

CARDIOVASCULAR SYSTEM

SUBJECT : Anatomy.

LEC NO. : lecture (1)

DONE BY : Rawan Alhindi

وَقُلْ رَبِّ زِدْنِي عِلْمًا



SCAN ME!



CVS..

Lecture (1)

Anatomy of Pericardium & Heart

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Assistant professor of Anatomy & Embryology

ILOs

- Describe the outline and normal position of the heart.
- Describe the general organization, surface landmarks & external features of the heart. List relations of different parts of the heart.
- Define the pericardium, describe its component & its attachment to the diaphragm and the root of the great vessels.
- Discuss the pericardial space, sinuses & the pericardial fluid in normal condition.
- Describe blood supply & innervations of the pericardium.
- Describe the internal features of each chamber of the heart

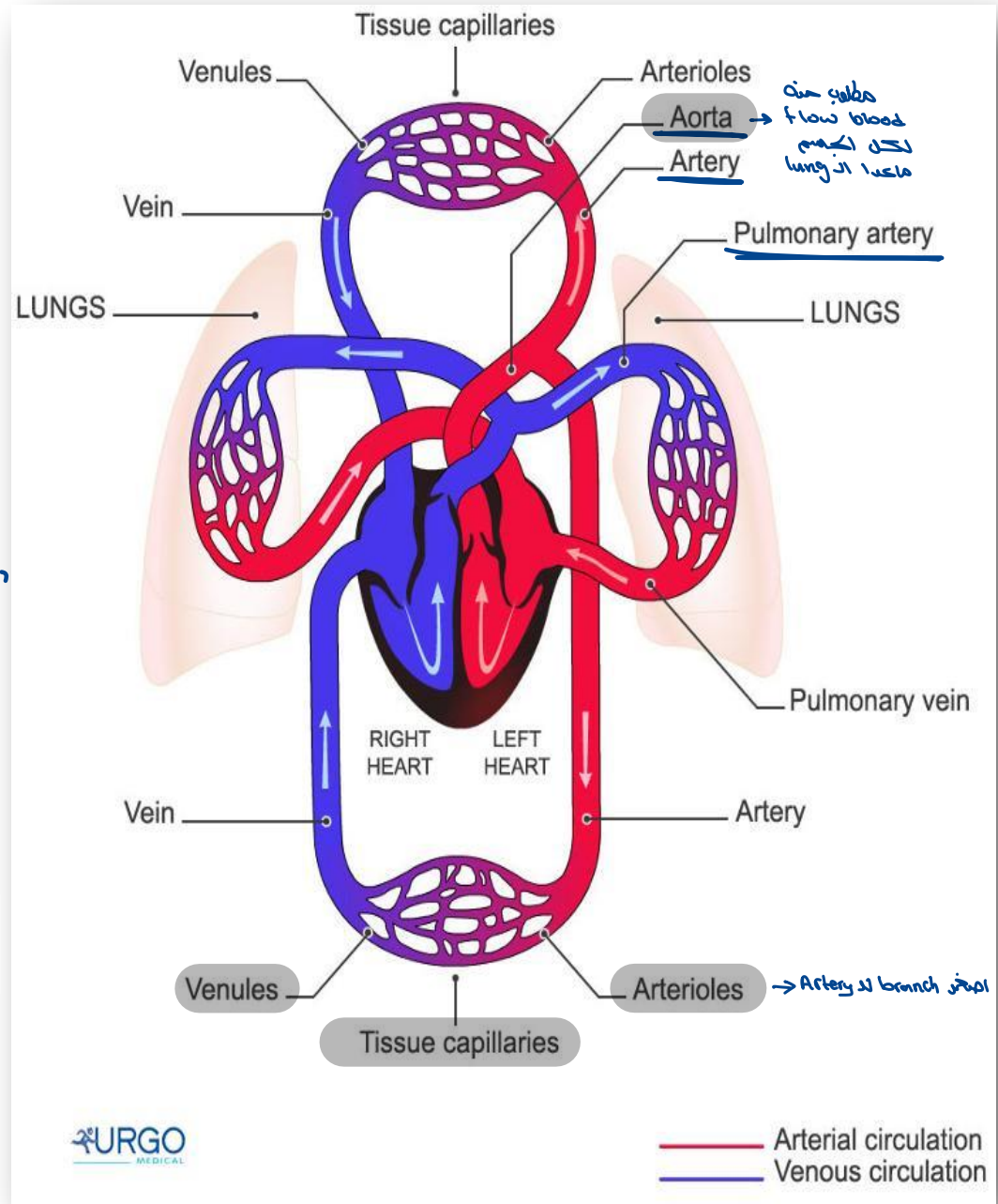
Components of the cardiovascular system

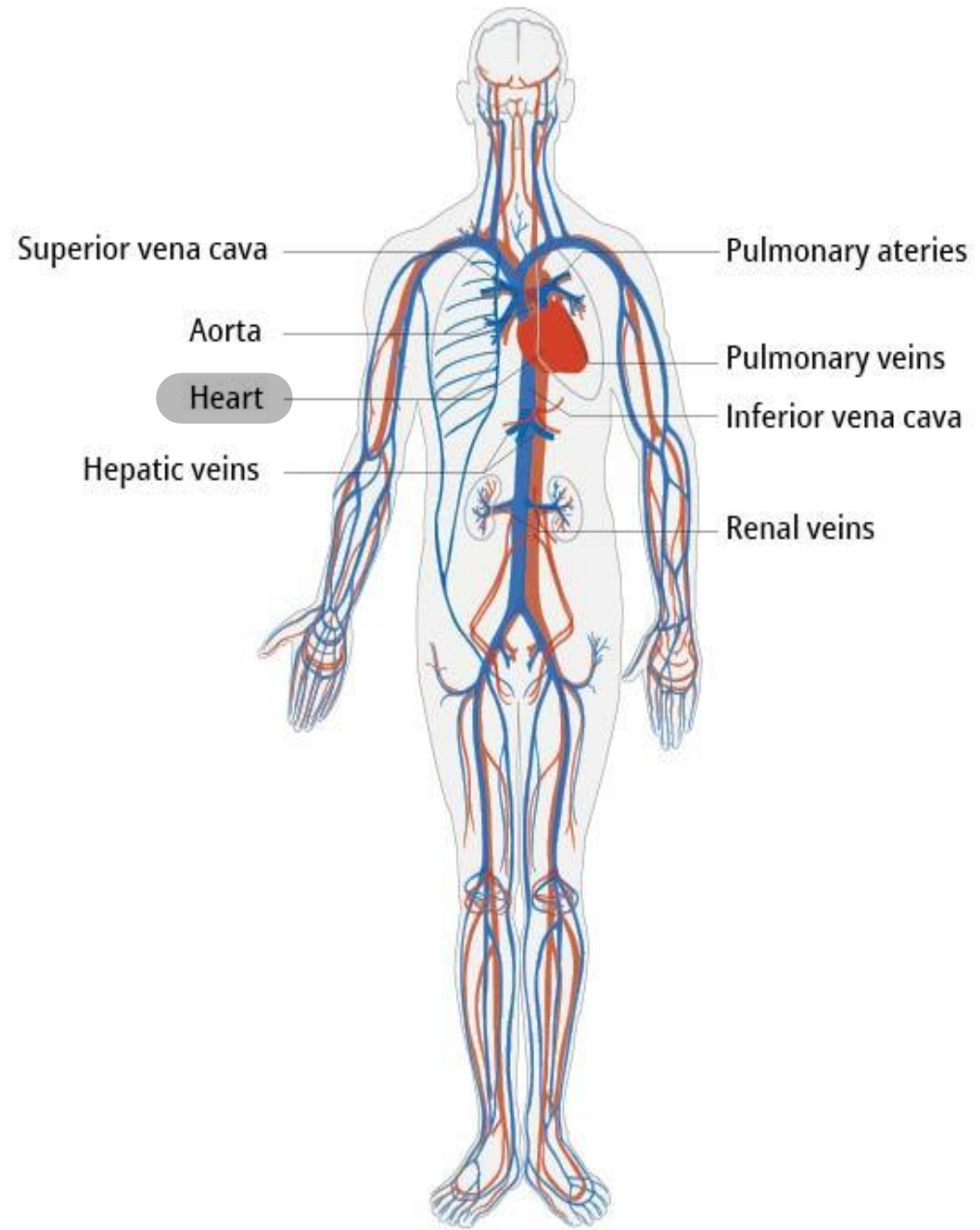
يتكون من شريطين :-

1) **The heart:** A muscular pump that forces blood around the body.

2) **A closed system of blood vessels:** These vessels include:

- 1 • **Arteries:** Vessels that carry blood away from the heart. " Blood → oxygenated except Pulmonary Artery "
- 2 • **Veins:** Vessels that bring blood back to the heart. " Blood → deoxygenated except Pulmonary vein "
- 3 • **Capillaries:** Tiny vessels that connect the arterial system to the venous system. The exchange of oxygen, nutrients, and the waste between blood and tissues also happens through the capillaries.





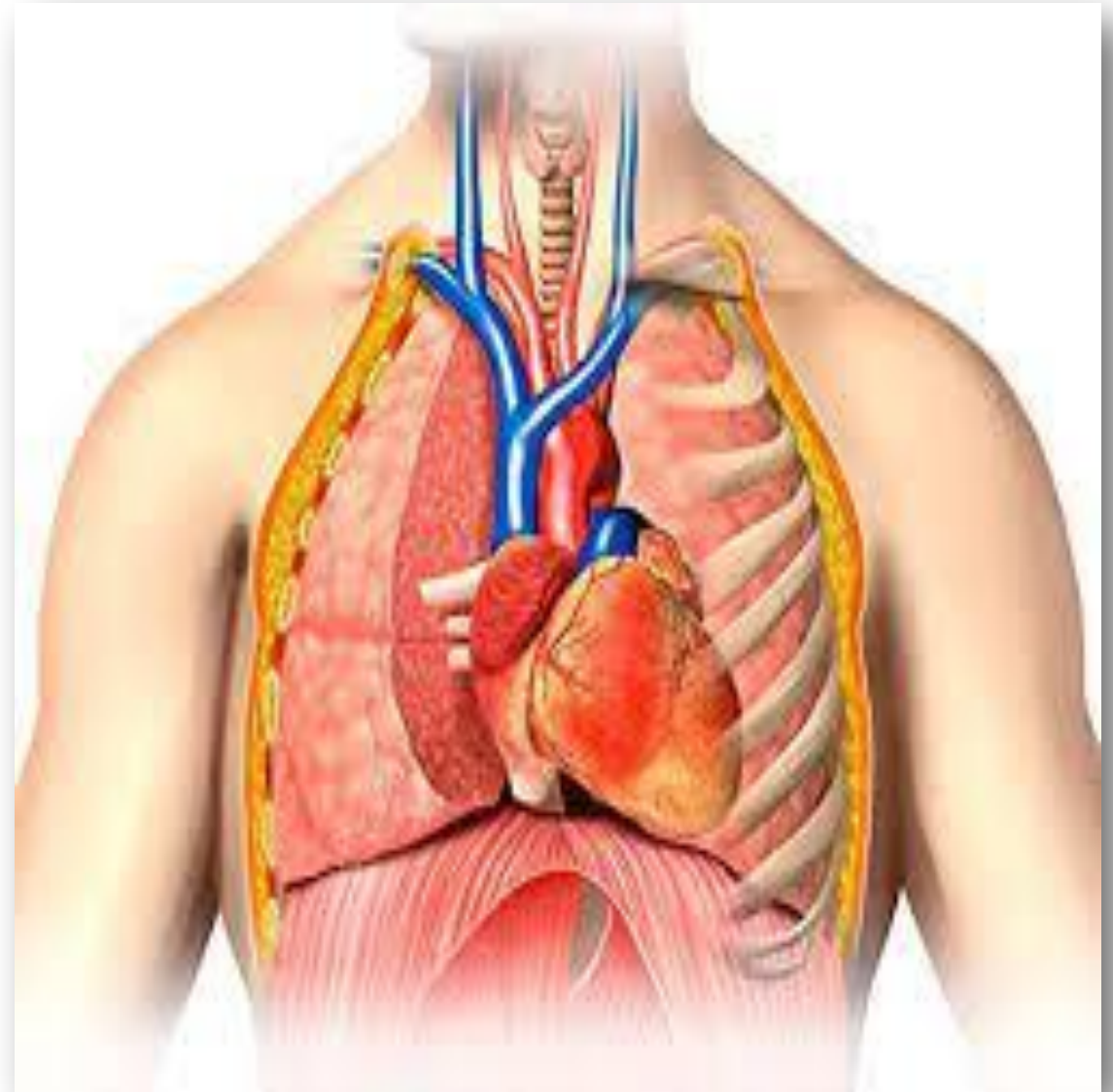
Heart

Definition:

- The heart is a hollow muscular organ, completely invested by the pericardium.
- **Size:** Size of a closed fist, an average adult heart is (12 cm) from base to apex, (8–9) cm at its broadest transverse diameter and (6 cm) at its anteroposterior diameter.
- **Weight:** average (300 g) in males & (250 g) in females.

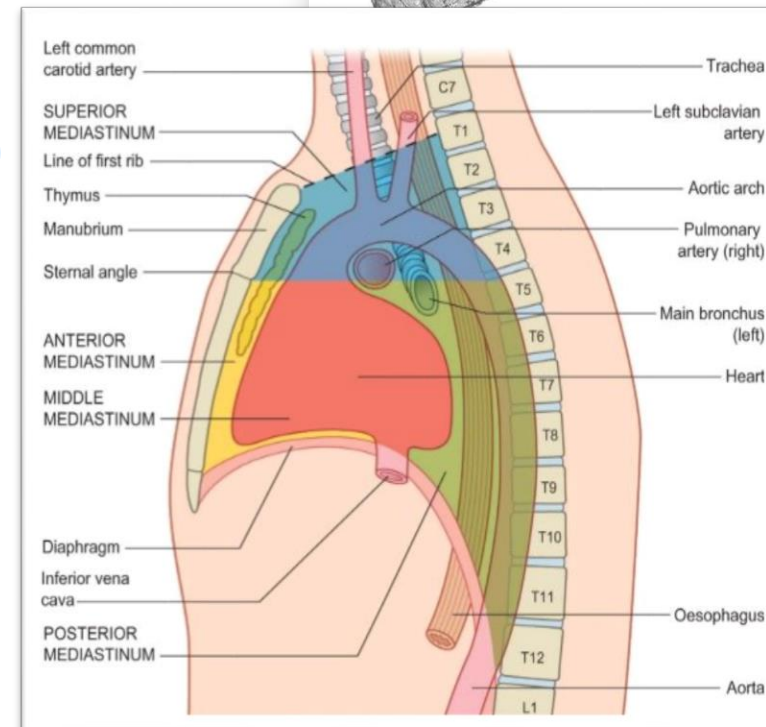
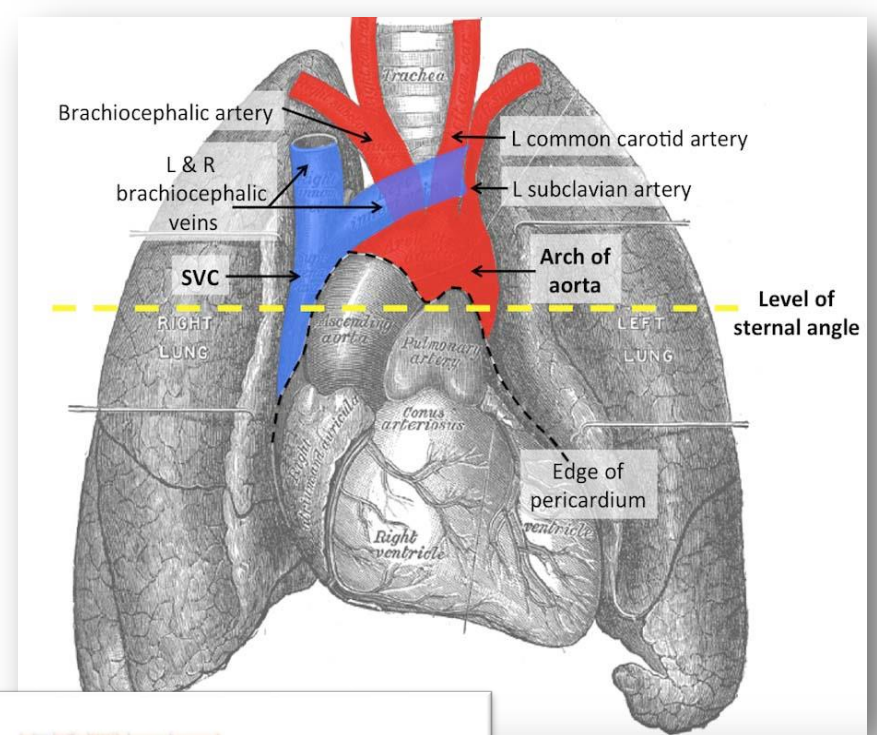
thickness
of the
heart.

الارتفاع الحفظ ١٢ سم
سؤال ١٢



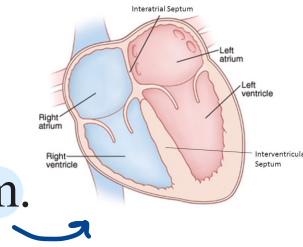
Site of the heart:

- The position of the heart within the thoracic cavity between the two lungs.
- It lies in the middle mediastinum. *bits*
- Within the mediastinum, the heart lies in its own space (pericardial cavity).



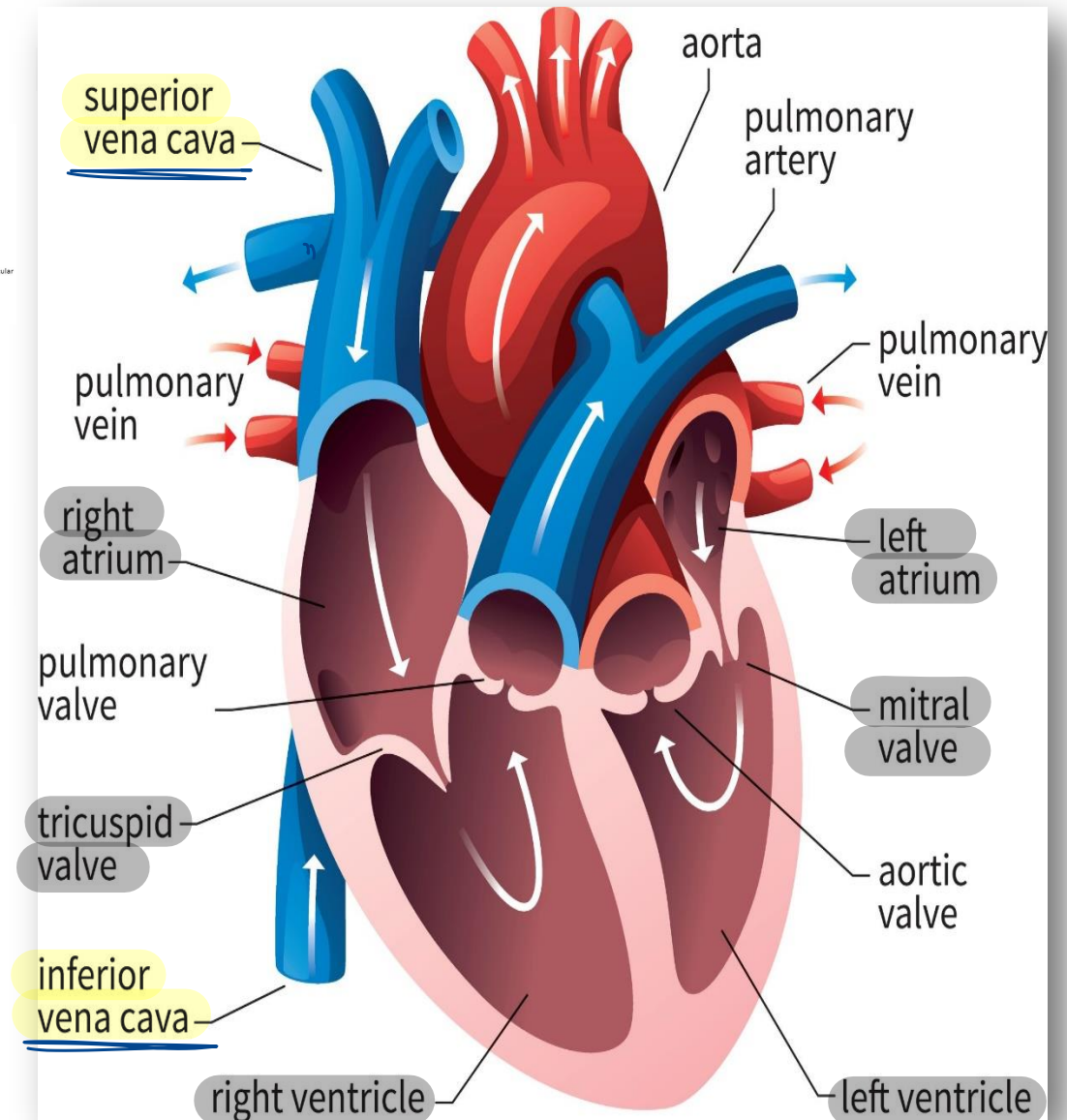
The heart consists of four distinct chambers:

- Two upper chambers called “**atria**”.
- Two lower chambers called “**ventricles**”.
- Interatrial septum & Interventricular septum.
- **Valves** control the flow of blood within the different chambers.
- The large arteries and veins directly connected with the heart are termed the **great vessels**, consisting of the **inferior vena cava**, **superior vena cava**, **pulmonary arteries**, **pulmonary veins**, and **ascending aorta**.



Blood follows the following path through the heart:

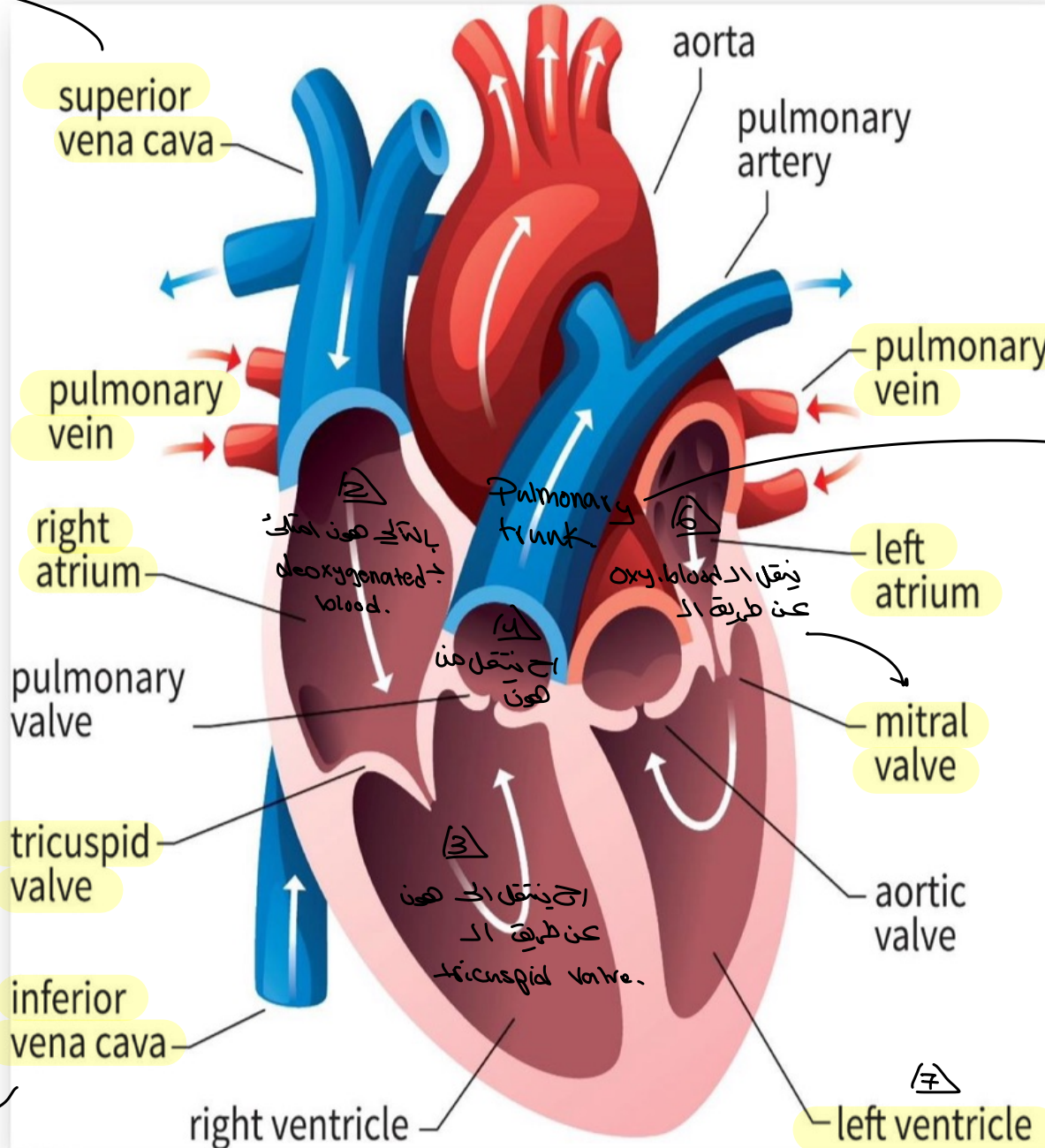
As shown in this figure.



bring deoxygenated blood from upper part of the body.

bring venous blood "deoxygenated" from whole body except lung.

bring deoxygenated blood from lower part of the body.



Connected with RV.
divided into Right/Left Pulmonary.

Corresponded wing.

Gas exchange

2 Pulmonary veins

1 Pulmonary vein =

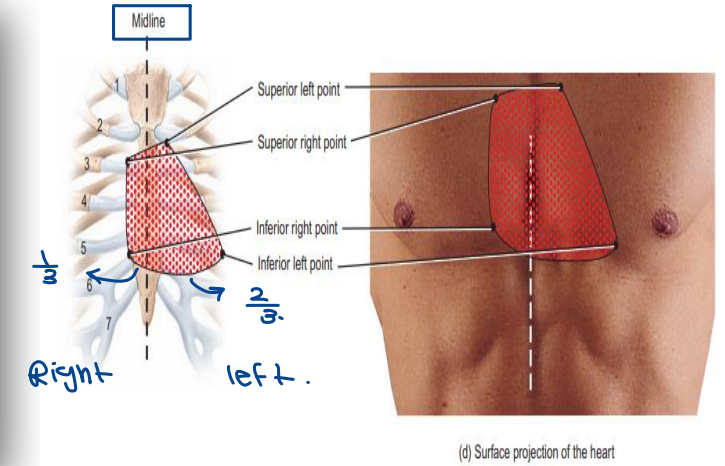
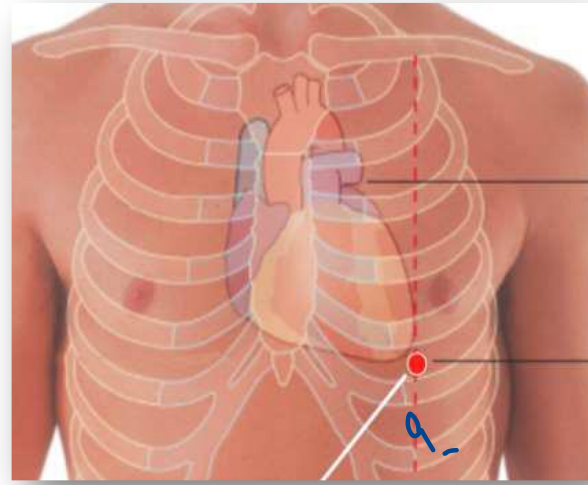
bring oxygenated blood from the lungs.
Left Atrium

bring oxygenated blood from the lungs. Left Atrium

To outline the heart:

The heart is **conical in shape**, having;

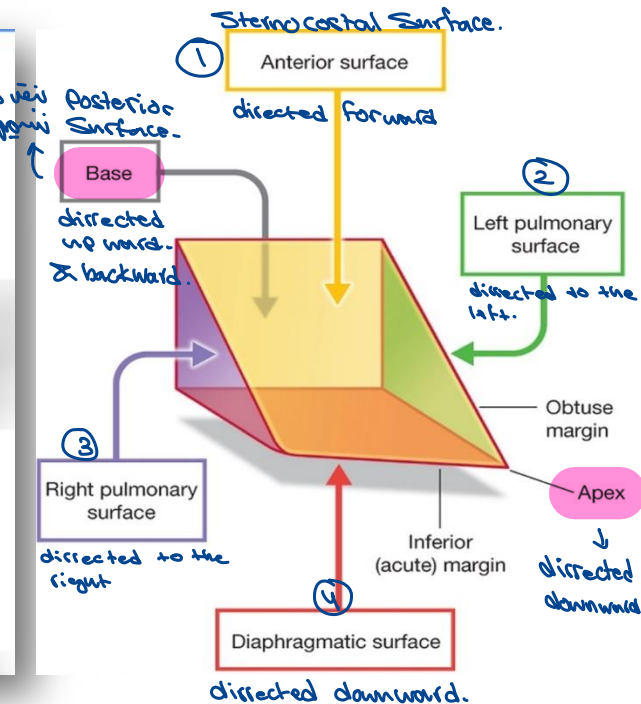
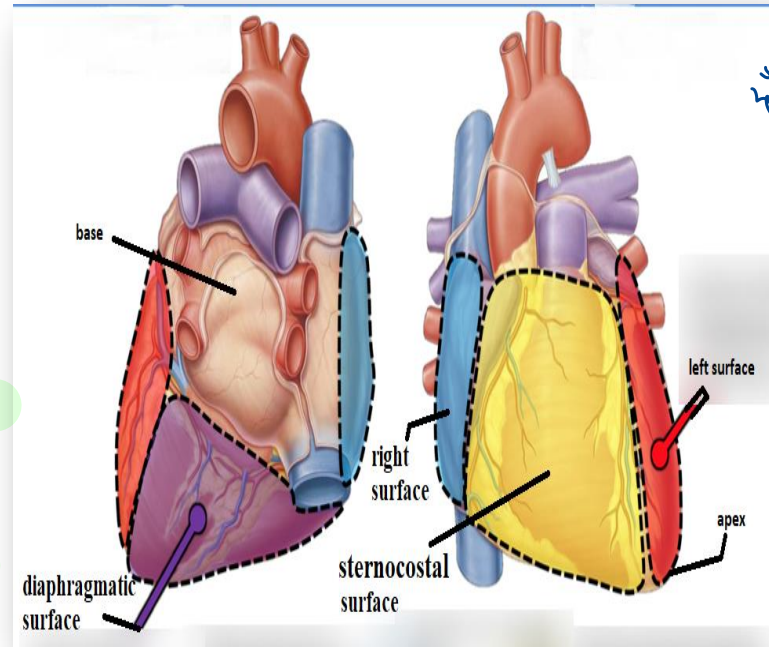
- **Apex & Base.** *Posterior surface. ←*
- **Four surfaces** (*Anterior.* Sternocostal, Diaphragmatic, Right and Left surfaces).
- **Four borders** (upper, lower, right and left).



It has an oblique position;

Its long axis directed downwards, forwards & to left. So

- 1- 1/3 of heart lies on right side & 2/3 on left side of the median plane.
- 2- Right side heart lies anterior to left side heart.



Apex of the heart

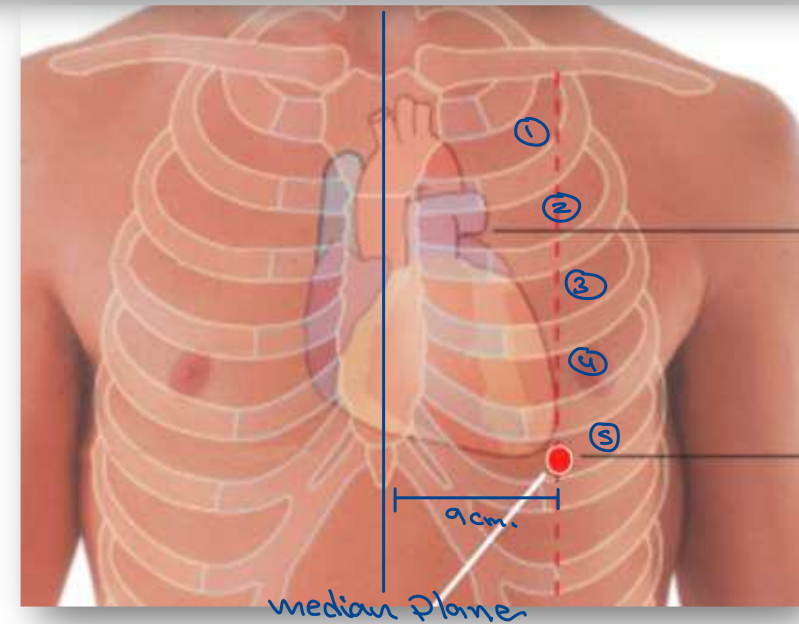
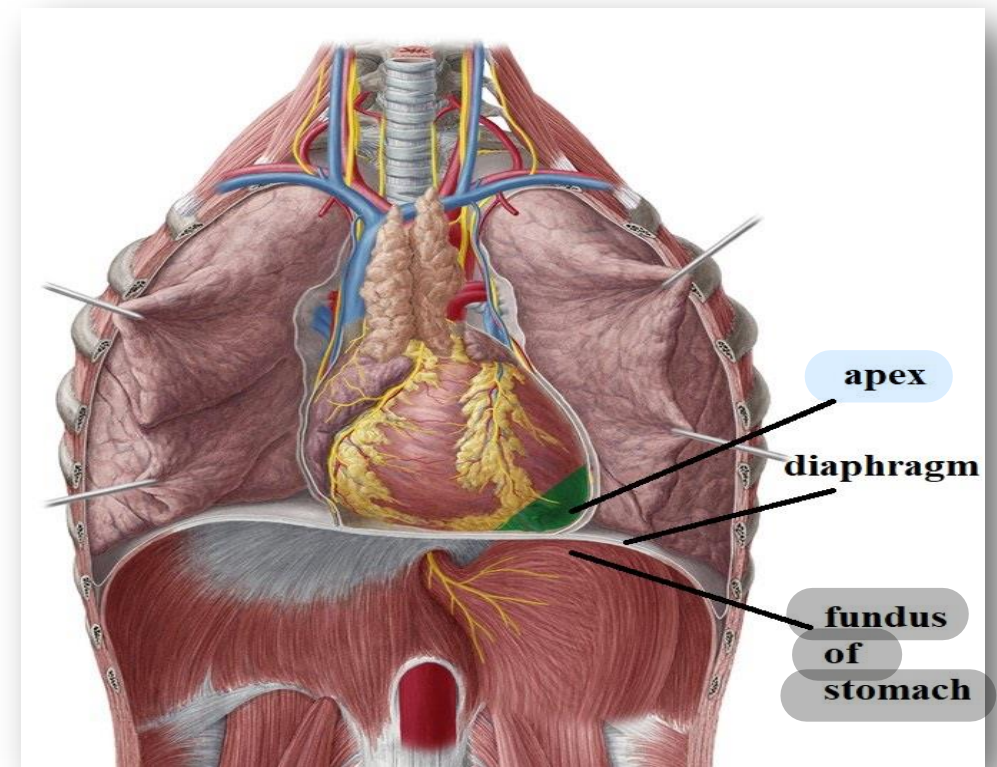
Formed by: Lt. ventricle.

Directed:

- Downward, forward & to Lt.
- It lies opposite left 5th intercostal space, 3.5 inches (9cm) to the left from median plane.

Relation:

- Left lung & pleura.
- The pericardium and diaphragm separate the apex of heart from the fundus of the stomach.



Base (Posterior Surface):

Formed by:

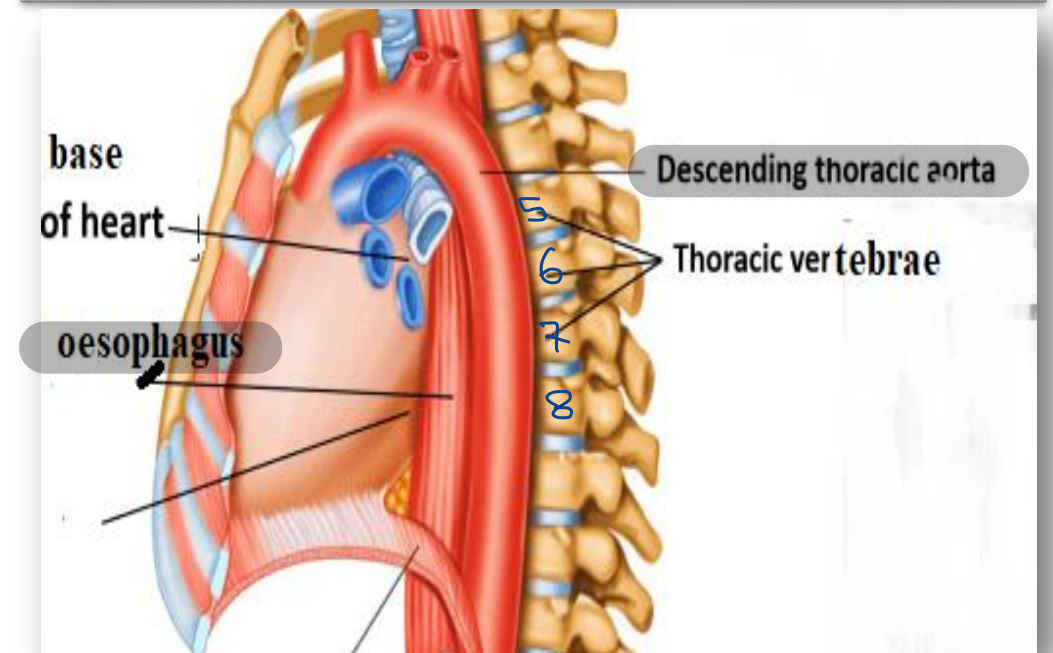
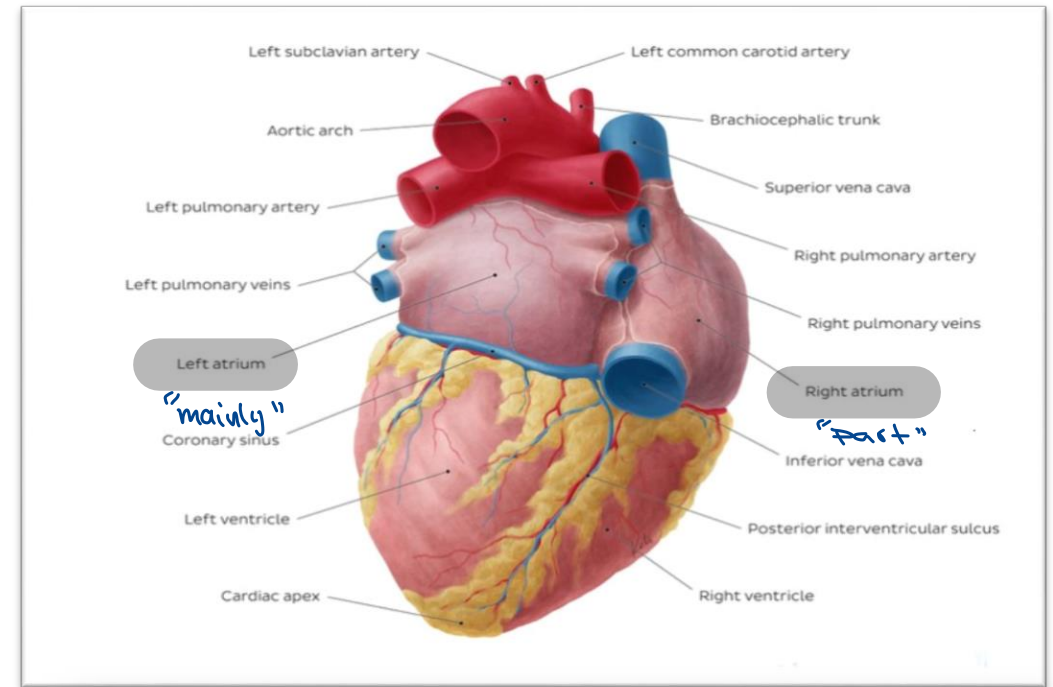
- Left atrium (mainly), part of right atrium & posterior inter atrial groove.

Direction:

- It is directed, upward backwards and slightly to the right.
- It lies opposite the middle 4 thoracic vertebrae (5, 6, 7 and 8).

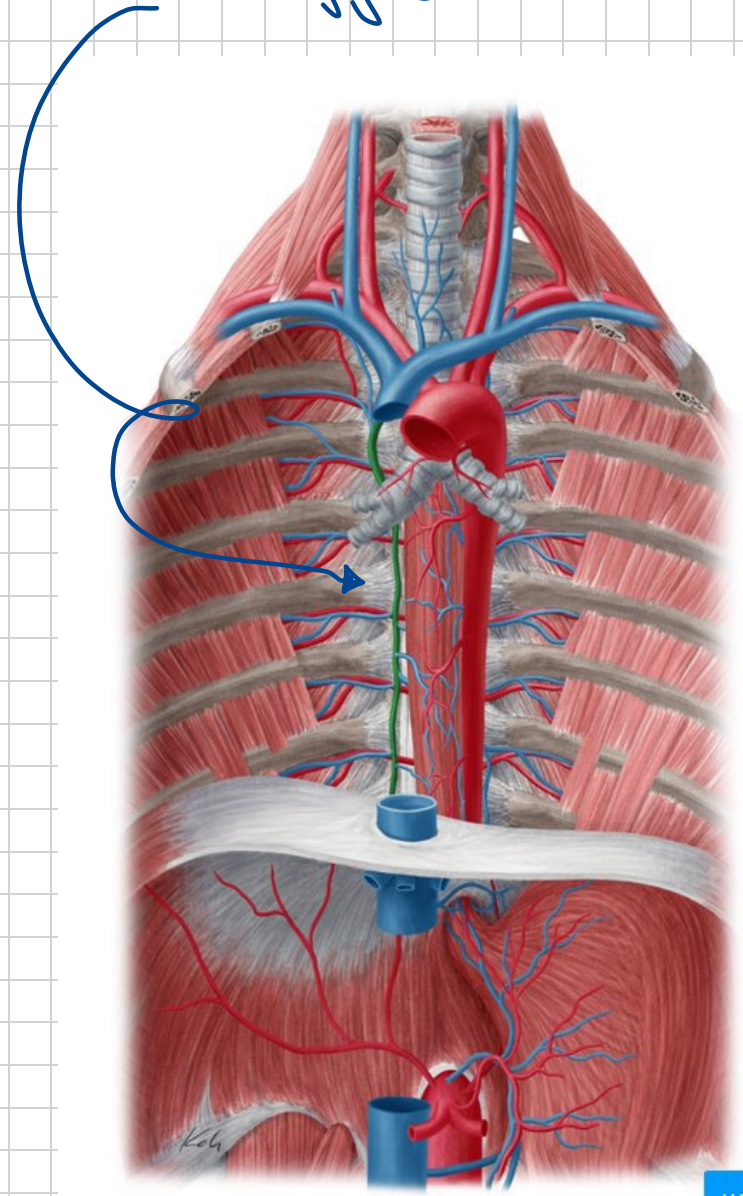
Relations:

- It is quadrilateral in shape, bounded inferiorly by the coronary (atrio-ventricular) groove.
- It is separated from the vertebral column by the descending aorta, oesophagus, Azygos vein & oblique sinus of the pericardium,

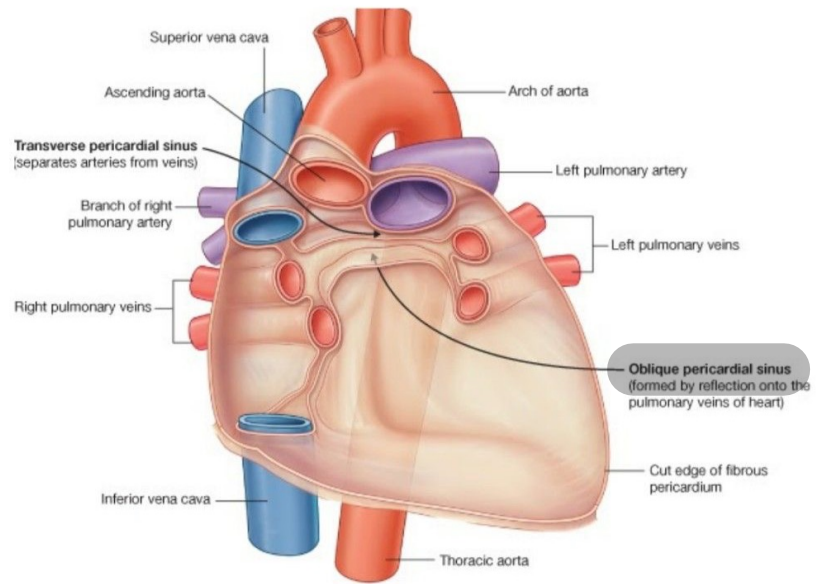


* axial *

Azygos vein

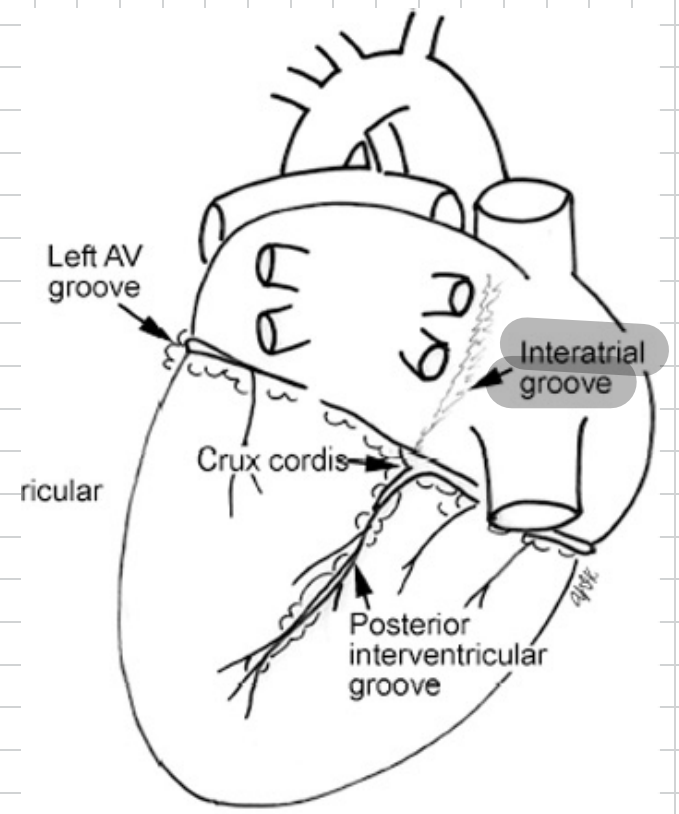


Oblique Sinus of the Pericardium.



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Posterior Interatrial groove.



Chambers →
Surface →

Anterior (sternocostal) surface:

It's divided by Atrio-ventricular groove into 2 portions:

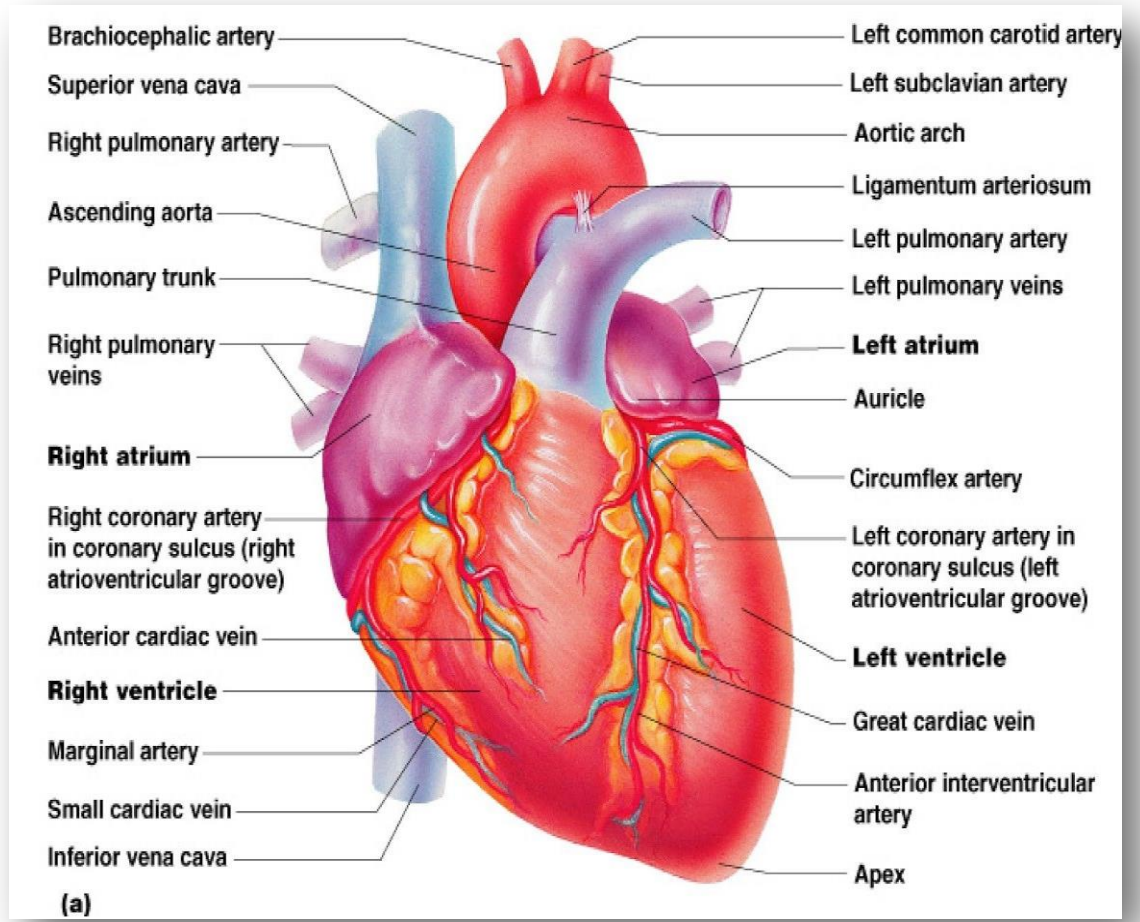
Atrial part: Formed by

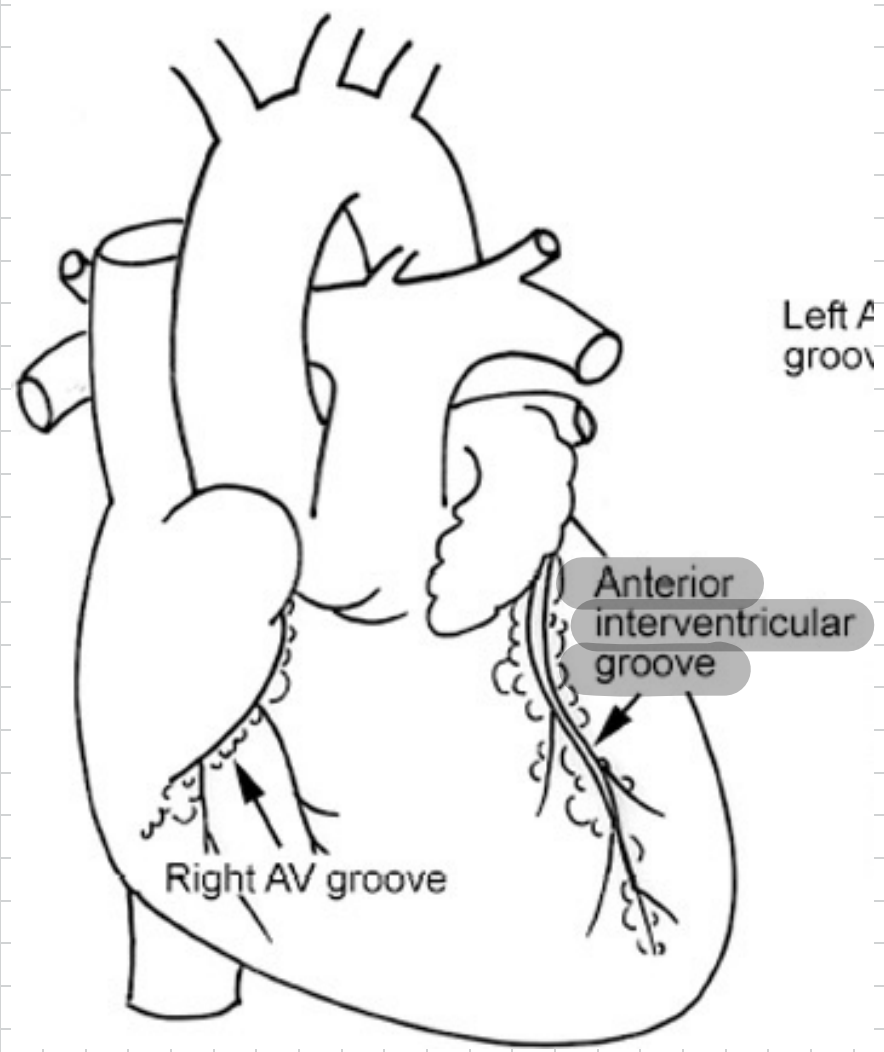
- Right atrium & its auricle.
- Left auricle.

Ventricular part:

- Right 2/3 of this part formed by the right ventricle.
- Left 1/3 formed by the left ventricle.
- Anterior interventricular groove & its contents.

لبسالة
سنة
الكبير





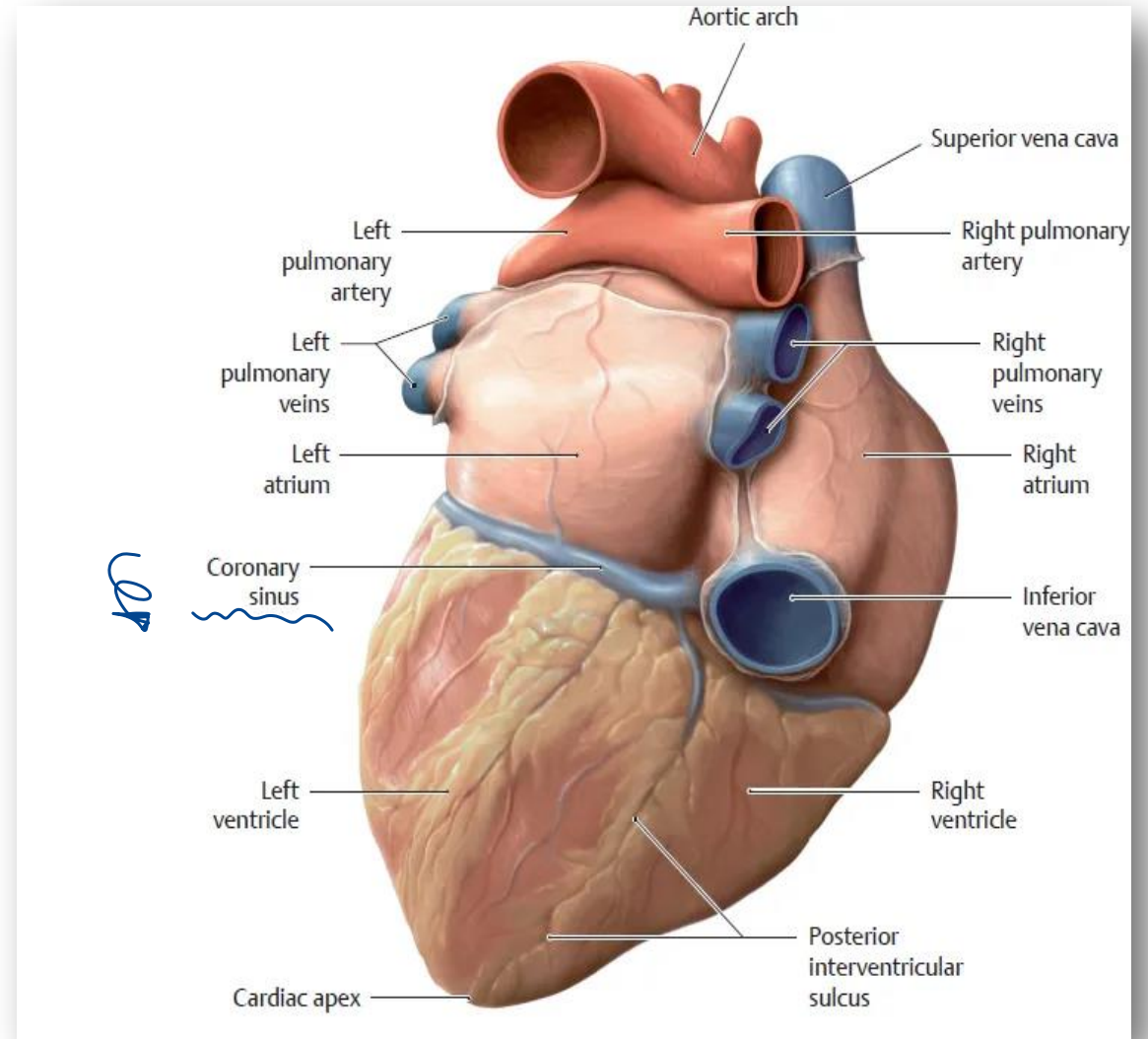
Inferior (diaphragmatic) surface

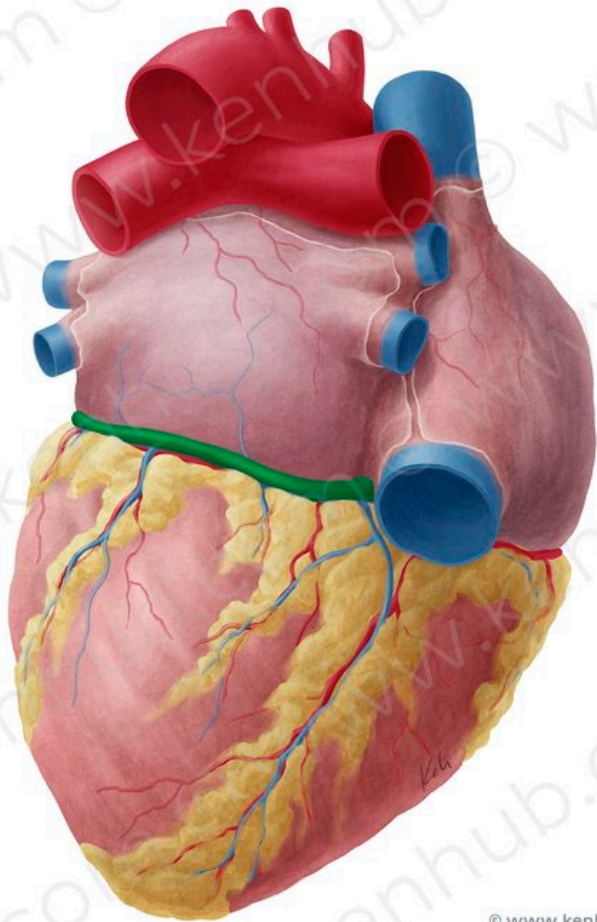
Formed by: the two ventricles, as;

- Its left 2/3 are formed by the **left ventricle**.
- Its right 1/3 is formed by the **right ventricle**.
- **Posterior interventricular groove** & its contents in between.

Relations:

- It rests on the **diaphragm**





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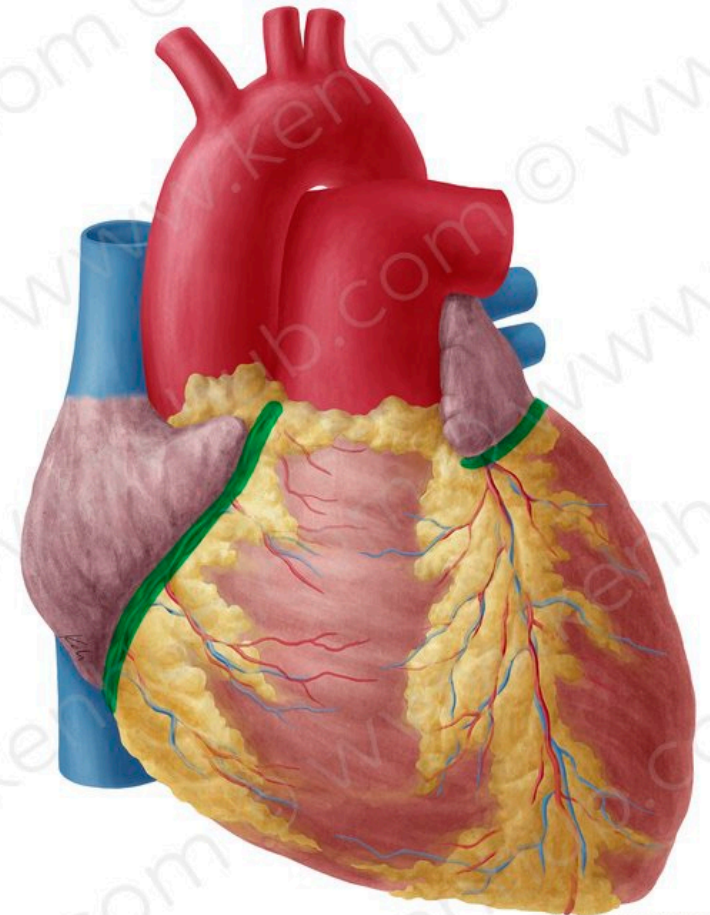
|| Coronary Sinus ||
 || Atrio-ventricular groove ||



	Coronary Artery	
	Aspect of the heart	
	Atrium / Ventricle	

Coronary groove Coronary

+
 Coronary Artery Coronary



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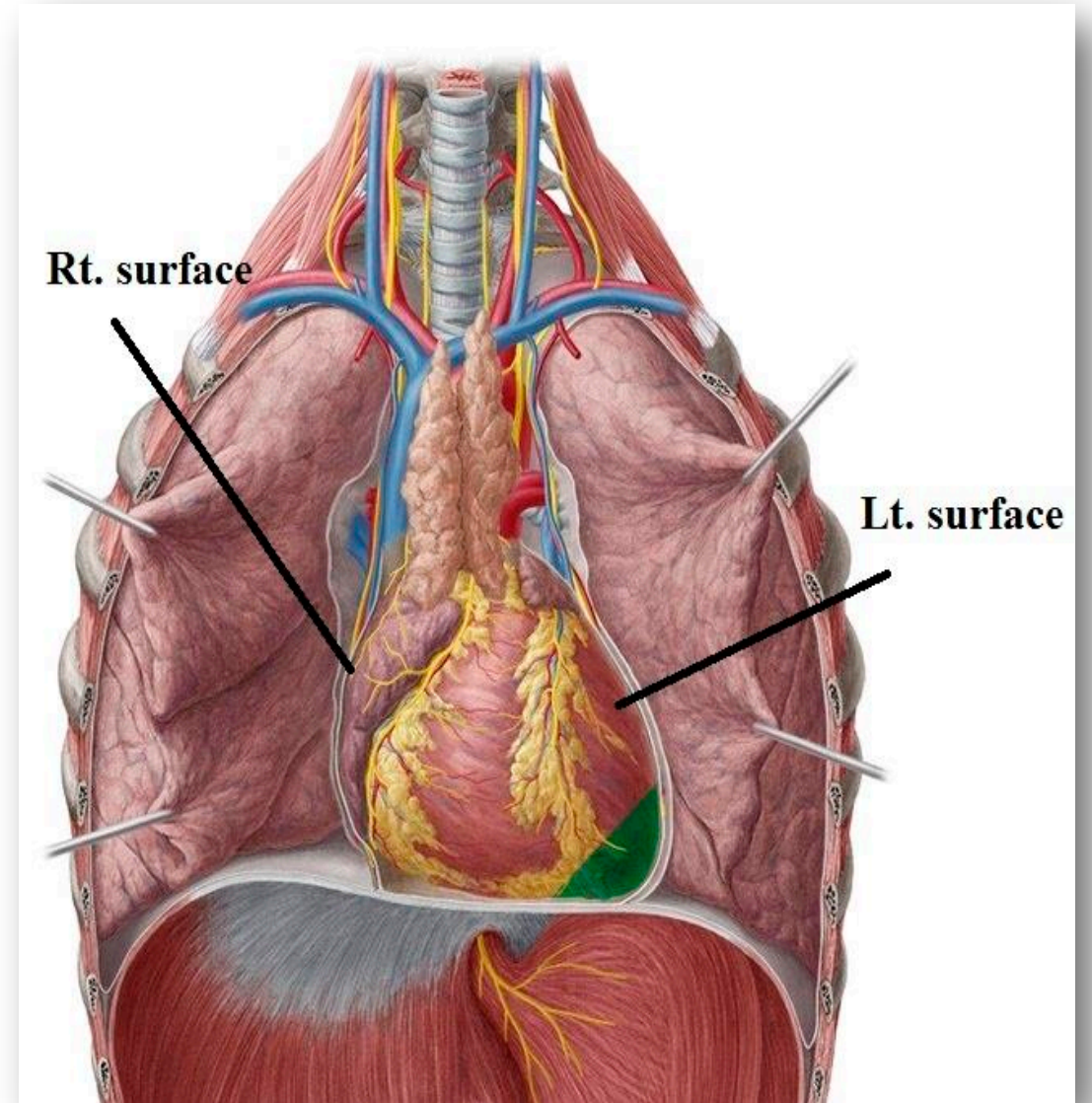


Right surface:

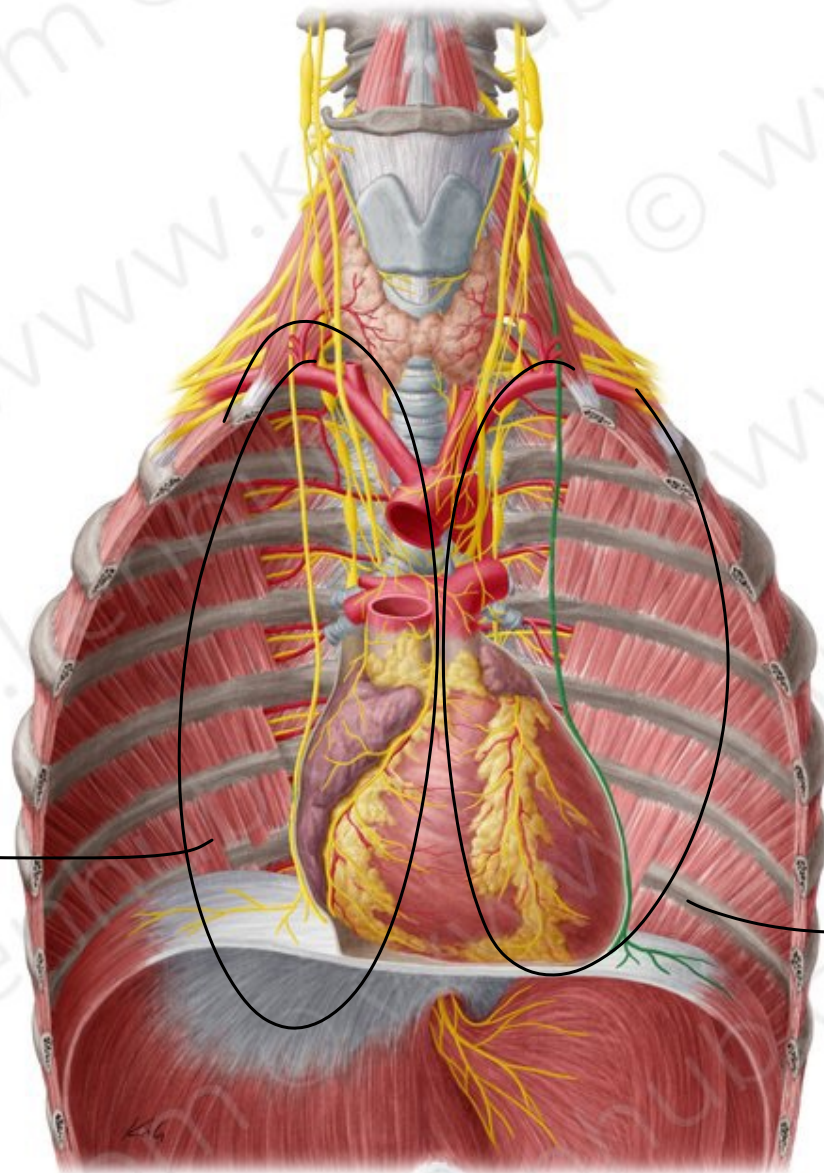
- Formed mainly by **right atrium.**
- Related **laterally to right** (lung, pleura, phrenic n.)

Left surface:

- Formed mainly by **left ventricle & left atrium.**
- Related **laterally to left** (lung, pleura, phrenic n.)



Right Phrenic
nerve.



left Phrenic
nerve.

Borders of heart:

Upper border:

- Formed by the two atria.
- It is hidden behind the ascending aorta and pulmonary trunk.

Right border:

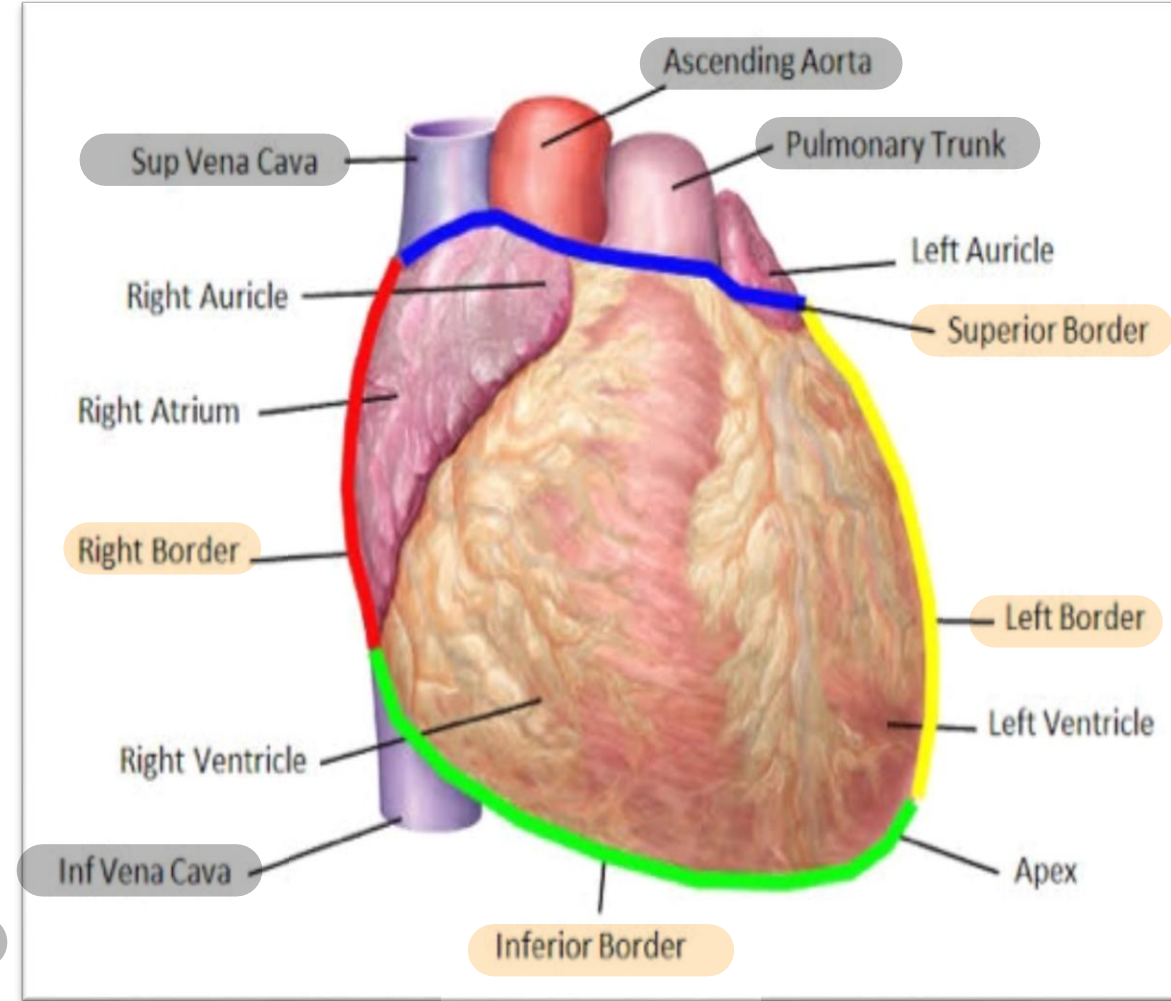
- Formed only by the right atrium. It is convex to the right.
- It extends from the opening of SVC to the opening of IVC.

Left border:

- Formed by the left ventricle and the left auricle.

Lower border:

- Formed by the right ventricle (mainly) and the left ventricle.
- It separates the sternocostal surface from the diaphragmatic surface.



Surface anatomy of the heart:

Surface anatomy of the sterno-costal surface of the heart is represented by the following points;

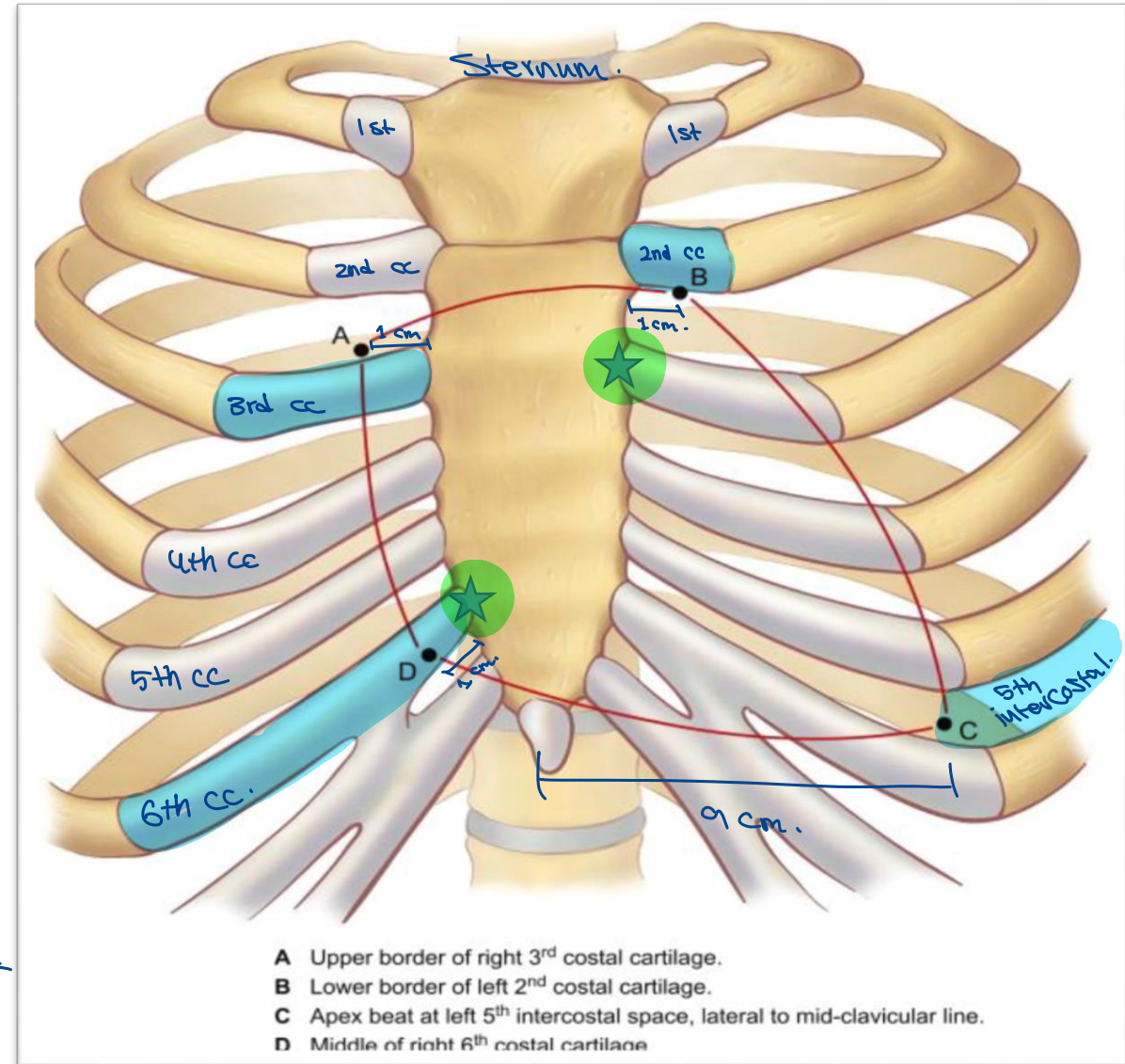
Point B: at Lt. ^{Costal Cartilage.} 2nd c.c. (1 cm) from the sternum.

Point A: at Rt. 3rd c.c. (1 cm) from the sternum.

Point D: at Rt. 6th c.c. (1 cm) from the sternum.

Point C (apex): at Lt. 5th intercostal space, (9cm) to the left from median plane.

Coronary groove: Oblique line from Lt. 3rd to rt. 6th sternocostal junctions.
left Right.



Pericardium

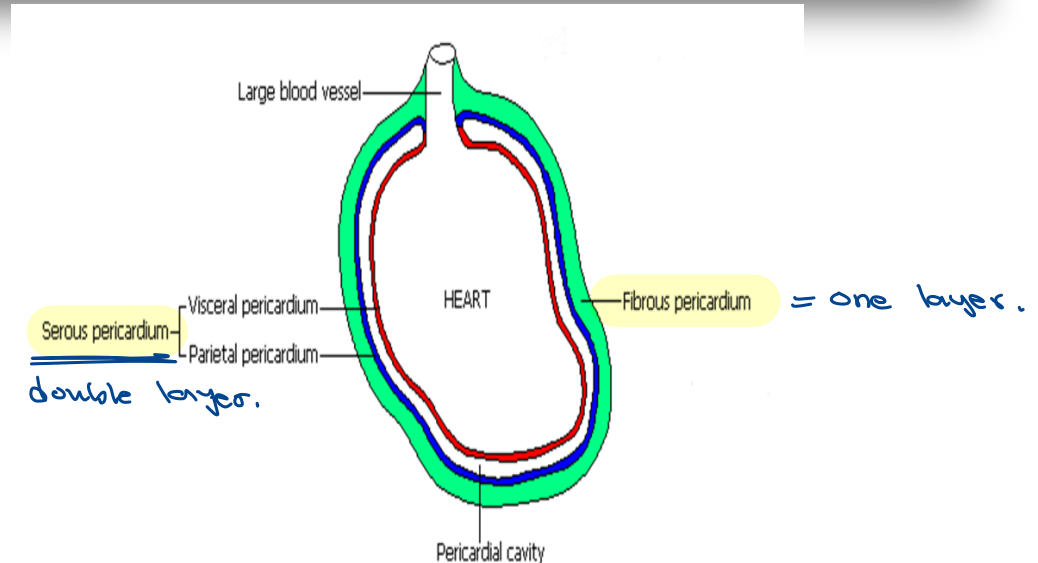
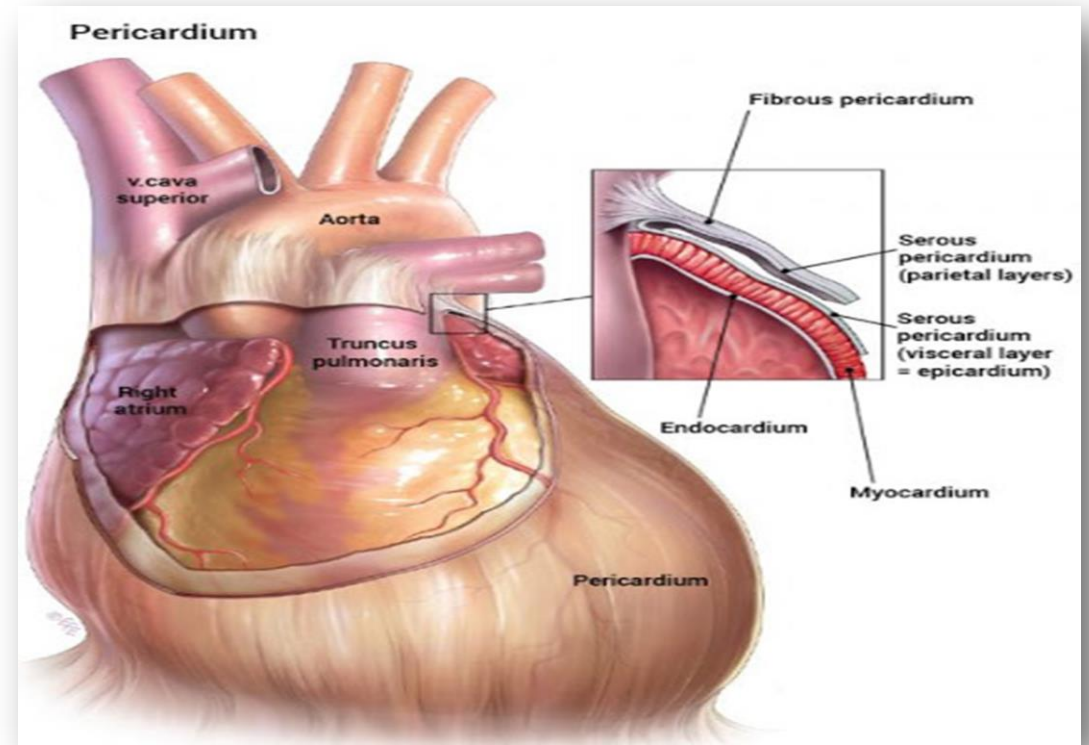
زفنه فكريه الا
Pleura.

Definition: a fibro serous sac" which surrounds the heart & the proximal parts of the great vessels.

Extension: it extends from 2 to 6 costal cartilages.

Structure:

- Outer fibrous layer called " **Fibrous pericardium**".
- Inner serous sac known as " **Serous pericardium**".



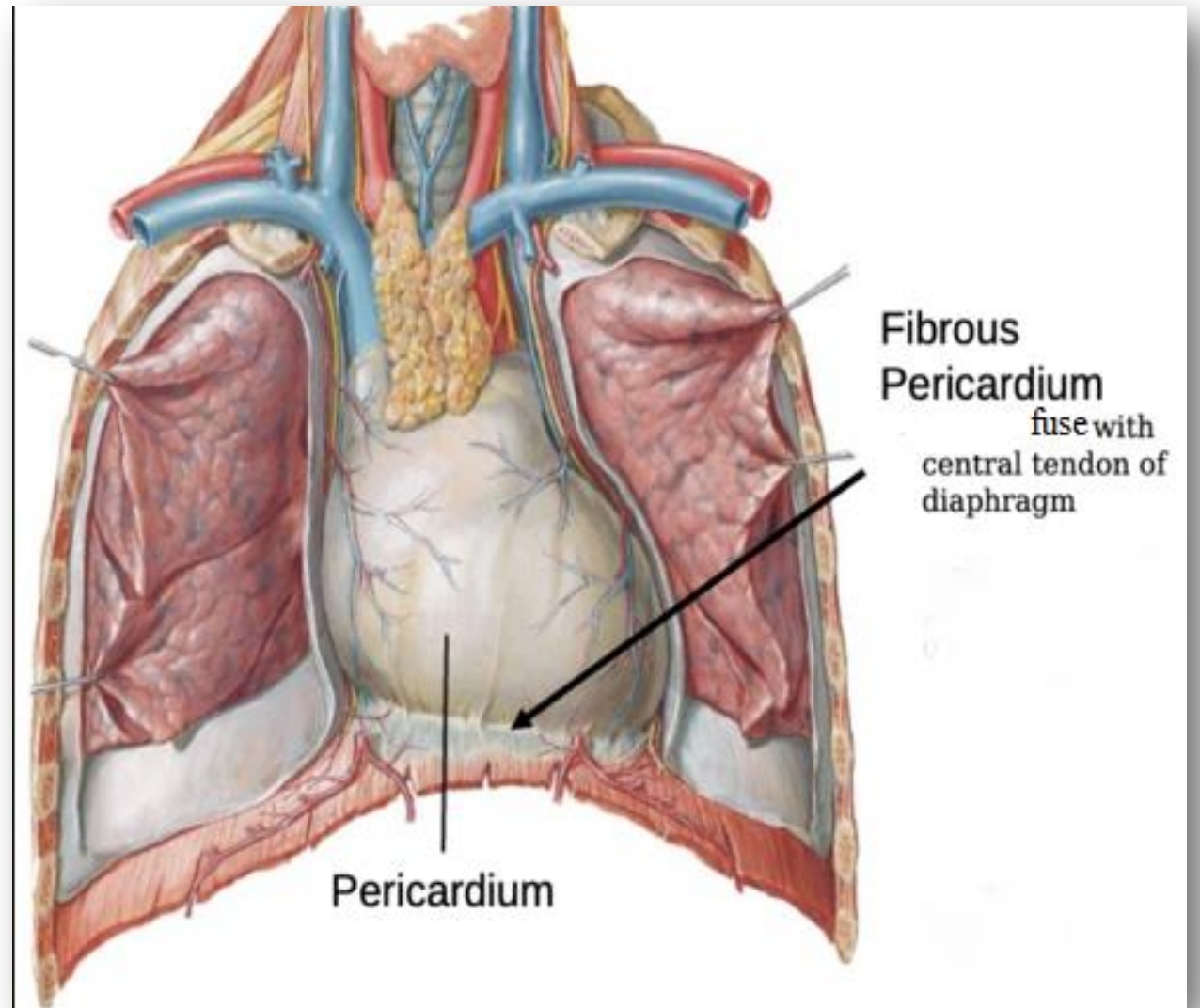
Fibrous pericardium

Shape: It is conical having base, apex and four surfaces (Anterior, Posterior & two laterals).

Relations & fixation:

Base: Directed downwards firmly attached to central tendon of diaphragm.

Apex: Directed upwards, and fused with the outer coats of the great vessels.



Fibrous Pericardium.

* Surround heart and blood vessels.

* function :-

① Protection.

② Prevents overdistension of the heart.

③ maintain heart in position.

فإن الألياف الليفية للقلب
Central tendon of diaphragm

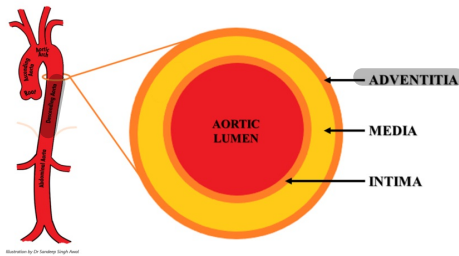
والأوعية الدموية للقلب
Heart
من عضلةaphragm

Base of the heart

Posterior surface:

→ of the heart -

- Related to the posterior mediastinum & its contents.
- Fuse with adventitia of descending thoracic aorta.

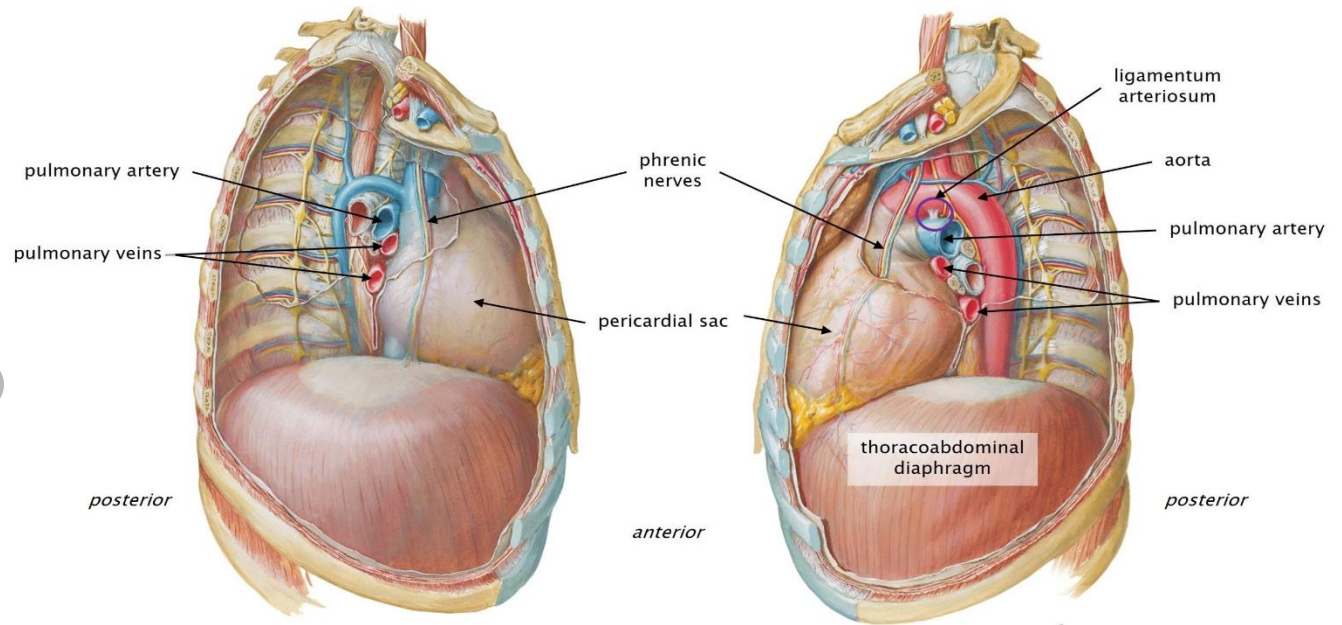


Two lateral surfaces:

- Related to the corresponding right & left lungs & pleura & phrenic nerves.

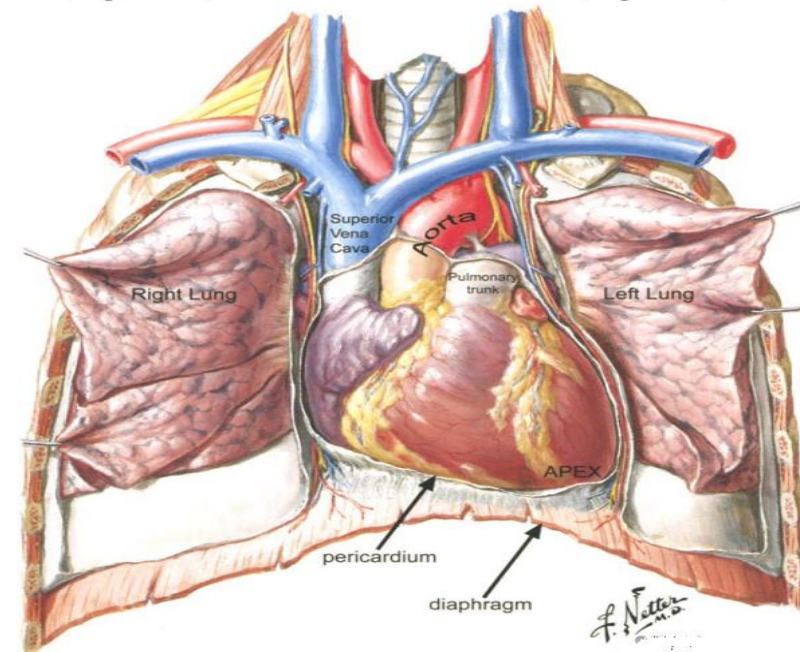
Function of Fibrous Pericardium

- Maintain central position of heart within the chest.
- Prevents the over-distension of heart.



View of thoracic cavity from right side (lung removed)

View of thoracic cavity from left side (lung removed)



Anterior surface of the fibrous pericardium;

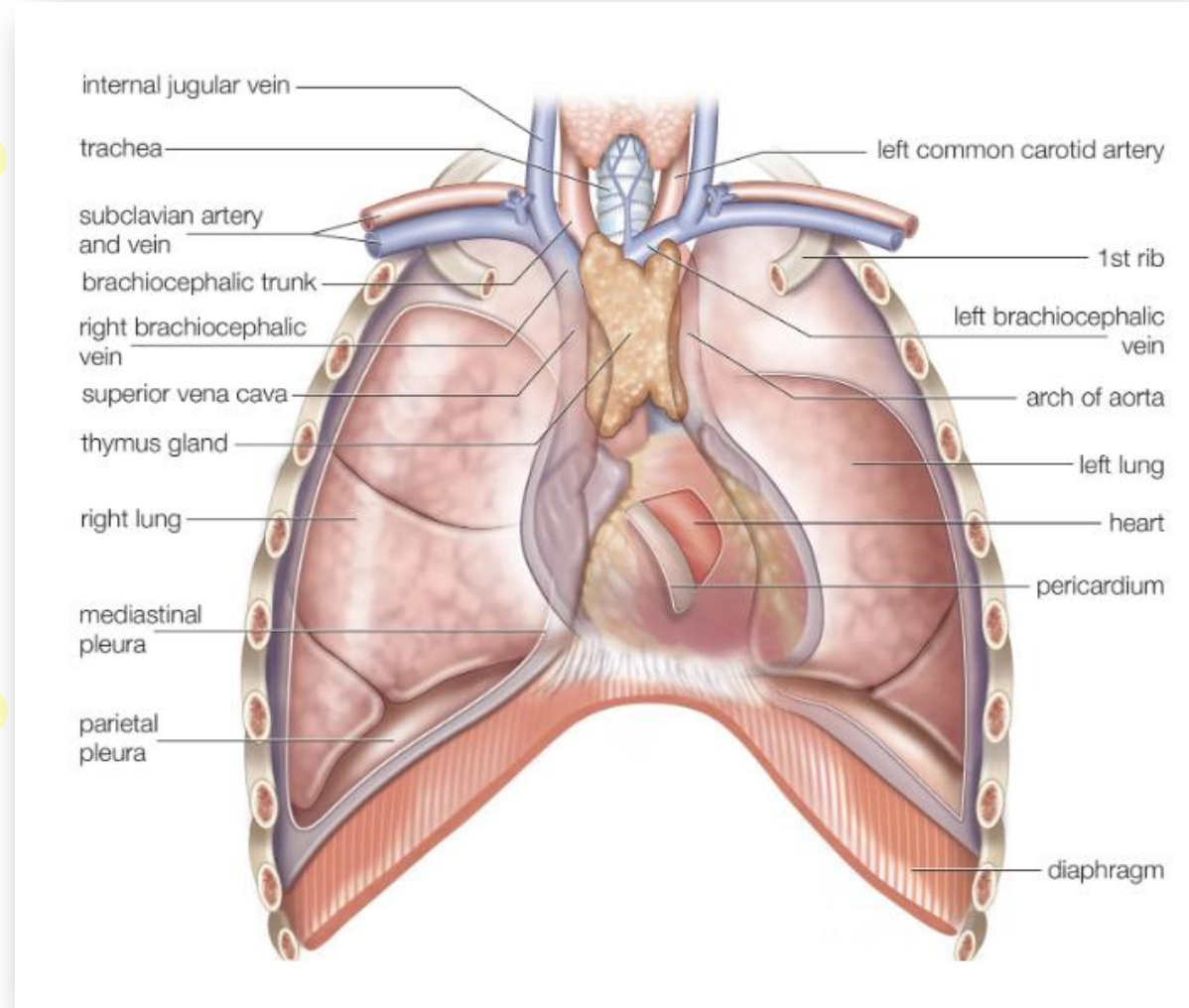
- It is separated from the thoracic wall (body of sternum & 3- 6 costal cartilages of both sides) by the pleural membranes and the anterior edges of the lungs.

Bare area of pericardium;

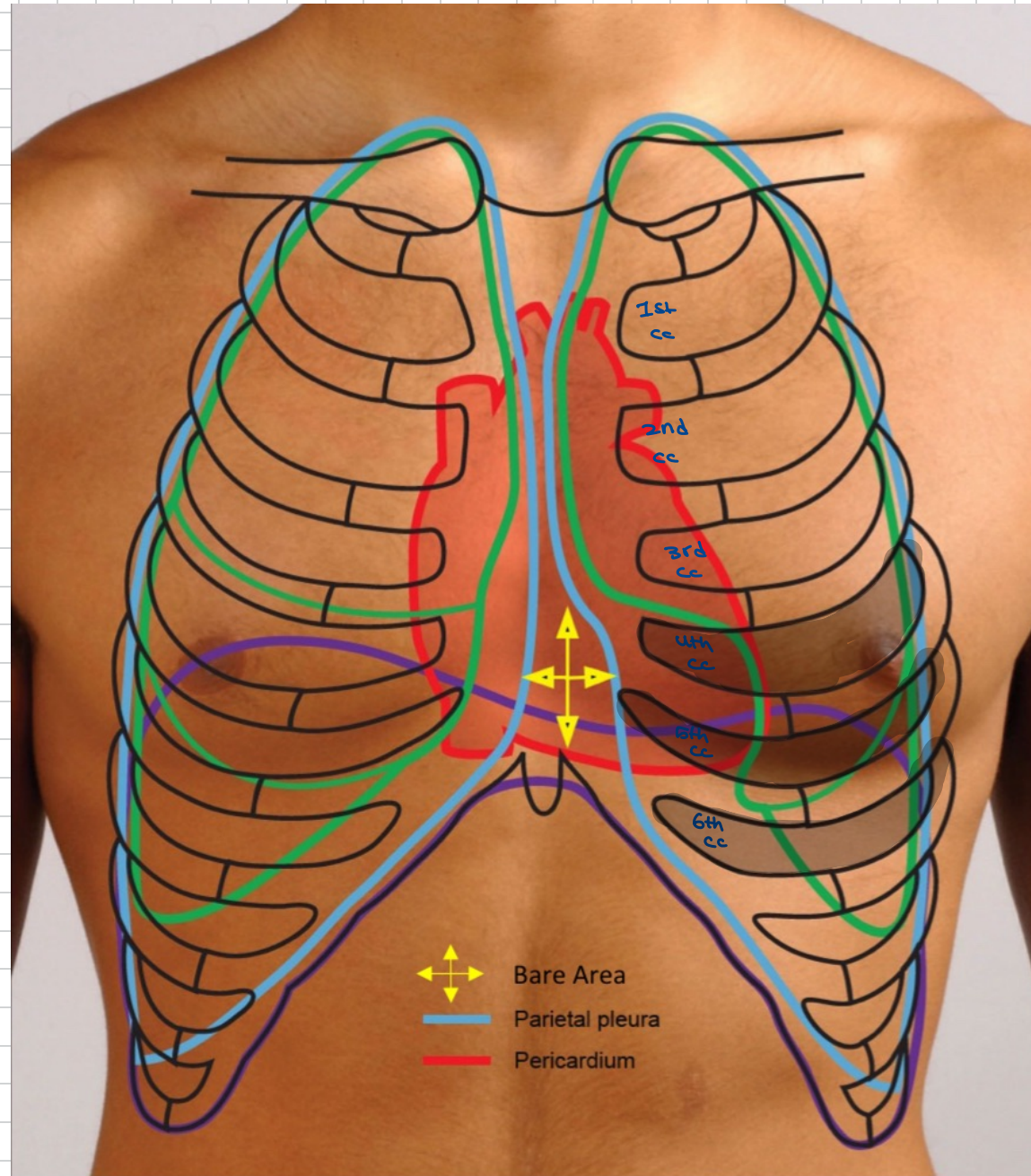
- It is an area of the anterior surface of the pericardium, at cardiac notch, behind the lower part of the left half of the body of the sternum and the sternal ends of the left 4th to 6th costal cartilages.

- At this area, the pericardium is in direct contact with the thoracic wall without lung in between.

- This surface attached to the body of sternum by pericardio-sternal ligaments.



Pericardial effusion / is abjad
في الجوف



Contents of the fibrous pericardium

- Serous pericardium & its sinuses
- Heart & its blood supply
- Great vessels of the heart

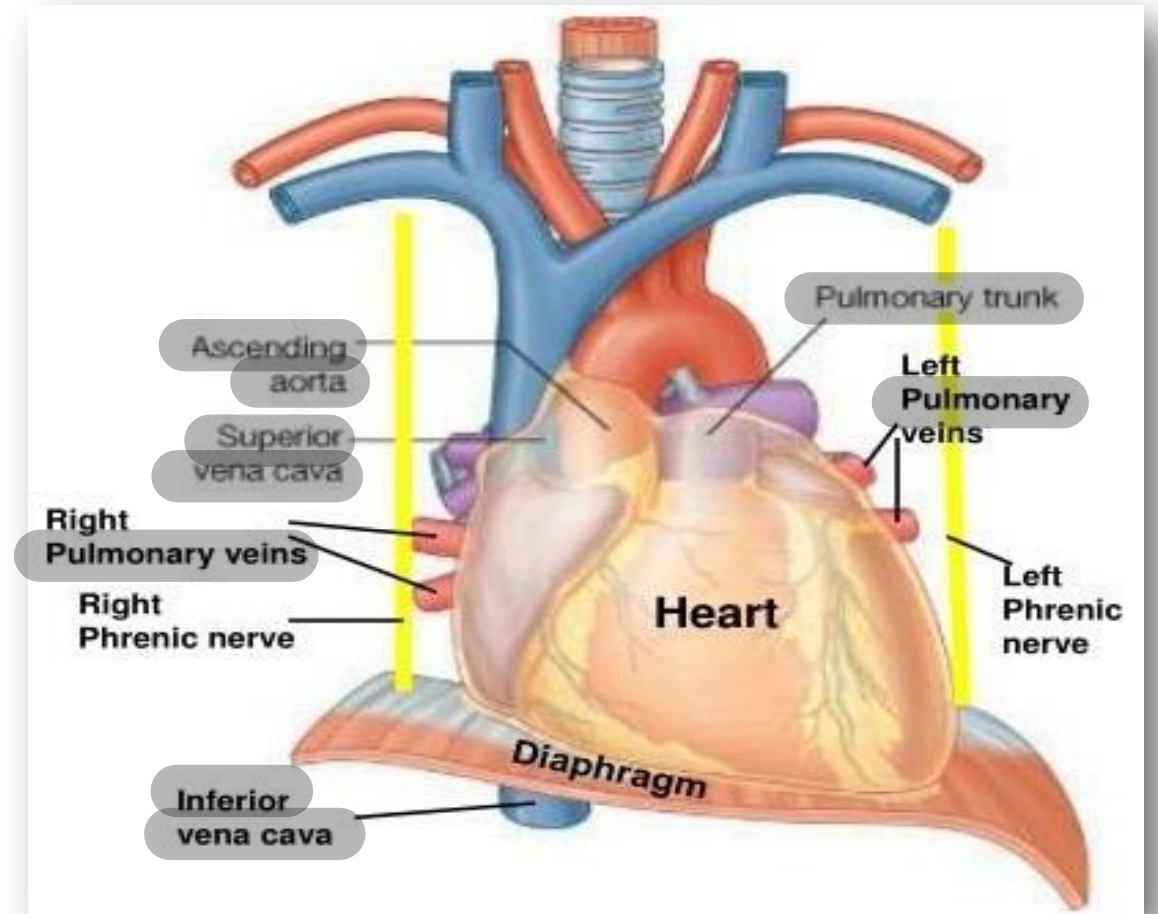
Ascending aorta

Pulmonary trunk

Lower 1/2 of SVC

Termination of IVC

Four pulmonary veins



Serous pericardium:

It is a closed serous sac, formed of two layers:

1) Visceral layer (epicardium of the heart)

- This layer is closely applied on the surface of the heart.

2) Parietal layer:

- This layer lines the inner surface of the fibrous pericardium.
- It is reflected around the roots of the great vessels to become continuous with the visceral layer of the serous pericardium.

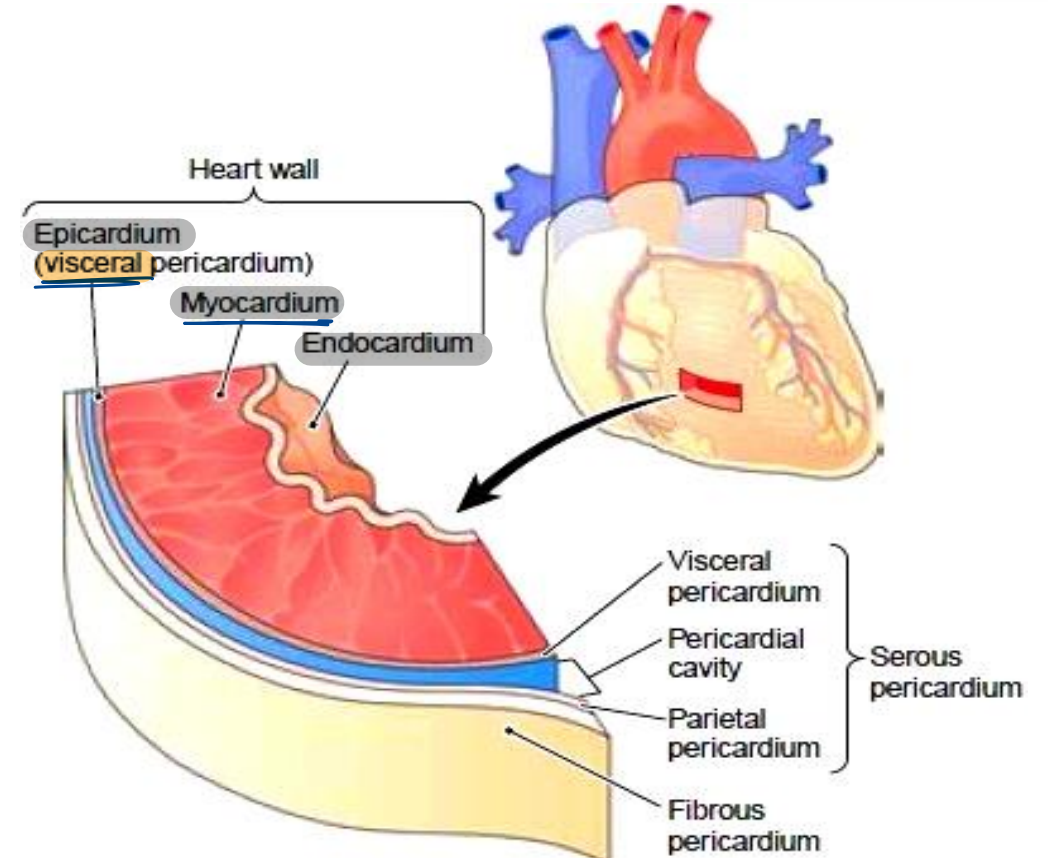
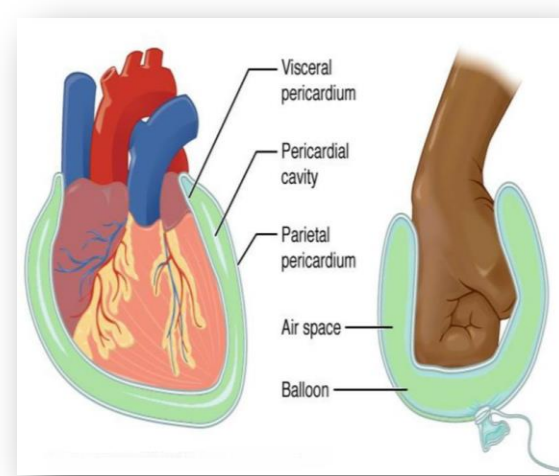
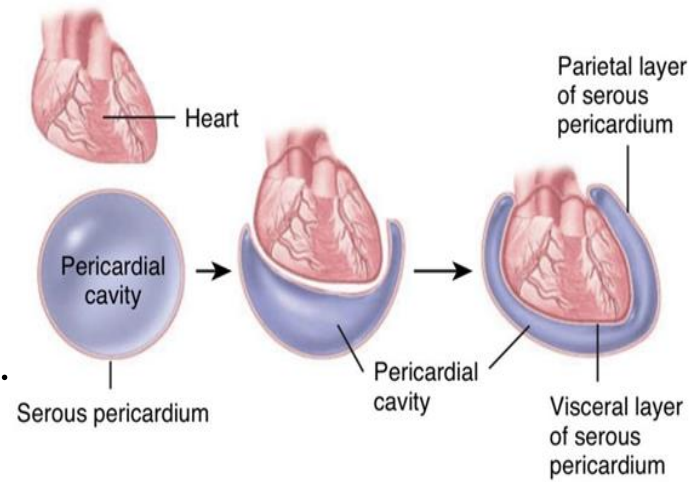
Pericardial cavity

- It is found between the visceral and parietal layers and contains thin film of fluid.

→ Pericardial effusion
هو تجمع سائل في تجويف
الغشاء الجداري، نتيجة
فشل القلب . heart failure

Function of serous pericardium:

- Responsible for lubrication of heart preventing the friction during its movement.



Pericardiocentesis

- It is a surgical puncture of the pericardial cavity for the aspiration of fluid, which is necessary to relieve the pressure of accumulated fluid on the heart in case of (pericardial effusion). A needle is inserted into the pericardial cavity through the fifth intercostal space left to the sternum, the needle doesn't penetrate the pleura and lungs, but it penetrates the pericardium

دواء
القلب

تدخل
البريتون
القلب

⇓
Penetration
Base area
5th left inter-
Costal space left
to the sternum.

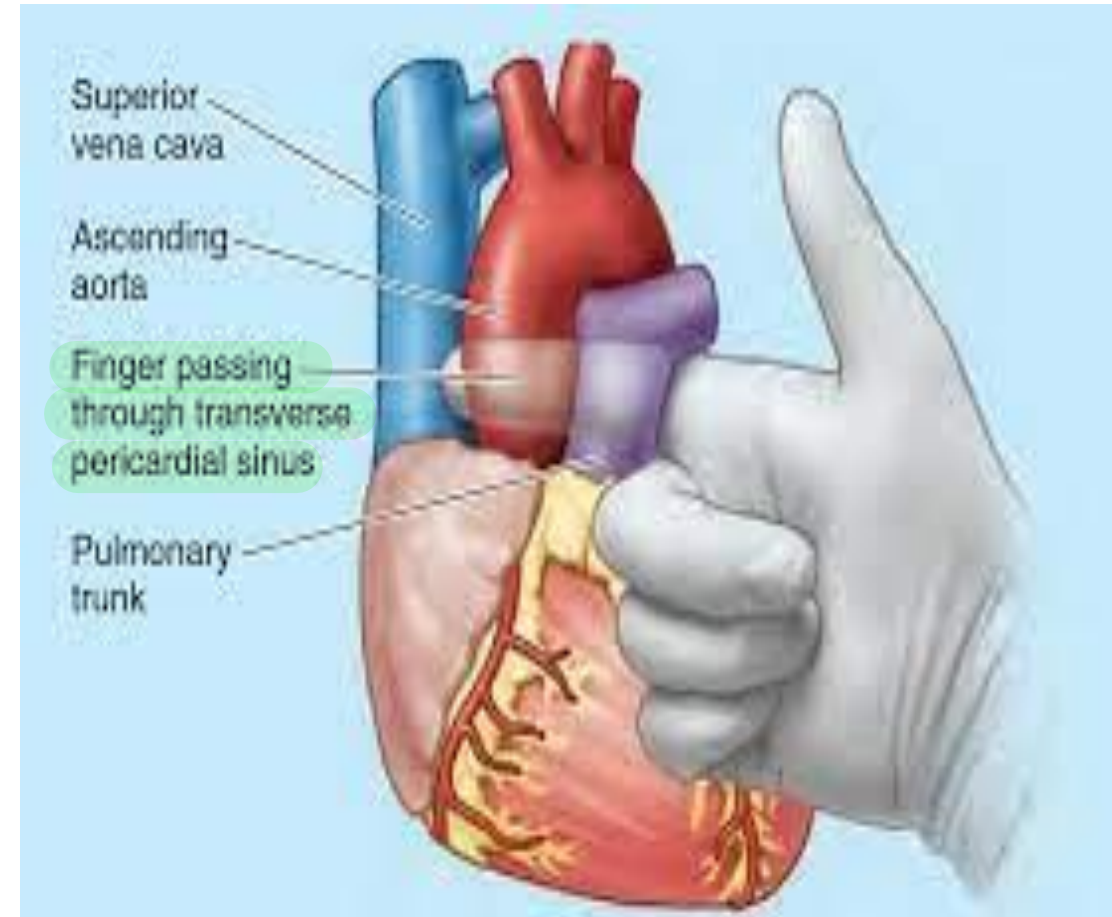
Pericardial Sinuses:

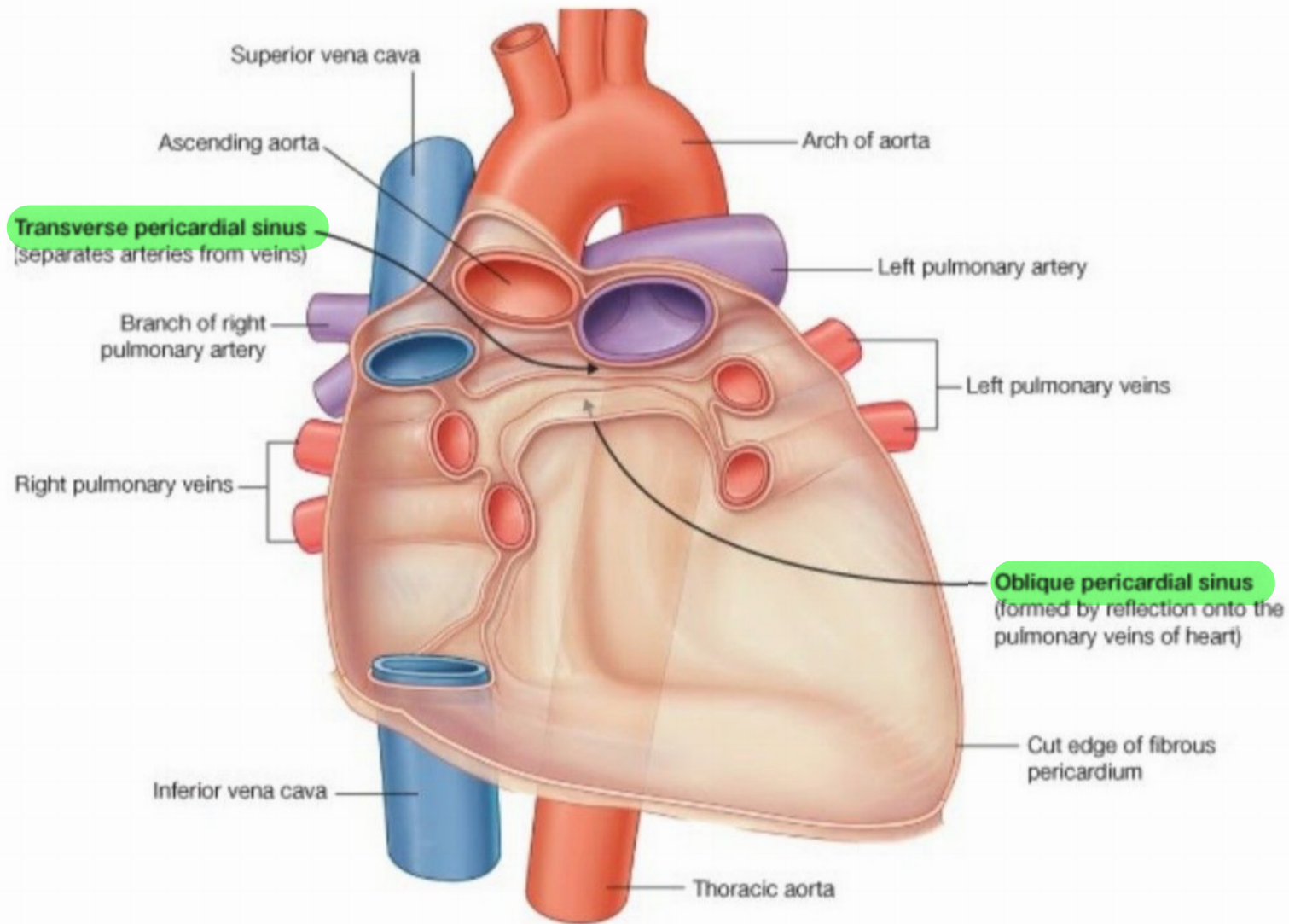
1-Transverse sinus:

- It is a transverse passage lined by the serous pericardium.
- It is situated between the ascending aorta and pulmonary trunk in front, and the superior vena cava, and pulmonary veins behind.

Clinical significance

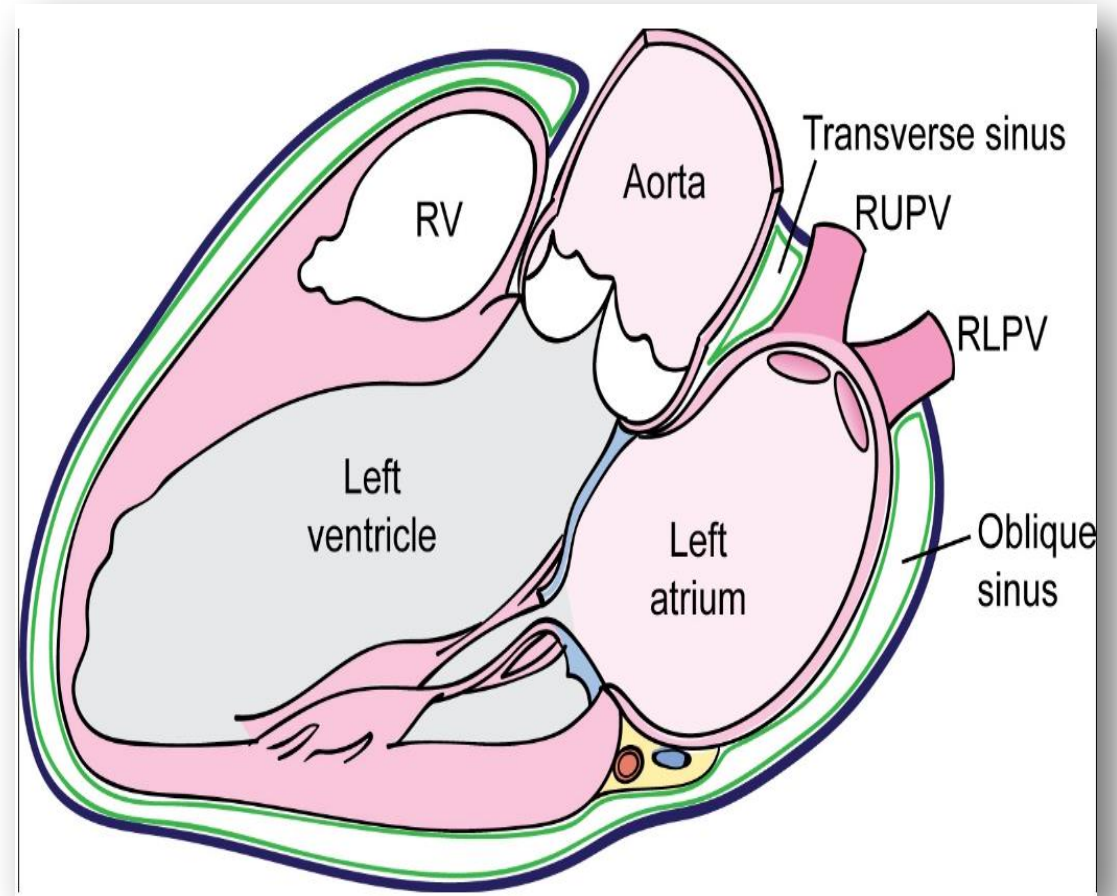
During cardiac surgery, the transverse pericardial sinus allows a surgeon to isolate the pulmonary trunk and ascending aorta and apply a temporary ligature or clamp.





2- Oblique Sinus:

- It is a recess of the serous pericardium, lies behind the left atrium of heart.
- The parietal layer of serous pericardium & fibrous pericardium separate the oblique sinus from the structures of the posterior mediastinum.



Arterial supply of pericardium:

Fibrous pericardium & parietal layer of the serous pericardium:

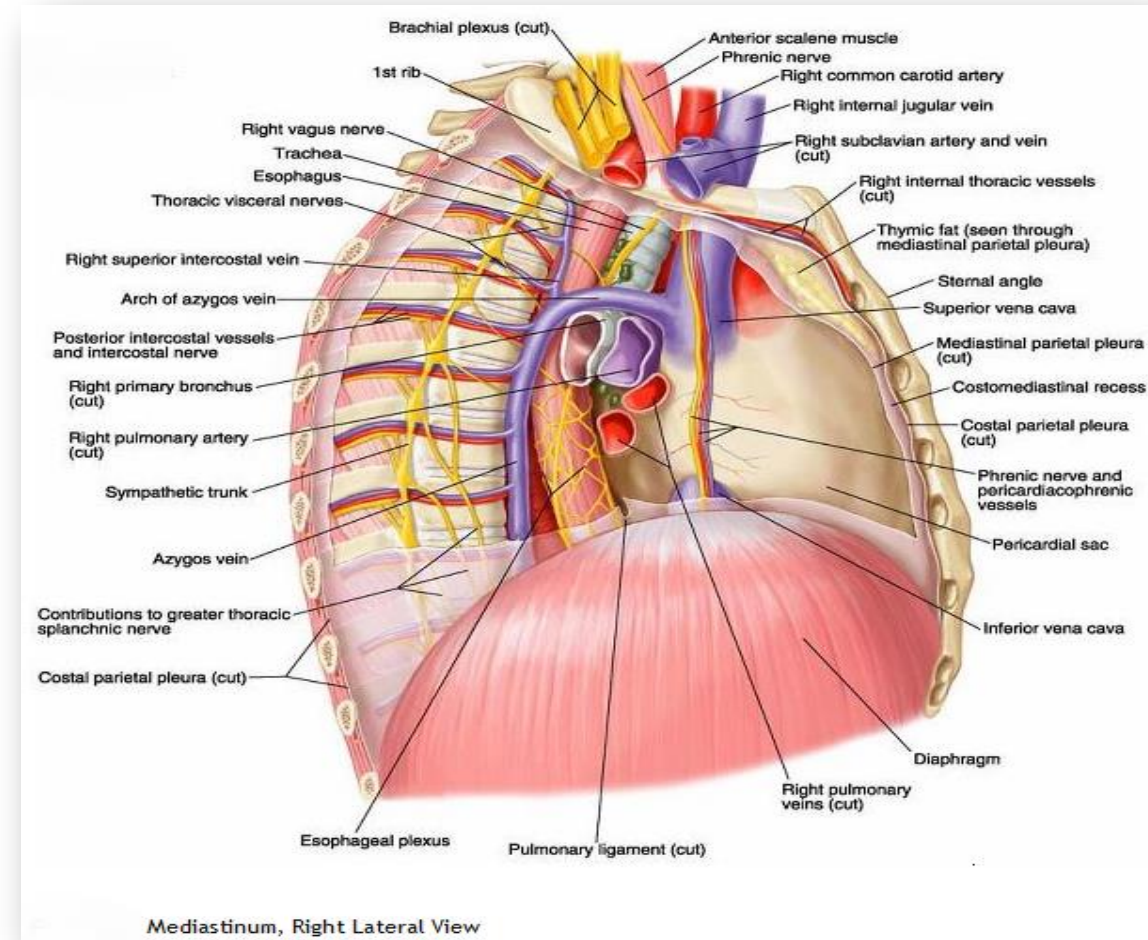
- Pericardiophrenic artery.
- Pericardial branches of descending thoracic aorta.

Visceral layer of serous pericardium: like cardiac muscle supplied by **coronary arteries**.

Nerve supply:

Fibrous & parietal layer of the serous pericardium: sensory fibers from the **phrenic nerve** (sensitive to pain).

Visceral layer of serous pericardium: supplied by **autonomic fibers** (not sensitive to pain).



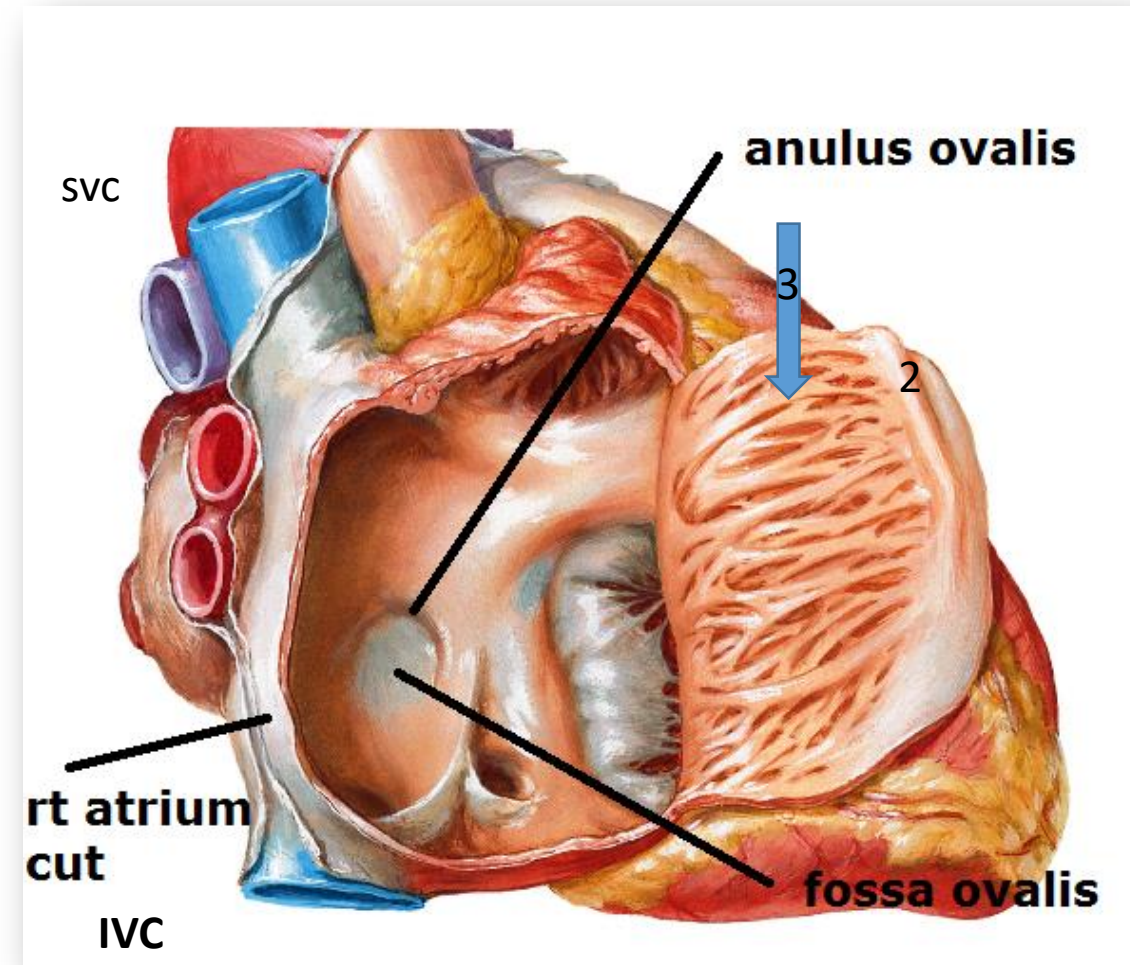
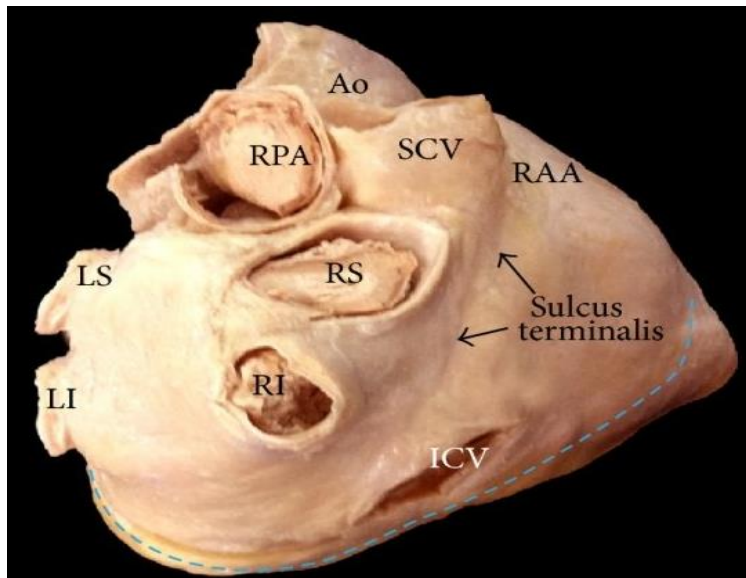
Interior of Right Atrium

A- Rough anterior part, show:

1- Openings of anterior cardiac veins.

2- **Crista terminalis:** Vertical muscular ridge between SVC & IVC, separate anterior part from posterior part and represented externally by the sulcus terminalis.

3- **Musculi Pectinati:** Transverse muscular ridges from crista terminalis to the right auricle.

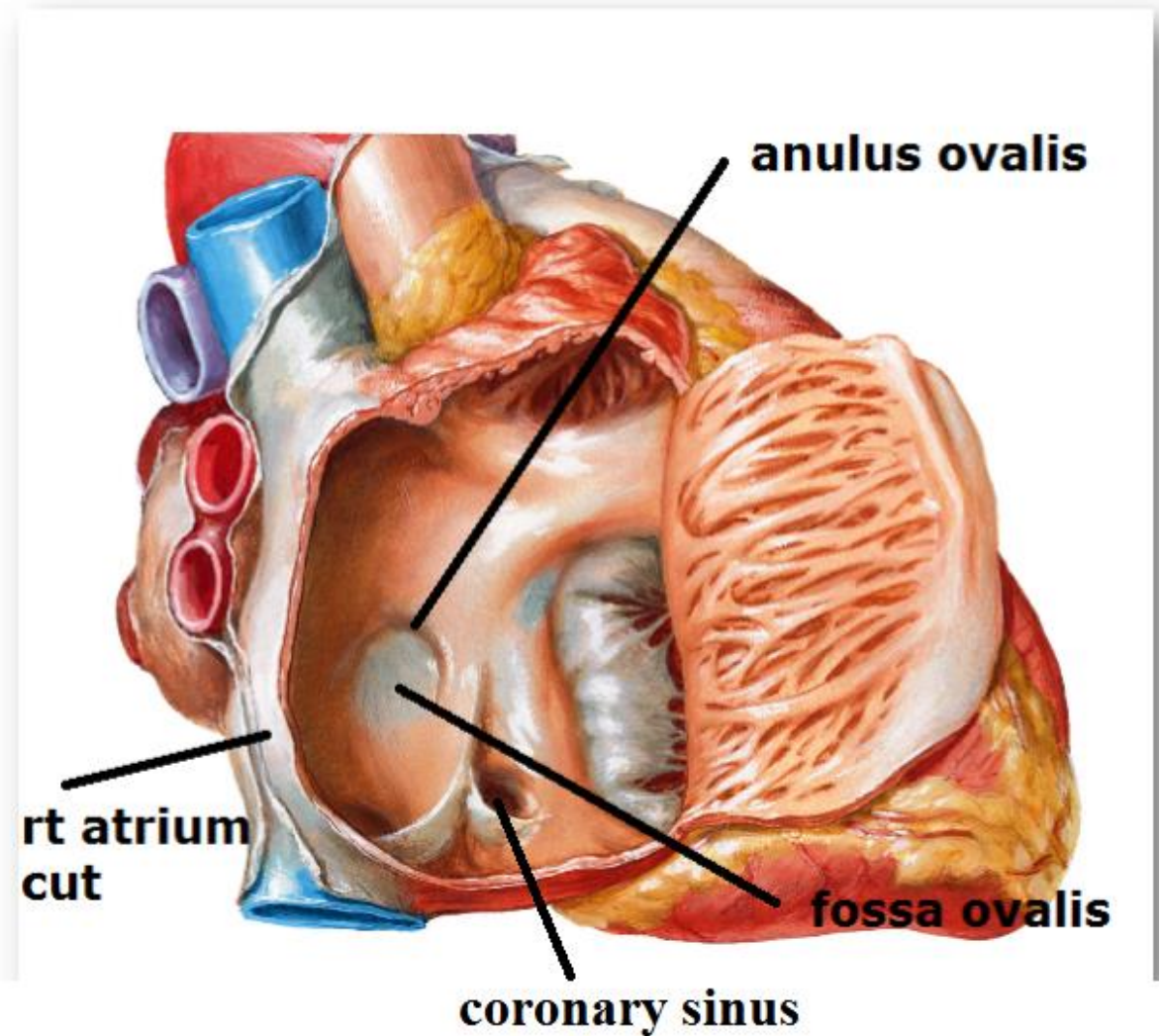


B- Smooth Posterior part, shows:

1. **Openings of:** S.V.C, I.V.C & coronary sinus.
2. **Interatrial septum which has:** fossa ovalis, limbus fossa ovalis.
 - **Fossa ovalis:** shallow depression on interatrial septum.
 - **Annulus ovalis:** Curved ridge that form upper & anterior boundaries of fossa ovalis.

C-Tricuspid opening:

- In lower anterior part of the right atrium.
- Guarded by tricuspid valve
- Admit three fingers.



Interior of Left atrium

A- Rough anterior part:

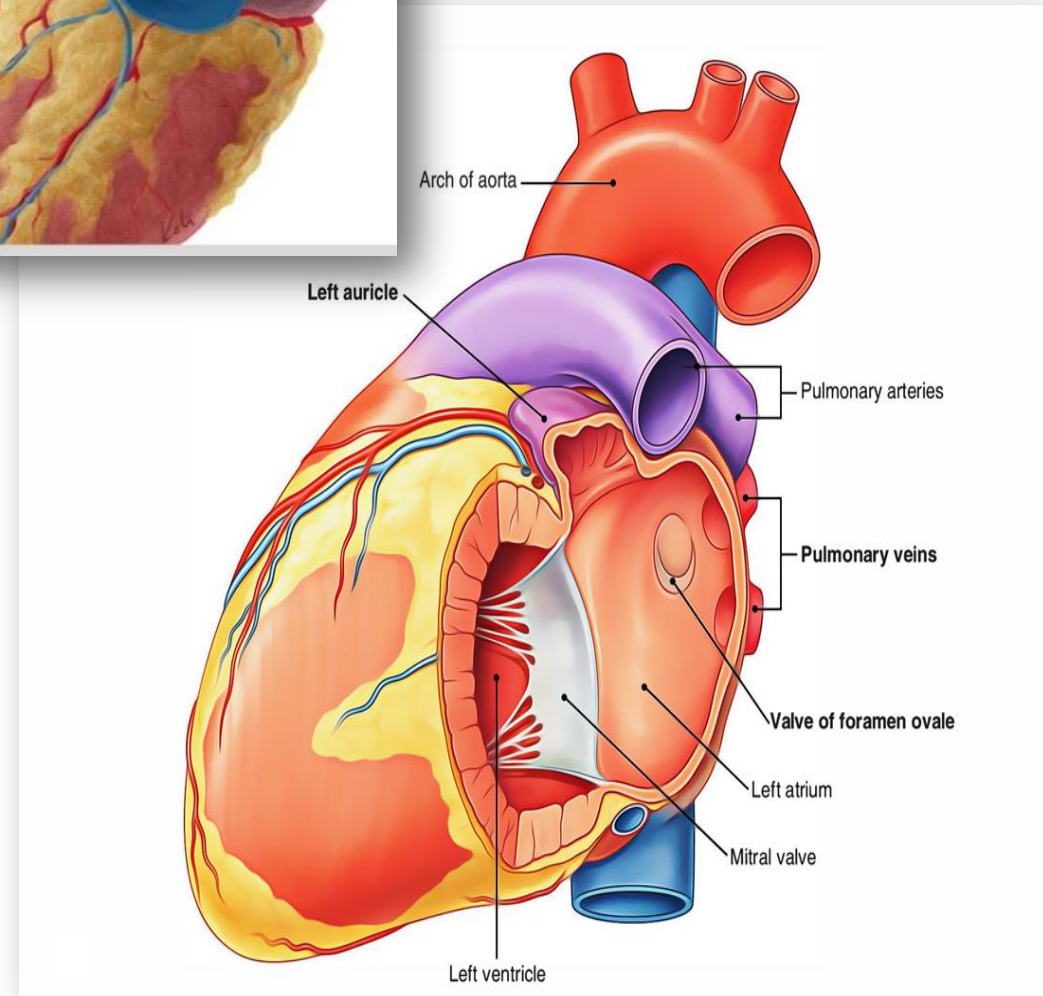
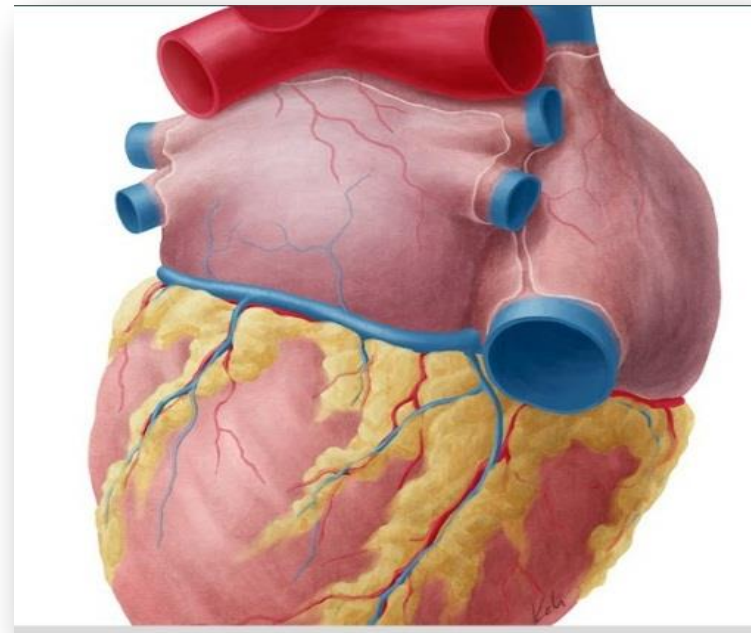
- Only its auricle that has muscoli pectinate.

B- Smooth posterior part shows:

- Openings of four pulmonary veins (Two at each side).

C- Mitral opening:

- Guarded by mitral valve.
- Admit two fingers.



Quiz

Which structure(s) compress(es) the posterior surface of the heart during cardiopulmonary resuscitation?

- a) The body of the sternum
- b) The bodies of the thoracic vertebra
- c) The tracheal bifurcation
- d) The inferior vena cava

In a posteroanterior radiograph of the thorax, the following structures form the left margin of the heart shadow except which?

- (a) Left auricle
- (b) Pulmonary trunk
- (c) Arch of aorta
- (d) Left ventricle
- (e) Superior vena cava