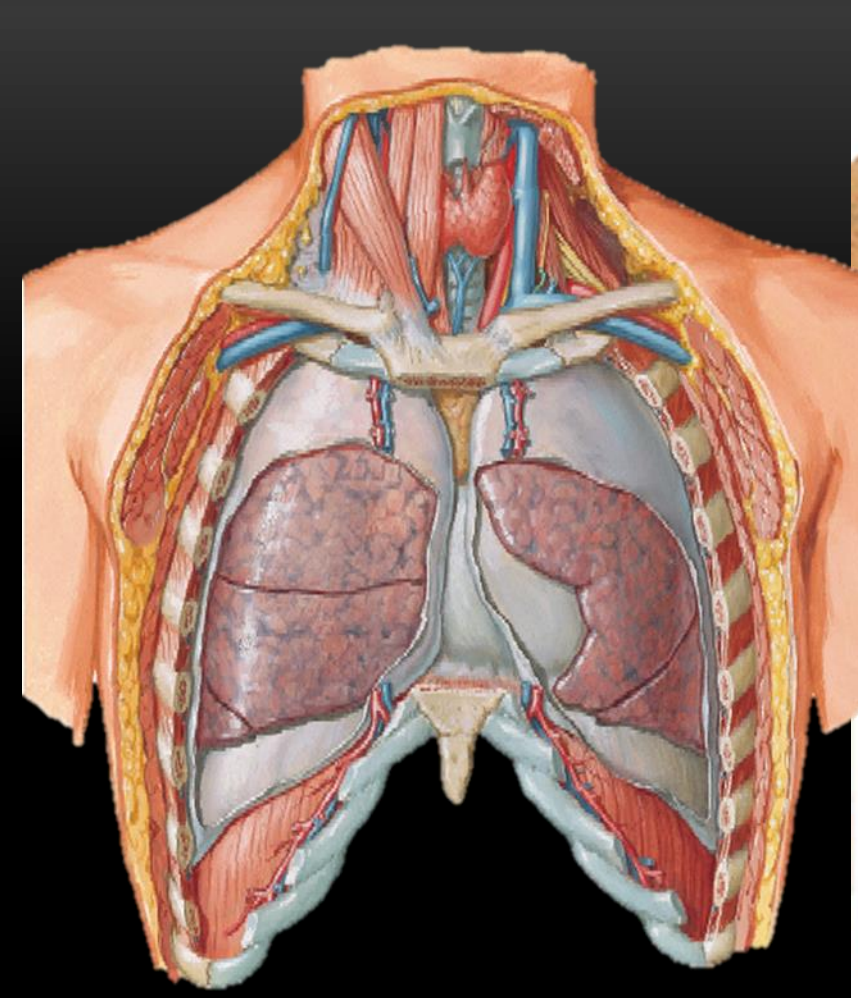
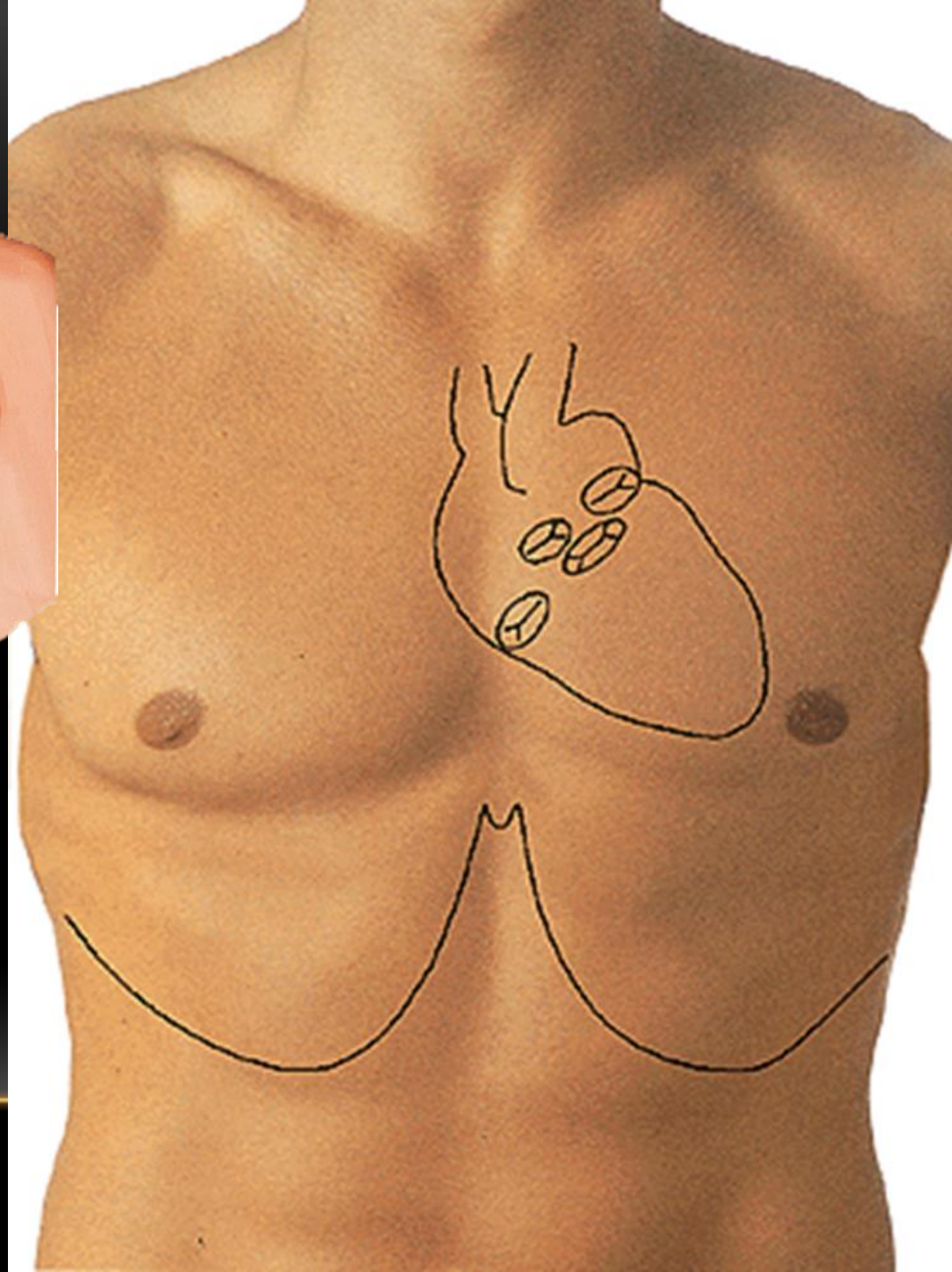
Pericardium and Heart



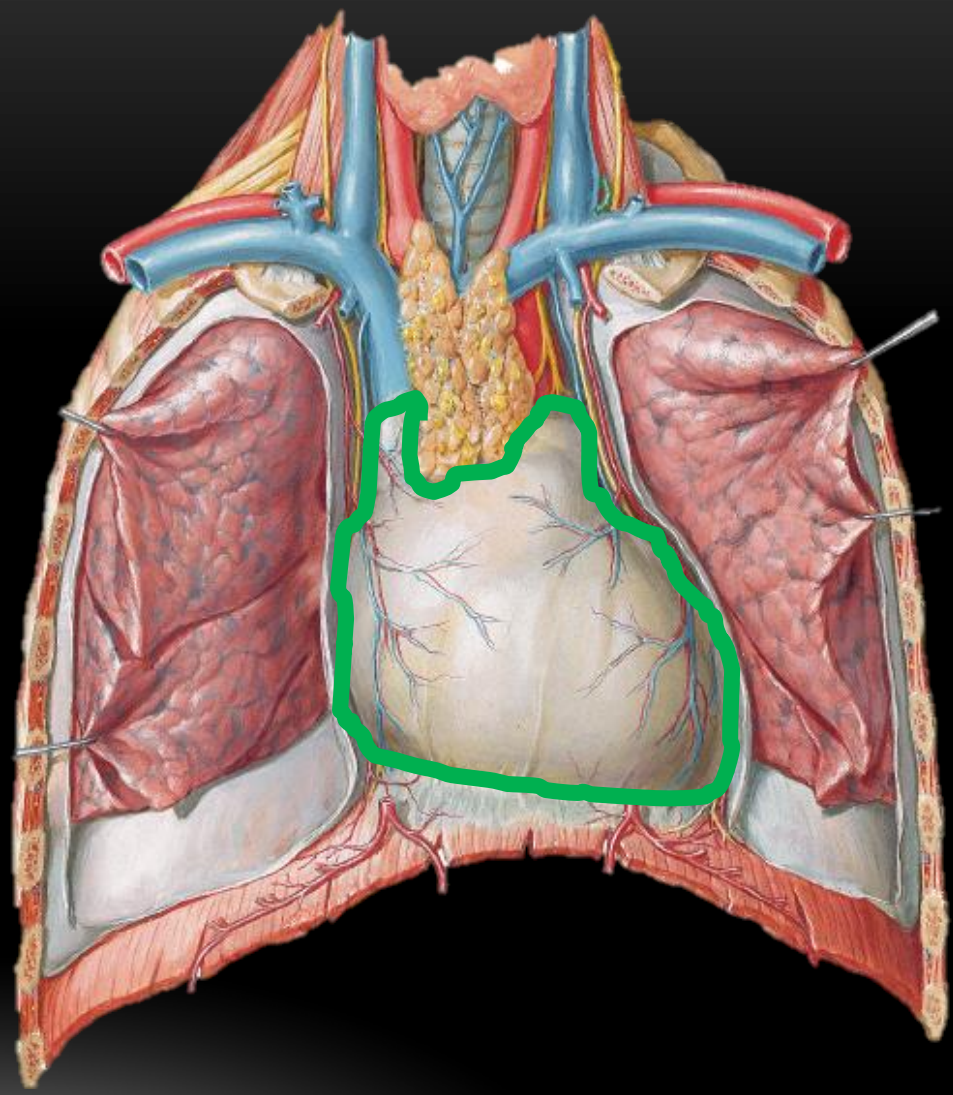


Pericardium

Conical fibroserous sac which contains the heart and the roots of the great vessels in the middle mediastinum.

It is formed of 2 sacs:

- Outer fibrous
- Inner serous:
  - Parietal pericardium
  - Visceral pericardium



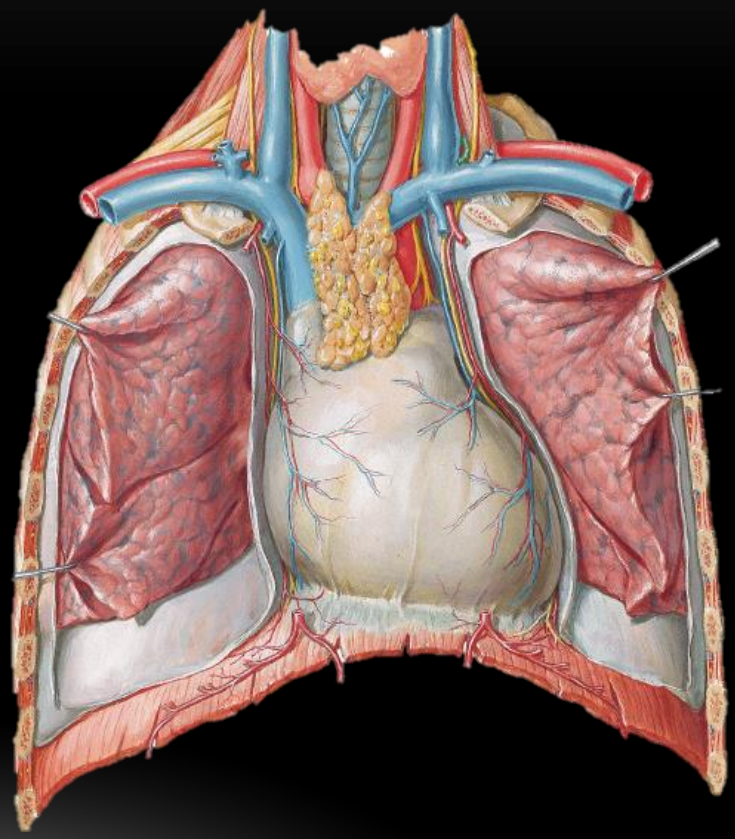
Fibrous Pericardium

It is the most superficial layer of the pericardium.

It is made up of dense connective tissue which acts to:

- Protect the heart
- Anchoring it to the surrounding walls, and preventing it from overfilling with blood.
- Checks down the upward movement of the heart

It is fused with the central tendon of the diaphragm and continuous with the outer adventitial layer of the neighboring great blood vessels.

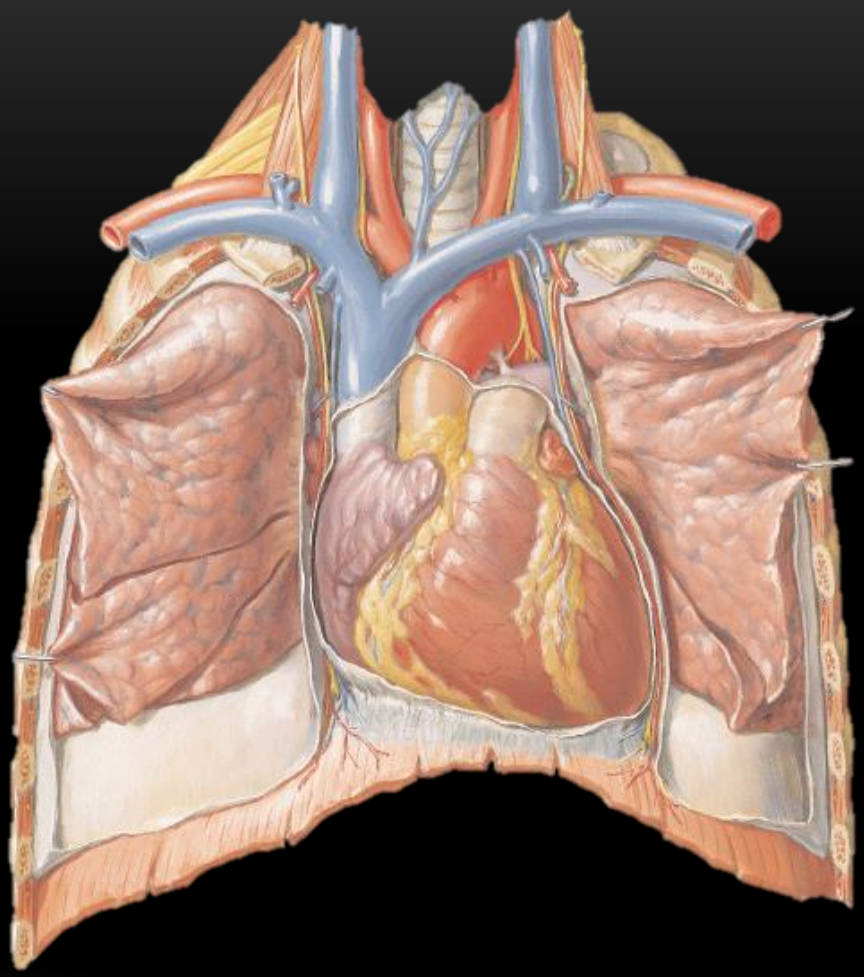


Relations of the pericardium..1/2

Anteriorly:

- Lung and pleurae separating it from the thymus.
- Body of the sternum
- Cartilage of 2-6 ribs

On the left side the pericardium is closely related to the lower part of the sternum and the left 4^{th} and 5^{th} costal cartilages.



Relations of the Pericardium..2/2

Posteriorly:

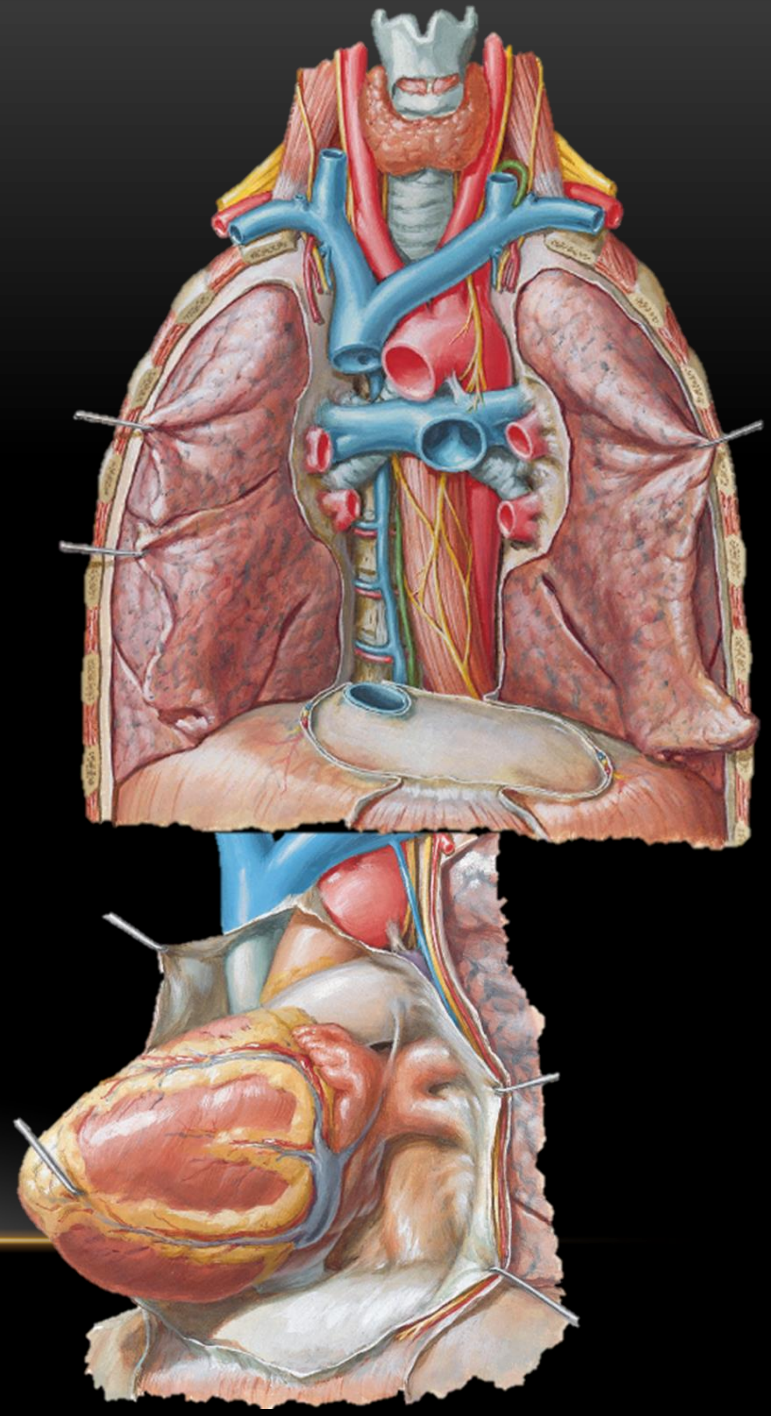
- Bronchi
- Oesophagus
- Oesophageal plexus
- Descending aorta
- T5-T8 vertebra

Inferiorly:

- Diaphragm

Laterally:

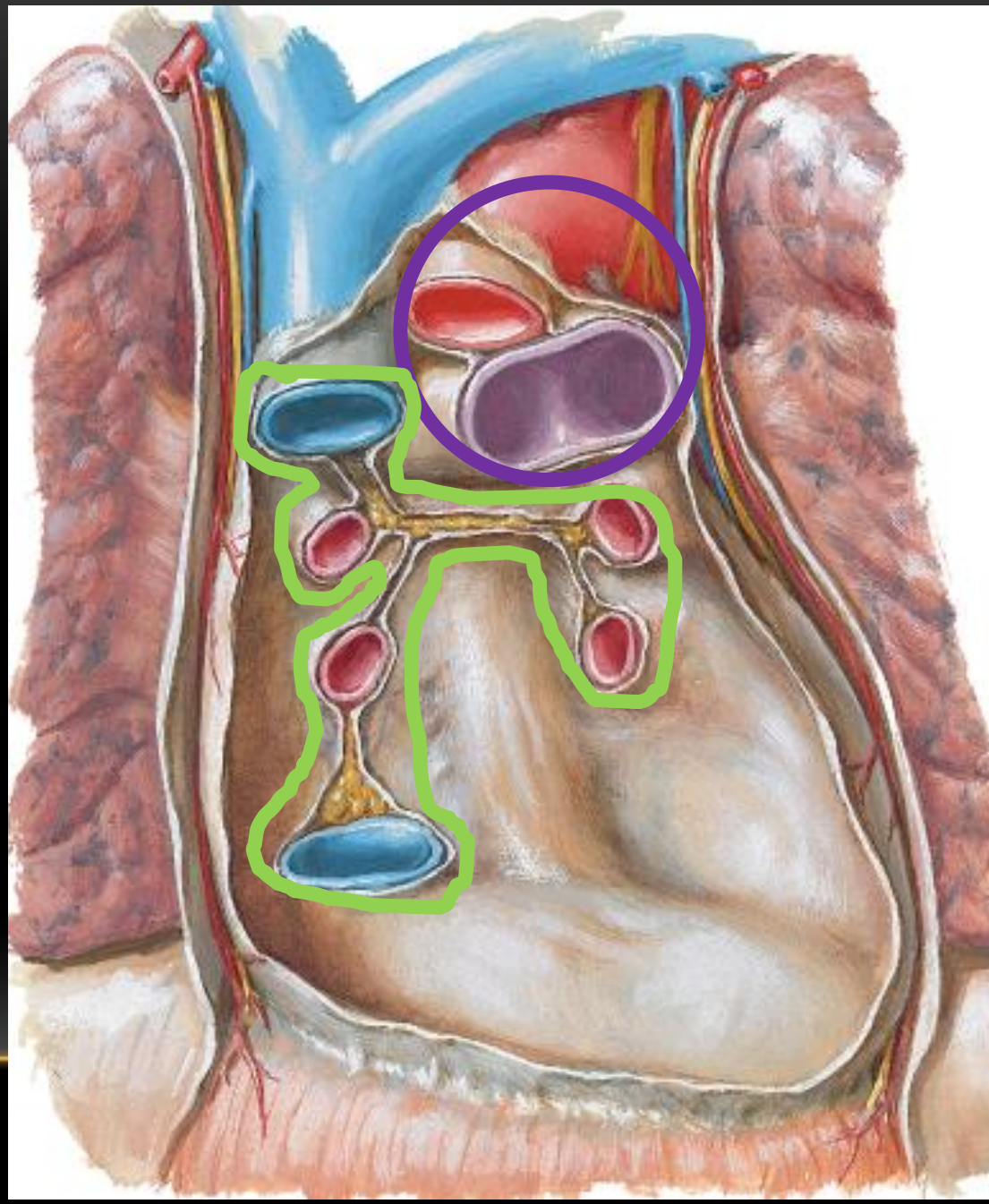
- Pleura and mediastinal surfaces of both lungs
- Phrenic nerves and musculophrenic vessels



Visceral Pericardium1/2..

Formed of two tubes:

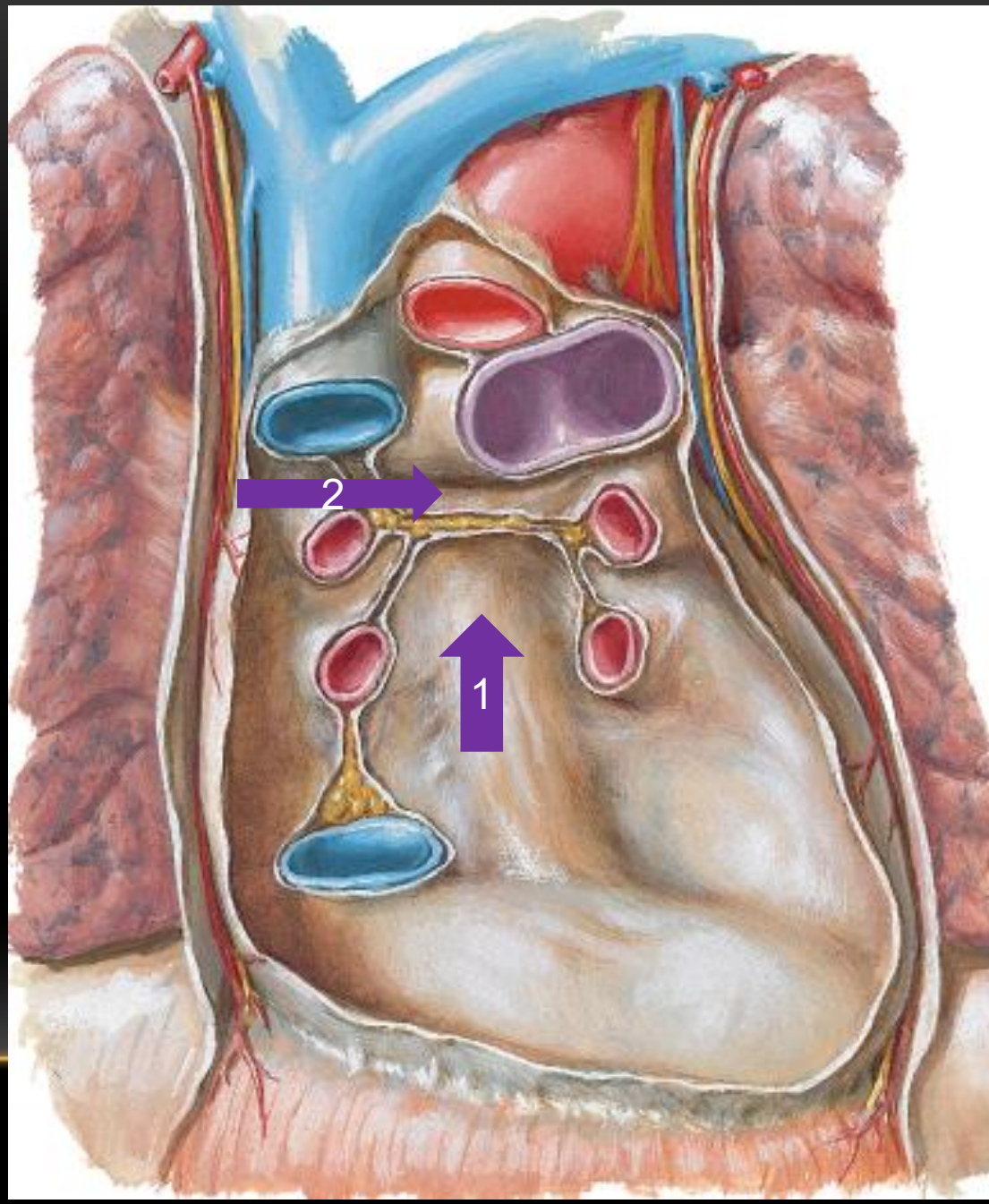
- 1st tube: closes the aorta and pulmonary trunk
- 2nd tube: closes the S.V.C, I.V. C and the 4 pulmonary veins and shows two sinuses:
  - Oblique
  - Transverse

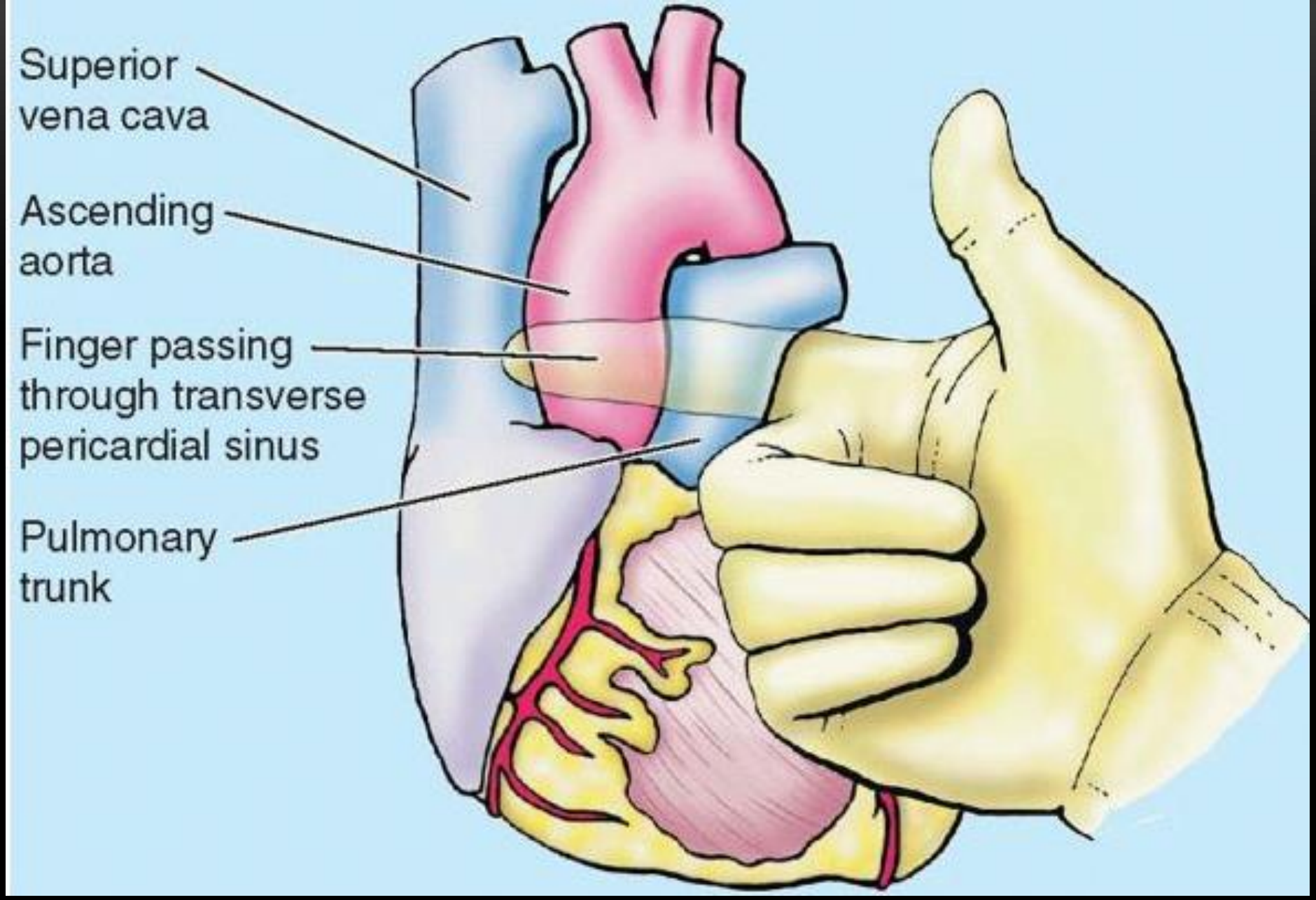


Visceral Pericardium2/2..

<u>The Oblique Sinus (1)</u>: lies behind the left atrium and the pericardium.

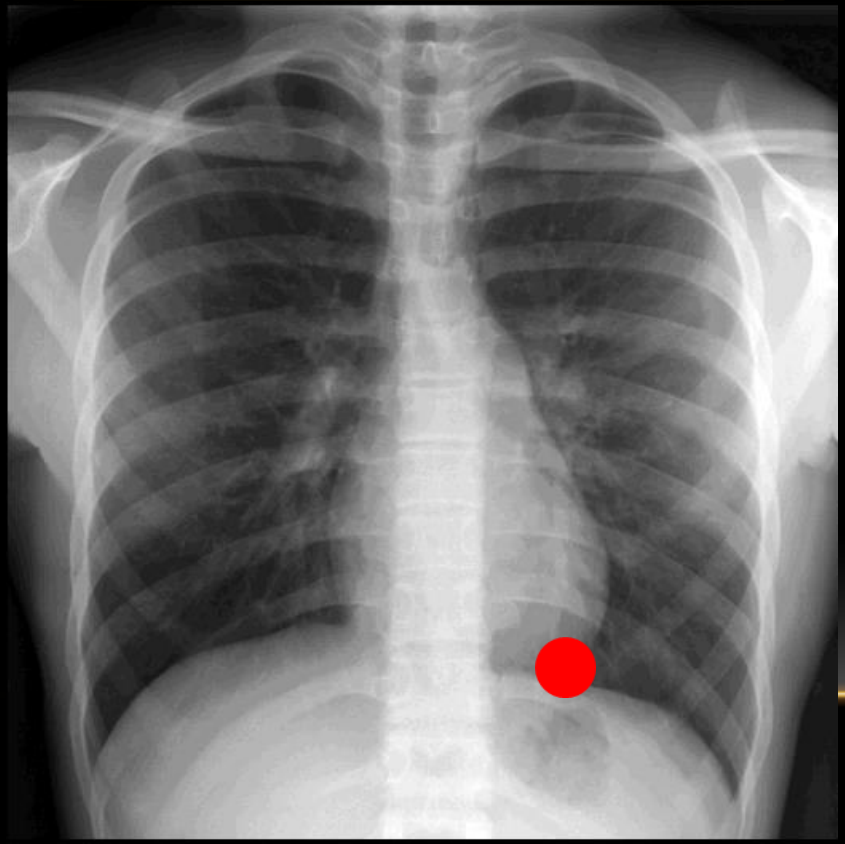
<u>The Transverse sinus (2)</u>: lies between the ascending thoracic aorta, pulmonary trunk and the left atrium .

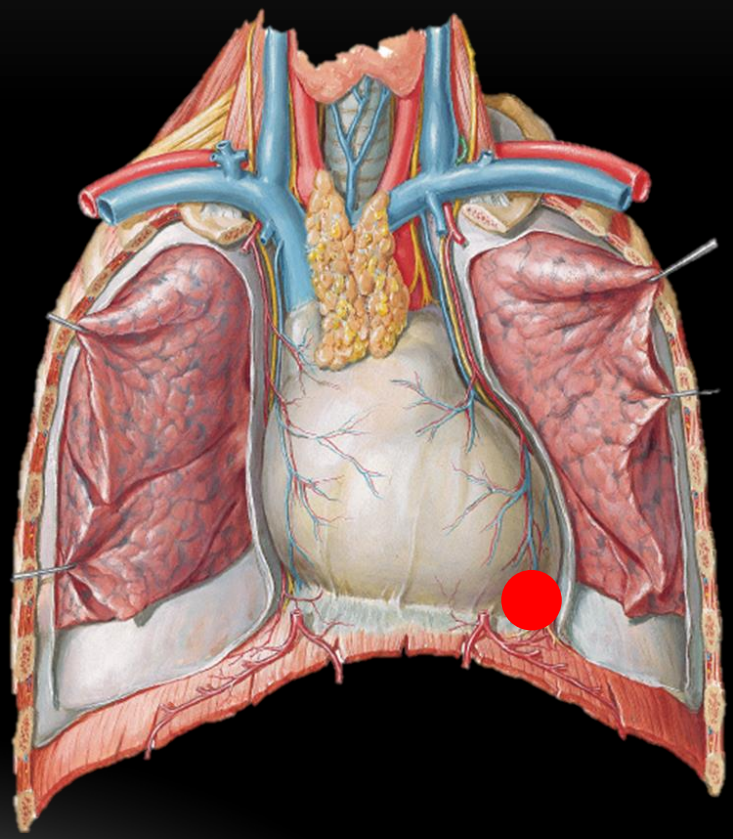



Superior vena cava
Ascending aorta
Finger passing through transverse pericardial sinus
Pulmonary trunk

The Heart, General Considerations..1/5

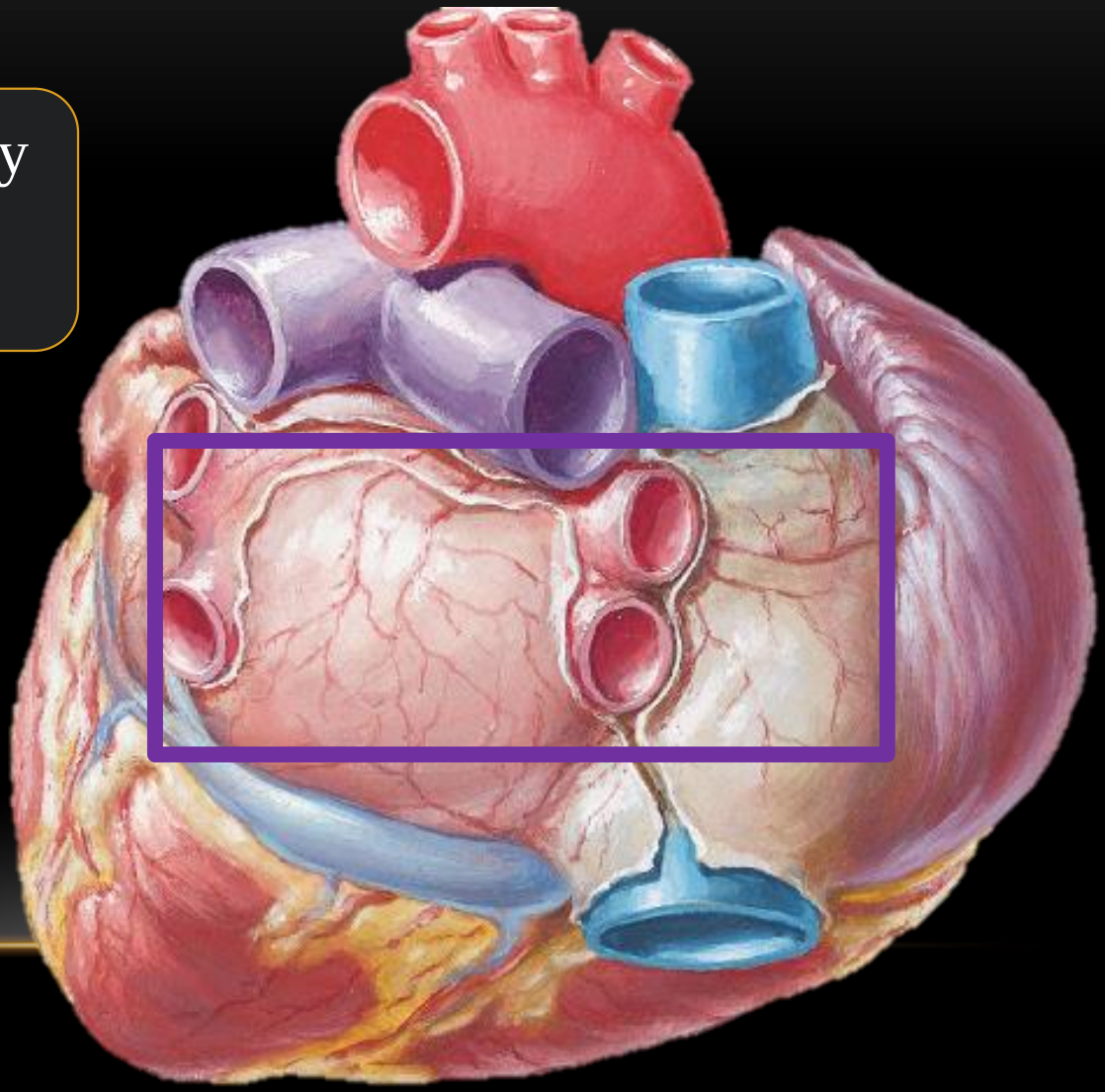
The APEX: lies in the 5th intercostal space, slightly medial to the mid clavicular line, 9 cm from the midline. This point is important for auscultating the mitral valve.





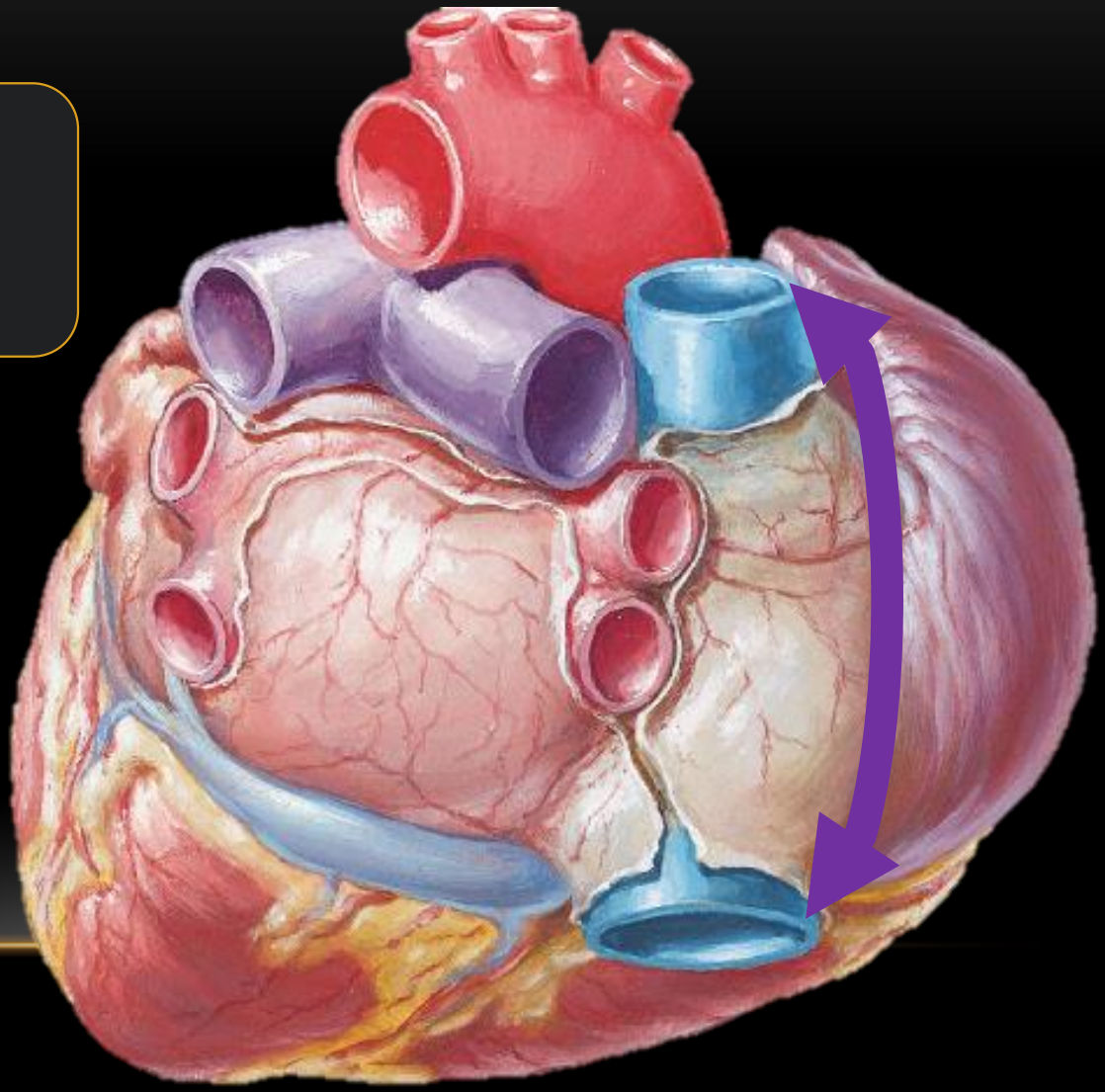
The Heart, General Considerations ..2/5

The BASE: formed mainly by the left atrium and part of the right atrium



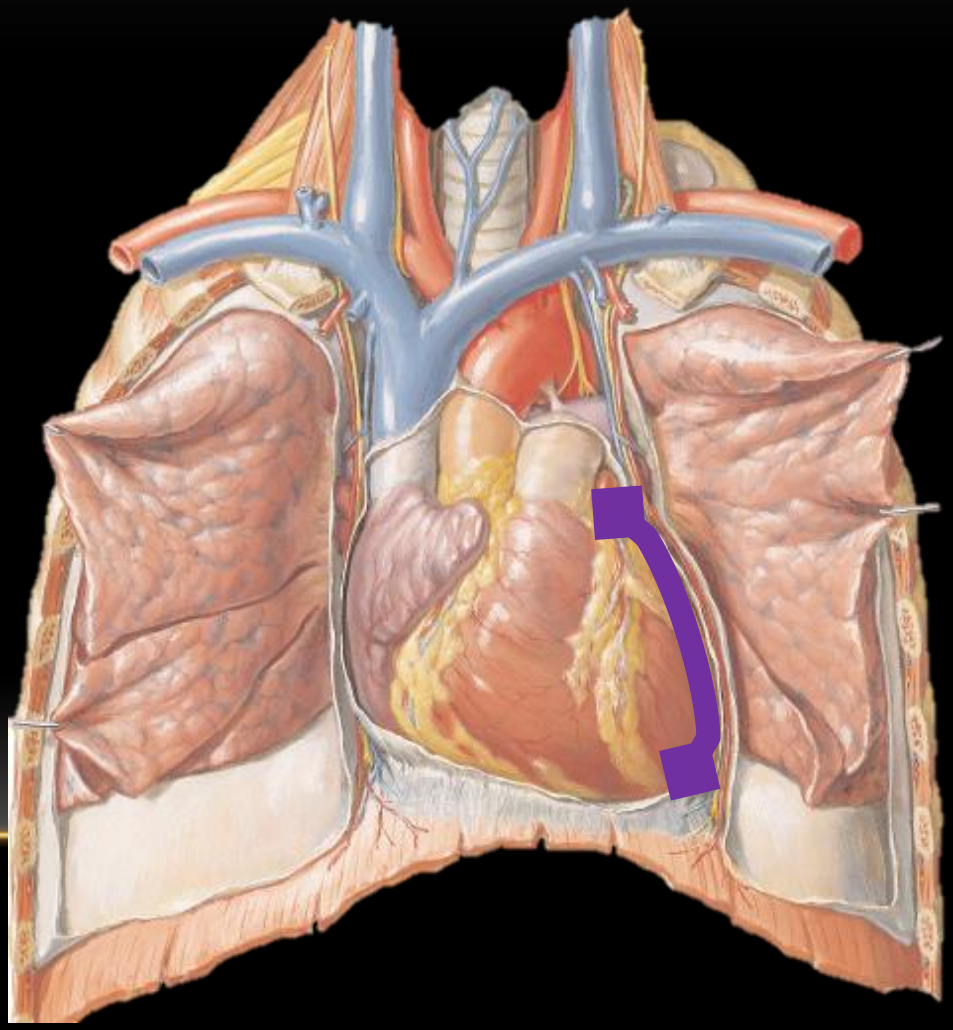
The Heart, General Considerations ..3/5

The RIGHT BORDER:
formed by the S.V.C,
right atrium and I.V.C.



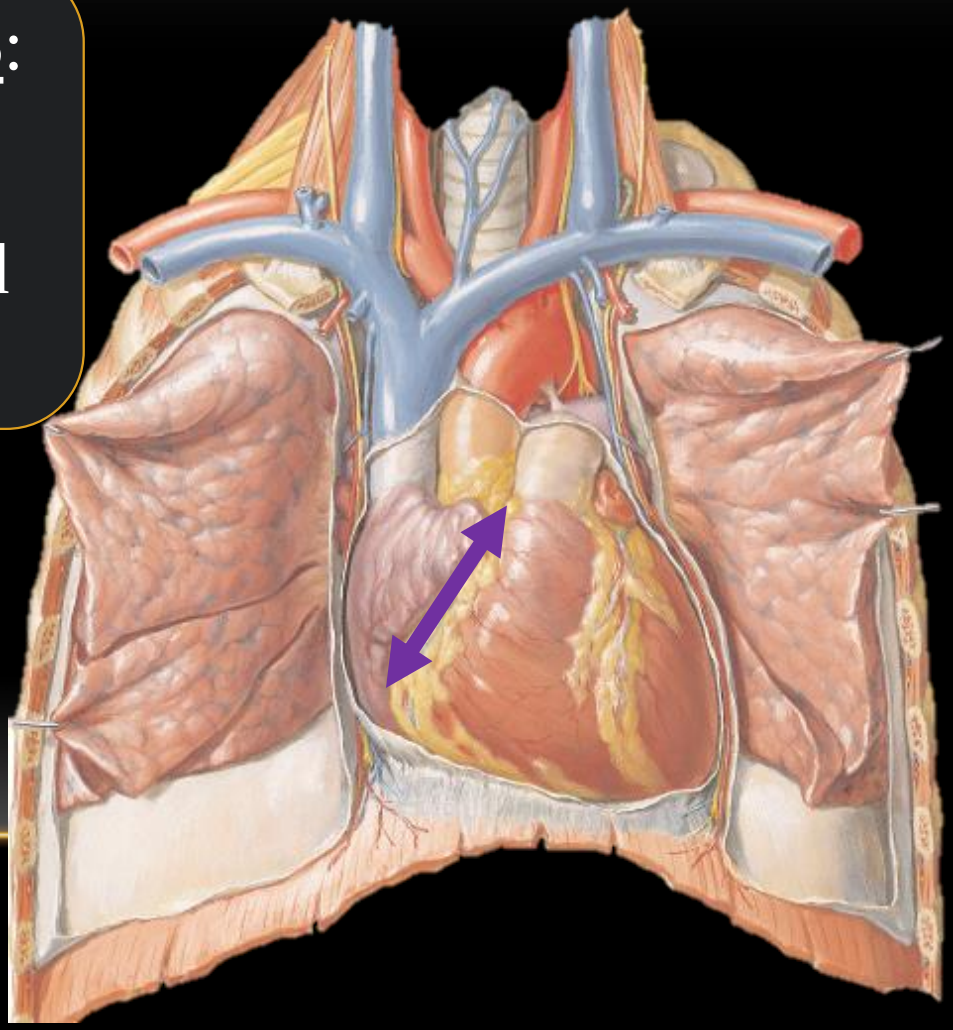
The Heart, General Considerations ..4/5

The LEFT BORDER:
formed the left ventricle.



The Heart, General Considerations ..5/5

The CORONARY SULCUS: a groove on the external surface of the heart marks the division between the atria and the ventricles.



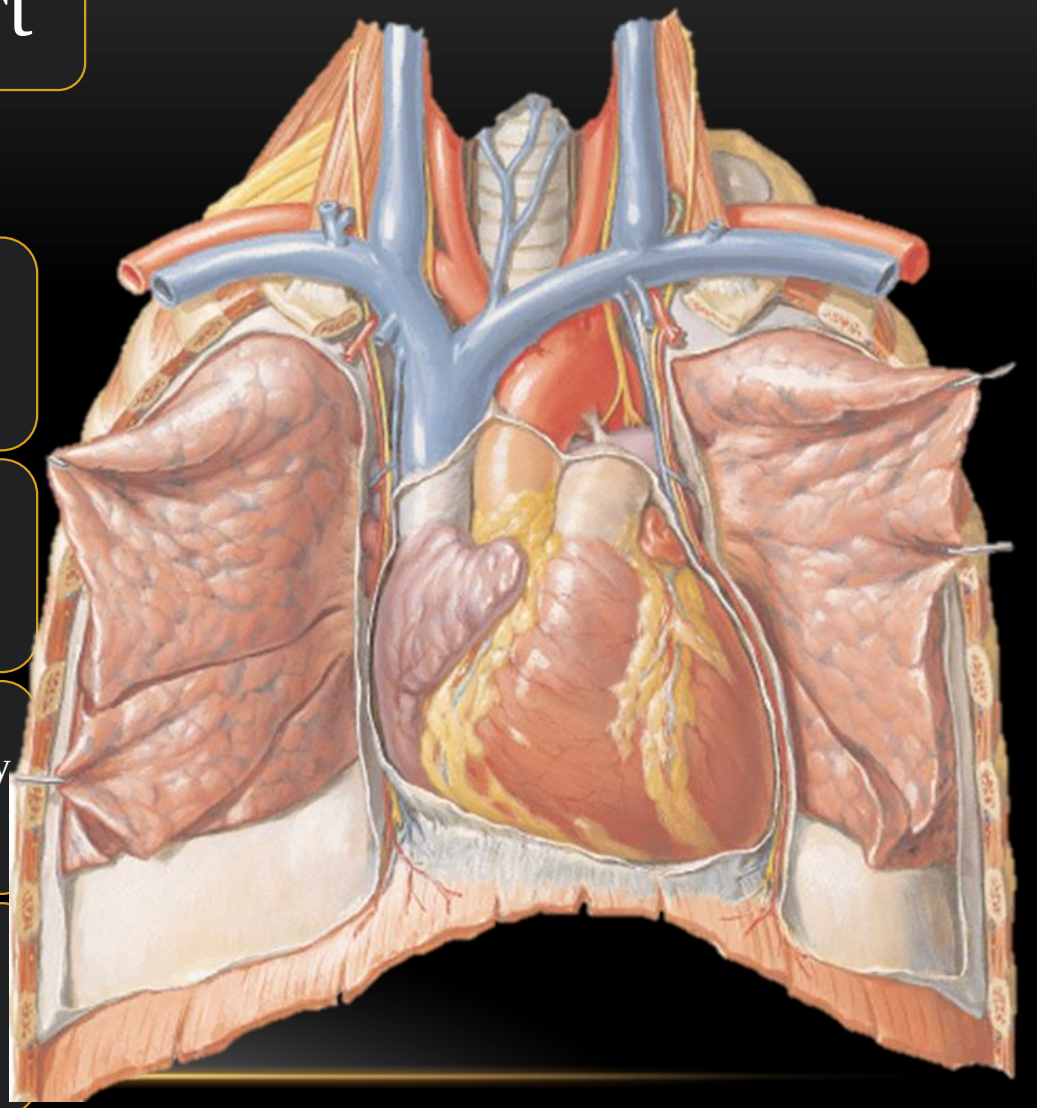
Surfaces of the Heart

Anterior (sternocostal) surface, formed mainly by the right ventricle.

Diaphragmatic (inferior) surface, formed mainly by the left ventricle and partly by the right ventricle; it is related mainly to the central tendon of the diaphragm.

Right pulmonary surface, formed mainly by the right atrium.

Left pulmonary surface, formed mainly by the left ventricle; it forms the cardiac impression in the left lung.



Surface anatomy of the Heart

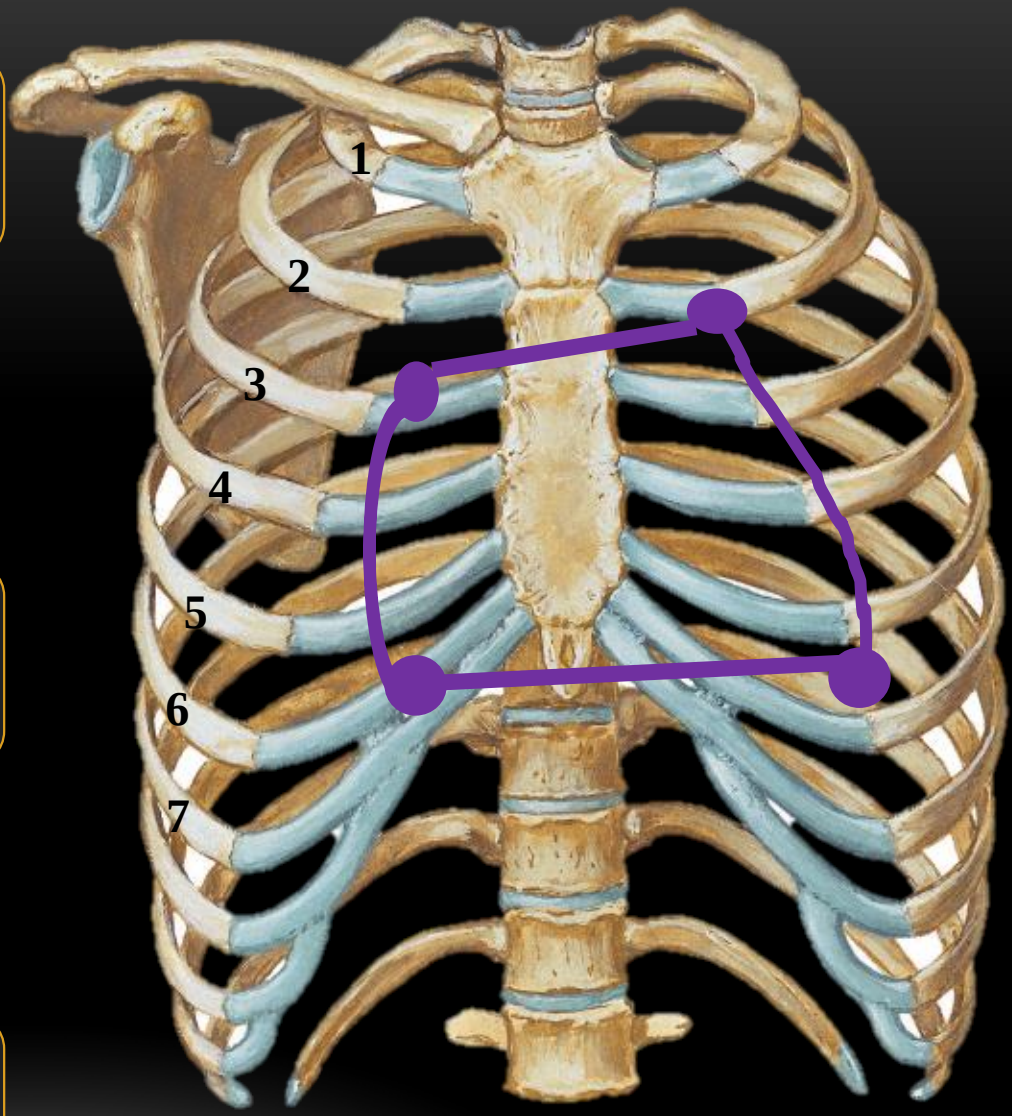
Right border: a curved line on the right side between:

- Upper border of the 3rd costal cartilage 3cm from midline, and
- 6th costal cartilage 3cm from midline

Left border: a curved line on the left between:

- Lower border of the 2nd costal cartilage 4cm from midline
- 5th left intercostal space 9cm from midline

Upper and lower borders: join corresponding points



Heart Valves and Their Surface Projections

Pulmonary Valve (P):

- At the 3rd left sternocostal junction
- Heard at the 2nd left space

Aortic Valve (A):

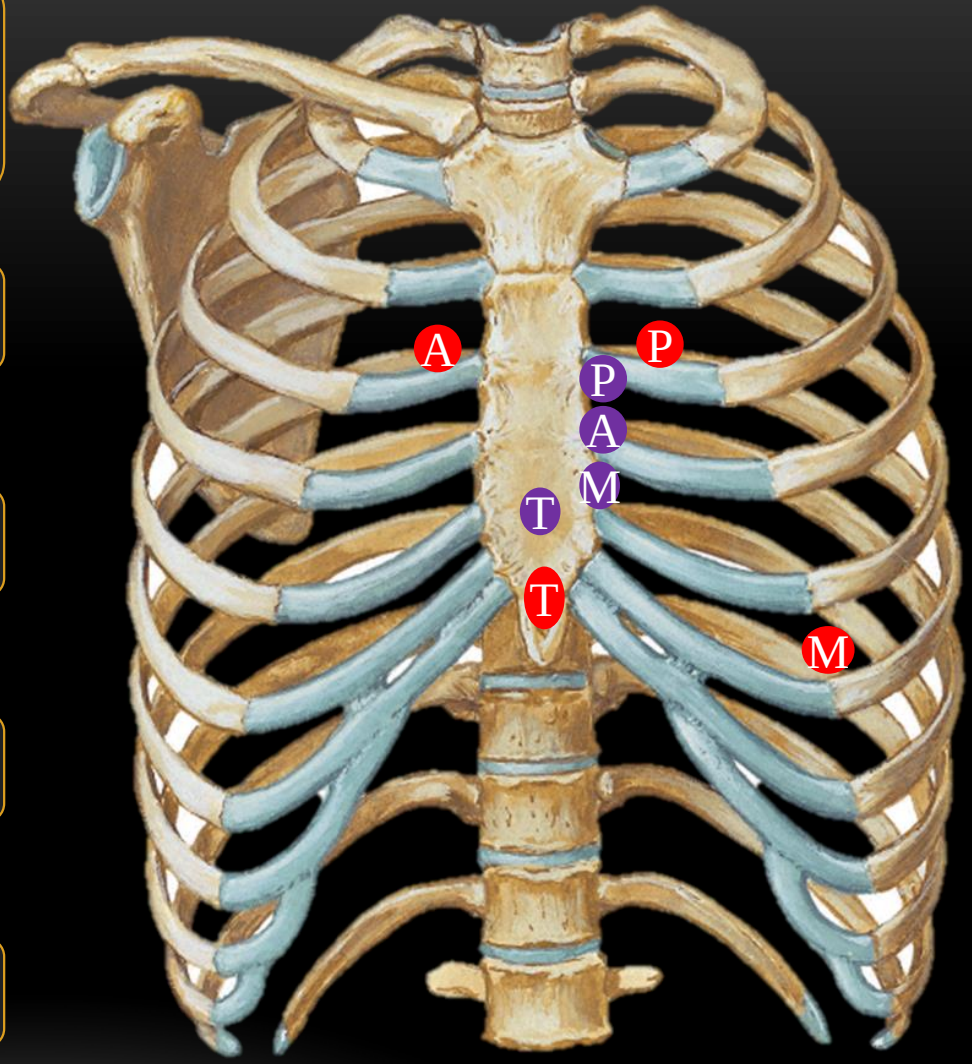
- 3rd space at the left sternal border
- Heard at the 2nd right space

Mitral Valve (M):

- At the 4th left intercostal space
- Heard at the apex of the heart

Tricuspid Valve:

- At the level of the 4th space behind the sternum
- Heard at the xiphesternal junction



Internal Anatomy of the Heart

Right Atrium

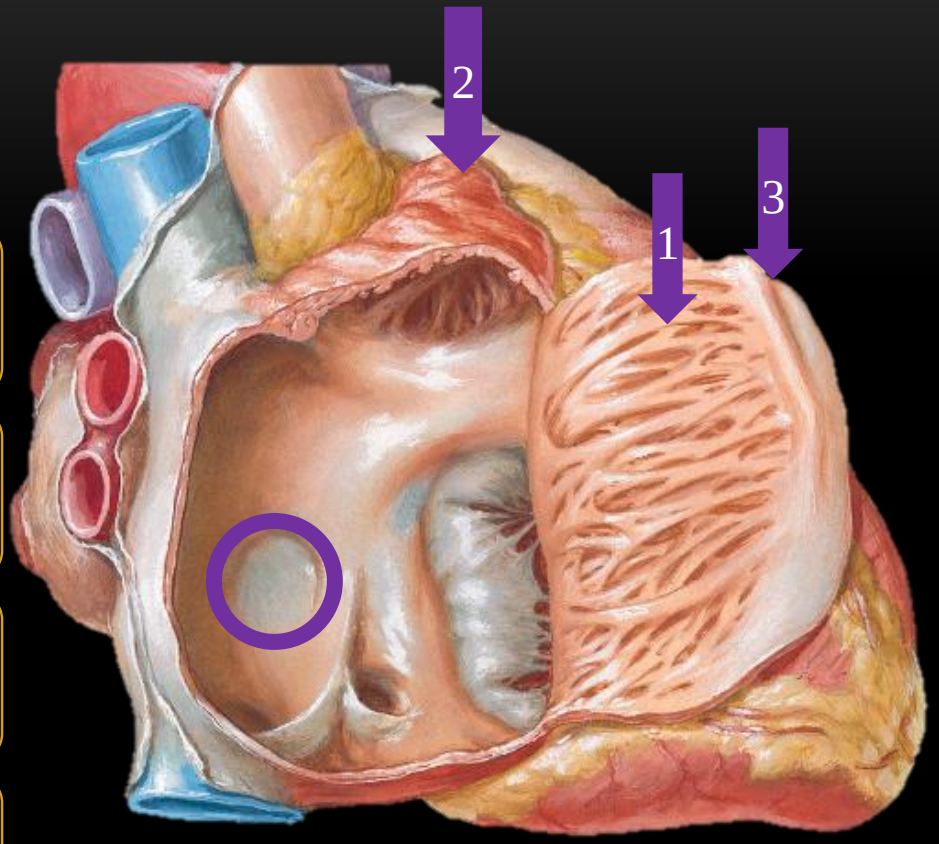
Larger than the left and has thinner wall.

Its walls are smooth except for the presence of pectinate muscles (1).

The right auricle (2) covers the beginning of RCA.

Sulcus terminalis (3) separates the smooth and rough parts.

Fossa ovalis represents the position of the foramen ovale in the embryo.

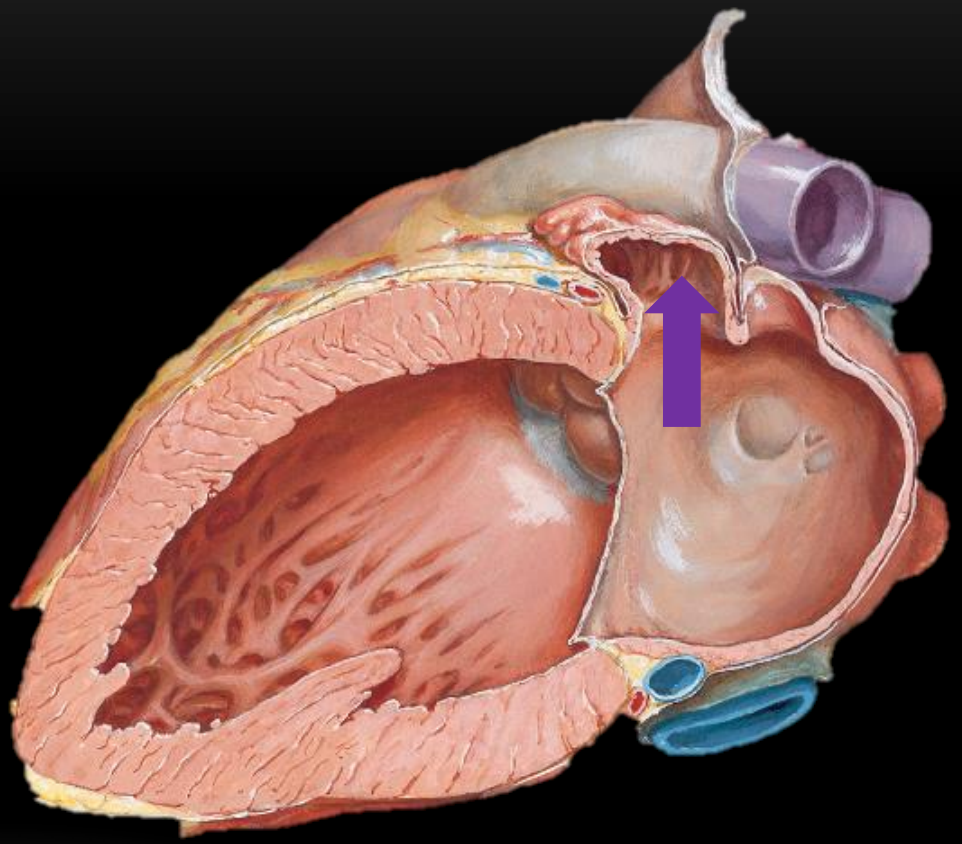


Left Atrium

The most posterior of the 4 chambers.

Its walls are smooth except for few pectinate muscles in the auricle.

Receives the 4 pulmonary veins.



Right Ventricle ..1/3

Forms the largest part of the anterior surface of the heart, a small part of the diaphragmatic surface, and almost the entire inferior border of the heart

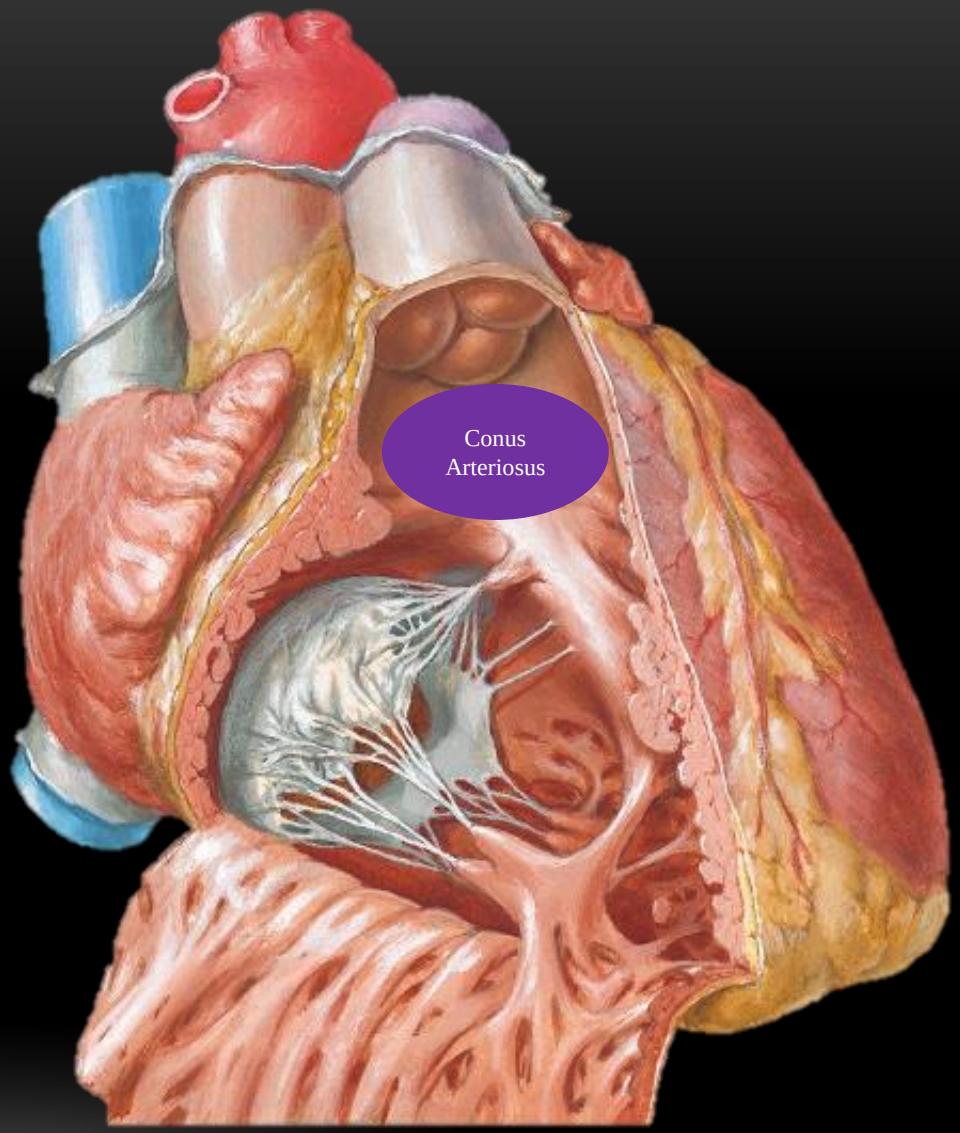
Superiorly it tapers into an arterial cone, the conus arteriosus (infundibulum), which leads into the pulmonary trunk.

The interior of the right ventricle has irregular muscular elevations (trabeculae carneae).

A thick muscular ridge, the supraventricular crest, separates the ridged muscular wall of the inflow part of the chamber from the smooth wall of the conus arteriosus, or outflow part.

The ventricle receives blood from the right atrium through the right AV (tricuspid) orifice, located posterior to the body of the sternum.

The right AV orifice is surrounded by one of the fibrous rings of the fibrous skeleton of the heart.



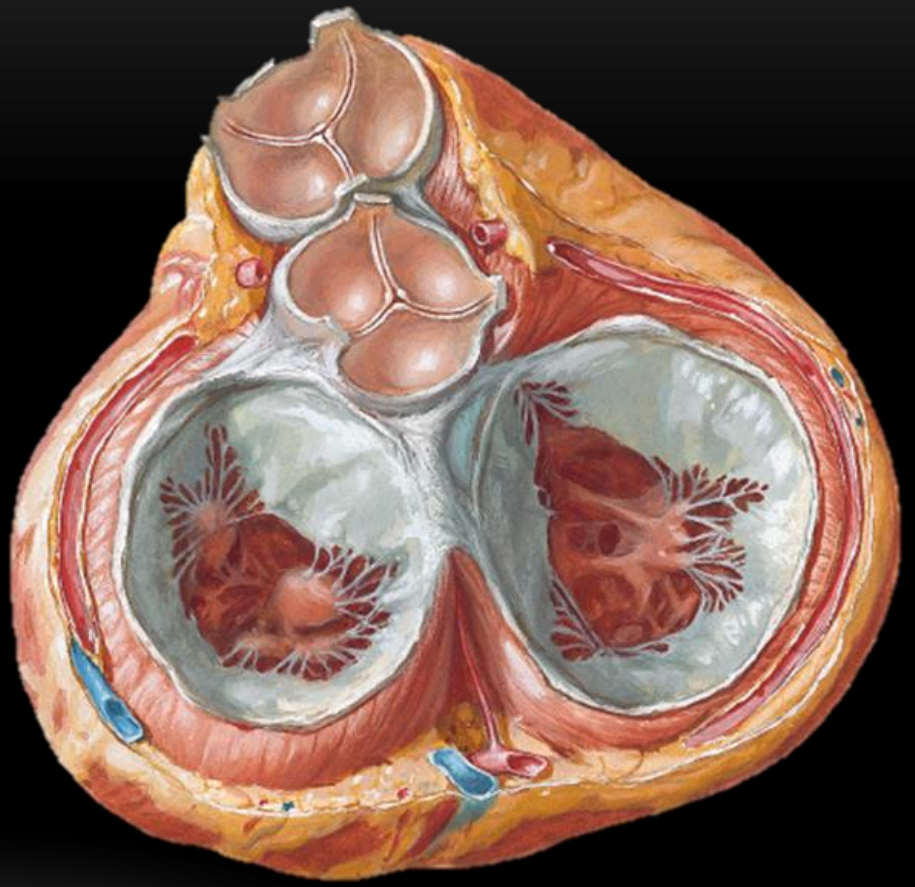
Right Ventricle ..2/3

The right AV orifice is surrounded by one of the fibrous rings of the fibrous skeleton of the heart.

The fibrous ring keeps the caliber of the orifice constant (large enough to admit the tips of three fingers).

Chordae tendineae attach to the free edges and ventricular surfaces of the anterior, posterior, and septal cusps, much like the cords attaching to a parachute.

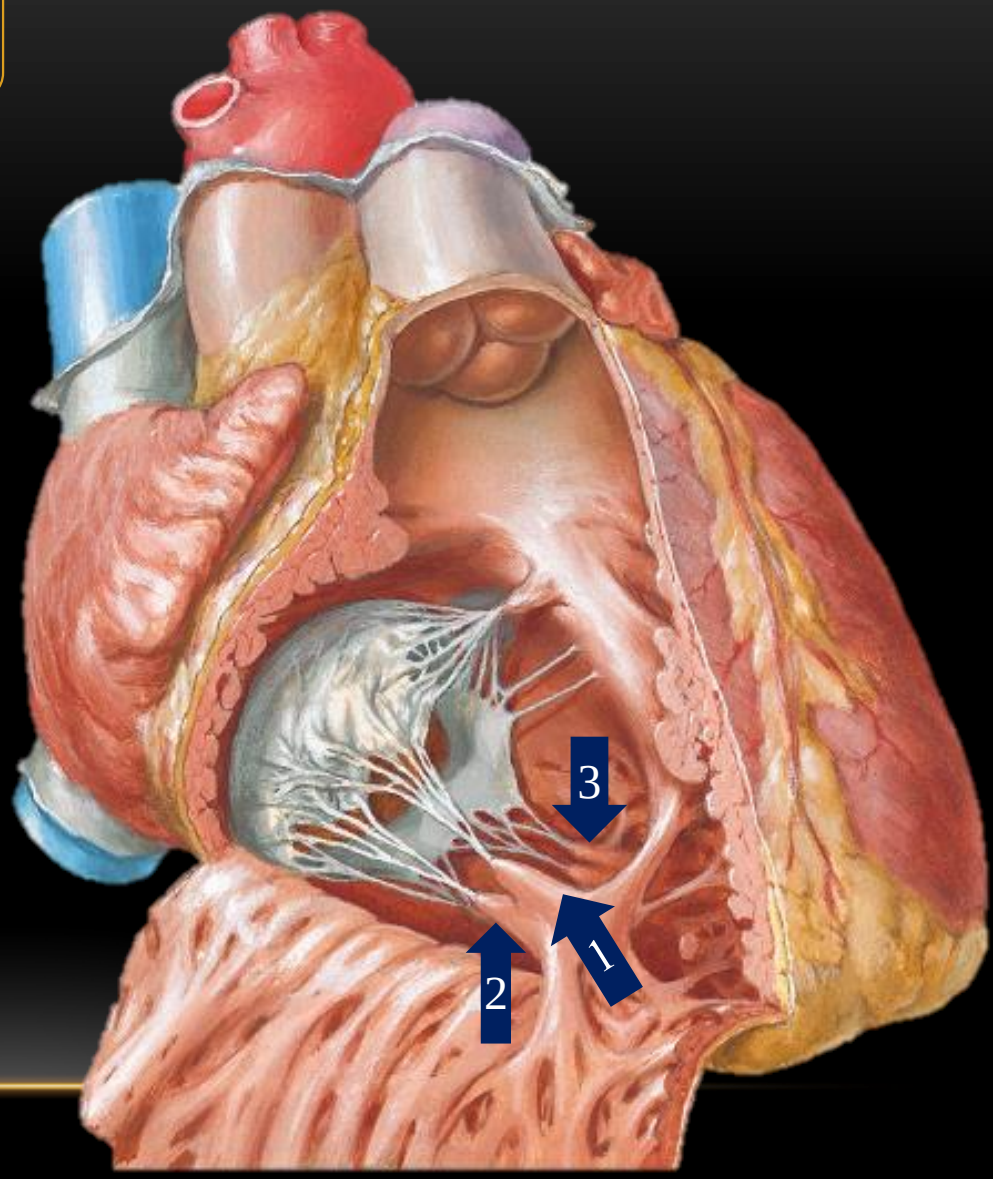
The tendinous cords arise from the apices of papillary muscles, which are conical muscular projections with bases attached to the ventricular wall.



Right Ventricle ..3/3

Three papillary muscles in the right ventricle correspond to the cusps of the tricuspid valve

- **Anterior papillary muscle (1)**, the largest and most prominent of the three,
- **Posterior papillary muscle (2)**, smaller than the anterior muscle, may consist of several parts
- **Septal papillary muscle(3)** arises from the interventricular septum, and its tendinous cords attach to the anterior and septal cusps of the tricuspid valve.



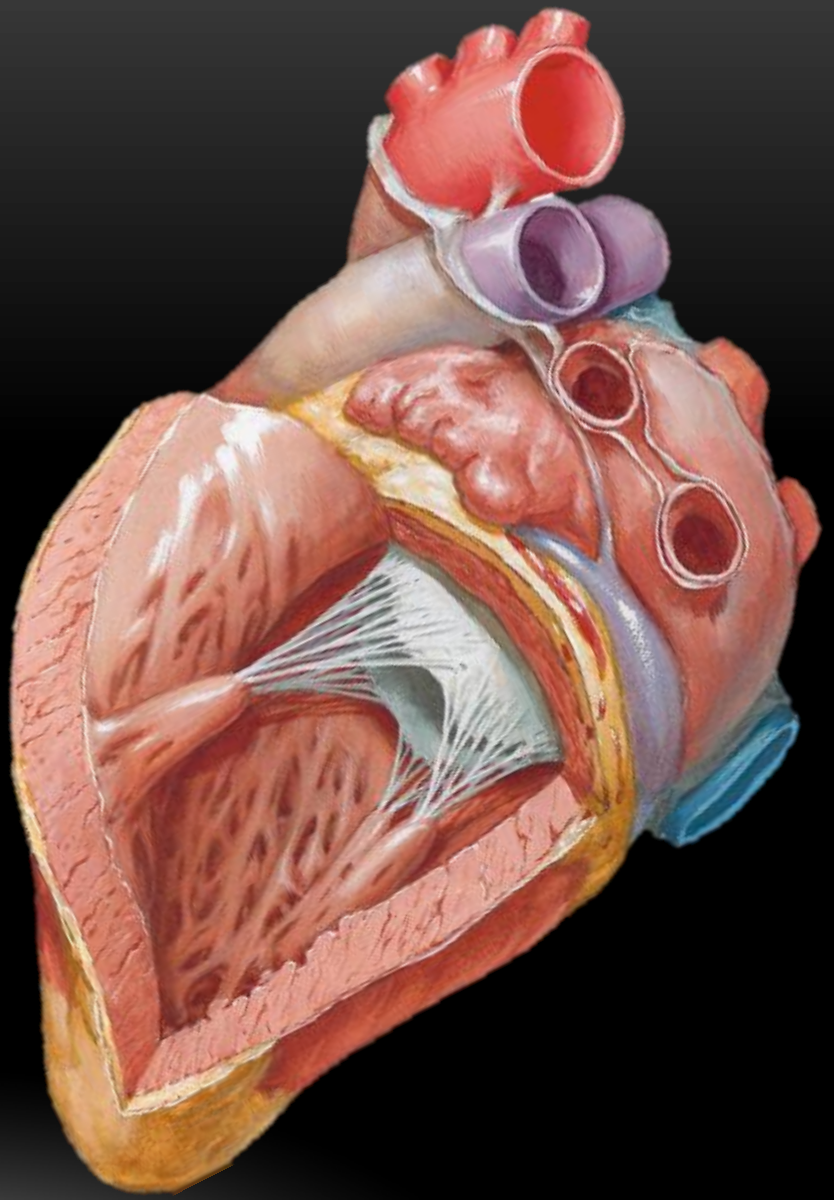
Left Ventricle ..1/2

Forms the apex of the heart, nearly all its left surface and border, and most of the diaphragmatic surface

Its wall is thicker than that of the right ventricle

The interior of the left ventricle has:

- Walls that are mostly covered with a mesh of trabeculae carneae that are finer and more numerous than those of the right ventricle.



Left Ventricle ..2/2

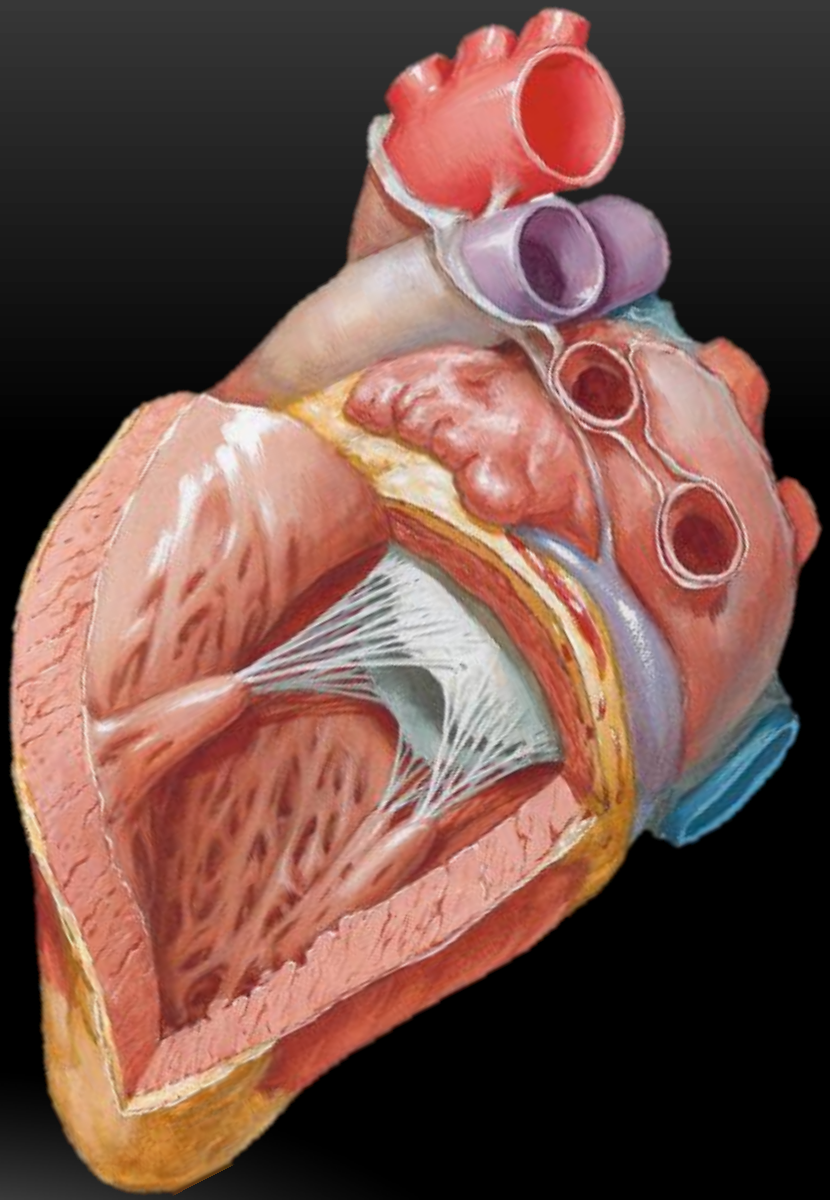
Its cavity is longer than that of the right ventricle.

Anterior and posterior papillary muscles are larger than those in the right ventricle.

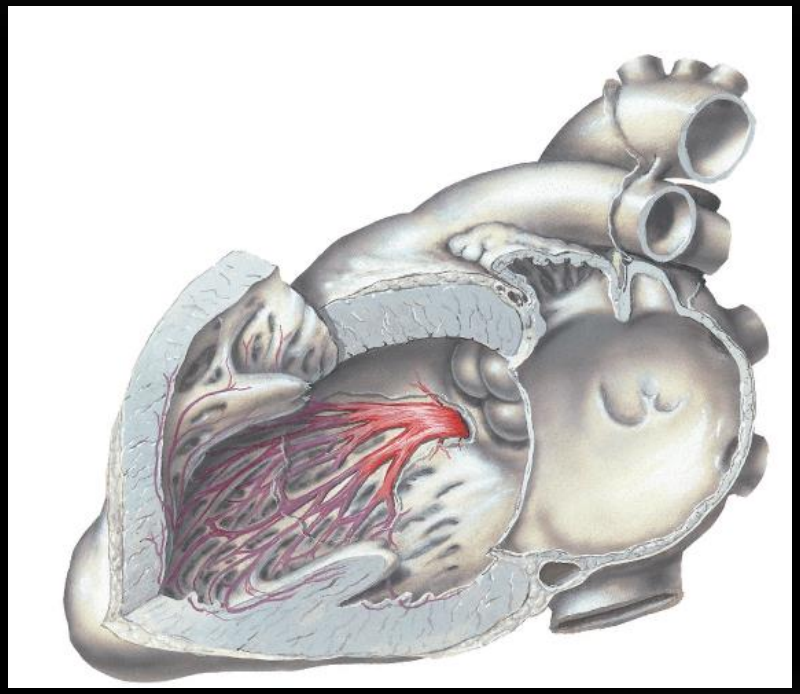
A smooth-walled, non-muscular, superoanterior outflow part, the aortic vestibule, leading to the aortic orifice and aortic valve.

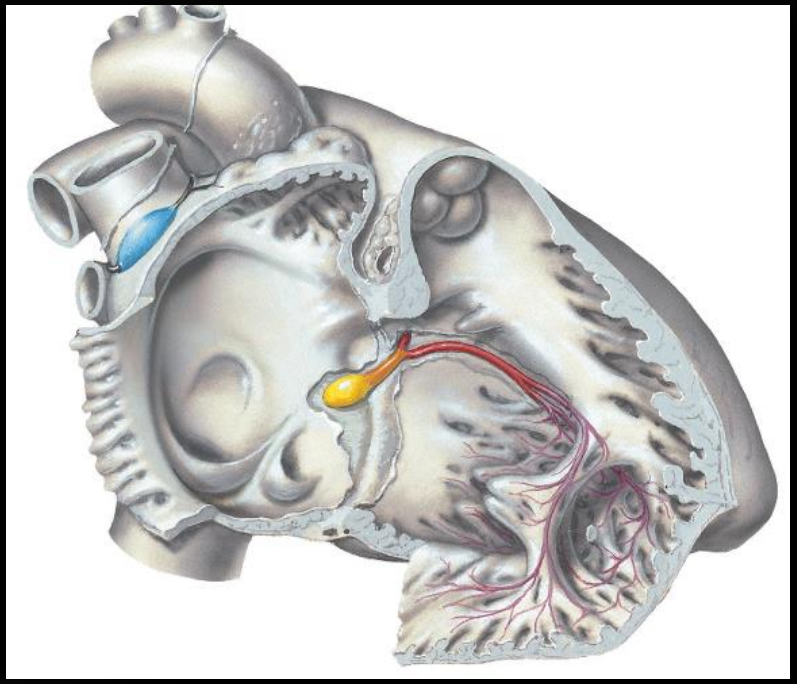
A double-leaflet mitral valve guards the left AV orifice.

The aortic orifice lies in its right posterosuperior part and is surrounded by a fibrous ring to which the right posterior, and left cusps of the aortic valve are attached; the ascending aorta begins at the aortic orifice.



CONDUCTING SYSTEM OF HEART





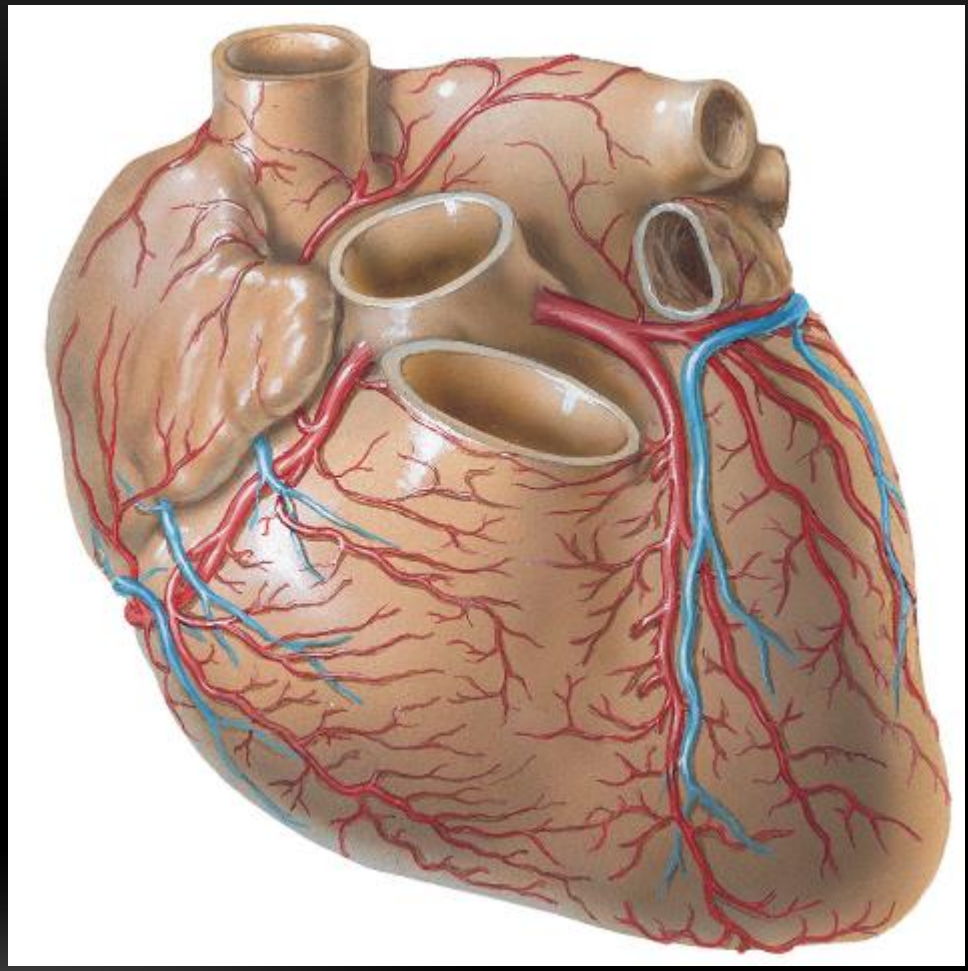
Blood Supply of the Heart

Coronary Arteries

The coronary arteries & their branches form a circle & loop around the heart.

The heart is supplied by two coronary arteries (right & left) which arise from the ascending aorta.

The right coronary artery arises from the anterior aortic sinus, while the left coronary artery arises from the left posterior aortic sinus.



Coronary Arteries ..2

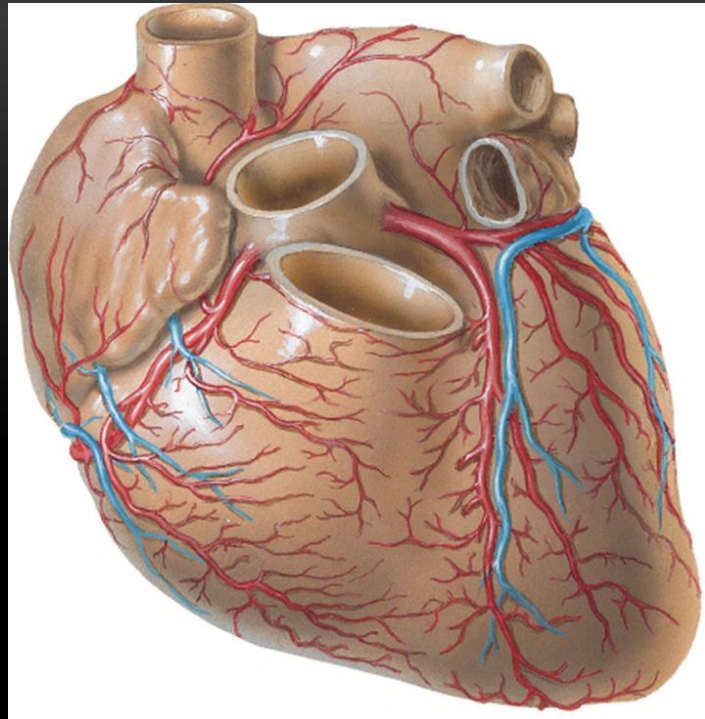
An arterial circle surrounds the heart lying in the A-V groove, from this arterial circle, an arterial loop runs in the anterior & inferior interventricular grooves.

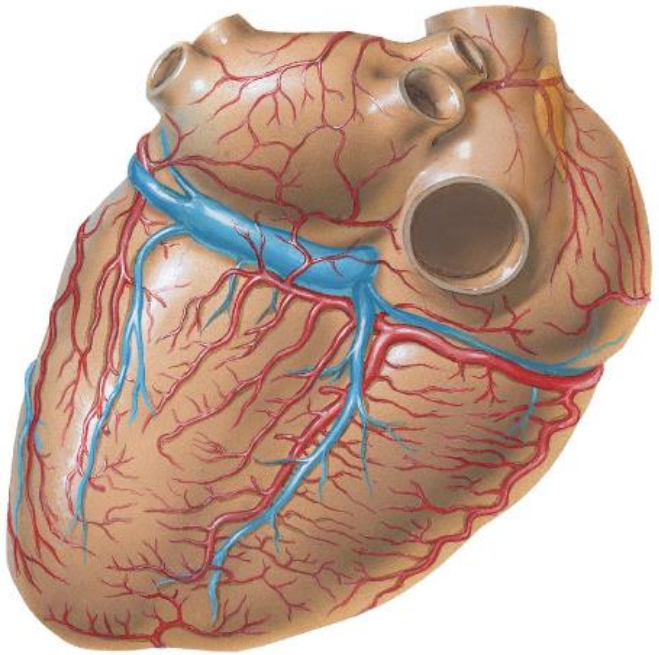
The circle is formed by the RCA & left CX artery, while the loop is formed by the LAD & PDA.

Variability in the origin of the PDA is expressed by the term dominance.

A right dominant coronary circulation is one in which the PDA is a terminal branch of the RCA, & so for the left dominance.

Left dominance occurs more commonly in males.



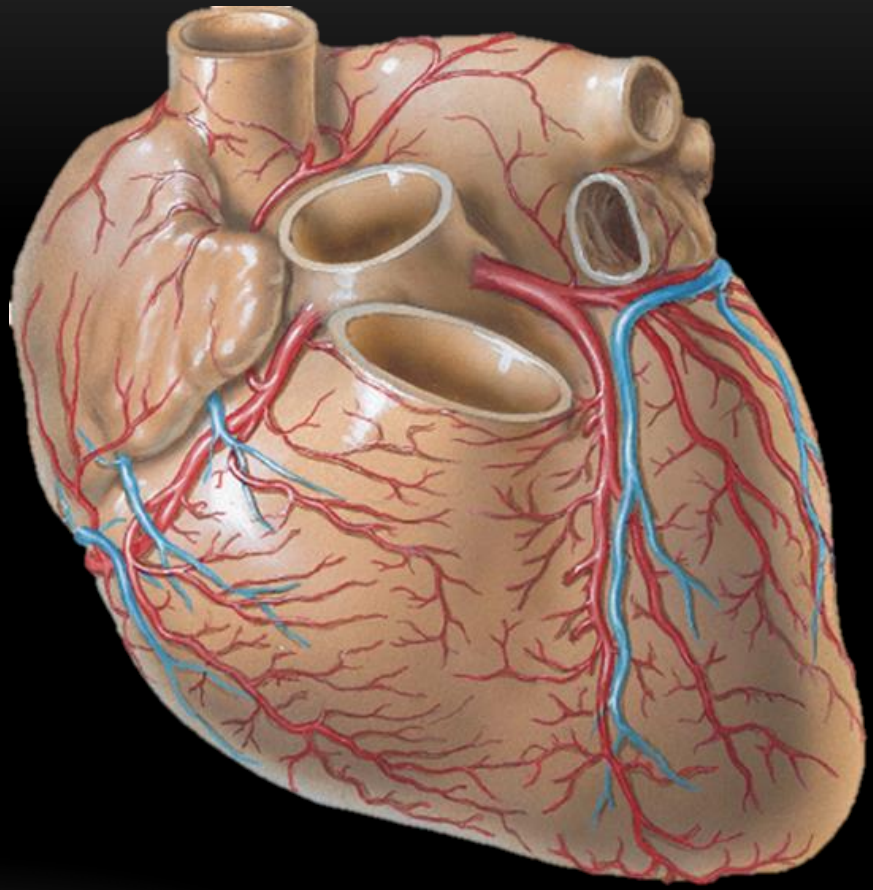


Left Main Coronary Artery

Extends from the ostium in the left sinus of valsalva to its bifurcation into the left anterior descending & left circumflex branches.

Usual length 10-20 mm.

Normally courses between the pulmonary trunk & the left atrial appendage to reach the left A-V groove, occasionally an additional artery originates from the left main & called ramus intermedius & courses parallel to the diagonals.

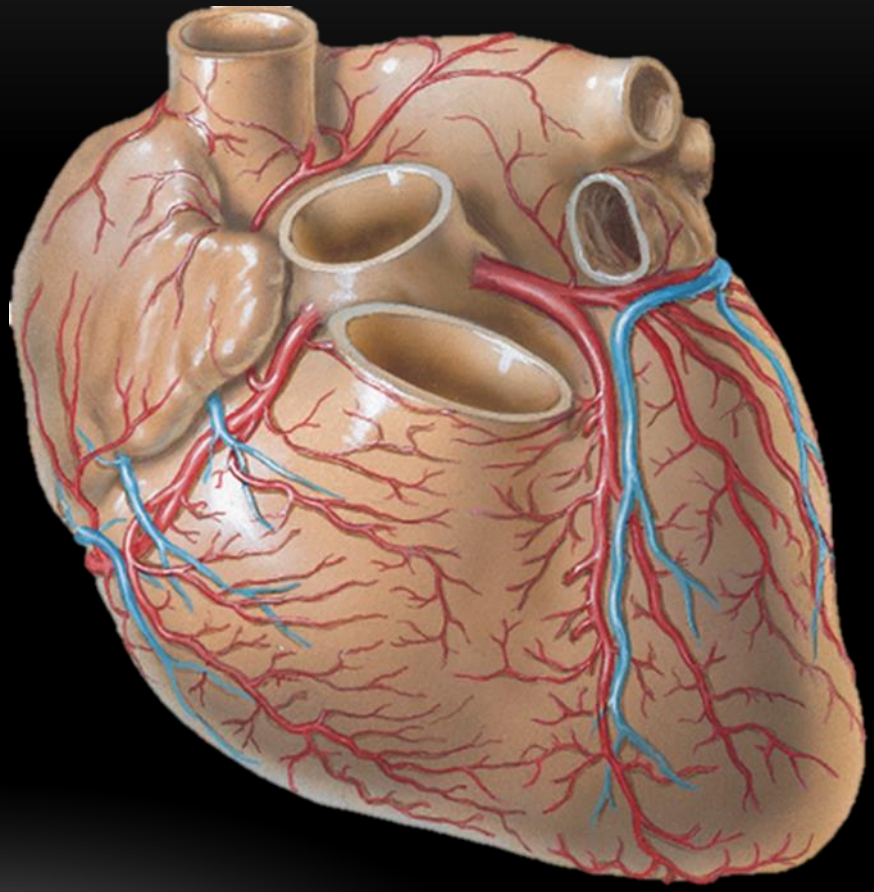


Left Anterior Descending Artery (LAD)

Courses along the anterior interventricular sulcus to the apex of the heart.

In most cases the LAD extends around the apex into the posterior interventricular sulcus supplying the apical portion of both right & left ventricles.

Supplies branches to the right ventricular free wall, to the septum & to the left ventricular free wall.



Circumflex Artery

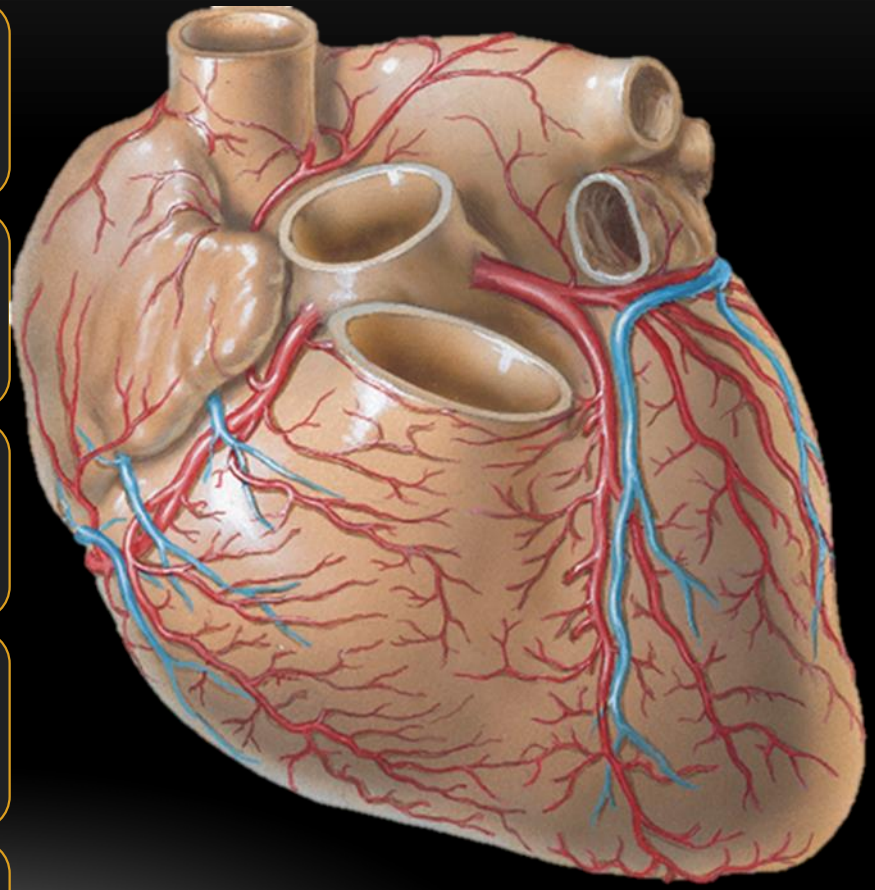
From the LM coronary artery, with its initial course medial to the base of the left atrial appendage.

Large branch in the proximal segment called atrial circumflex artery, coursing around the left atrium.

The ventricular branches are called Obtuse marginal arteries, supply the obtuse margin of the heart.

In hearts with left dominance or codominance these obtuse marginal arteries supply the inferior surface of the LV.

Variations in the origin & length of the CX are common.



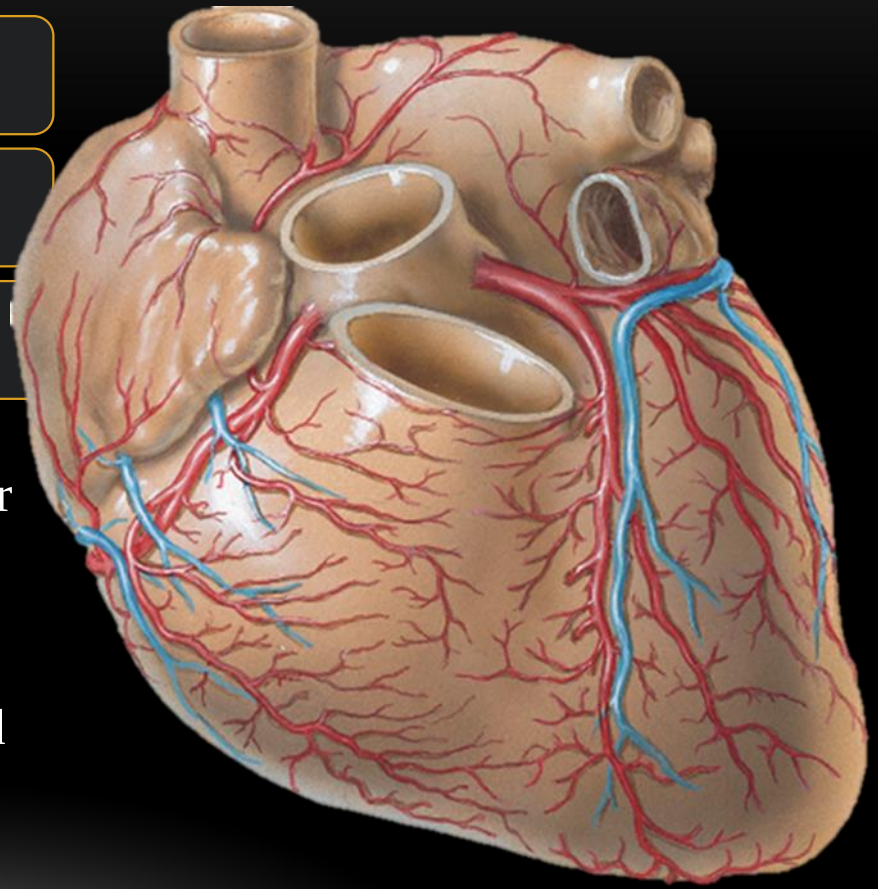
Right Coronary Artery (RCA)

Usually single artery.

Courses down the right A-V groove.

Branches:

- 1. Conus artery.
- 2. Branches to the anterior right ventricular free wall.
- 3. Anterior right atrial artery ** this artery commonly gives the SA nodal artery.
- 4. Lateral right atrial artery (usually injured in oblique right atriotomy).
- 5. Acute marginal artery in the region of the acute margin of the heart, which courses most of the way to the apex of the heart.
- 6. A-V nodal artery at the crux.



Anastomosis between the Coronary Arteries

Anastomosis exist at the arteriolar level between the terminations of the right & left coronary arteries in the atrioventricular groove & between the interventricular branches & conus branches.

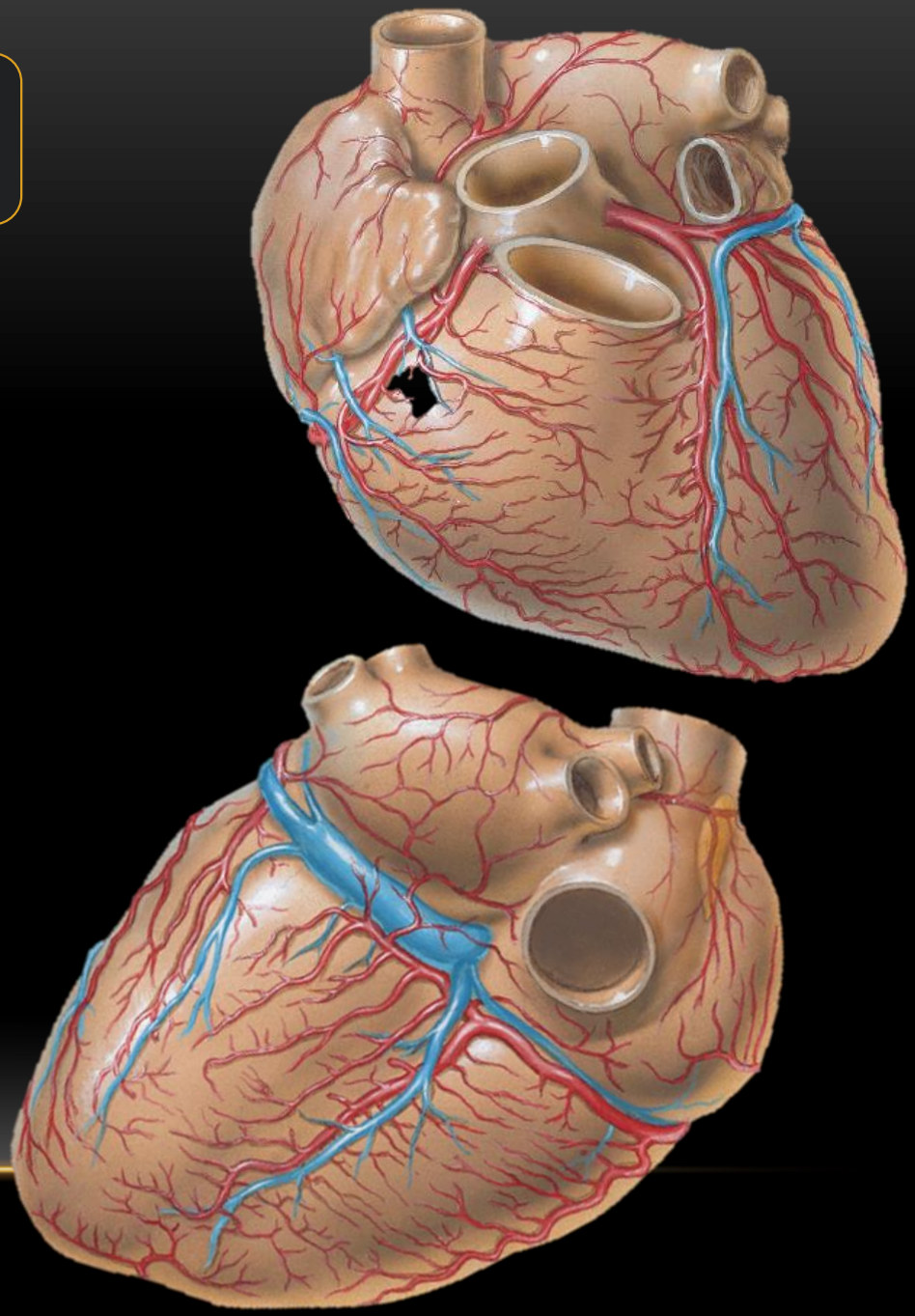
These anastomosis on the surface of the heart are insignificant.

Cardiac Veins ..1/4

Most of the cardiac veins accompany the coronary arteries.

Most of the cardiac veins end in the coronary sinus, which opens into the right atrium.

The heart is similar to the brain in the manner that the veins are not named similar to the accompanying arteries.



Cardiac Veins ..2/4

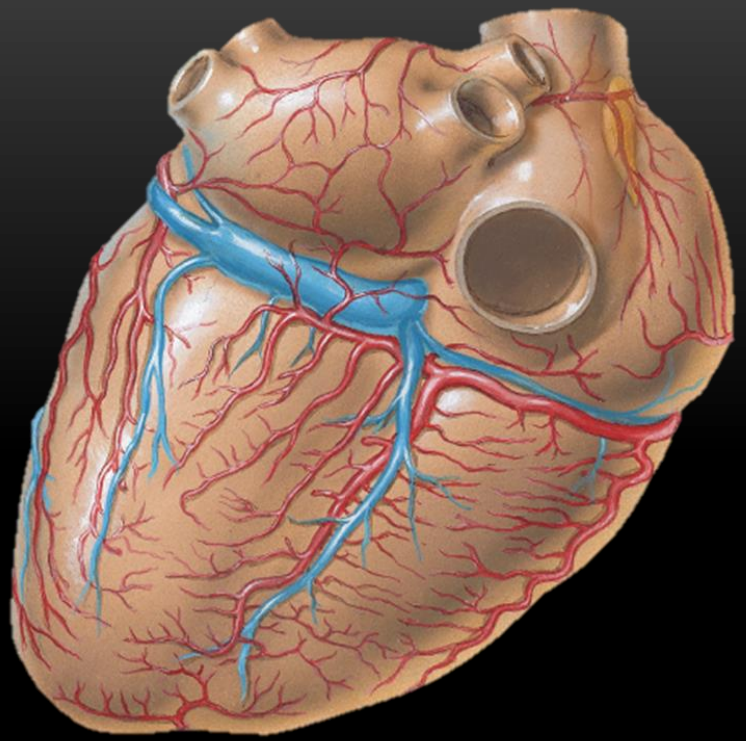
The veins of the heart fall into three groups:

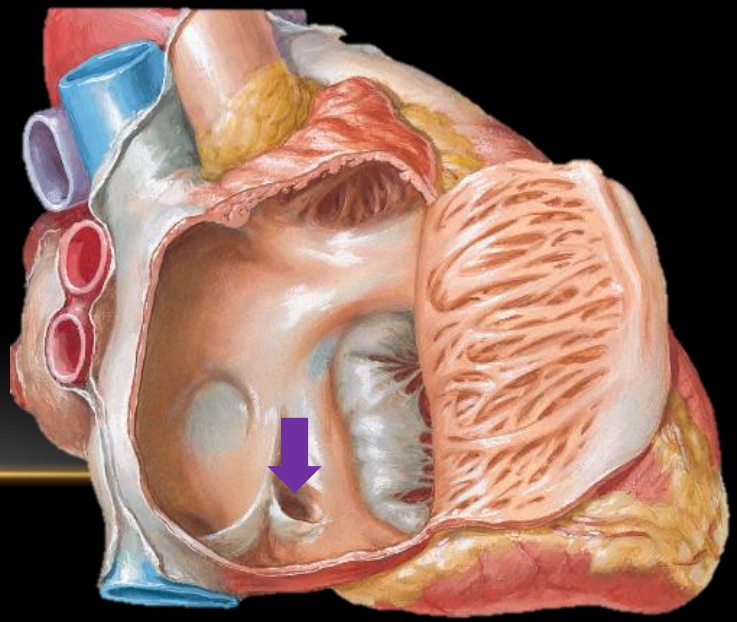
1. Venae cordis minimae (Thebesian veins): found within the myocardium and drain directly into the heart chamber.

2. Anterior cardiac veins (2-3 in number): run on the sternocostal surface and drain into the right atrium

3. Coronary sinus:

- Lies in the posterior part of the AV groove.
- Covered by a thin layer of myocardium.
  It is a wide-bored vessel, about 3 cm long.
- It opens in the right atrium





Cardiac Veins ..3/4

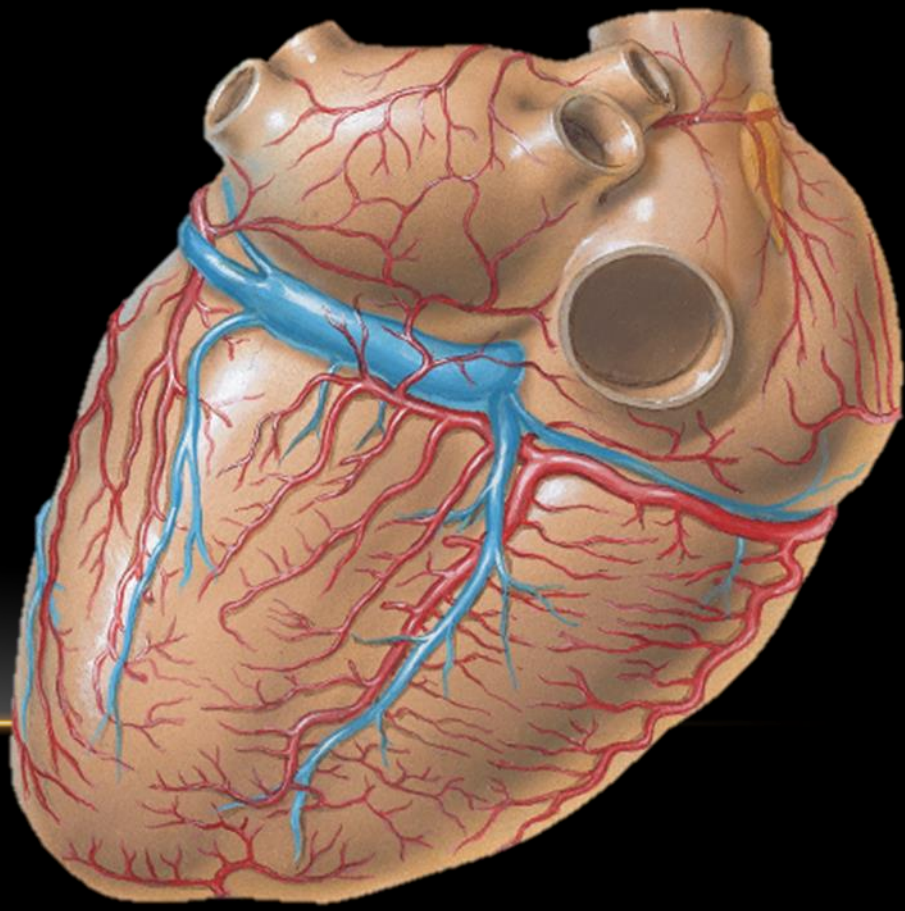
The veins of the heart fall into three groups:

1. Venae cordis minimae: found within the myocardium and drain directly into the heart chamber.

2. Anterior cardiac veins (2-3 in number): run on the sternocostal surface and drain into the right atrium

3. Coronary sinus:

- Great cardiac vein
- Middle cardiac vein
- Small cardiac vein
- Post vein of the LV
- Oblique vein of the LA



Cardiac veins 4/4

Tributaries of the coronary sinus:

- Great cardiac vein
- Middle cardiac vein
- Small cardiac vein
- Post vein of the LV
- Oblique vein of the left atrium