

Al-Mustaqbal University

College of Engineering and Engineering Technologies

Biomedical Engineering Department

Subject: *Systemic Physiology I*

The heart and circulatory system

Class : *3th*

Lecture: *3*

By Assistant Lecturer : Zainab Sattar Jabbar



The heart and circulatory system

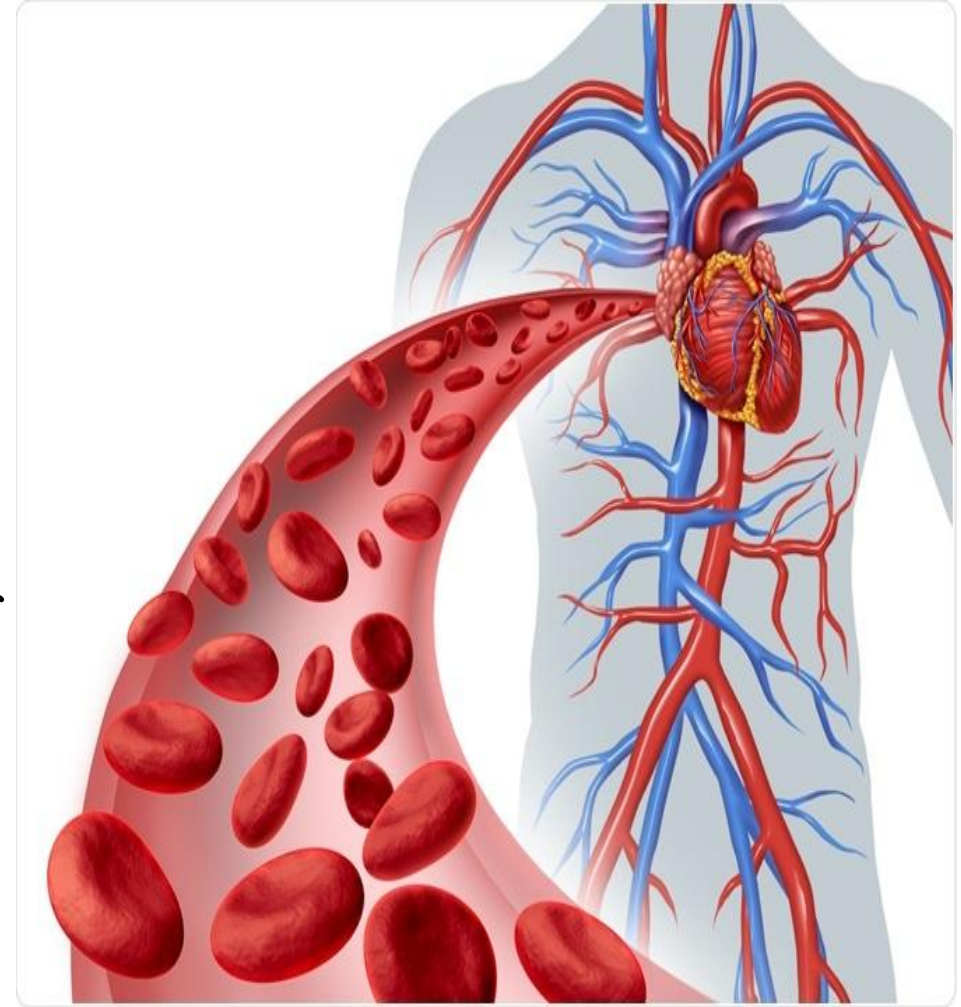
- The **circulatory system**, which contributes to homeostasis by serving as the body's transport system, consists of the heart, blood vessels, and blood.
- All body tissues constantly depend on the life-supporting blood flow the heart provides them by contracting or beating.
- The heart drives blood through the blood vessels for delivery to the tissues in sufficient amounts, whether the body is at rest or engaging in vigorous exercise.



The heart and circulatory system

➤ The circulatory system has **three** components:

1. The **heart** is the pump that imparts pressure to the blood to establish the pressure gradient needed for blood to flow to the tissues.
2. The **blood vessels** are the passageways through which blood is directed and distributed from the heart to all parts of the body and subsequently returned to the heart.
3. The **blood** is the transport medium within which materials being transported long distances in the body, such as O₂, CO₂.



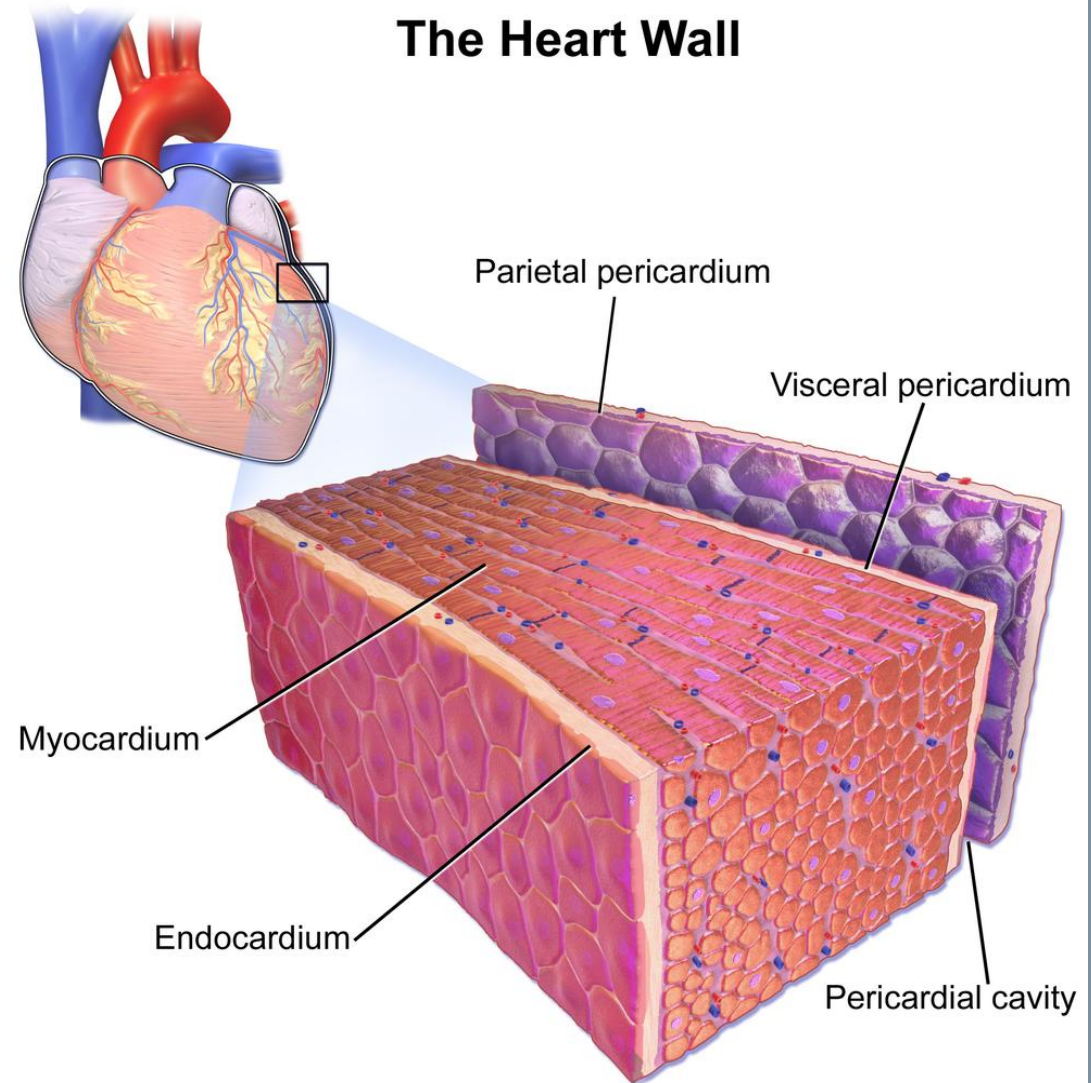
The Heart

- The **heart** is a hollow, muscular organ about the size of a clenched fist.
- Human **heart** is a single organ, the right and left sides of the heart function as two separate pumps.
- The **heart** is divided into right and left halves and has **four chambers**, well adapted to separation of oxygen rich and oxygen poor blood handled by left and the right side of the heart respectively. Thin wall atria receive blood, which reaches into thick-walled ventricles that pump blood into systemic and pulmonary circuits through great vessels.



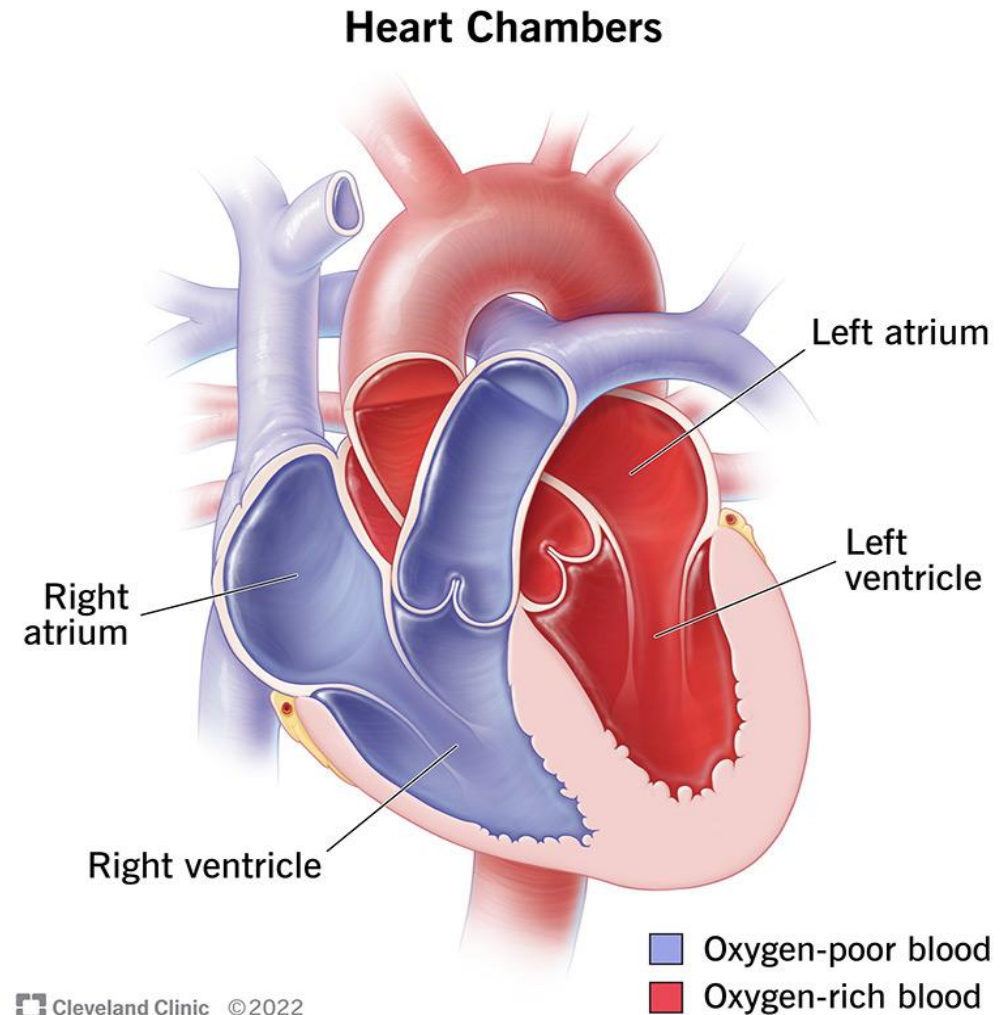
Layers of the Heart Wall

- Three layers of tissue form the heart wall namely:
 1. Epicardium – the external layer.
 2. Myocardium – the center layer.
 3. Endocardium – the innermost layer.
- Together, these three layers play a significant role in the normal working of the human heart.



Heart chambers

- The heart is divided into four chambers, namely:
1. Right upper chamber – Right atrium.
 2. Right lower chamber – Right ventricle.
 3. Left upper chamber – Left atrium.
 4. Left lower chamber – Left ventricle.

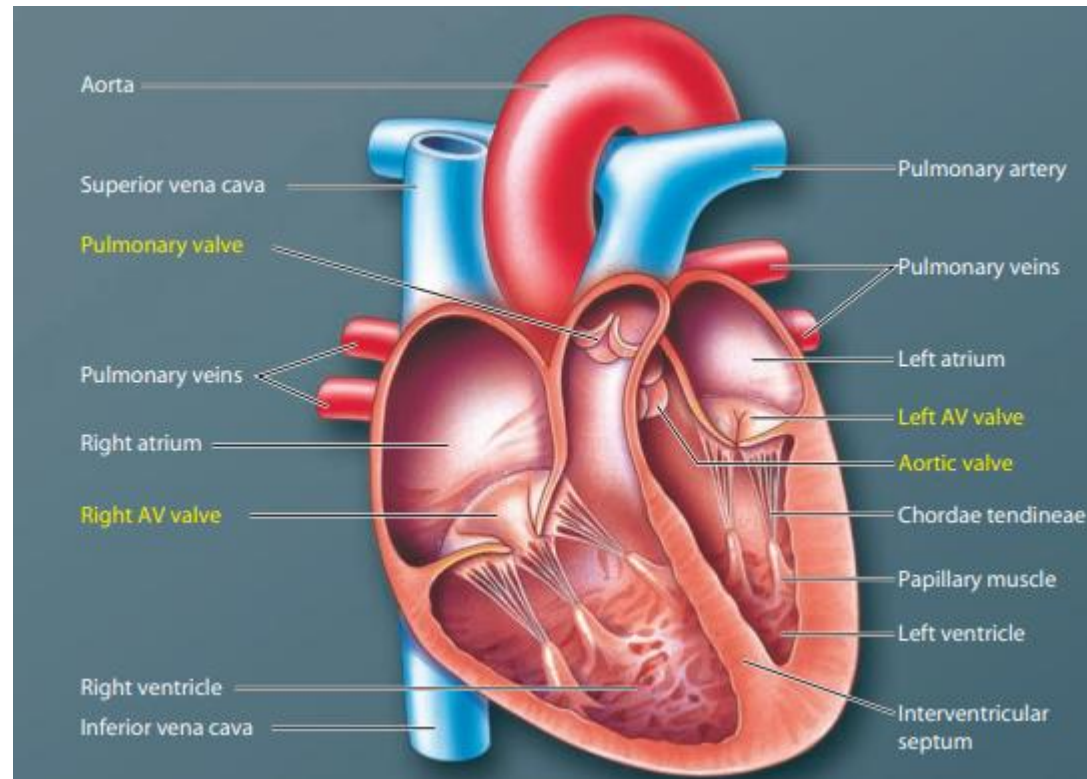


Atria and Ventricles

- The heart is divided into right and left halves and has four chambers, an upper and a lower chamber within each half.
- The upper chambers, the **atria** (singular, atrium), the **atria**, which are thin-walled chambers, receive blood from the veins and pump it to the lower chambers.
- The **ventricles**, which are thick-walled chambers, pump the blood out of the heart.
- The **atria** and **ventricles** are connected together by valves which ensure that blood flows only in one direction inside the heart.
- The vessels that return blood from the tissues to the atria are **veins**, and those that carry blood away from the ventricles to the tissues are **arteries**.
- The wall that separates the left and right sides of the heart is called the **septum** that prevents blood mixing from the two sides of the heart.

Circulatory system

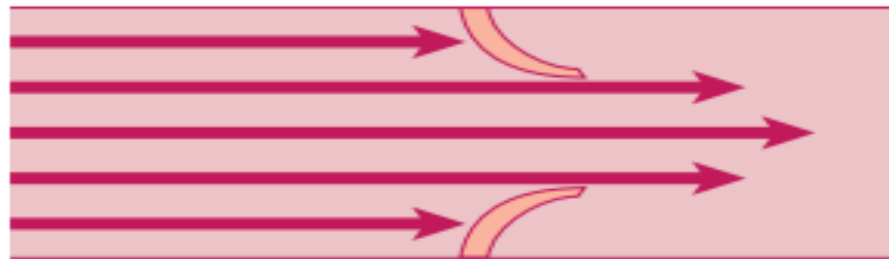
- The left side of the heart receives oxygen-rich blood from the pulmonary veins (the only veins that carry oxygenated blood from the lungs to the heart) and pumps it into the aorta (the largest artery), while the right part of the heart receives low-oxygen blood directly from the largest vein or the vena cava and transports it to the lungs via the pulmonary artery.



Valves of the Heart

➤ How do they help with blood flow?

The heart valves act like gates at the chamber openings, they open and close to allow blood to flow through the chambers. Their main function is to ensure that blood flows only in one direction through the heart.



Valve opened

When pressure is greater behind the valve, it opens.

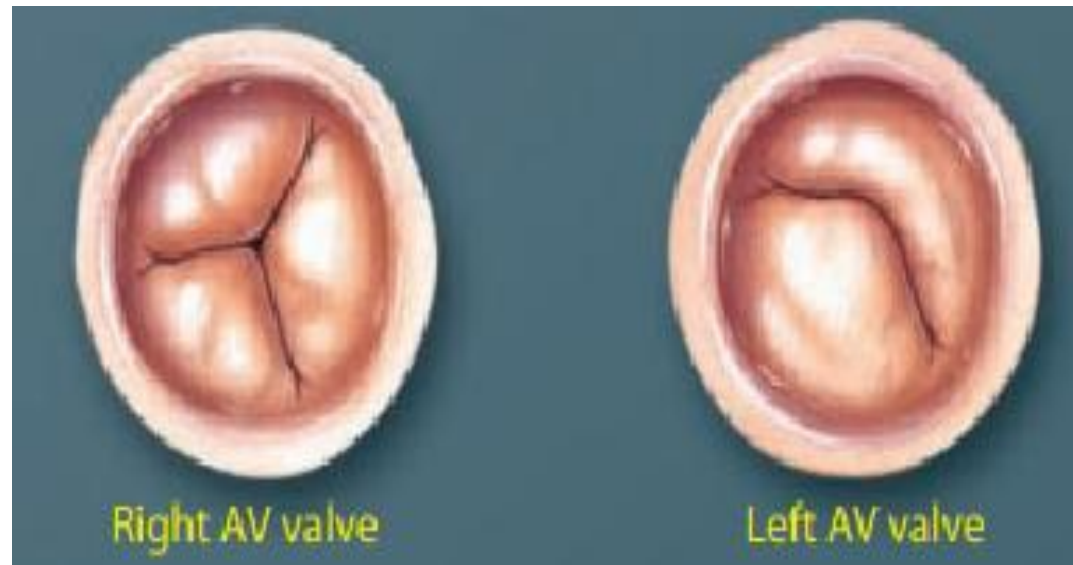


Valve closed; does not open in opposite direction

When pressure is greater in front of the valve, it closes. Note that when pressure is greater in front of the valve, it does not open in the opposite direction; that is, it is a one-way valve.

The atrioventricular (AV) valves

- The **atrioventricular (AV) valves** are located between your upper and lower heart chambers.
- They include:
 1. Tricuspid valve – This valve opens to facilitate blood flow from the right atrium to the right ventricles.
 2. Mitral valve (bicuspid valve) – This valve opens to allow blood to flow from the left atrium to the left ventricle.



Semilunar (SL) valves

- The **Semilunar (SL) valves**, which are located between the ventricles and the arteries that emerge from the heart, consist of:
 1. Aortic valve – This valve manages the blood flow from the left ventricle to the aorta.
 2. Pulmonary valve – This valve opens to allow blood to flow from the right ventricle to your pulmonary artery.

Functioning of valves

- For a healthy functioning of valves, it is important that:
 1. The valve is properly formed and flexible.
 2. The valves are able to open fully so that the blood can pass through without any obstruction.
 3. The valves are able to shut tightly so that the leakage of blood back into the heart chambers does not occur.

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THANK YOU