بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ

ANATOMY

وَلَقَدْ خَلَقْنَا الْإِنسَانَ وَنَعْلَمُ مَا تُوَسْوِسُ بِهِ نَفْسُهُ ۖ وَنَحْنُ أَقْرَبُ إِلَيْهِ مِنْ حَبْلِ الْوَرِيدِ

MID | Lecture 6

Cardiovascular System Pt.1

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Joud Alsafadi

Introduction to Anatomy

1st Year Medical Students

2025-2026
Second Semester

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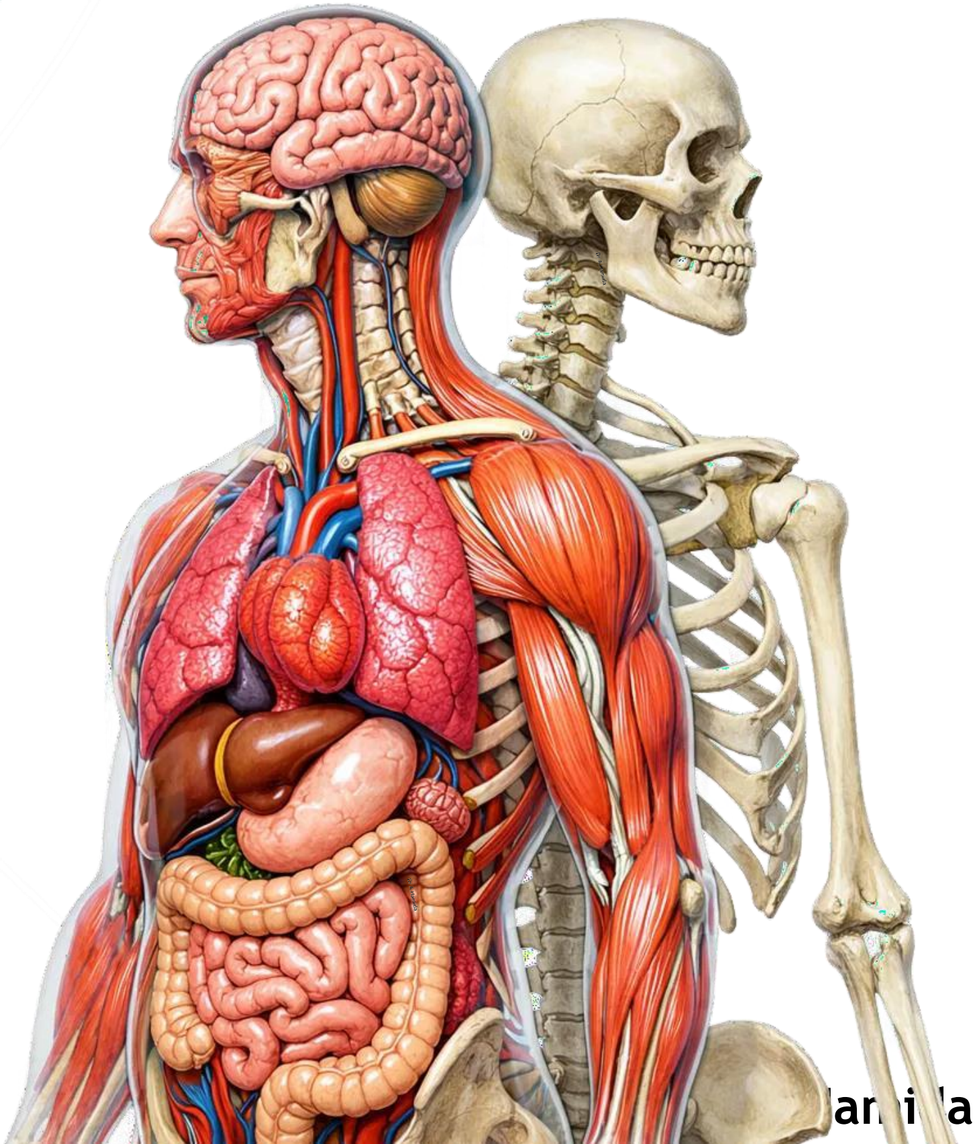
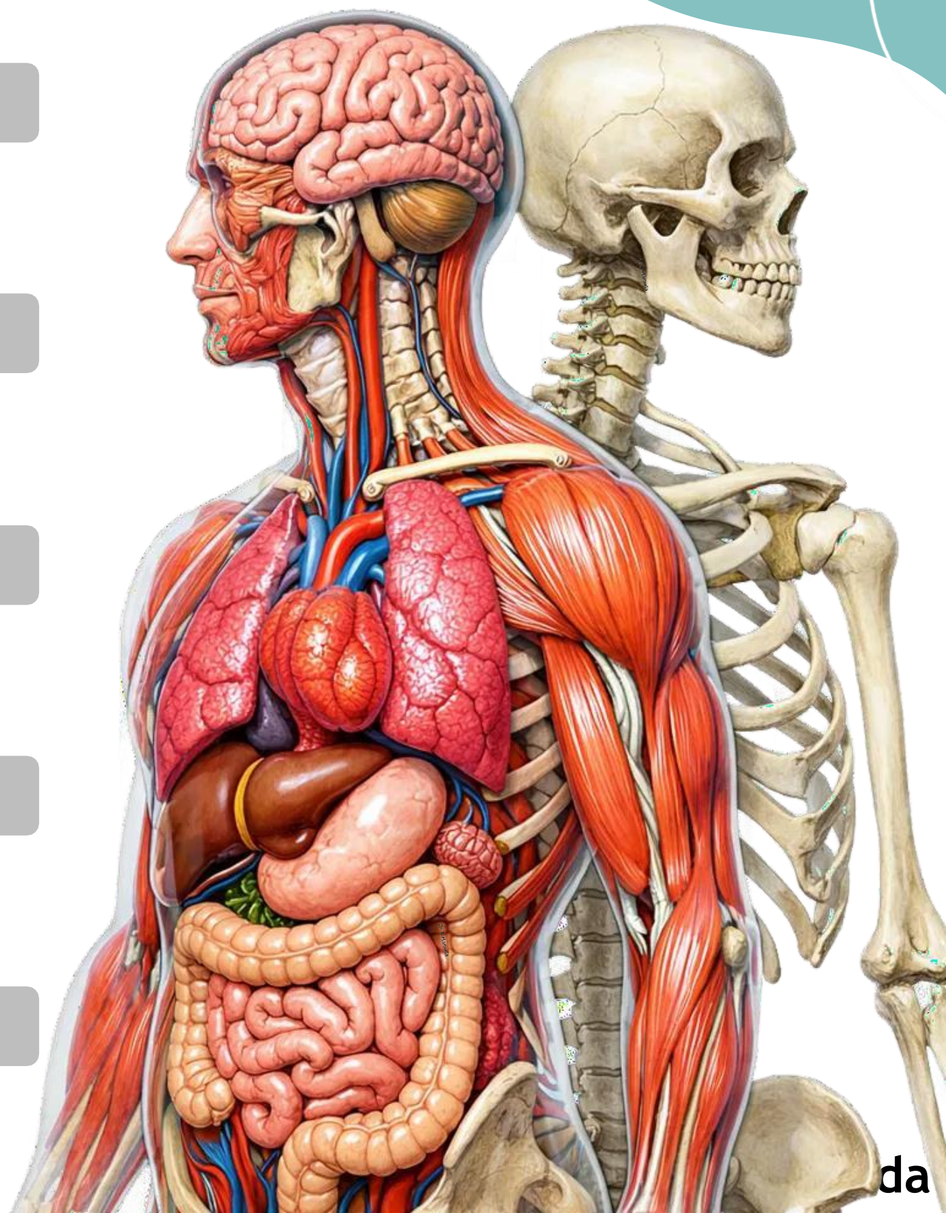


Course Outline:

1. Introduction and Terminology
2. Skeletal System
3. Cardiovascular System
4. Lymphatic System
5. Nervous System
6. Muscular System
7. Respiratory System
8. Digestive System
9. Urinary System
10. Endocrine System



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3 Cardiovascular System

- The cardiovascular system (cardio- = heart; vascular = blood vessels)
- The system supplies nutrients to and removes waste products from various tissues of the body.
- The cardiovascular system consists of the:

1. Heart, which pumps blood throughout the body.
2. Blood Vessels, which are a closed network of tubes that transport the blood.

القلب هو عبارة عن "pump" أو مصدر قوة الي بضخ الدم حتى يتوزع حوالين الجسم عبر الشرايين

The organ that is responsible for the distribution of oxygenated blood (blood filled with oxygen) to other organs & rest of the body by pumping the blood is the heart through blood vessels that carry the blood, the heart itself acts as the pump to distribute the blood around the body.

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3 Cardiovascular System

Gross lecture-6

System Outline:

3.1 Blood

3.2 Heart

3.3 Blood Vessels

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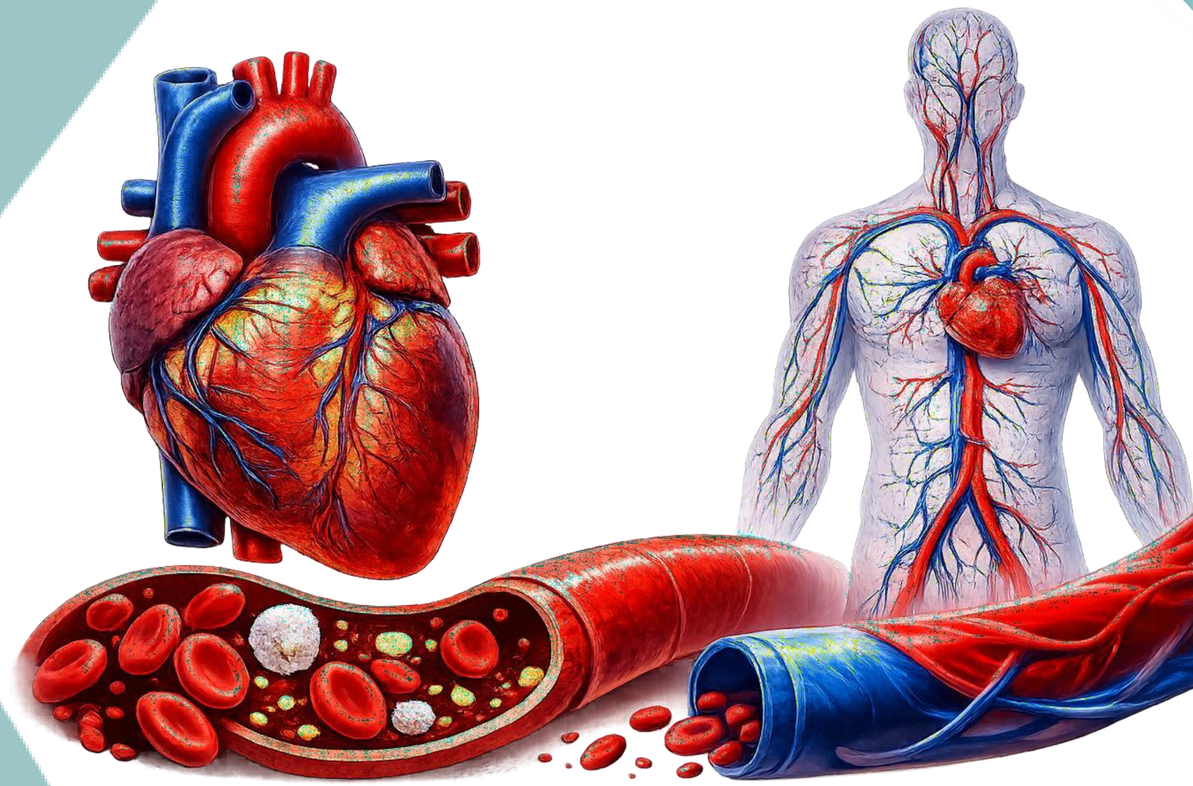
3

Gross lecture-6

- Cardiovascular System
- 1. Blood



Blood

➢ The blood is a highly specialized connective tissue consisting of:

1. Plasma

- It is the fluid portion of the blood.
- About ninety percent of it is made up of water, and the remaining portion consists of proteins, inorganic salts, lipids, and other dissolved substances.

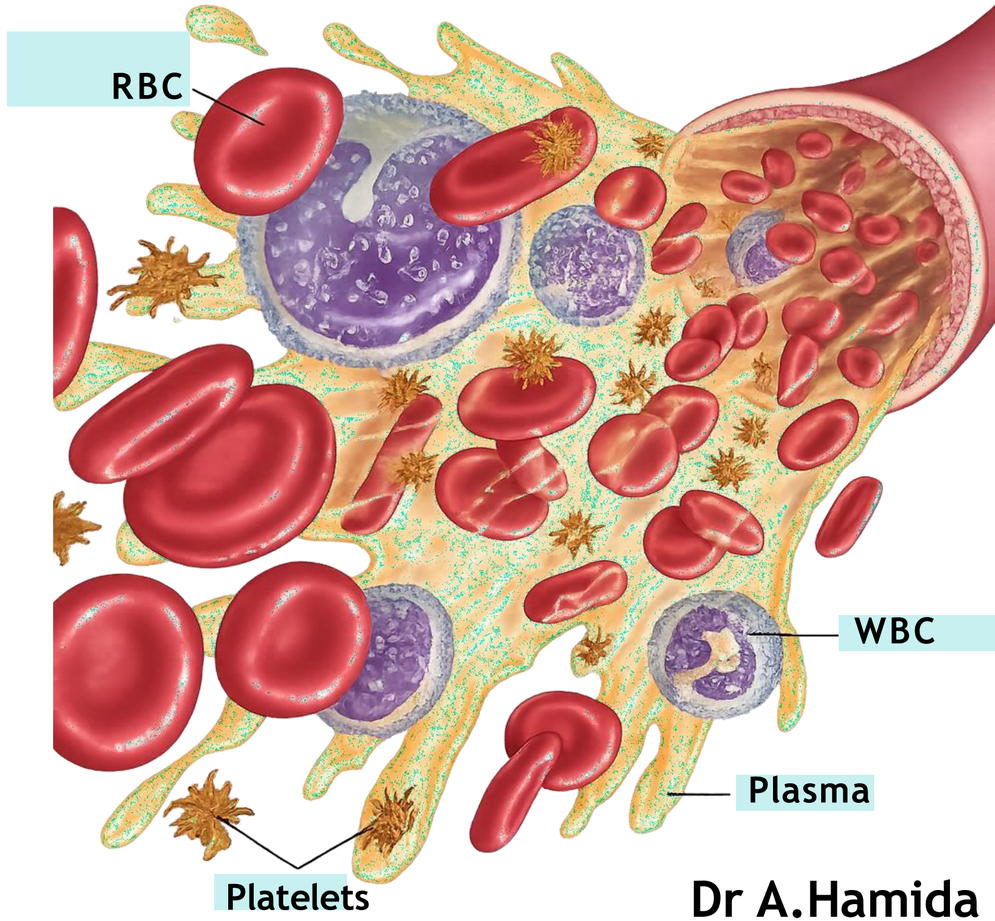
2. Blood Cells

Erytho = Red
Leuko = White
Cytes = Cells

The blood cells are of three types:

i. Red blood cells (RBCs) or erythrocytes

- They are disc-shaped cells that lack nuclei and mitochondria.
- They transport oxygen from the lungs to body cells and deliver carbon dioxide from body cells to the lungs.



When you get injured, the platelets are responsible to cover the damaged area. They stack each other to build a barrier (creating the blood clotting) to stop the bleeding

ii. White blood cells (WBCs) or leukocytes:

- Protect the body from invading pathogens and other foreign substances

iii. Thrombocytes (platelets):

- The platelets play an important role in blood clotting.

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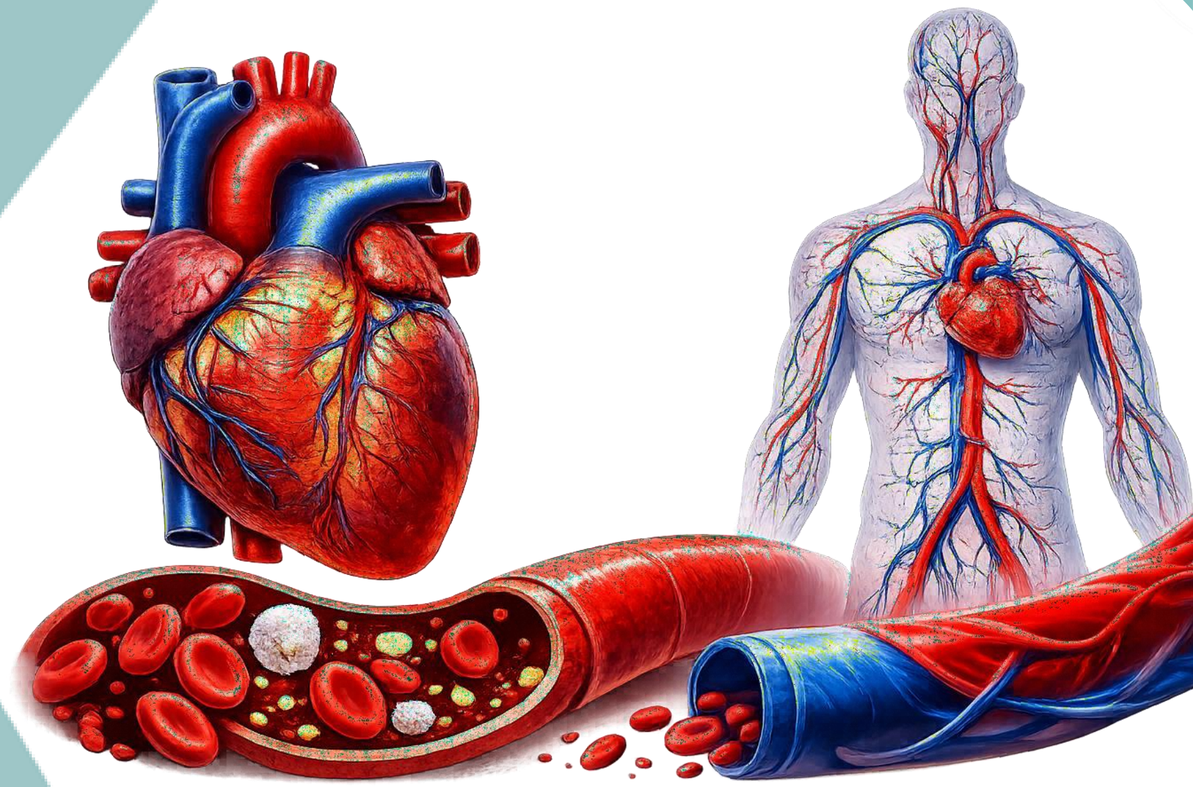
Gross lecture-6

- Cardiovascular System
- 2. Heart



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3.2 Cardiovascular System-Heart

Gross lecture-6

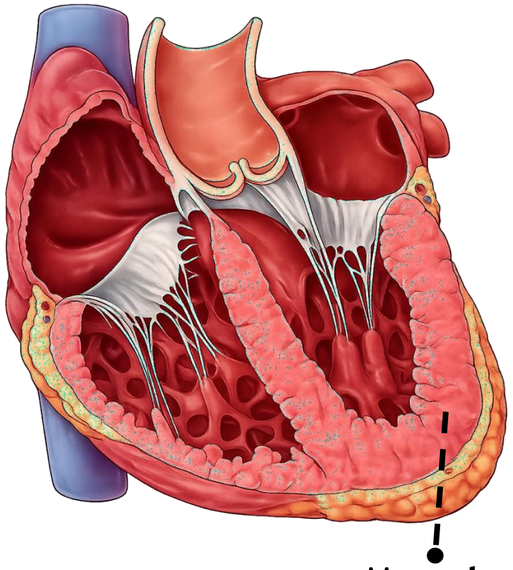
Outline:

- 3.2.1 Location of the heart
- 3.2.2 Shape of the heart
- 3.2.3 Pericardium
- 3.2.4 Chambers of the Heart
- 3.2.5 Valves of the Heart

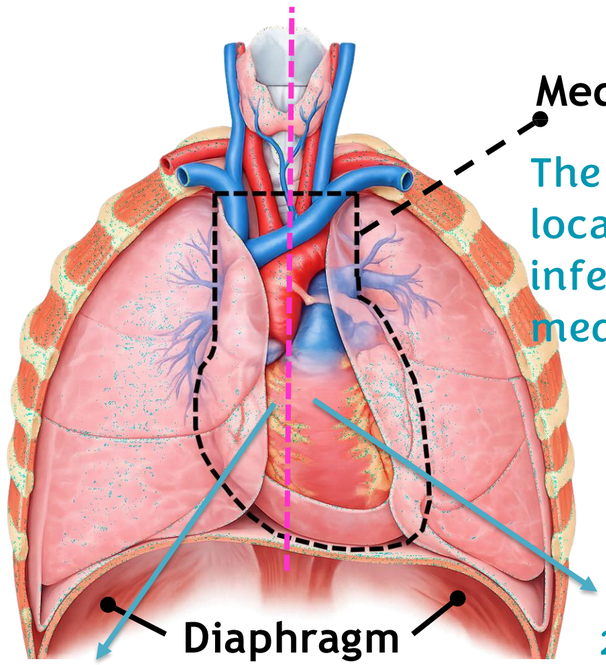
3.2.1 Location of the heart

- The heart is a four-chambered, hollow muscular organ, roughly the size of a clenched fist.
- It is situated in the thoracic cavity between the lungs in a cavity known as mediastinum.
- It rests on the diaphragm, near the midline of the thoracic cavity (about two-third of the heart is located on the left of the midline and one-third on the right of the midline)

Mediastinum is divided into two compartments
1) Superior Mediastinum
2) Inferior Mediastinum (This is where the heart is located)



Myo = Muscle
Cardium = Heart
Myocardium = Heart Muscle

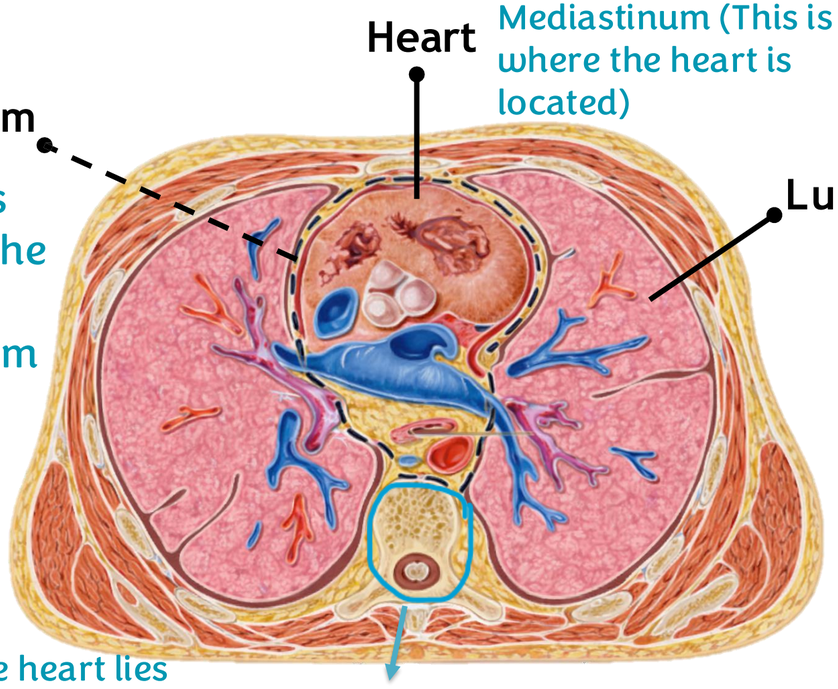


The heart is located in the inferior mediastinum

1/3 of the heart lies on the right side

2/3 of the heart lies on the left side

Anterior view of the heart



Transverse section of the thoracic cavity showing the heart in the mediastinum

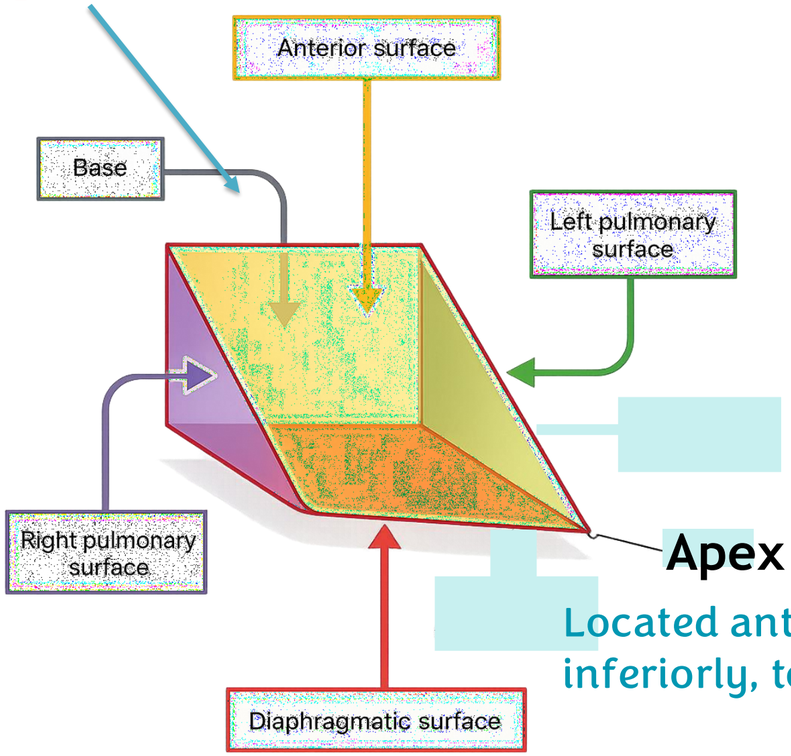
Shape of the heart

➢ The heart is somewhat pyramid-shaped, lying on its side, with an apex, a base, and four surfaces.

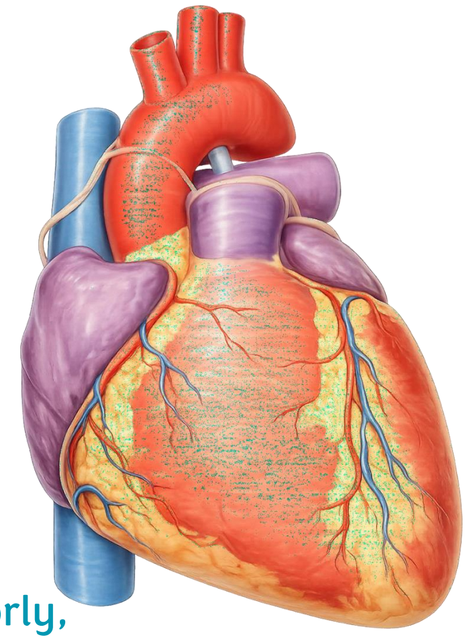
- The apex is directed anteriorly, inferiorly, and to the left.
- The base is opposite the apex and forms the posterior aspect of the heart.
- Surfaces:
  i. **Anterior surface (sternocostal surface):** lies deep to the sternum and ribs.
  ii. **Inferior surface (diaphragmatic surface):** is the part of the heart that rests mostly on the diaphragm.
  iii. **Right surface:** faces the right lung.
  iv. **Left surface:** faces the left lung.

Anterior to the heart (in front of the heart) lies the sternum and ribs

Posterior to the heart (behind the heart) lies the vertebral column

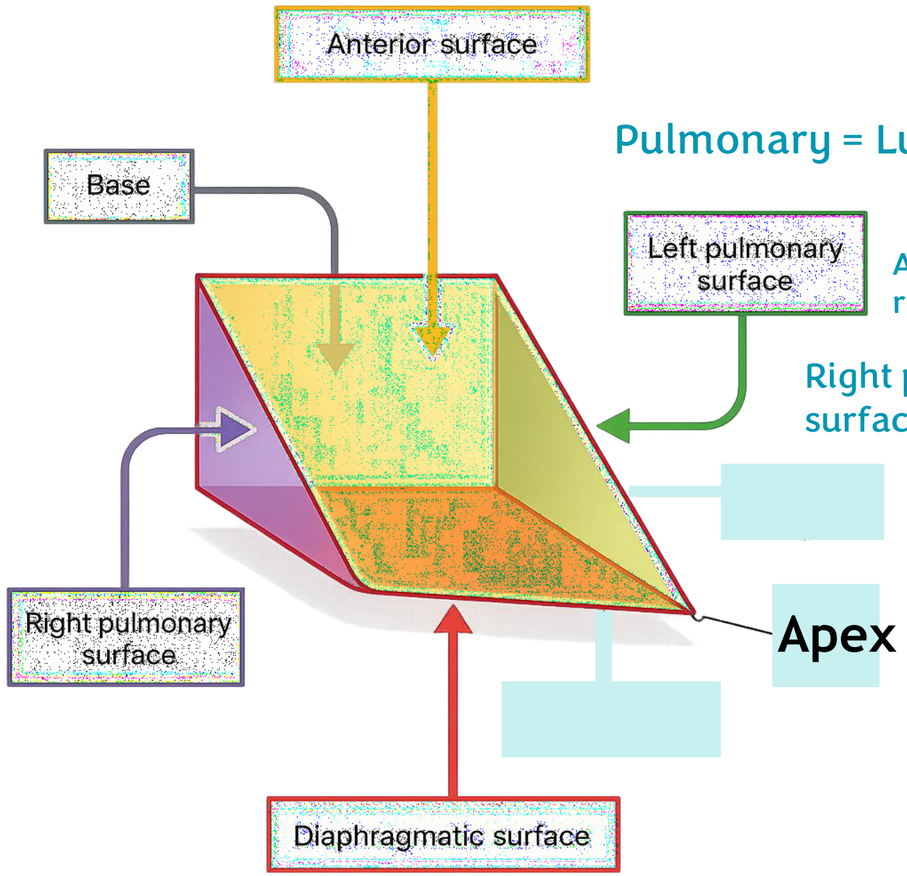


Located anteriorly, inferiorly, to the left



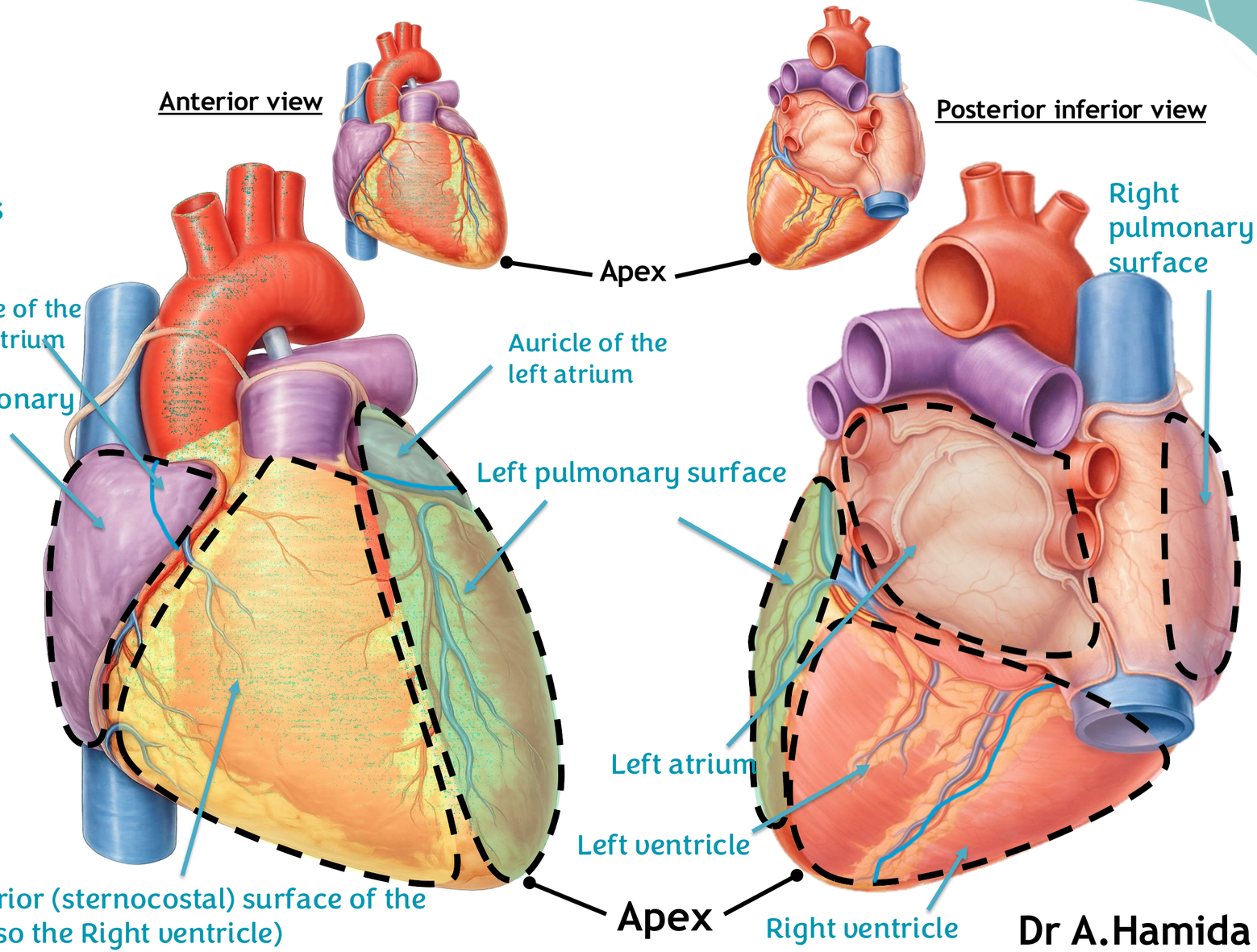
Shape of the heart

➢ The heart is somewhat pyramid-shaped, lying on its side, with an apex, a base, and four surfaces.



Pulmonary = Lungs

Opposite to the Apex is the base (located posteriorly relative to the Apex)



The anterior (sternocostal) surface of the heart (also the Right ventricle)

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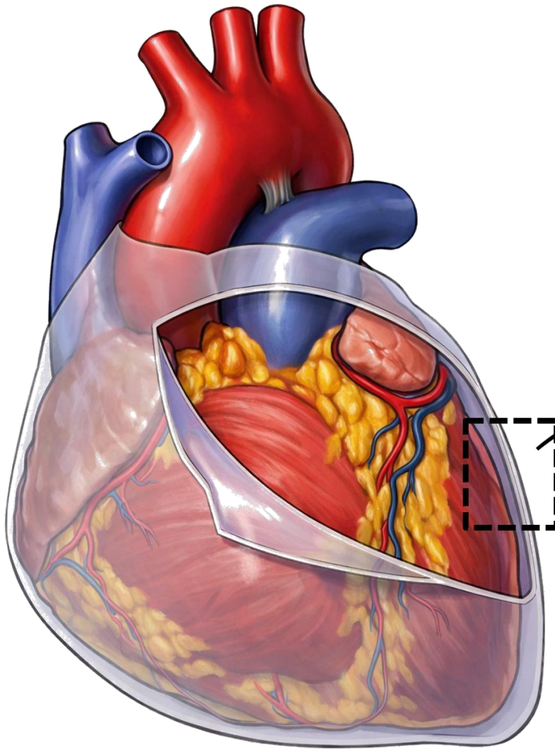
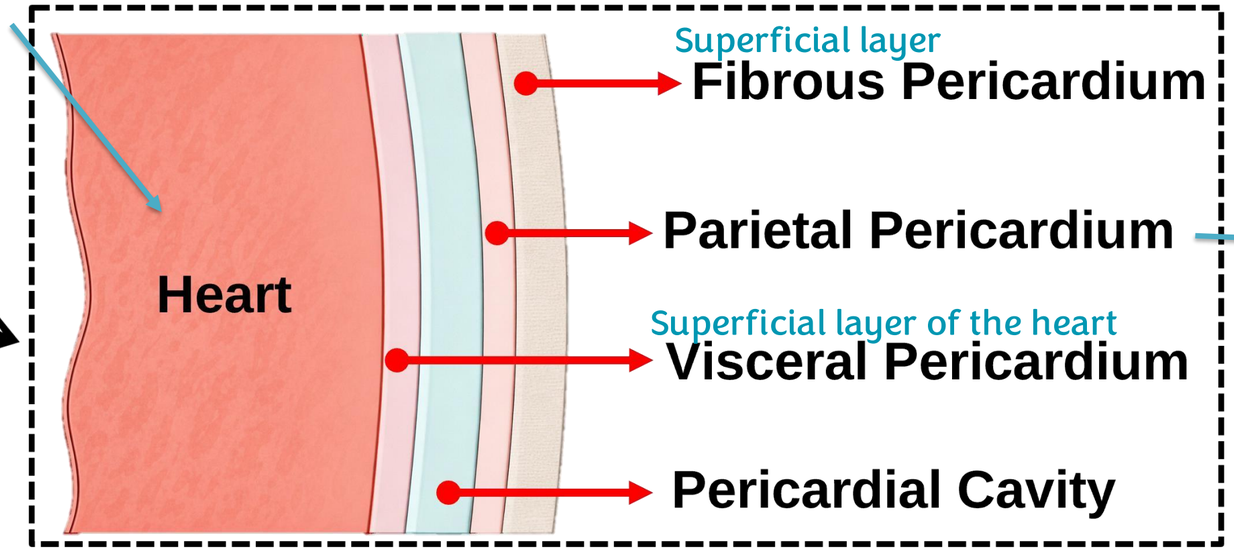
3.2.3

Pericardium

- It is the membrane that surrounds and protects the heart
- The pericardium consists of two main parts:
  1. Fibrous pericardium (superficial layer).
  2. Serous pericardium (deeper layer).

Composed of 2 layers : parietal pericardium which lines the fibrous pericardium, and visceral pericardium which covers the heart. Between these two layers there are pericardial cavity that contains small amount of serous fluid to lubricate (to reduce the friction) with the lungs, sternum and diaphragm while the heart is pumping blood



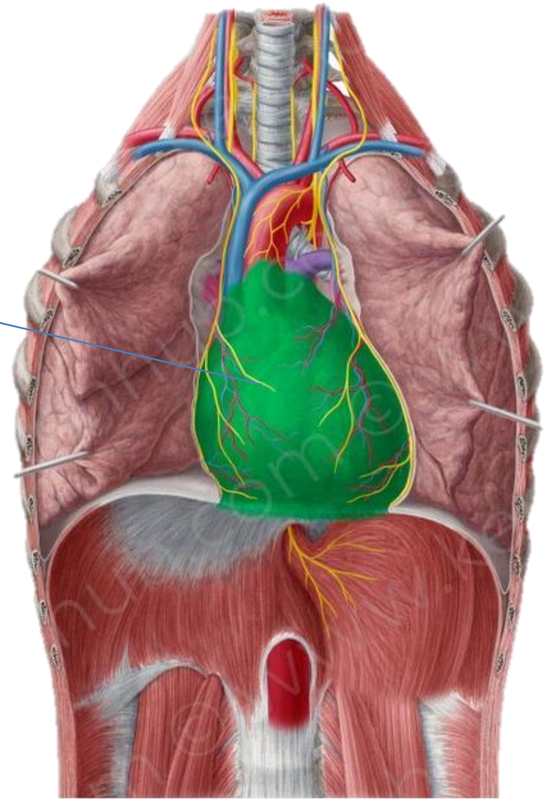


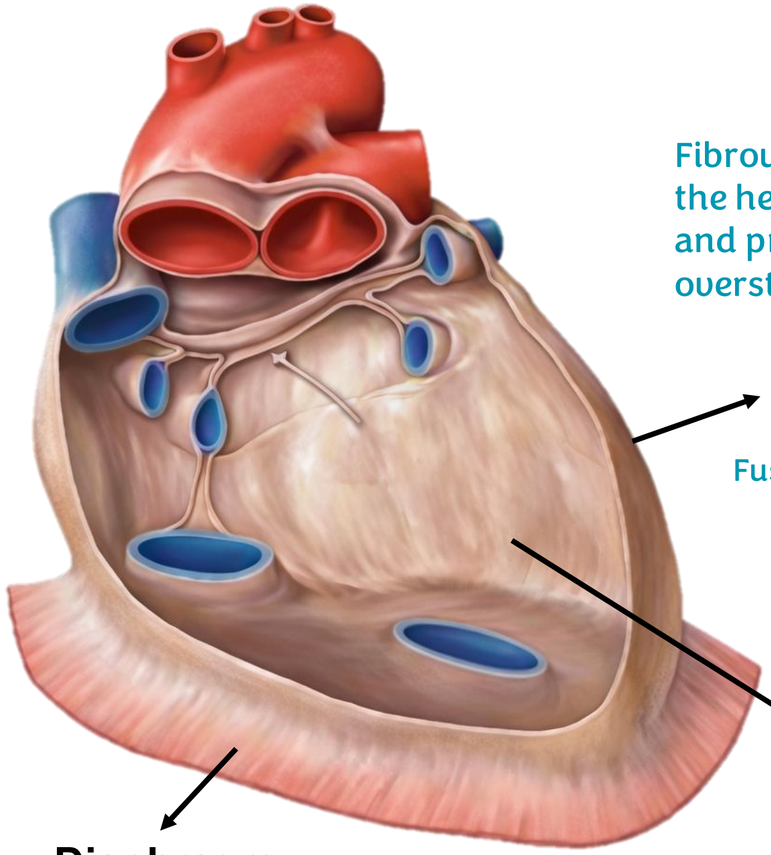
3.2.3

Pericardium

1. Fibrous pericardium (superficial layer):

- It is composed of tough, inelastic, dense irregular connective tissue.
- It prevents overstretching of the heart, provides protection, and anchors the heart in the mediastinum.





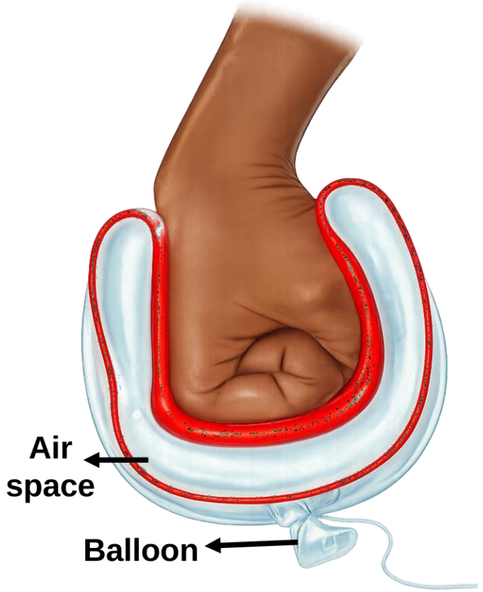
3.2.3

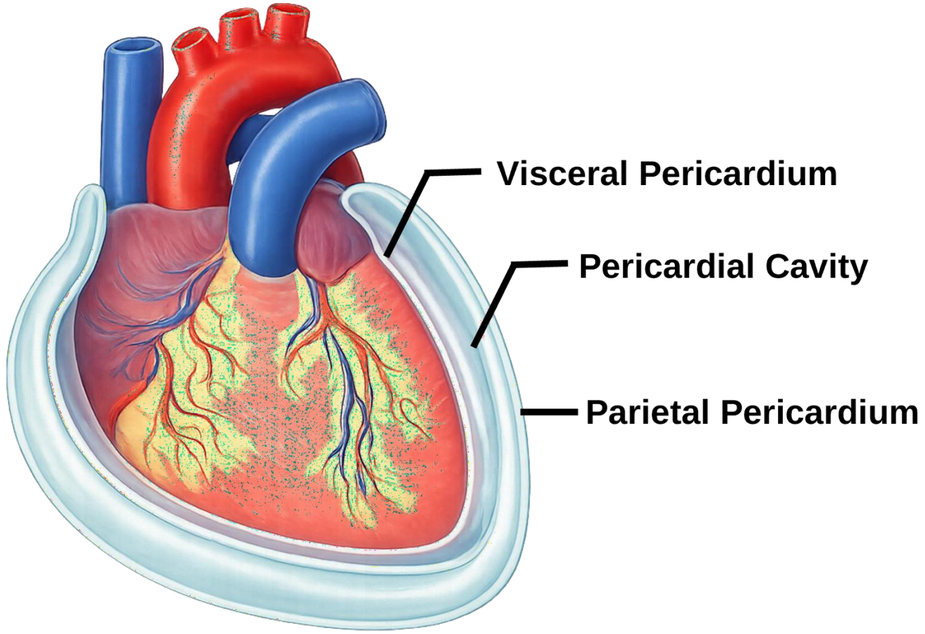
Pericardium

2. Serous pericardium (deeper layer):

- It is a thinner, more delicate membrane that forms a double layer around the heart.
- The outer parietal layer lines the inner surface of the fibrous pericardium and is fused to it.
- The inner visceral layer adheres tightly to the surface of the heart (it is also called the epicardium)
- Between the parietal and visceral layers of the serous pericardium is a cavity called the pericardial cavity.
- It contains a few milliliters of lubricating serous fluid, known as pericardial fluid, which reduces friction between the layers of the serous pericardium as the heart moves.

This is the way that the pericardium was formed by. We can compare this by placing your fist in a balloon. The two layers of the heart are a continuation for each other, as one them line the organ (heart) and the other lines the cavity of that organ.





3.2.4

Chambers of the Heart

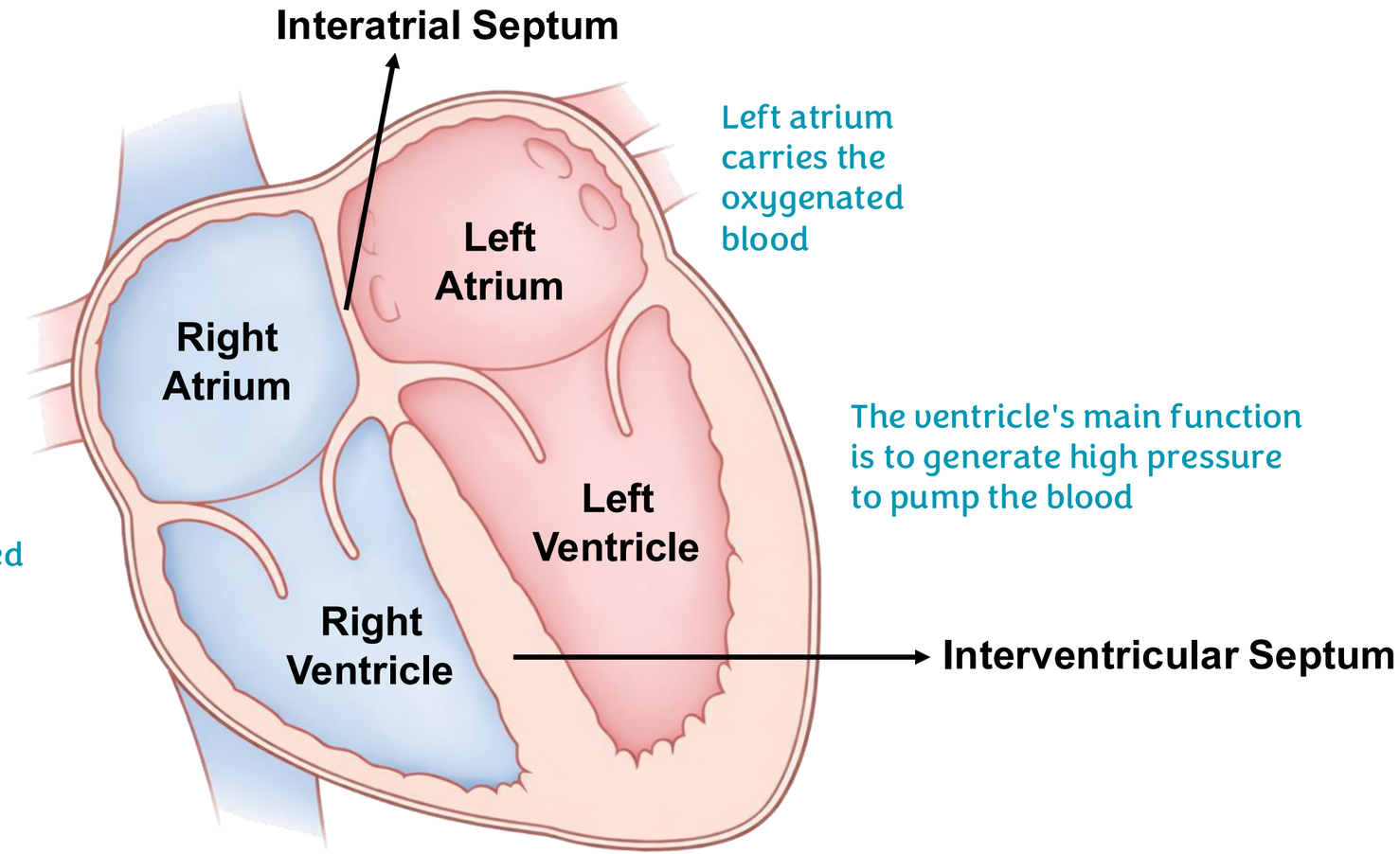
➢ The interior of the heart is divided into four chambers:

- Right and Left atria (above): separated from each other by interatrial septum
- Right and Left ventricles (below): separated from each other by interventricular septum.

The anatomical position of the heart is not like what it looks in the picture, instead this picture is a way to simplify the location of the heart champers.

Generally, the atria are above the ventricles but not directly (somewhat rotative),as the atrium is not directly above the ventricle and the atria are not directly beside each other.

Because it separates the two atriums



Left atrium carries the oxygenated blood

Right atrium carries the deoxygenated blood

The ventricle's main function is to generate high pressure to pump the blood

Chambers of the Heart

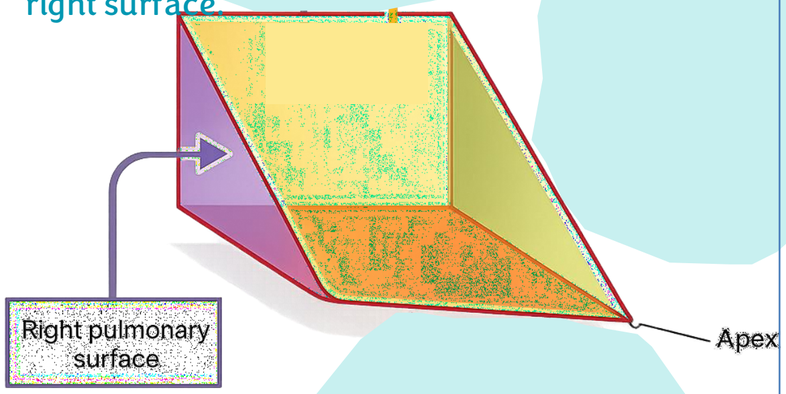
This is a 3d model to visualize the heart:
https://www.msdmanuals.com/home/multimedia/3dmodel/cardiac-conduction-system

Gross lecture-6

➢ Right Atrium

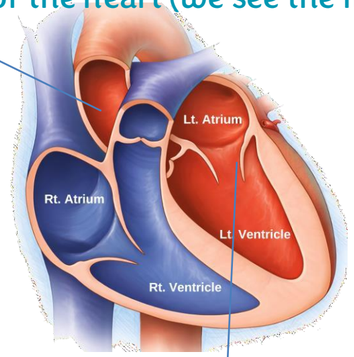
- The right atrium forms the right surface of the heart
- It has an ear-shaped appendage called an auricle; each auricle slightly increases the capacity of an atrium so that it can hold a greater volume of blood.

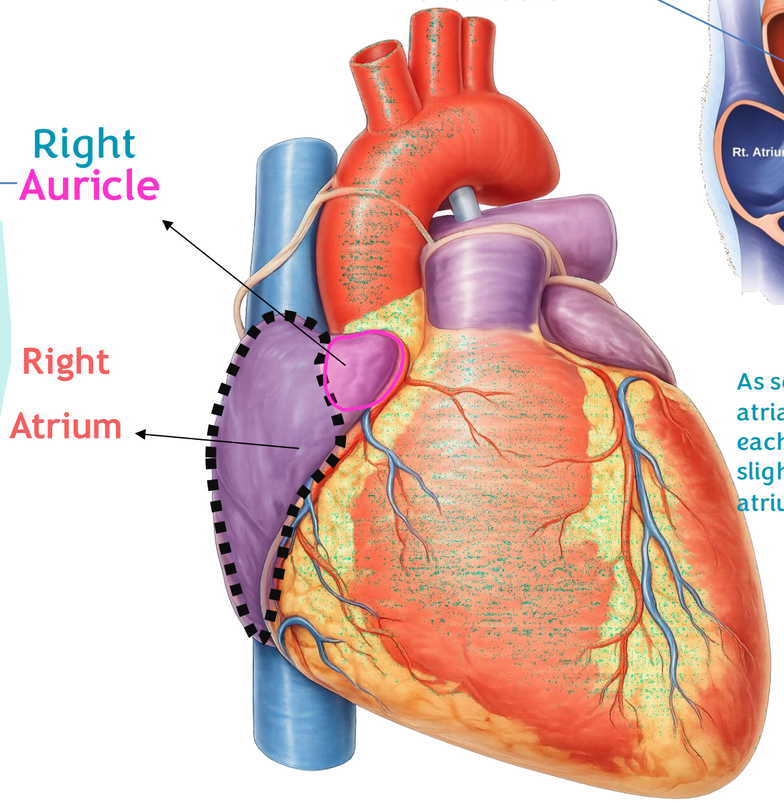
To determine the location of the right atrium, first we should hold the heart in its anatomical position, by putting the apex anteriorly to the left and slightly downward, with the base posteriorly. Place your hand beneath the heart as it is the diaphragm then direct the heart as mentioned. The right atrium then is on the right surface.



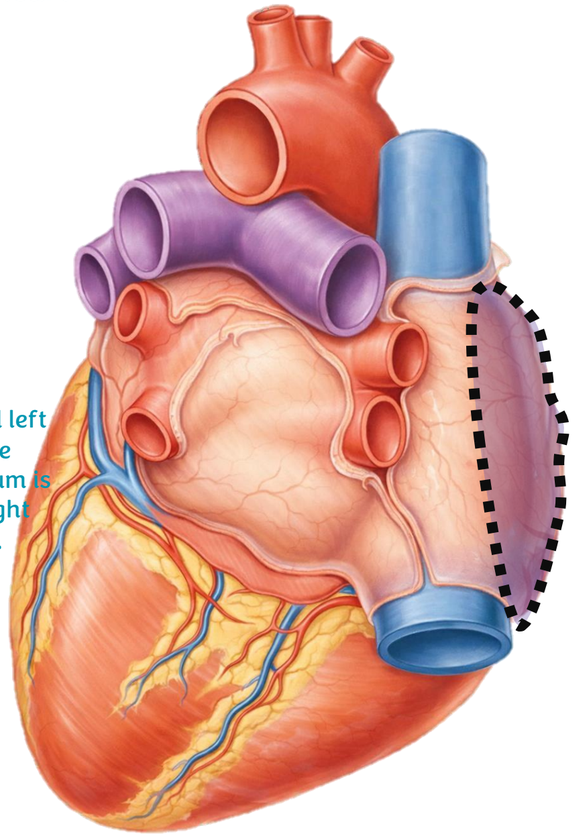
Each atrium has pouch (extension) like the pocket of the coat, to increase the area of the chamber called Auricle . So it's a part of the atrium. Auricle means ear.

This is the shape we see if remove the right, left and anterior face of the heart (we see the heart chambers





As seen here, the right and left atria are not directly beside each other, as the left atrium is slightly upward and the right atrium slightly downward.



Anterior view

Posterior-inferior view

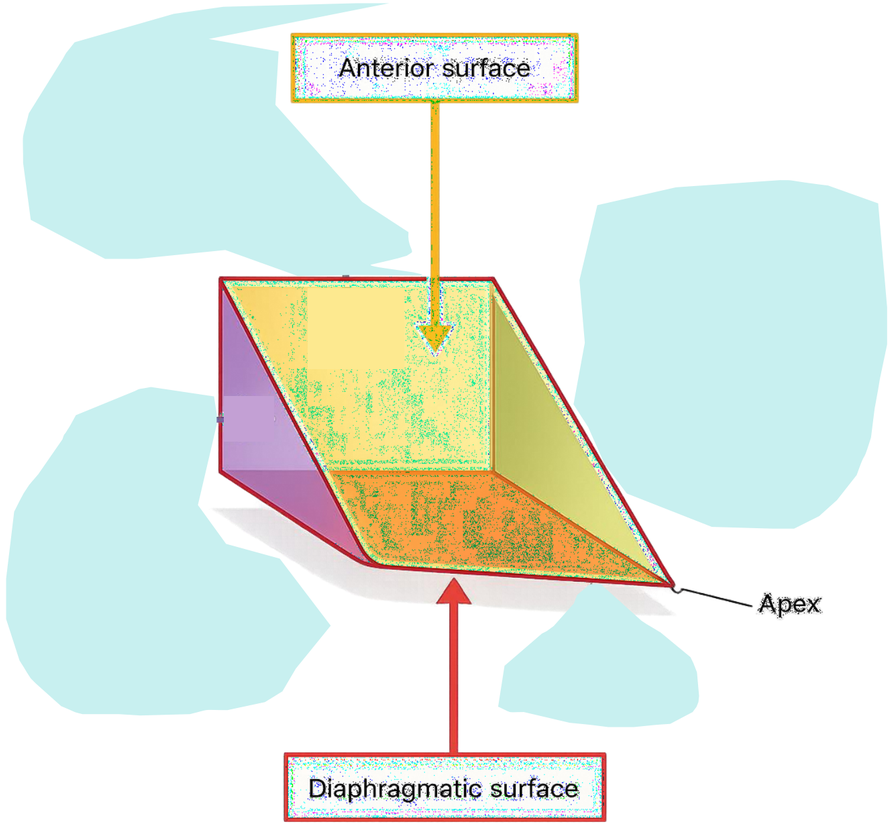
Chambers of the Heart

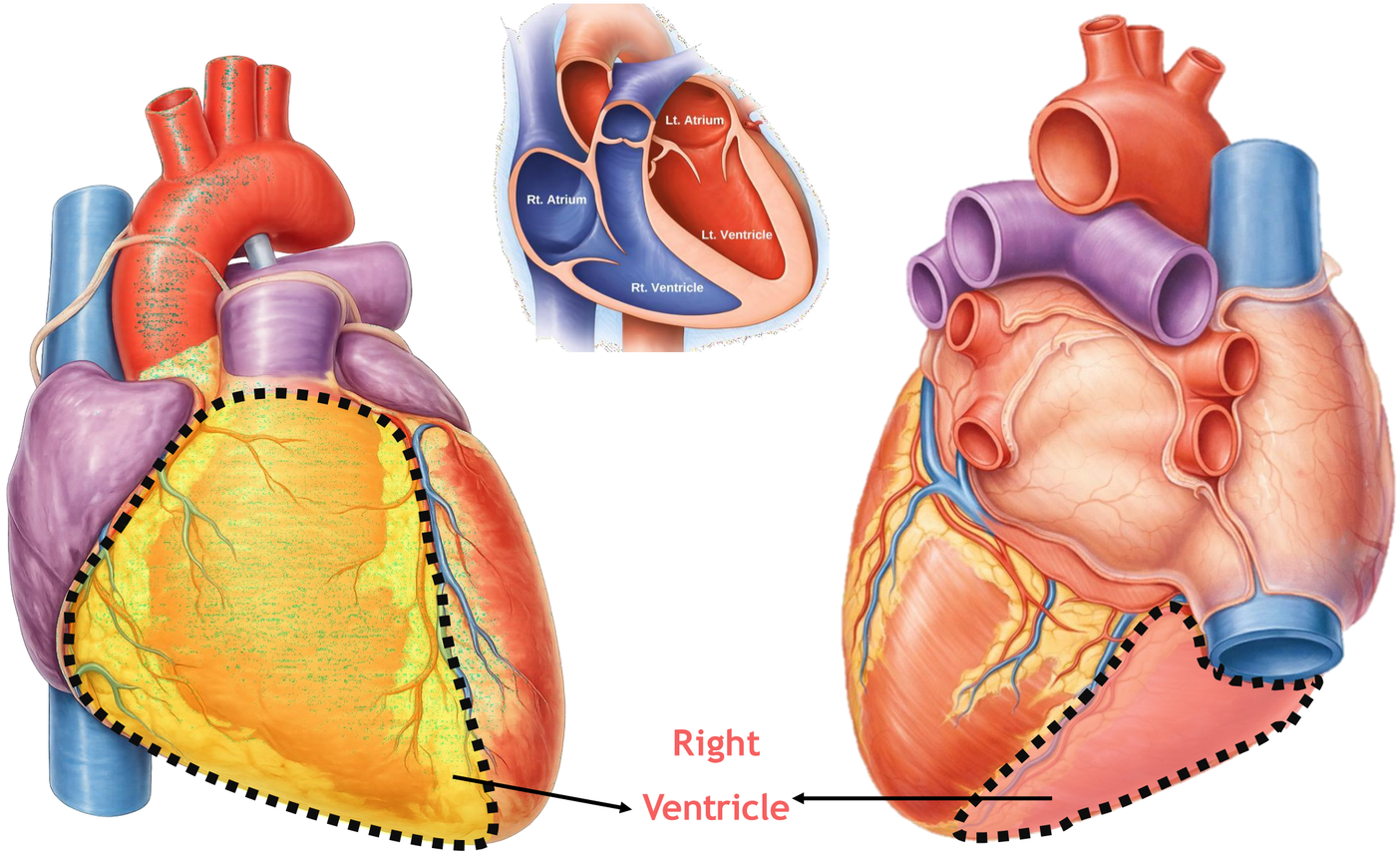
➢ Right Ventricle

Approximately one third of the diaphragmatic surface

- **The right ventricle forms most of the anterior surface and part of the diaphragmatic surface of the heart.**

To imagine what the right ventricle looks like, imagine it's like letter (L) forming a part of the anterior surface and a part of inferior surface.





Anterior view

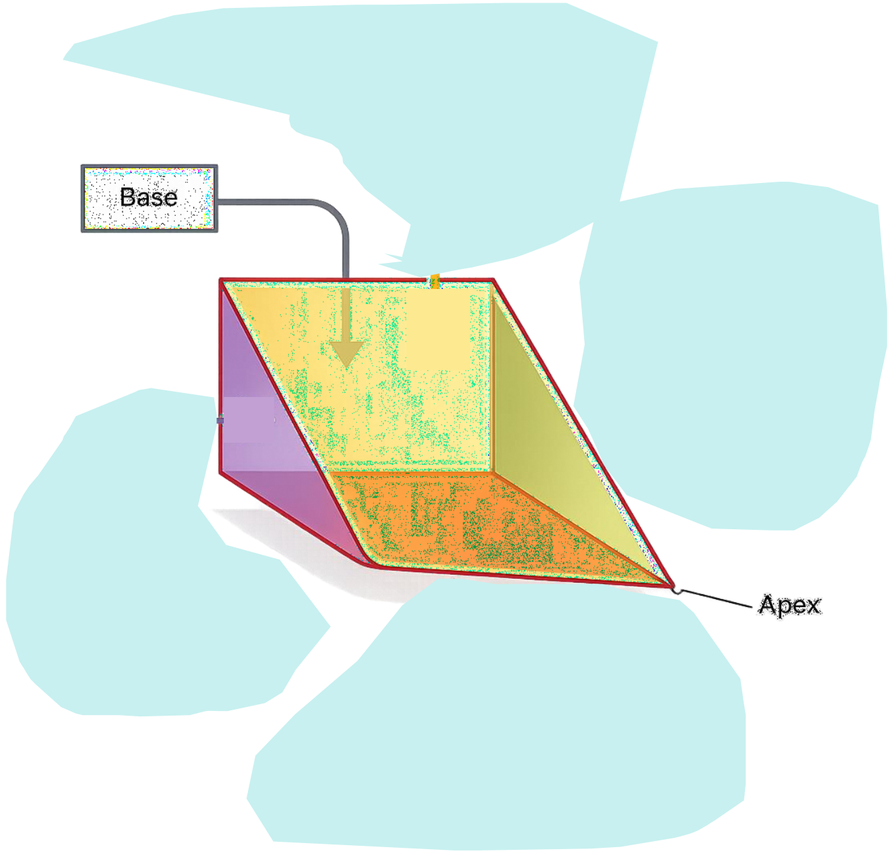
Posterior-inferior view

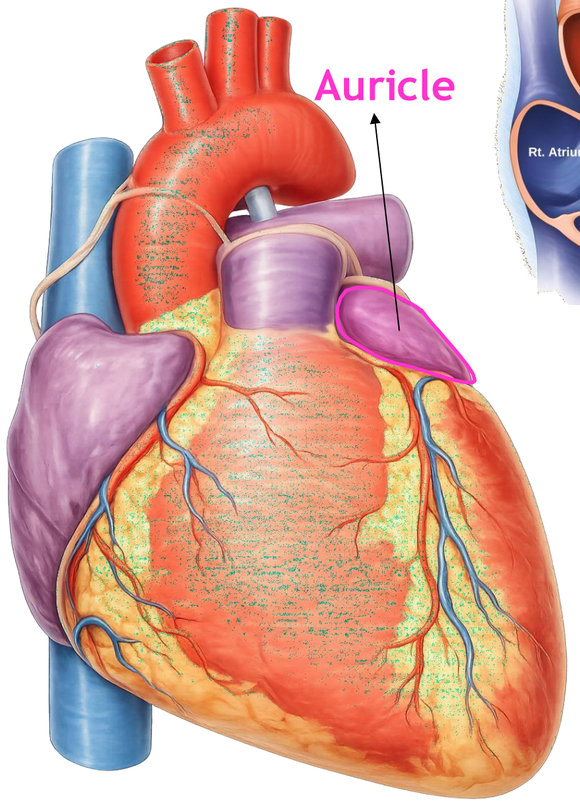
Chambers of the Heart

It's hard to see the left atrium anteriorly , so we should turn the heart to see the posterior side. But we can see the left Auricle anteriorly .

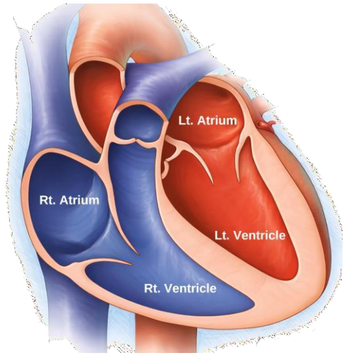
➢ Left Atrium

- The left atrium forms most of the base of the heart (or posterior surface).
- It has an ear-shaped appendage called an auricle.





Anterior view



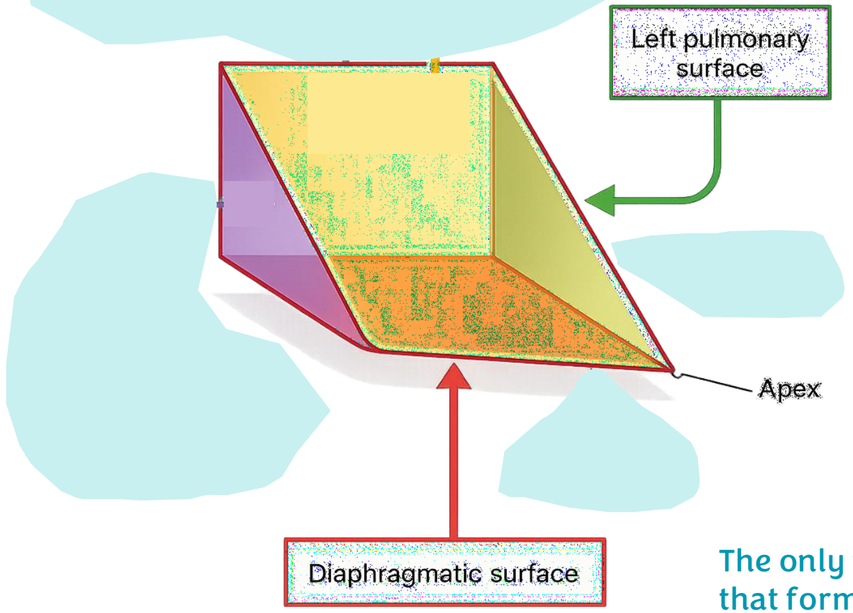
Posterior-inferior view

Chambers of the Heart

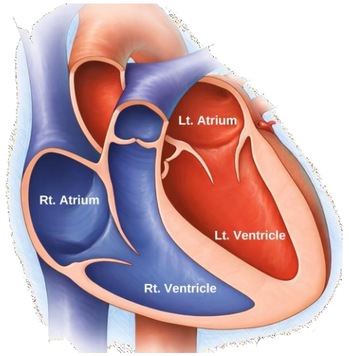
➢ Left Ventricle

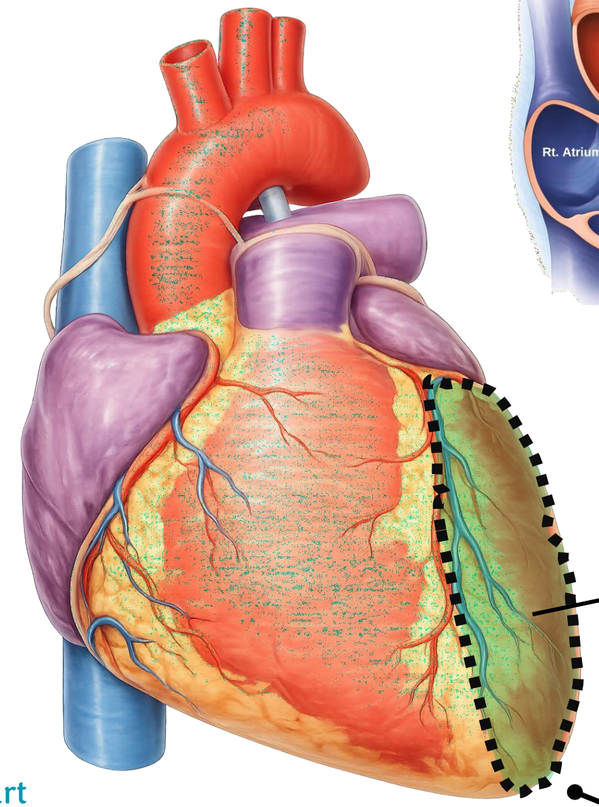
- The left ventricle is the thickest chamber of the heart.
- It forms most of the left surface, part of the diaphragmatic surface, and the apex of the heart.

To sum up, in the inferior surface we have parts of the two ventricles , and anteriorly a part of one ventricle (right ventricle) , and on the left side parts of one ventricle (left ventricle).



Forming two thirds of the diaphragmatic surface.

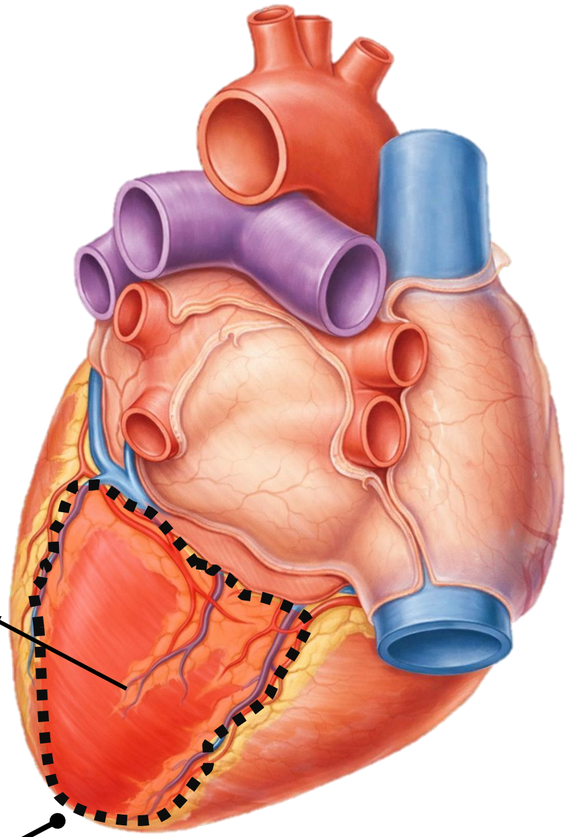




Left Ventricle

Apex

Anterior view



Posterior-inferior view

The only part of the heart that forms the apex is the left ventricle .

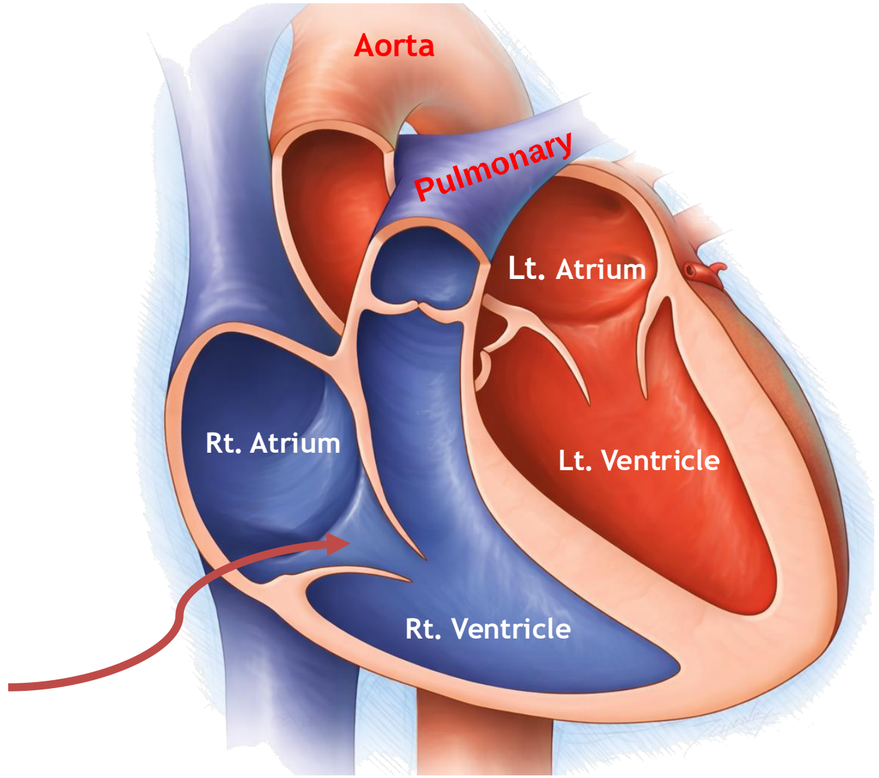
3.2.5

Valves of the Heart

- There are two pairs of valves in the heart:
  - (a) a pair of atrioventricular valves (Tricuspid valve and Bicuspid valve)
  - (b) a pair of semilunar valves (Aortic valve and Pulmonary valve)
- Each of the four valves helps ensure the one-way flow of blood by opening to allow blood to pass through and then closing to prevent backflow (regurgitation) of blood.

The right side of the heart carries deoxygenated blood, which will be pumped to the lungs through the Pulmonary artery,
Meanwhile, the left side of the heart carries oxygenated blood which has come from the lungs, and is supposed to be pumped through Aorta to the whole body

there is a gate "valve" that enables the pass of deoxygenated blood from the right atrium to the right ventricle, however, this valve prevents the backflow of the blood during the contraction of the heart.



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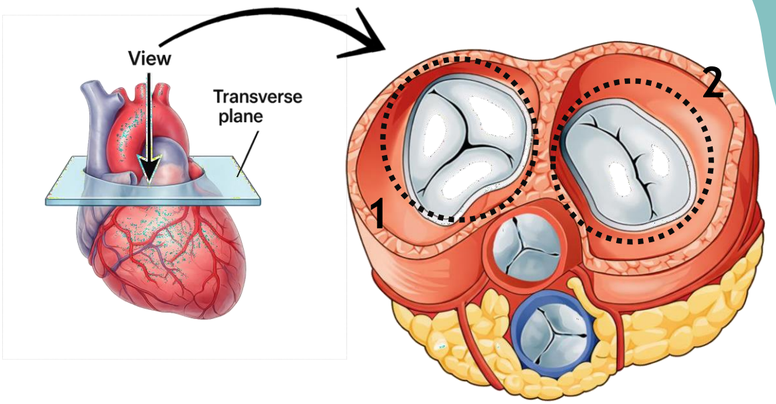
3.2.5

Valves of the Heart

Gross lecture-6

➢ Atrioventricular Valves (AV):

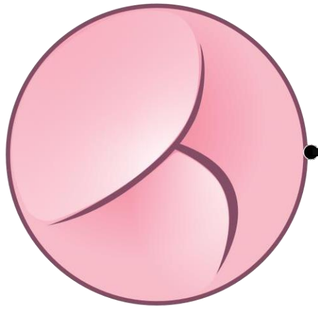
- They allow the flow of blood from the atria into the ventricles and prevent backflow of blood into the atria.



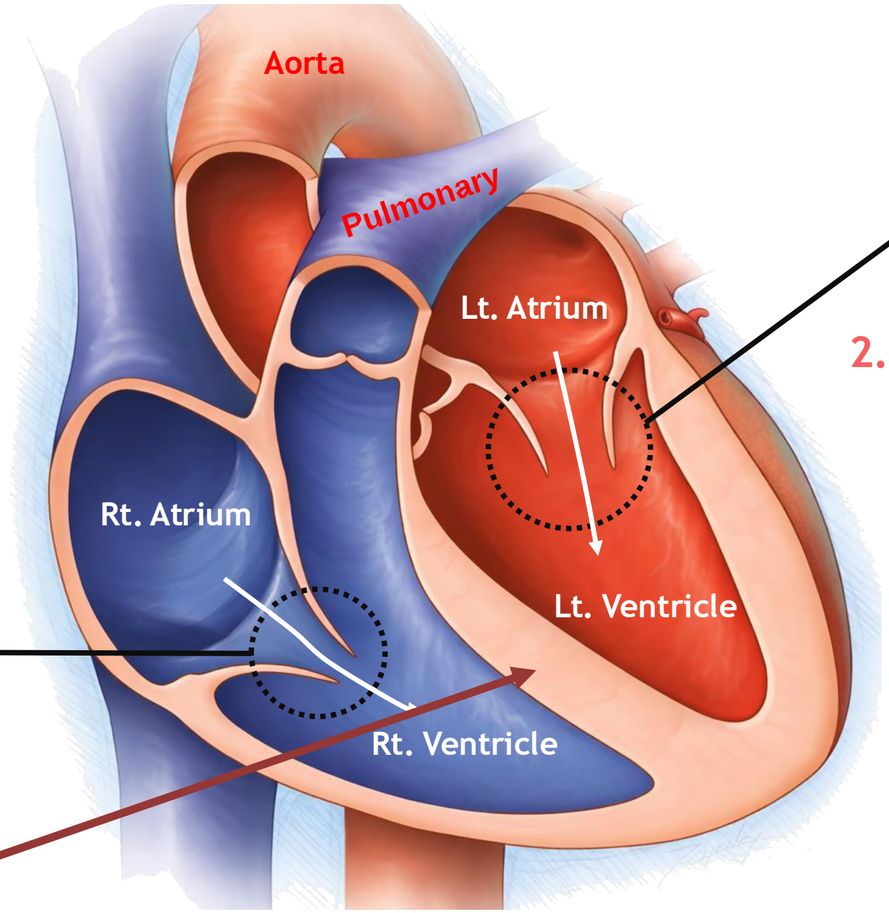
1. Right atrioventricular valve: Another name: Tricuspid valve: صمام ثلاثي الشرفات

- Located between the right atrium and right ventricle.
- It is also known as the tricuspid valve; as the name indicates, it has three cusps (anterior, posterior, and septal).

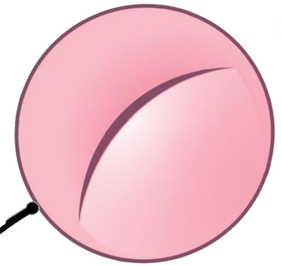
Every cusp indicates the direction it points at There are anterior cusp, posterior one and a cusp that points at the septum which is the barrier between the right and left ventricles (there is also other one between left and right atrium)



Tricuspid valve



Mitral valve (bicuspid valve)



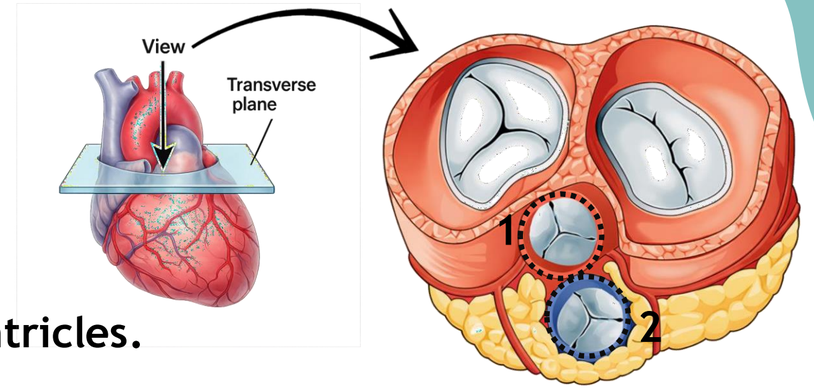
2. Left atrioventricular valve:

- Located between the left atrium and left ventricle
- It is also known as mitral valve or bicuspid valve; as the name indicates, it has two cusps (anterior and posterior).

3.2.5

Valves of the Heart

Gross lecture-6



➢ Semilunar Valves: Semilunar شكل هلالي

- They allow ejection of blood from the ventricles into the arteries and prevent backflow of blood into the ventricles.
- They are composed of three crescent-shaped cusps, hence the name “semilunar.”

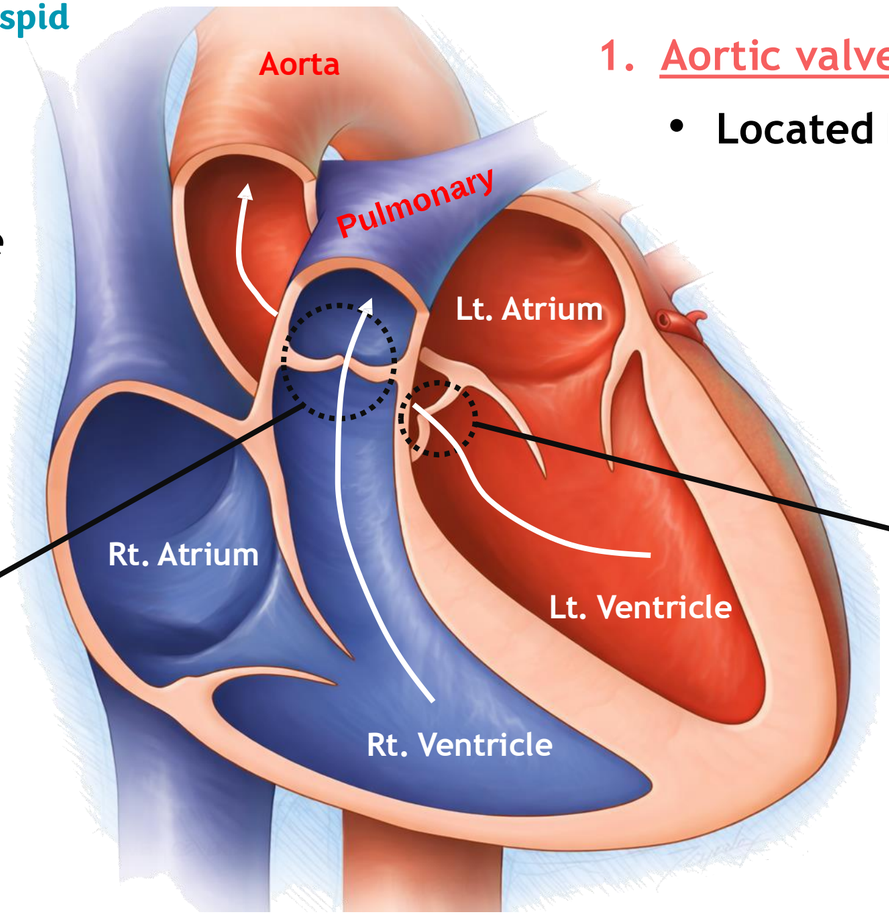
The pulmonary and aortic valve are tricuspid

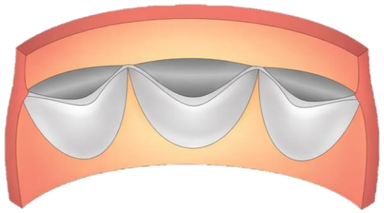
1. Aortic valve:

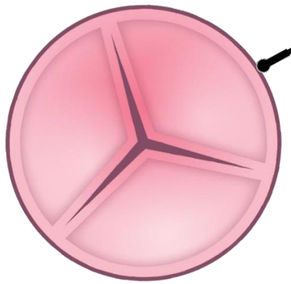
- Located between left ventricle and aorta.

2. Pulmonary valve:

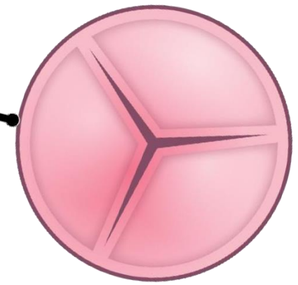
- Located between the right ventricle and pulmonary trunk.

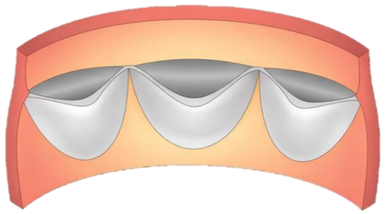






Pulmonary valve





Aortic valve

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3.2.5

Valves of the Heart

➢ Atrioventricular Valves (AV):

- When an AV valve is open, the cusps project into the ventricle, and blood moves from a region of higher pressure in the atria to a region of lower pressure in the ventricles through the open AV valves.
- When the ventricles contract, the rising blood pressure drives the cusps upward until their edges meet and close the opening, preventing backflow into the atria.

➢ Semilunar Valves:

- When the ventricles contract, pressure builds up within the chambers.
- The semilunar valves open when the pressure in the ventricles exceeds the pressure in the arteries, permitting ejection of blood into the pulmonary trunk and aorta.
- As the ventricles relax, blood begins to flow back toward the heart.
- This backflow fills the valve cusps, causing their free edges to meet tightly and close the opening between the ventricle and the artery.

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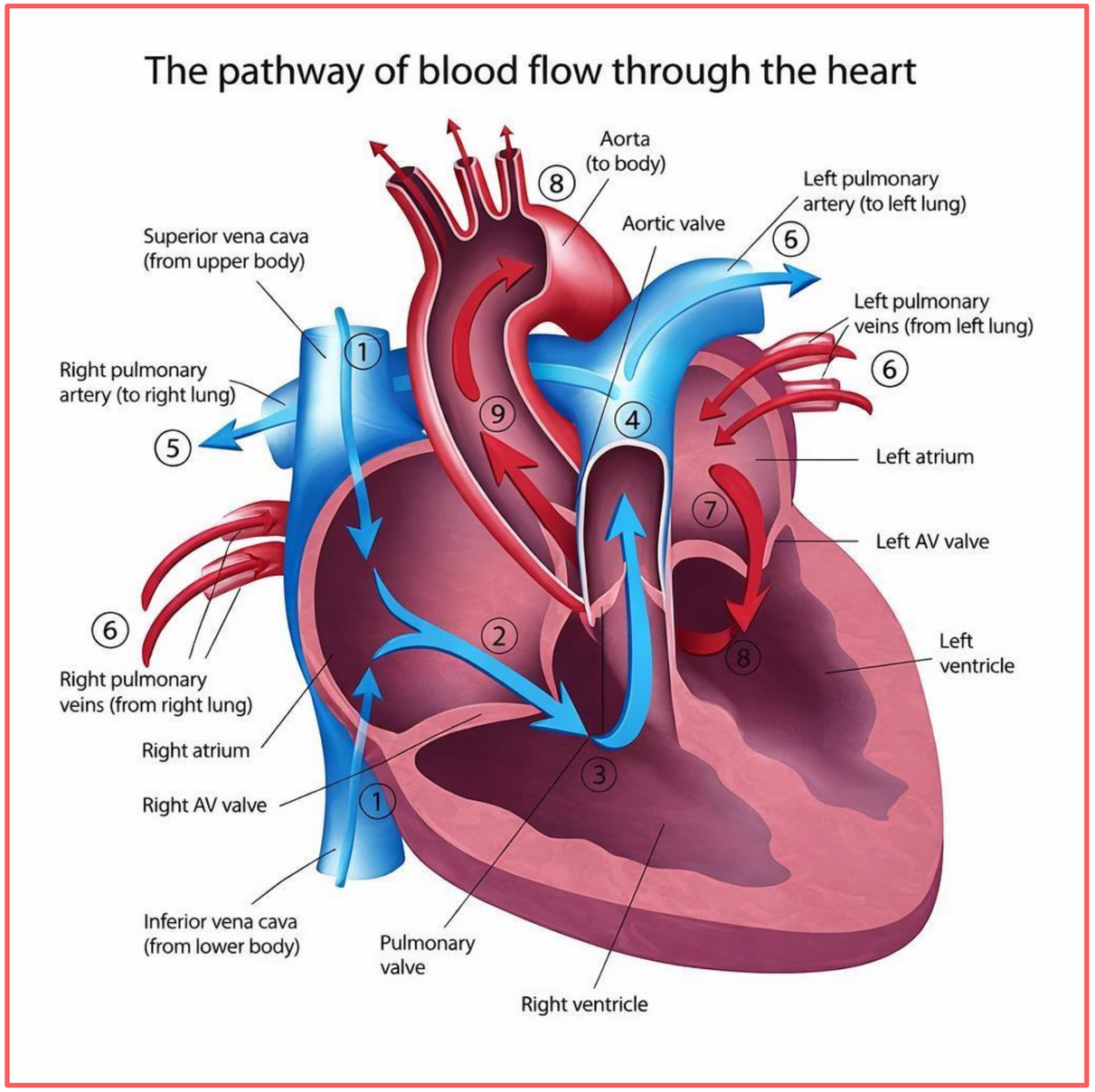
3.2 Cardiovascular System-Heart

Gross

At first, the vena cava provide The right atrium with deoxygenated blood,
Then this blood passes toward the right ventricle where it will be pumped to the lungs through the Pulmonary artery.
There, the blood is oxygenated And it will move back to the heart.
the left atrium passes oxygenated blood which has come from the lungs to the left ventricle, and then is pumped through Aorta to the whole body.



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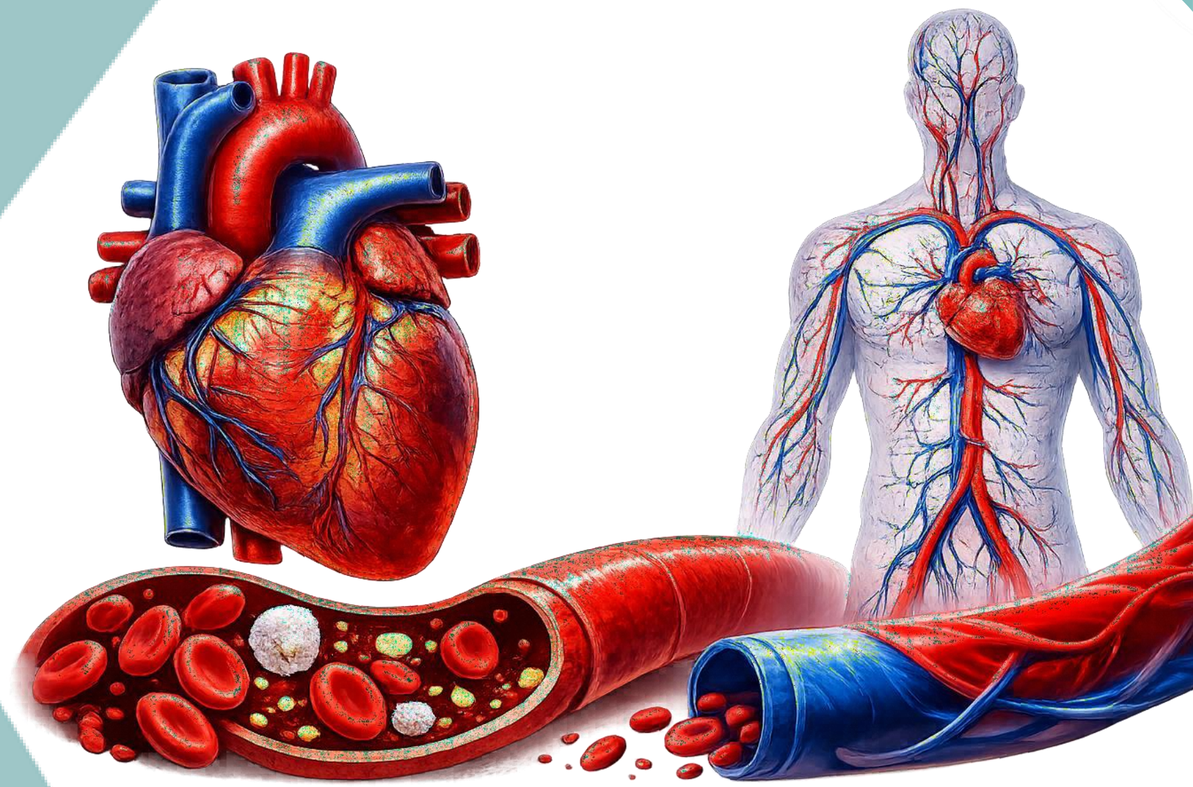
3

Gross lecture-6

- Cardiovascular System
- 3. Blood Vessels



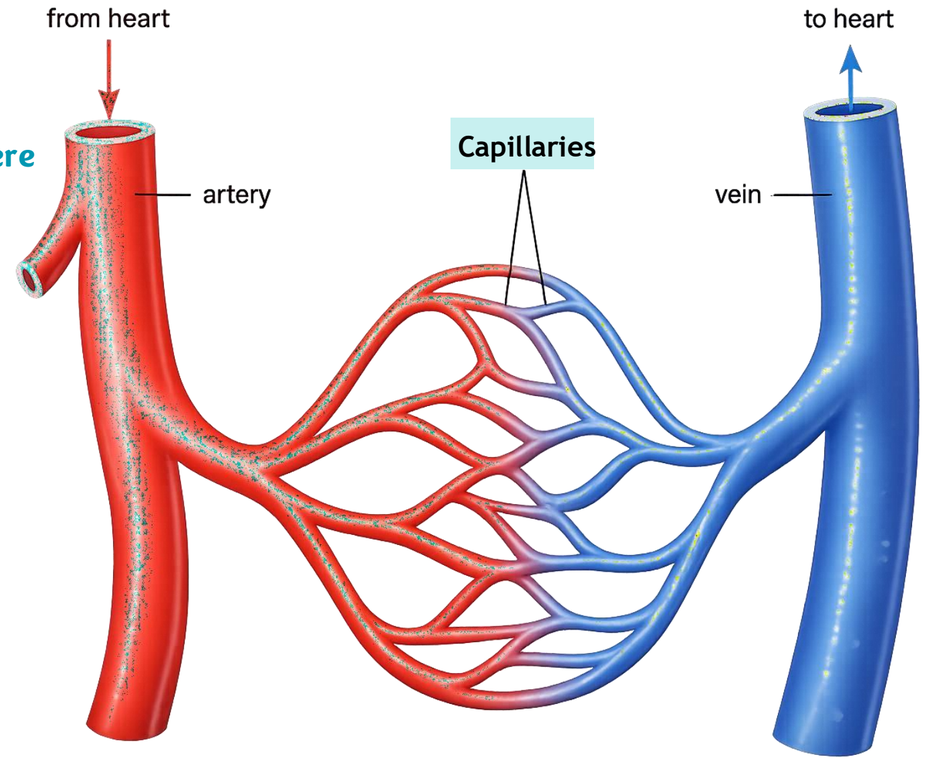
3.3 Cardiovascular System-Blood Vessels

Gross lecture-6

- The blood vessels form a closed system of tubes that carry blood away from the heart to the tissues of the body and then return it back to the heart.

- The blood vessels include:
  1. Arteries
  2. Capillaries — gas exchange process happens here
  3. Veins

Not all veins carry deoxygenated blood as well as not all arteries carry oxygenated blood. That's why the only difference between them is that arteries carries blood away from the heart whereas veins carry it toward the heart



3.3 Cardiovascular System-Blood Vessels

Gross lecture-6

Outline:

- 3.3.1 Arteries
- 3.3.2 Veins
- 3.3.3 Capillaries
- 3.3.4 Major Arteries Leaving the Heart
- 3.3.5 Major Veines Entering the Heart

3.3.1

Arteries

- They are thick-walled tubes that carry blood away from the heart to other organs.
- They divide repeatedly like a branch of a tree and gradually become smaller in size.

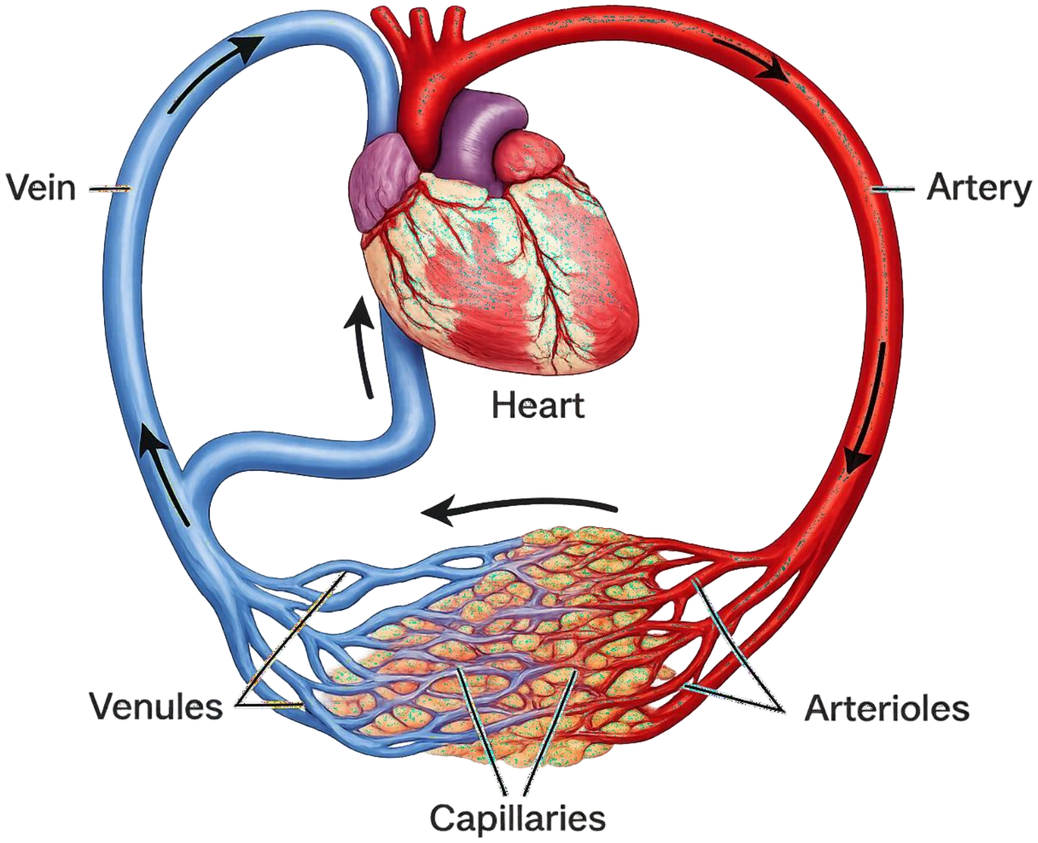
- Large elastic arteries leave the heart and divide into medium-sized arteries.

Branching

- These then divide into small arteries, which in turn divide into still smaller arteries called arterioles.

- As the arterioles enter a tissue, they branch into numerous tiny vessels called capillaries.

- The thin walls of capillaries allow the exchange of substances between the blood and body tissues.



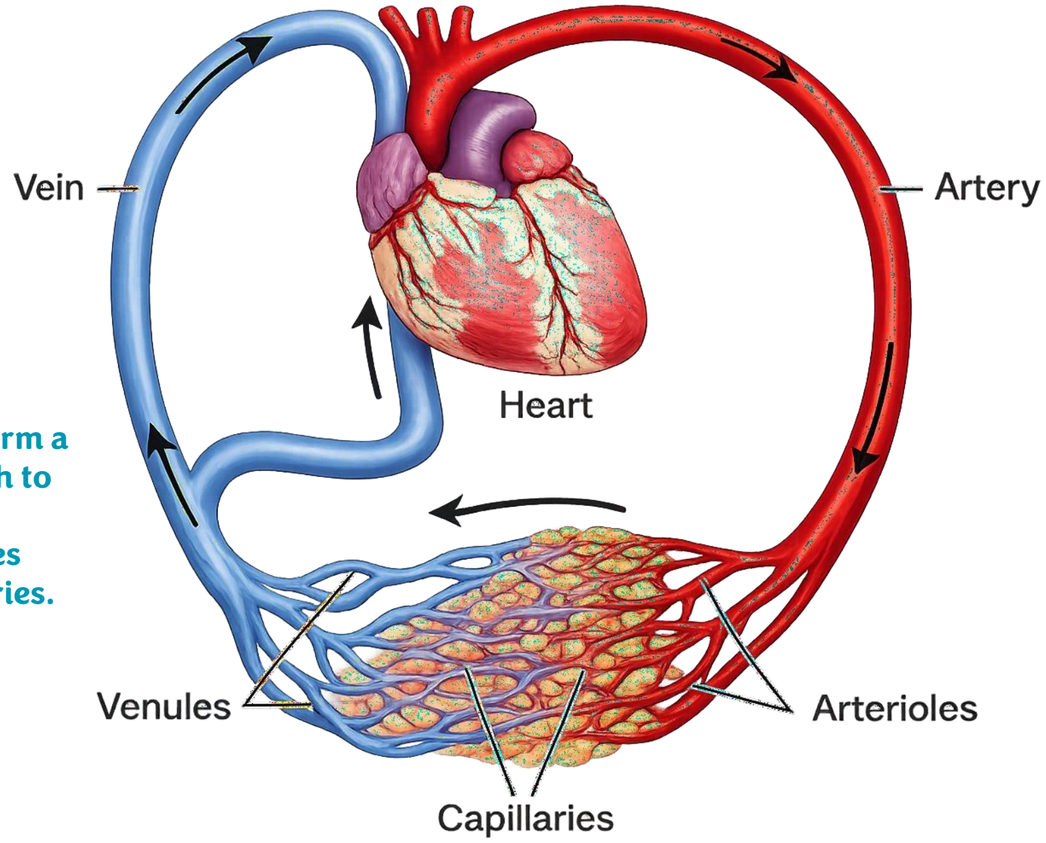
3.3.2

Veins

- They are thin-walled tubes that carry blood from tissues of different parts of the body back to the heart.
- Large veins are formed by the union of smaller veins, like tributaries of a river.

- Groups of capillaries within a tissue reunite to form small veins called venules.
- These, in turn, merge to form progressively larger blood vessels called veins.

Venules aggregate to form a vein, but arteries branch to form arterioles
What connects arterioles and venules are capillaries.



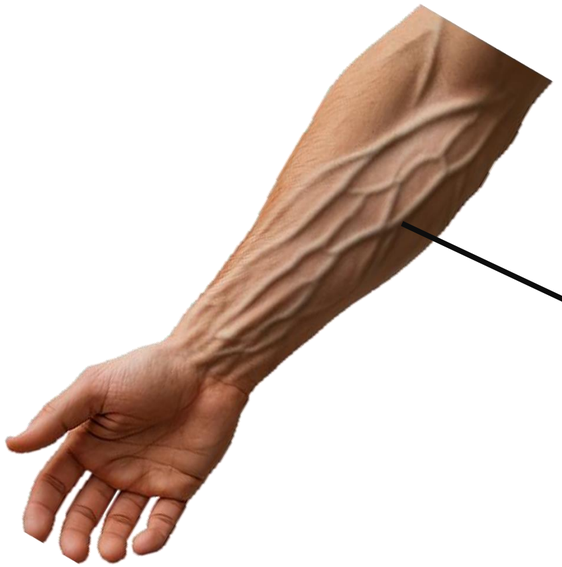
Veins

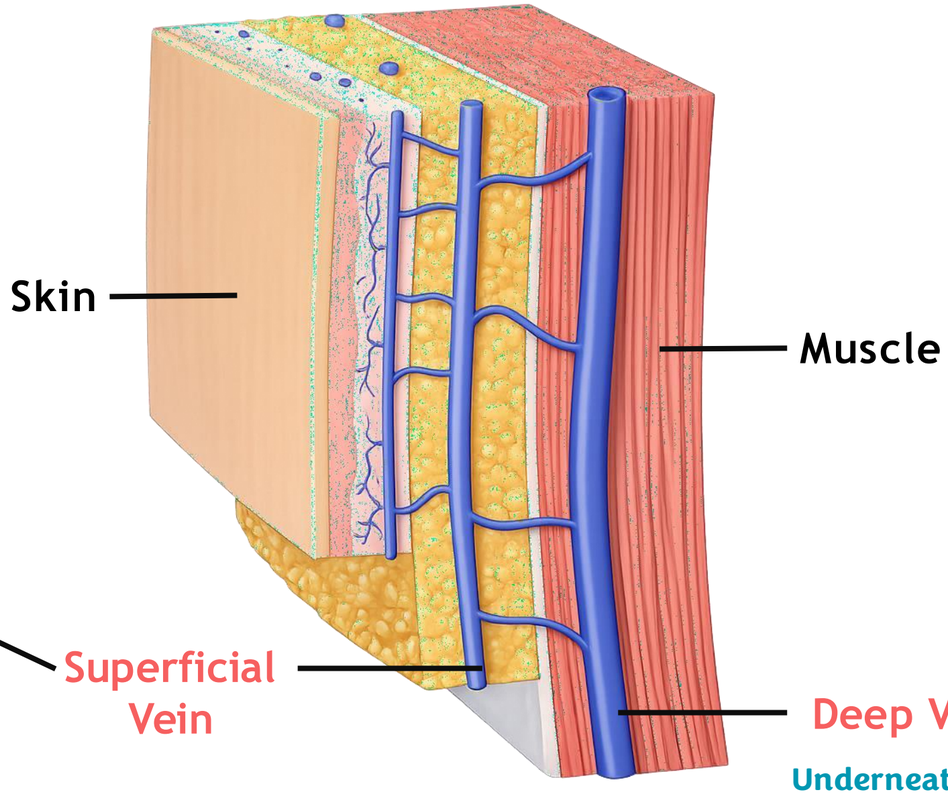
➢ Veins may be superficial or deep.

- Superficial veins are located just beneath the skin and can be seen easily.
- They are clinically important as sites for withdrawing blood or administering intravenous injections.
- Deep veins generally travel alongside arteries and usually bear the same name as the corresponding artery.

* Whenever there is a vein, there is an artery nearby and the will usually have the same name

Arteries are always deep (there are no superficial ones)





Underneath muscles to be protected by muscles

For any feedback, scan the code or click on it.

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			

Additional Resources:

رسالة من الفريق العلمي:

"المُسْتَرَاحُ بِجَنّةٍ أَمّا هُنَا : "يَا أيُّها ٱلإِنسَانُ إنَّك كَادِحُ"" !