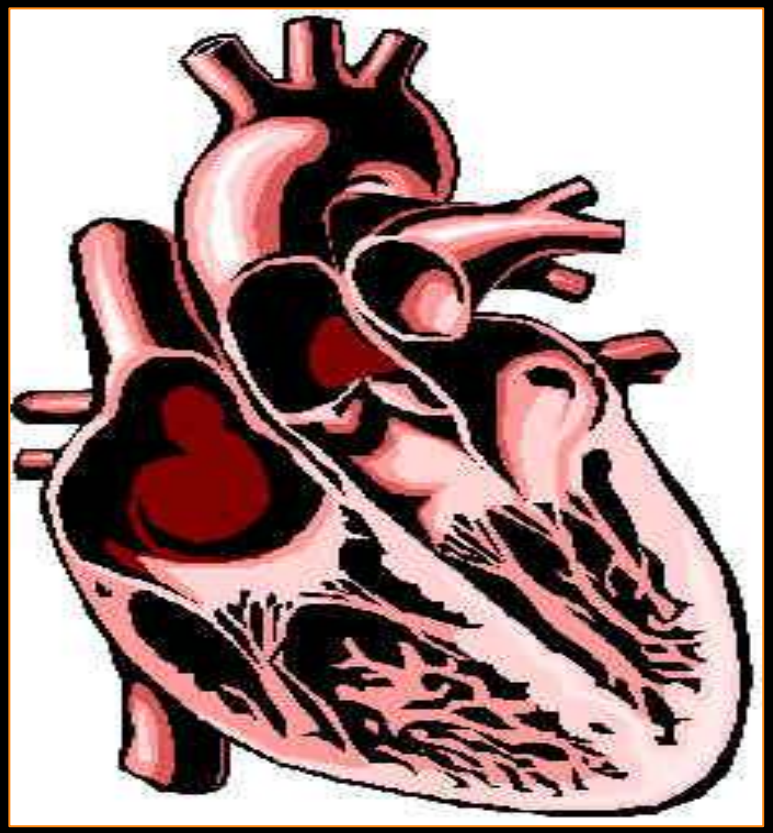
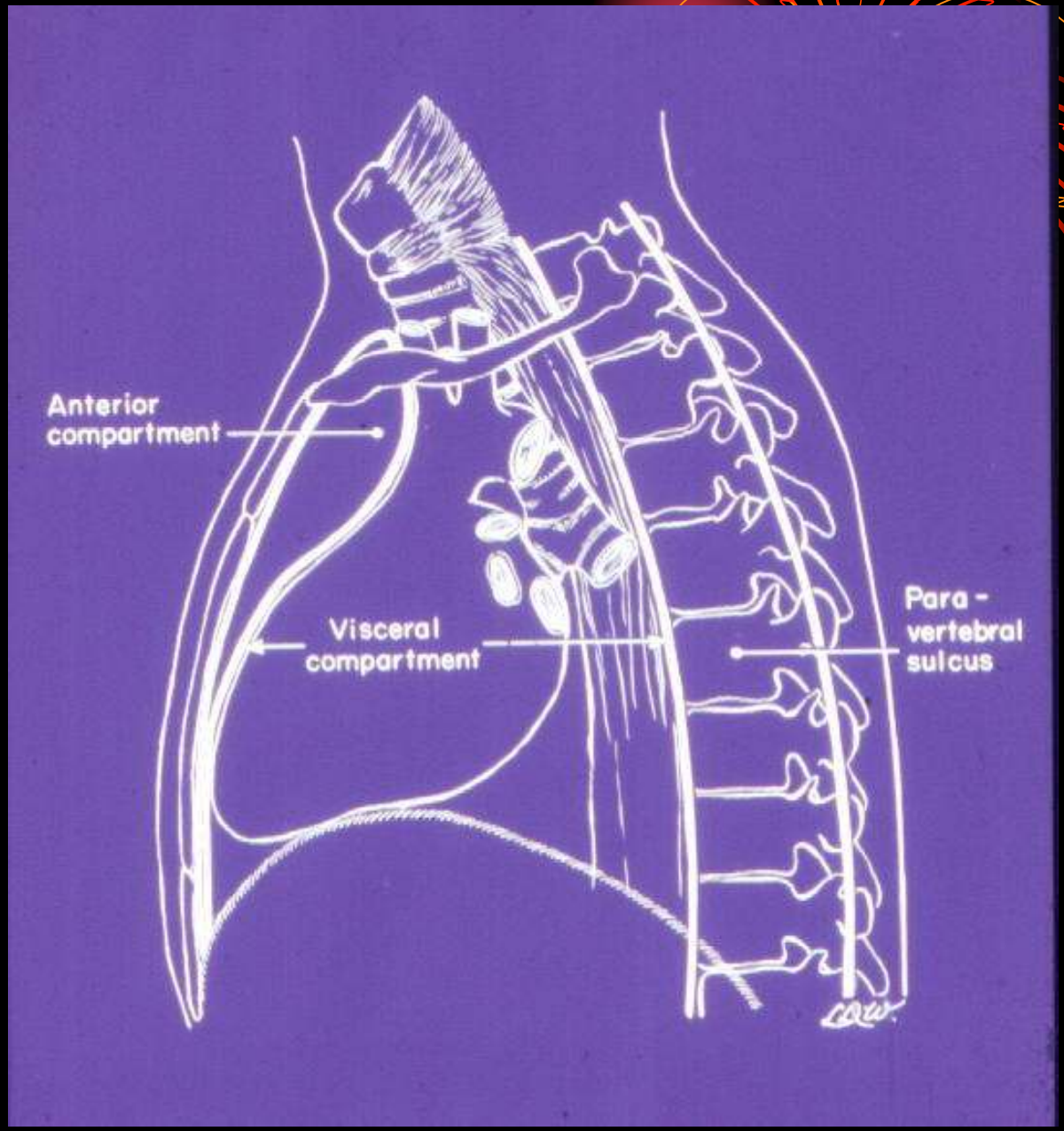

بسم الله الرحمن الرحيم
أحمد عبدالرحيم الصديقي

Clinically Oriented Anatomy of The Heart & The Great Vessels



The heart in relation to The Mediastinum



Surface Anatomy of the Heart

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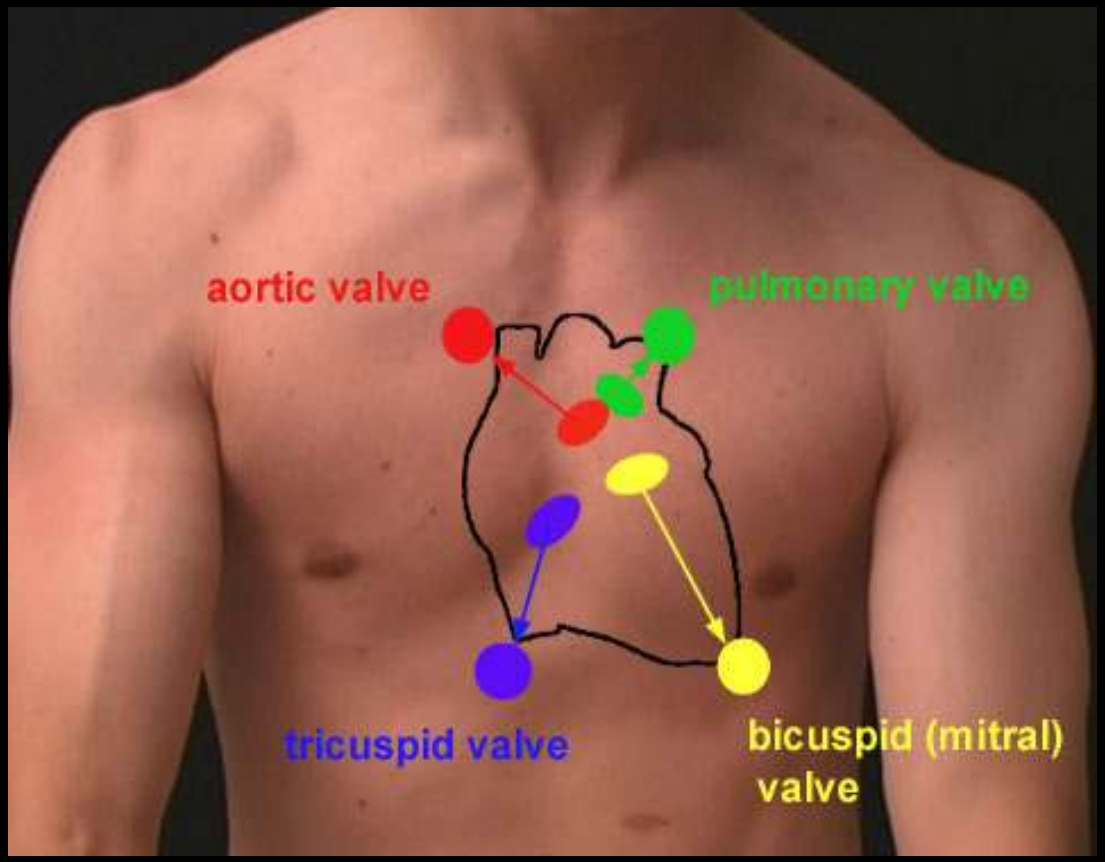


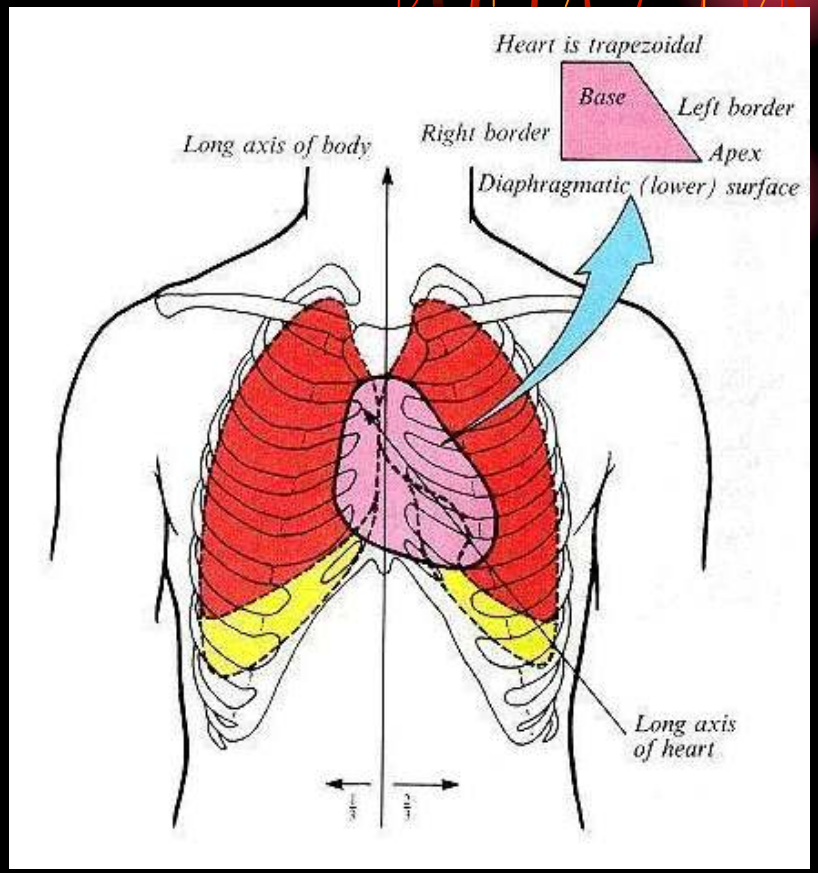
Surface Anatomy of the Heart

- It is important to know surface anatomy
- Knowing the limits of the normal can help one appreciates the abnormal.
- Has great importance in clinical assessment.

Surface Anatomy of the Heart

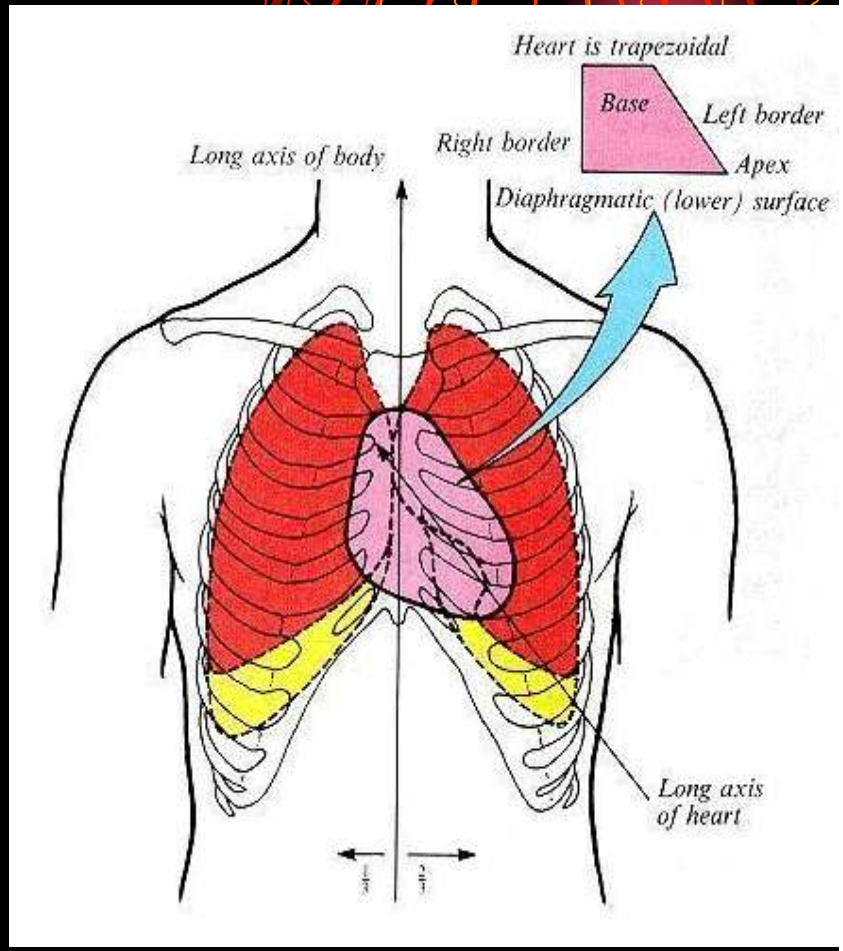
The Apex

Is usually in the 5th intercostal space below & medial to the left nipple.



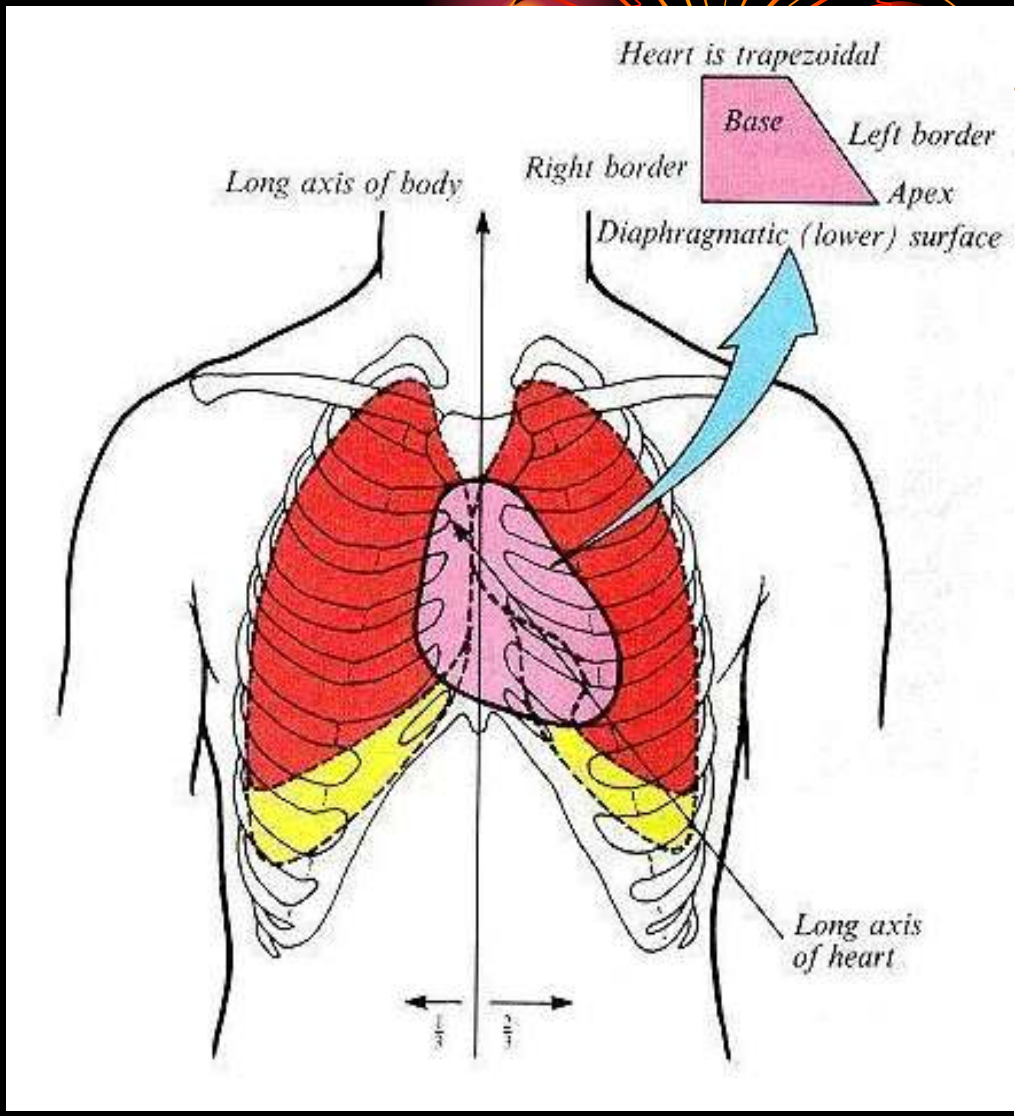
The Right Border

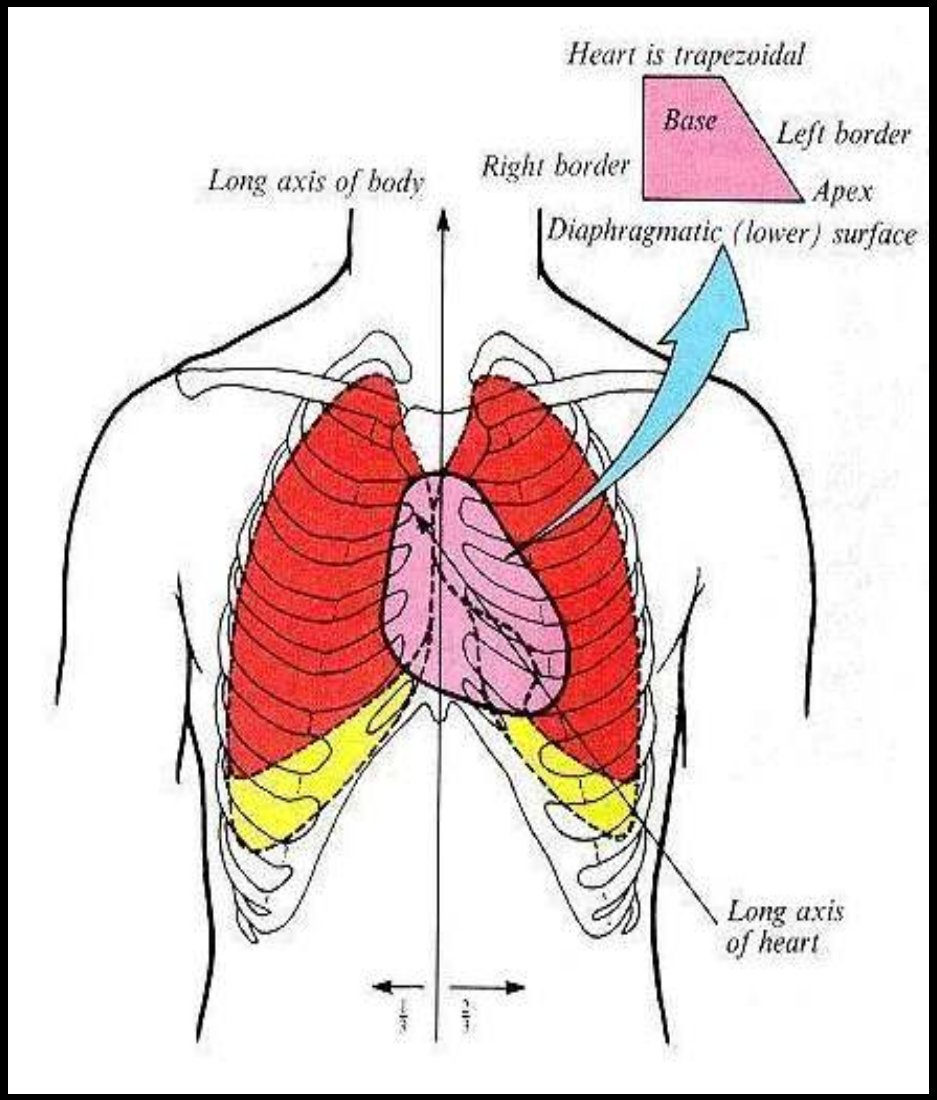
Is convex line from the upper border of the ***Right 3rd costal cartilage*** 1.2 cm from sternum to the ***6th Costal Cartilage.***



Left Border

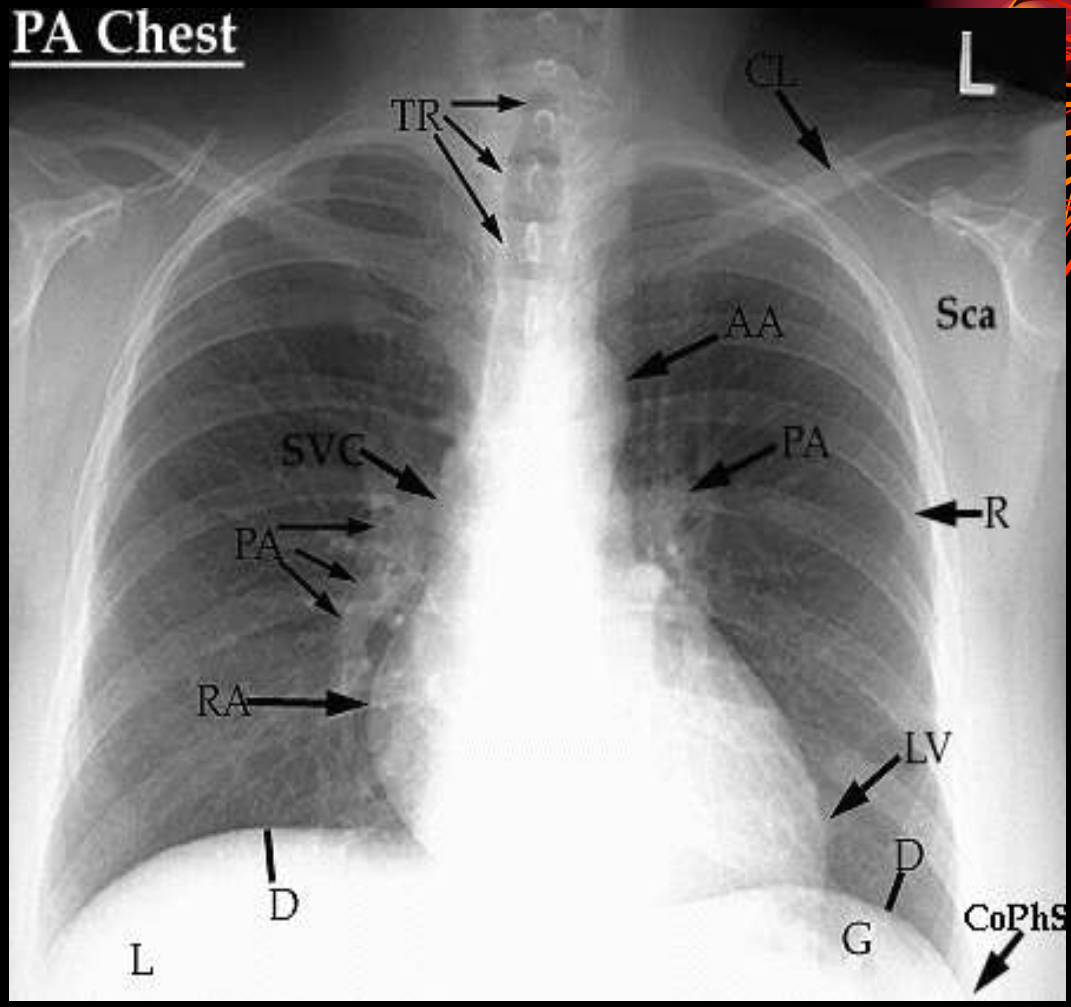
Is a convex line drawn from the Apex upward medially to lower border of Left 2nd Costal Cartilage 1.2 cm from Sternal margin.



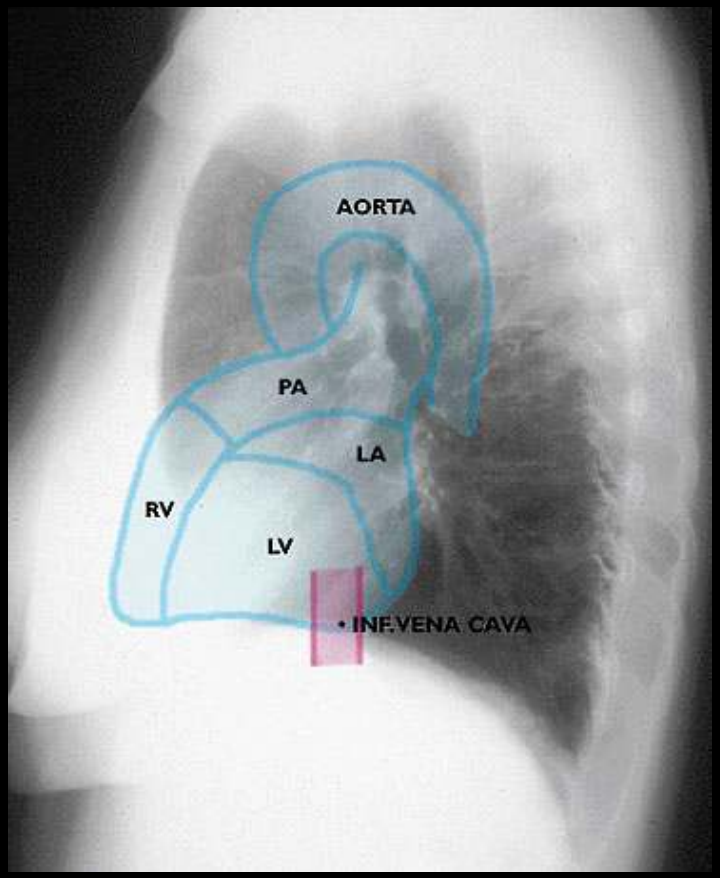


Lower Border

Is a line that joins lower border of the right to the apex.

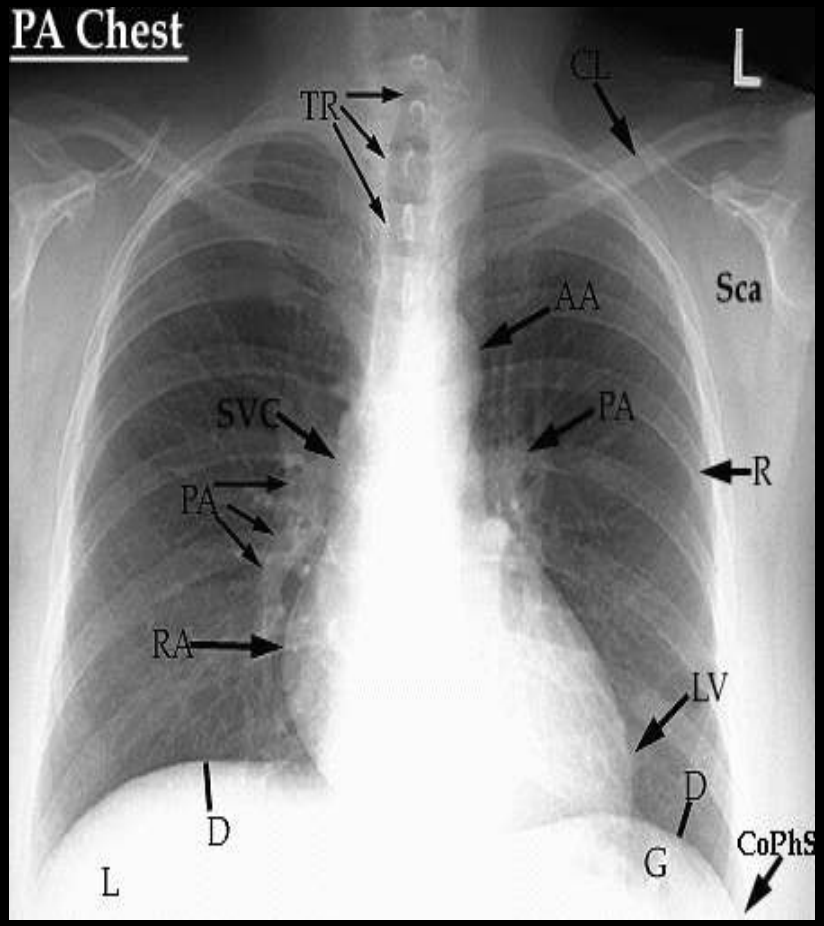


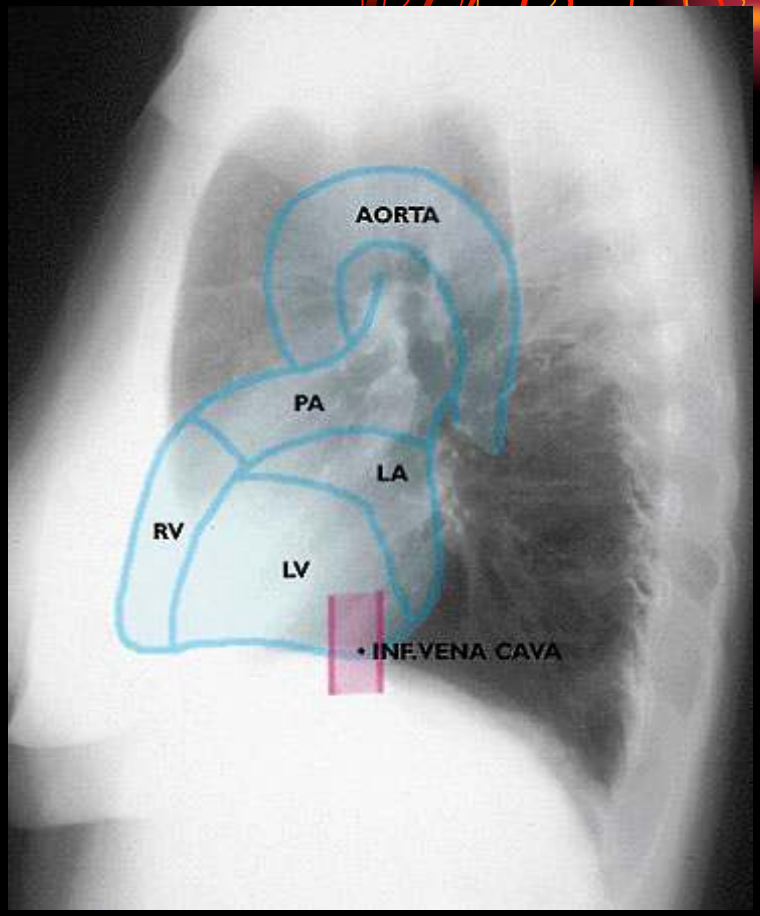
Postero anterior (PA) View of the Chest CoPHS: Costophrenic Sulcus



Lateral view of chest x-ray

PA & Lateral Chest X- Rays



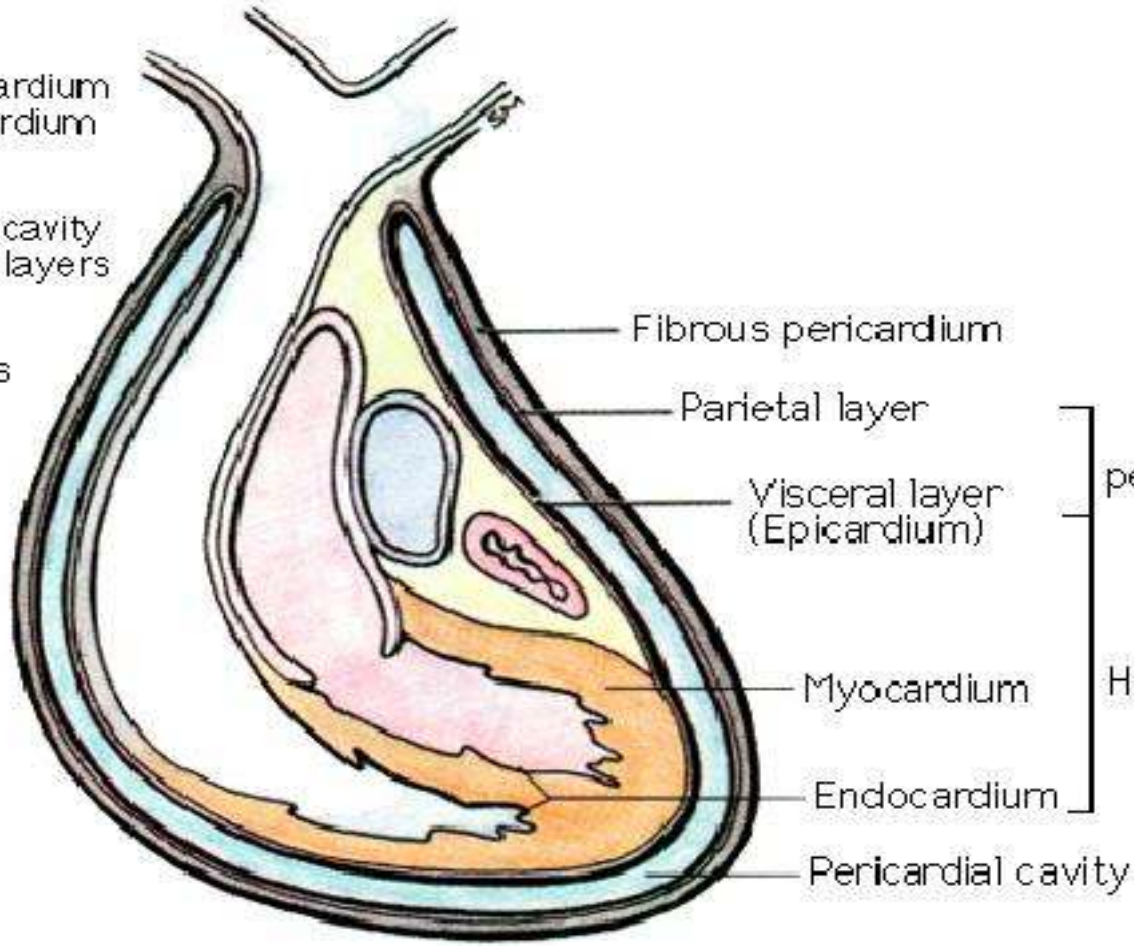


Layers of the Pericardium & Heart

Pericardium
- External sac - fibrous pericardium
- Internal sac - serous pericardium
  - Parietal layer
  - Visceral layer
- Thin fluid film in pericardial cavity between parietal & visceral layers

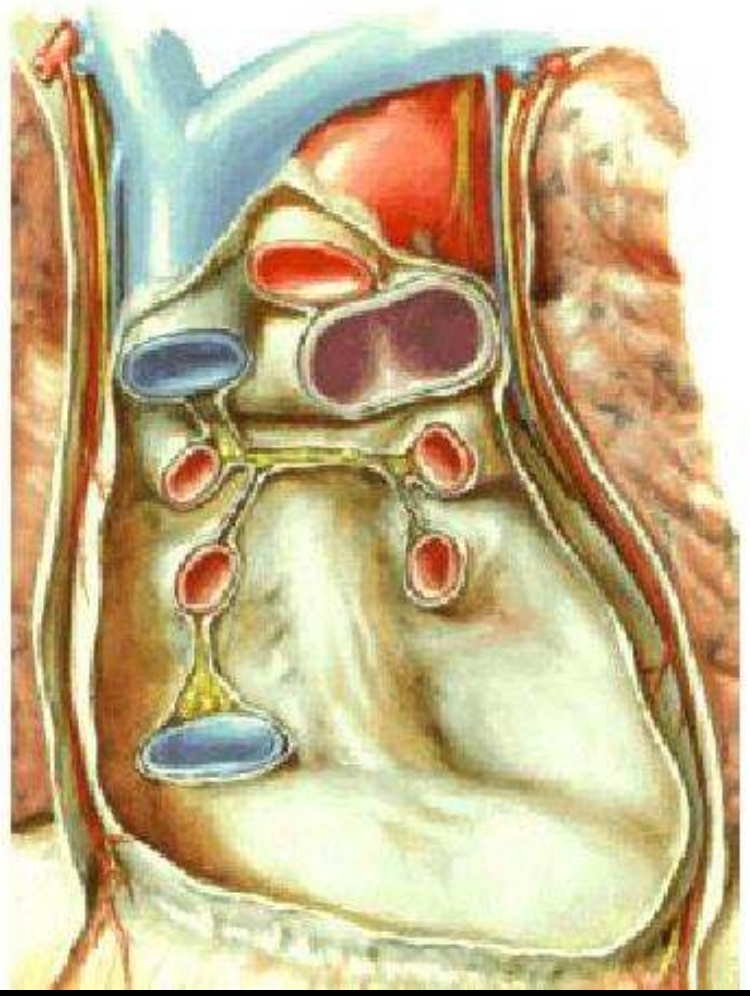
Heart
- Wall consists of three layers
- Epicardium
- Myocardium
- Endocardium

Pericardial sac lies
1. **Posterior to sternum,**
2. **2nd - 6th CC**
3. **T5-T8 vertebrae**

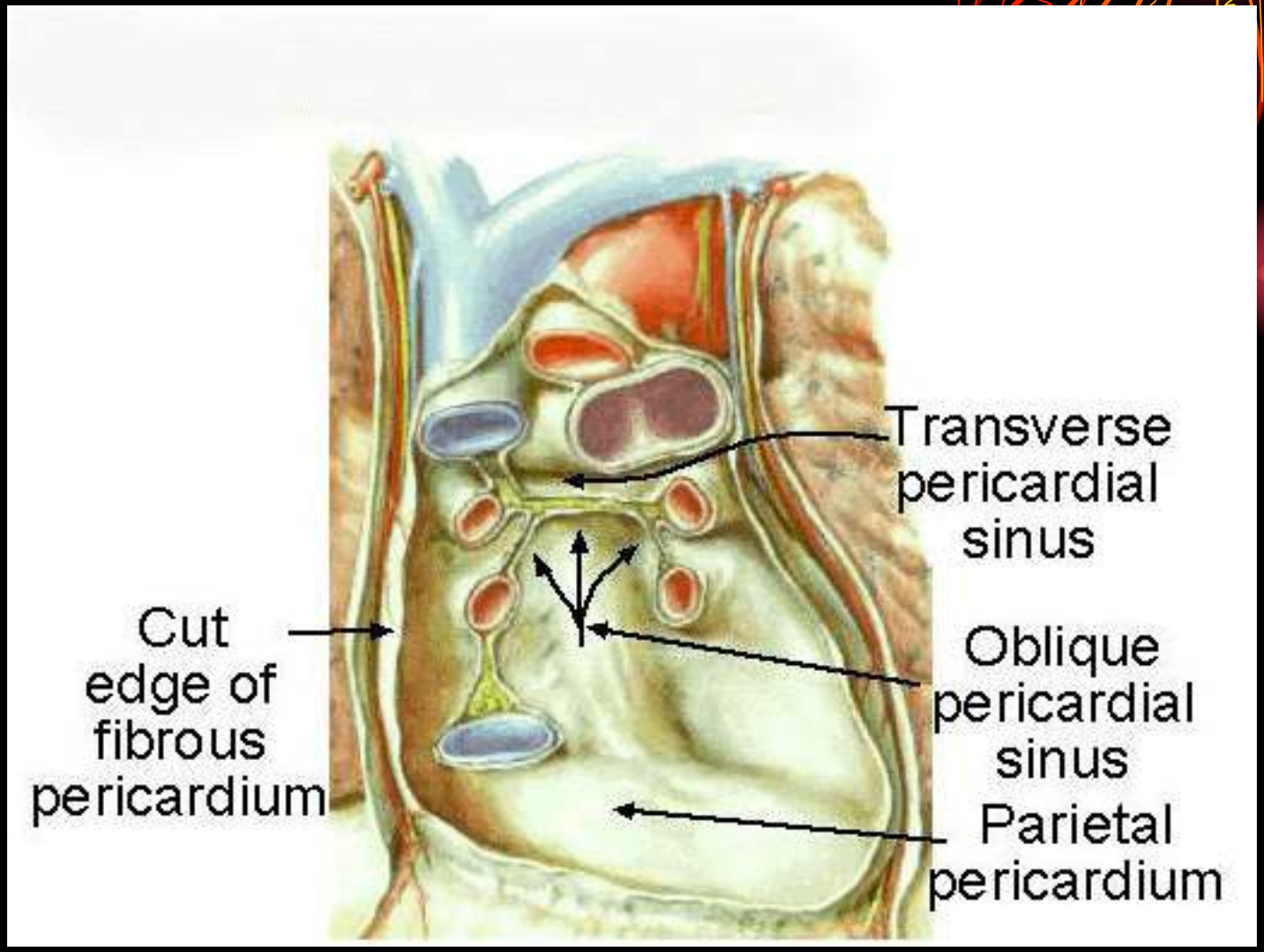


Blood Supply of Pericardium

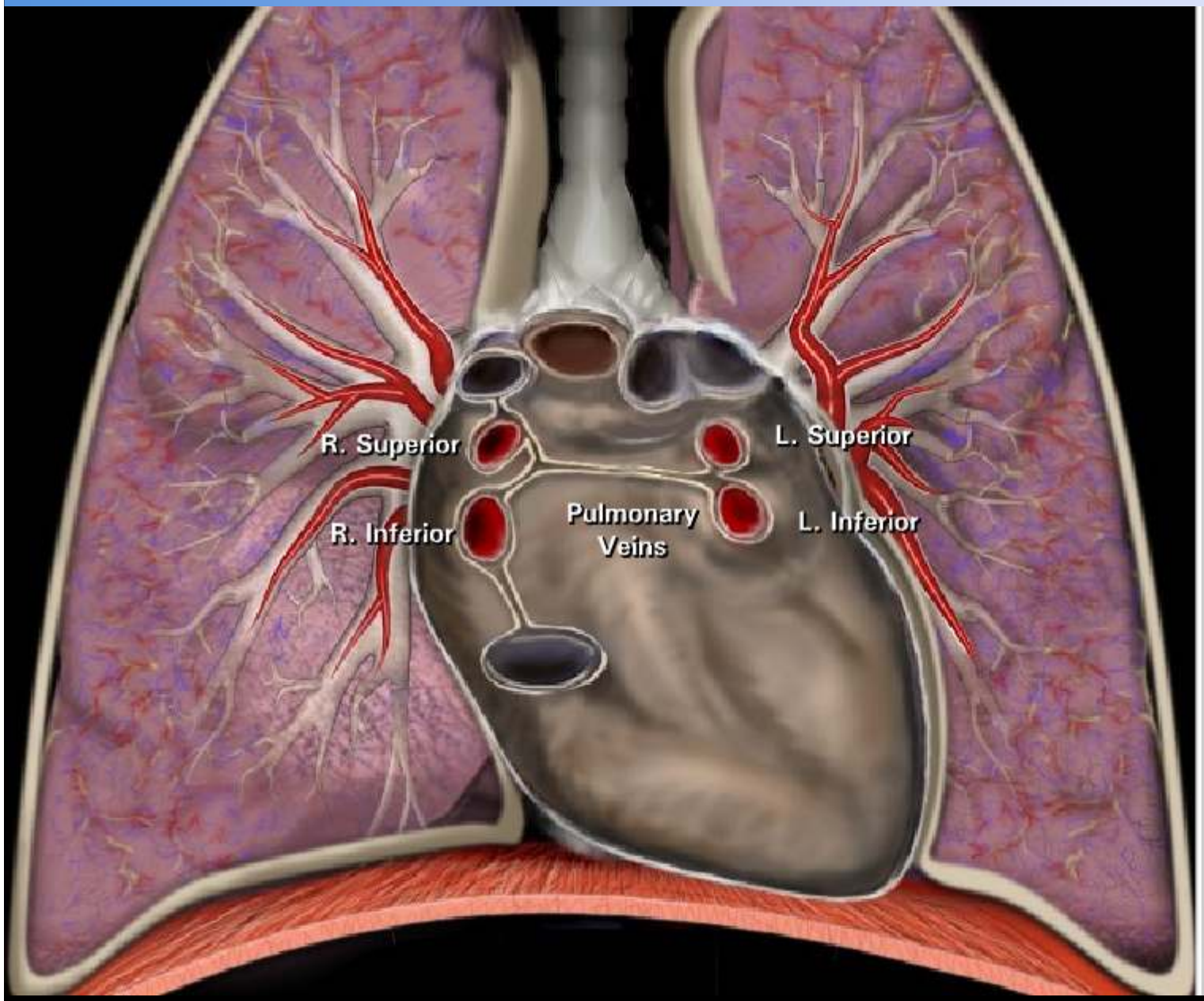
- Pericardiacophrenic artery
  - slender branch from internal thoracic (runs with phrenic nerve)
- Musculophrenic artery
  - a terminal branch of internal thoracic
- Bronchial arteries
- Thoracic aorta



Pericardial Sinuses



Cardiac Anatomy



- Pulmonary veins
- Left atrium
- Left ventricle
- Aorta
- Right Atrium
- Right ventricle
- Pulmonary arteries
- Ribs

Roll over list above to control animation.

Left Heart

Right Heart

Entire Heart

Active View

Cartoon

X-Ray

Innervation of the Pericardium

- **Fibrous pericardium**
- **Phrenic nerve (C3-5).**

Innervation of the Pericardium

Serous pericardium

- **Parietal layer** — **Phrenic nerve (C3-5)**

Visceral layer — **Insensitive**

Innervation of the Pericardium

Fibrous pericardium

Phrenic nerve (C3-5).

Serous pericardium

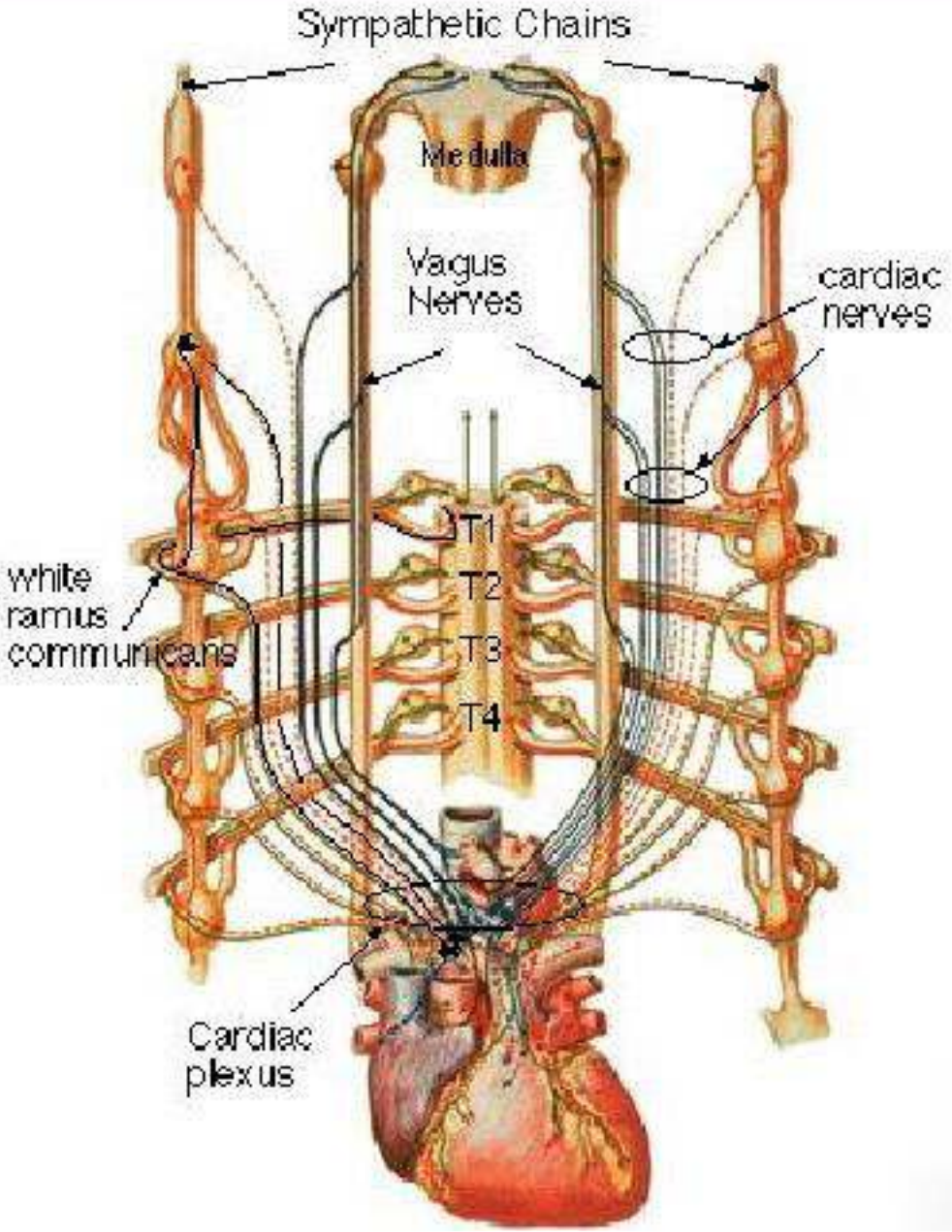
Parietal layer - phrenic nerve.

Visceral layer – insensitive.

Clinical Pearle

- **Pericarditis pain originates from the parietal layer of the pericardium mediated by the phrenic nerve.**

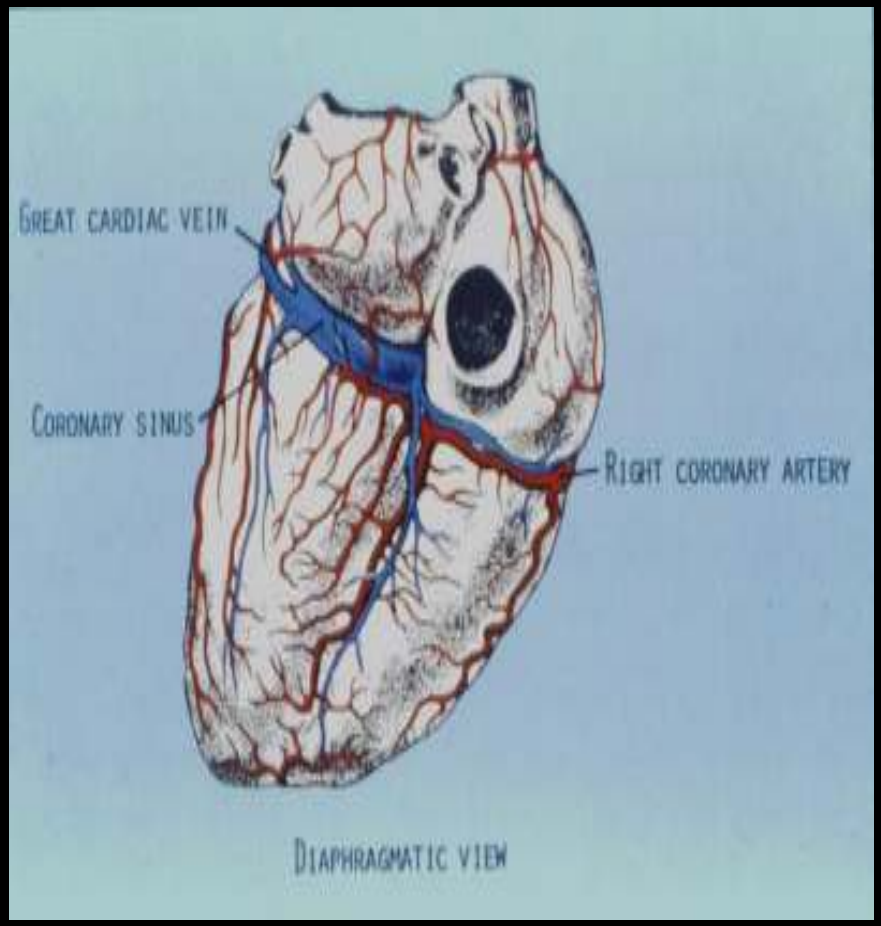
Innervation of the Heart

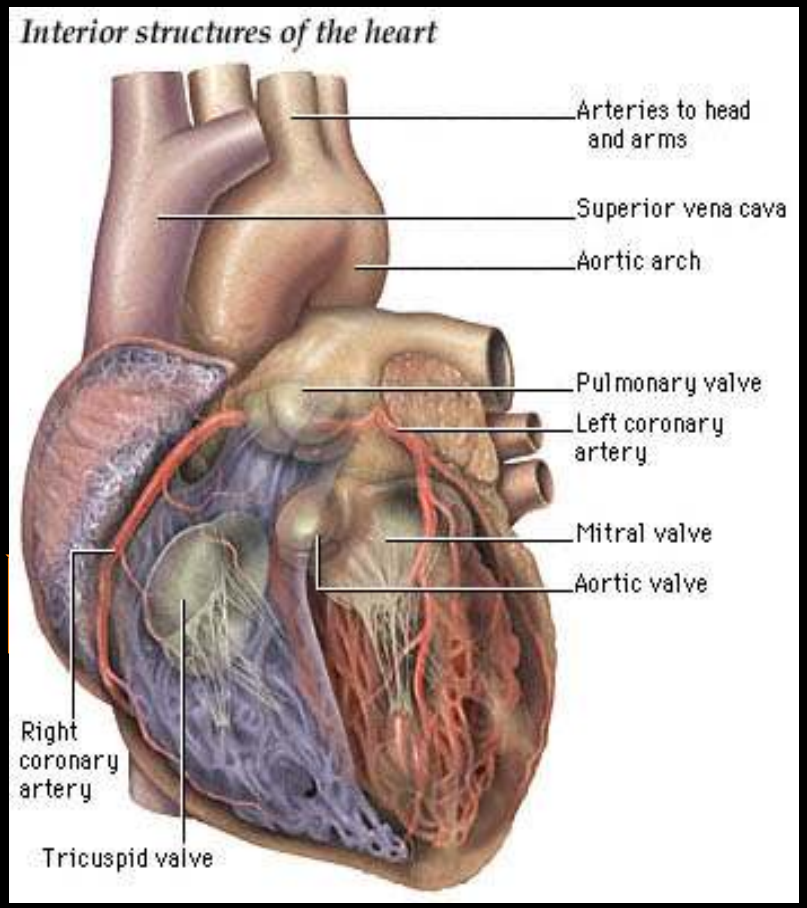


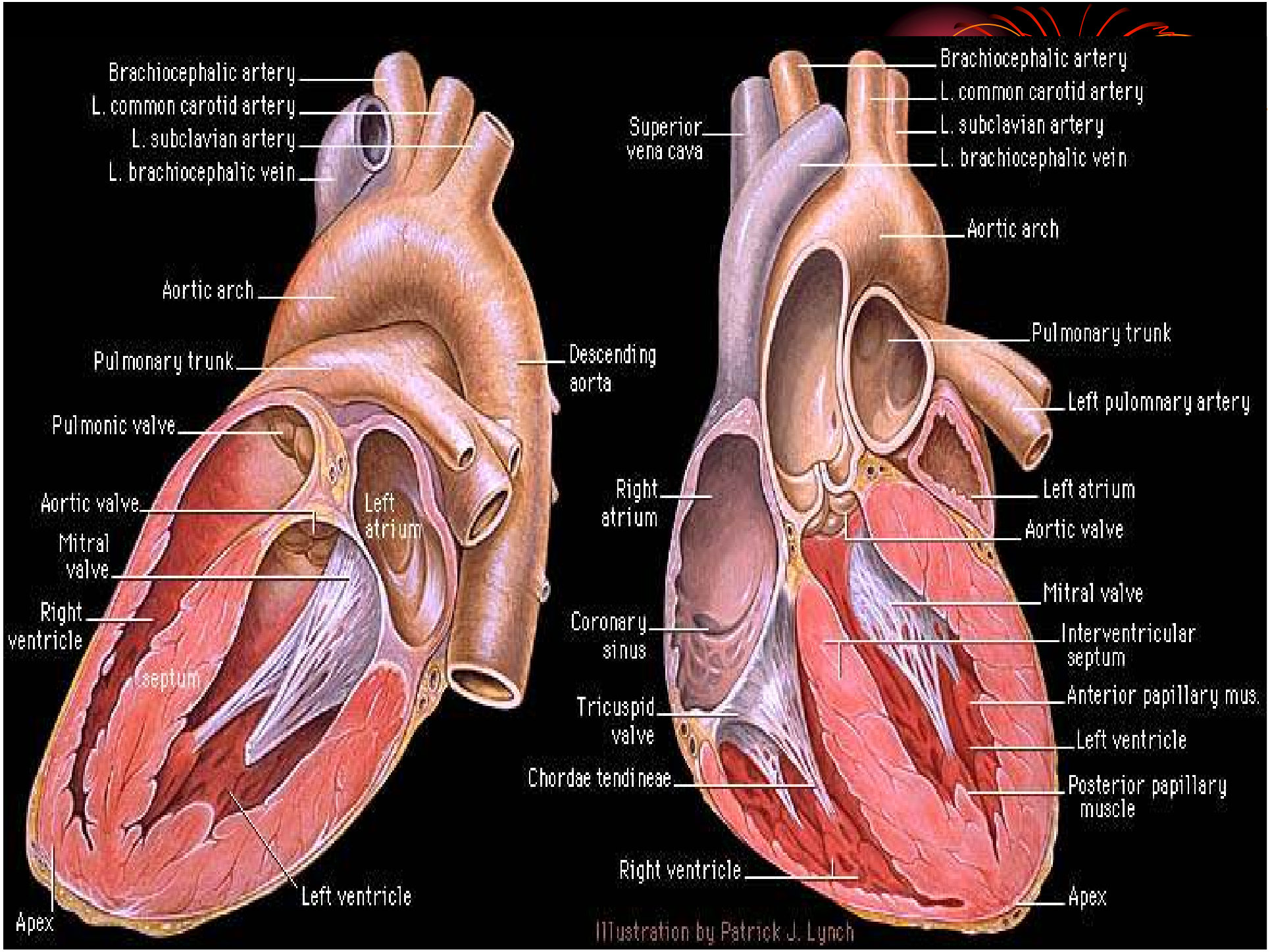
Clinical Pearle

- **Angina originates in myocardium or vessels' sympathetic nerves.**

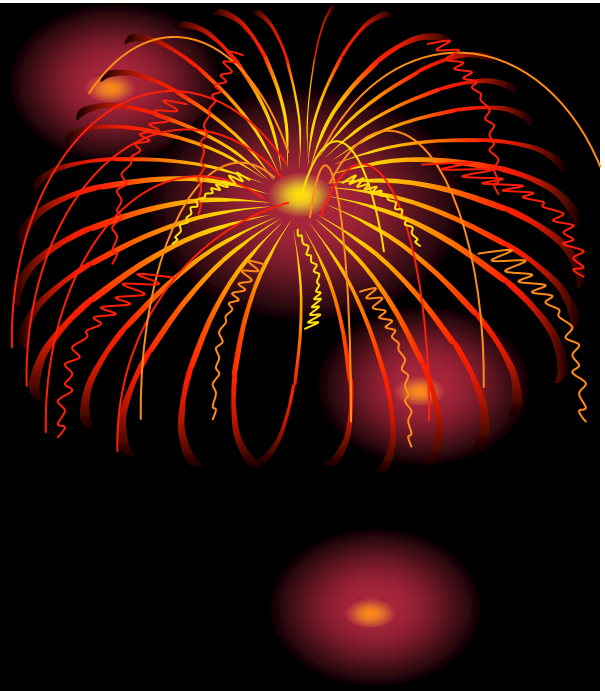
The Heart Anterior & Posterior Views





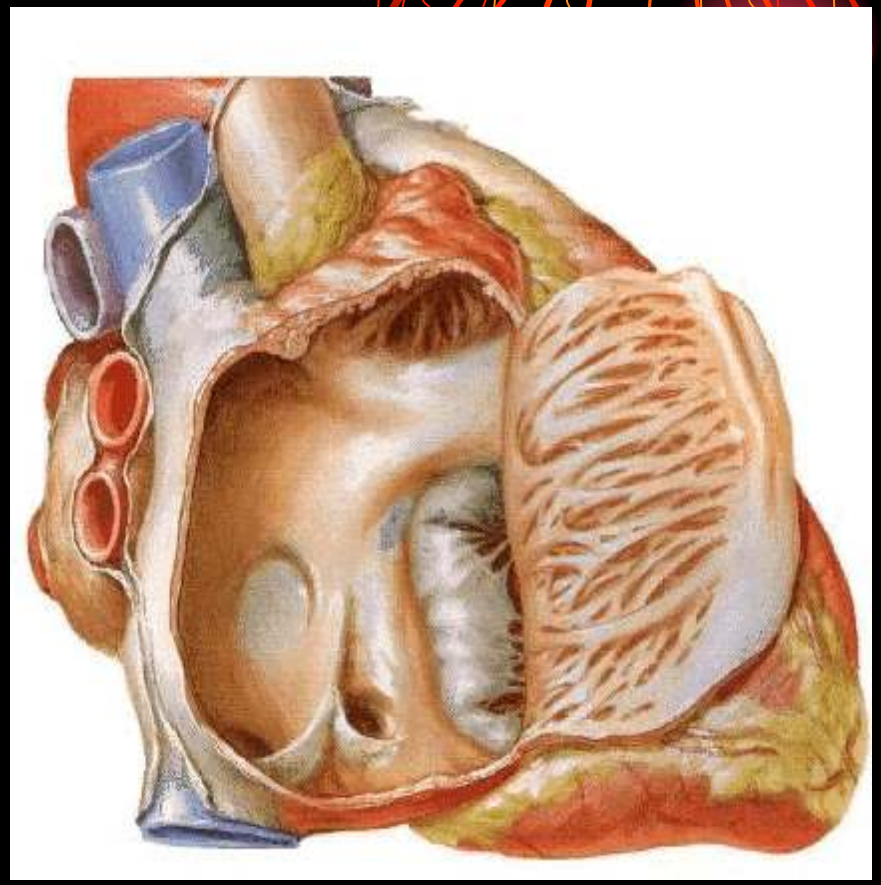

Brachiocephalic artery
L. common carotid artery
L. subclavian artery
L. brachiocephalic vein
Aortic arch
Pulmonary trunk
Pulmonic valve
Aortic valve
Mitral valve
Right ventricle
septum
Left atrium
Left ventricle
Apex
Descending aorta
Brachiocephalic artery
L. common carotid artery
L. subclavian artery
L. brachiocephalic vein
Superior vena cava
Aortic arch
Pulmonary trunk
Left pulomnary artery
Right atrium
Left atrium
Aortic valve
Mitral valve
Coronary sinus
Interventricular septum
Anterior papillary mus.
Tricuspid valve
Left ventricle
Chordae tendineae
Posterior papillary muscle
Right ventricle
Apex
Illustration by Patrick J. Lynch

The Right Atrium

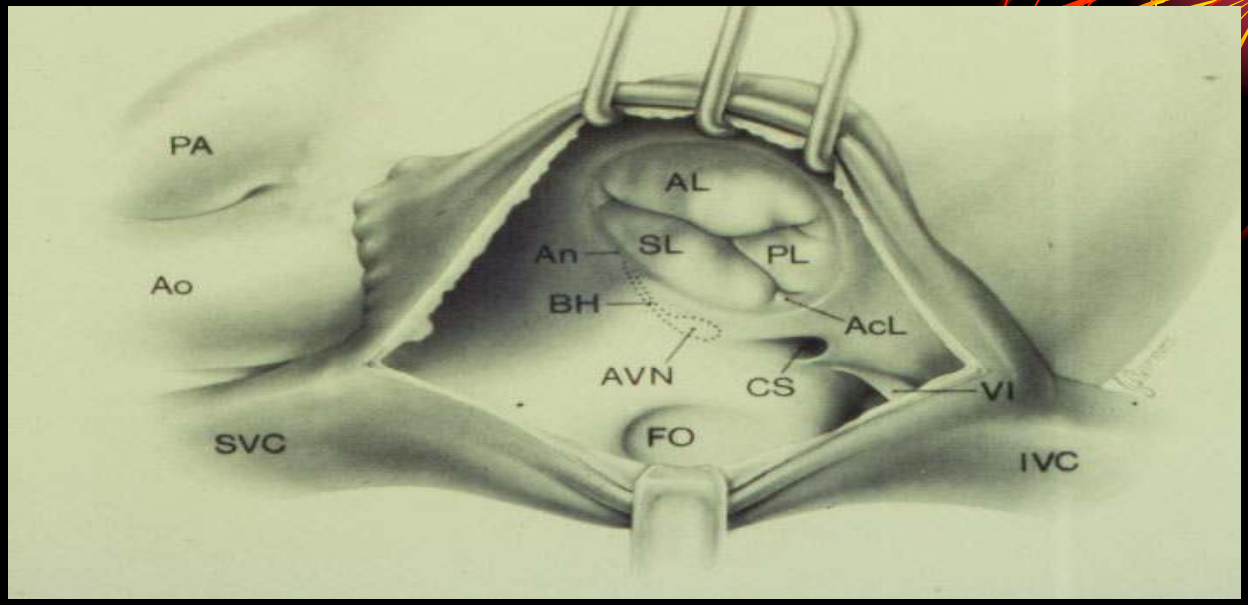


The Right Atrium (RA)

- Receives systemic venous drainage from the superior and inferior vena cavae
- Receives major portion of coronary sinus drainage



The Right Atrium (RA)



Morphologic characteristics for identification include:

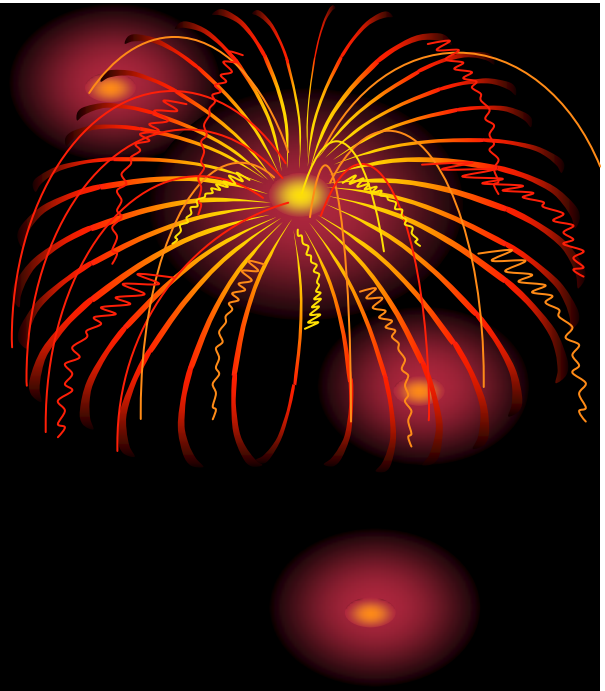
1- The presence of the limbus of the fossa ovalis.

2- The right atrial appendage.

3- The eustachian valve at the orifice of IVC.

4- Thebesian valve at the orifice of the coronary sinus.

5- The cirsta terminalis that separates the trabeculated from the non-trabeculated portion of the atrium.



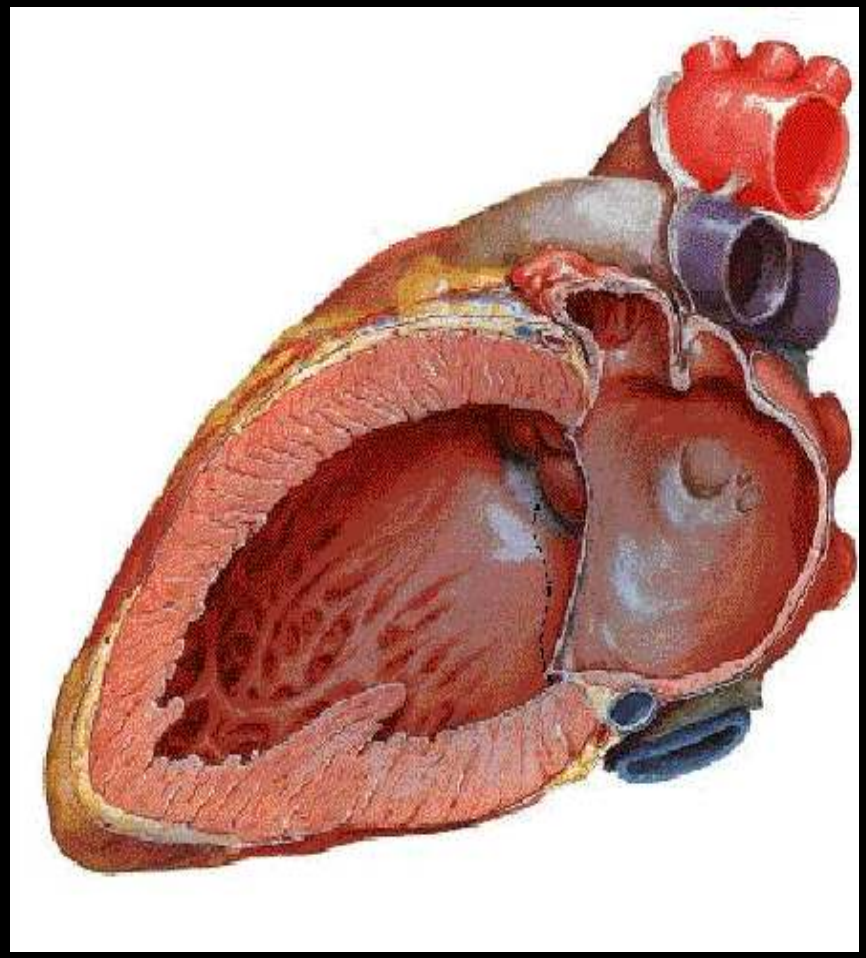
The Left Atrium

The Left Atrium (LA)

- **Receives pulmonary venous drainage from the four pulmonary veins.**

LA Surgical View

The Left Atrium (LA)



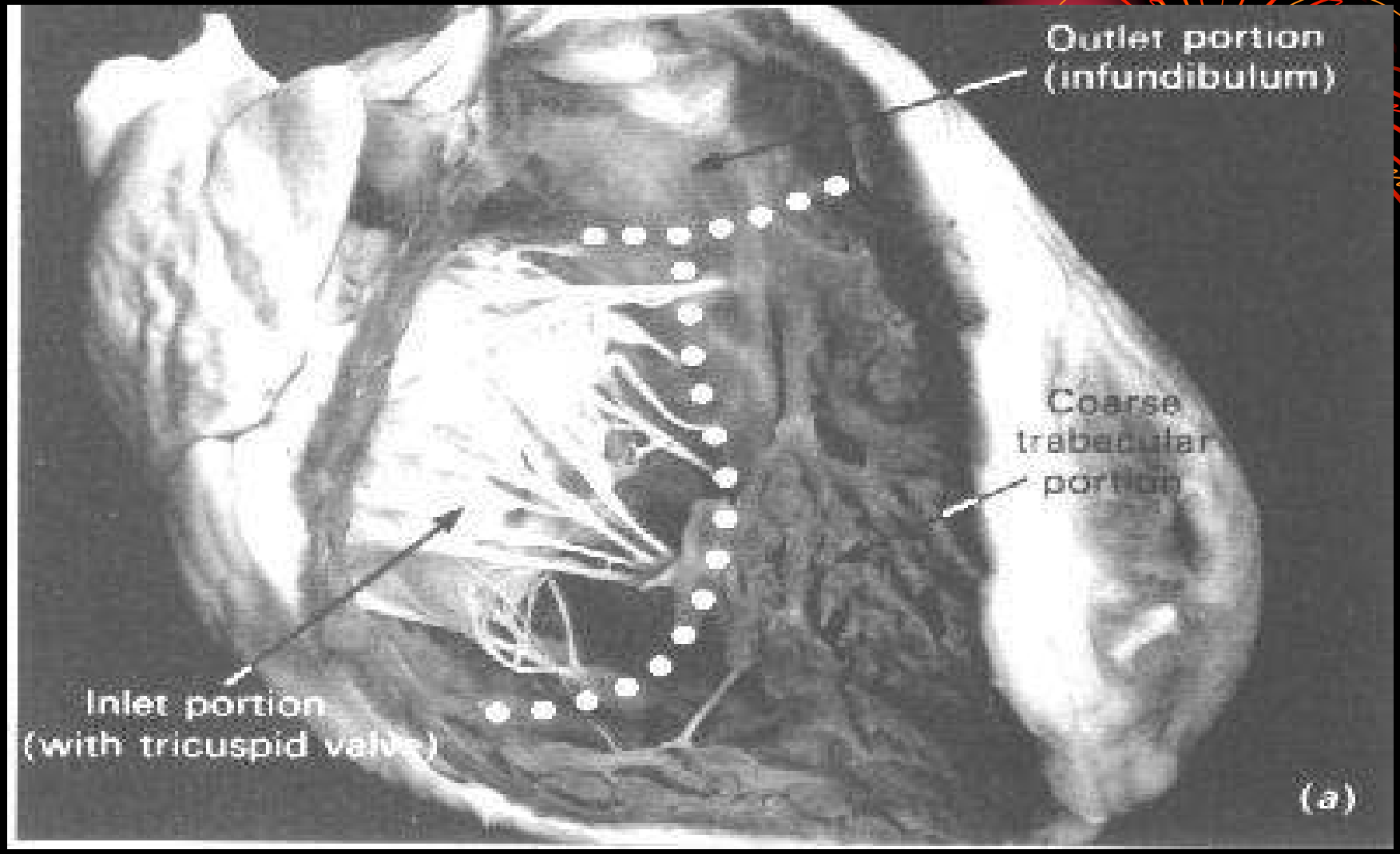
- The septal surface of the LA is characterized by the flap valve of the fossa ovalis.


The Ventricles

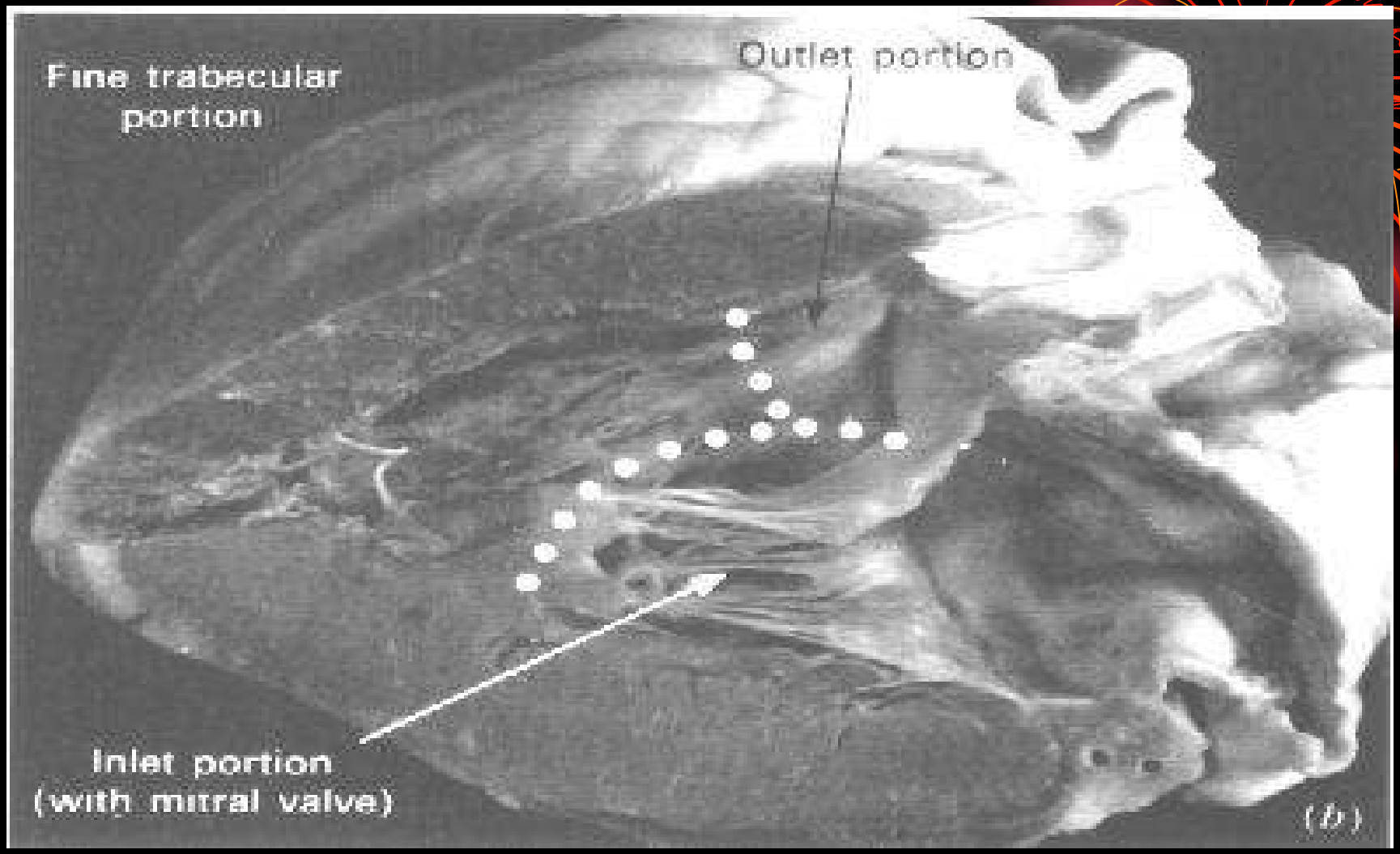
The Ventricles

The normal ventricle can be divided into three components:

1- ***Inlet component***
2- ***Trabecular component***
3- ***Outlet component***

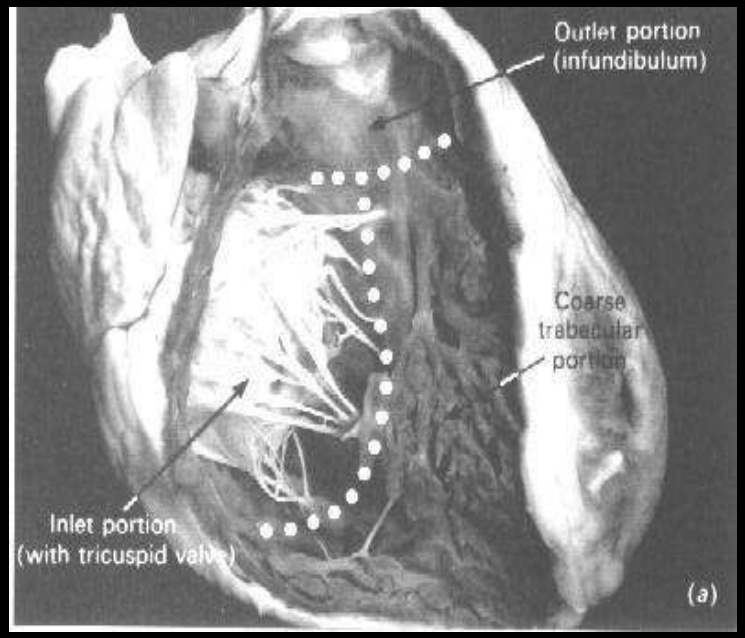


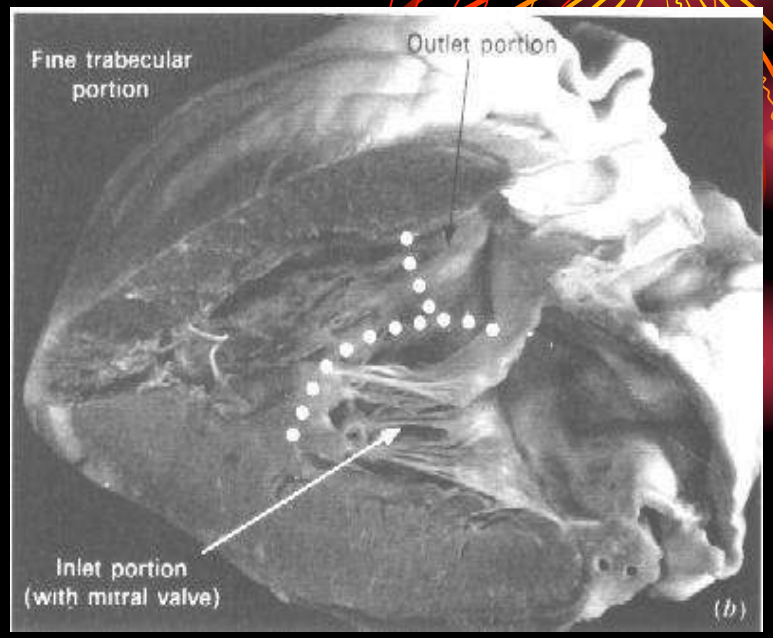
Right Ventricle



Left Ventricle

The Ventricles





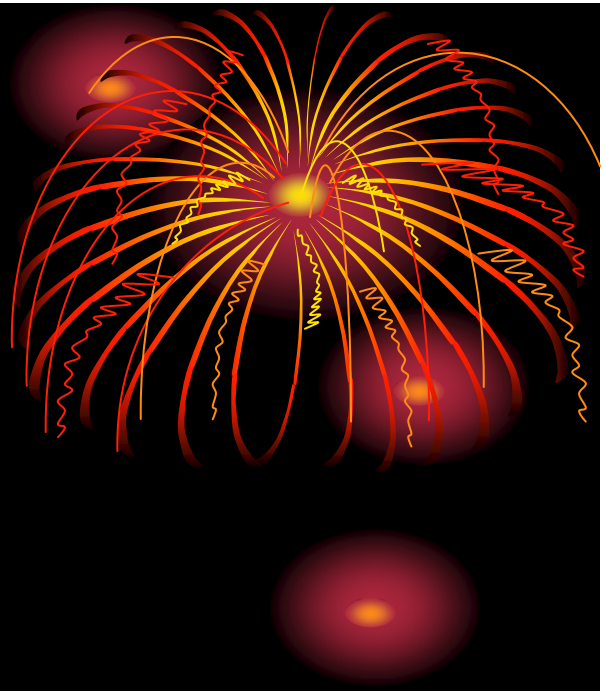
RV

LV

Inlet component

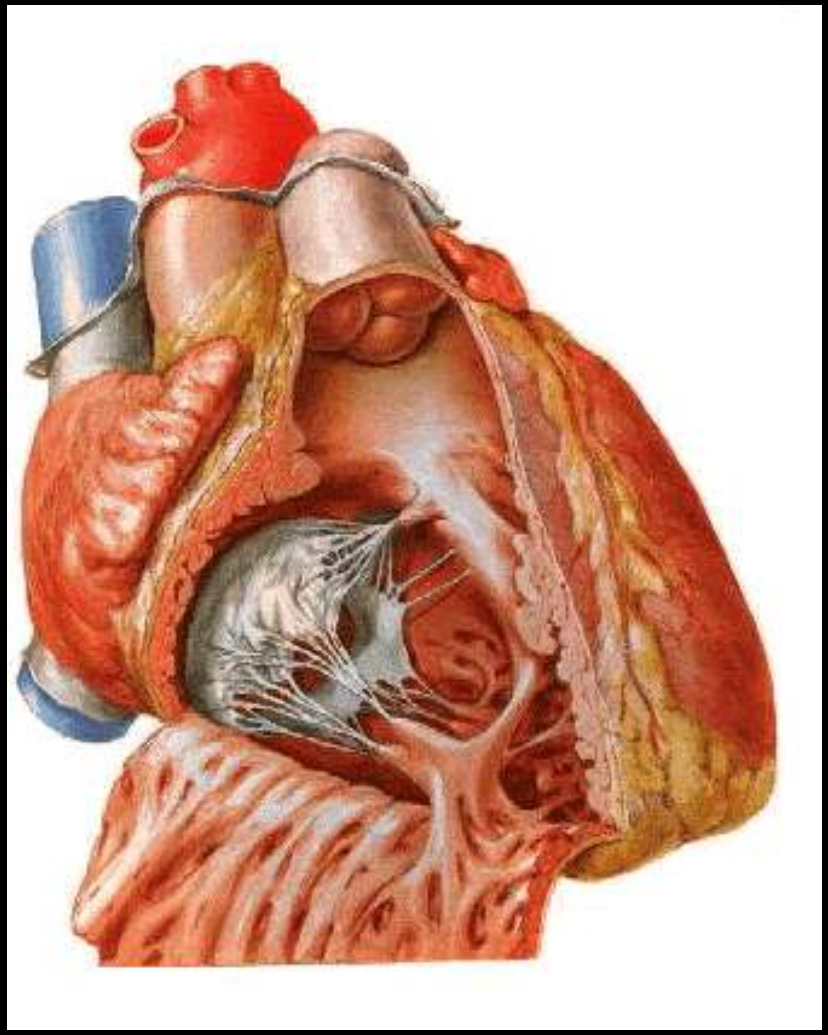
Trabecular component

Outlet component



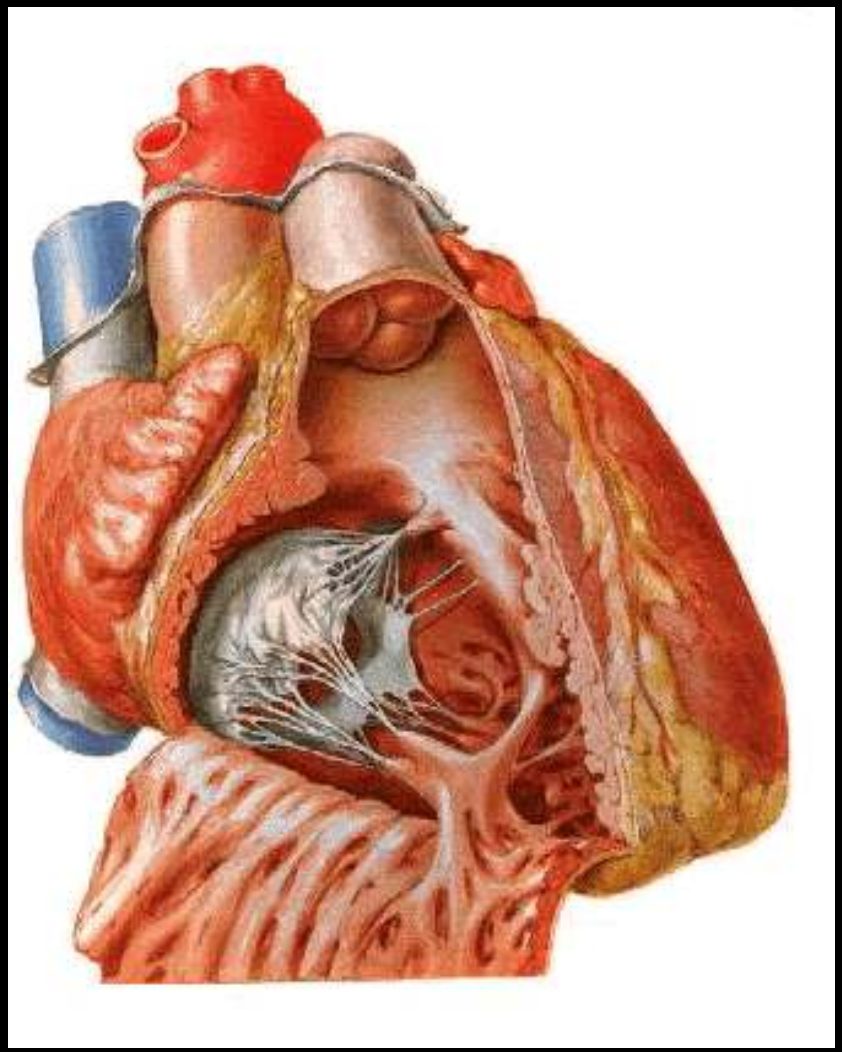
The Right Ventricle

The Right Ventricle (RV)



- **Composed of a large *Sinus Portion* that surrounds and supports the tricuspid AV valve & includes the apex.**

The Right Ventricle

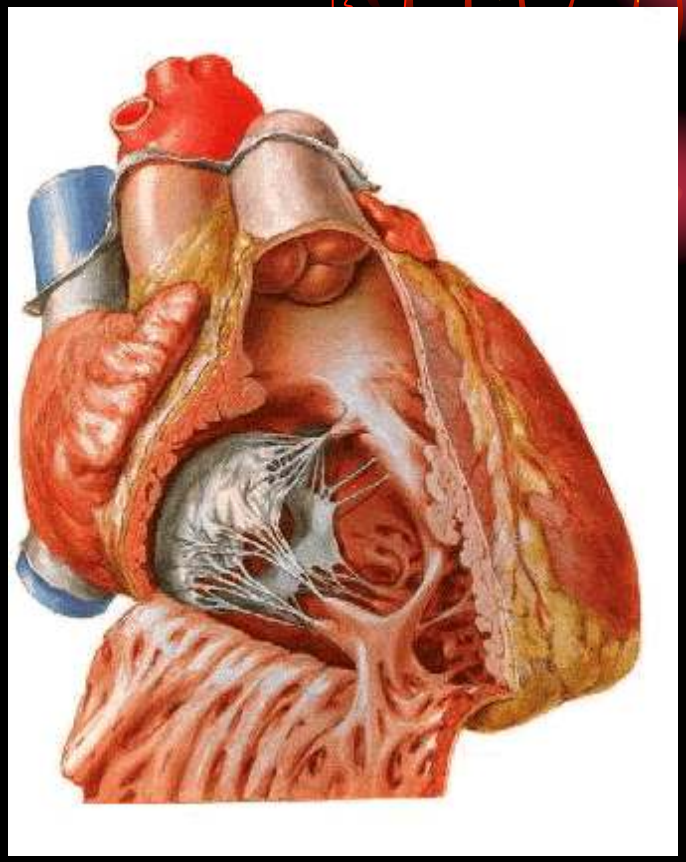


- A smaller infundibulum, or outlet portion,

  that gives attachment to a semilunar valve.

The Right Ventricle (RV)

- **The entire of the sinus portion and most of the infundibulum (both the free wall & septum) are coarsely trabeculated**



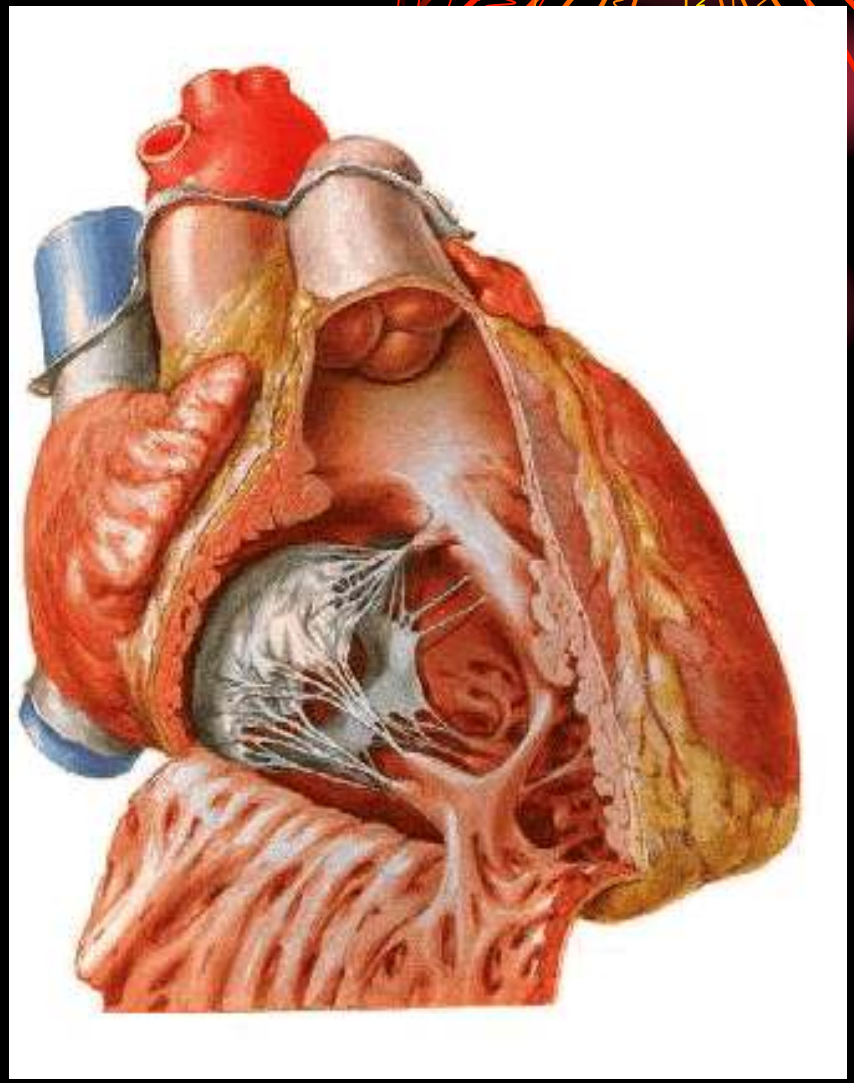
The Right Ventricle (RV)

The septal surface is divided into:

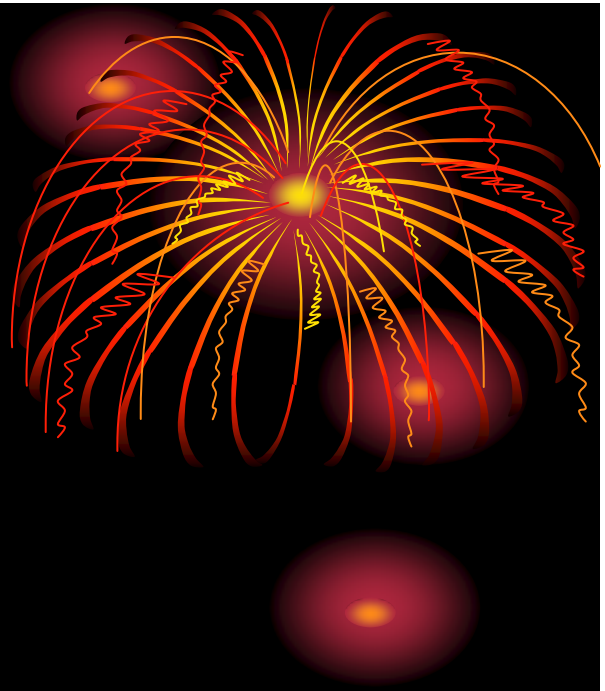
1- Inlet portion.

2-Trabecular portion or the apical, trabecular portion.

3- Outlet portion.

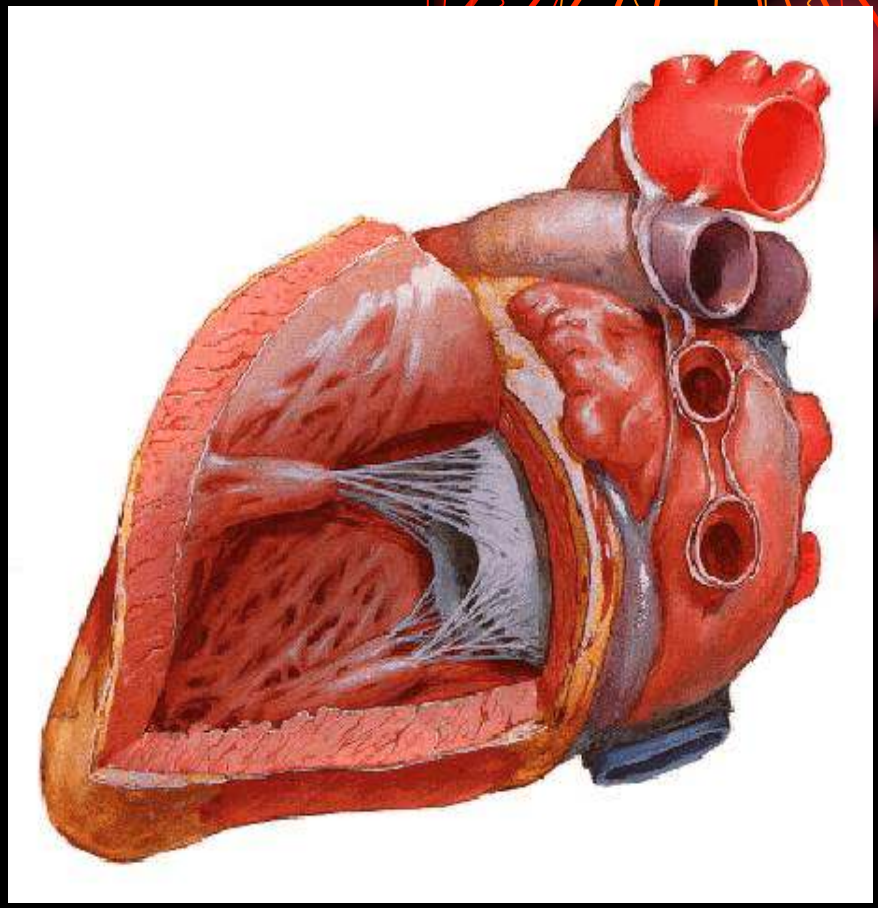


The Left ventricle



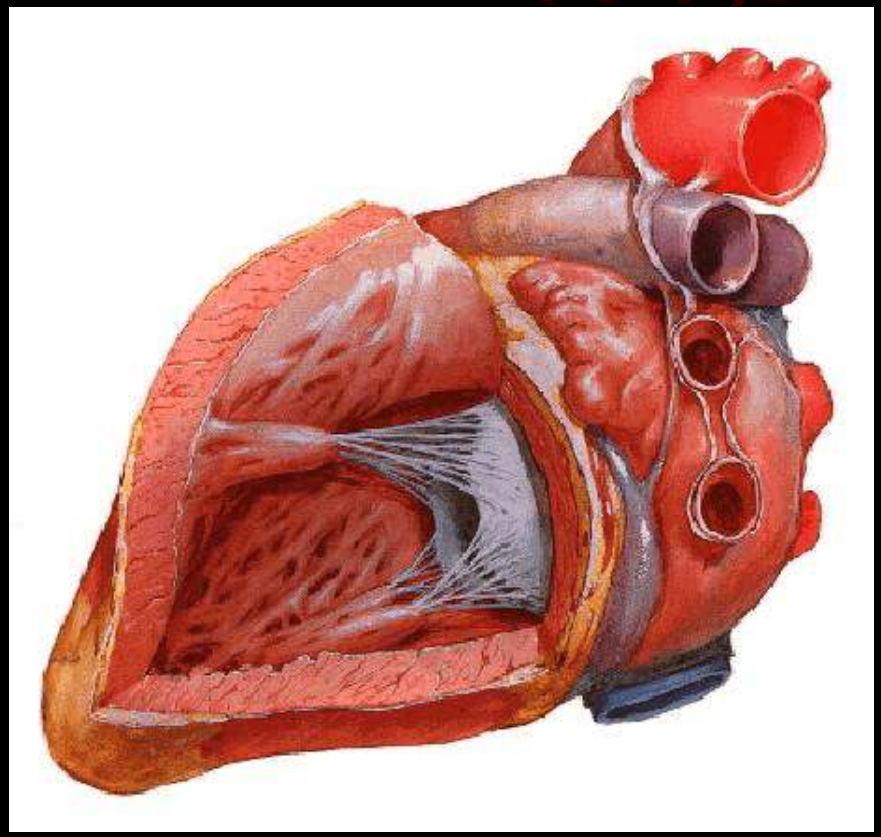
The Left Ventricle (LV)

- **Consists of a large sinus portion that supports the mitral valve & includes the apex.**



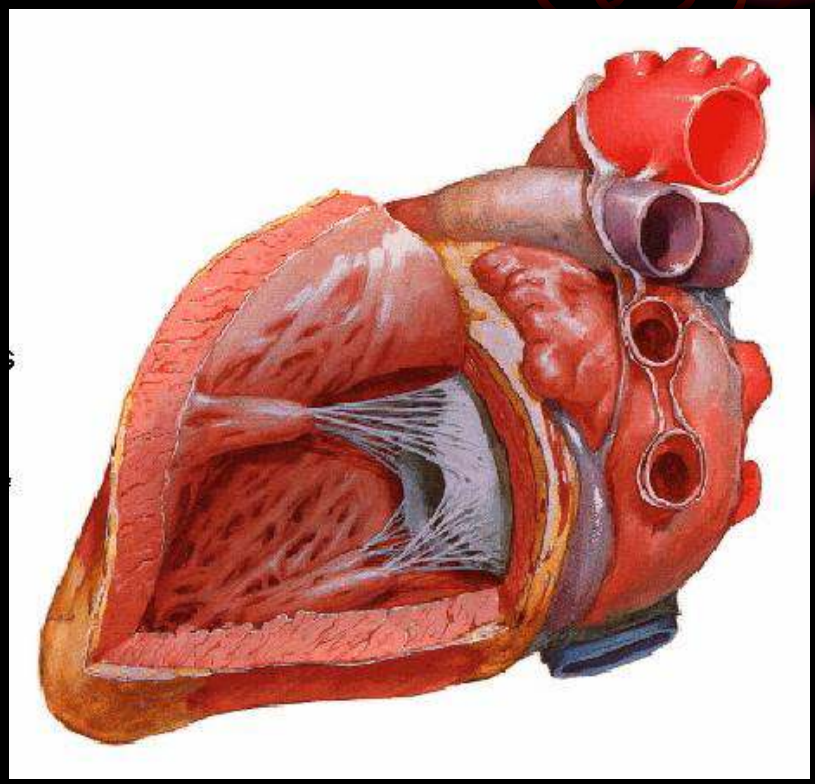
The Left Ventricle (LV)

- **Smaller outlet portion beneath a semilunar valve.**



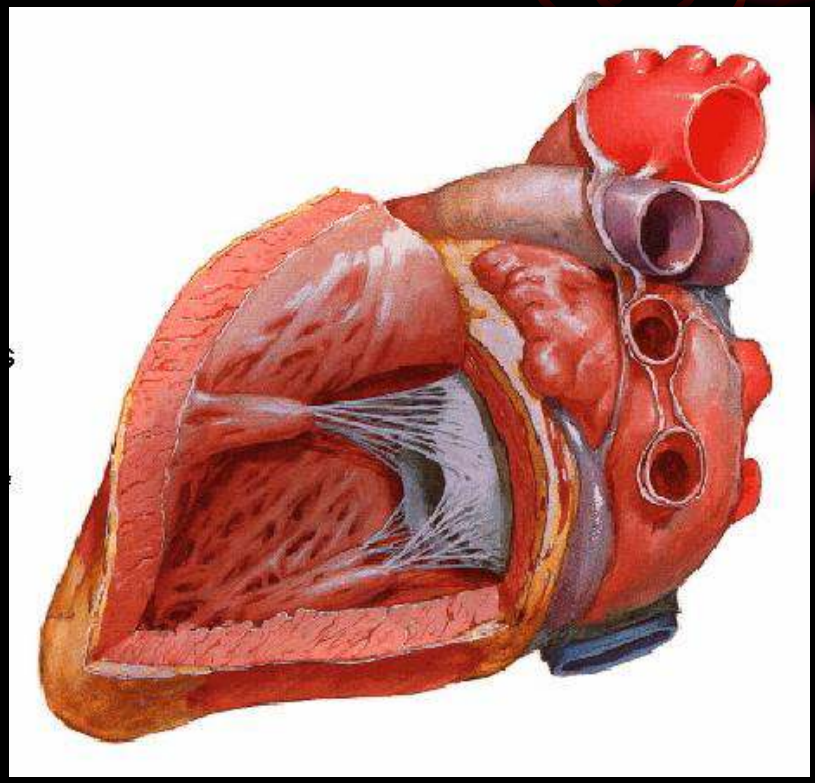
The Left Ventricle (LV)

- **The entire free wall & the apical half to two-thirds are trabeculated.**
- **LV trabeculations are finer than the RV.**



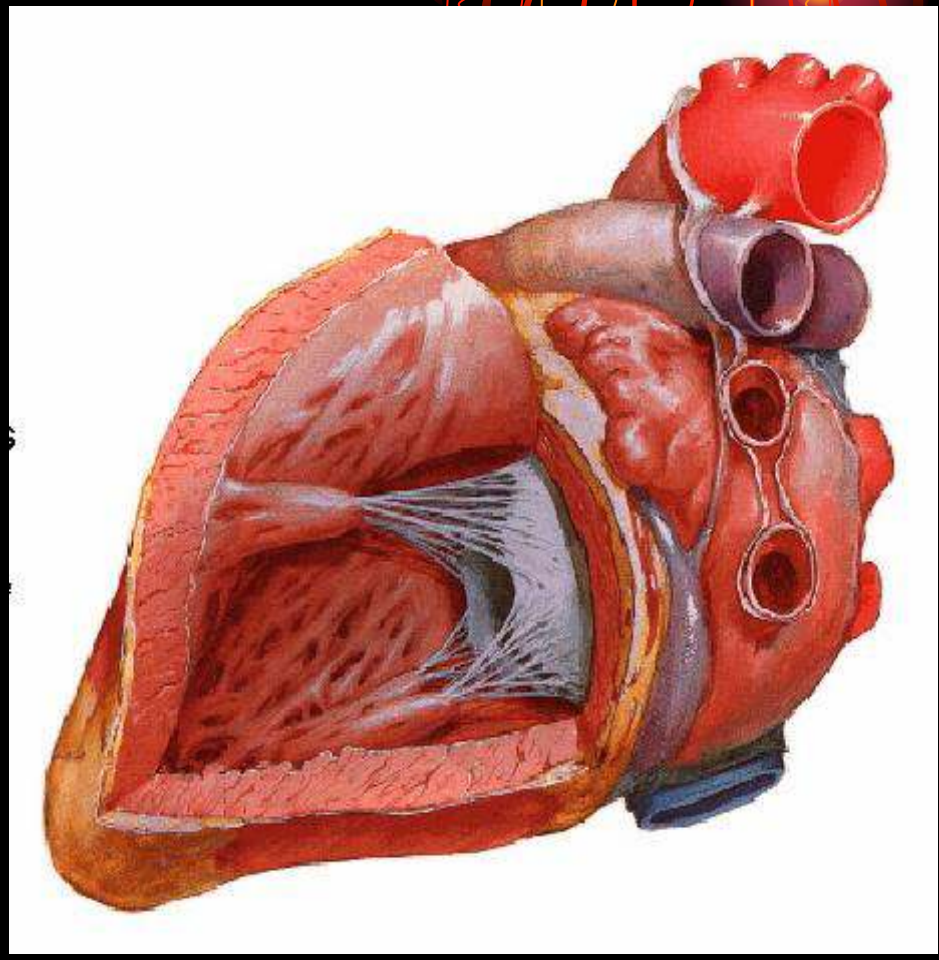
The Left Ventricle (LV)

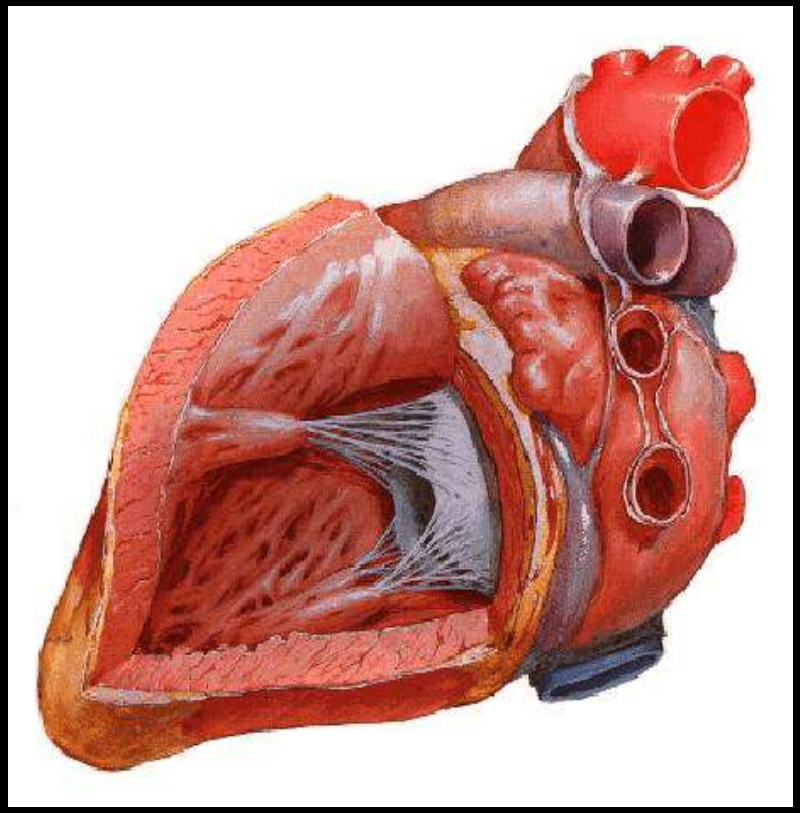
- There are two large papillary muscles attach to the free wall (anterolateral & posteromedial).

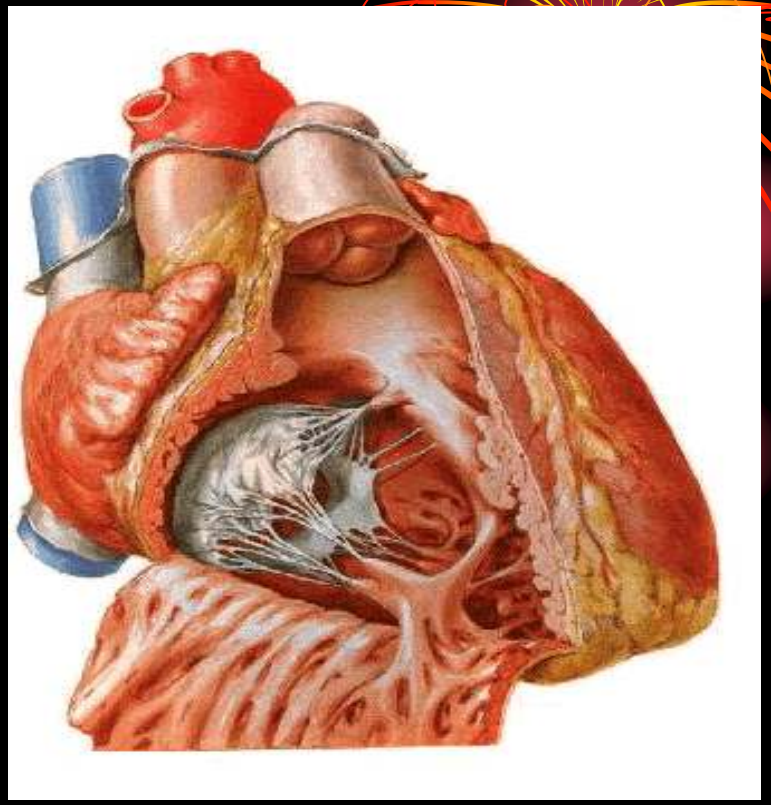


The Left Ventricle (LV)

- **No papillary muscles attach to the left side of LV septum.**





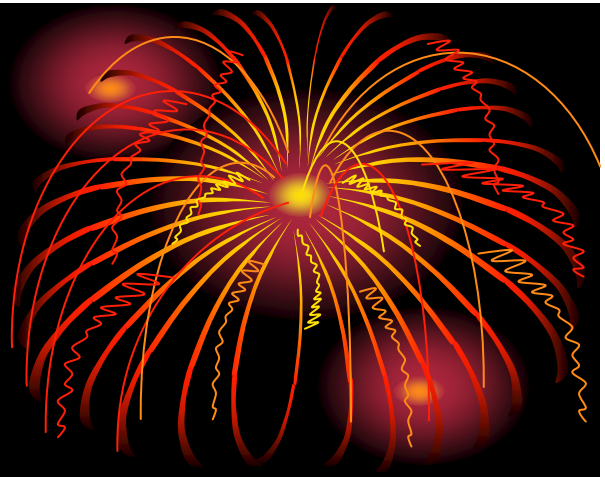


L V

RV

The characteristic trabeculations of both ventricles are compared

The great vessels ?



2 Veins

3 Arteries

The Great Vessels

The "5 vessels" above aortic arch:

1-Right brachiocephalic vein (R BCV)
2-Left brachiocephalic vein (L BCV)

3-Right brachiocephalic artery (R BCA)
4-Left common carotid artery (L CCA)
5-Left subclavian artery (L SCA)

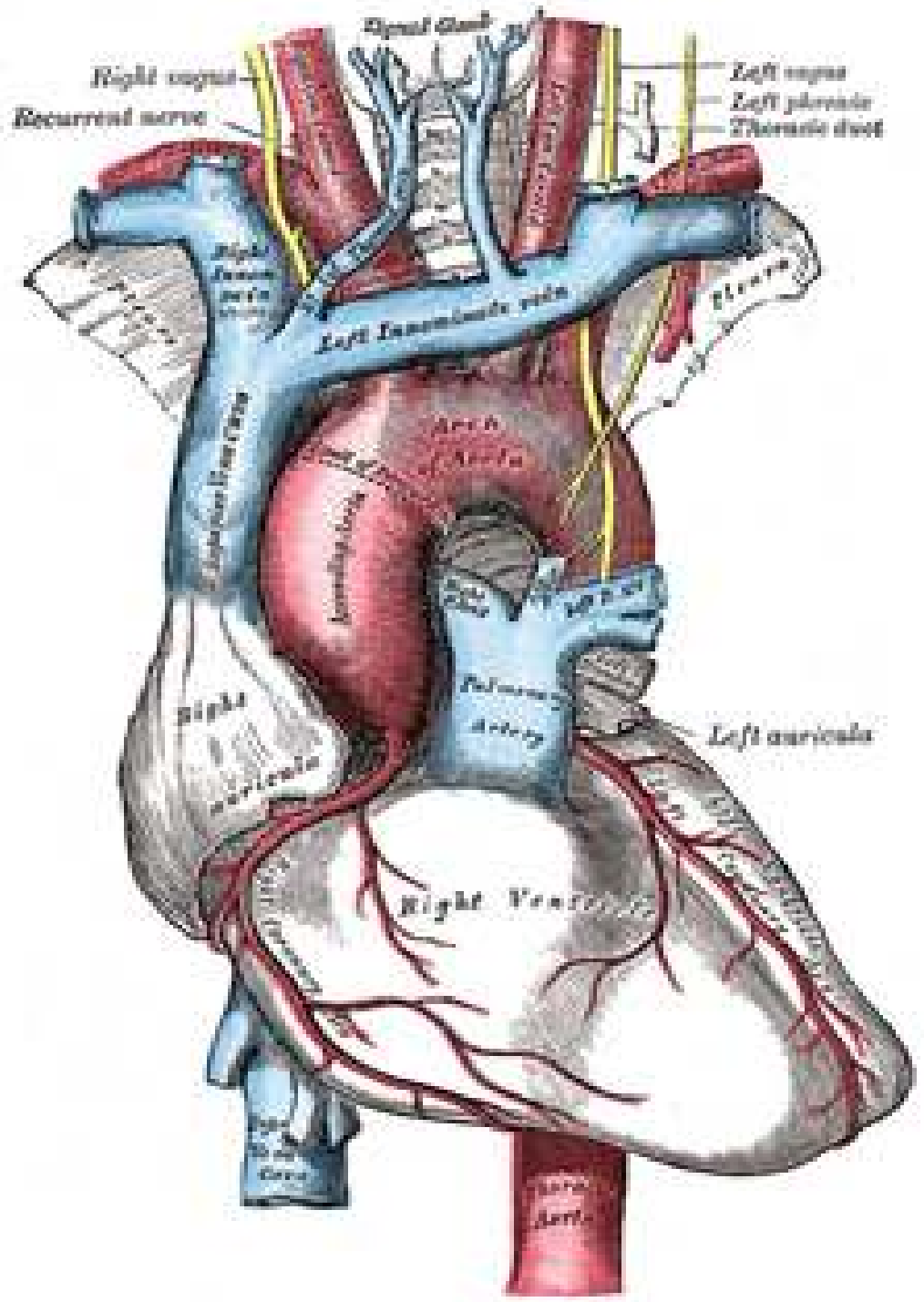
1- Right brachiocephalic vein (R BCV)

2- Left brachiocephalic vein (L BCV)

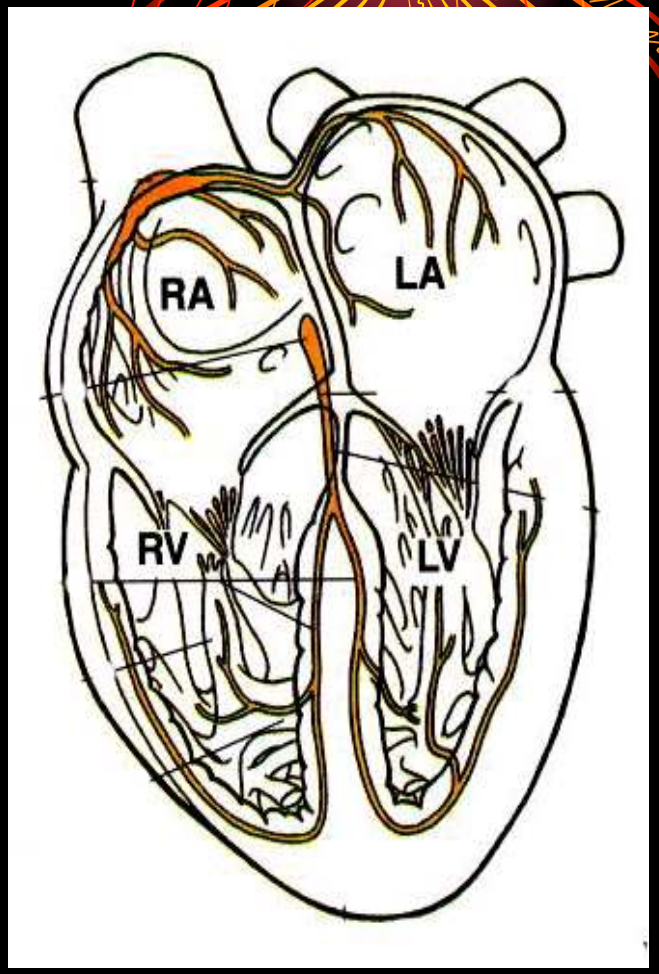
3- Right brachiocephalic artery (R BCA)

4- Left common carotid artery (L CCA)

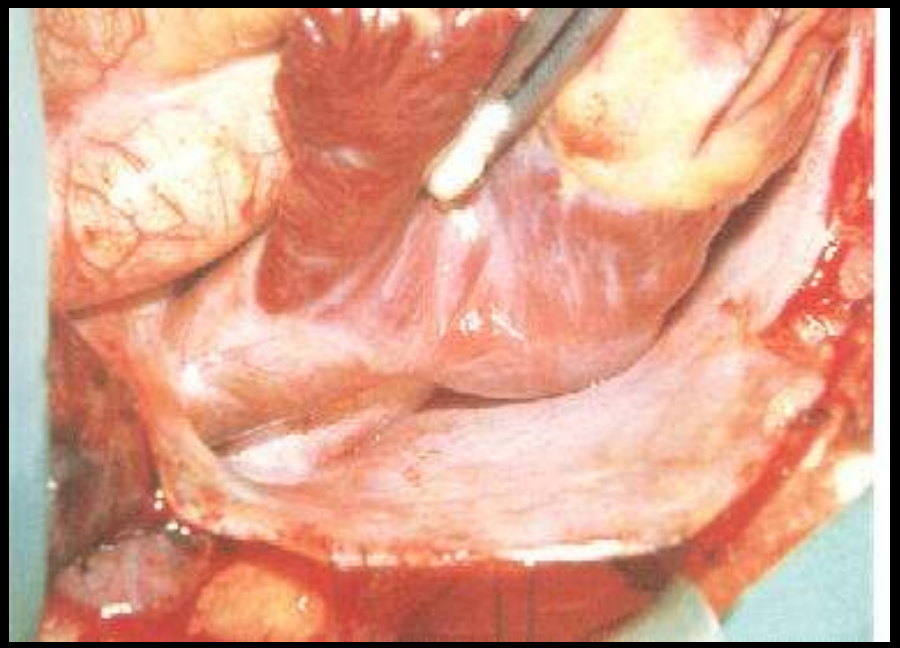
5- Left subclavian artery (L SCA)

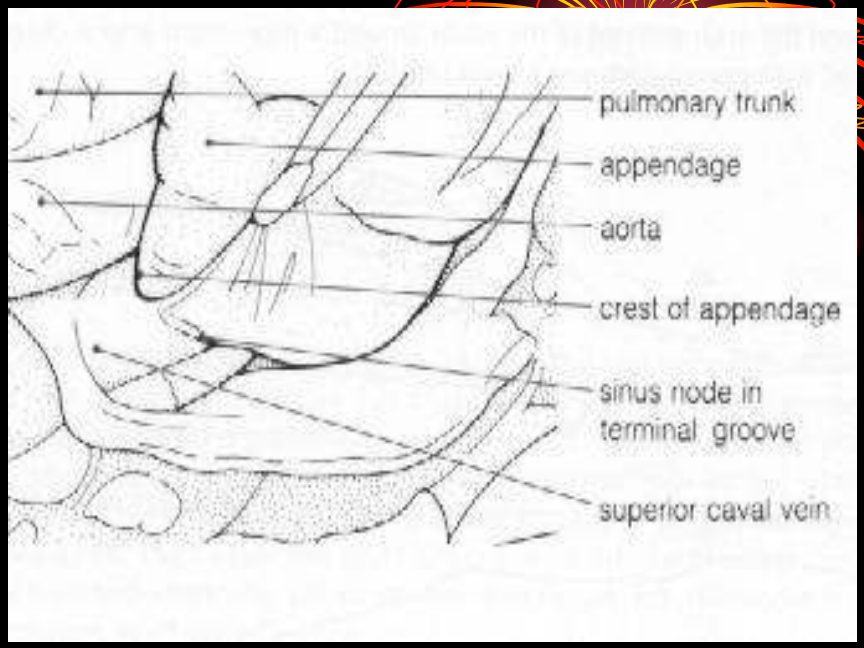


The Conduction System



Sinus (SA) Node

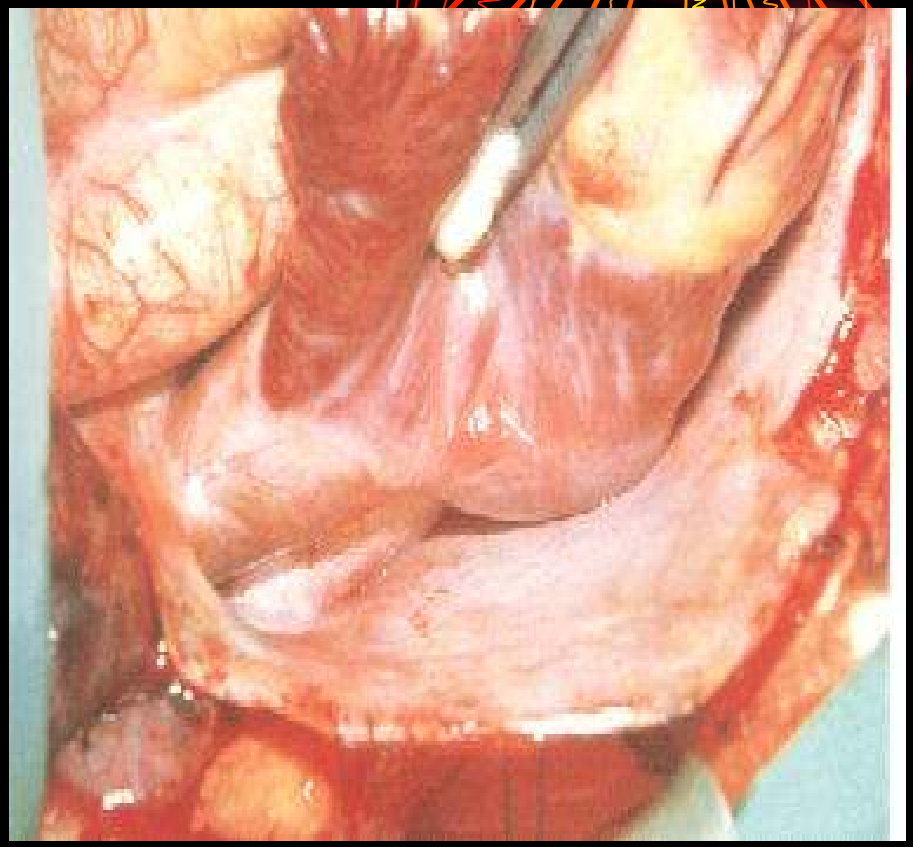




Surgical view showing the location of the Sinus Node along the anterolateral aspect of the junction between the superior vena cava and the right atrial appendage.

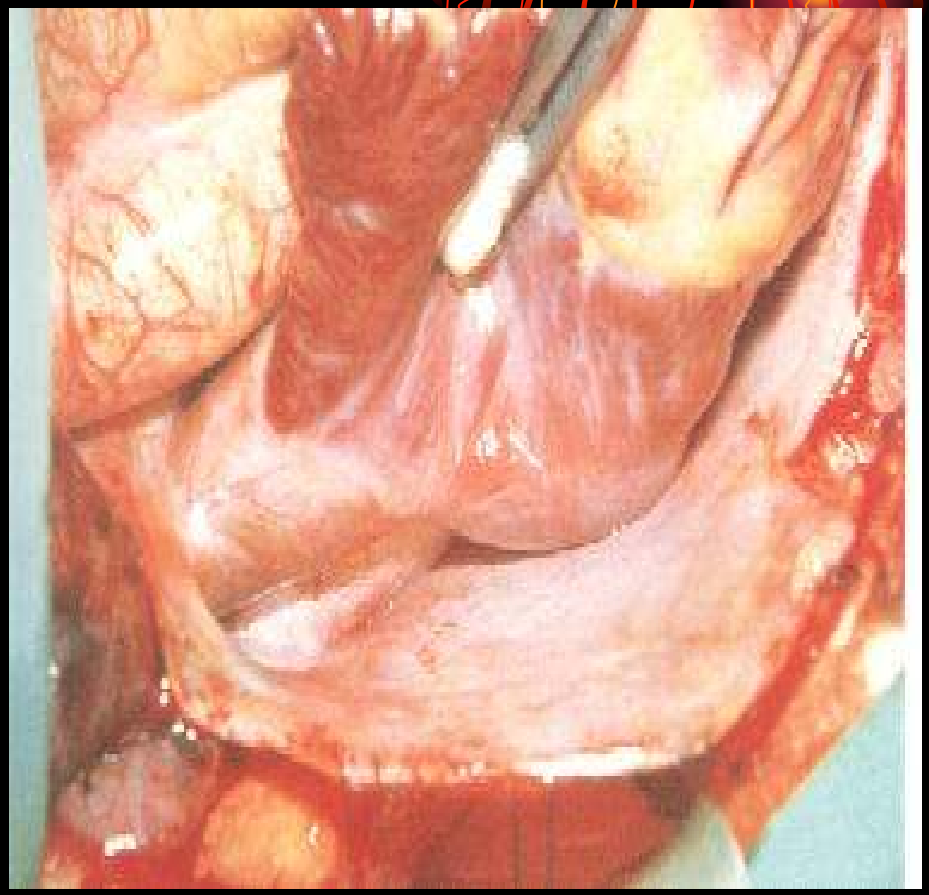
SA Node

- It is superficial lying just beneath the epicardial surface in the sulcus terminalis
- The size is approximately 15 X 5 X 1.5 mm.

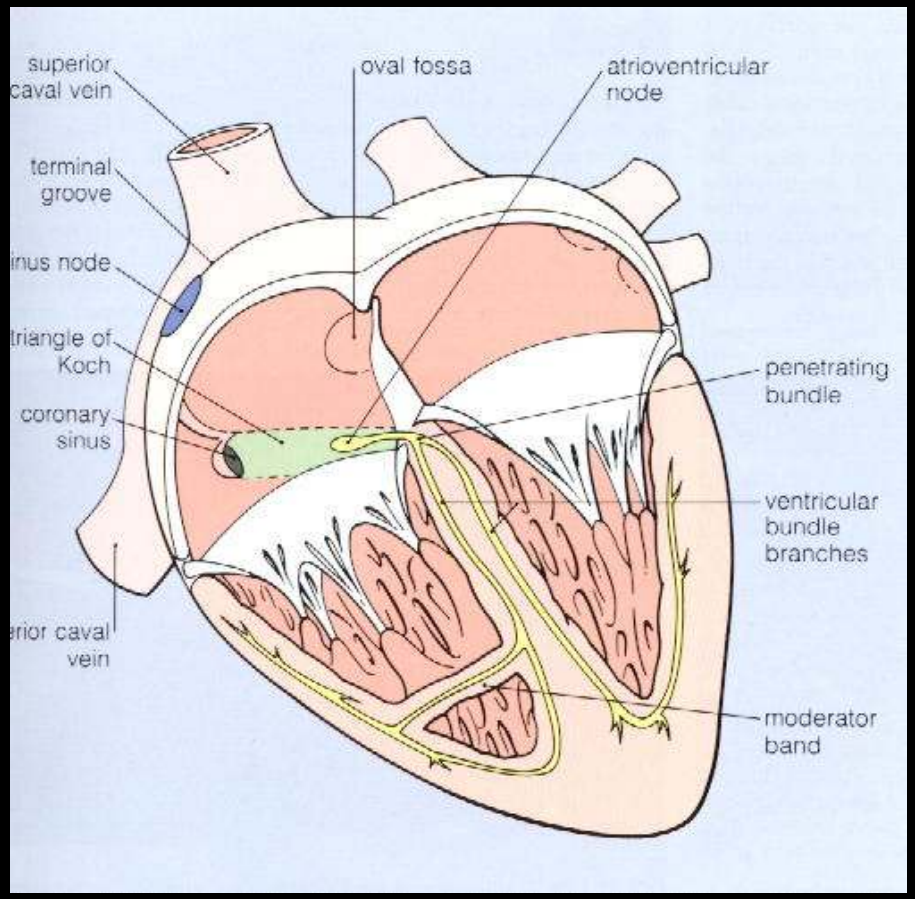


SA Node

- The spread of activation between the SA & AV nodes occurs preferentially through muscle bundles.
- It is pierced by the sinus node artery



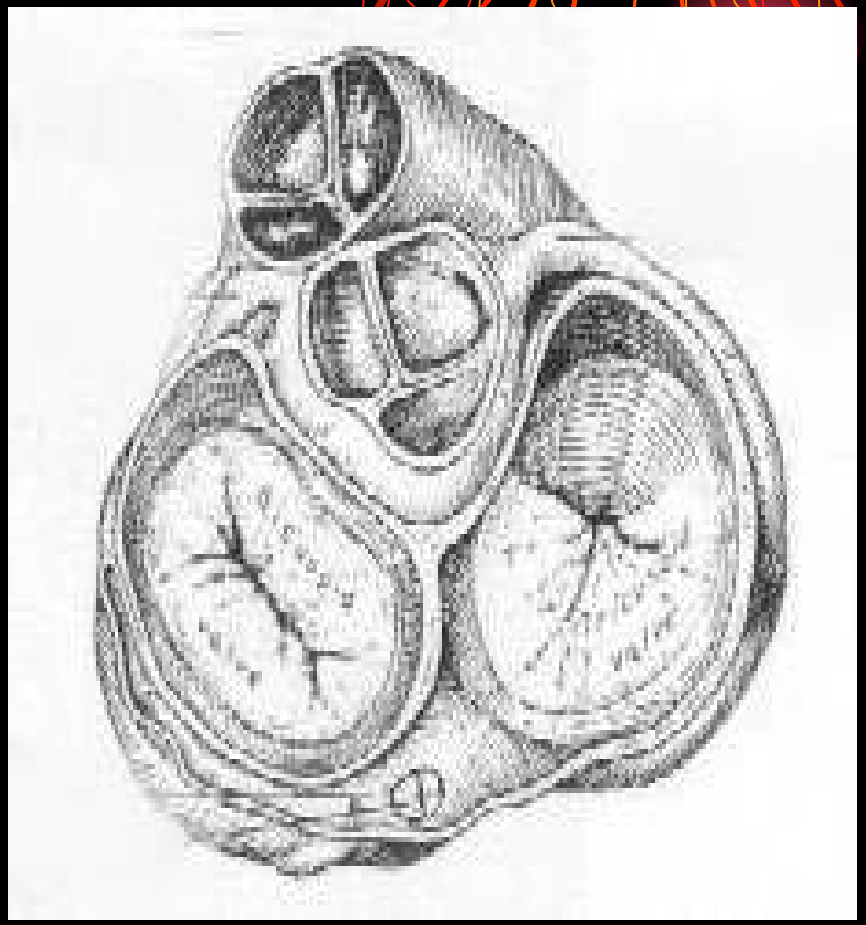
Atrioventricular (AV) Node



- Lies on right atrial side of the central fibrous body in the muscular portion of the atrioventricular septum, just anterosuperior to the ostium of the coronary sinus
- Its average dimension 1 X 3 X 6 millimeter

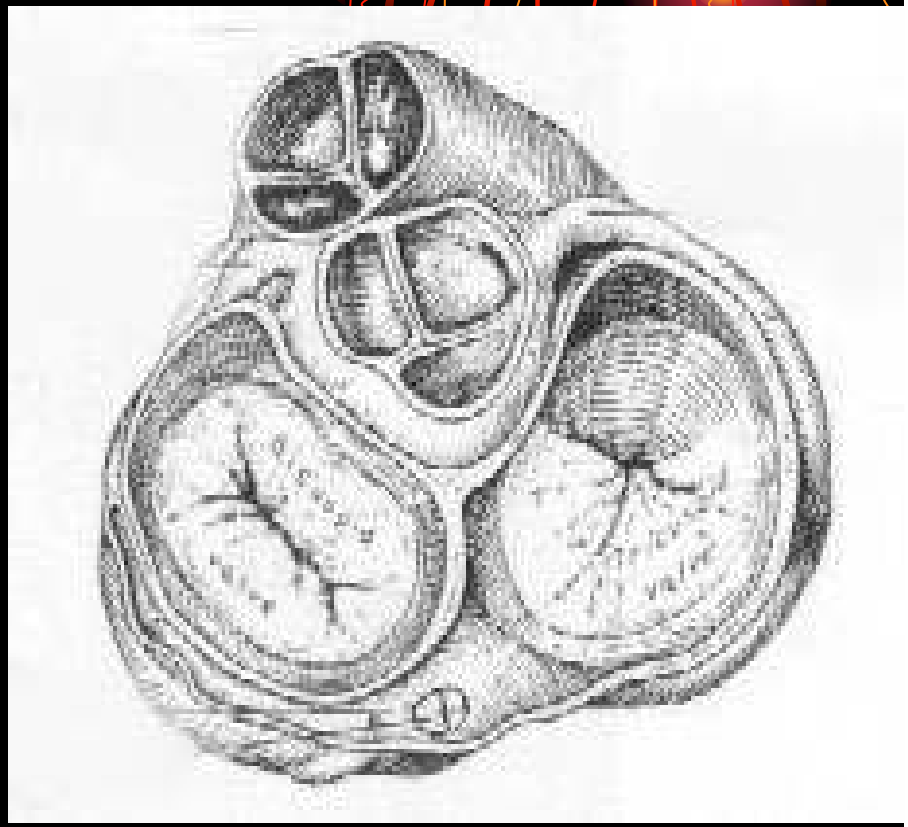
Cardiac Valves

The aortic valve occupies a central position between the mitral and Tricuspid valves.



Cardiac Valves

- **The anuli of the mitral & tricuspid valves merge with each other & with the membranous septum to form the skeleton of the heart.**



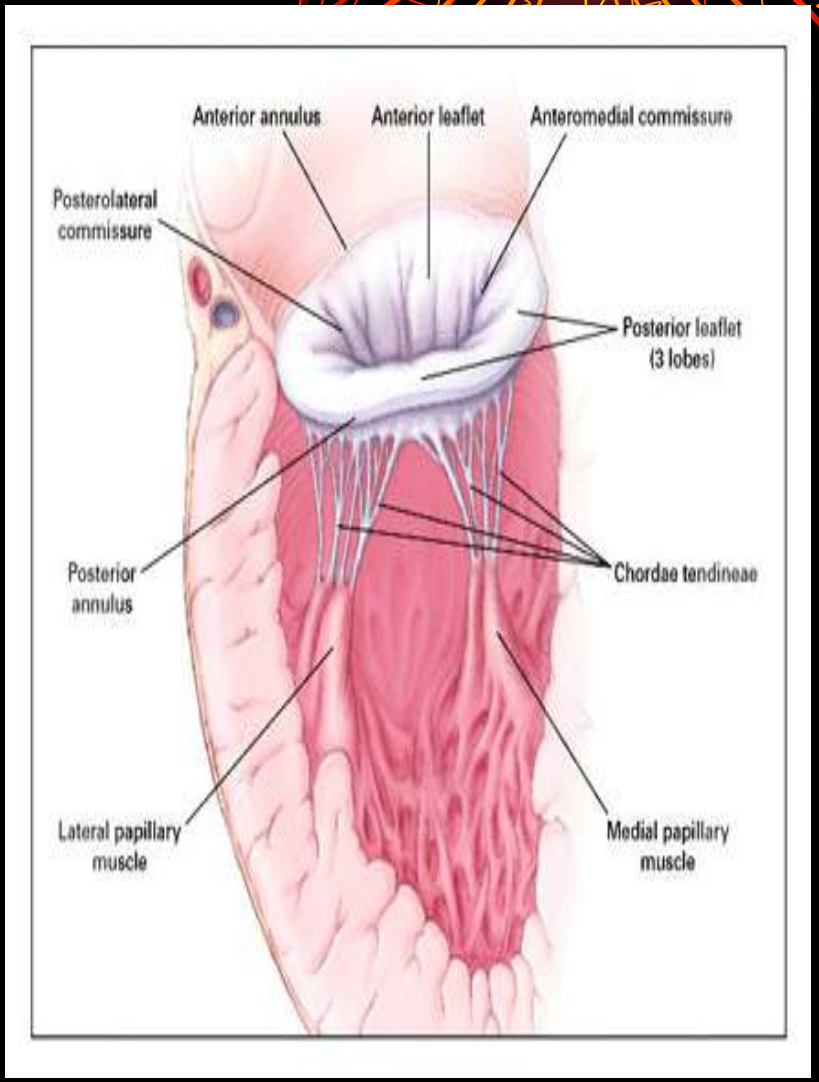
Mitral Valve

- Is also called the “Atrioventricular of the left ventricle.
- It is bicuspid with an anterior (aortic or septal) and a posterior (mural or ventricular leaflet)
- Has a cross sectional area of between
  4 – 6 cm^2

Mitral Valve

- **The anterolateral and posteromedial papillary muscles of the LV give rise to *chordae tendineae.***

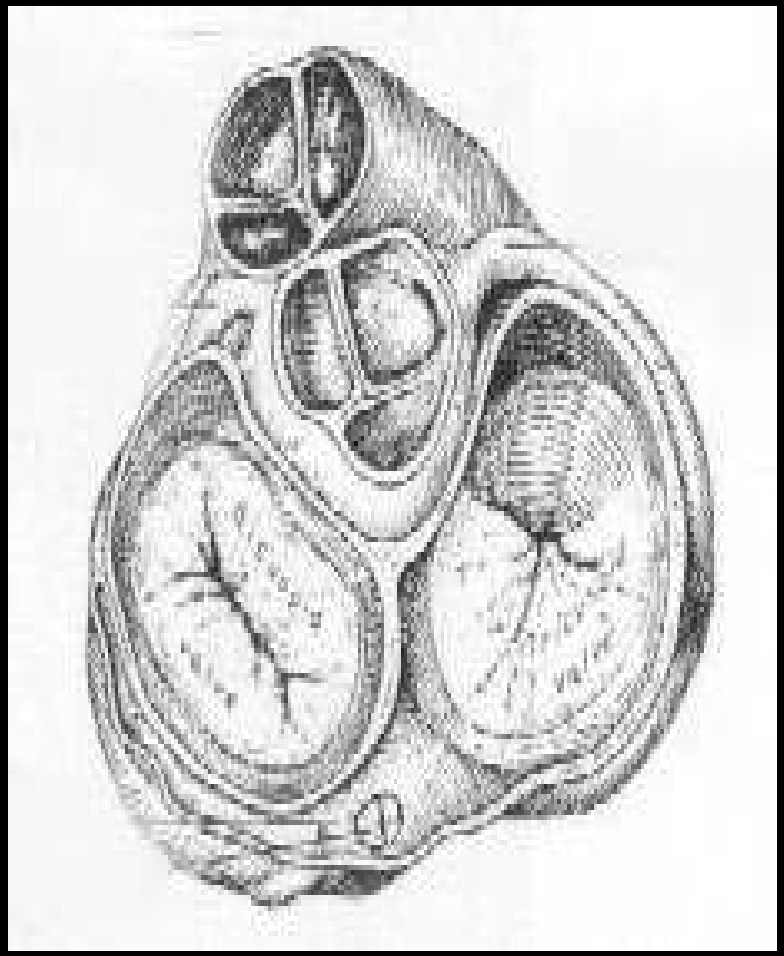
- **The mitral valve leaflets receive these chordae**



Mitral Valve

- The surgeon's view of the mitral valve as it is exposed through a left atriotomy.
- The two leaflets of the valve are apparent the anterior and posterior

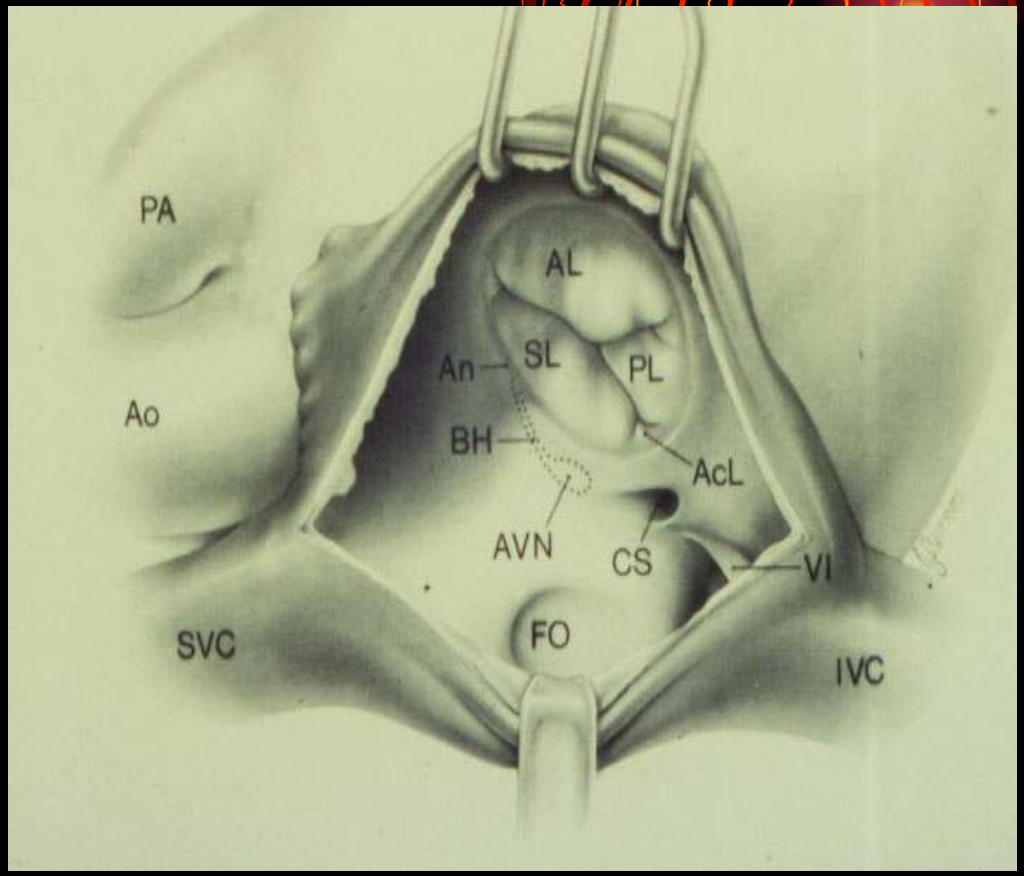
Aortic Valve



- **Normally is tricuspid & is composed of delicate cusps and sinuses.**

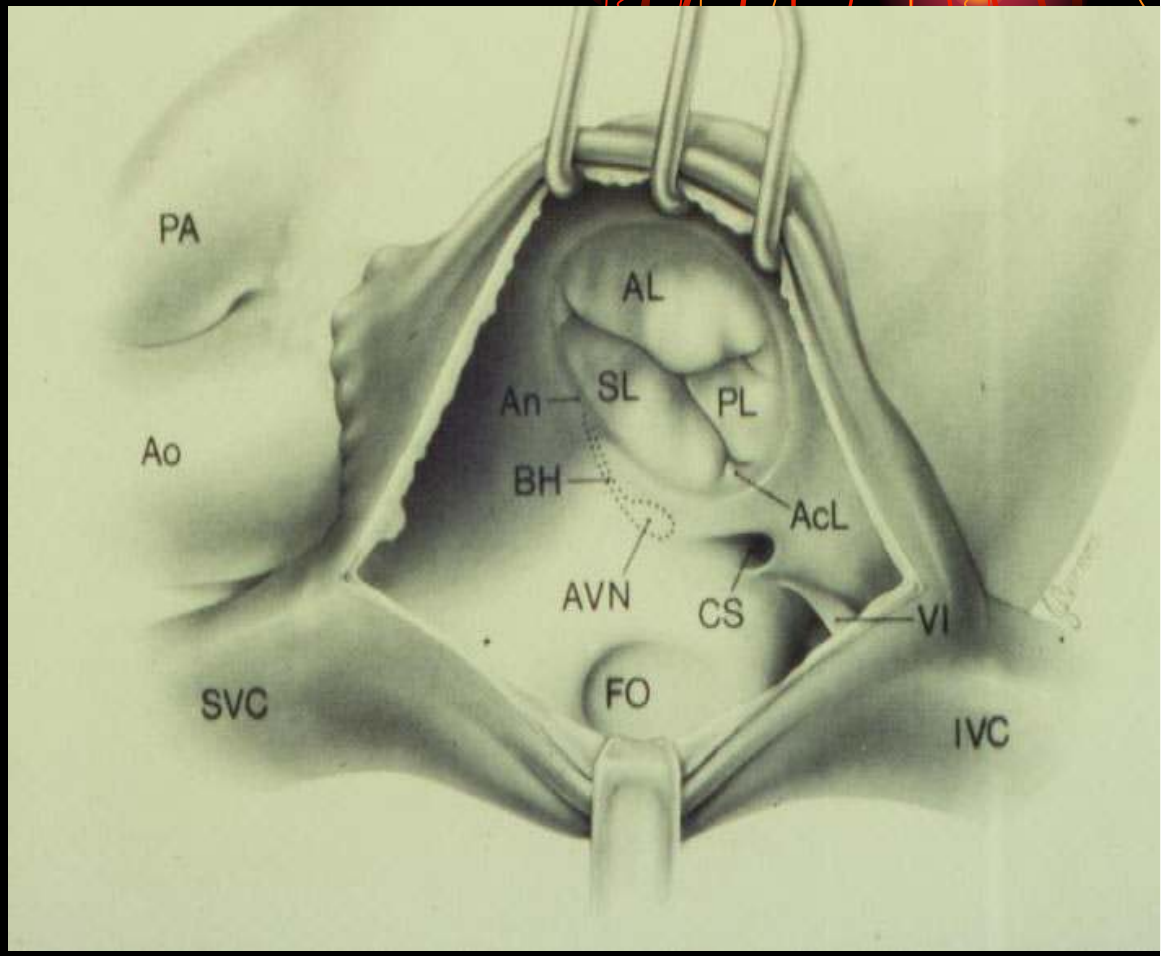
Tricuspid valve

- Is the atrioventricular valve of the right ventricle, has three leaflets.
- The tricuspid valve is larger than the mitral valve but the leaflets and chordae tendineae are thinner.

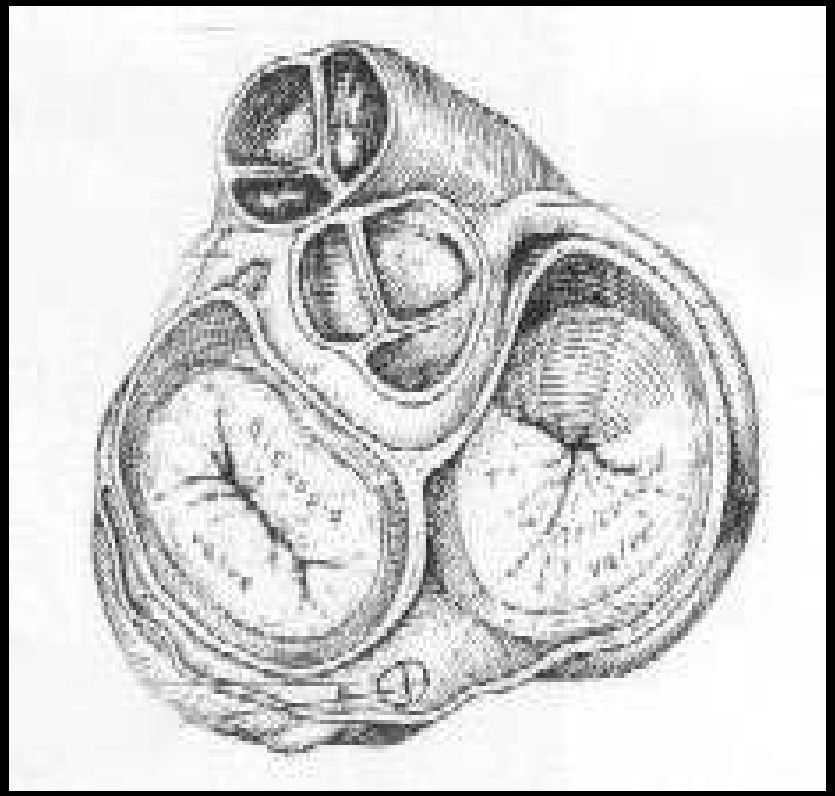


Tricuspid Valve

- The conduction system is close to the septal leaflet and its anteroseptal commissure



Pulmonary Valve



- Situated anterior, superior and slightly to the left of the aortic valve.
- The structure is similar to that of the aortic valve.

Coronary Arteries

From an anatomic point of view there are two right and left coronary systems.

Coronary Arteries

From surgical point of view it is divided into four parts.

1- Left Main (LM)

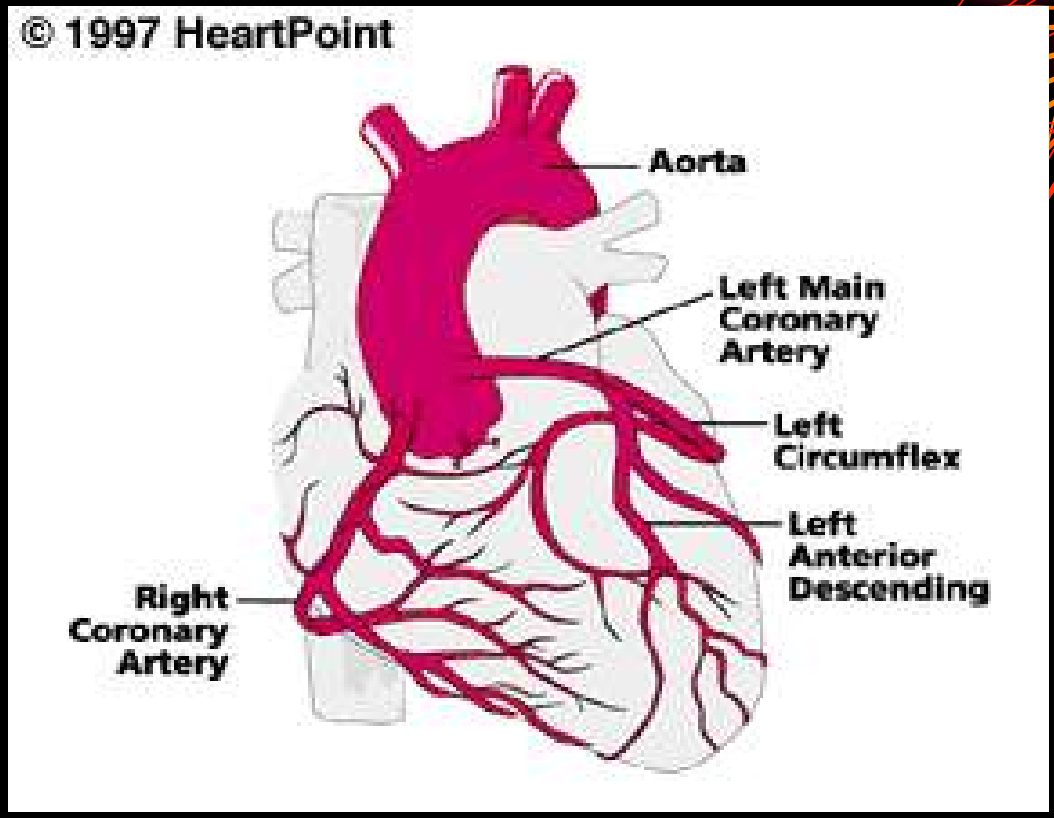
2- Left Anterior Descending (LAD) and its branches

3- Circumflex and its branches (OMs)

4- Right Coronary (RCA)and its branches

The Left Main Coronary Artery

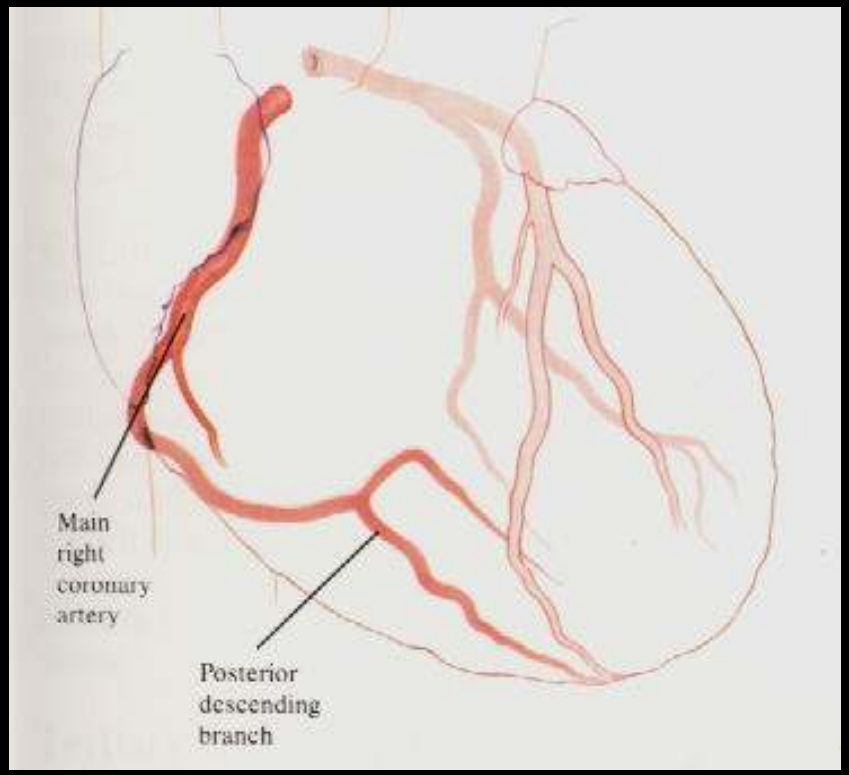
- Arises from the left sinus of Valsalva.
- Its usual length is 10 – 20 mm with a range of 0 – 40 mm.



The coronary circulation

Note that the coronaries supply the heart with blood during diastole, unlike any other organ !

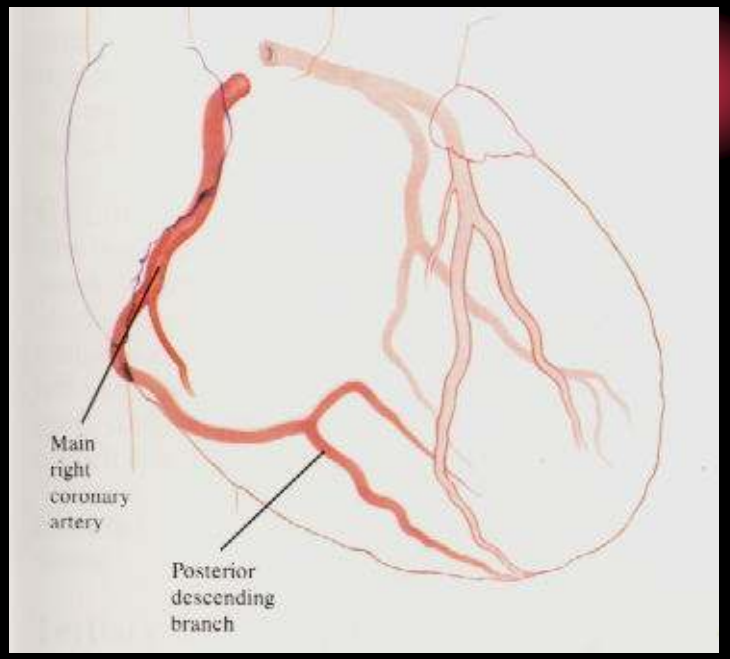
The Right Coronary Artery (RCA)



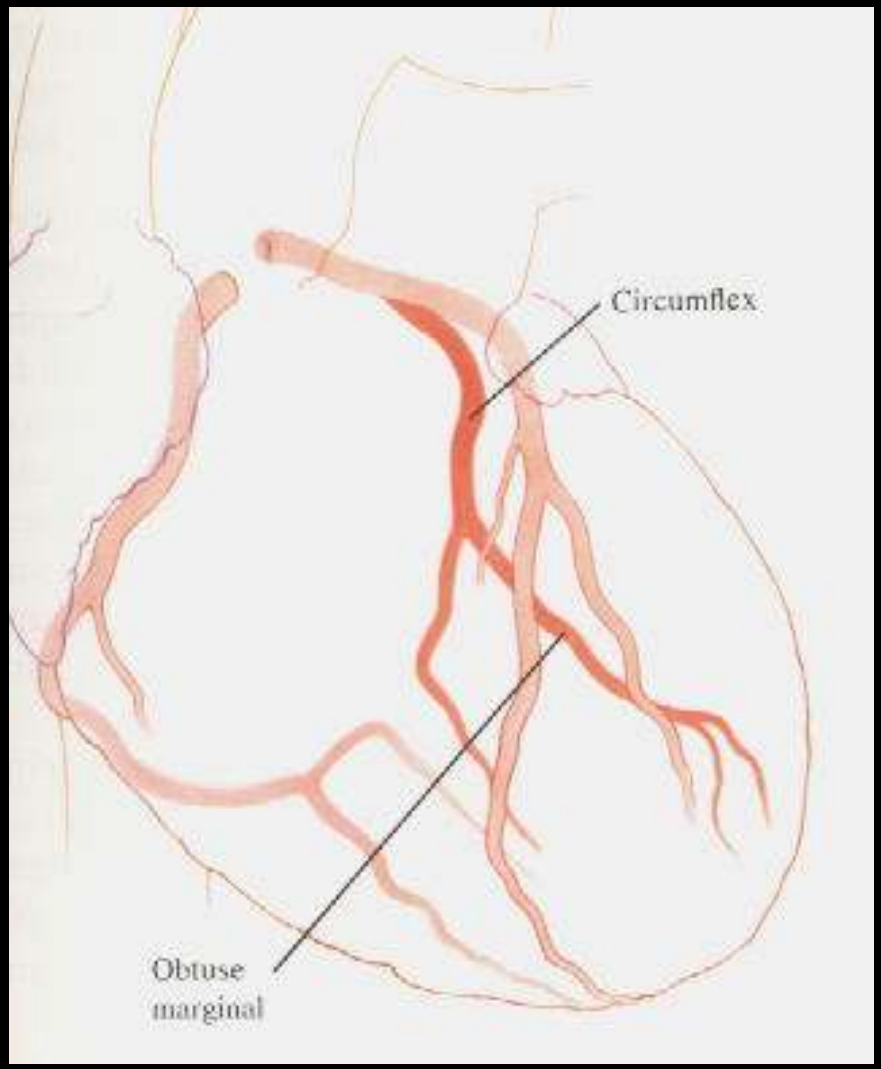
- Courses down along the atrioventricular groove.
- One of the branches is the right atrial artery that gives origin to the sinus node artery.

Right Coronary Artery (RCA)

- **It terminates by bifurcating into the right posterior descending artery (PDA) & the right posterolateral artery.**



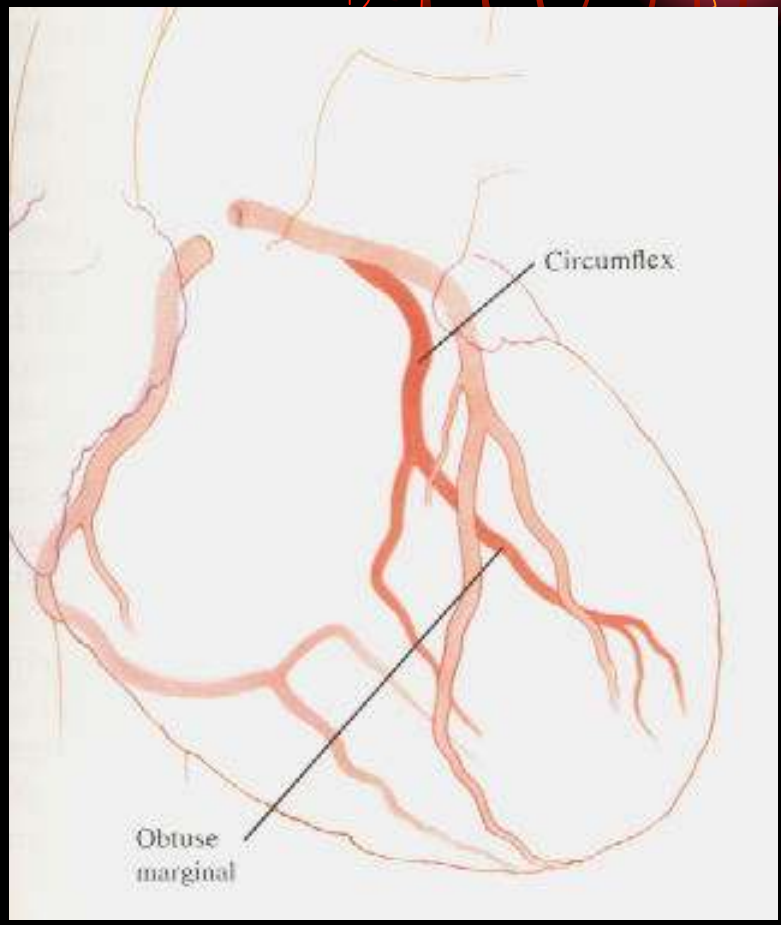
Left Circumflex Coronary Artery



- Originates from the left main at about a right angle.
- A large proximal branch is the atrial circumflex artery.

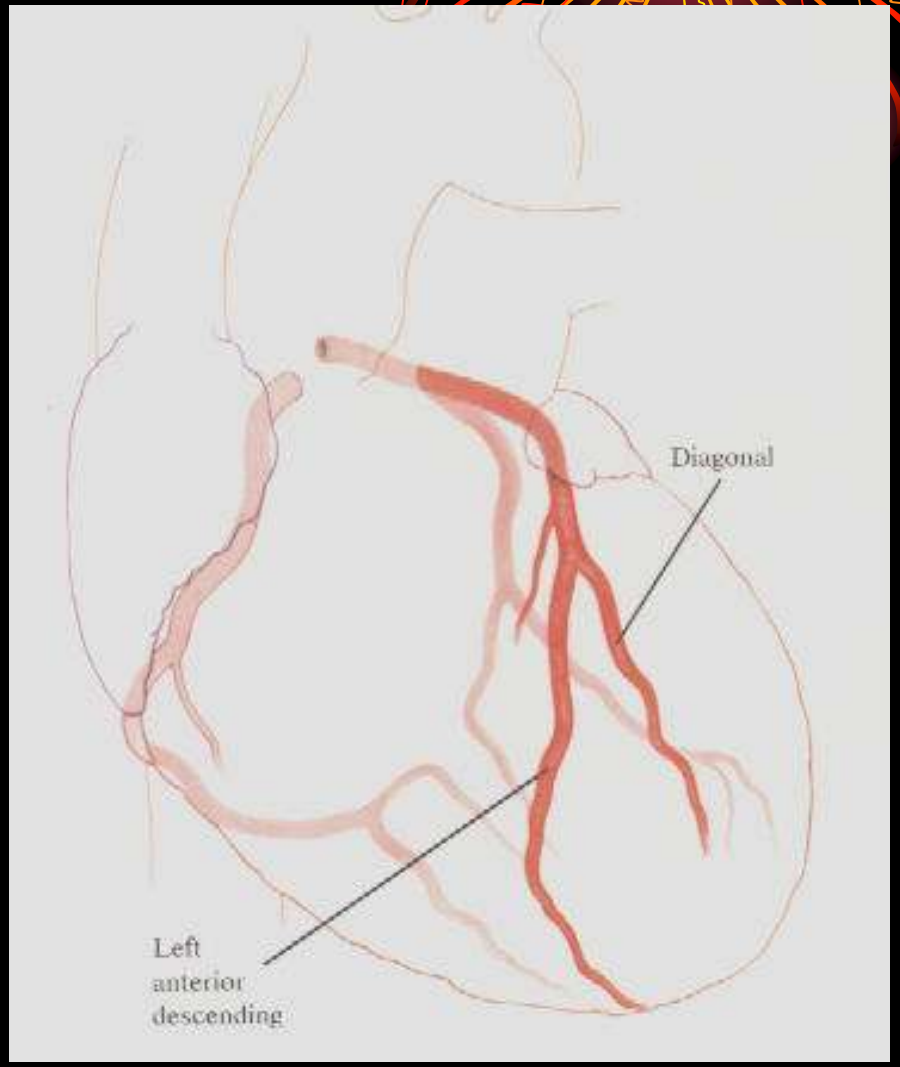
Left Circumflex Coronary Artery

- The ventricular branches are Obtuse Marginal Arteries
  (OMs).
- In left dominant systems it gives rise to the posterior descending artery



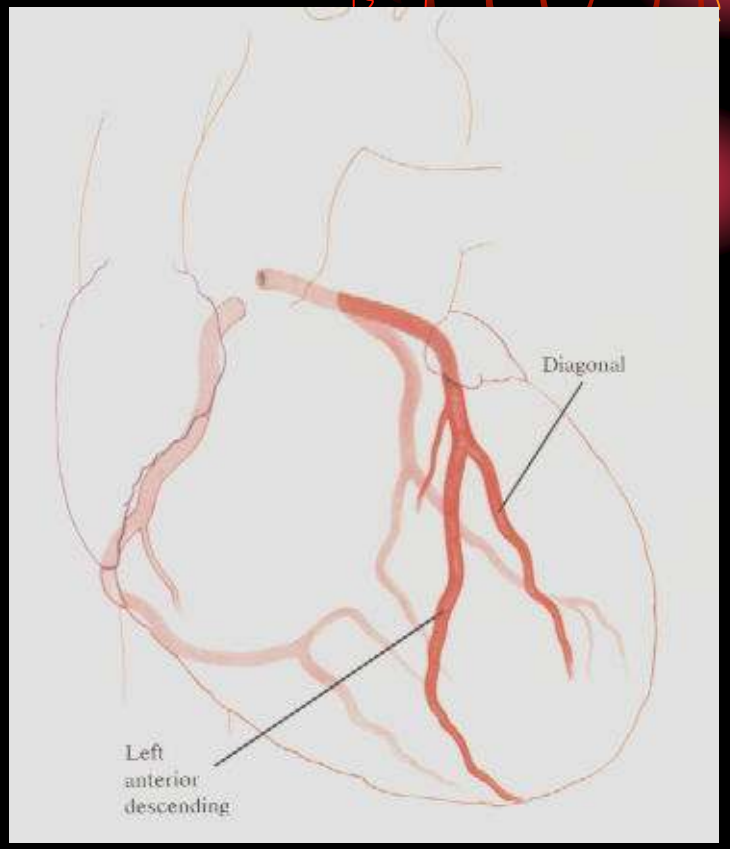
Left Anterior Descending Coronary Artery

- **Begins as a continuation of the left main courses along the anterior interventricular sulcus to the apex.**

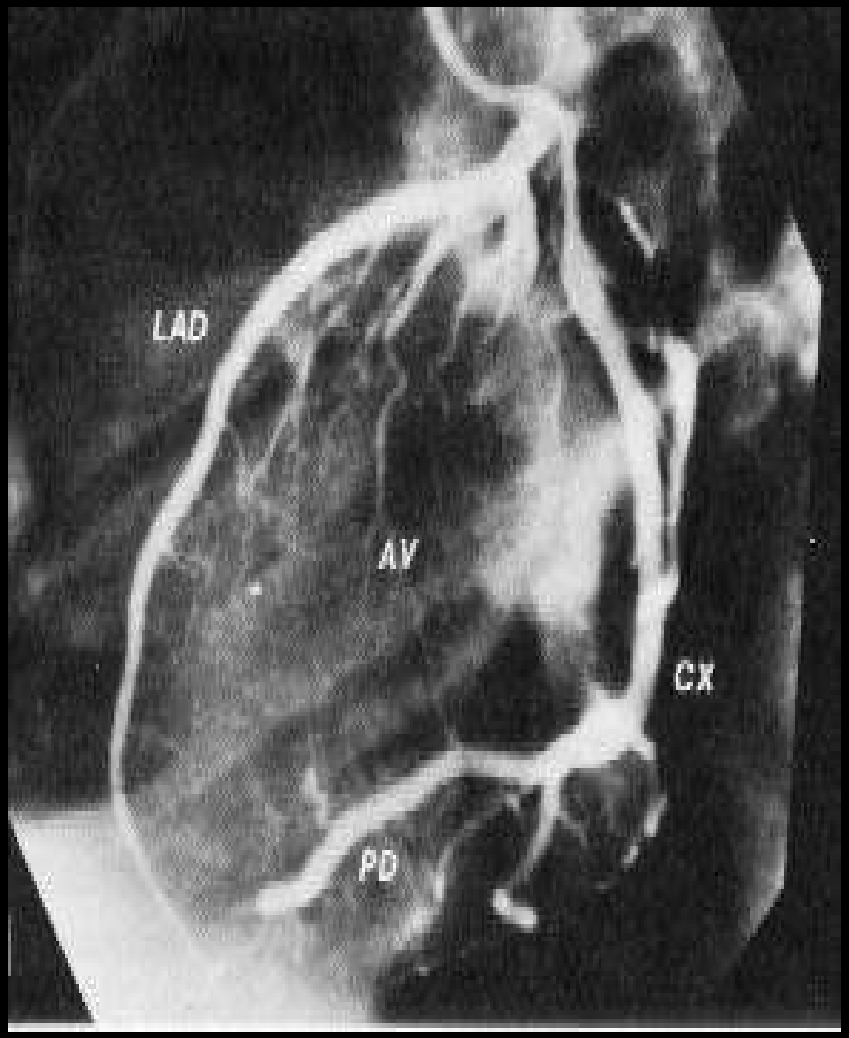


The Left Anterior Descending Coronary Artery

- Supplies branches to the LV free wall & to the IV septum.
- Has a variable number of diagonal branches that supply LV free wall anteriorly and laterally.



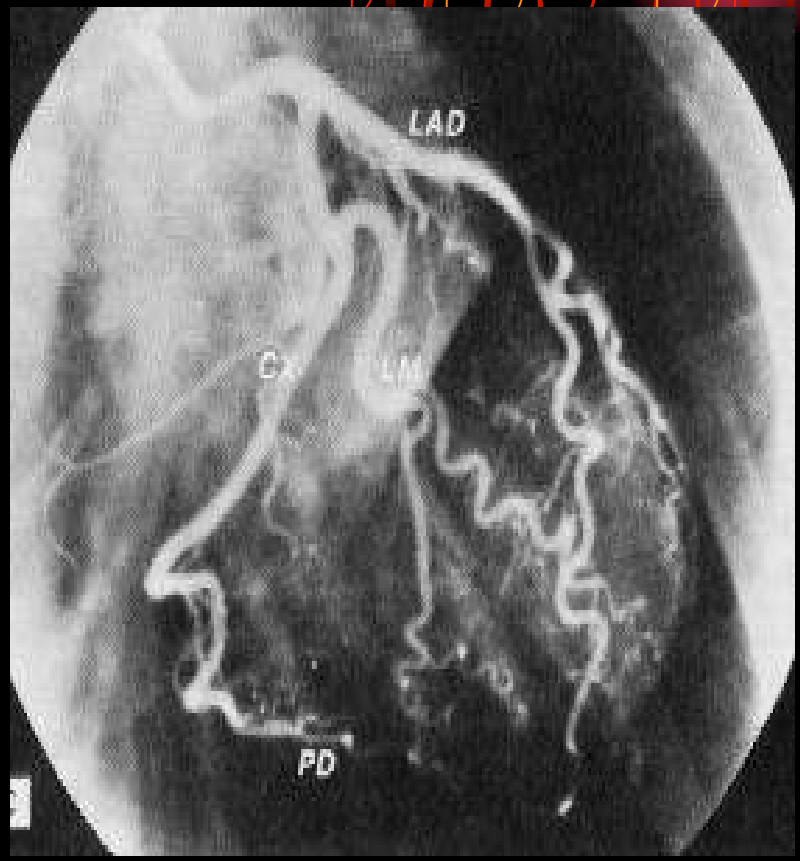
Coronary Angiogram



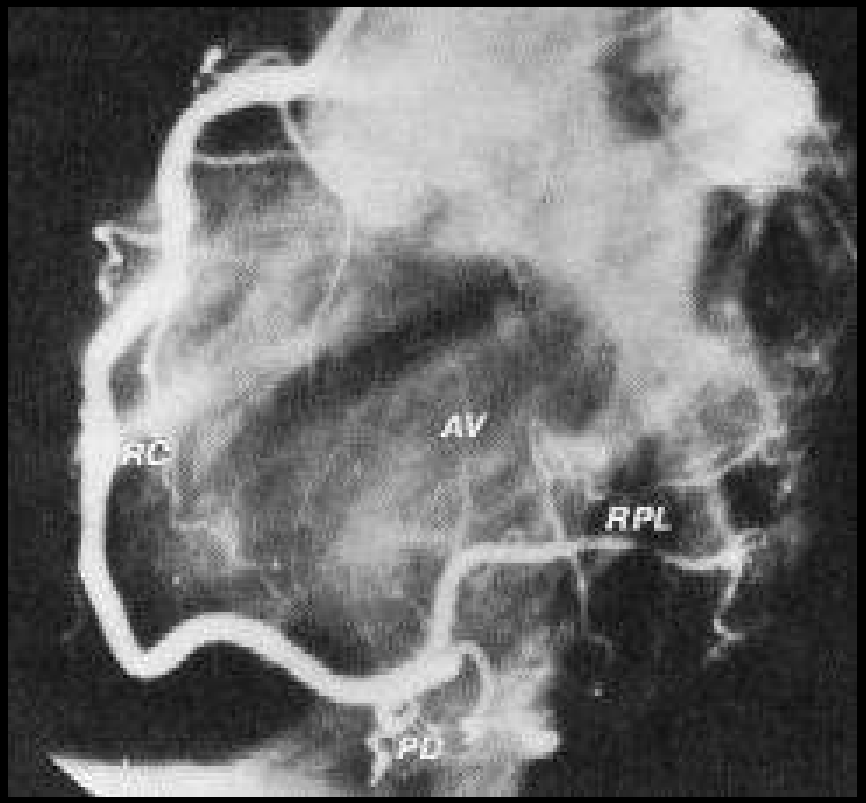
- **Left coronary injection in the Left Anterior Oblique (LAO) projection.**

Coronary Arteriogram

- **Left coronary injection in the RAO projection.**



Coronary Arteriogram



- Right coronary injection in the LAO projection