HEART ANATOMY

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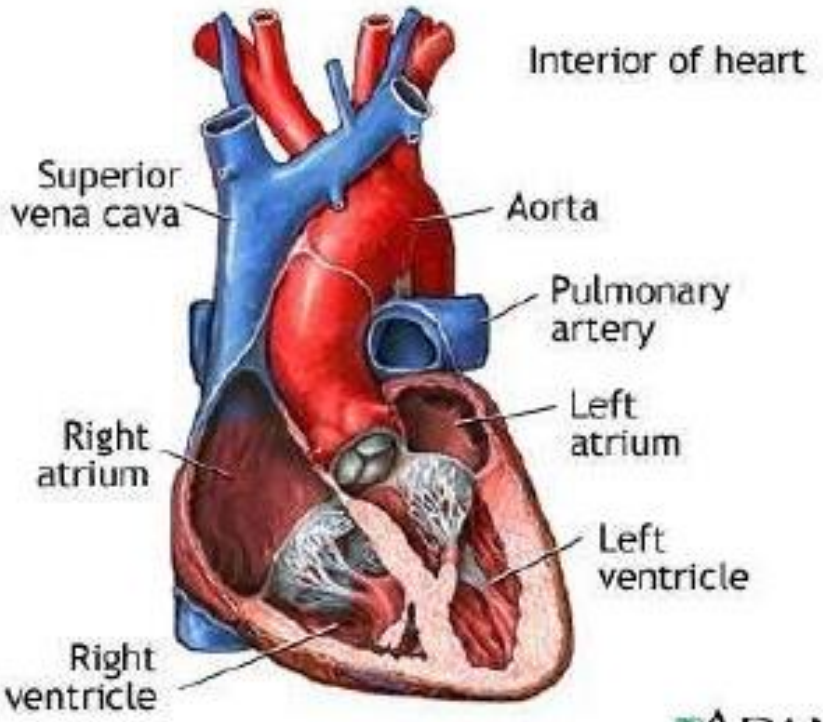
LECTURER ANATOMY KGMC

HEART



- A hollow muscular organ.
- Located in thorax between 2 lungs.
- 4 Chambers.
- 4 Valves.
- 2 Atriums & 2 Ventricles.
- 2 separate pumps (R&L sides)
- ***Right side*** receives blood from the body and sends it to the lungs (pulmonary)
- ***Left side*** receives blood from lungs and sends it to the body (systemic)

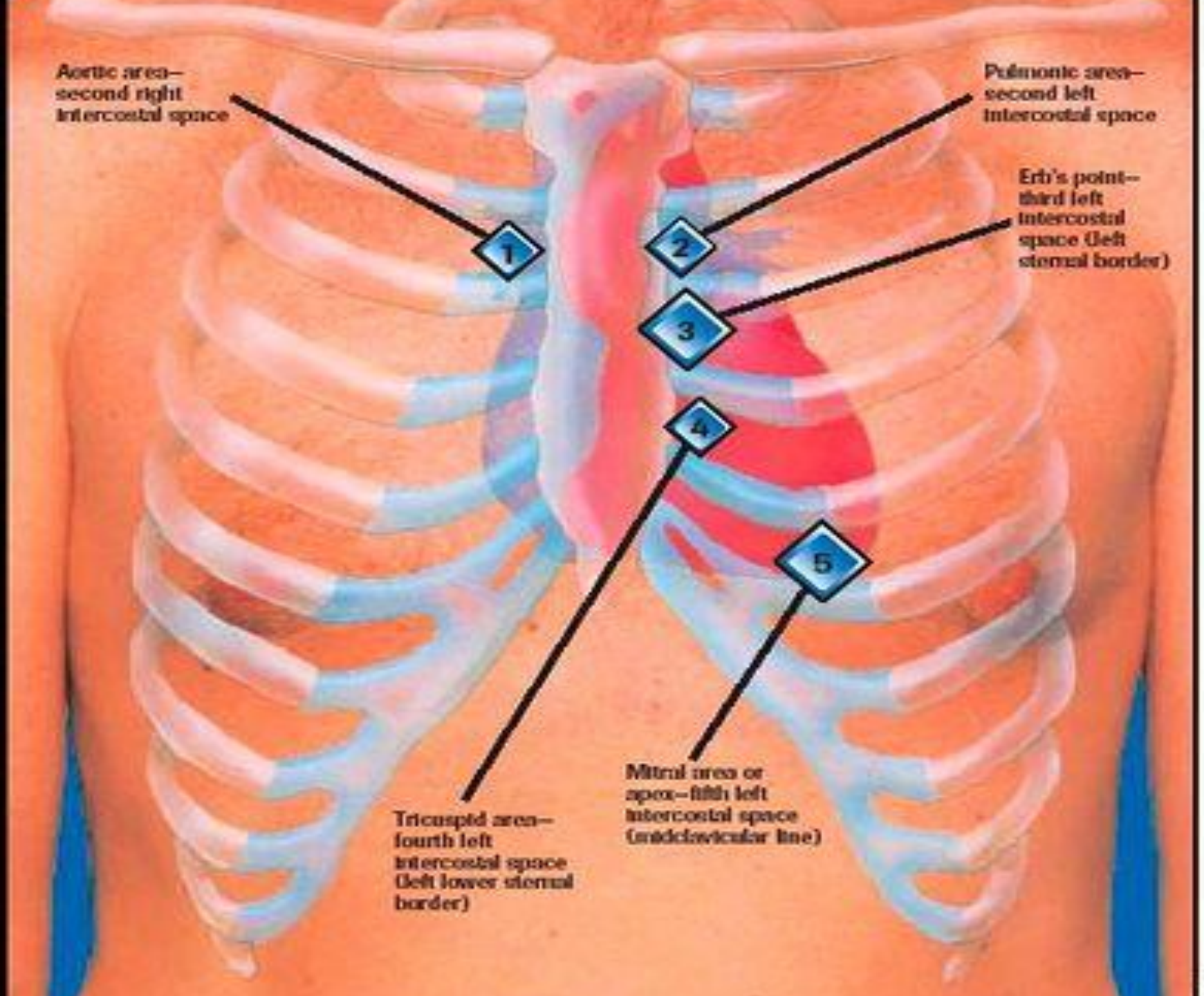
LOCATION OF THE HEART

- The heart is roughly in a plane that runs from the right shoulder to the left nipple.

- It lies in the protective thorax, posterior to the sternum and costal cartilages, and rests on the superior surface of the diaphragm.
- The heart is located between the two lungs in the space referred to as the mediastinum

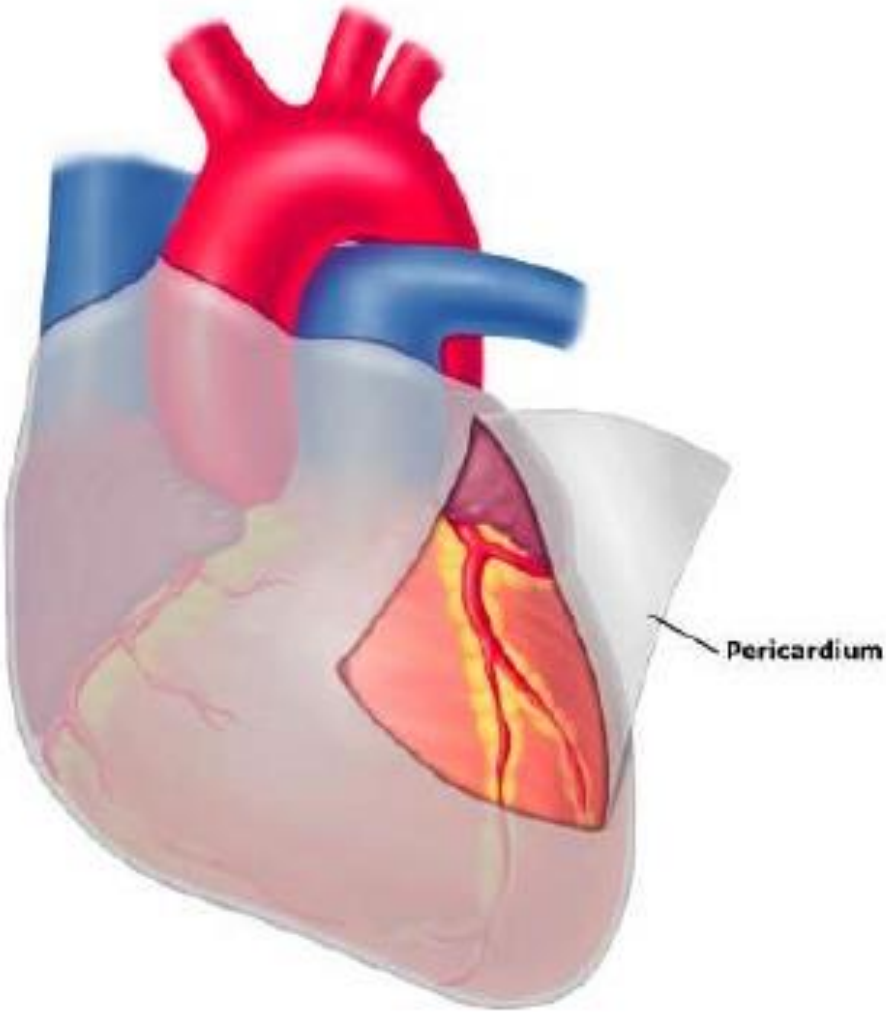
LOCATION

- The human heart assumes an oblique position in the thorax, one-third of the heart is located on the right side, while two-thirds are located on the left side of the midline.
- The base is located below the third rib as it approaches the sternum (note that the sternal angle occurs at the level of the second rib).
- The pointed apex projects to the left of the midline and anterior. Thus, the heartbeat can be most easily heard at the left fifth intercostal space, 8-9 cm from the midsternal line (just inferior to the left nipple)


Aortic area–
second right
intercostal space
Pulmonic area–
second left
intercostal space
Erb's point–
third left
intercostal space (left
sternal border)
1
2
3
4
5
Tricuspid area–
fourth left
intercostal space
(left lower sternal
border)
Mitral area or
apex–fifth left
intercostal space
(midclavicular line)

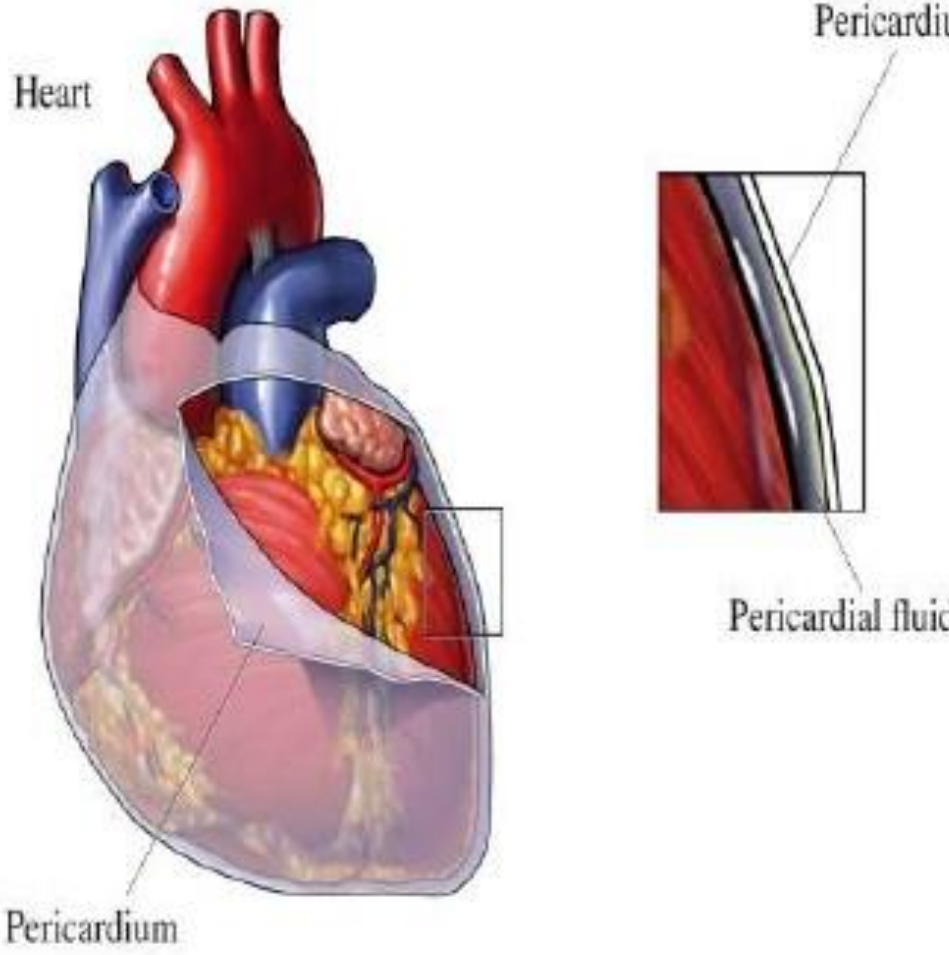
HEART

- The heart is surrounded by membrane called **Pericardium**.



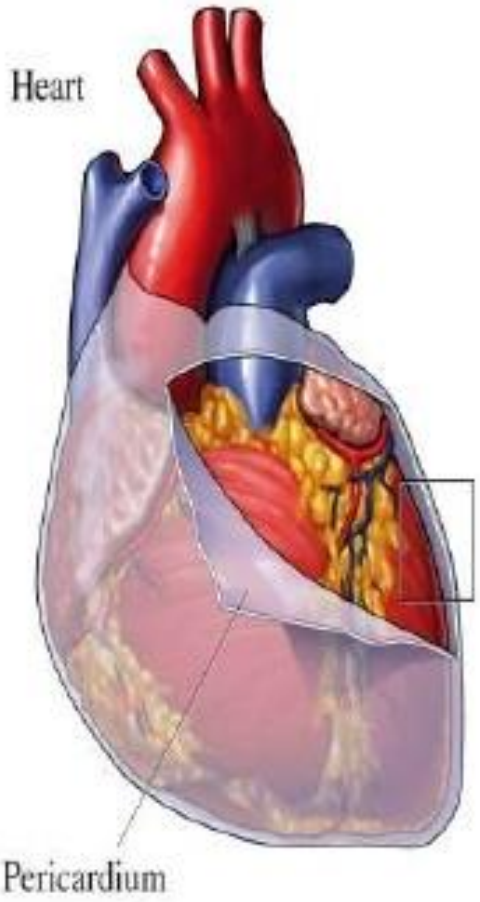
The Pericardium

- The pericardium is a fibroserous sac that encloses the heart and the roots of the great vessels.
- The pericardium lies within the middle mediastinum.



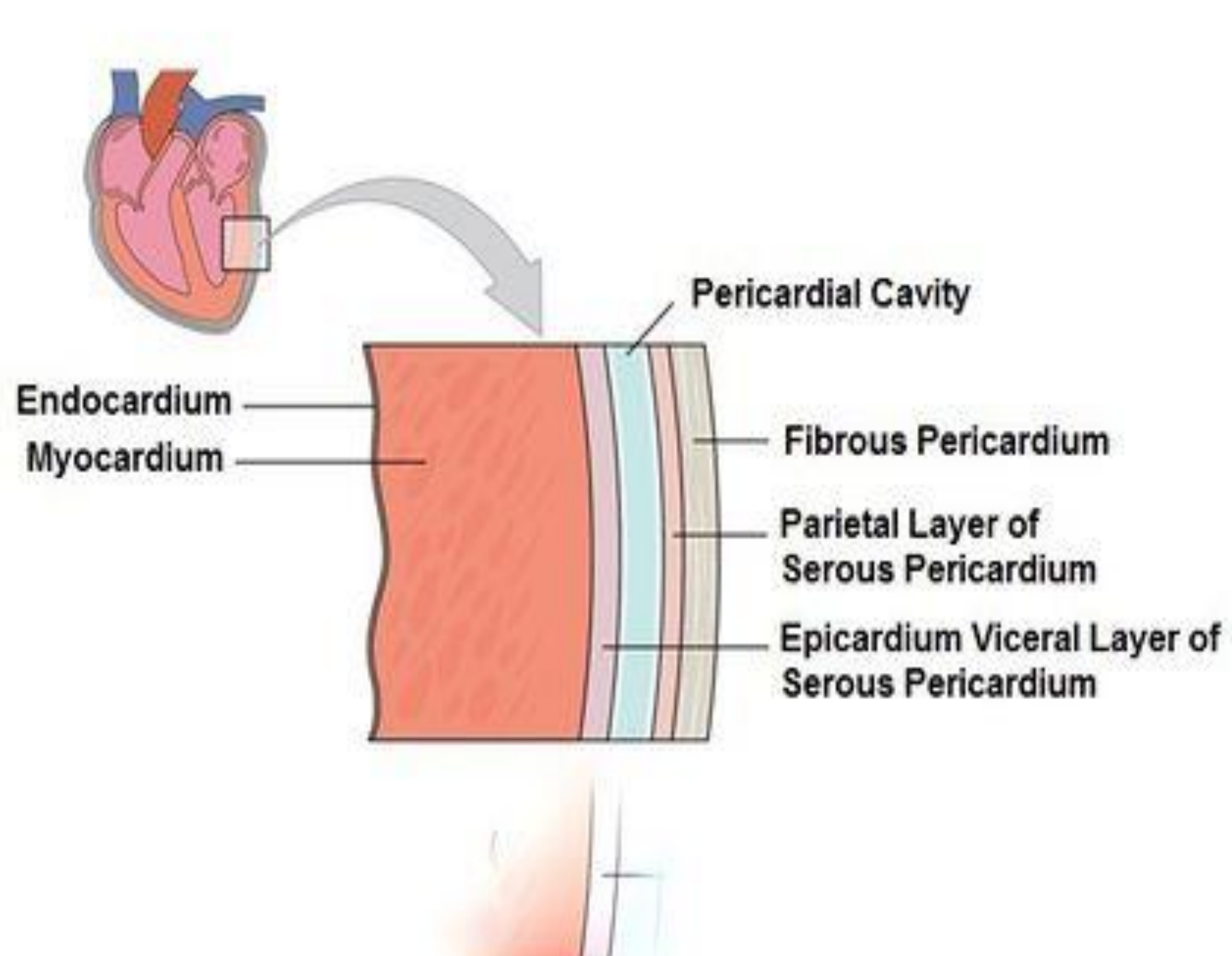
The Pericardium

- Its function is to restrict excessive movements of the heart as a whole and to serve as a lubricated container in which the different parts of the heart can contract.

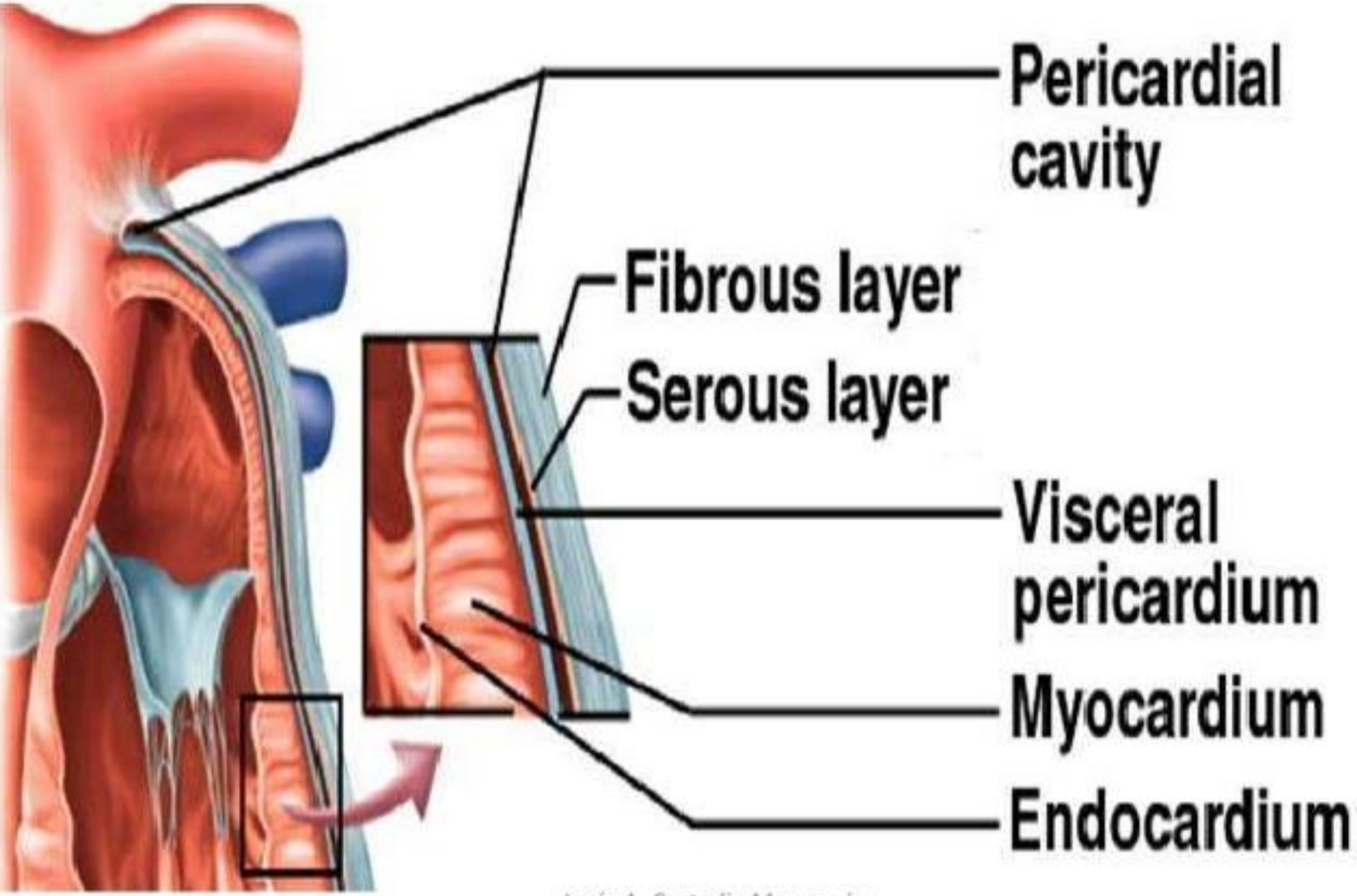


Heart Wall

- Endocardium
  - deepest layer of the heart
  - smooth lining to reduce friction of bloodflow
- Myocardium
  - middle layer of the heart
  - location of muscle fibers responsible for pumping
- Pericardium
  - outer protective layer
  - composed of :
  - visceral pericardium
  - paricardial cavity
  - parietal pericardium

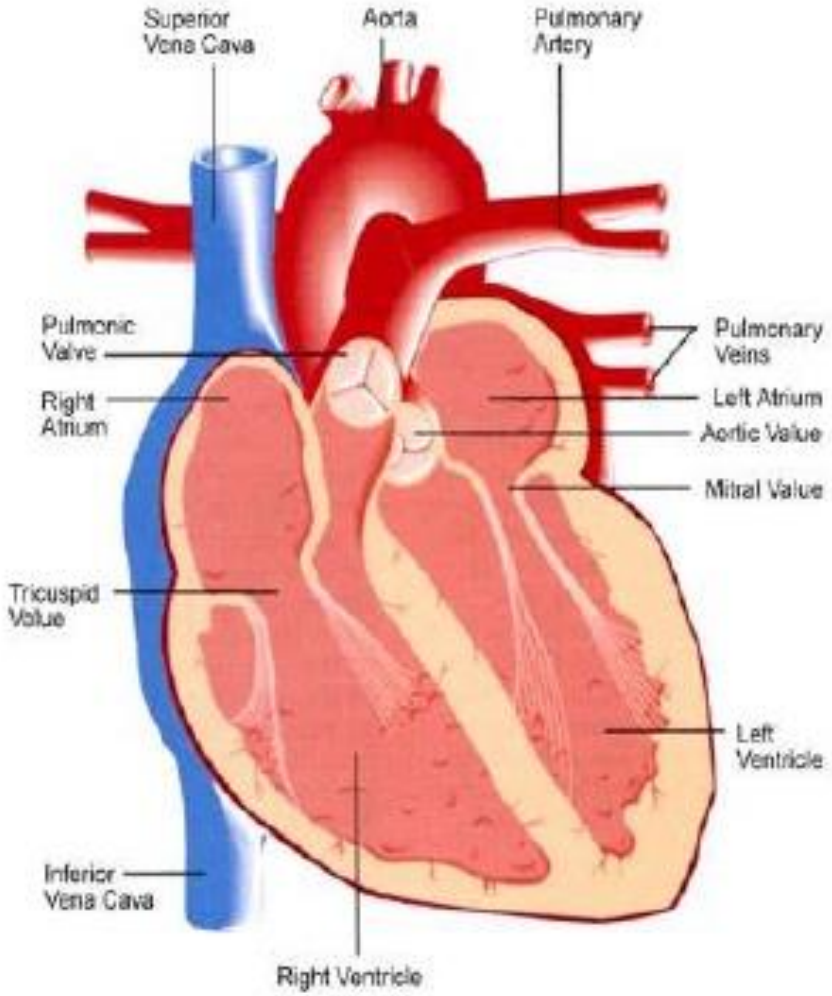

Pericardial Cavity
Endocardium
Myocardium
Fibrous Pericardium
Parietal Layer of
Serous Pericardium
Epicardium Viceral Layer of
Serous Pericardium

Heart Wall


Pericardial cavity
Fibrous layer
Serous layer
Visceral pericardium
Myocardium
Endocardium

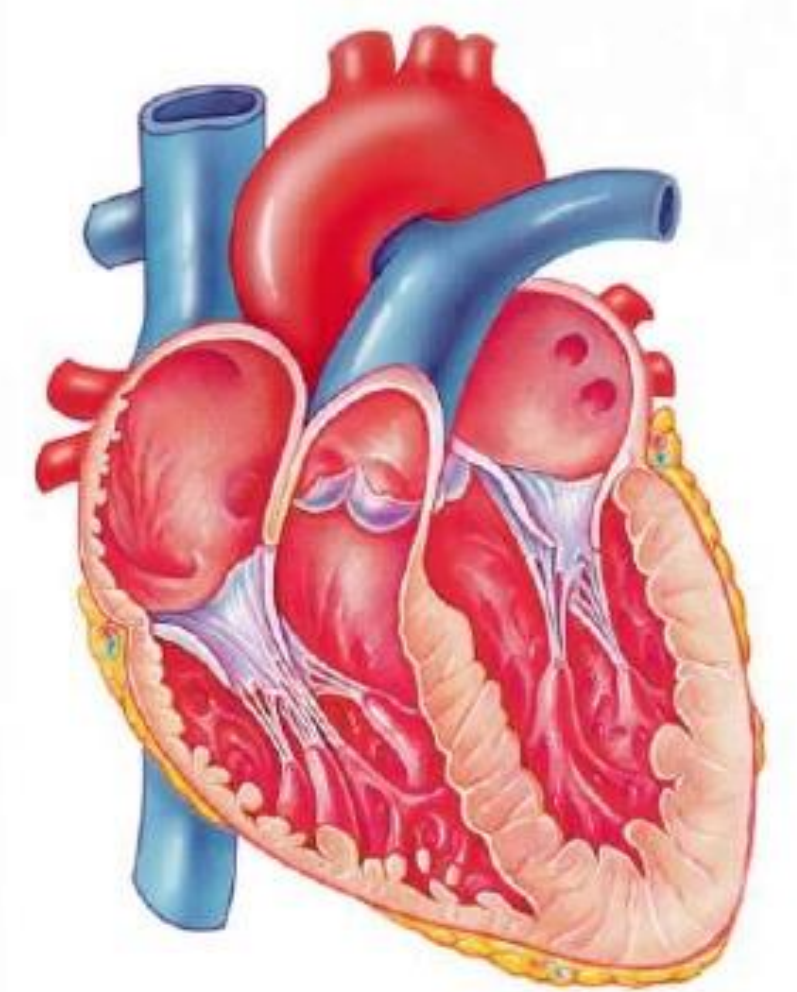
The Heart Chambers

- Four chambers
  - Two atria (Right and Left)
  - Two ventricles (Right and Left)



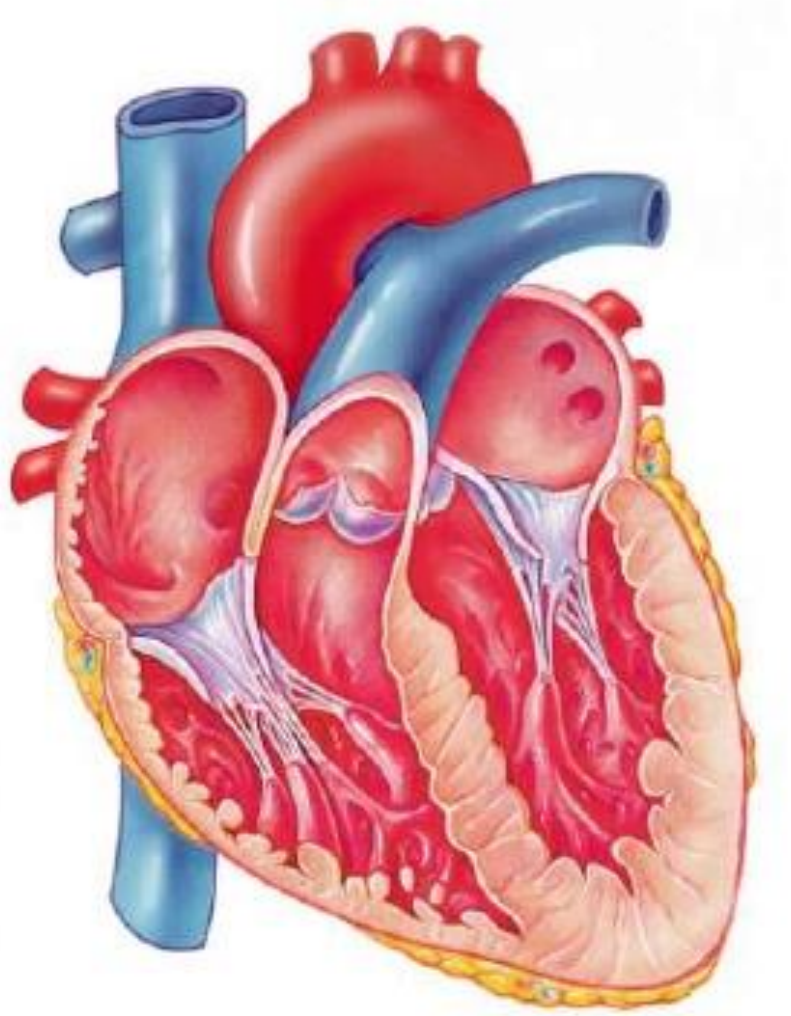
The Heart Chambers

- Atria
  - *Features*
    - small, thin-walled chambers
  - *Functions*
    - receiving chambers for blood returning to the heart from the circulation
    - push the blood into the adjacent ventricles.



The Heart Chambers

- Atria
  - Receive blood from
    - ➢ *Right side*
      - ❖ Superior and Inferior Vena Cava
    - ➢ *Left side*
      - ❖ Pulmonary Veins



LEFT ATRIUM

- Receives oxygenated blood from the lungs via the left and right pulmonary veins.
- The pulmonary veins enter the heart as two pairs of veins inserting posteriorly and laterally into the left atrium.
- The left atrium is found midline, posterior to the right atrium and superior to the left ventricle.
- It discharges into the left ventricle through the mitral valve

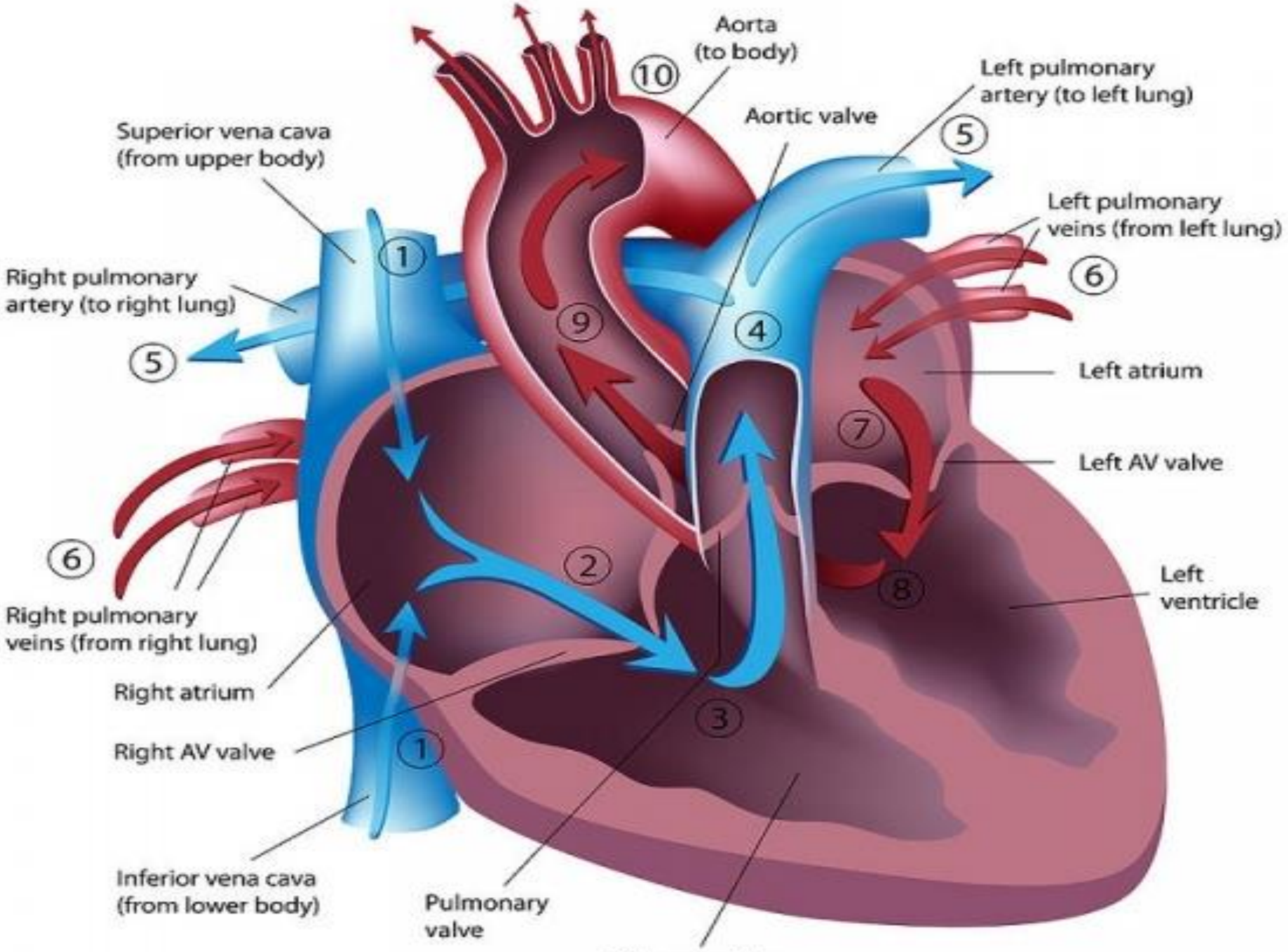
RIGHT ATRIUM

- The interior of the right atrium has three anatomically distinct regions.
- 1. Posterior part - is a smooth-walled and is termed sinus venarum.;
- 2. Anterior part - which is lined by horizontal, parallel ridges of muscle bundles that resemble the teeth of a comb, hence the name pectinate muscle (pectin = "a comb,")
- 3. Atrial septum - receives both the superior and inferior venae cavae and the coronary sinus. It also contains the fossa ovalis, the sinoatrial node and the atrioventricular node.

RIGHT ATRIUM

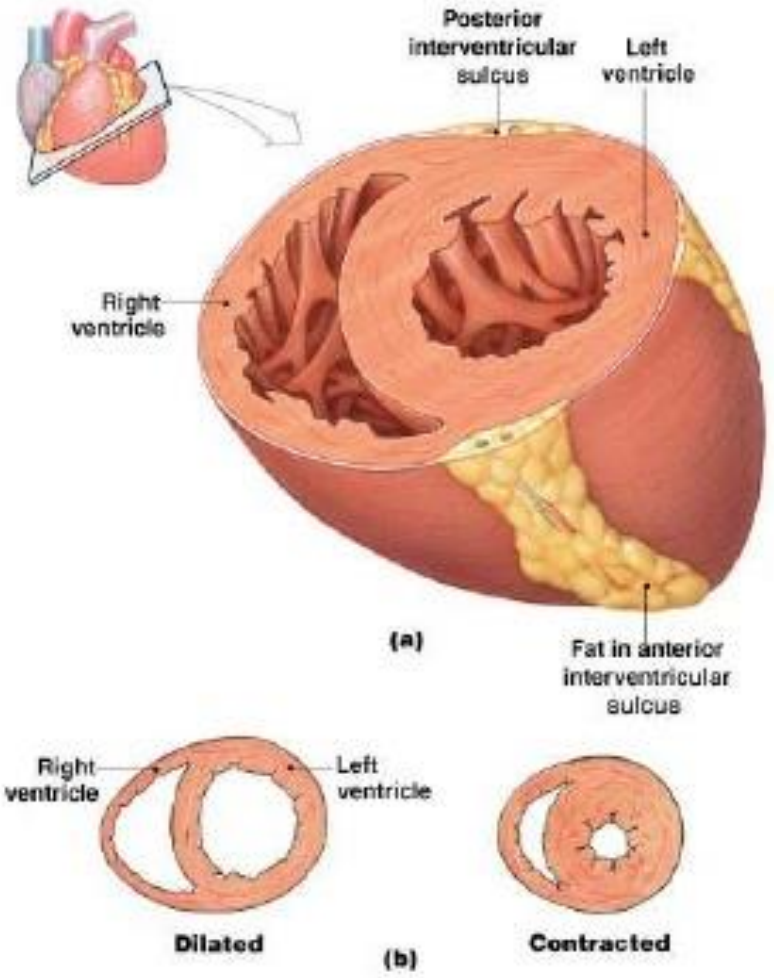
- On the "floor" of the right atrium is the atrioventricular portion of the atrial septum, which has muscular and membranous components.
- At the anterior and inferior aspect of the atrial septum, the tricuspid valve annulus (annulus = "ring") is attached to the membranous septum.

The pathway of blood flow through the heart



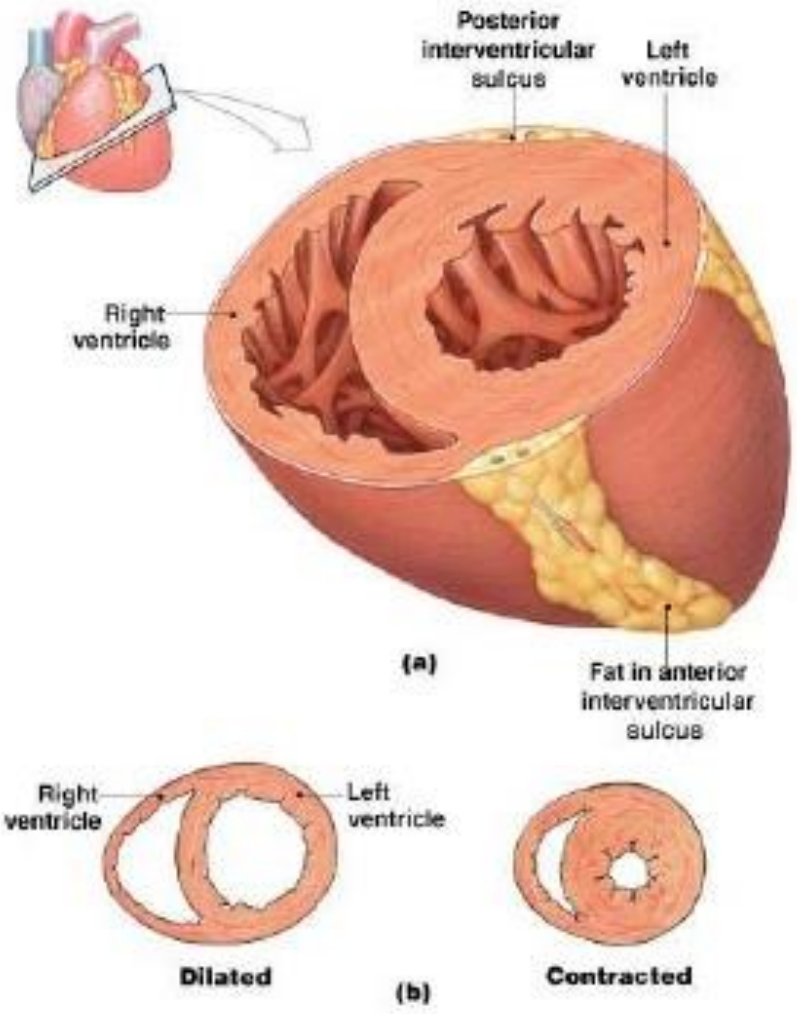
The Heart Chambers

- Ventricles
  - Features
    - make up most of the mass of the heart
    - the walls of the left ventricle are 3X thicker than those of the right



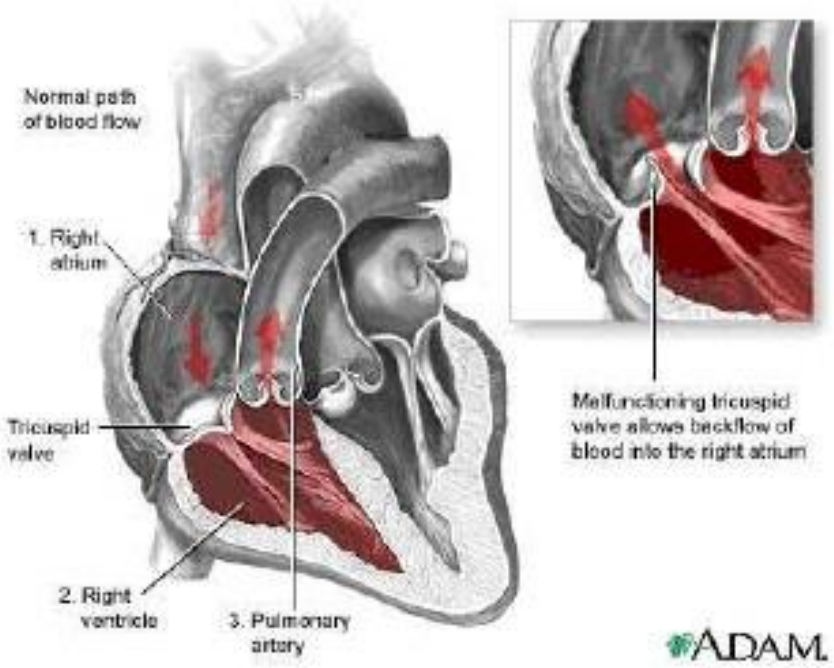
The Heart Chambers

- Ventricles
  - Functions
    - discharging chambers of the heart
    - propel blood to Pulmonary Trunk (right ventricle), Aorta (left ventricle)



The Right Ventricle

- Receives blood from the right atrium through the **tricuspid valve** .



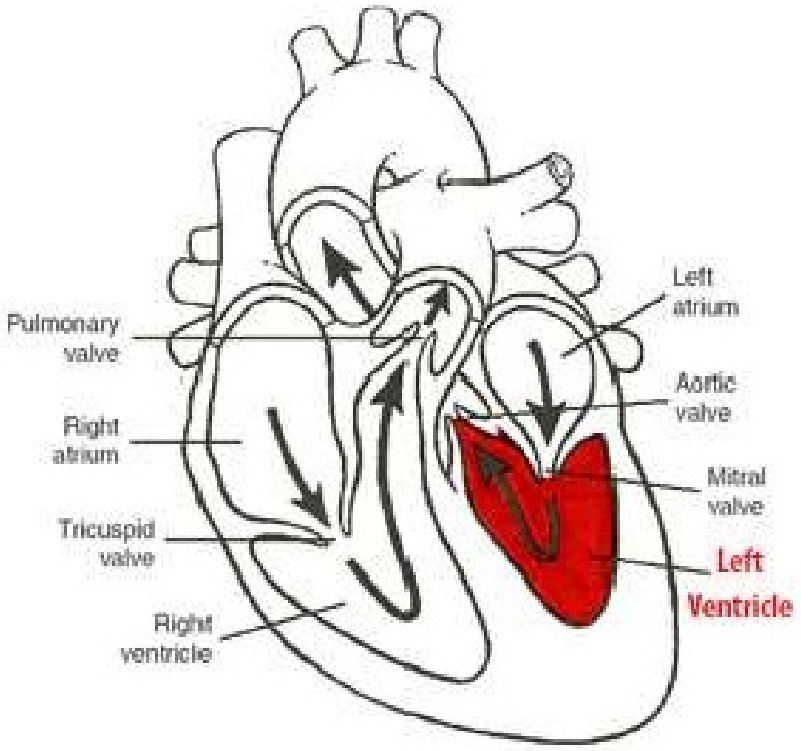
RIGHT VENTRICLE

- It comprised of an

- The Inlet - extends from tricuspid annulus to the insertions of the papillary muscles. Abundant, coarse trabeculae carneae ("beams of meat") characterize the walls of the right ventricle. Trabeculae carneae are similar to pectinate muscle of the right atrium (as bundles of myocardium) .
- Outflow tract -carries blood out of the ventricle in an anterior-superior direction and is relatively smooth walled.

The Left Ventricle

- The wall of the left ventricle is thicker than the right ventricle but the structure is similar.
- The thick wall is necessary to pump oxygenated blood at high pressure through the systemic circulation.



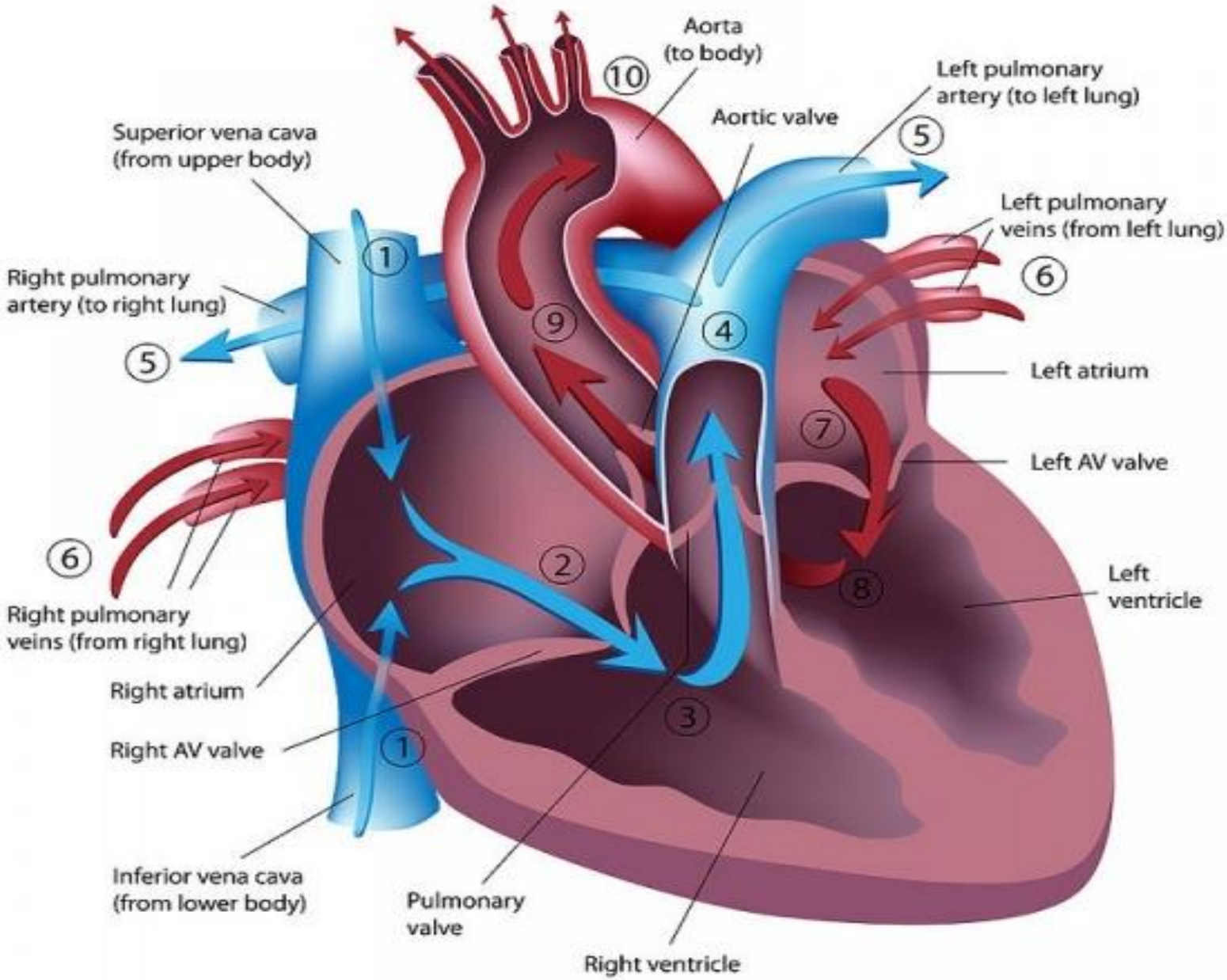
LEFT VENTRICLE

- It pumps blood throughout the body via the aorta.
- Most of the left lateral surface of the heart is formed by the left ventricle, also forming part of the inferior and posterior surface.
- Abundant trabeculae carneae characterize the walls of the left relatively
- LV apex is less trabeculated than the RV apex.

LEFT VENTRICLE

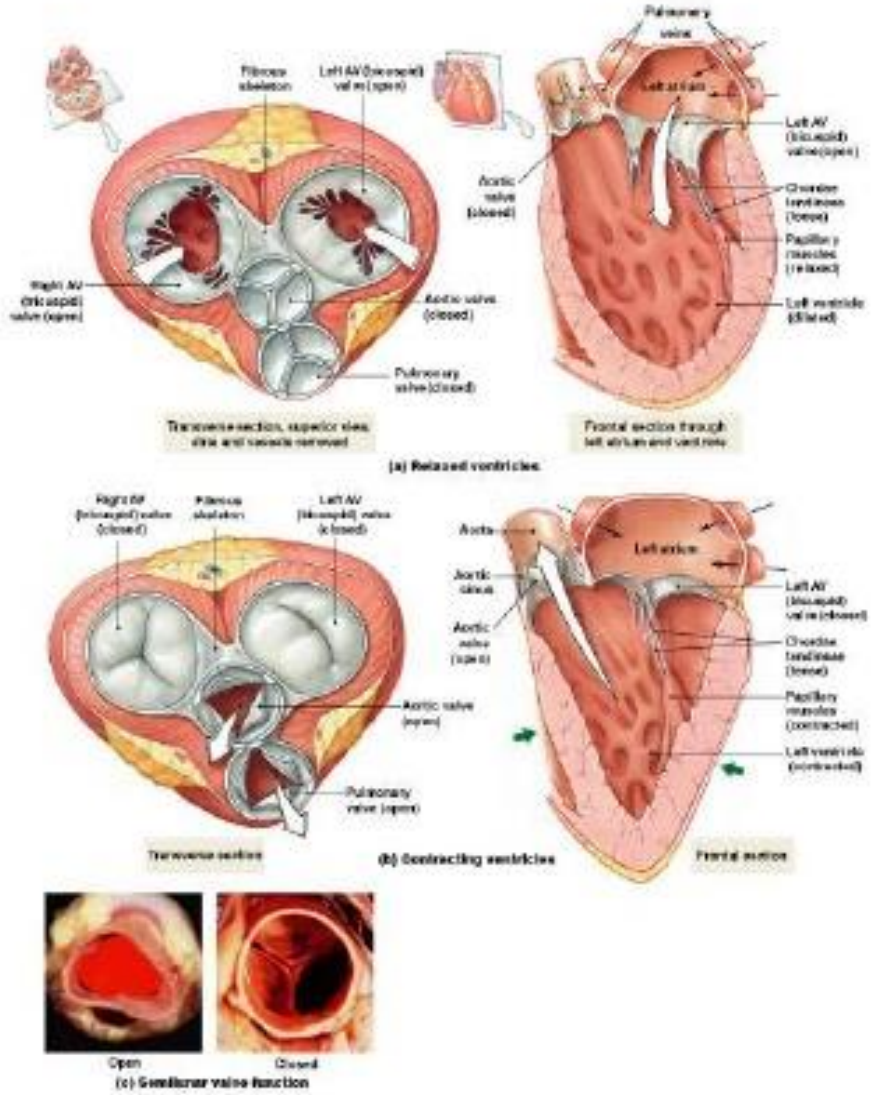
- In contrast to the right ventricle, the muscular ridges tend to be relatively fine and the myocardium in the wall of the left ventricle is three times thicker; thickest towards the base and thinnest towards the apex.
- The interventricular septum appears from within the left ventricle to bulge into the right ventricle; this creates a barrel-shaped left ventricle. I

The pathway of blood flow through the heart

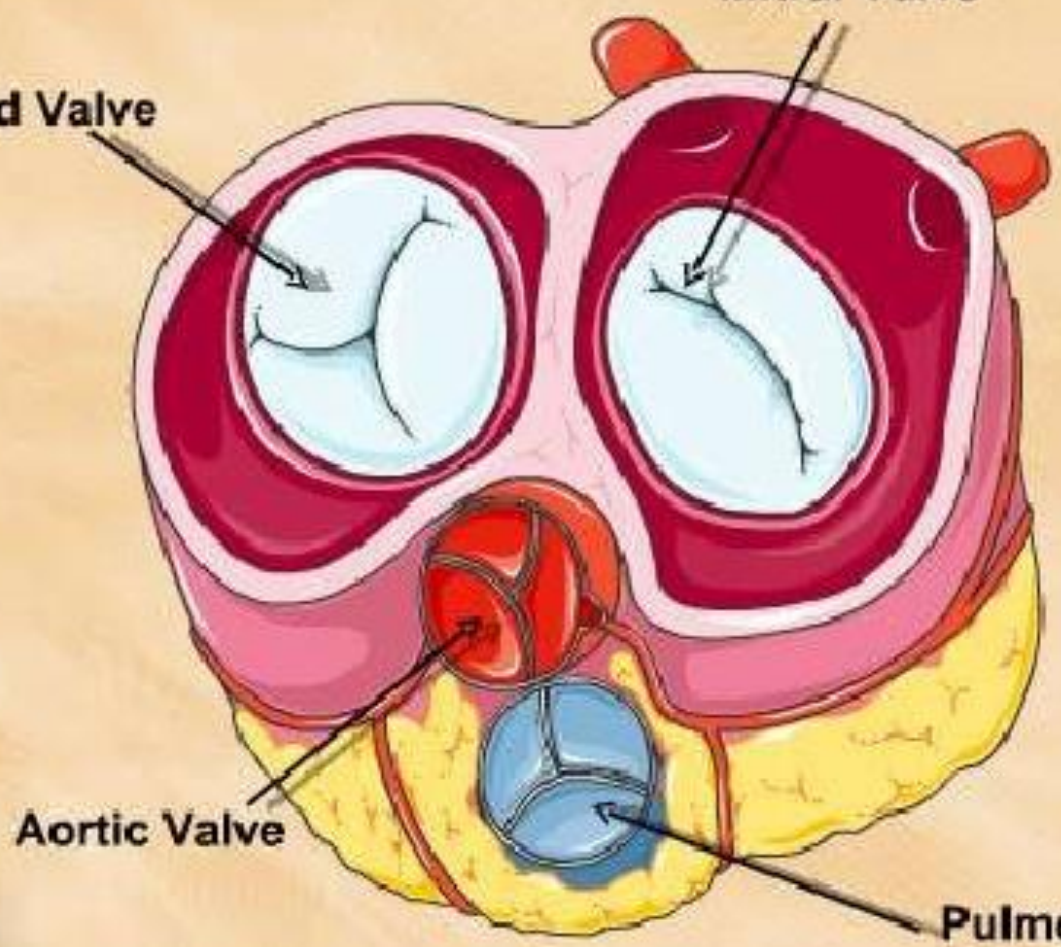


The Heart Valves

- Heart valves ensure unidirectional blood flow through the heart
  - Composed of an endocardium with a connective tissue core.
- Two major types
  - Atrioventricular valves
  - Semilunar valves

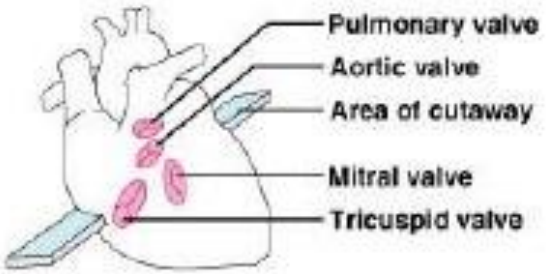


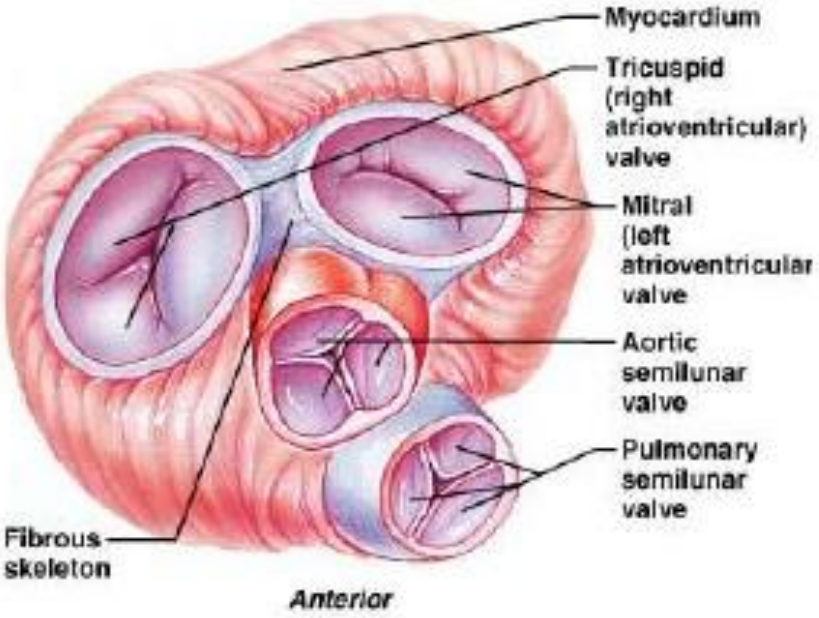
Valves of the Heart



Atrioventricular (AV) Valves

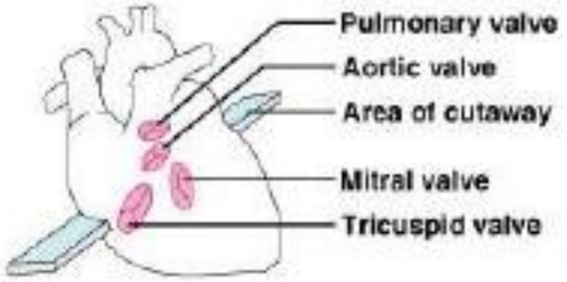
- Atrioventricular (AV) valves lie between the atria and the ventricles
  - R-AV valve = tricuspid valve
  - L-AV valve = bicuspid or mitral valve
- AV valves prevent backflow of blood into the atria when ventricles contract

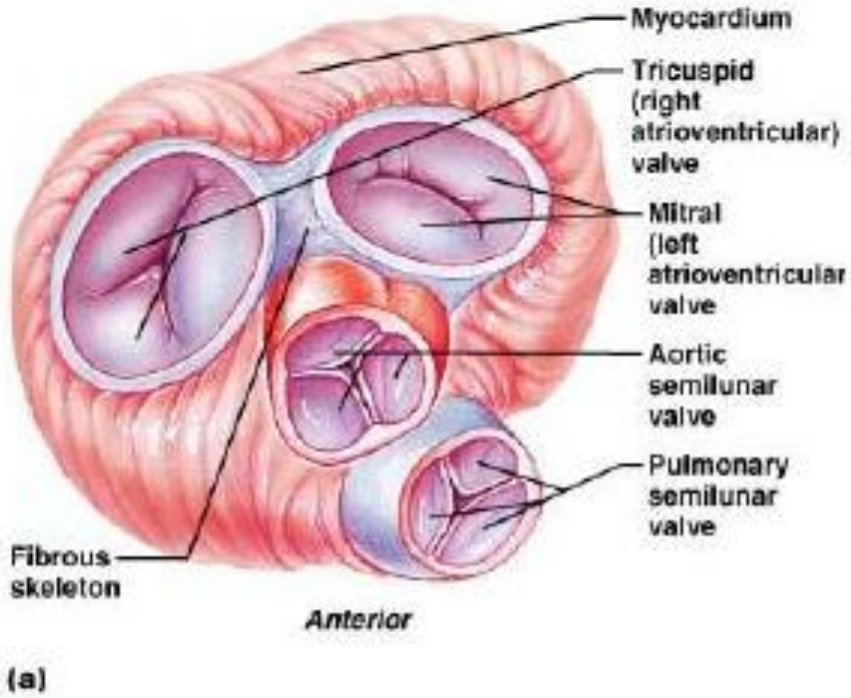




Semilunar Heart Valves

- Semilunar valves prevent backflow of blood into the ventricles
- Aortic semilunar valve lies between the left ventricle and the aorta
- Pulmonary semilunar valve lies between the right ventricle and pulmonary trunk
- Heart sounds ("lub-dup") due to valves closing
  - "Lub" - closing of atrioventricular valves
  - "Dub"- closing of semilunar valves





The Heart Valves

Atrioventricular valves

Right AV (Tricuspid)

- separates the right atrium from the right ventricle. Prevents backflow into atrium.

Left AV (Bicuspid)

- separates the left atrium from the left ventricle. Prevents backflow into atrium.

Semilunar valves

- Pulmonary valve
  - separates the right ventricle from the pulmonary arteries. Prevents backflow after ventricular contraction.
- Aortic valve
  - separates the left ventricle from the aorta. Prevents backflow after ventricular contraction

PULMONARY VALVES

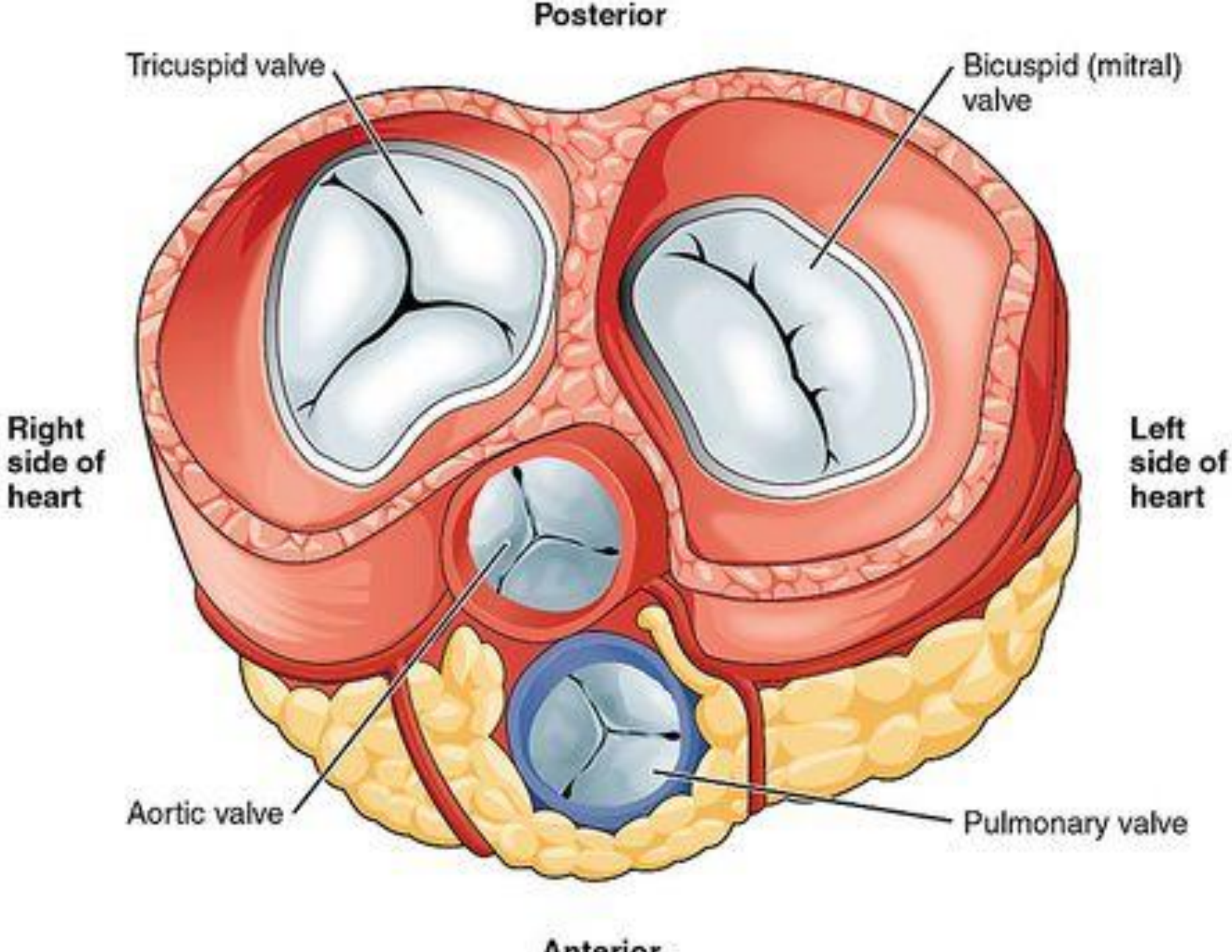
.The opening into the pulmonary trunk is closed by the pulmonary valve, which consists of three semilunar cusps with free edges projecting upward into the lumen of the pulmonary trunk thus prevents the backflow of blood as it is pumped from the right ventricle to the pulmonary artery.

- The cusps are named the left, right and anterior semilunar cusps, relative to their fetal position.

- Each cusp forms a pocket-like sinus; a dilation in the wall of the initial portion of the pulmonary trunk.

TRICUSPID VALVES

- The right atrioventricular opening is closed during ventricular contraction by the tricuspid valve (right atrioventricular valve) thus prevents the backflow of blood as it is pumped from the right atrium to the right ventricle. It's named tricuspid valve because it made up of three cusps or leaflets. The naming of the three cusps, the anterior, septal, and posterior cusps, is based on their position in relation to the right ventricle.


Posterior
Tricuspid valve
Bicuspid (mitral) valve
Right side of heart
Left side of heart
Aortic valve
Pulmonary valve
Anterior

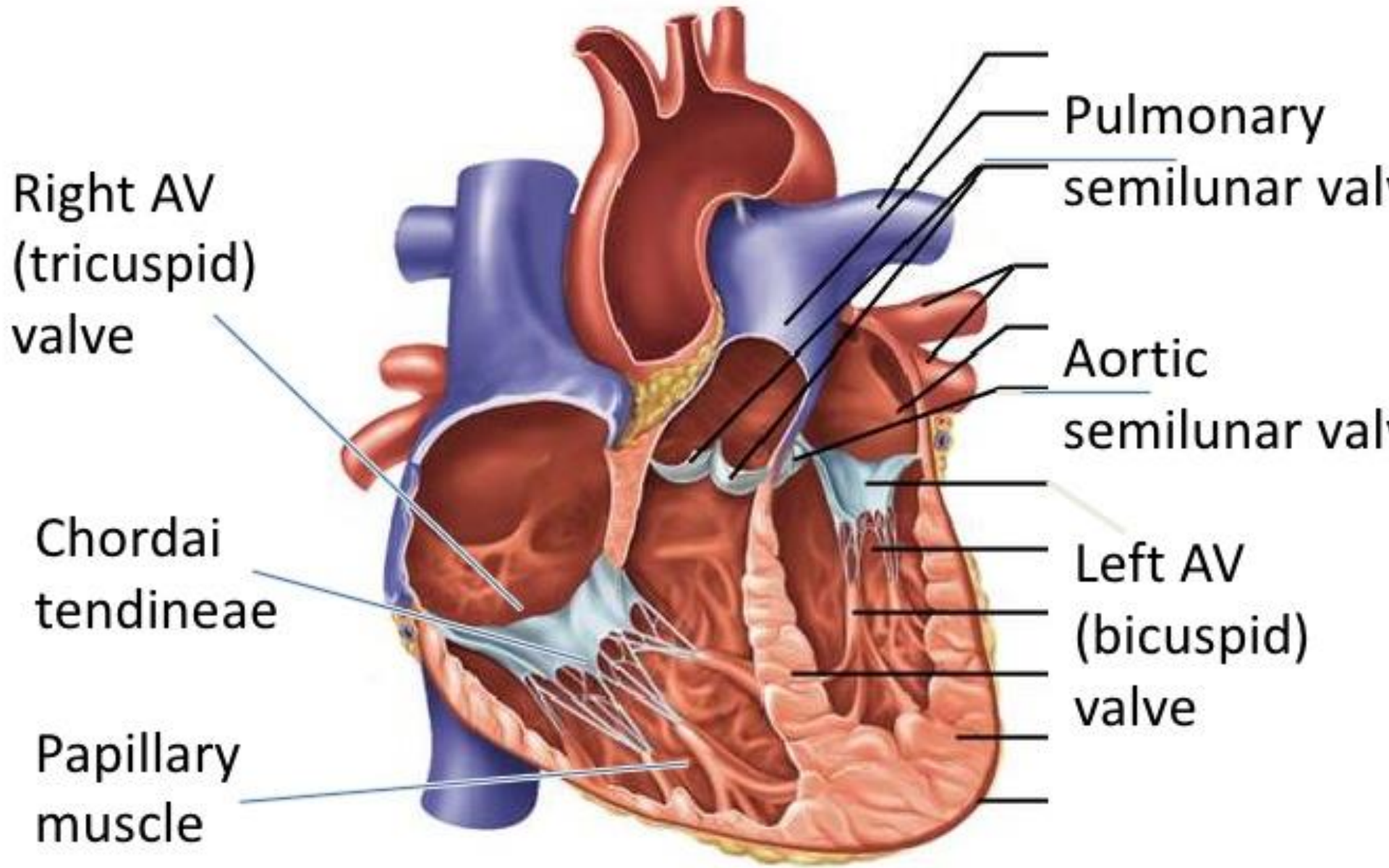
AORTIC VALVES

- The opening from the left ventricle into the aorta is closed by the aortic valve thus prevents the backflow of blood as it is pumped from the left ventricle to the aorta.
- It consists of three semilunar cusps with the free edge of each projecting upward into the lumen of the ascending aorta.
- Between the semilunar cusps and the wall of the ascending aorta are pocket-like sinuses-the right, left, and posterior aortic sinuses. The right and left coronary arteries emanates from the right and left aortic sinuses; Thus, the posterior aortic sinus and cusp are sometimes called noncoronary sinus and cusp.

MITRAL VALVE

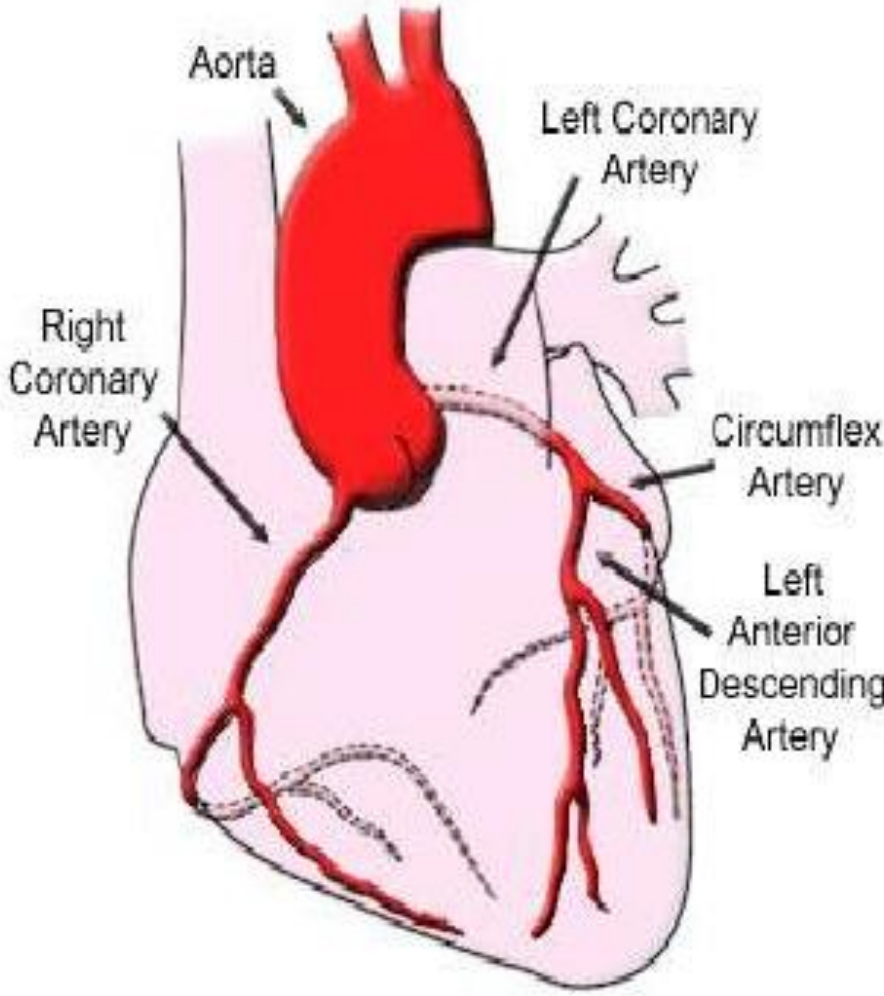
- The left atrioventricular orifice opens into the posterior right side of the superior part of the left ventricle.
- It is closed during ventricular contraction by the mitral valve (left atrioventricular valve), which is also referred to as the bicuspid valve as it has two cusps; the anterior and posterior cusps.
- It prevents the backflow of blood as it is pumped from the left atrium to the left ventricle and are continuous with each other at the commissures

The Heart Valves



Arterial Supply of the Heart

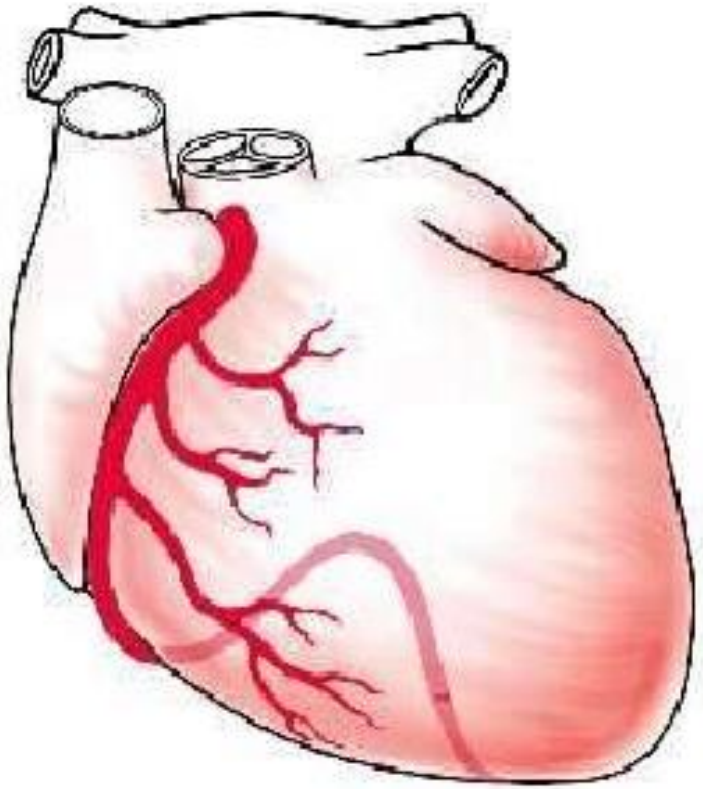
- The arterial supply of the heart is provided by the **right** and **left** coronary arteries, which arise from the **ascending aorta** immediately above the aortic valve.



Right coronary artery

Branches

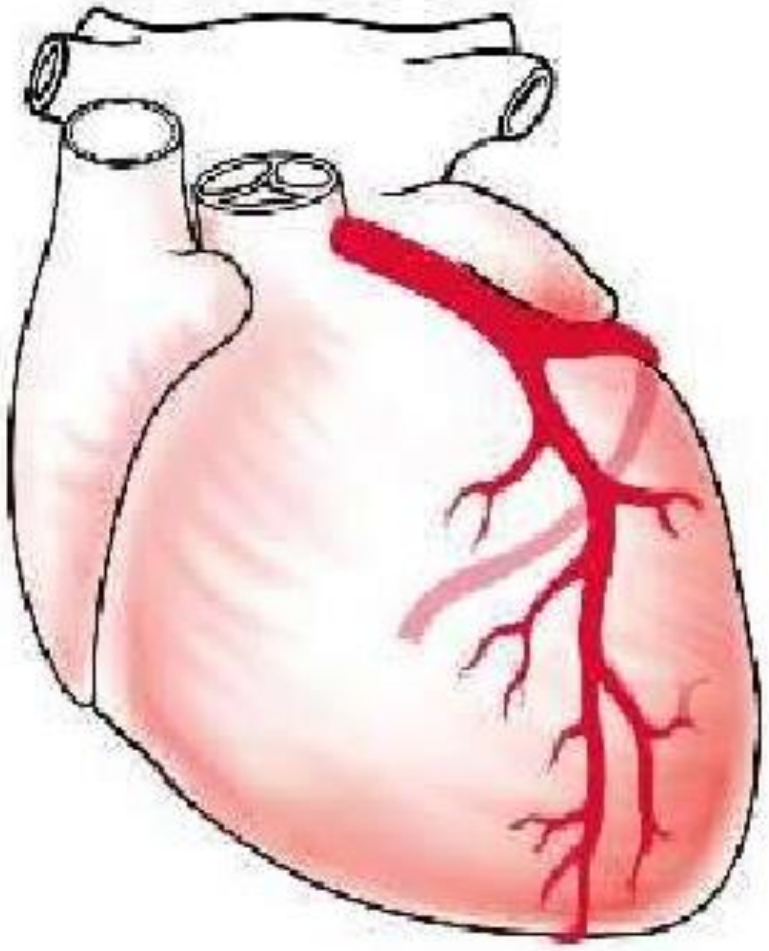
- Right marginal arteries (acute marginal artery)
- Posterior interventricular artery. (in post. IV sulcus)
- Sinoatrial nodal artery.
- Atrioventricular nodal artery.



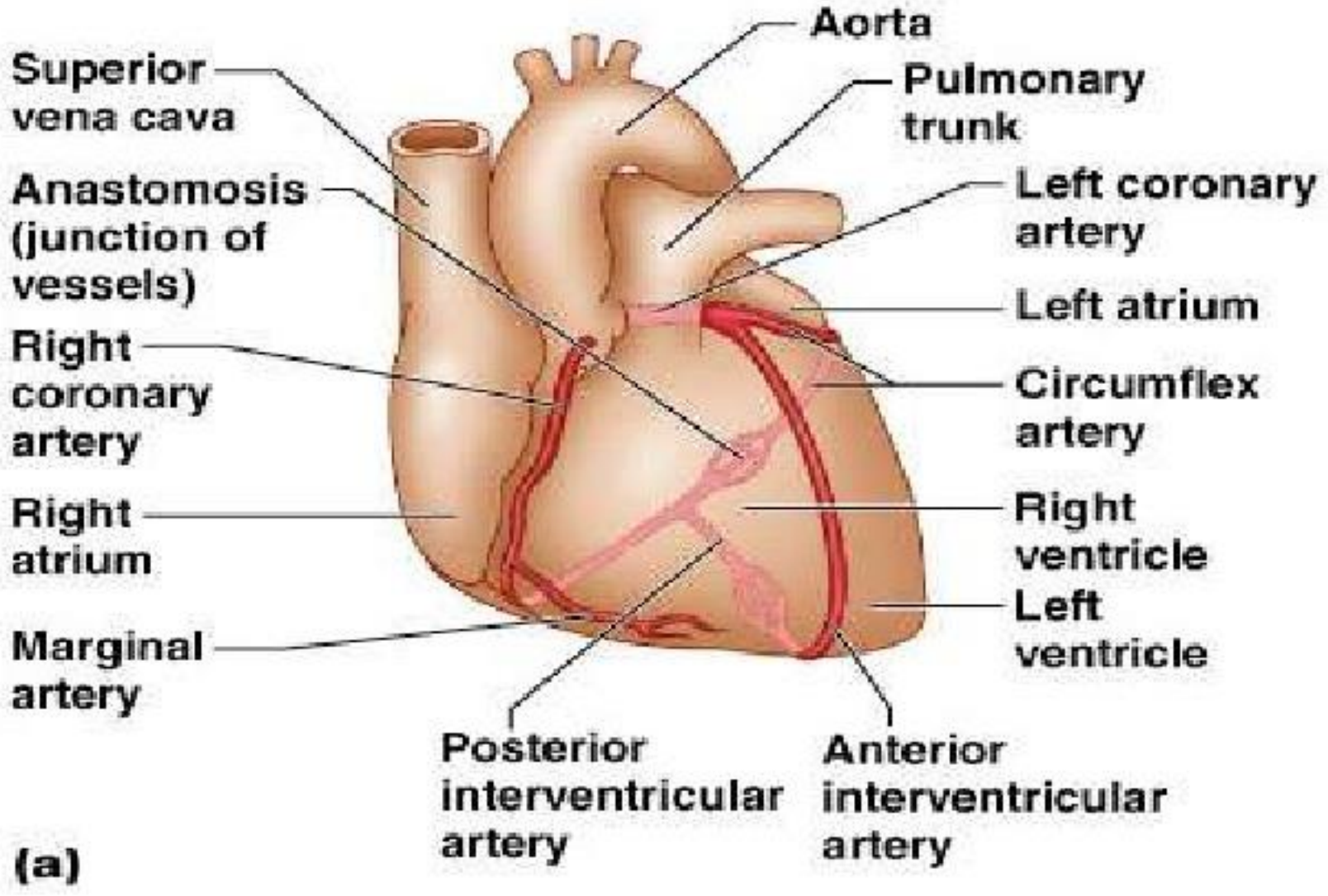
Left coronary artery

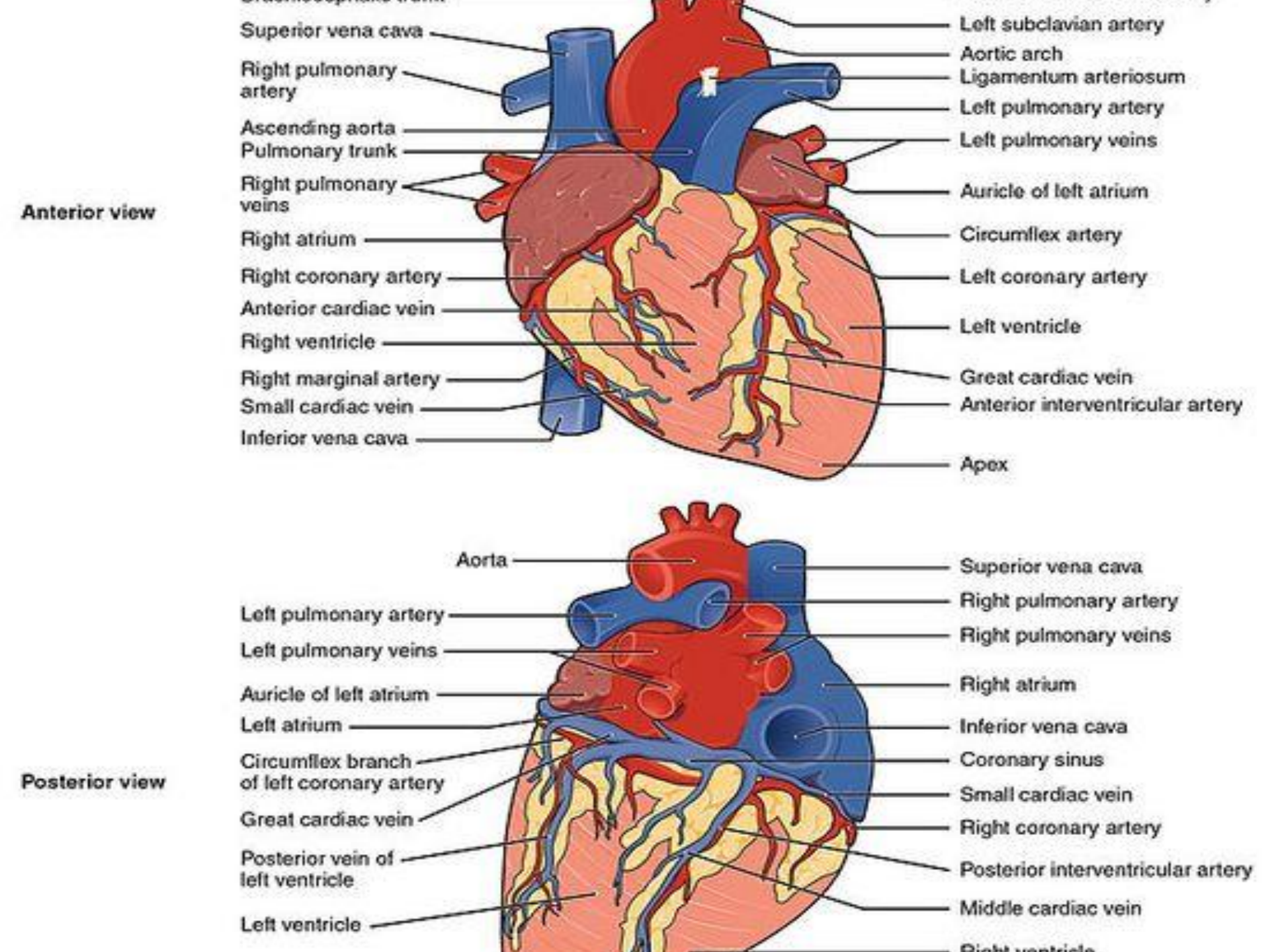
Branches

- Left anterior descending (LAD) or anterior interventricular artery. (lies in anterior IV sulcus)
  - Septal branches.
  - Diagonal branches
- Left marginal artery. (Obtuse marginal artery)
- Left circumflex artery.



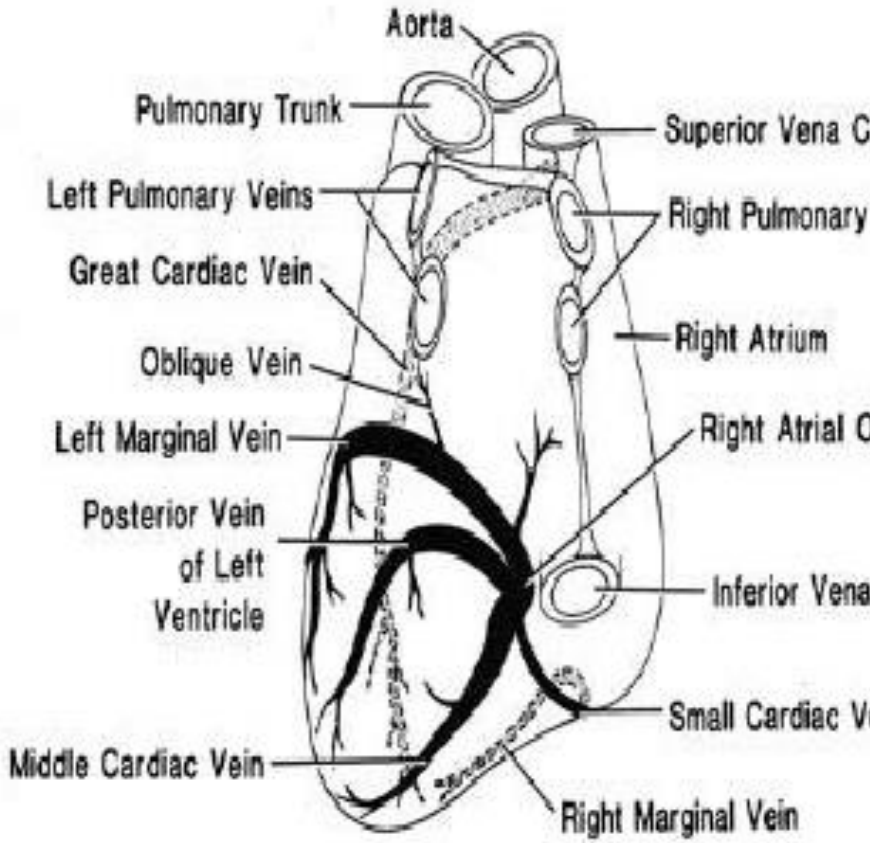
Coronary Arteries



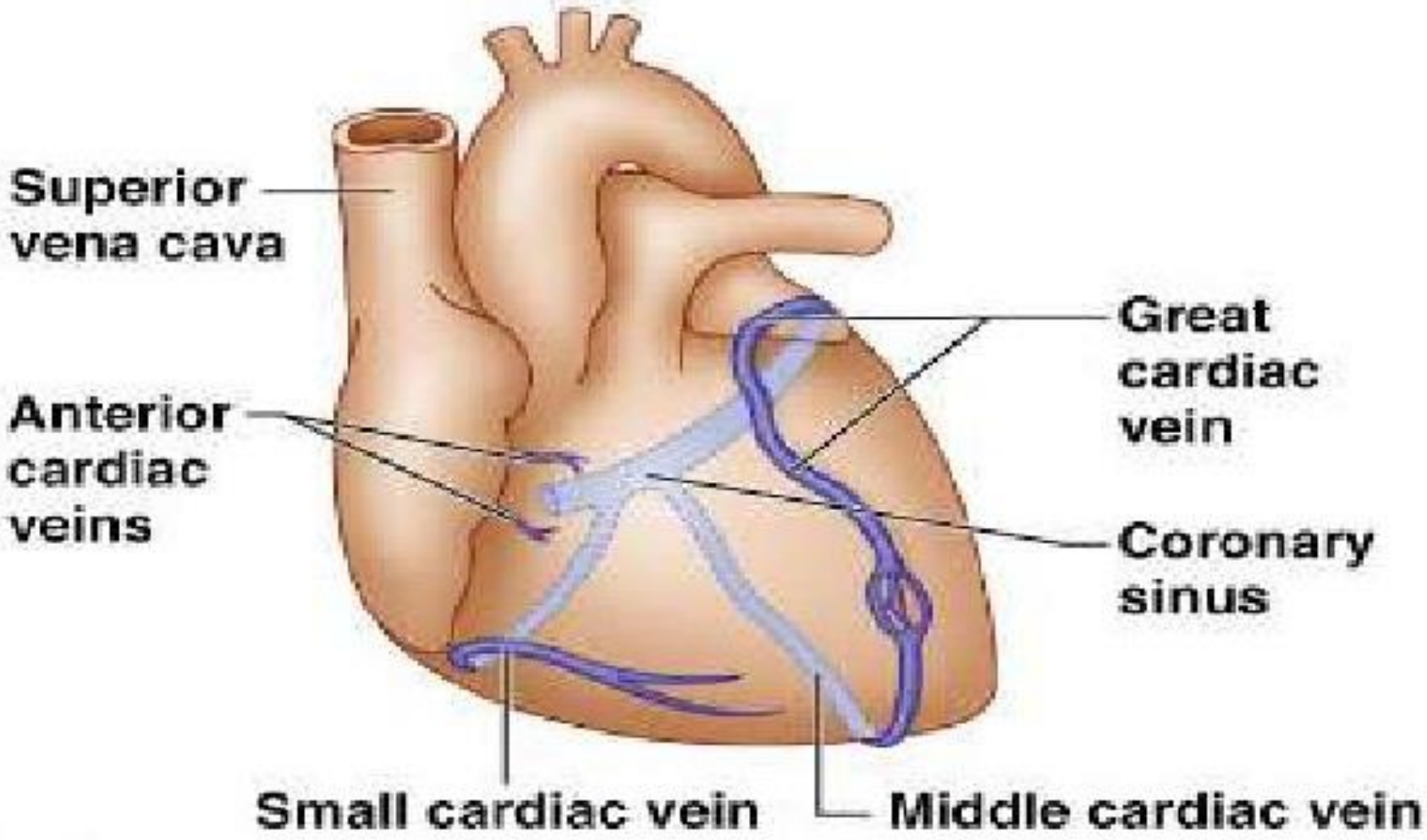

Anterior view
Superior vena cava
Right pulmonary artery
Ascending aorta
Pulmonary trunk
Right pulmonary veins
Right atrium
Right coronary artery
Anterior cardiac vein
Right ventricle
Right marginal artery
Small cardiac vein
Inferior vena cava
Left subclavian artery
Aortic arch
Ligamentum arteriosum
Left pulmonary artery
Left pulmonary veins
Auricle of left atrium
Circumflex artery
Left coronary artery
Left ventricle
Great cardiac vein
Anterior interventricular artery
Apex
Posterior view
Aorta
Left pulmonary artery
Left pulmonary veins
Auricle of left atrium
Left atrium
Circumflex branch of left coronary artery
Great cardiac vein
Posterior vein of left ventricle
Left ventricle
Superior vena cava
Right pulmonary artery
Right pulmonary veins
Right atrium
Inferior vena cava
Coronary sinus
Small cardiac vein
Right coronary artery
Posterior interventricular artery
Middle cardiac vein

Venous Drainage of the Heart

- Most blood from the heart wall drains into the right atrium through the ***coronary sinus*** ,which lies in the posterior part of the atrioventricular groove .
- It is a continuation of the ***great cardiac vein***.
- It opens into the right atrium to the left of the inferior vena cava



Venous Drainage of the Heart



Nerve Supply of the Heart

- The heart is innervated by sympathetic and parasympathetic fibers of the autonomic nervous system via the cardiac plexuses situated below the arch of the aorta.

NERVE SUPPLY

- The nerve supply to the heart is from two sets of nerves originating in the medulla of the brain.

- The nerves are part of the involuntary (autonomic) nervous system.

- One set, the branches from the vagus nerve, keeps the heart beating at a slow, regular rate.
- The other set, the cardiac accelerator nerves, speeds up the heart.
- The heart muscle has a special ability; it contracts automatically, but the nerve supply is needed to provide an effective contraction for blood circulation.

THANX