

Lecture 1

ANATOMY OF THE HEART



OBJECTIVES

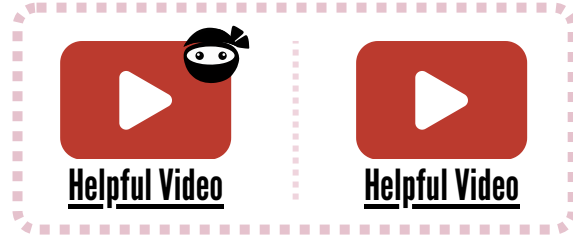
- Describe the shape of heart regarding : apex, base, sternocostal and diaphragmatic surfaces.
- Describe the interior of heart chambers : right atrium, right ventricle, left atrium and left ventricle.
- List the orifices of the heart : Right atrioventricular (Tricuspid) orifice, Pulmonary orifice, Left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

Color Index:

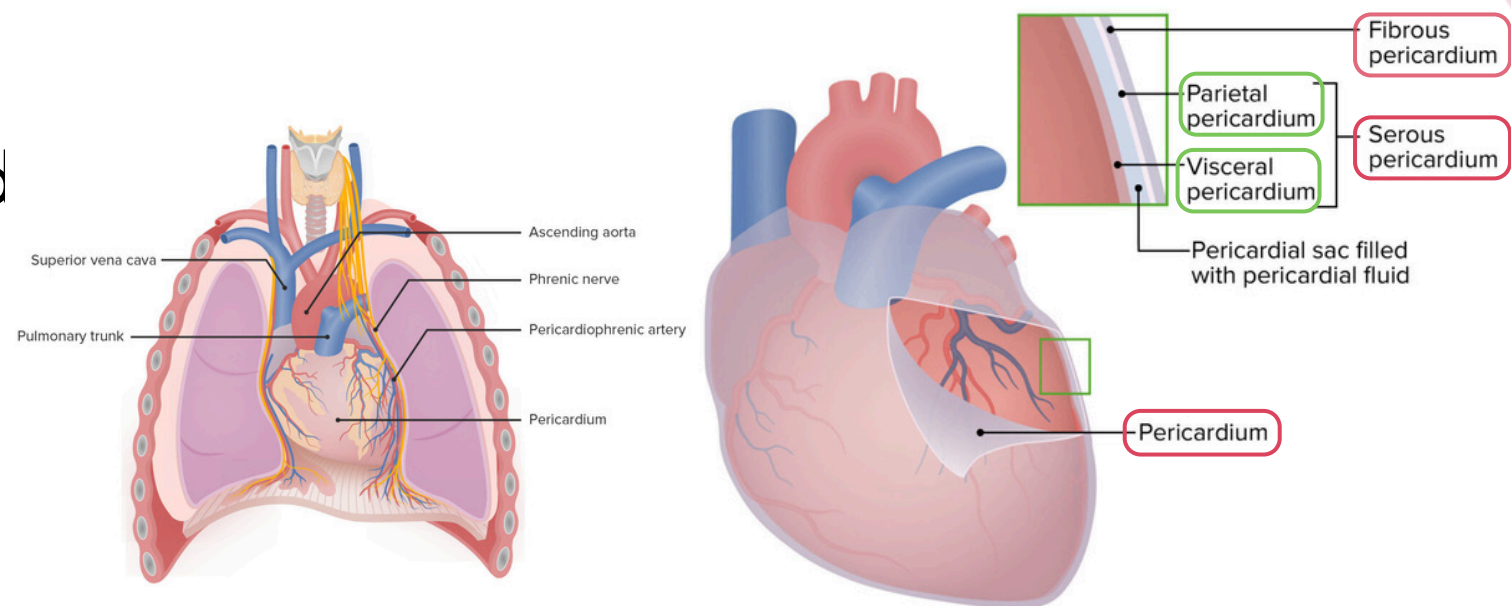
- Main text
- Boys' Slides
- Girls' Slides
- Important
- Dr's Notes
- Extra

 Editing File

The Heart



- ◆ It lies in the **middle mediastinum**.
- ◆ It is surrounded by a fibroserous sac called **pericardium** which is differentiated into :
 - 1- **Outer fibrous layer (Fibrous pericardium)**.
 - 2- **Inner serous sac (Serous pericardium)**.



↳ Subdivided into : **parietal layer (outer layer) - visceral layer (inner layer)**.

The Heart is somewhat pyramidal in shape, having:

External features:	Internal features:
Apex	Consists of 4 Chambers : <ul style="list-style-type: none"> ◆ 2 Atria (right & left). ◆ 2 Ventricles (right & left).
Sterno-costal (anterior surface)	
Base (posterior surface)	
Diaphragmatic (inferior surface)	

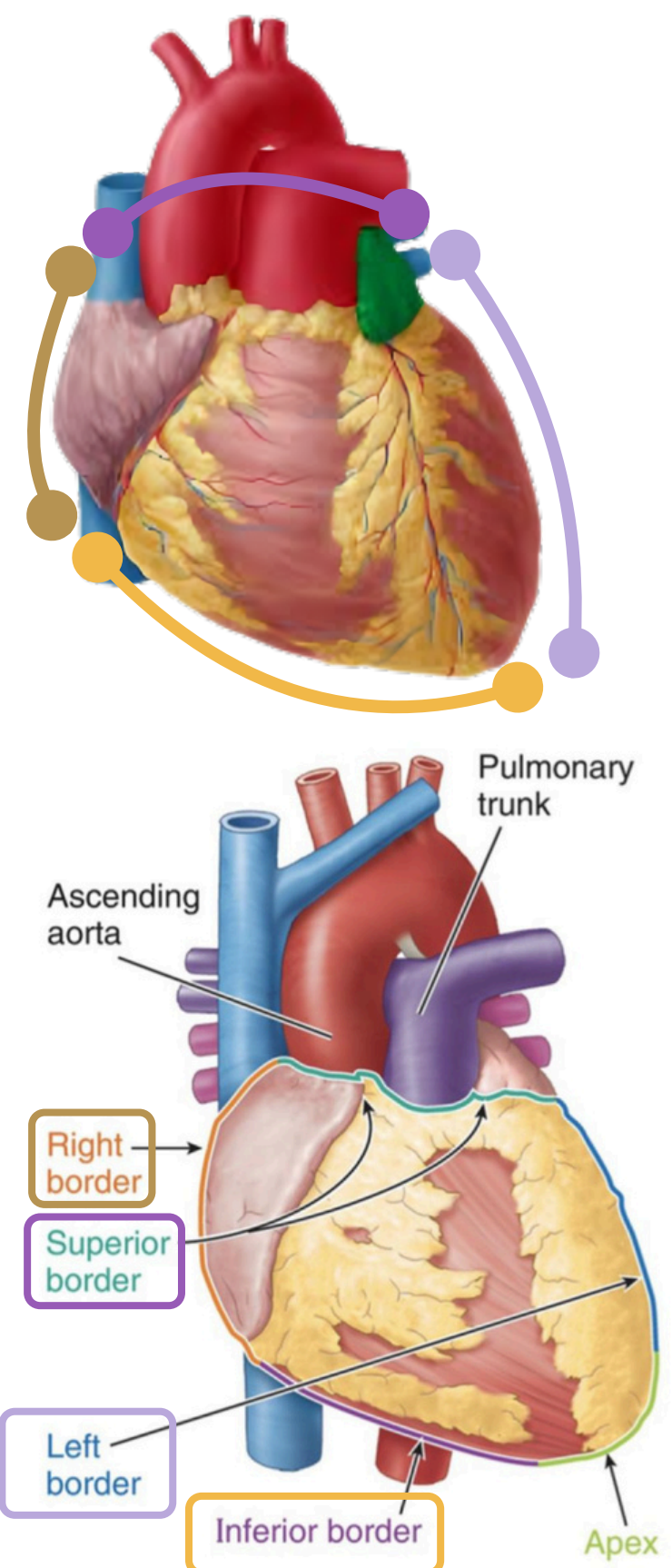
◆ Borders of the Heart :

- 1 Upper Border :**
 - Formed by the **2 atria**.
 - Concealed by ascending aorta & pulmonary trunk.

- 2 Right Border :**
 - Formed by the **right atrium**.

- 3 Lower Border :**
 - Formed **mainly** by the **right ventricle + apical part of the left ventricle**.

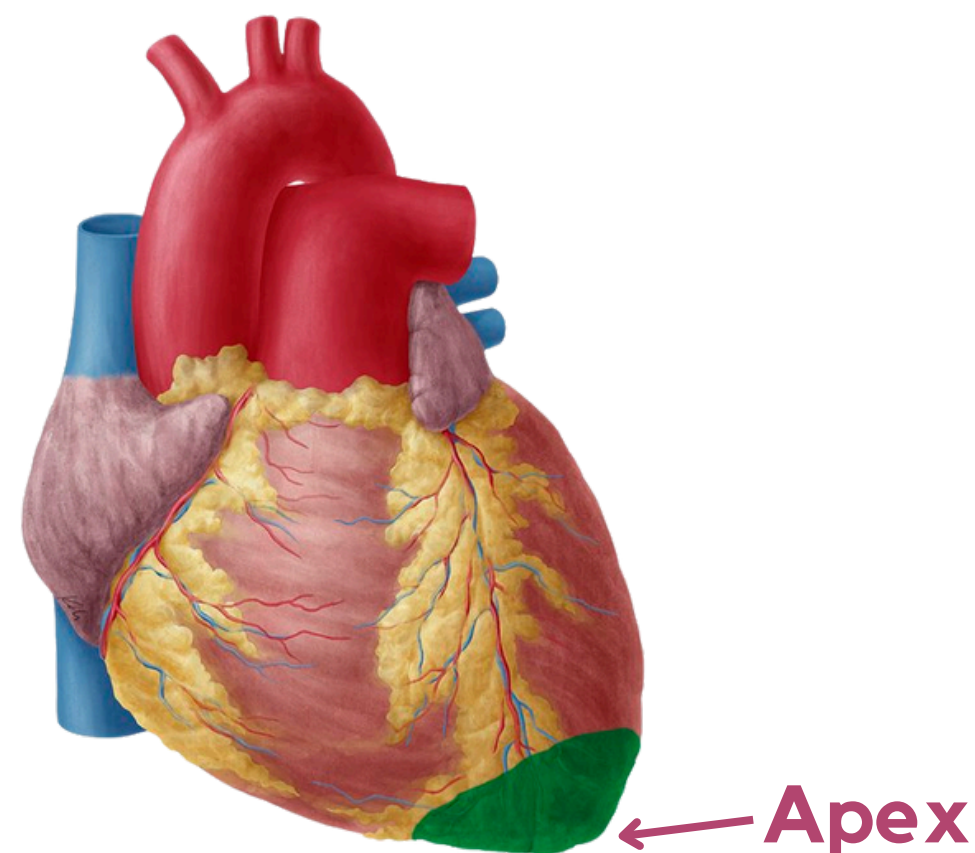
- 4 Left Border :**
 - Formed **mainly** by the **left ventricle + auricle of the left atrium**.



External Features of The Heart

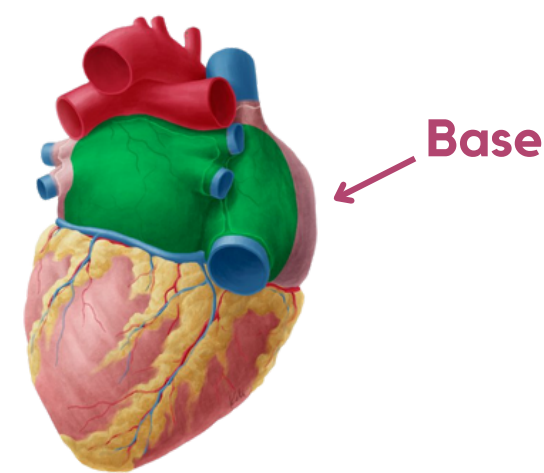
1- Apex of the Heart

- ◆ 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.



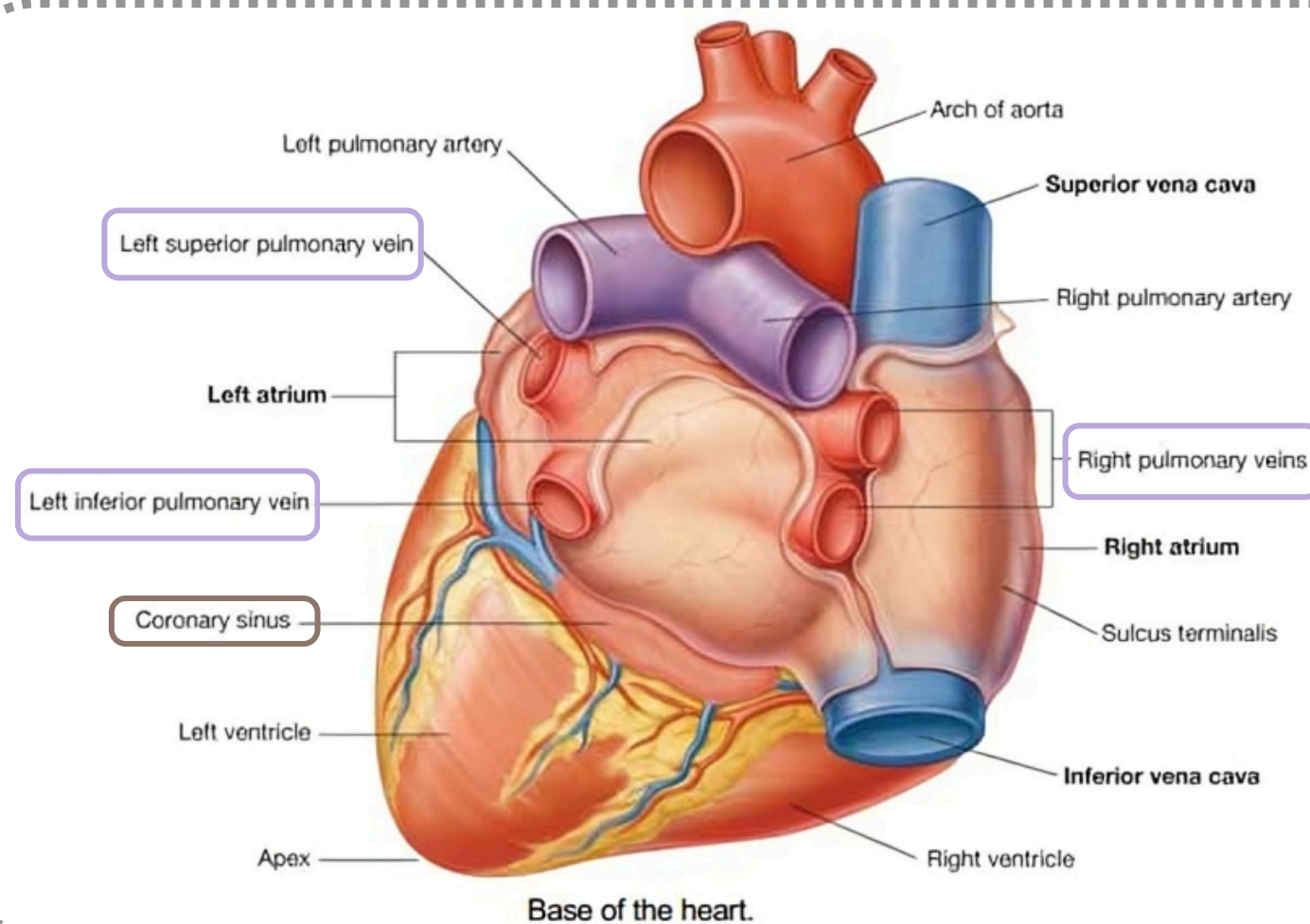
2- Base of the Heart (Posterior Surface)

- ◆ 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 (T5-T7)**.
- ◆ Is **separated** from the **vertebral column** by : **(from posterior to anterior)**
 1. **descending aorta**.
 2. **esophagus**.
 3. **oblique sinus** of pericardium.
- ◆ Bounded inferiorly by the posterior part of **coronary sulcus**, which **lodges** the **coronary sinus**.



Note that :

- ◆ **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.

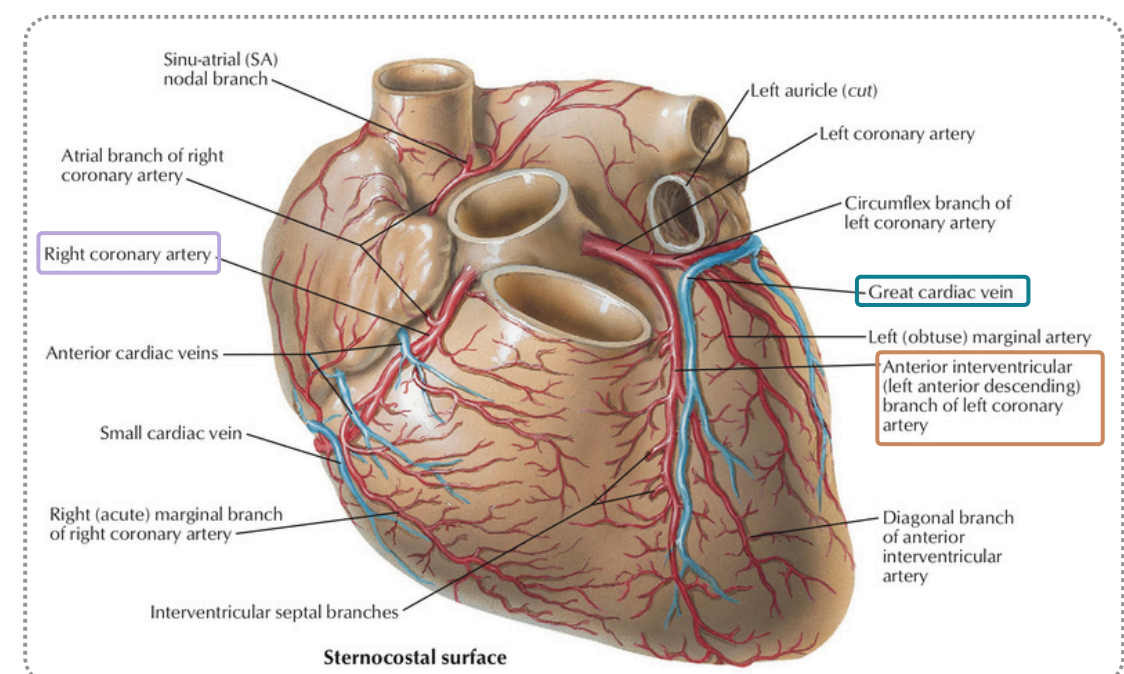
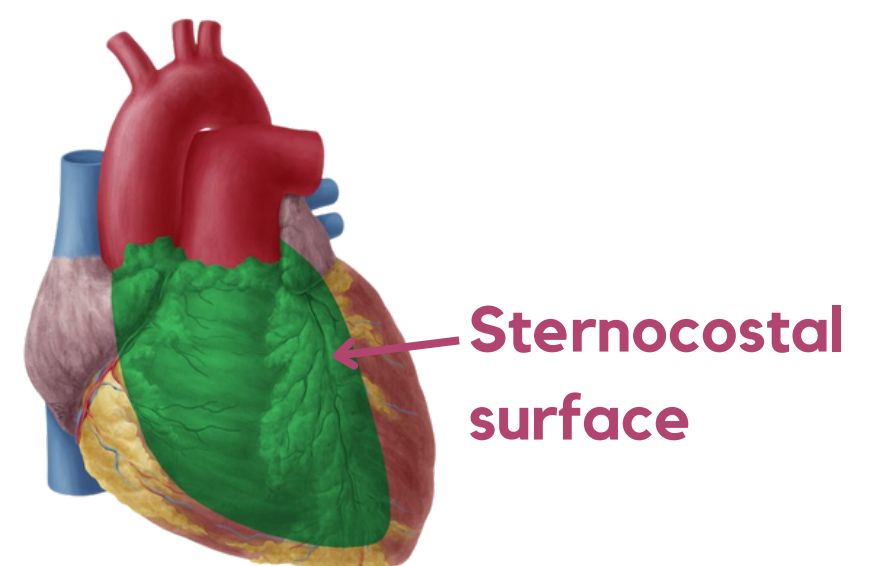


External Features of The Heart

3- Sterno-costal (Anterior) Surface

- ◆ This surface is formed mainly by the right atrium and the right ventricle
- ◆ Divided by coronary (atrio-ventricular) groove into:
 1. **Atrial part:** Formed mainly by the right atrium.
 2. **Ventricular part:** The right 2/3 is formed by right ventricle, while the left 1/3 is formed by left ventricle.
- ◆ So, it is also formed of some of the left ventricle.
- ◆ The coronary groove lodges the right coronary artery.
- ◆ The 2 ventricles are separated by anterior interventricular groove, which lodges:

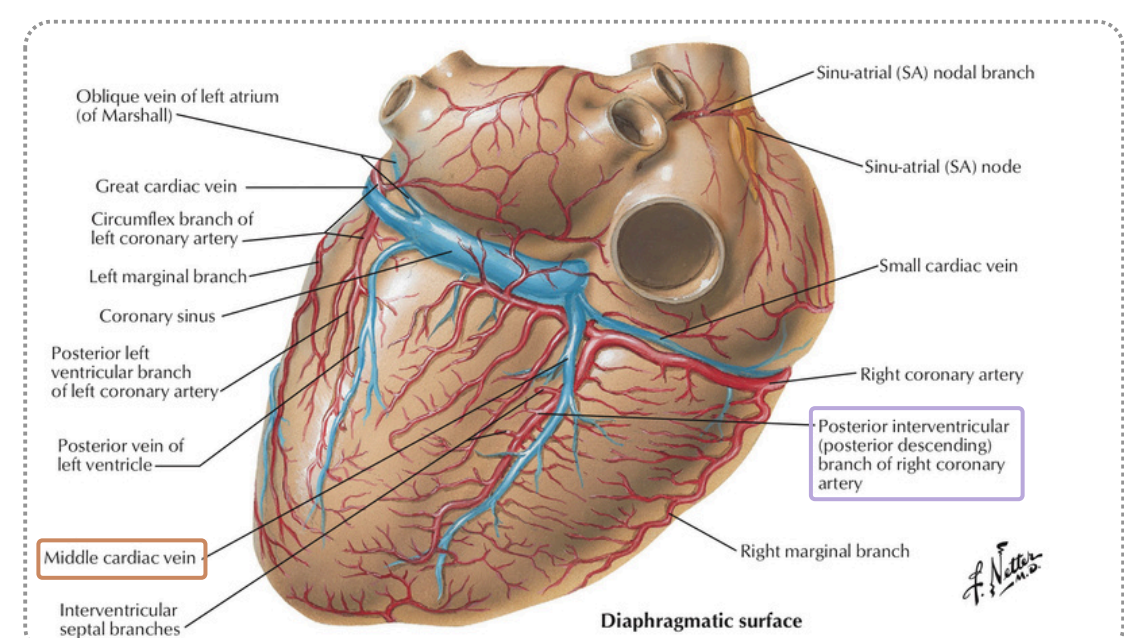
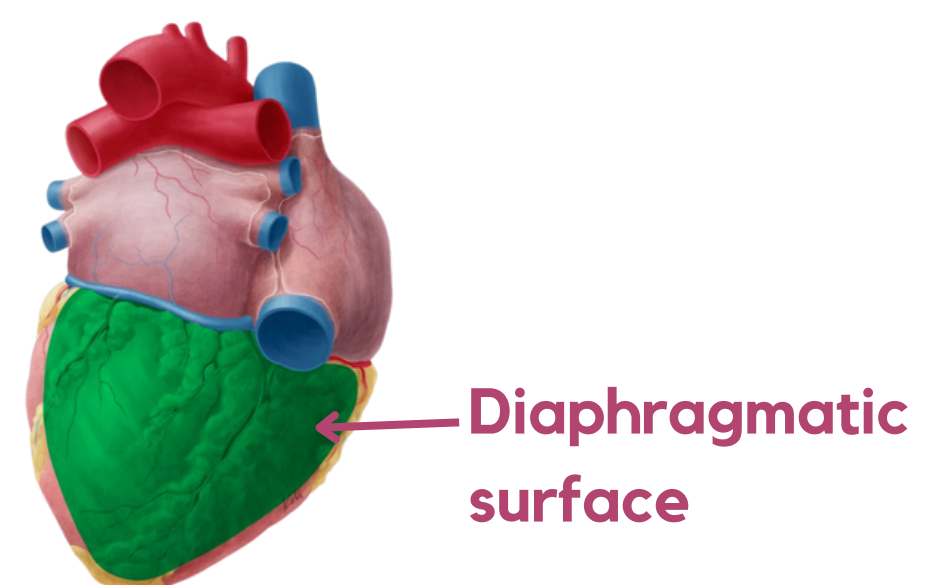
- **Anterior interventricular artery (a branch of the left coronary artery).**
- **Great cardiac vein.**



4- Diaphragmatic (Inferior) Surface

- ◆ Formed by the 2 ventricles, mainly left ventricle (left 2/3) + small portion of right ventricle.
- ◆ 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 (a branch of the right coronary artery)**
- **Middle cardiac vein**

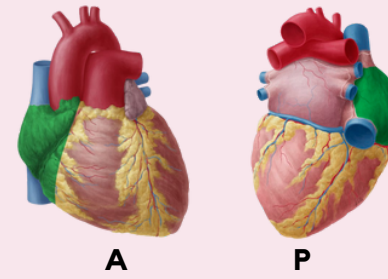


Chambers of the Heart

- ◆ 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.

◆ Atria ◆

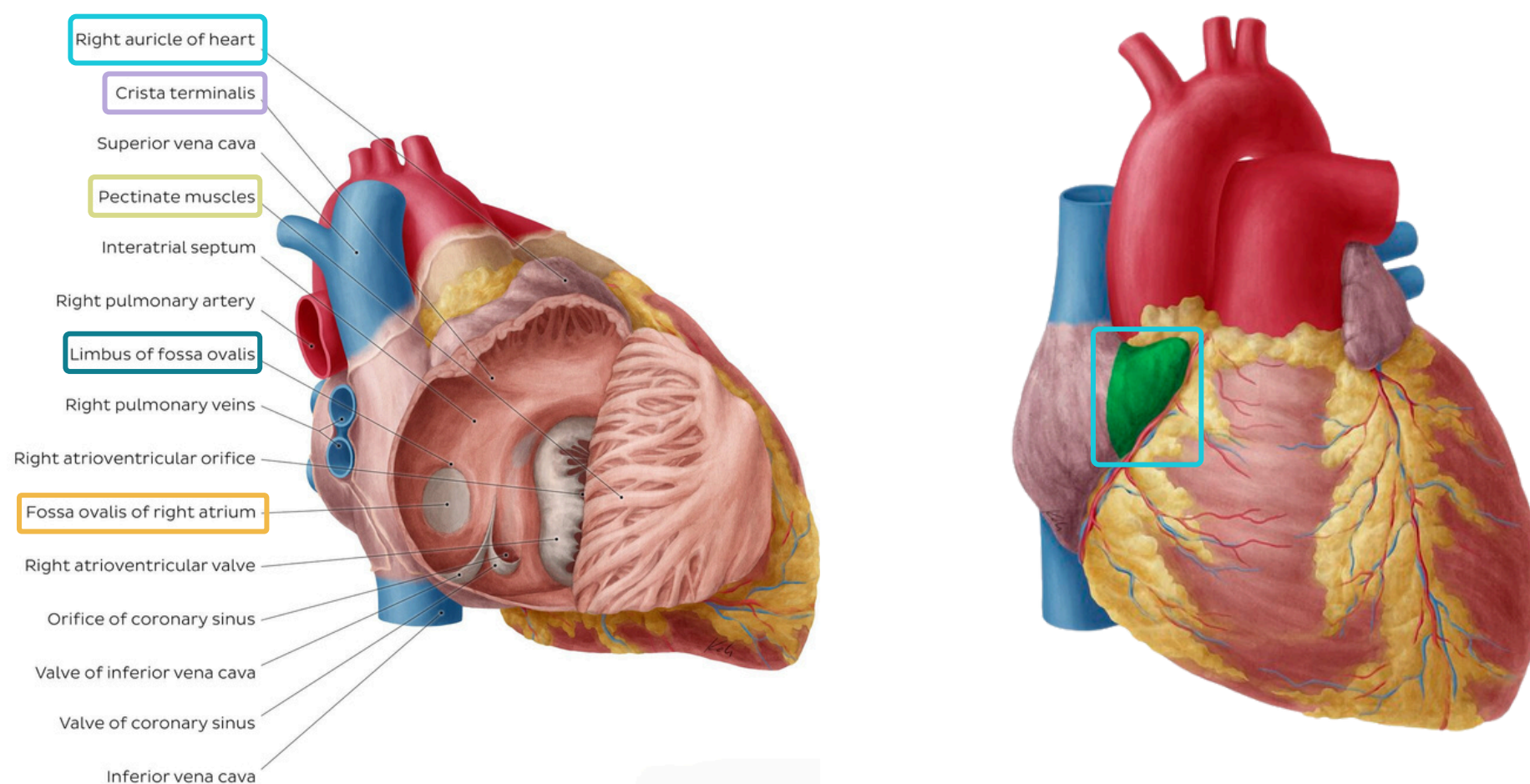
1- Right Atrium



- ◆ 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**.

Crista terminalis divides the right atrium into:

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



Chambers of the Heart

IMPORTANT!

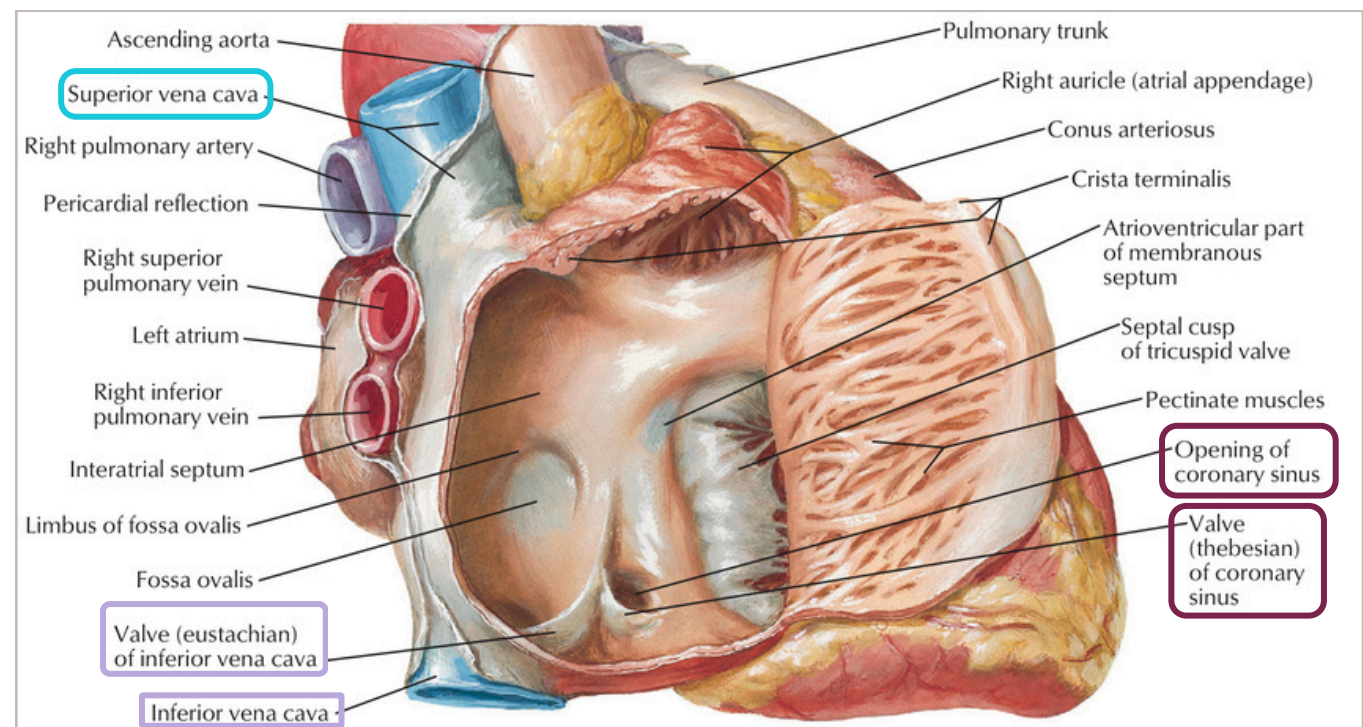
Openings in Right atrium :

1. **SVC*** → has no valve
2. **IVC*** → guarded by a valve
3. **Coronary sinus** → has a well-defined valve
4. **Right atrioventricular orifice:** lies anterior to **IVC opening**, it is surrounded by a fibrous ring which gives attachment to the tricuspid valve.
5. **Small orifices of small veins.** (small cardiac veins)

It's important for SAQ and MCQs

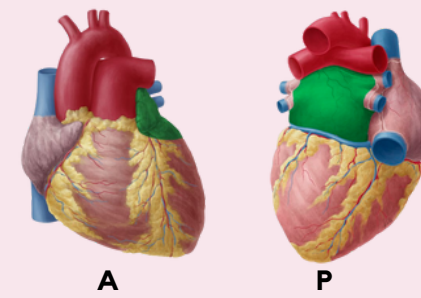


*SVC: Superior vena cava.
*IVC: Inferior vena cava.

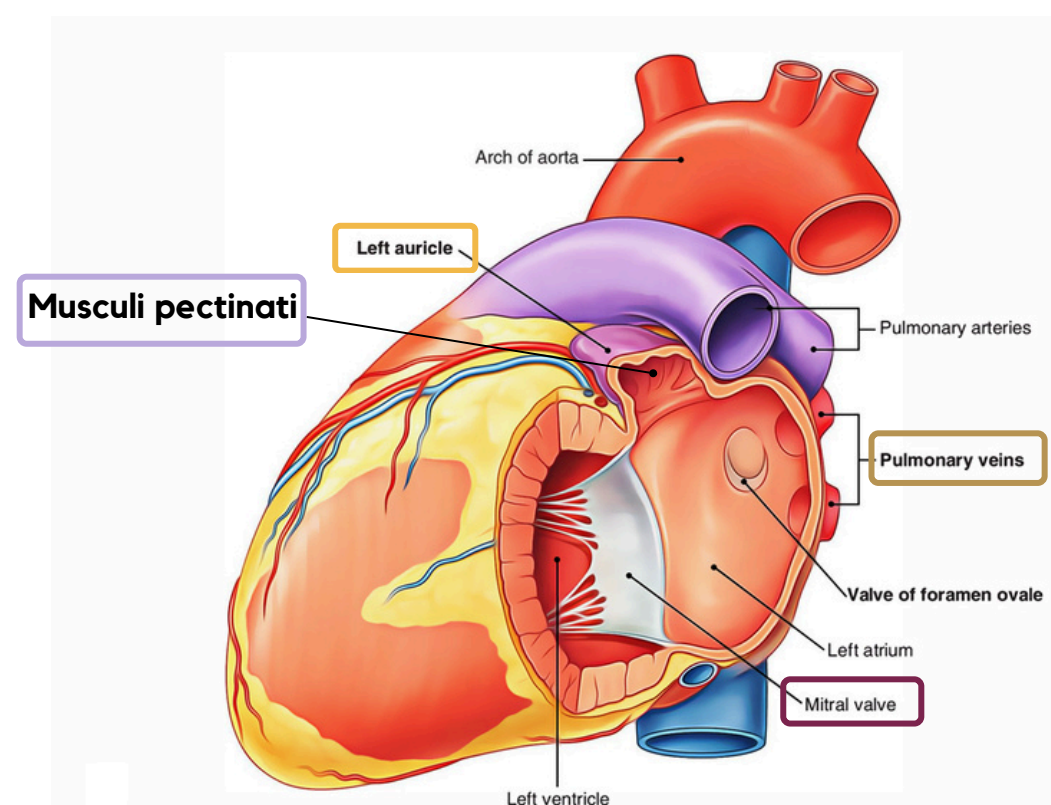
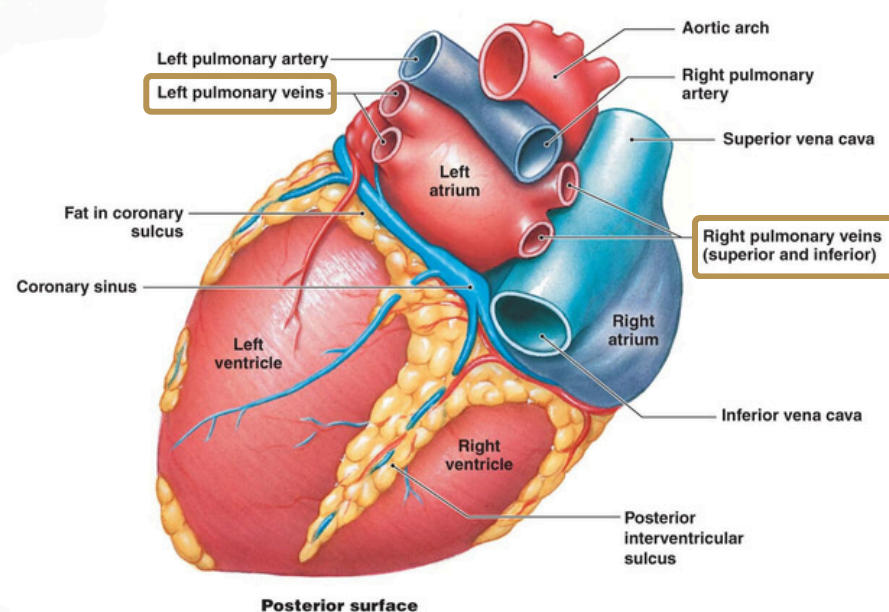


◆ Atria ◆

2- Left Atrium



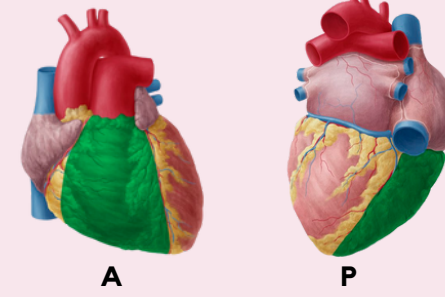
- ◆ The left atrium communicates with the left ventricle through the **left atrioventricular orifice**, and with the aorta through the **aortic orifice**.
- ◆ It forms the greater part of base of heart.
- ◆ Its wall is smooth, except for small **musculi pectinati** in the **left auricle**.
- ◆ Receives **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)**.



Chambers of the Heart

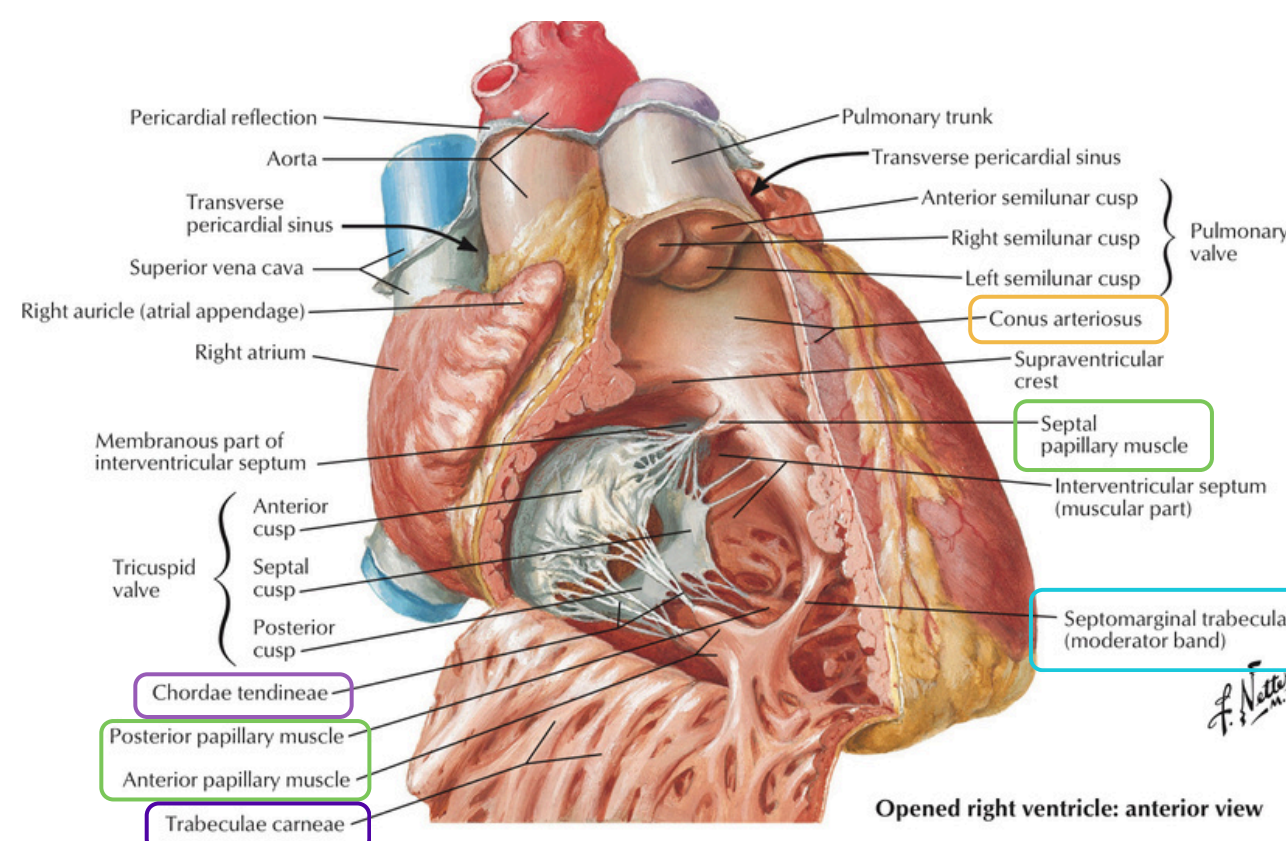
◆ Ventricles ◆

1- Right Ventricle



- ◆ Its wall is **thinner** than that of left ventricle.
- ◆ Its wall contains projections called **trabeculae carneae**.
- ◆ The right ventricle communicates with:
 1. Right atrium through **right atrioventricular orifice**.
 2. Pulmonary trunk through **pulmonary orifice**.
- ◆ The part (**cavity**) of right ventricle leading to the pulmonary trunk becomes funnel shaped, and referred as the **infundibulum**.
- ◆ The wall of **infundibulum (Conus Arteriosus)** is smooth and contains no trabeculae.
- ◆ Large projections arise from the walls, and are called **papillary muscles**:
 - Anterior papillary muscle
 - Posterior papillary muscle
 - Septal papillary muscle

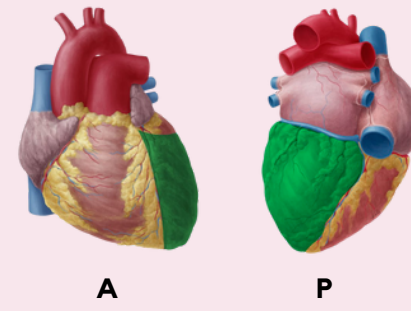
3 muscle because it's "Tricuspid"
- ◆ Each papillary muscle is attached to the **cusps of tricuspid valve** by tendinous threads called **chordae tendinae**.
- ◆ Interventricular septum is connected to **anterior papillary muscle** by a muscular band called **moderator band**.
- ◆ Blood leaves the right ventricle to pulmonary trunk through **pulmonary orifice**.



Chambers of the Heart

◆ Ventricles ◆

2- Left Ventricle



- ◆ Its wall is **thicker** than that of right ventricle.
- ◆ It receives **oxygenated** blood from left atrium through left atrio-ventricular orifice which is guarded by **mitral valve (bicuspid)**.

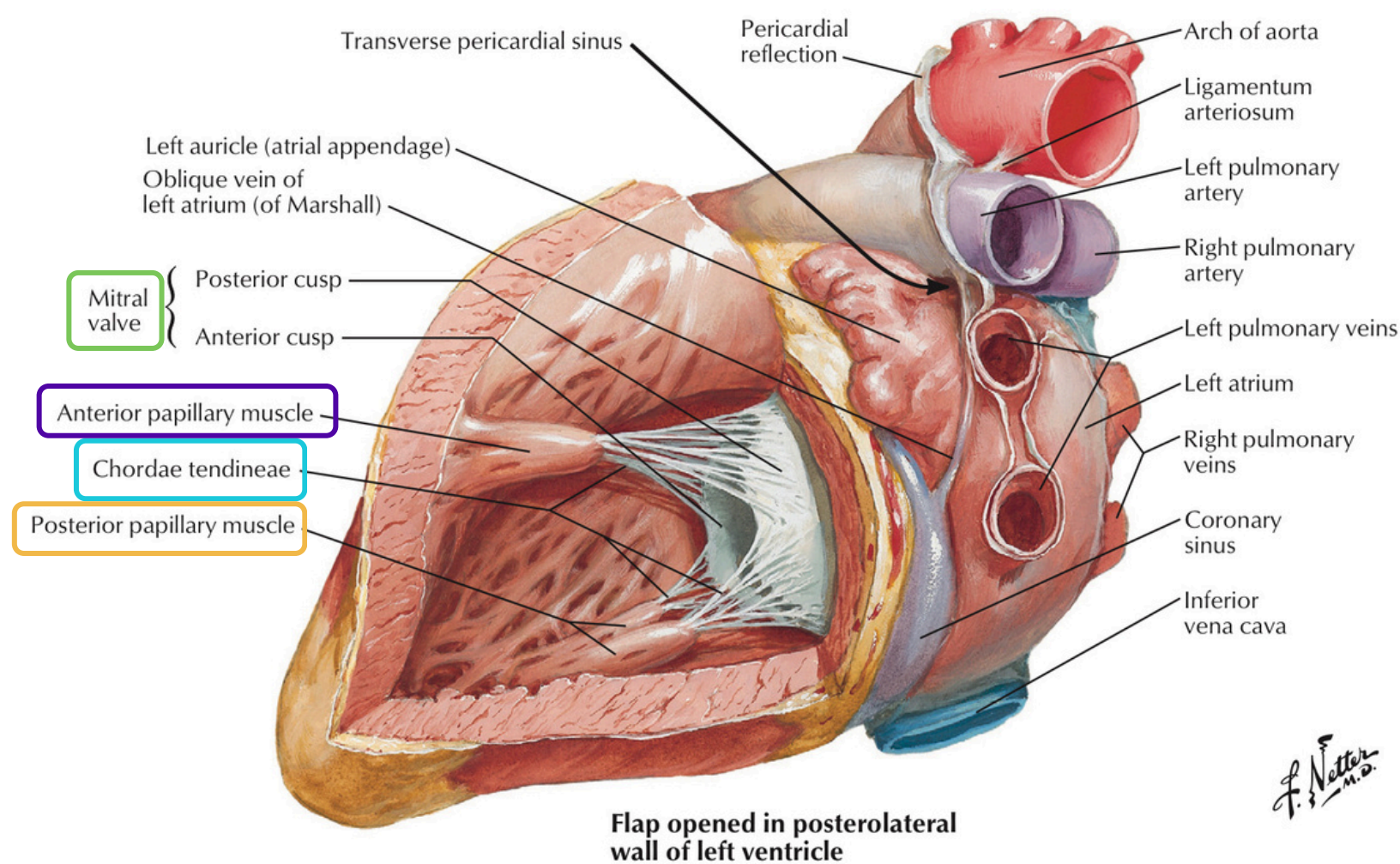
Its wall contains:

1. Trabeculae carneae
2. **2 large papillary muscles:** 2 muscle because it's "Bicuspid"

● **Anterior**

● **Posterior**

- ◆ They are attached by **chordae tendineae** to cusps of **mitral valve**.
- ◆ 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**.



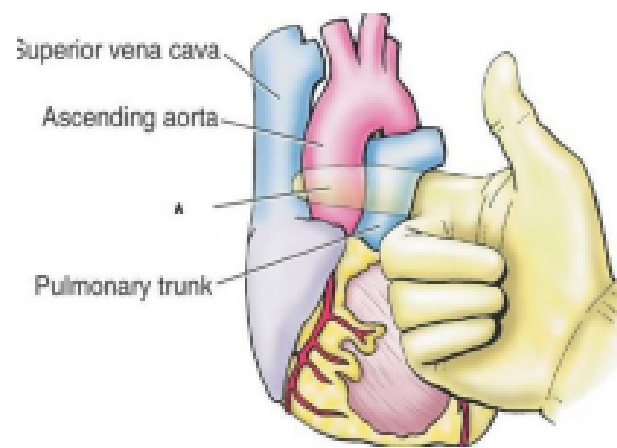
Pericardial Sinuses and the Orifices

Pericardial Sinuses

Girls' Slides

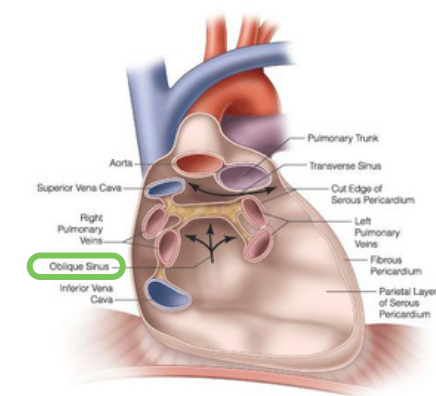
Transverse Sinus

It is a recess of serous pericardium between ascending aorta & pulmonary trunk anteriorly, and upper parts of 2 atria & S.V.C posteriorly.



Oblique Sinus

It lies posterior to the heart. (three fingers Behind the heart)
It is a recess of serous pericardium behind the base of heart (left atrium), separate base from descending thoracic aorta, esophagus & vertebral column.



Two Sinuses

Orifices

Orifices

Semilunar orifices

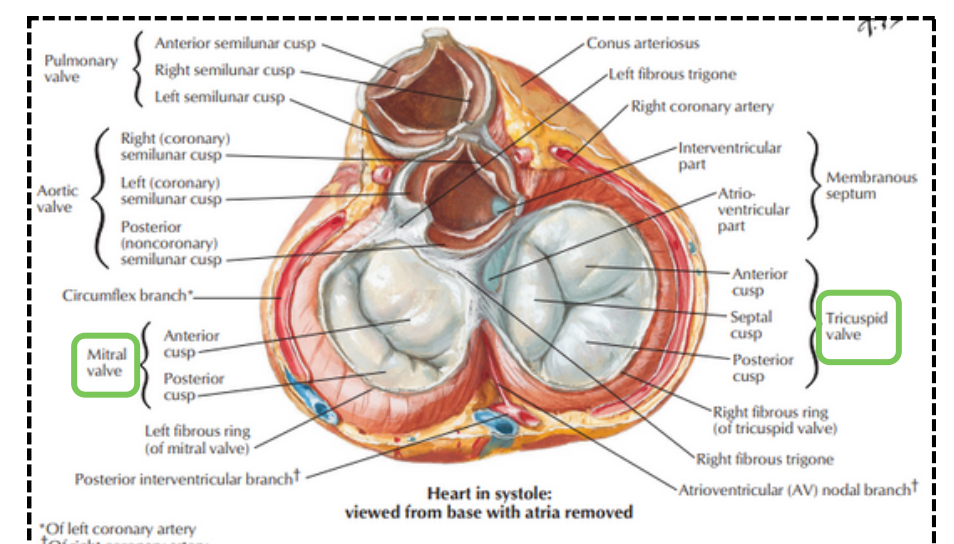
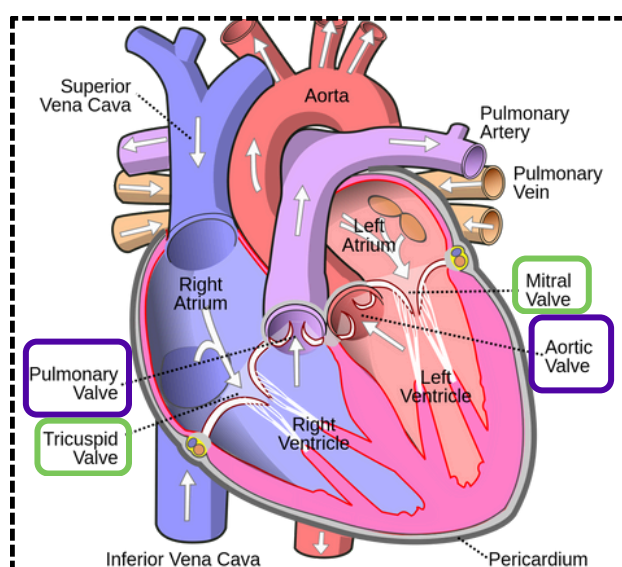
Pulmonary Orifice

Aortic Orifice

Atrioventricular orifices

Right Tricuspid Orifice

Left Mitral (bicuspid) Orifice



The Orifices

IMPORTANT!

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: This note will help you to remember :)
 - **Two** anterior
 - **One** posterior

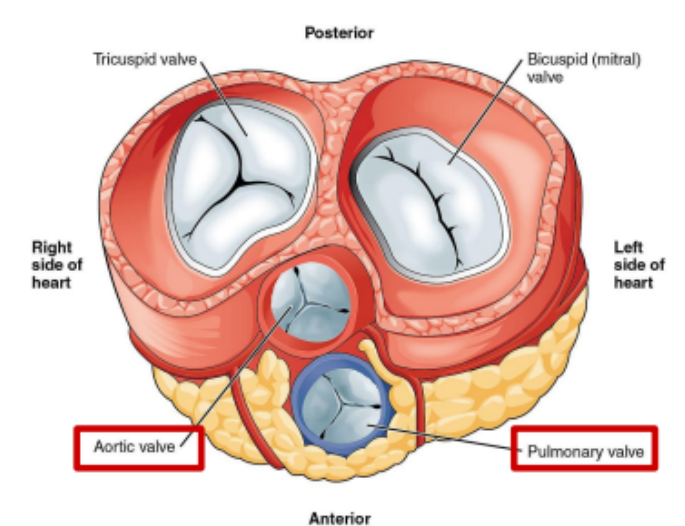
Pulmonary = 1 Posterior
- ◆ The valves are concave superiorly and convex inferiorly.
- ◆ No chordae tendineae or papillary muscles are attached to these cusps.



Aortic Orifice

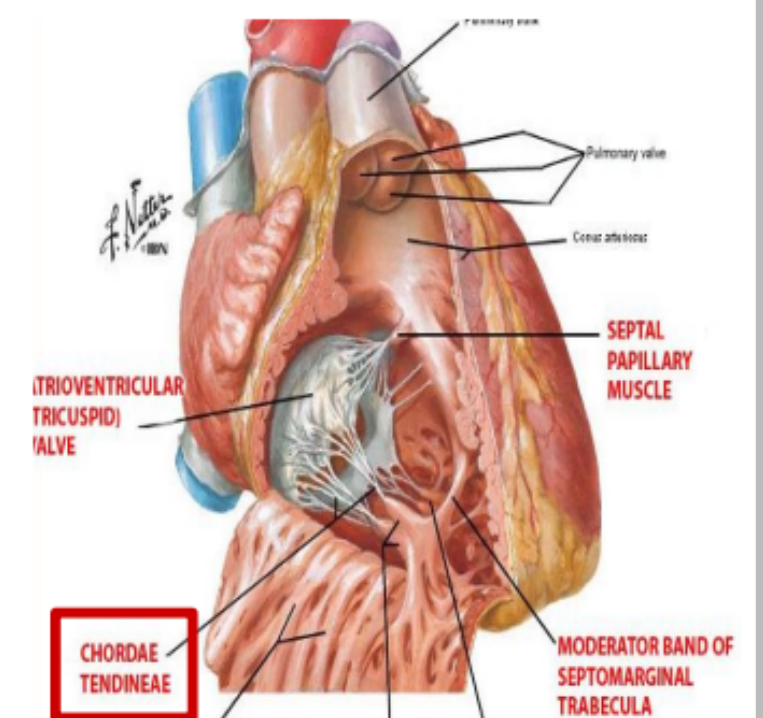
- ◆ Surrounded by a fibrous ring which gives attachment to the **cusps of aortic valve**.
- ◆ Aortic valve is formed of 3 semilunar cusps **which are similar to those of pulmonary valve, but the position of the cusps differs being:**
 - **One** anterior
 - **Two** posterior

Aortic = 1 Anterior



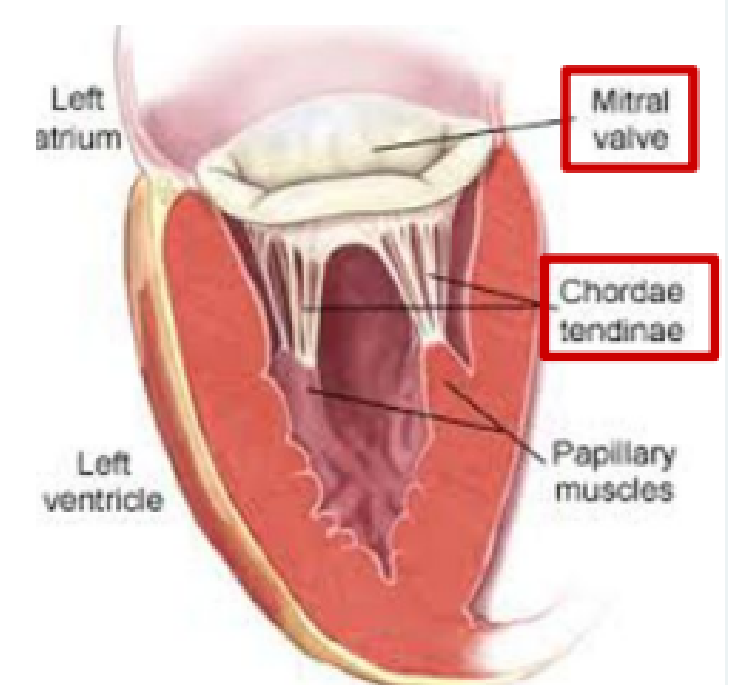
Right Tricuspid Orifice

- ◆ Right atrio-ventricular 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** (connect cusps with papillary muscle).



Left Mitral (bicuspid) 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**.



Nerve Supply and Conduction System of the Heart

Nerve Supply

By sympathetic & parasympathetic fibers via the **cardiac plexus** situated below arch of aorta.

Sympathetic fibres

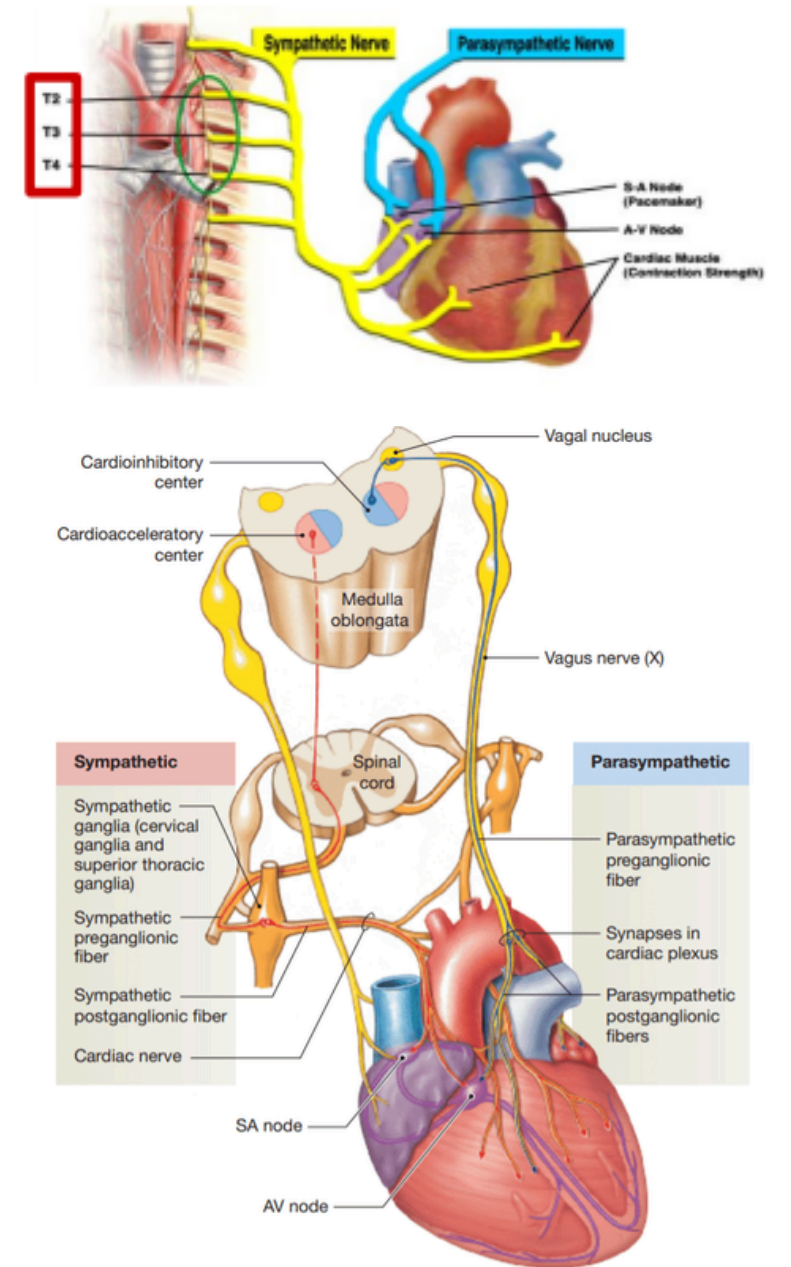
- ◆ Arise from the cervical & upper thoracic ganglia of sympathetic trunks.
- ◆ Accelerate heart rate.

Postganglionic fibres

- ◆ Reach heart along - SAN, AVN & nerve plexus around coronary arteries.

Parasympathetic fibres

- ◆ Arise from the vagus nerves.
- ◆ **Slow heart rate** (constriction of coronary arteries).



IMPORTANT!

Conduction System

described in physiology



You must know each location of it

- ◆ **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:

Sinoatrial (SA) node

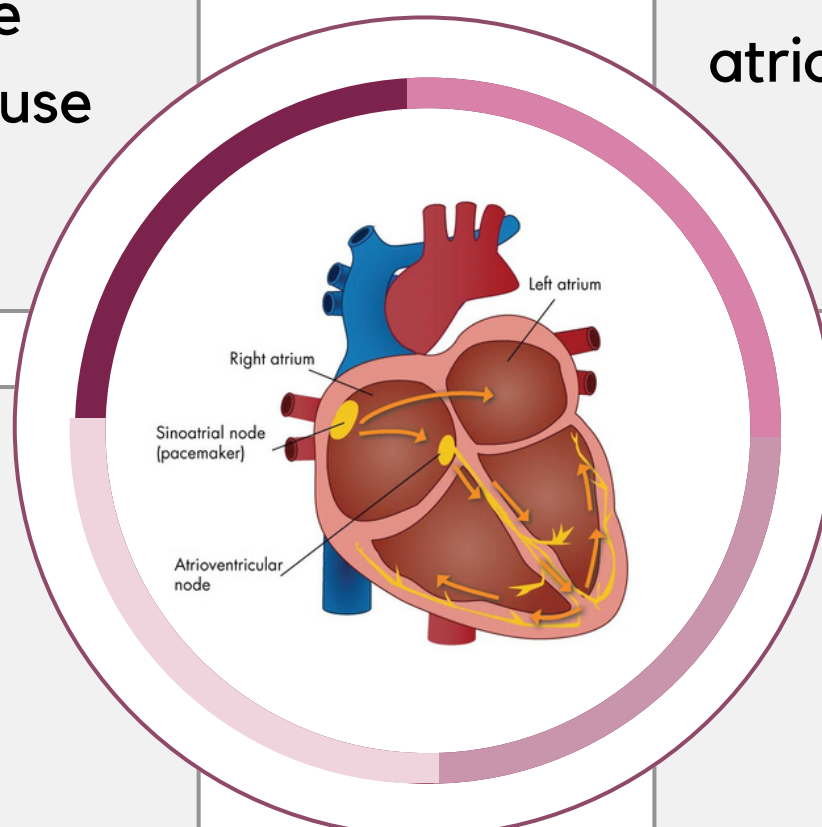
It is the main center located in the right atrium. It is called the **pacemaker** of the heart, because it generates the impulse.

Atrioventricular (AV) node

It is located at the junction of the atria and the ventricles.

Purkinje fibers

They are located inside the walls of the ventricles.



Atrioventricular (AV) bundle (bundle of His)

It is located in the **interventricular septum**.

CLICK HERE

[Summary of the lecture](#)

Thanks to Norah Aljulaihim 

MCQs

1

The right ventricle communicates with the right atrium through which one of the following?

A) Right atrio-ventricular orifice.	B) Pulmonary Orifice	C) Aortic Orifice	D) Left Mitral Orifice
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2

Fahad works as a professor at RSCI, he asked the students this MCQ: "which one of the following is located in the interventricular septum?" if you were one of the students, what answer will you choose?

A) Sinoatrial (SA) node	B) Atrioventricular (AV) node	C) Purkinje fibers	D) Atrioventricular (AV) bundle (bundle of His)
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3

Which one of the following is called the pacemaker of the heart?

A) Purkinje fibers	B) Sinoatrial (SA) node	C) Atrioventricular (AV) bundle (bundle of His)	D) Atrioventricular (AV) node
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4

What forms the apex of the heart?

A) Right atrium	B) Right ventricle	C) Left ventricle	D) Left atrium
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5

The apex of the heart lies at which one of the following levels?

A) left 4th intercostal space	B) left 5th intercostal space	C) left 6th intercostal space	D) left 7th intercostal space
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1)A 2)D 3)B 4)C 5)B

SAQs


Enumerate 4 Orifices?

1

 Pulmonary Orifice - Aortic Orifice - Right Tricuspid Orifice - Left Mitral (bicuspid) Orifice.

Enumerate 2 things that the wall of the left ventricle contains?

2

 1- Trabeculae carneae
2- large papillary muscles:
Anterior
Posterior


Enumerate 4 openings of the right atrium?

3

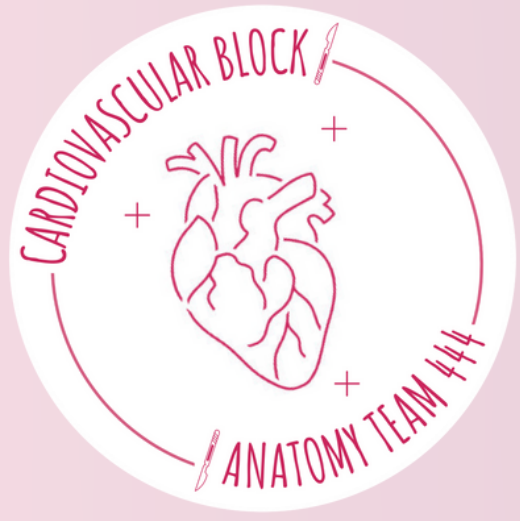
 Superior vena cava - Inferior vena cava - Coronary sinus - Right atrioventricular orifice.

Enumerate 3 things that separate the base of the heart from the vertebral column?

4

 1- descending aorta.
2- esophagus.
3- oblique sinus of pericardium.

More questions? [Click here!](#)



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Ziyad Alenazi

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