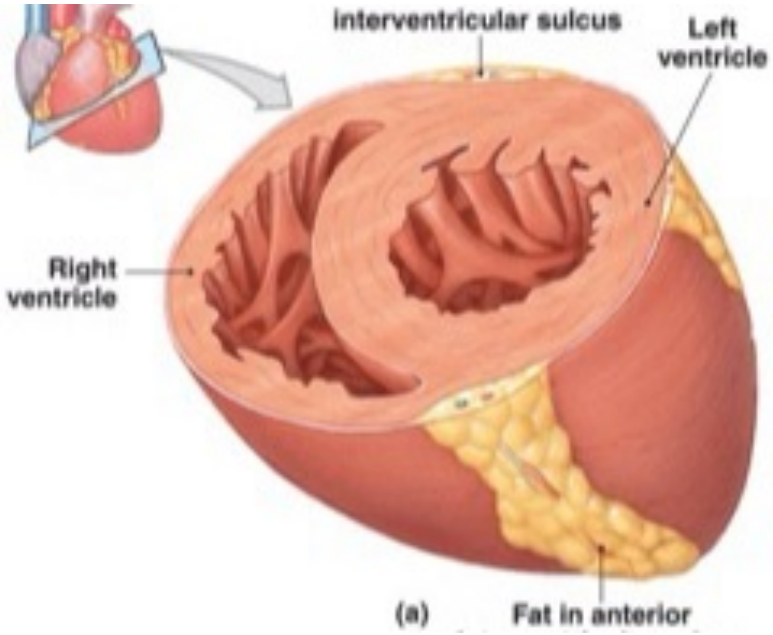
2-The left atrioventricular orifice is guarded by mitral valve



To transfer the blood from the left atrium into the left ventricle



Left ventricle



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

It has :-

Because it's pump the heart all over the bo

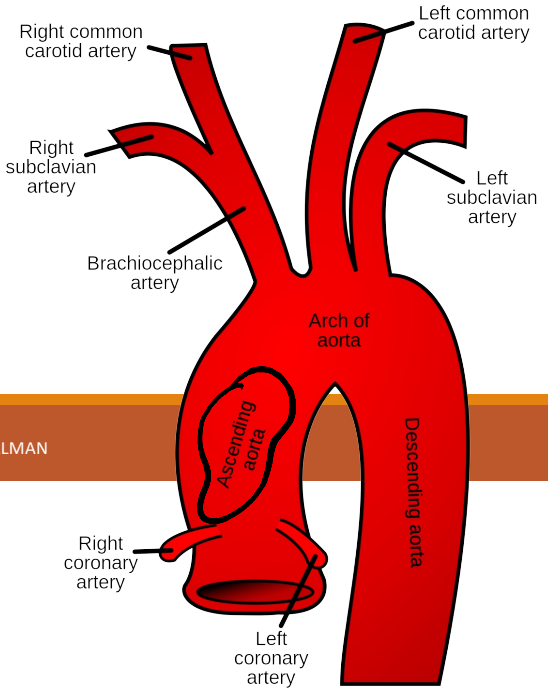
Rough Inflow rough part:

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

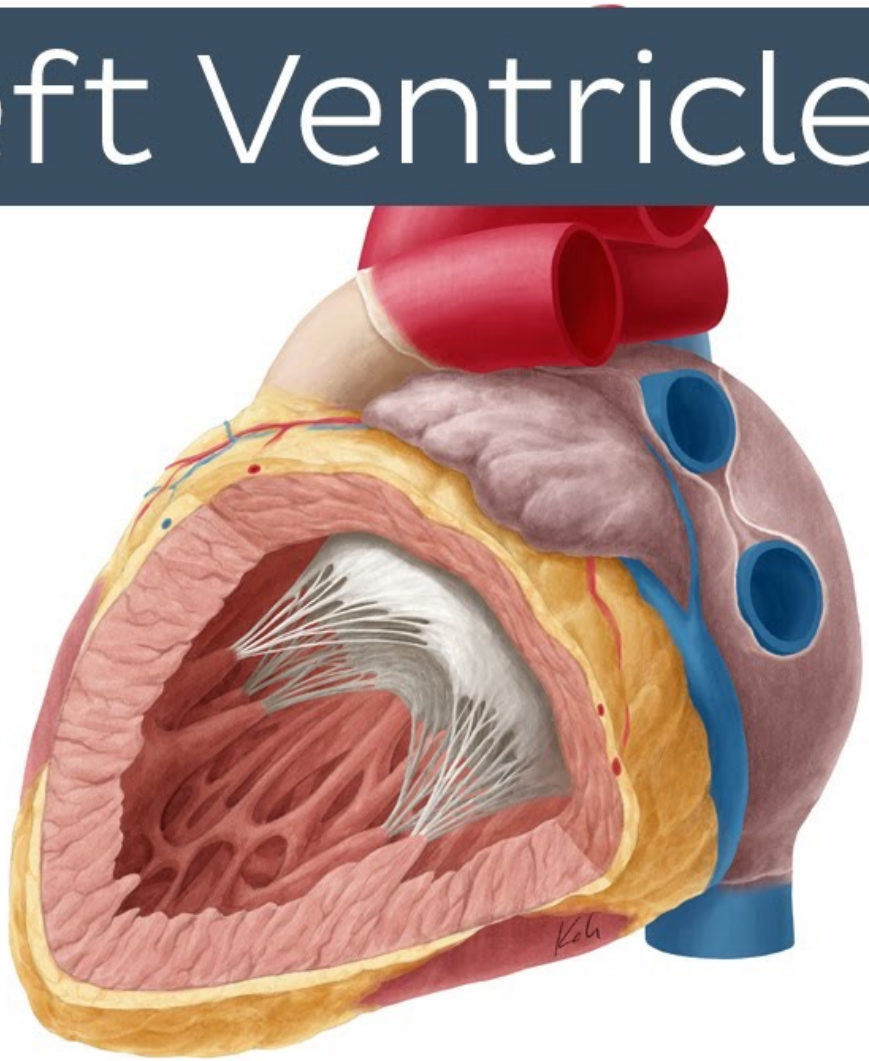
Communication of Right ventricle

left

Left Atrium and Aorta



Left Ventricle



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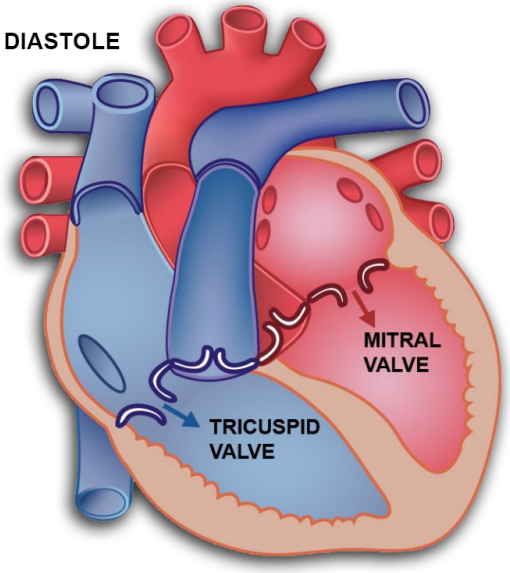
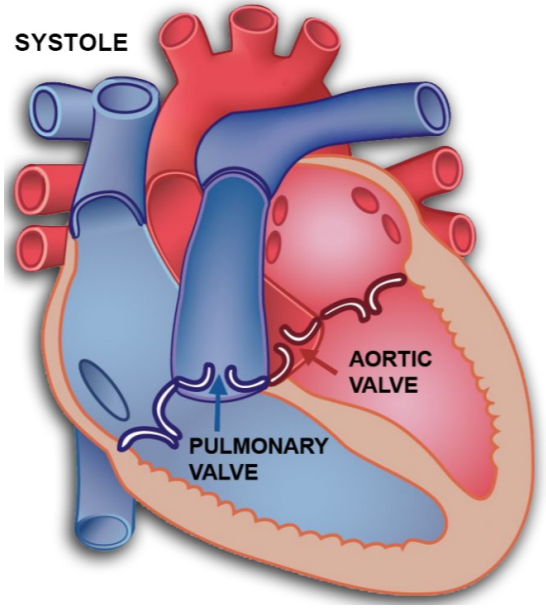


VALVES OF THE HEART



1. Atrioventricular valves

A. **Tricuspid valve:** Between right atrium and right ventricle

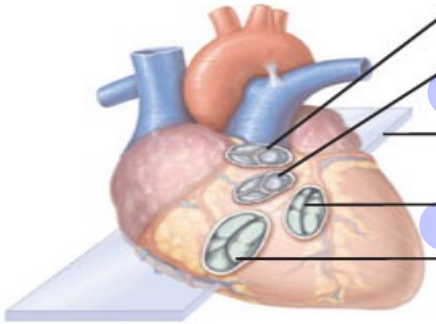
B. **Mitral or Bicuspid valve:** Between left atrium and left ventricle

2. Semilunar valves

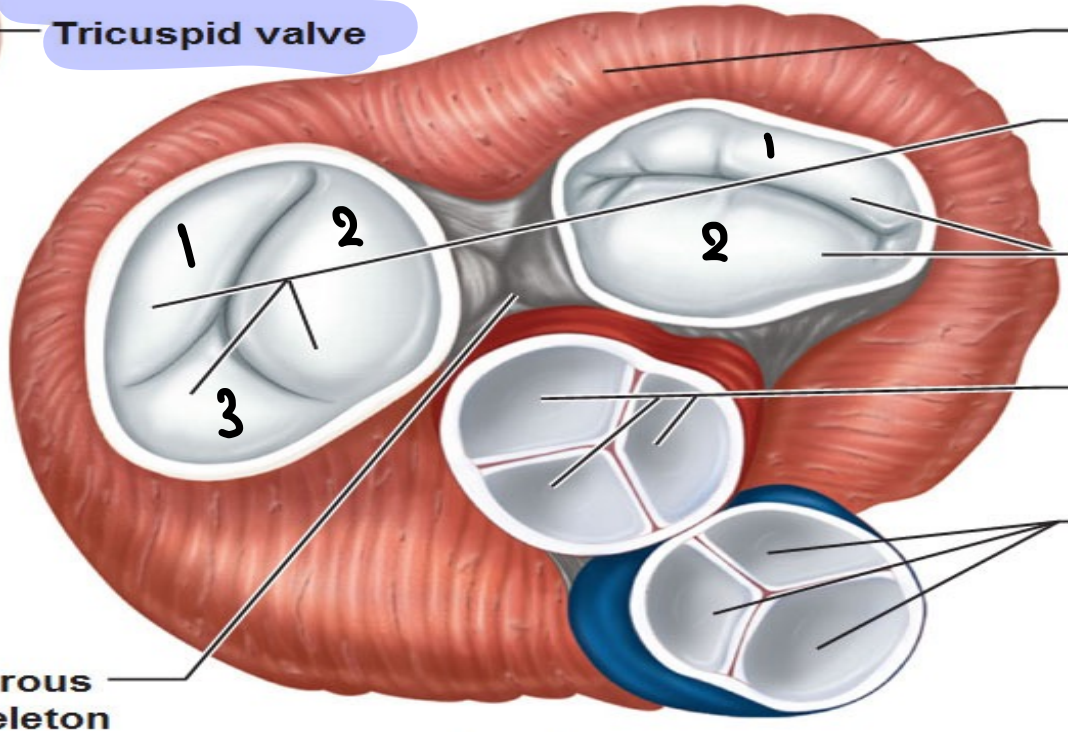
A. **Pulmonary valve** Between right ventricle and pulmonary artery

B. **Aortic valve** Between left ventricle and Aortic artery

Heart Valves and the Fibrous Skeleton (dense CT)



Pulmonary valve
Aortic valve
Area of cutaway
Mitral valve
Tricuspid valve



Myocardium
Tricuspid (right atrioventricular) valve
Mitral (left atrioventricular) valve
Aortic valve
Pulmonary valve
Fibrous skeleton

Anterior

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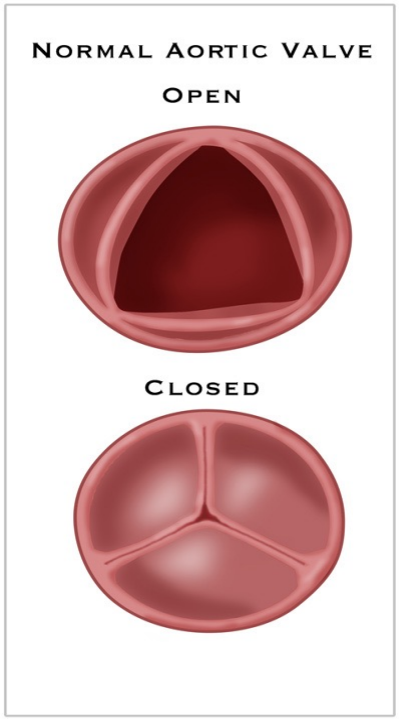
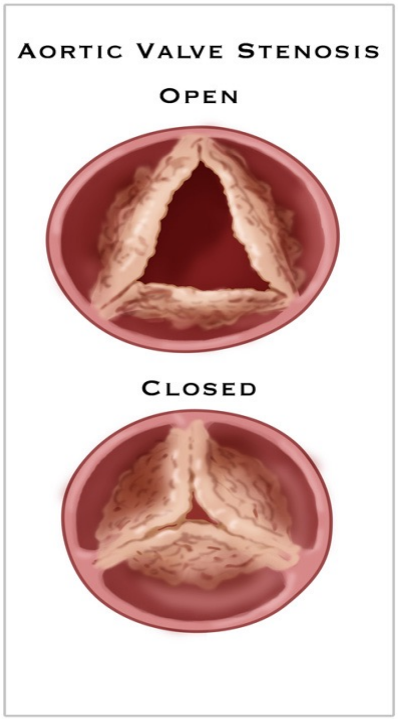
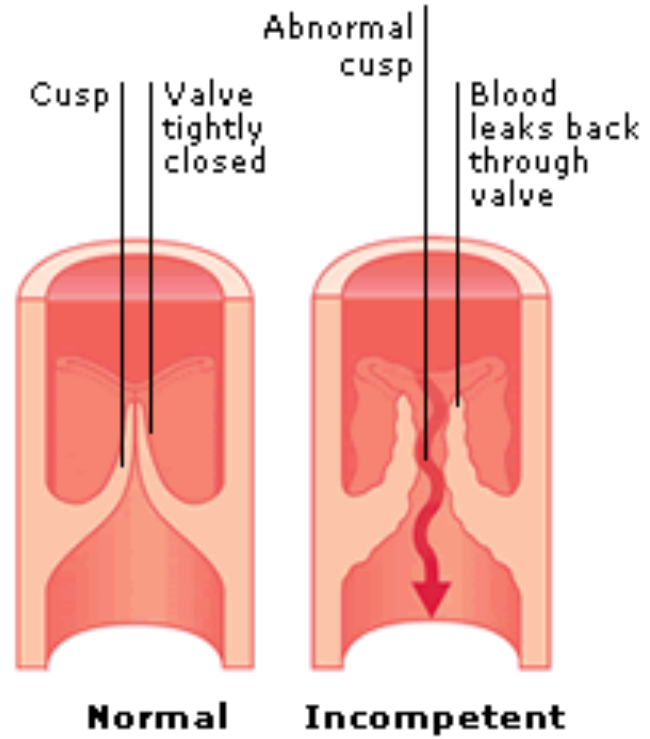
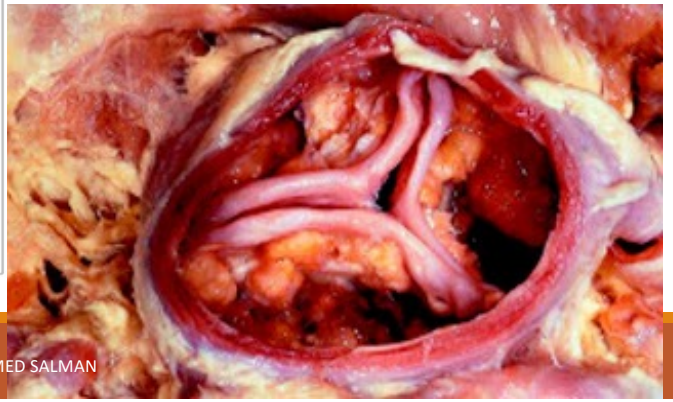
Clinical Anatomy

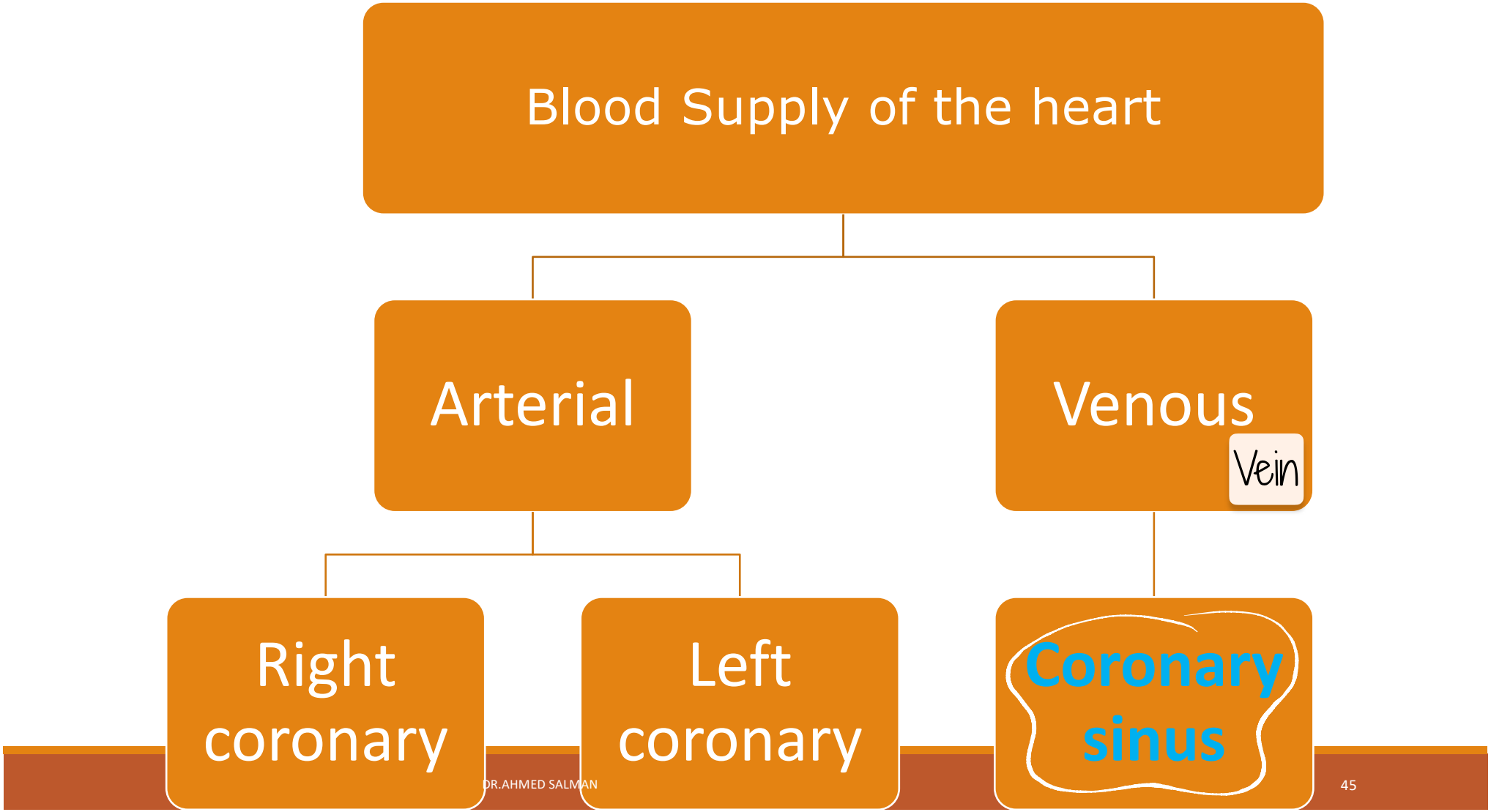
Incompetent valve leads to regurgitation of blood
Stenosis of the valve leads to heart over load

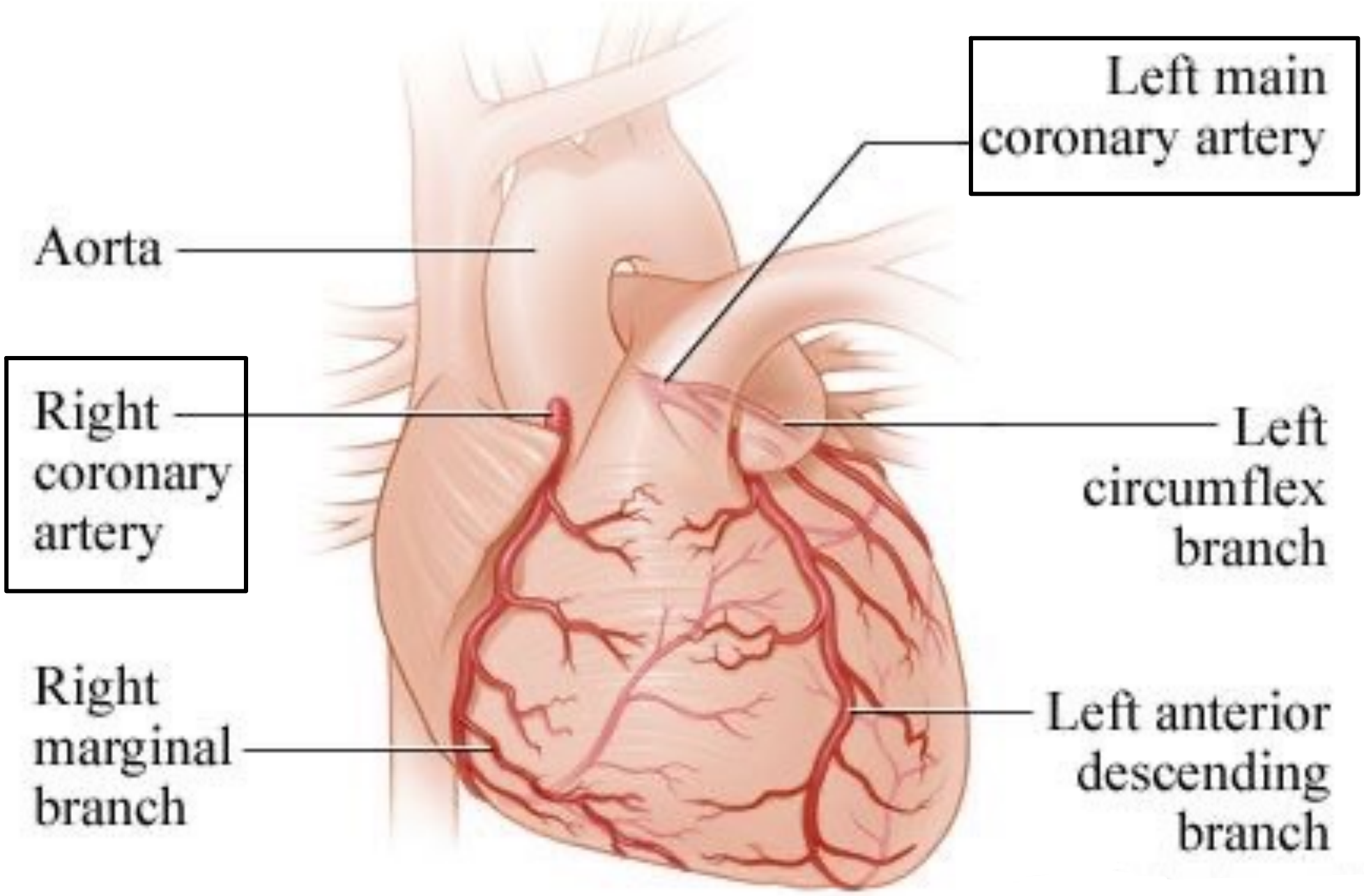






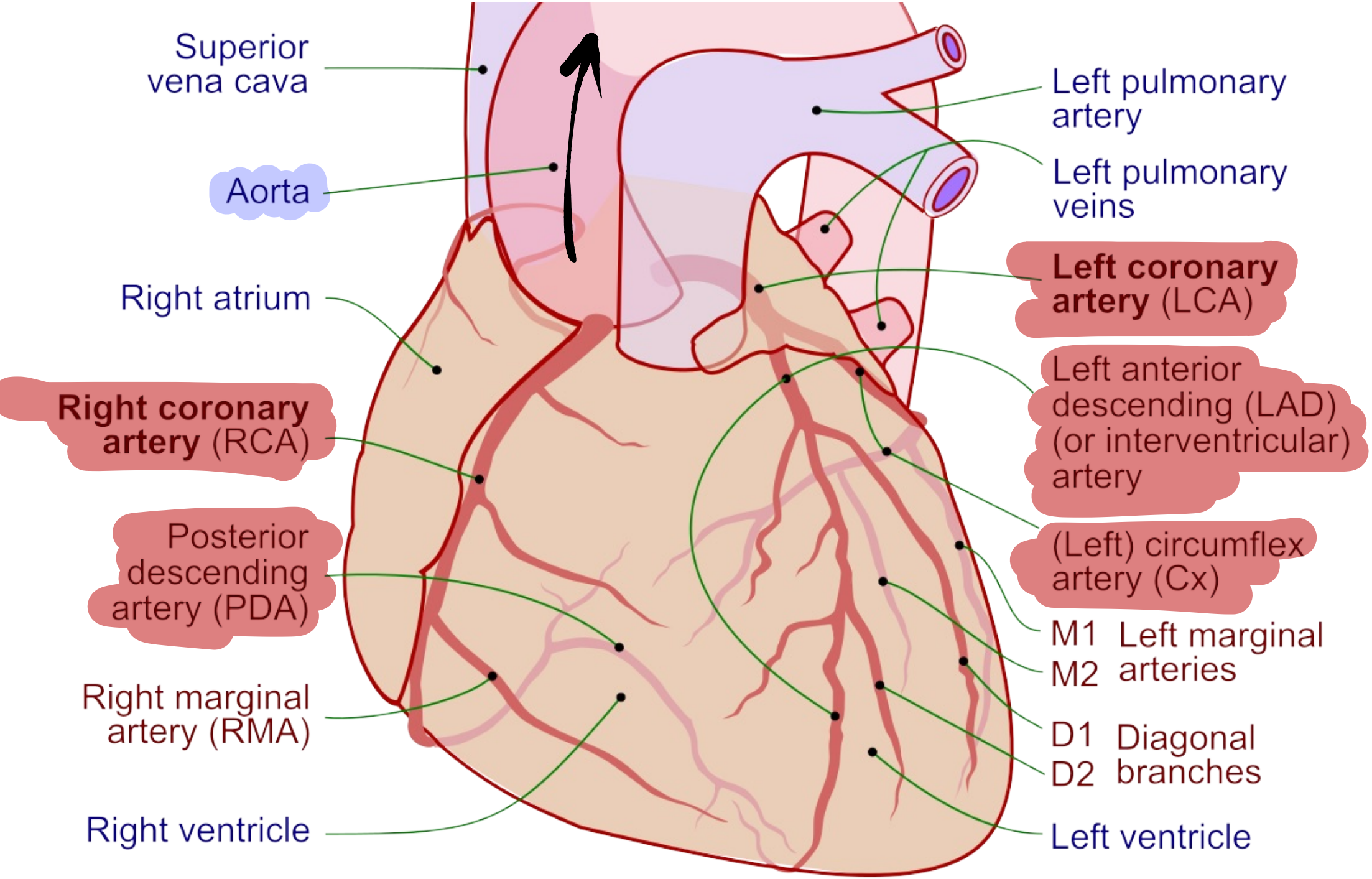



Blood Supply of the heart
Arterial
Venous
Vein
Right coronary
Left coronary
Coronary sinus
Open in the right atrium

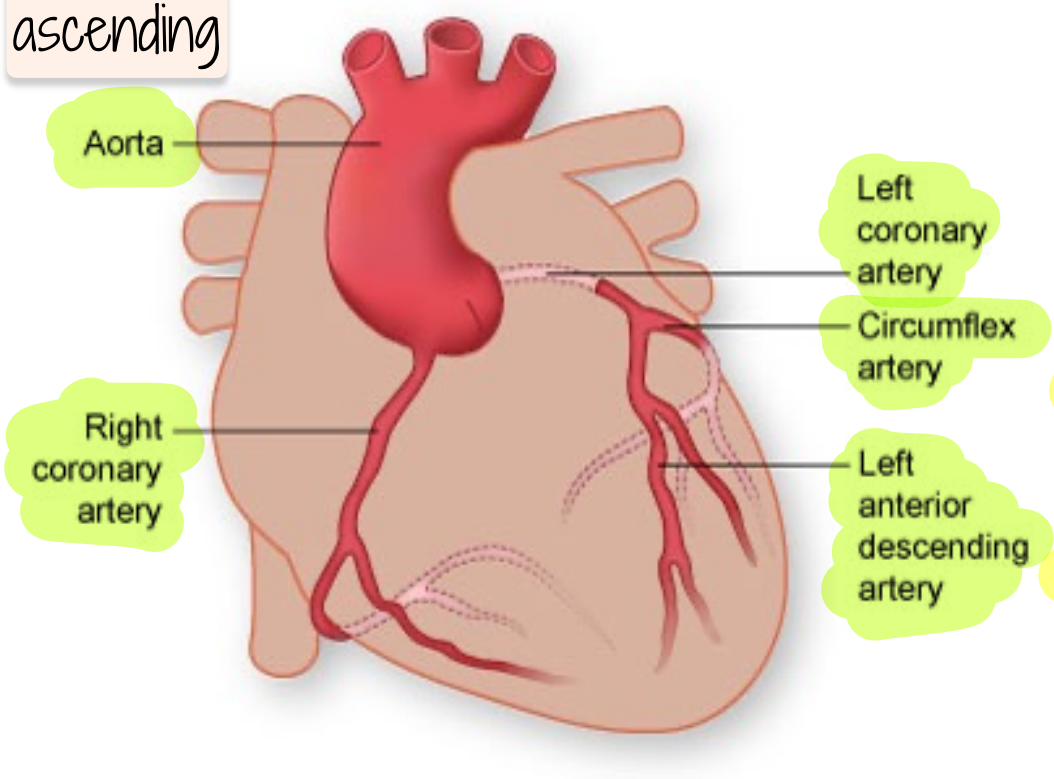

Left main coronary artery
Aorta
Right coronary artery
Left circumflex branch
Right marginal branch
Left anterior descending branch

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 : 1-Posterior interventricular artery 2- SA node branch	Important branches : it gives 1-Anterior interventricular artery 2-Circumflex

If the coronary artery get thrombosis's it will lead into myocardial infraction (death for the muscle)

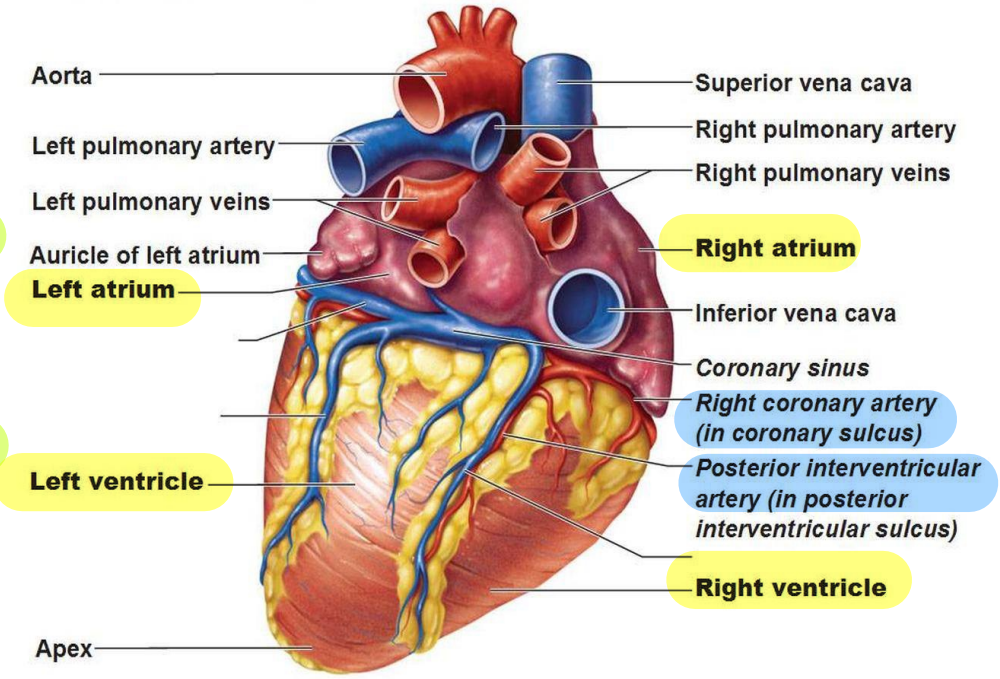

Superior vena cava
Aorta
Right atrium
Right coronary artery (RCA)
Posterior descending artery (PDA)
Right marginal artery (RMA)
Right ventricle
Left pulmonary artery
Left pulmonary veins
Left coronary artery (LCA)
Left anterior descending (LAD) (or interventricular) artery
(Left) circumflex artery (Cx)
M1 Left marginal
M2 arteries
D1 Diagonal
D2 branches
Left ventricle

ascending



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

surface shown rests on the diaphragm.



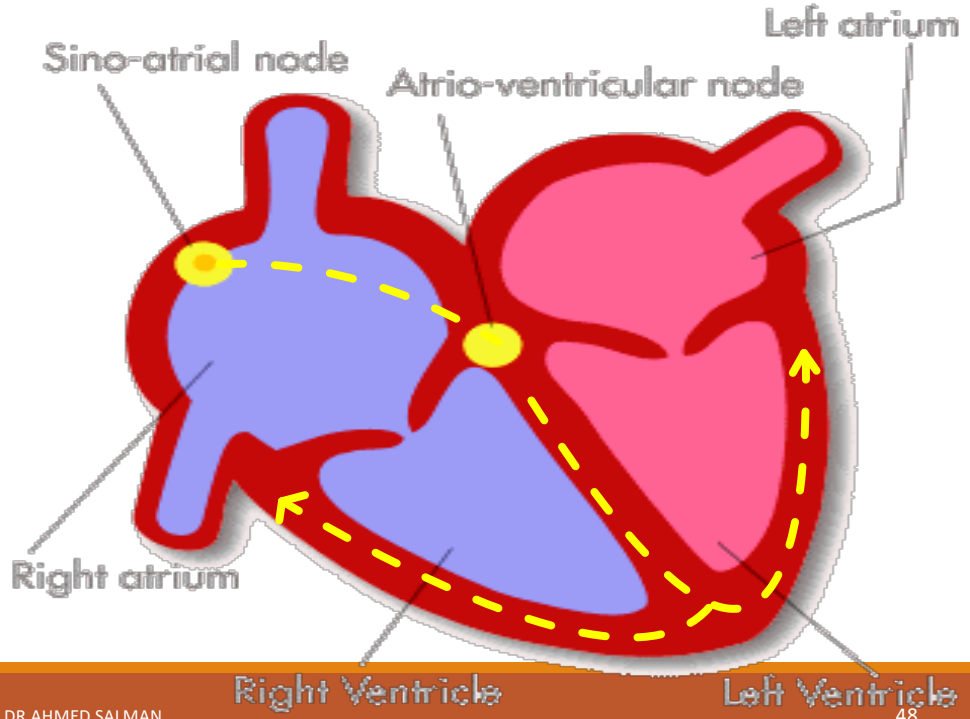
If the atrium get contraction, the ventricle Must relax this is the responsibility of the conducting system of the heart

Conducting system of the heart

- Responsible for initiation and conduction of cardiac impulses.

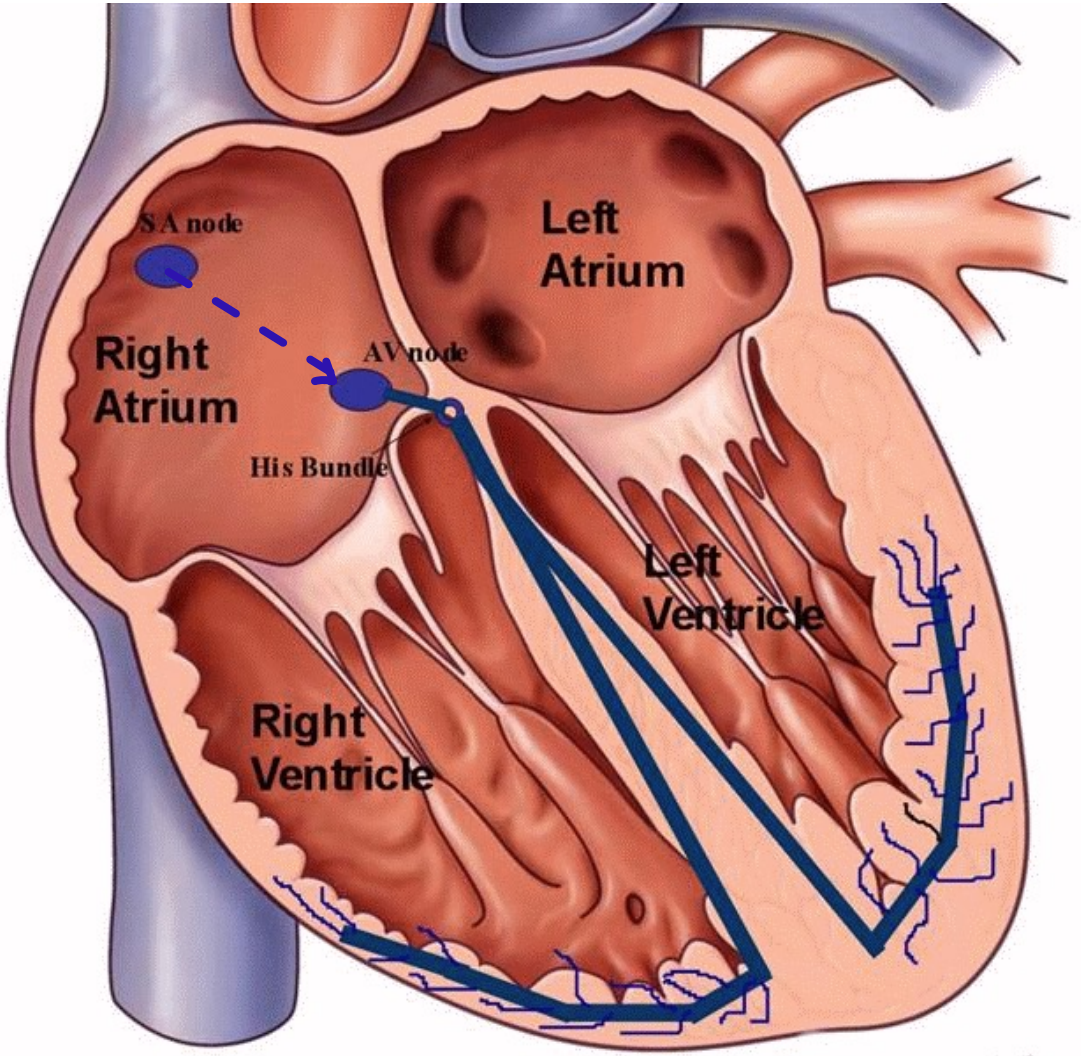
It's under effect of autonomic nervous system, the sympathetic and the parasympathetic division

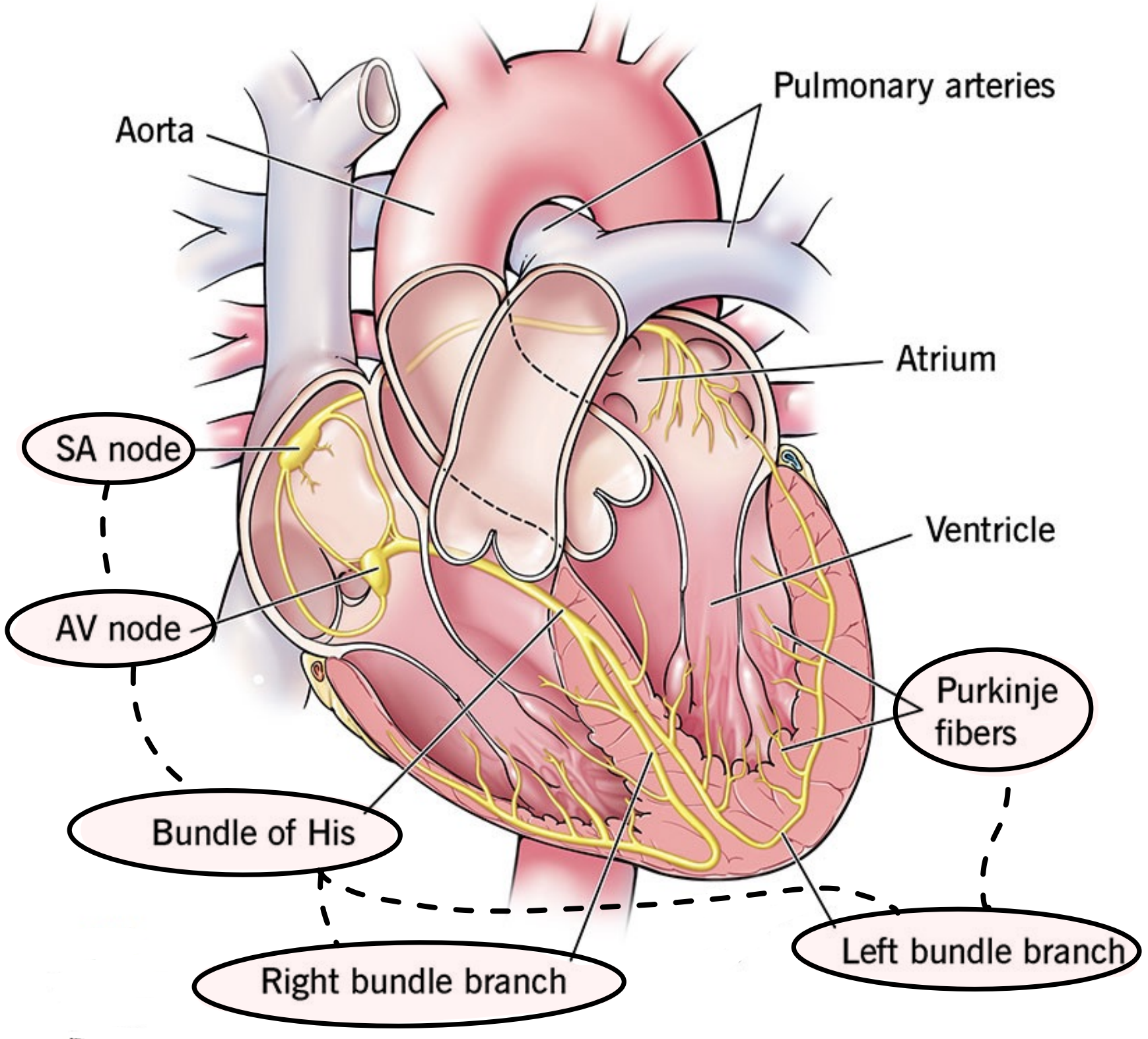
Irregular heartbeat : ARRHYTHMIA

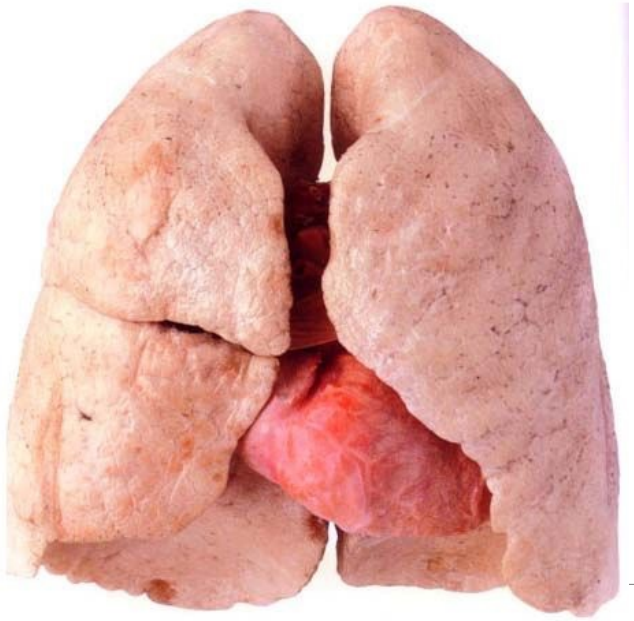


Parts of Conducting system of the he

- 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.




Aorta
Pulmonary arteries
Atrium
SA node
Ventricle
AV node
Purkinje fibers
Bundle of His
Left bundle branch
Right bundle branch

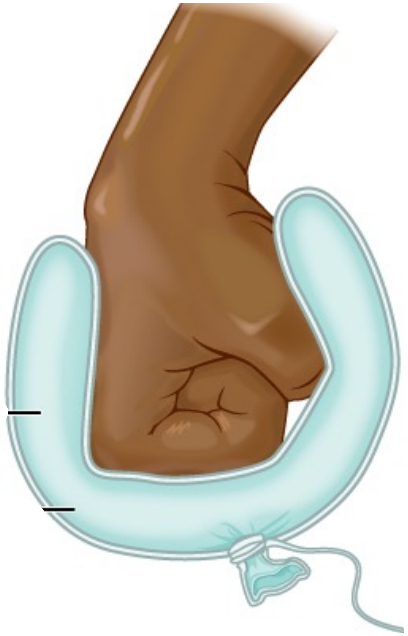


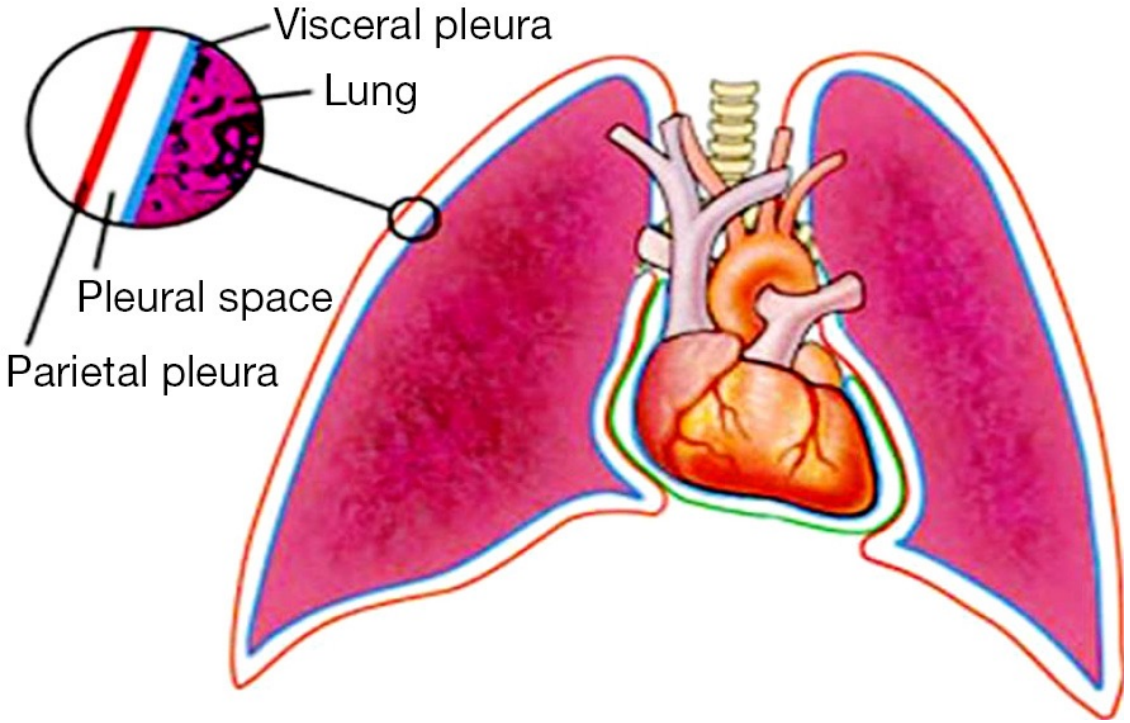
Lungs and Pleura

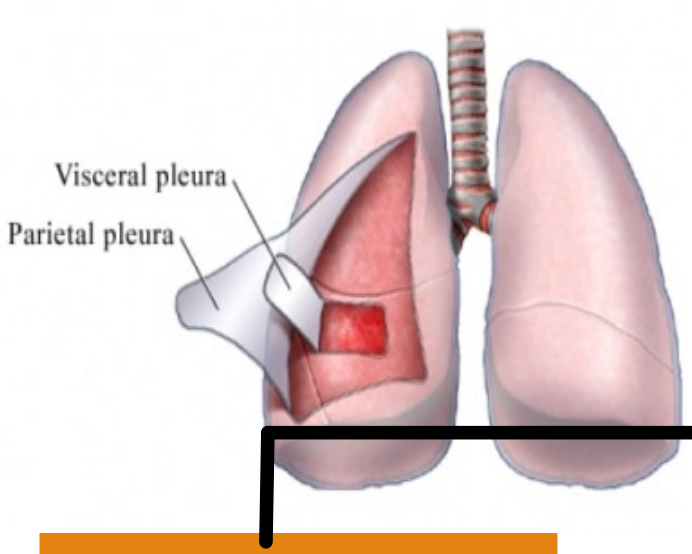
Pleura

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

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



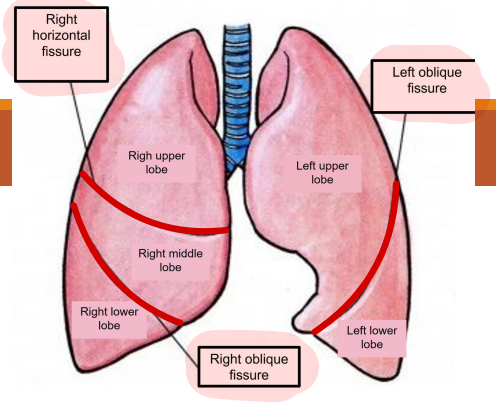




The pleura

1. Visceral layer

1. covers the outer surfaces of the lungs and extends into the
2. interlobar fissures

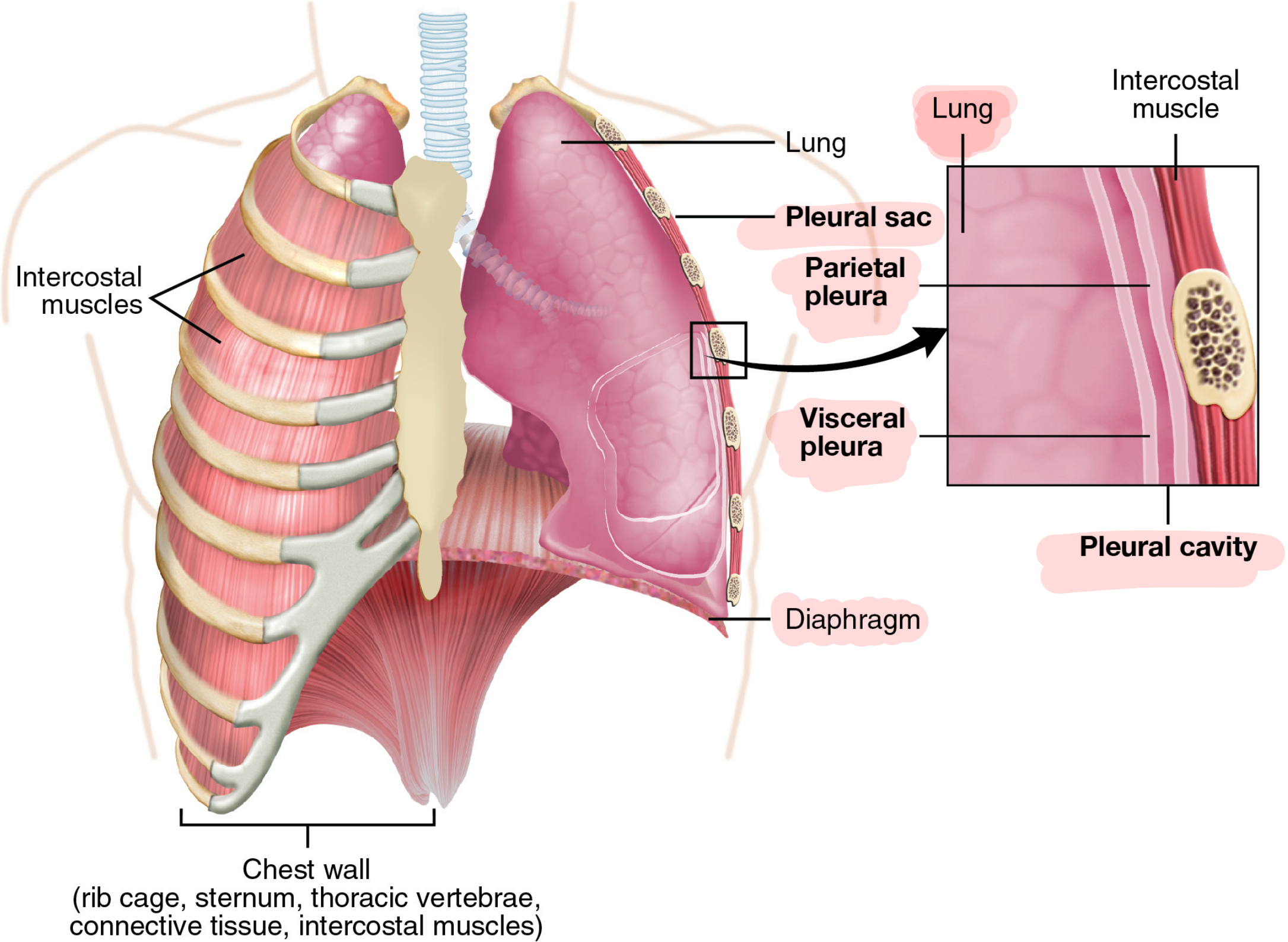


2. Parietal layer

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

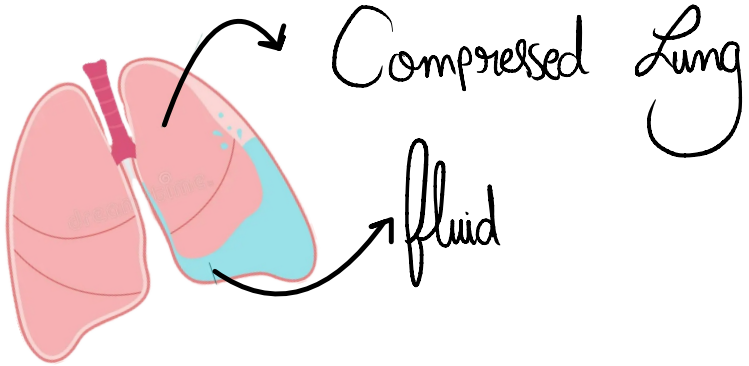
3. Pleural cavity

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


Lung
Pleural sac
Intercostal muscles
Diaphragm
Chest wall
(rib cage, sternum, thoracic vertebrae, connective tissue, intercostal muscles)
Lung
Intercostal muscle
Parietal pleura
Visceral pleura
Pleural cavity

Nerve supply of pleura

1. Parietal Pleura	2. 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***



When the fluid enter , the lungs will be compressed, so there is no enough space for the air to enter it

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

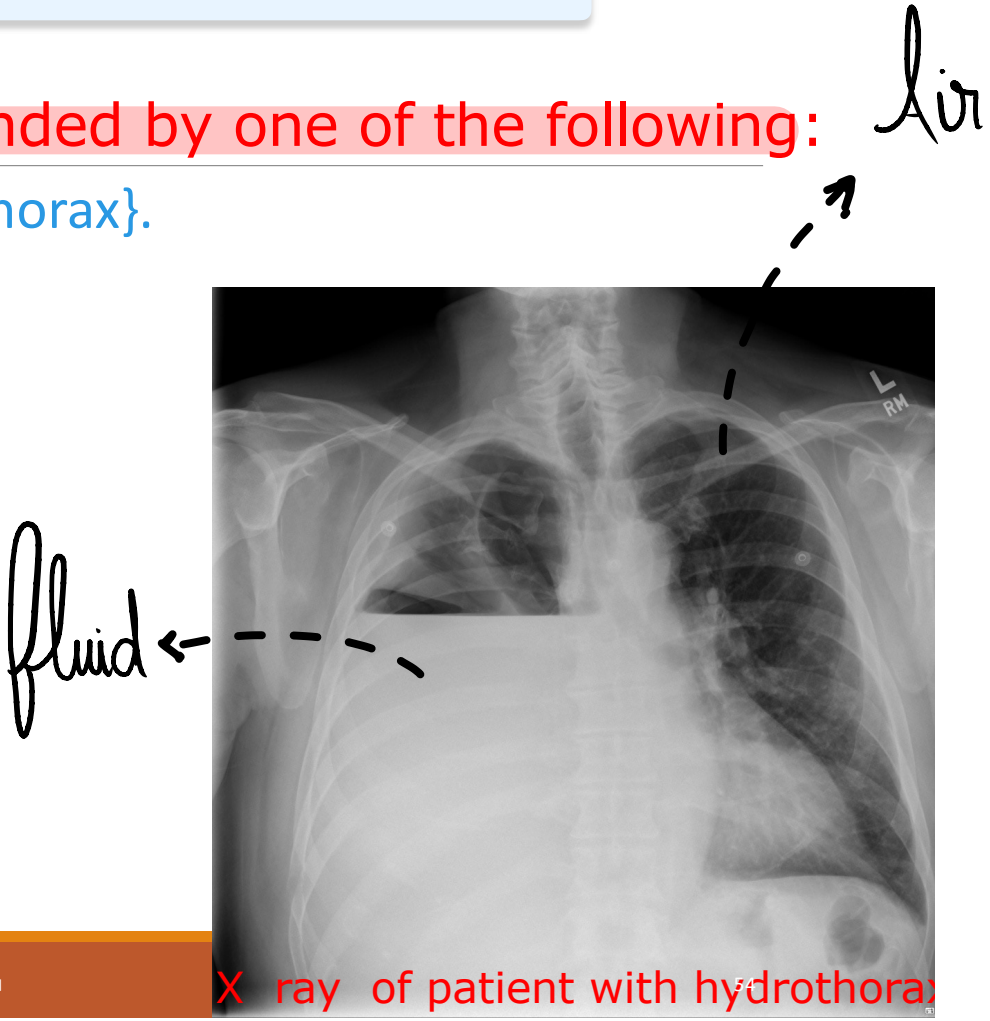
Fluid ---------- Pleural effusion {hydrothorax}.

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

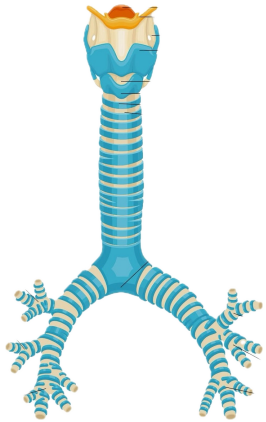
Blood ---------- Haemothorax.

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

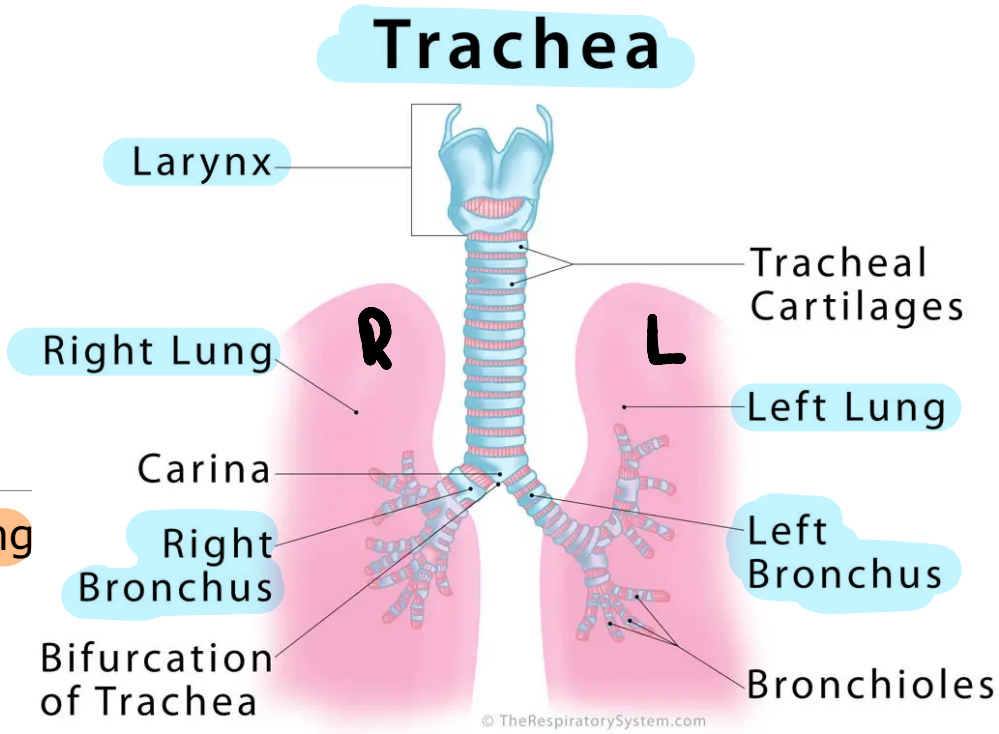
Lymph ---------- Chylothorax.



X ray of patient with hydrothorax



Trachea



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

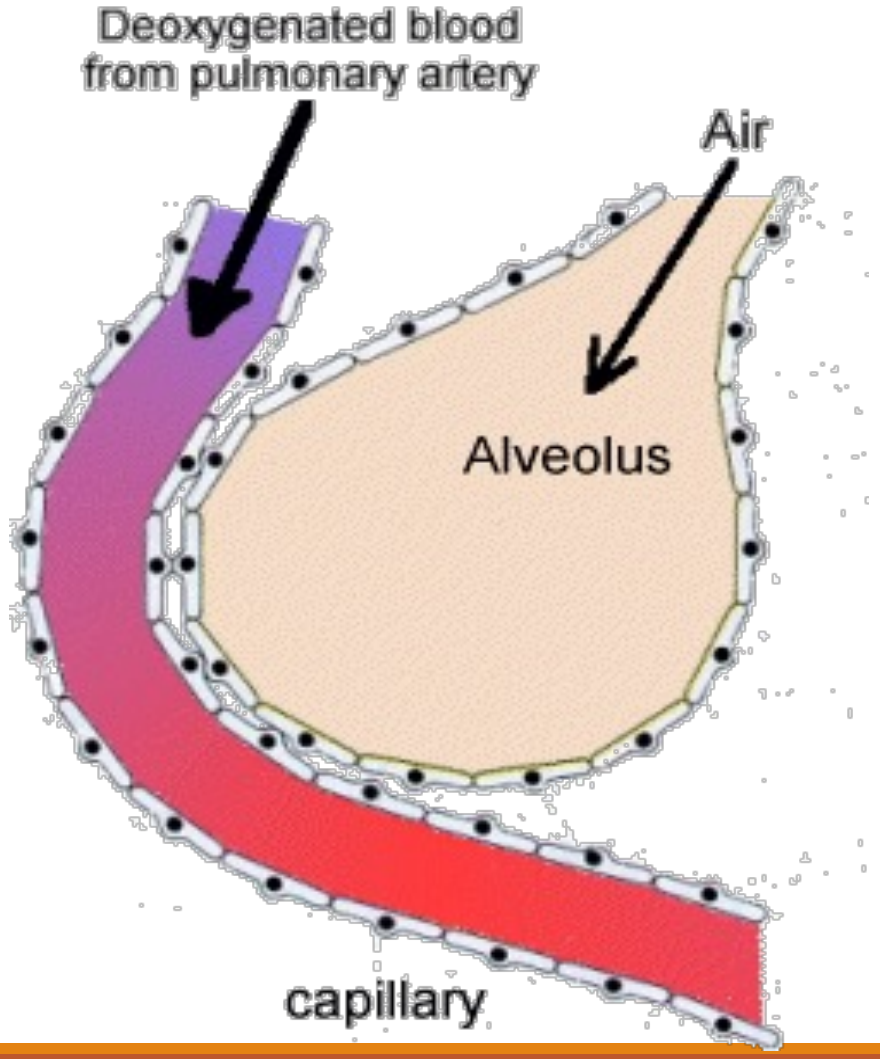
Beginning : At the level 6th cervical vertebra

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

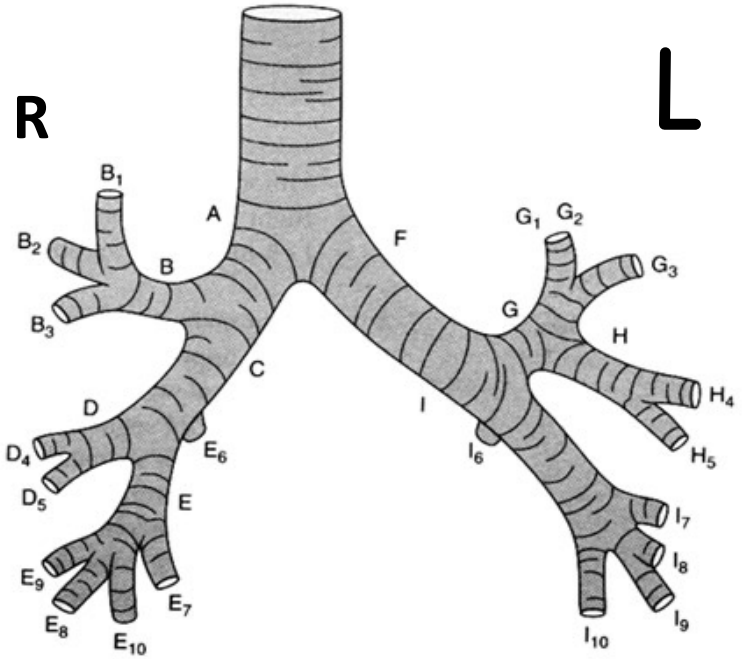
On the 2 coastal or the fourth thoracic vertebra

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

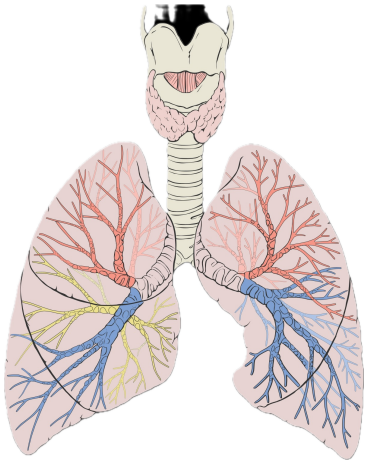
The trachea is kept patent by the presence of U-shaped bars (rings) of hyaline cartilage


Deoxygenated blood
from pulmonary artery
Air
Alveolus
capillary

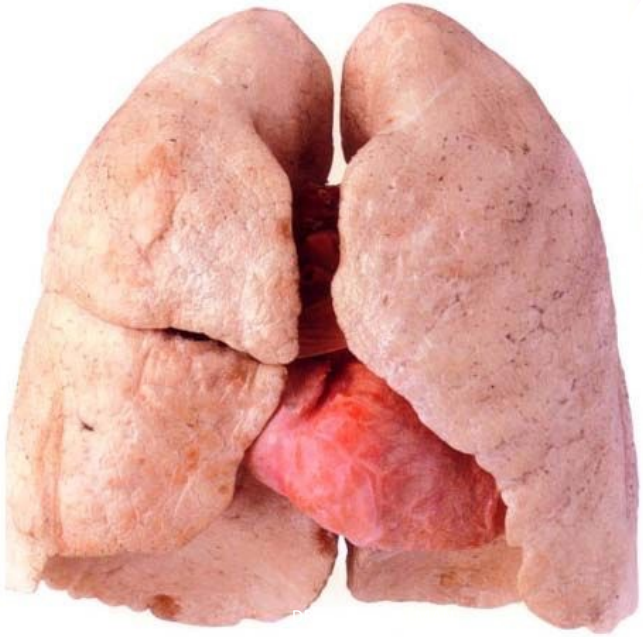
Right principal bronchus	Left principal bronchus
Shorter	Longer
wider	Narrower
more vertical	More horizontal
Inhalation of foreign bodies into the lower respiratory tract is common, especially in children	Less common



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

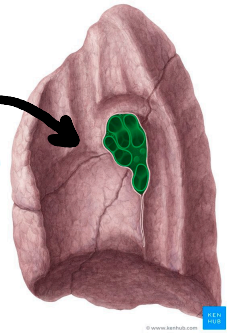
Base : is a concave and related to the diaphragm

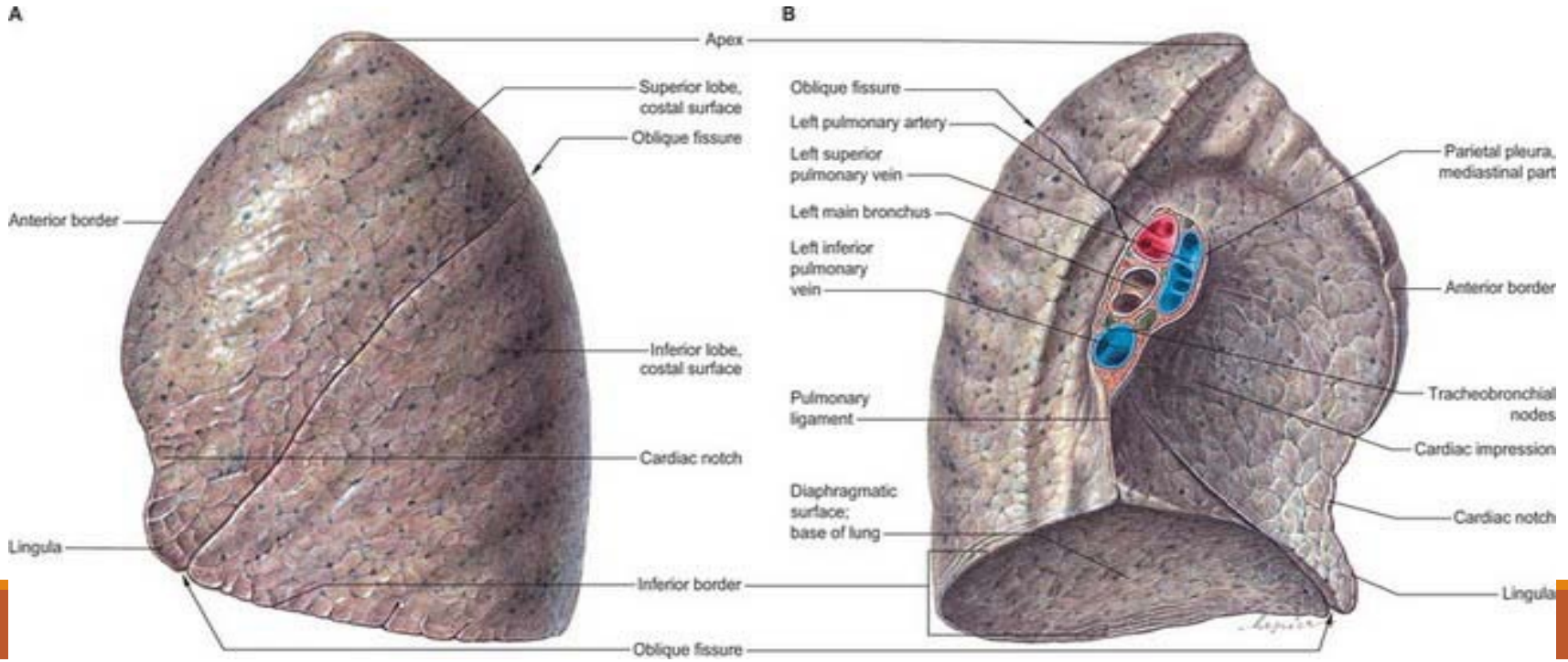
Costal Surface : is convex related to ribs and costal cartilages

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



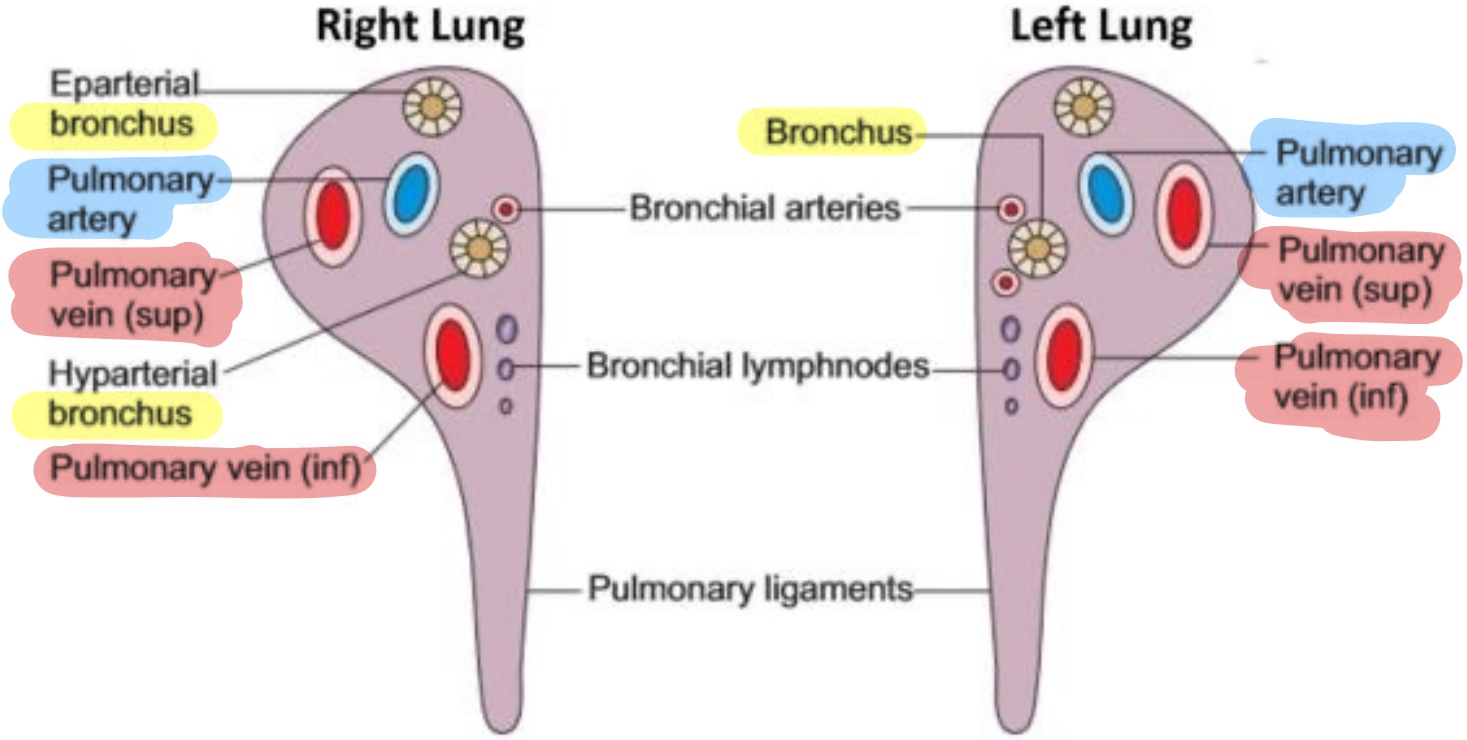


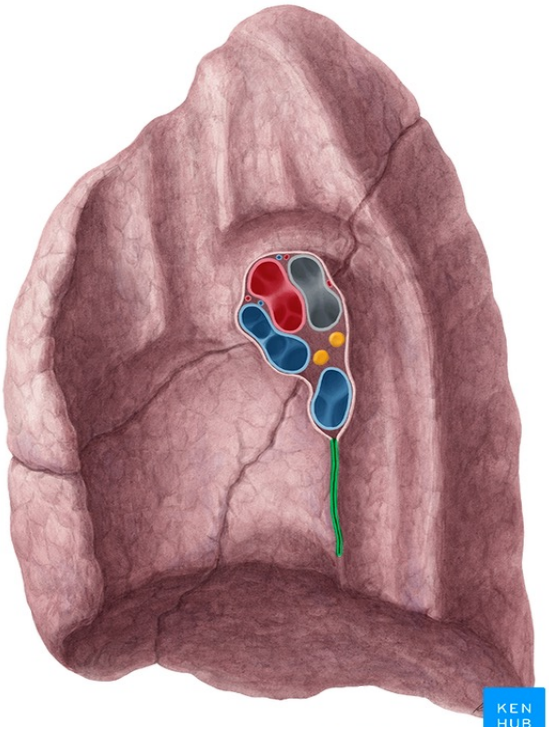
Hilum

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

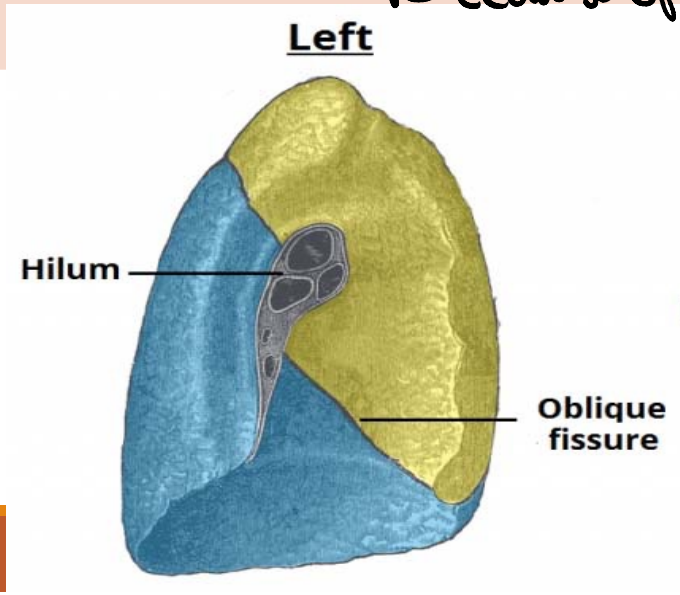
Contents :

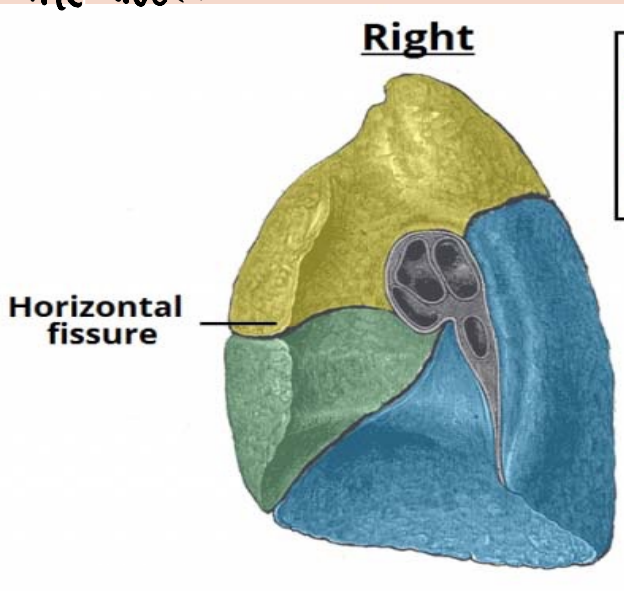
- ✓Bronchus
- ✓Pulmonary artery
- ✓Superior pulmonary vein
- ✓Inferior pulmonary vein
- ✓Vessels ,nerves and lymphatics

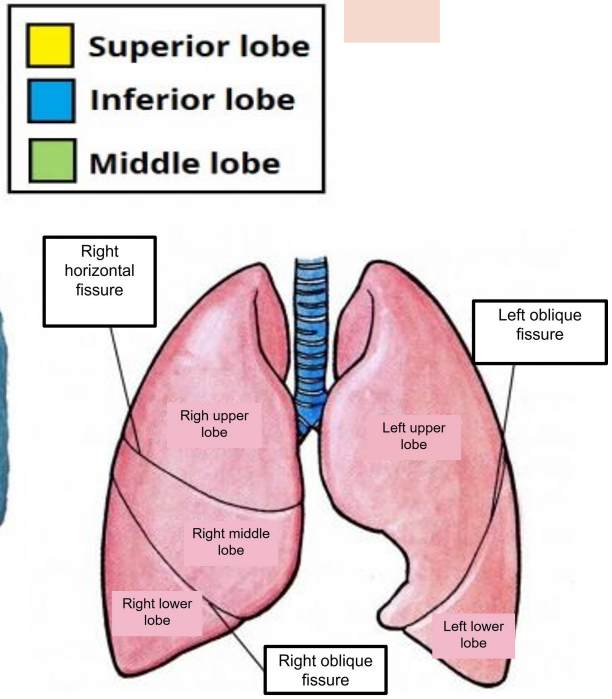




Difference between right and left lung	
Right lung	**left lung**
Larger	Smaller Because of the heart.
Has two fissures oblique and horizontal fissures	Has oblique fissures only
Has three lobes ,upper , middle and lower lobes	Has two lobes ,upper and lower lobes
Shorter Because of the liver.	Taller

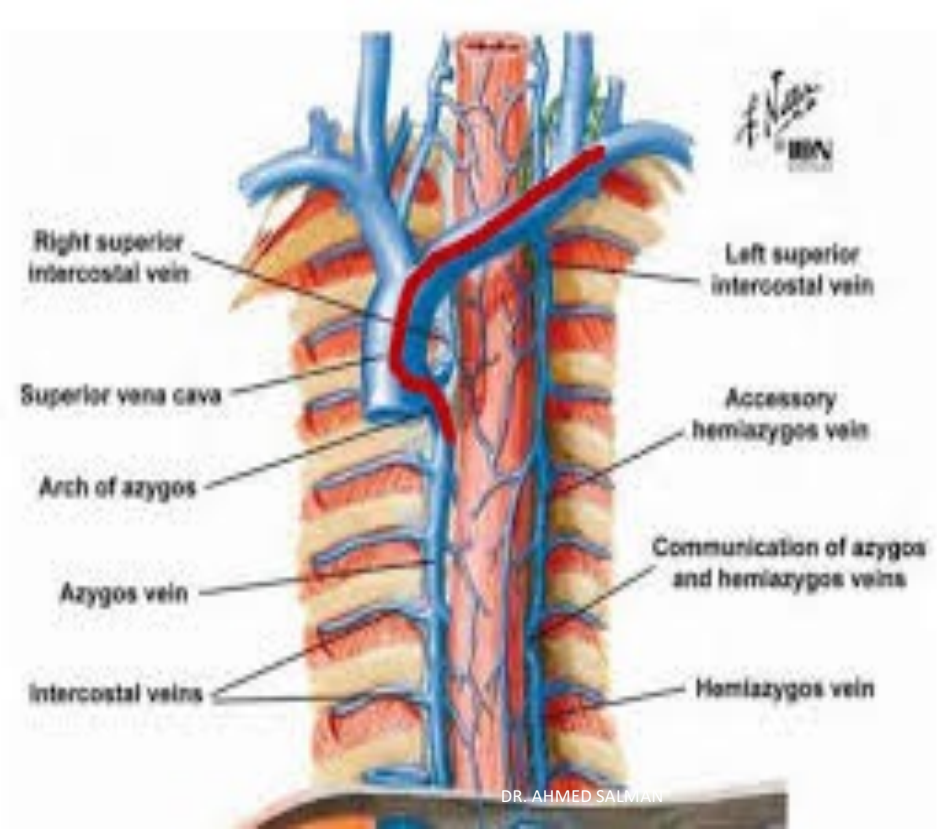






Blood Supply of the Lungs

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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YOU!