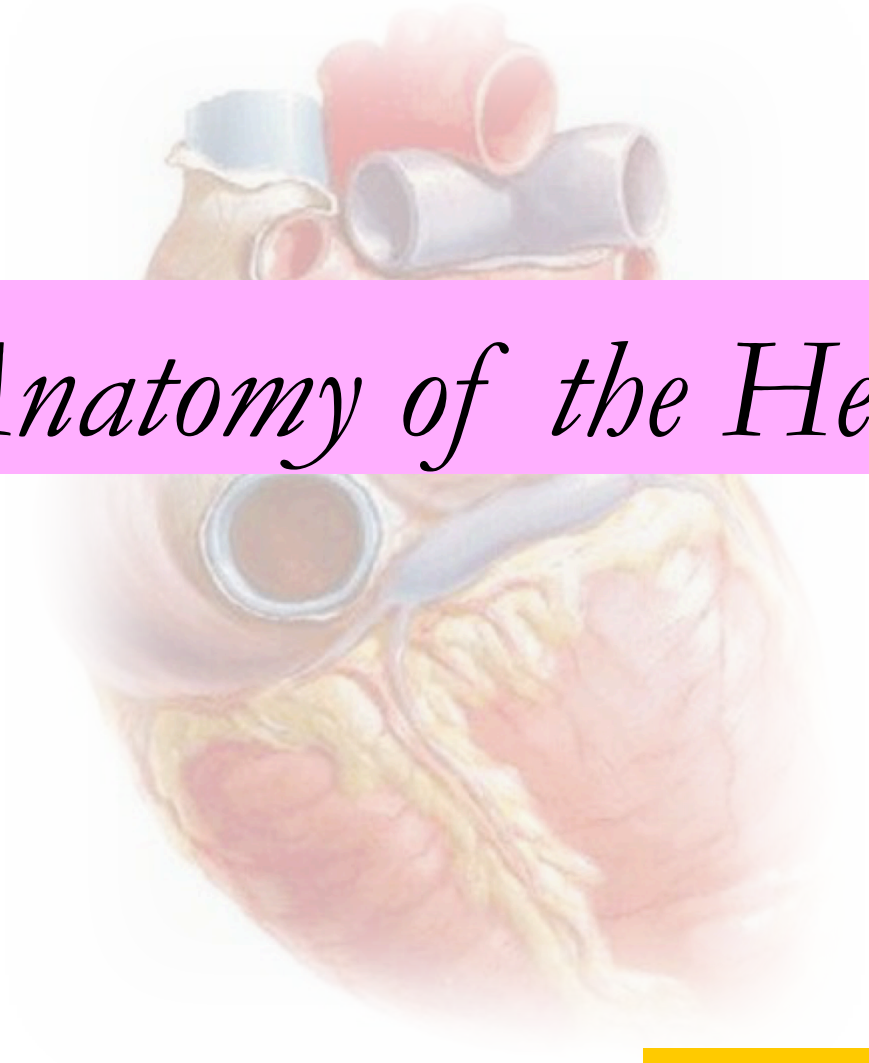

Anatomy of the Heart

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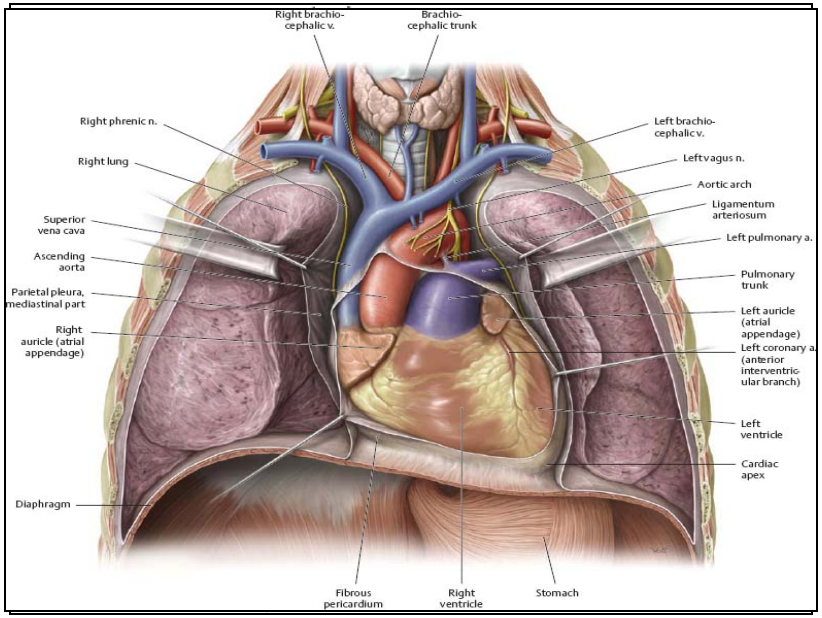
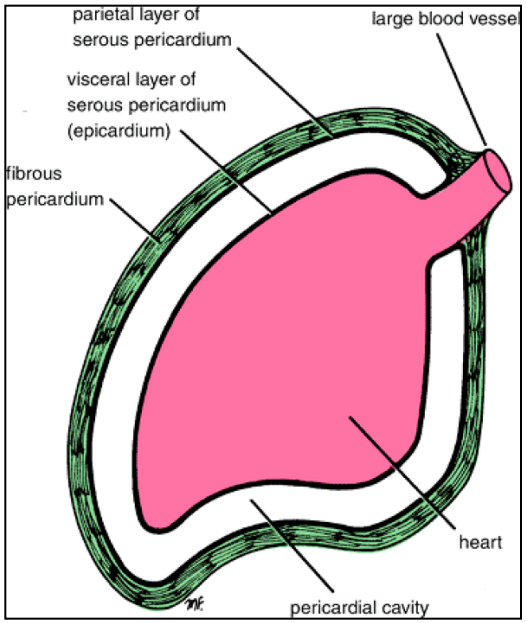
DR. SAEED VOHRA

OBJECTIVES

- ***At the end of the lecture, the student should be able to :***
- ***Describe the shape of heart regarding :*** *apex, base, sternocostal and diaphragmatic surfaces.*
- ***Describe the interior of heart chambers :*** *right atrium, right ventricle, left atrium and left ventricle.*
- ***List the orifices of the heart :***
- *Right atrioventricular (Tricuspid) orifice.*
- *Pulmonary orifice.*
- *Left atrioventricular (Mitral) orifice.*
- *Aortic orifice.*
- ***Describe the innervation of the heart***
- *Briefly describe the conduction system of the Heart*

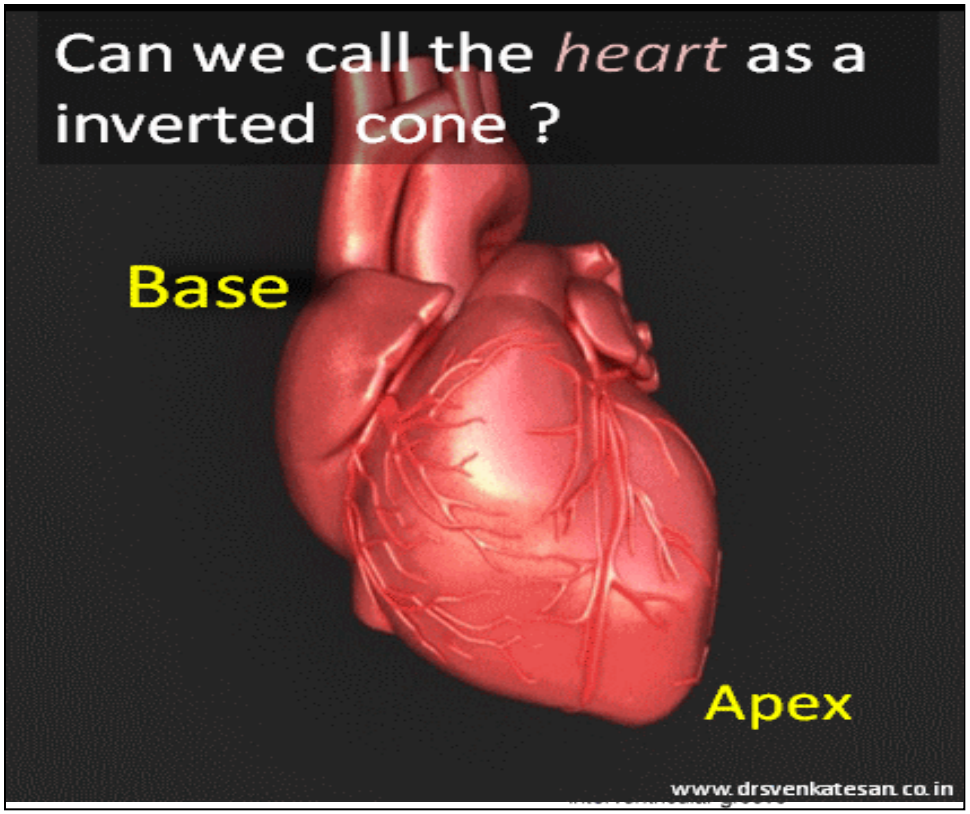
The Heart





- It lies in the middle mediastinum.
- It is surrounded by a fibroserous sac called pericardium which is differentiated into an outer fibrous layer (Fibrous pericardium) & inner serous sac(Serous pericardium).
- The Heart is somewhat pyramidal in shape, having:
- Apex
- Sterno-costal (anterior surface)
- Base (posterior surface).
- Diaphragmatic (inferior surface)
- It consists of 4 chambers, 2 atria (right& left) & 2 ventricles (right& left).

Apex of the heart

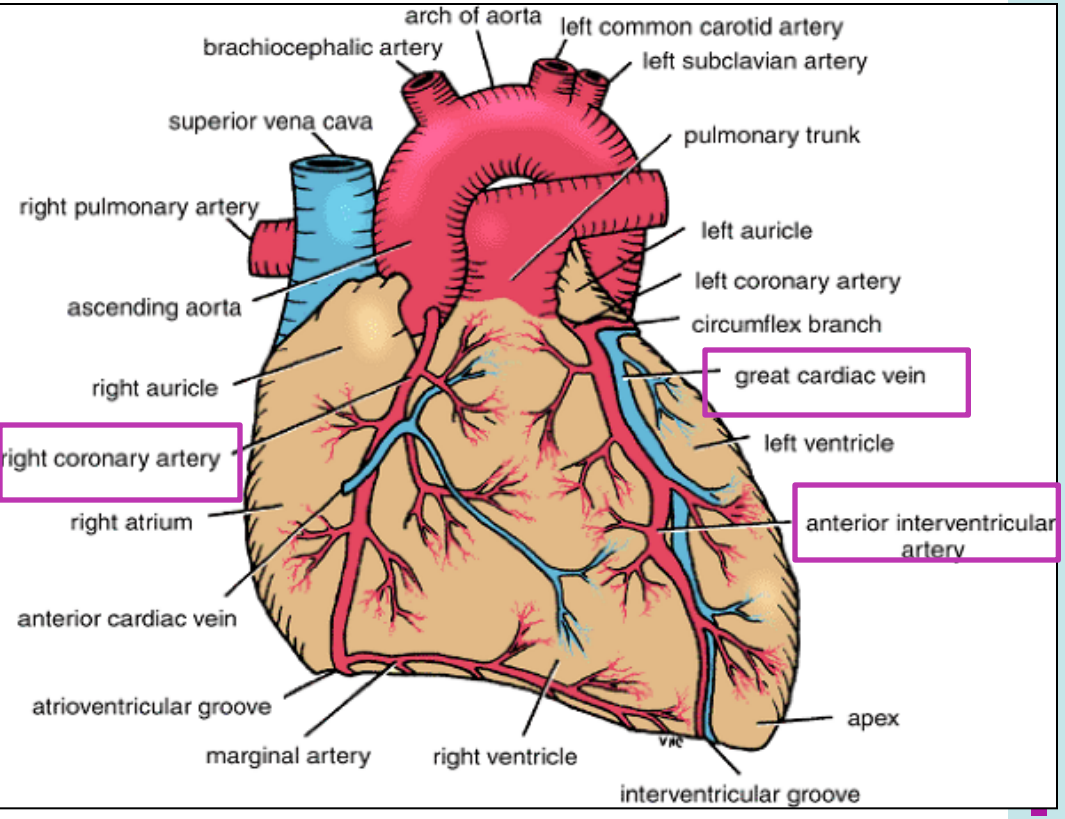


- Directed downwards, forwards and to the left.
- It is formed by the **left ventricle.**
- Lies at the level of **left 5th intercostal space** 3.5 inch from midline.

Note that the base of the heart is called the base because the heart is pyramid shaped; the base lies opposite to the apex. The heart does not rest on its base; it rests on its diaphragmatic (inferior) surface

Sterno-costal (anterior)surface

This **surface** is formed **mainly** by the **right atrium** and the **right ventricle**



- Divided by coronary (atrio-ventricular) groove into :
- Atrial part, formed mainly by right atrium.
- Ventricular part , the right 2/3 is formed by right ventricle, while the left l1/3 is formed by left ventricle.So, it is also formed of some of the left ventricle.

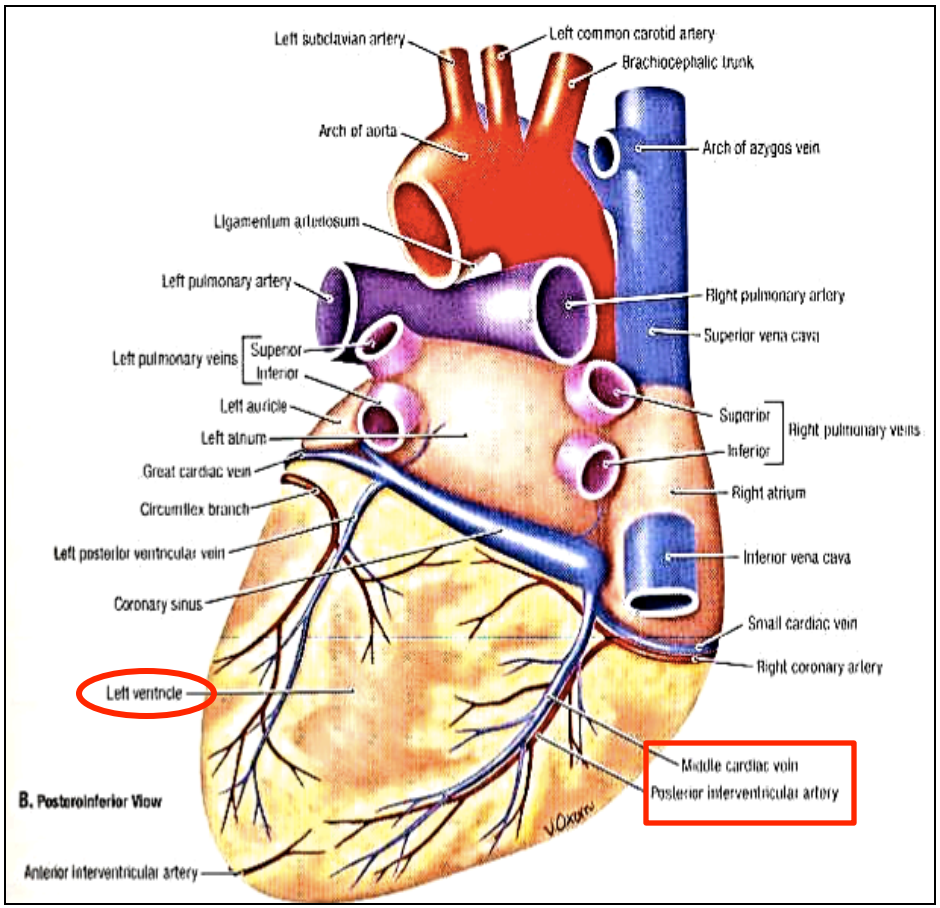
The 2 ventricles are separated by **anterior interventricular groove**, **which lodges** :

Anterior interventricular artery (branch of left coronary).

Great cardiac vein.

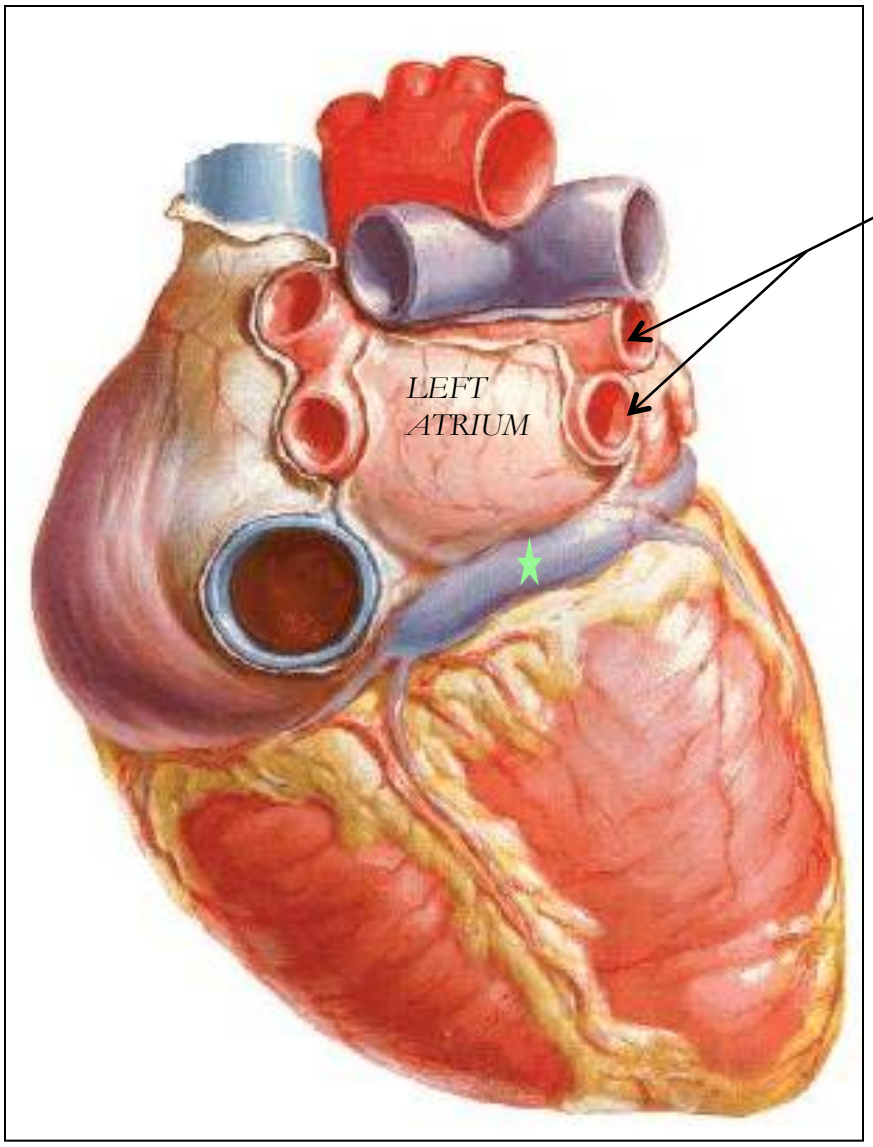
- **The coronary groove lodges** : the right coronary artery.

Diaphragmatic (Inferior)surface



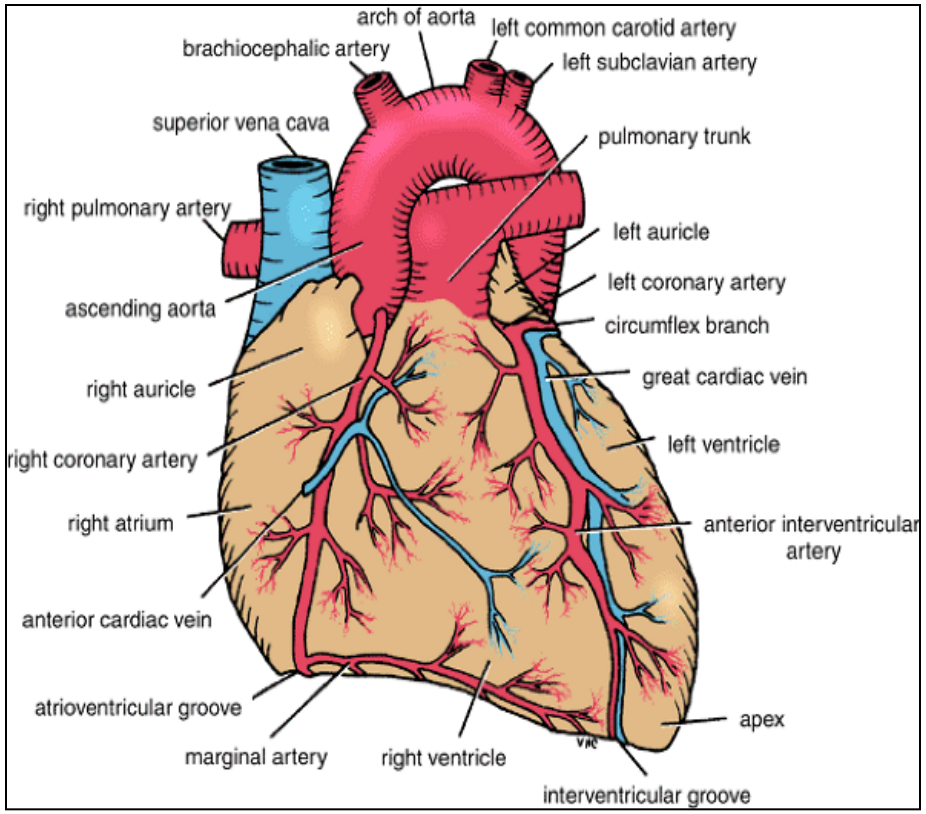
- **Formed by** the 2-ventricles, mainly left ventricle(left 2/3).
- Slightly concave as it rests on diaphragm.
- **Directed** inferiorly & backward.
- **Separated from** base of heart by posterior part of coronary sulcus
- The 2-ventricles are separated by **posterior interventricular groove** which lodges:
- **Posterior interventricular artery**
- **Middle cardiac vein**

Base of the Heart (posterior surface)



- It is formed by the 2 atria, mainly left atrium, into which open the 4 pulmonary veins.
- It is directed backwards.
- Lies opposite middle thoracic vertebrae(5-7)
- Is separated from the vertebral column by descending aorta, esophagus and oblique sinus of pericardium
- Bounded inferiorly by post part of coronary sulcus , which lodges the coronary sinus

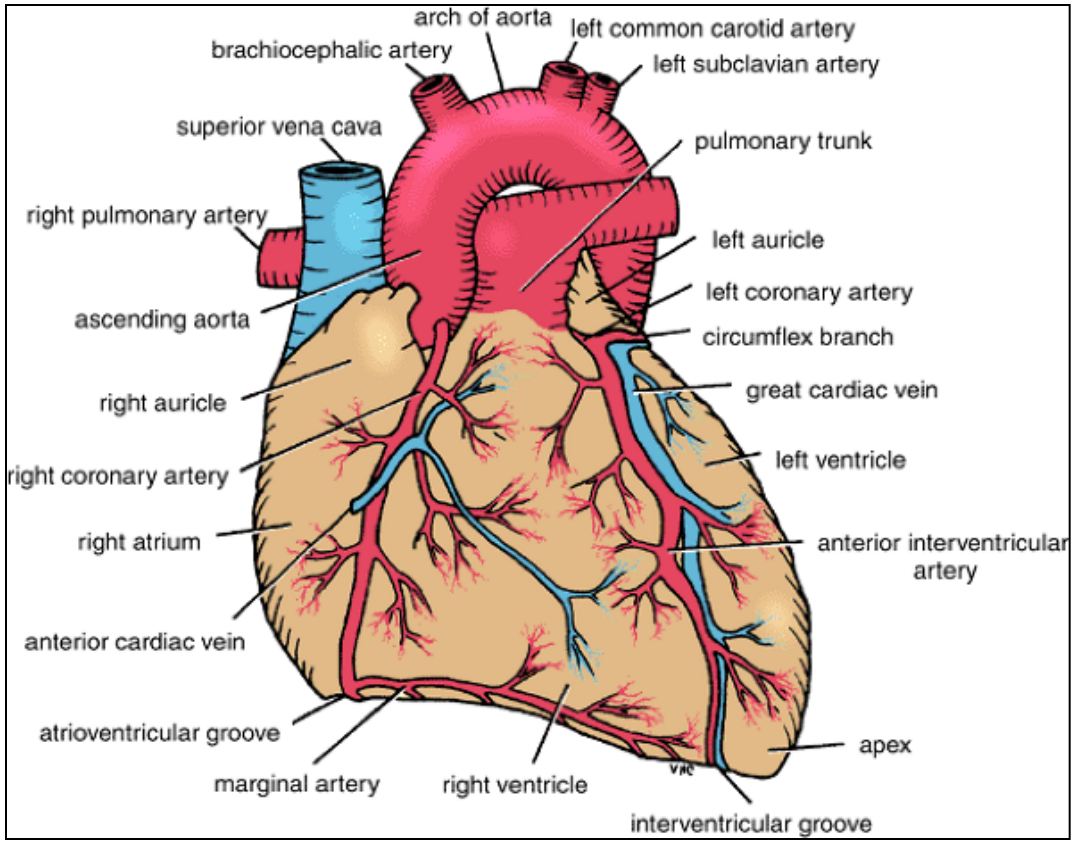
Borders of the Heart



- **Upper border:**
- Is formed by the 2 atria.
- It is concealed by ascending aorta & pulmonary trunk.
- **Right border:**
- Is formed by right atrium
- **Lower border:**
- Is formed mainly by right ventricle + apical part of left ventricle.
- **Left border:**
- Is formed mainly by left ventricle + auricle of left atrium.

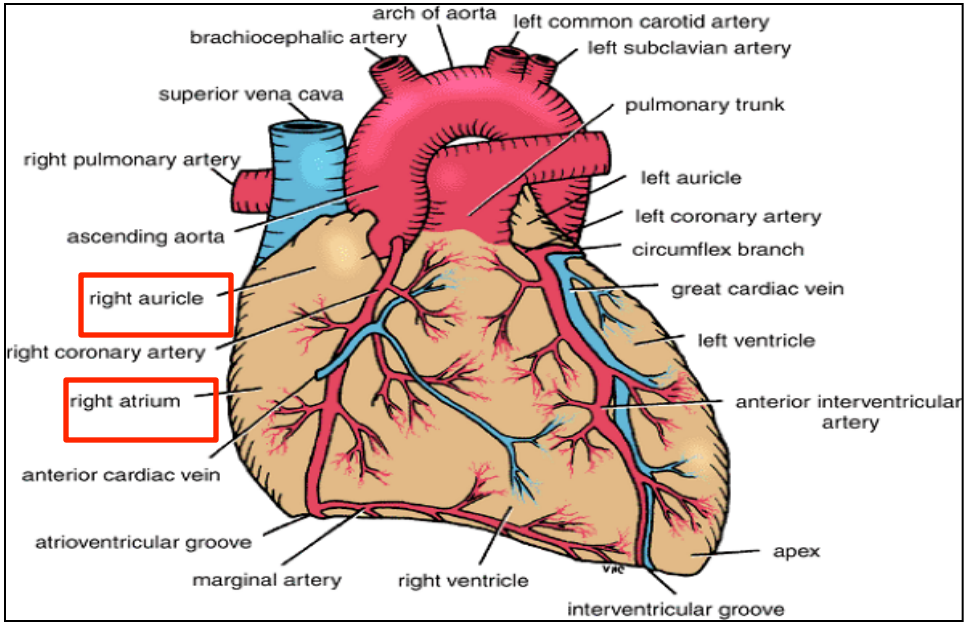
Chambers of the Heart

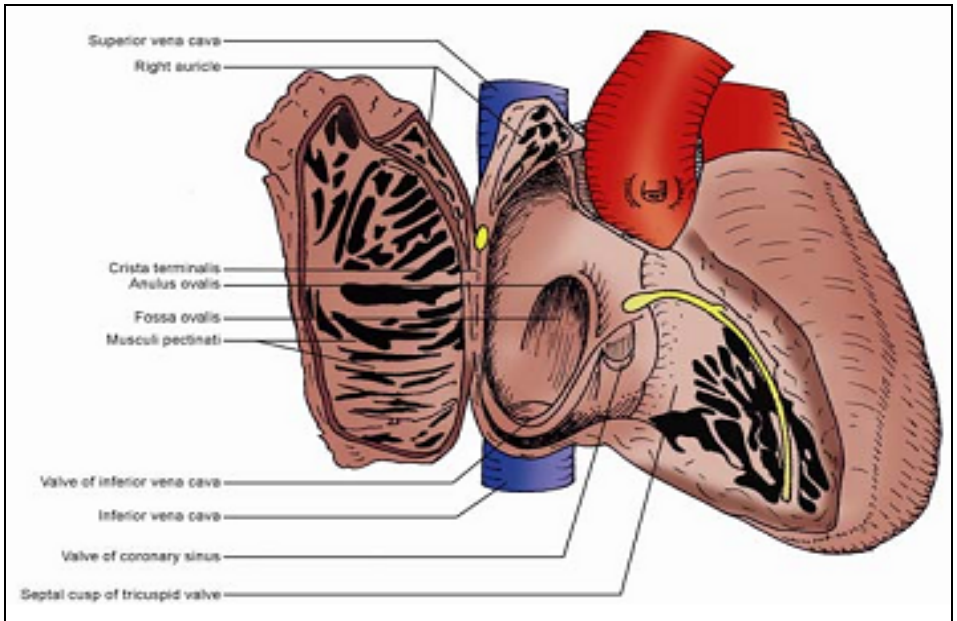
The heart is divided by vertical septa into four chambers: the right and left atria and the right and left ventricles. The right atrium lies anterior to the left atrium, and the right ventricle lies anterior to the left ventricle.



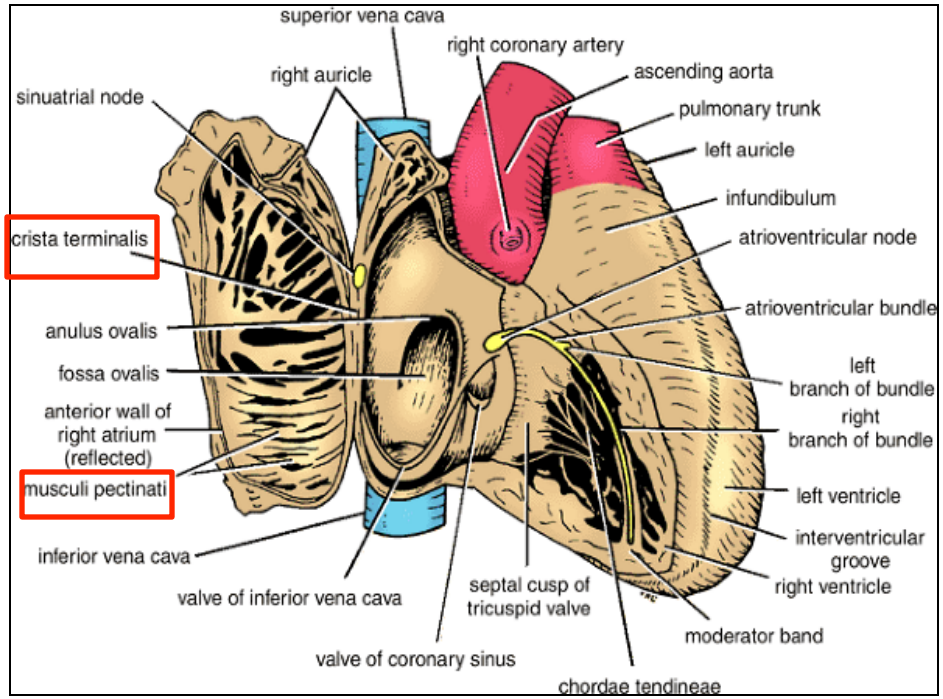
Right Atrium

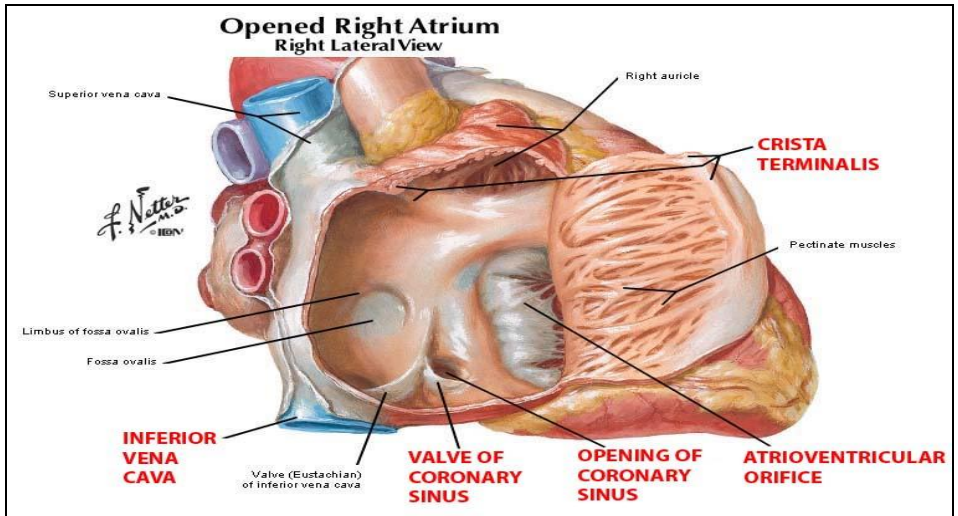
- The right atrium consists of a **main cavity** and a small out pouching, the **auricle.**
- **On the outside** of the heart at the junction **between** the **right atrium** and the **right auricle** is a **vertical groove**, the **sulcus terminalis,** which **on the inside** forms a ridge, the **crista terminalis.**





Cavity of Right Atrium





➢**Crista terminalis divides** right atrium into:

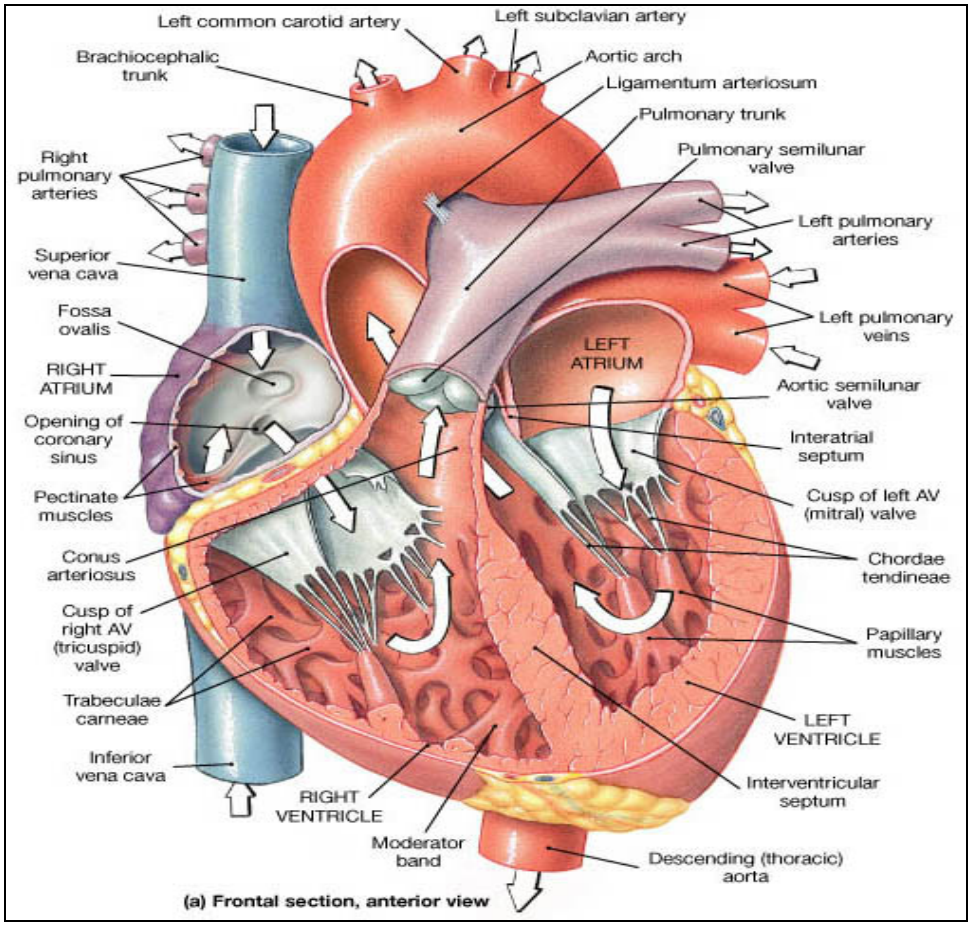
1- Anterior part: **rough** and trabeculated by bundles of muscle fibres **(musculi pectinati).**

2- Posterior part (sinus venarum) is **smooth.**

➢**The interatrial septum** carries an **oval depression** called *Fossa ovalis* **The margin** of this depression is called *Anulus ovalis*

➢*The blood leaves right atrium to right ventricle via tricuspid valve.*

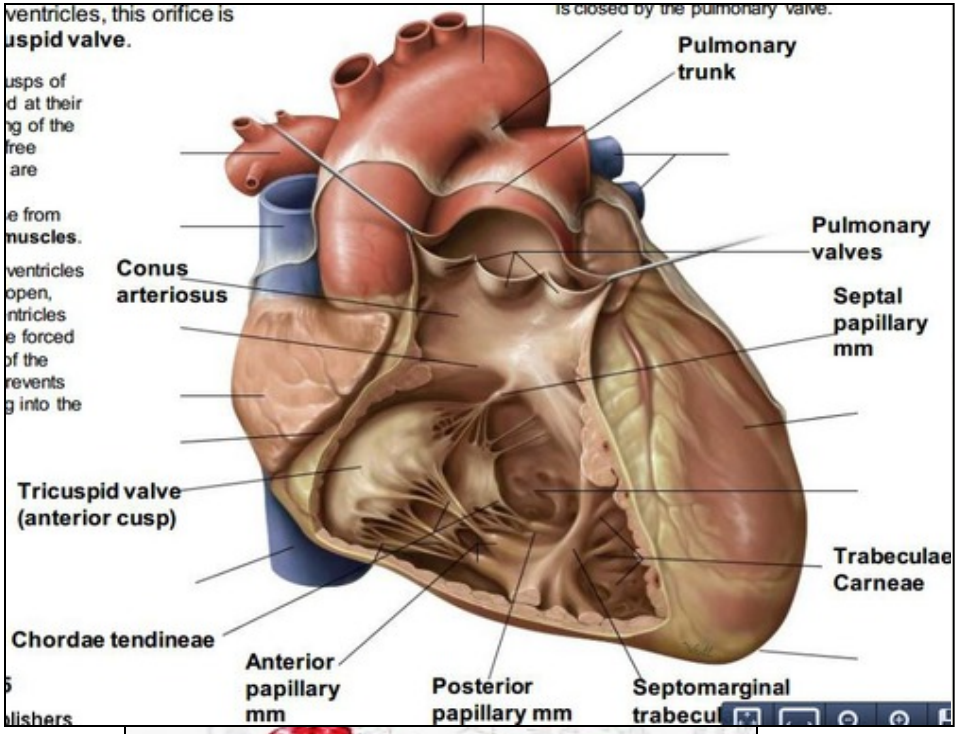
Cavity of Right Atrium

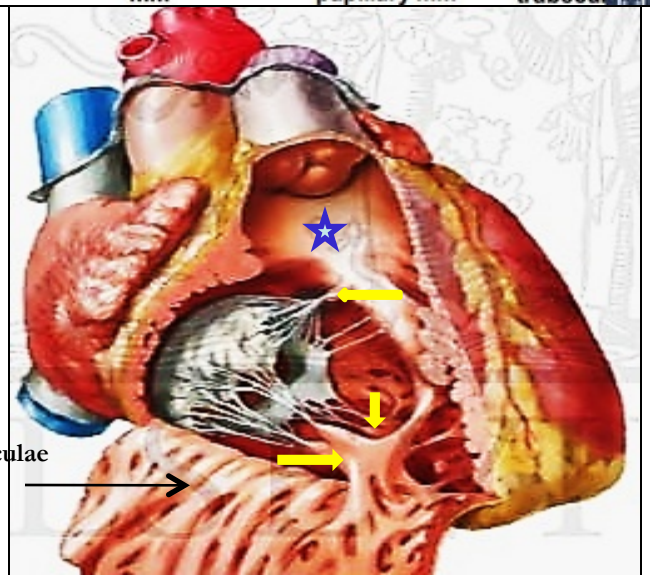


Openings in right atrium:

- **SVC** --- has no valve
- **IVC** --- guarded by a valve
- **Coronary sinus :** has a well-defined valve
- **Right atrioventricular orifice** lies anterior to IVC opening , it is **surrounded by a fibrous ring** which gives attachment to the **tricuspid valve**
- **Small orifices** of small veins

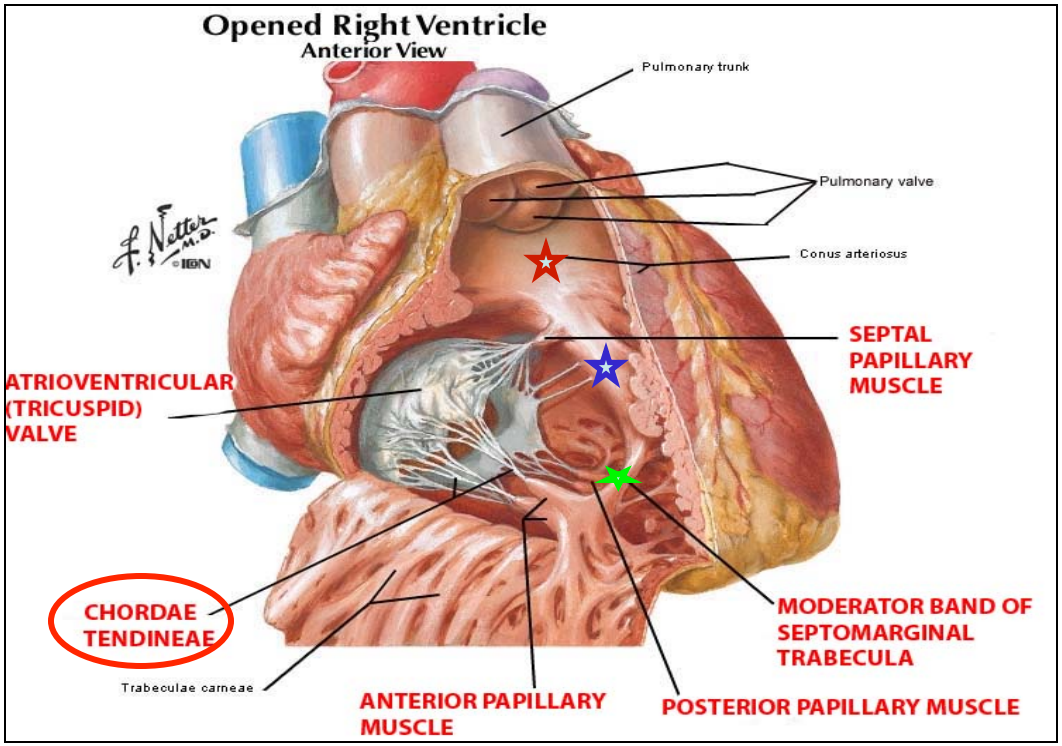
Cavity of right ventricle





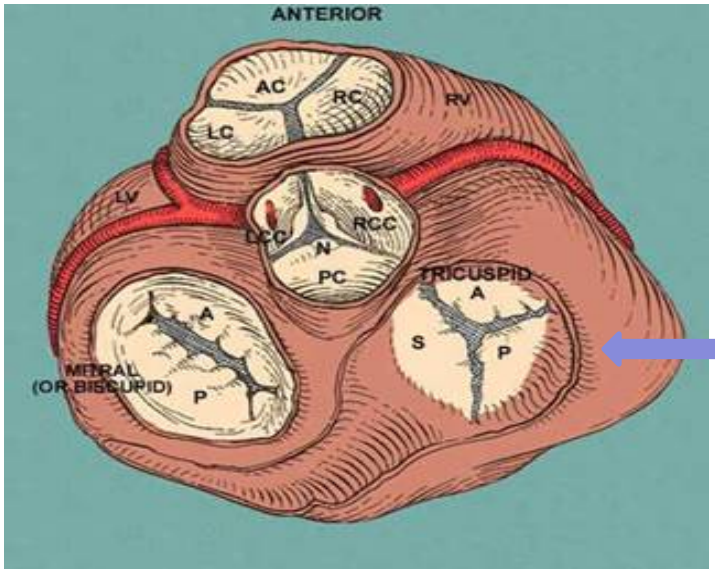
- **Its wall** is **thinner** than that of left ventricle
- **Its wall** contains projections called *trabeculae carnae.*
- **The right ventricle communicates with right atrium** through **right atrioventricular orifice** & **with pulmonary trunk** through **pulmonary orifice.**
- As **the cavity** approaches the pulmonary orifice it **becomes funnel shaped,** at which point it is referred to as the **infundibulum.** ★
- Large projections arise from the walls called *papillary muscles :*
  - *Anterior papillary muscle*
  - *Posterior papillary muscle*
  - *Septal papillary muscle*

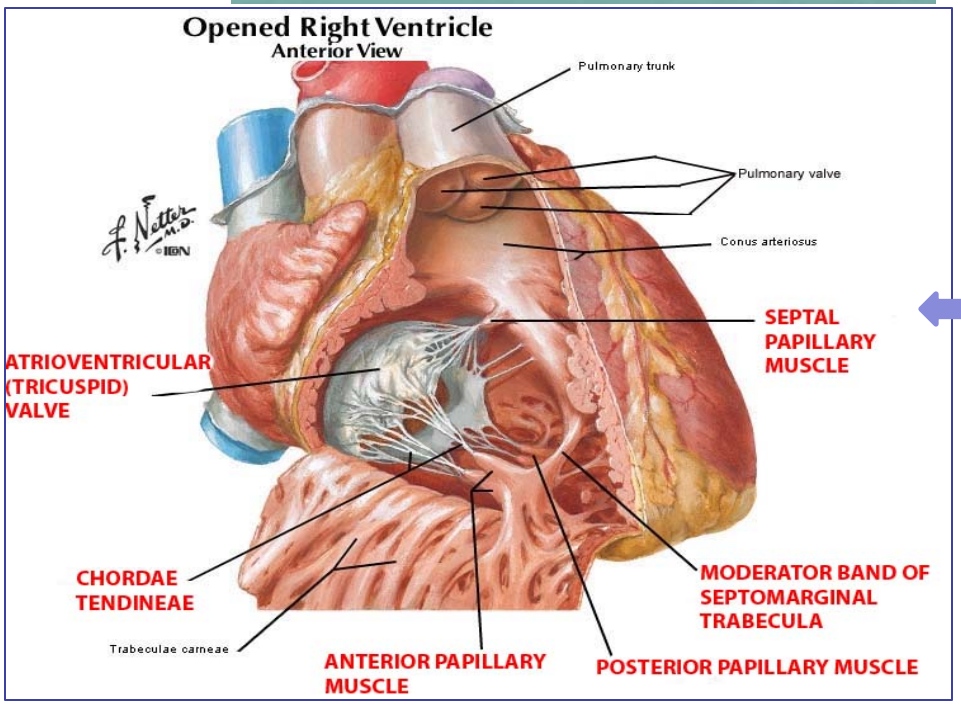
Cavity of right ventricle



- Each papillary muscle is attached to the cusps of tricuspid valve by tendinous threads called *chordae tendinae.*
- *Blood leaves the right ventricle to pulmonary trunk through pulmonary orifice.*
- *The wall of infundibulum (conus arteriosus) is smooth and contains no trabeculae.*
- *Interventricular septum is connected to anterior papillary muscle by a muscular band called moderator band*

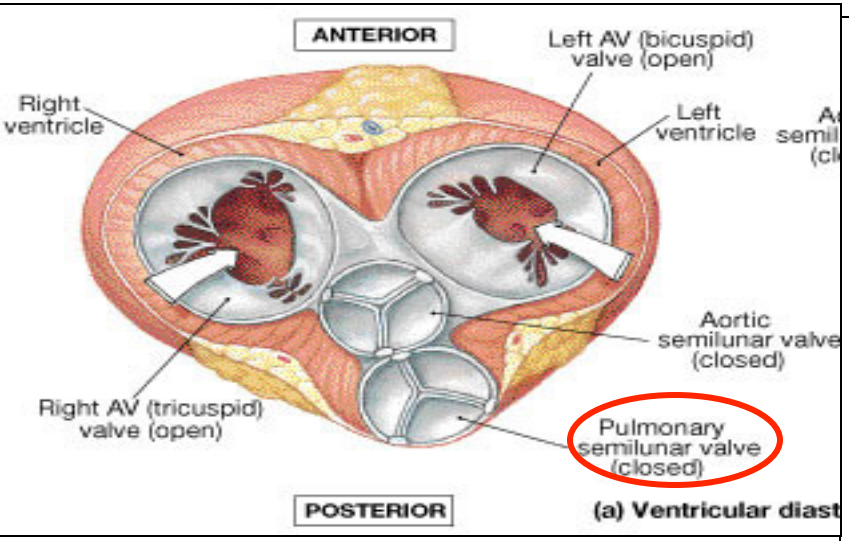
Right atrio-ventricular (tricuspid) orifice





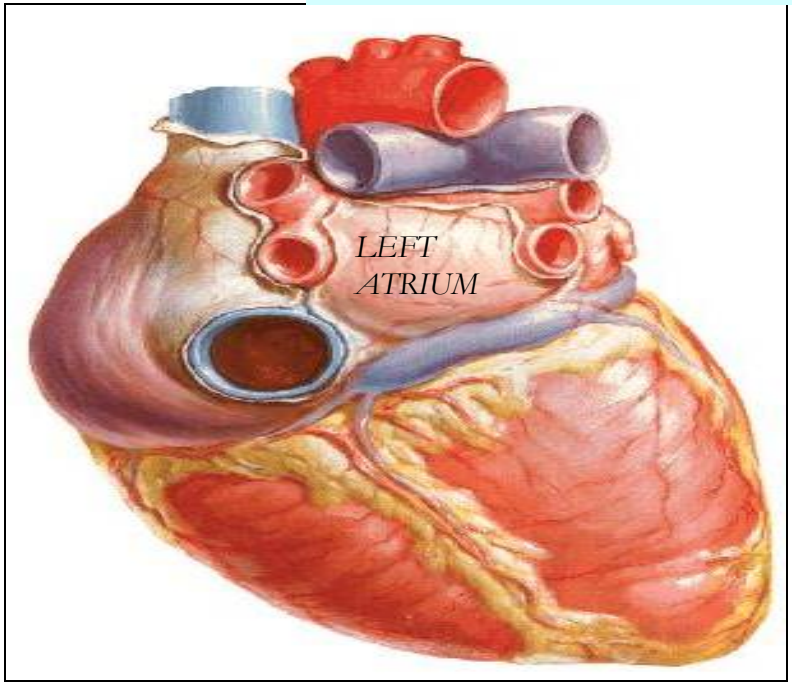
- About one inch wide, admitting tips of 3 fingers.
- It is guarded by a fibrous ring which gives attachment to the cusps of tricuspid valve.
- It has 3-cusps (anterior-posterior-septal or medial).
- The atrial surface of the cusps are smooth, while their ventricular surfaces give attachment to the chordae tendinae.

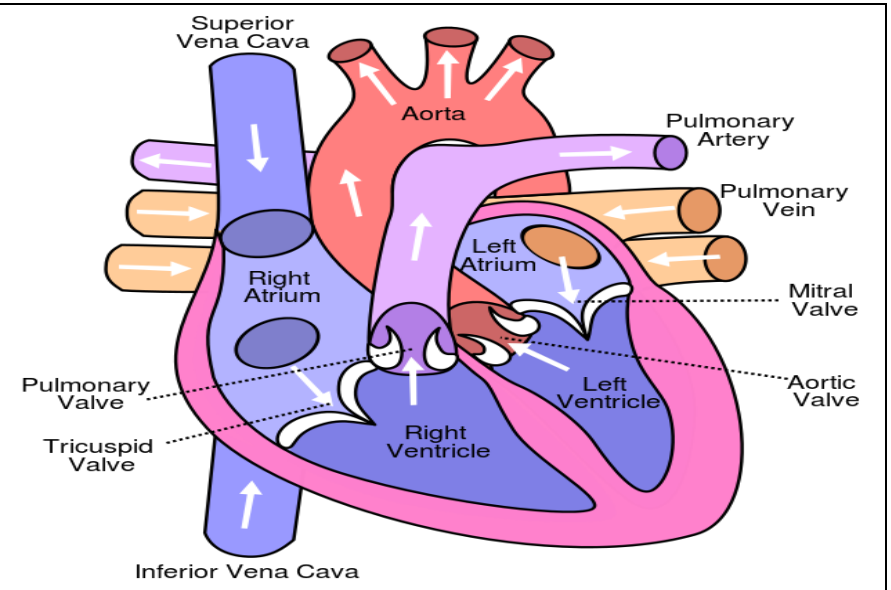
Pulmonary orifice



- Surrounded by a fibrous ring which gives attachment to the **cusps of the pulmonary valve.**
- The valve is formed of **3 semilunar cusps :**
  2 anterior and one posterior which are concave superiorly and convex inferiorly.
- **No chordae tendineae or papillary muscles** are attached to these cusps

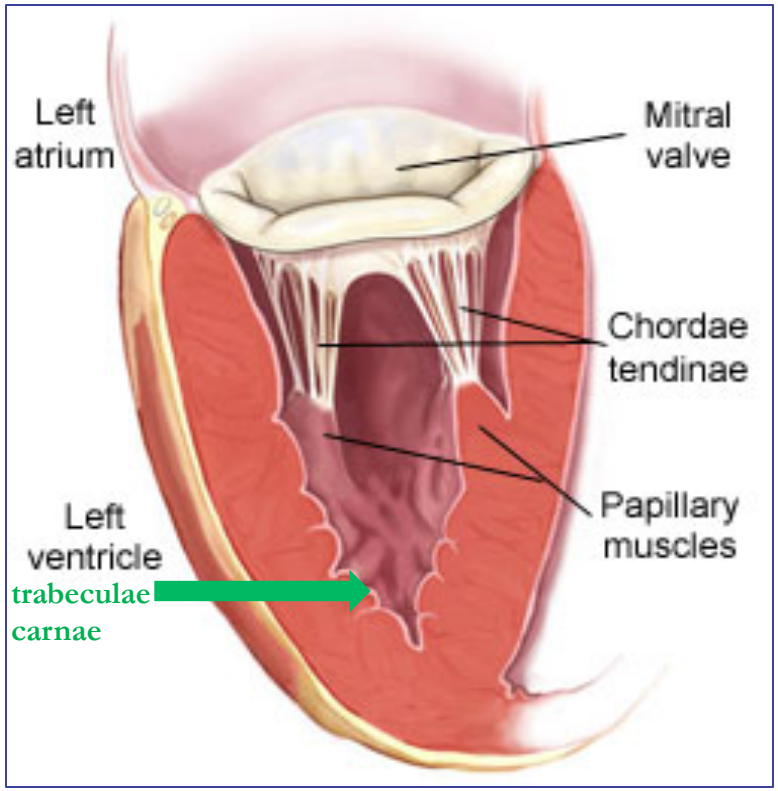
Left atrium of the heart





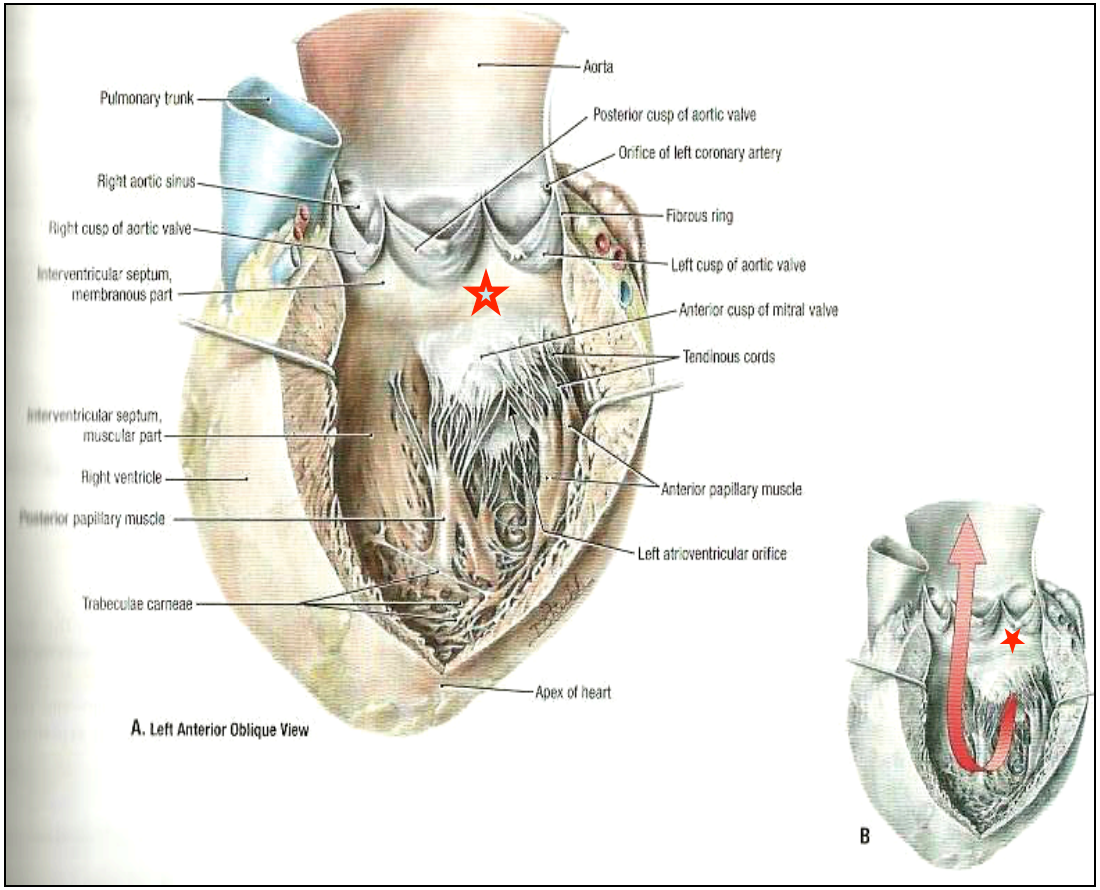
- The left atrium communicates with the left ventricle through the left atrioventricular orifice.
- It forms the greater part of base of heart.
- Its wall is smooth except for small musculi pectinati in the left auricle.
- Recieves 4 pulmonary veins which have no valves.
- Sends blood to left ventricle through the left atrioventricular orifice which is guarded by mitral valve (Bicuspid valve).

Left ventricle of the heart



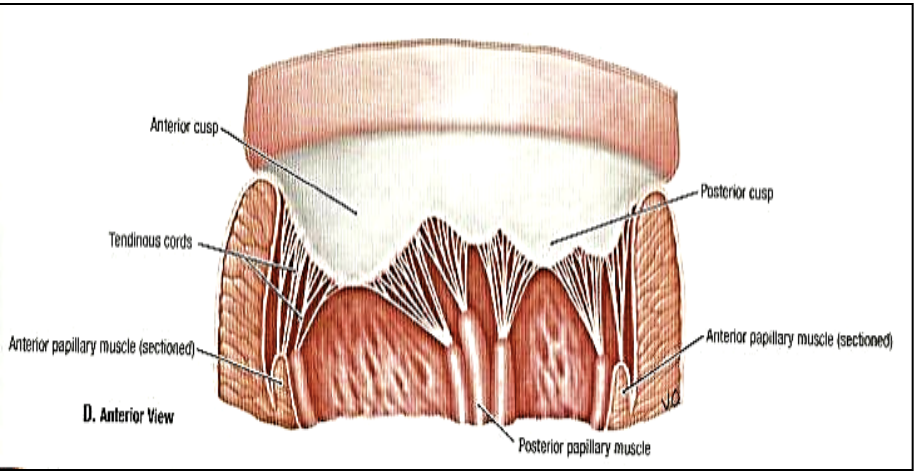
- Its wall is thicker than that of right ventricle.
- It receives blood from left atrium through left atrio-ventricular orifice which is guarded by mitral valve (bicuspid)
- Its wall contains trabeculae carnae.
- Its wall contains 2 large papillary muscles (anterior & posterior). They are attached by chordae tendinae to cusps of mitral valve.

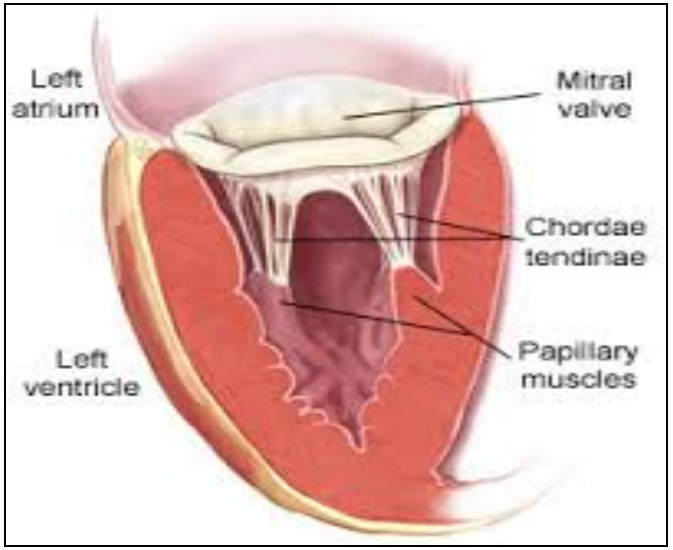
Left ventricle of the heart



- The blood leaves the left ventricle to the ascending aorta through the aortic orifice.
- The part of left ventricle leading to ascending aorta is called aortic vestibule ✭
- The wall of this part is fibrous and smooth.

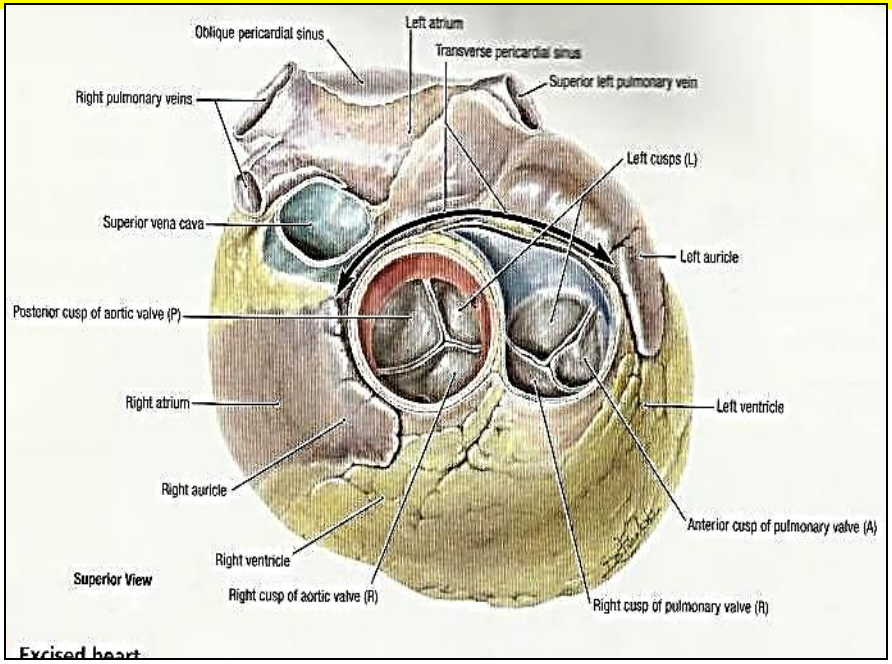
Left atrio-ventricular (mitral) orifice

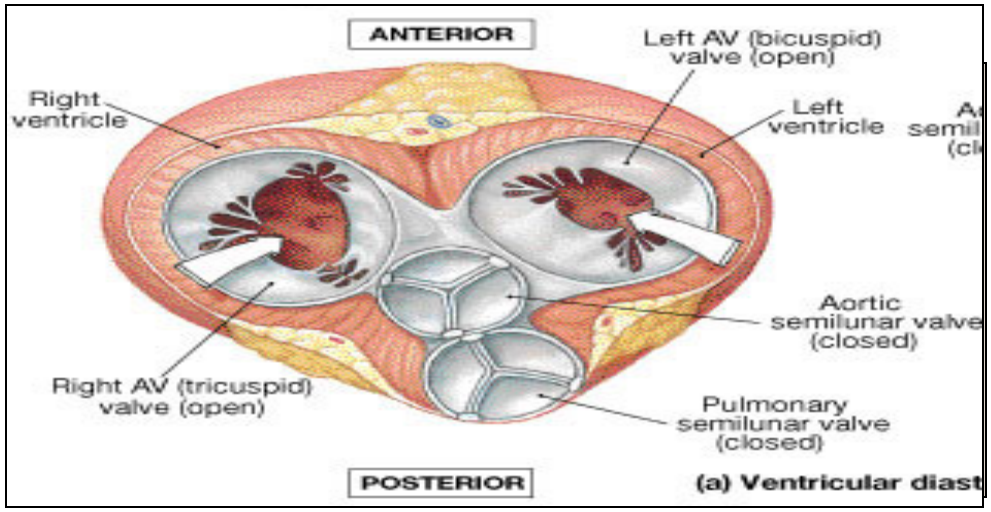




- Smaller than the right, admitting only tips of 2 fingers.
- Guarded by a mitral valve.
- Surrounded by a fibrous ring which gives attachment to the cusps of mitral valve.
- Mitral valve is composed of 2 cusps:
- Anterior cusp : lies anteriorly and to right.
- Posterior cusp : lies posteriorly and to left.
- The atrial surfaces of the cusps are smooth, while ventricular surfaces give attachment to chordae tendinae.

Aortic orifice

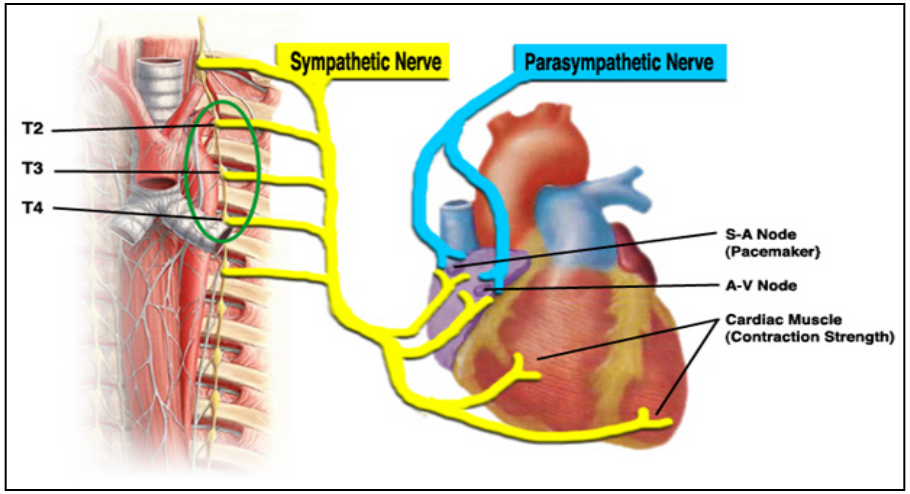


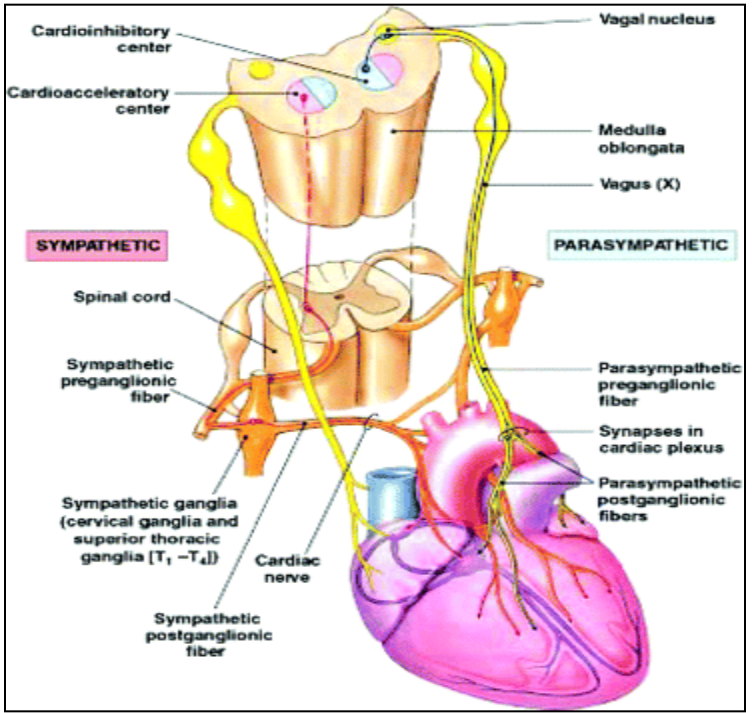


- Surrounded by a **fibrous ring** which gives attachment to the **cusps** of **aortic valve.**
- **Aortic valve** is formed of **3 semilunar cusps** which are similar to those of pulmonary valve, but the position of the cusps differs being **one anterior and 2 posterior**.

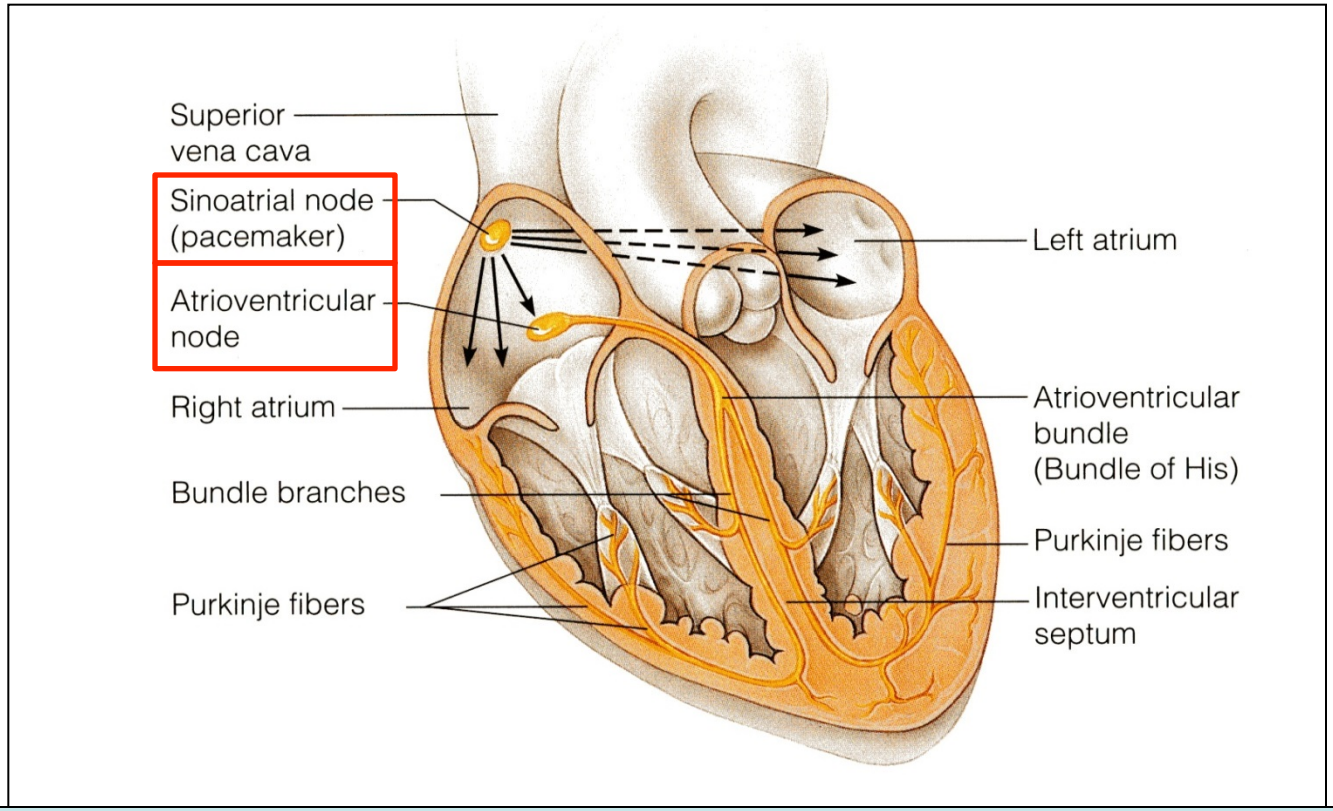
Nerve supply of the heart

- ***By sympathetic & parasympathetic fibers*** via the ***cardiac plexus*** situated below arch of aorta.
- ***The sympathetic fibres*** arise from the cervical & upper thoracic ganglia of *sympathetic trunks.*
- ***The parasympathetic fibres*** arise from the *vagus nerves.*
- **Postganglionic fibres** reach heart along – SAN, AVN & nerve plexus around coronary arteries.
- Symp. Fibers--- accelerate heart rate but
- Parasymp. Fibers --- slow heart rate (constriction of coronay arteries)



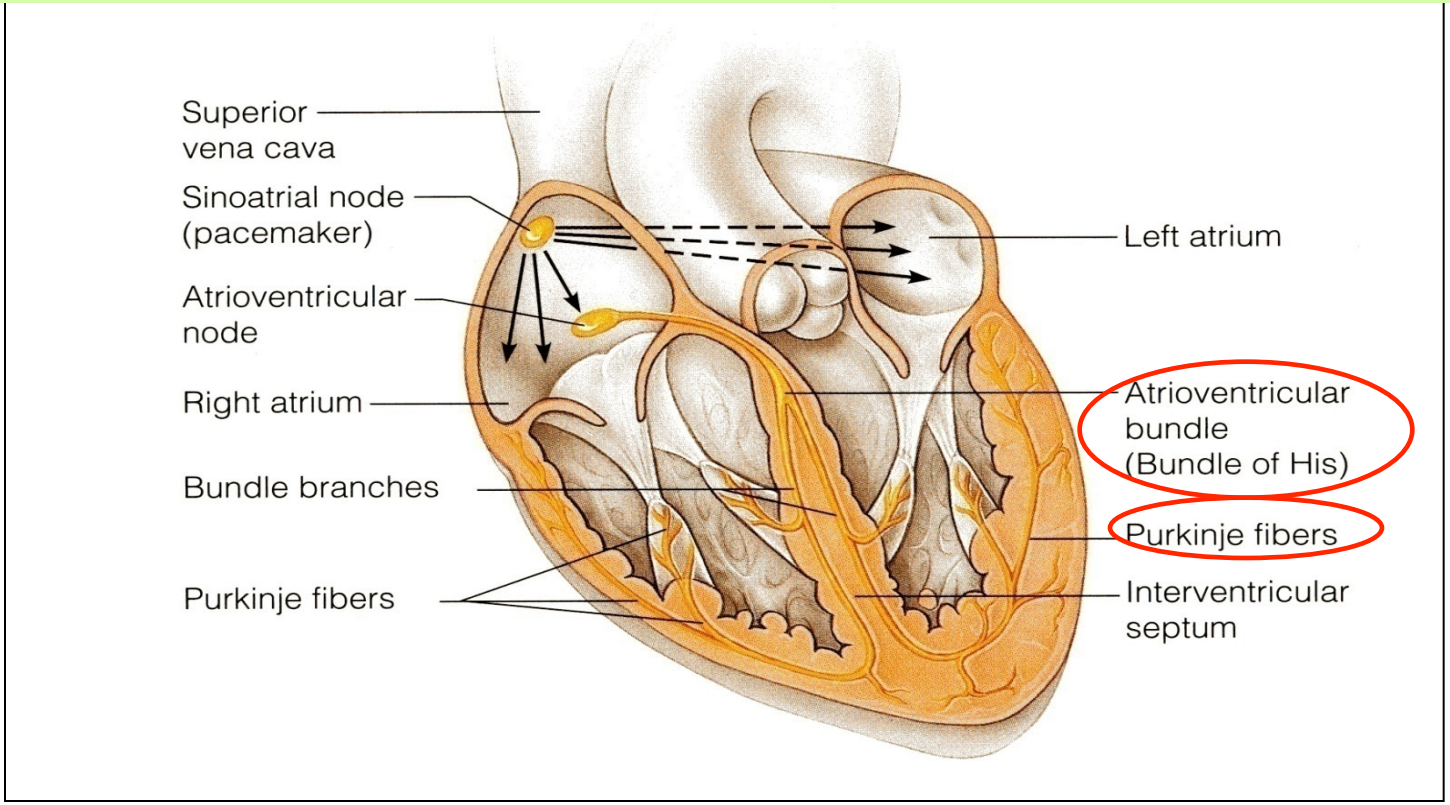


Conduction system of the heart



- The **beating of the heart** is regulated by the **intrinsic conduction (nodal) system**
- **Its function** is to ensure that the chambers of the heart contract in the proper rhythm and sequence:
- The **main center** is the **sinoatrial (SA) node**, located in the right atrium
- The **atrioventricular (AV) node** is located at the junction of the atria and the ventricles

Conduction system of the heart



- The **atrioventricular (AV) bundle (bundle of His)** is located in the interventricular septum
- The **Purkinje fibers** are located inside the walls of the ventricles
- the SA node is called the **pacemaker** of the heart, because it generates the impulse.

THANK YOU

Pericardial Sinuses

➢ *Transverse Sinus: It is a recess of serous pericardium between ascending aorta & pulmonary T. anteriorly , and upper parts of 2 atria & S.V.C. Posteriorly.*

➢ *Oblique Sinus : It lies posterior to the heart. It is a recess of serous pericardium behind the base of heart (left atrium), separate base from descending aorta & esophagus.*