

## The cardiovascular system

### 1- Heart

### 2- Blood vessels

### 3-Blood

## The Heart

The heart is a muscular organ that acts like a pump to continuously send blood throughout your body.

-The heart is at the center of the circulatory system -This system consists of a network of blood vessels, such as arteries, veins, and capillaries.

-These blood vessels carry blood to and from all areas of the body

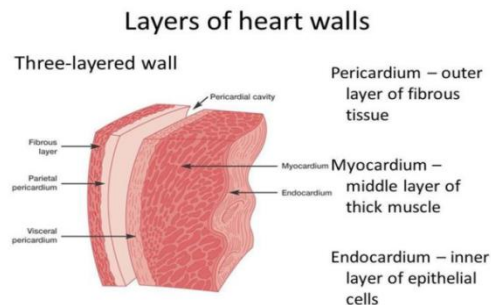
-The main function of the heart is to generate the pressures, which produce blood flow

## The wall of the heart consists three layers

**1-Epicardium** is the external layer which imparts a smooth, slippery texture to the outermost surface of the heart. The epicardium contains blood vessels, lymphatics, and vessels that supply the myocardium

**2-Myocardium** is the middle layer which is responsible for the pumping action of the heart and is composed of cardiac muscle tissue. It makes up approximately 95% of the heart wall

**3-Endocardium** the inner most layer of heart wall is a thin layer of endothelium overlying a thin layer of connective tissue. It provides a smooth lining for the chambers of the heart and covers the valves of the heart. The smooth endothelial lining minimizes the surface friction as blood passes through the heart



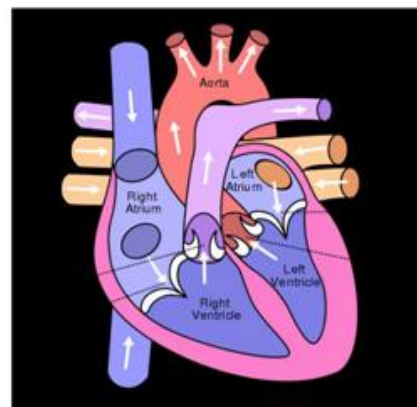
### Heart chamber

*has four chambers*

**two atria and two ventricles.**

The **atria** are smaller, with thin walls while the **ventricles** are larger, Thick wall and much stronger.

**Atrium**



There are two atria on either side of the heart

The right atrium receives de-oxygenated blood from the - superior vena cava and inferior vena cava

The left atrium receives oxygenated blood from the left and right pulmonary veins

## The Ventricle

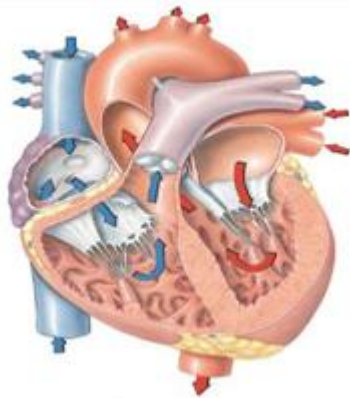
is a heart chamber which collects blood from an atrium and pumps it out of the heart.

There are **two ventricles**:

**The right ventricle** pumps blood into the pulmonary circulation for the lungs, and

**The left ventricle** pumps blood into the systemic circulation for the rest of the body.

-Comparing the left and right ventricle, the left ventricle has thicker walls because it needs to pump blood to the whole body. This leads to the common misconception that the heart lies on the left side of the body.



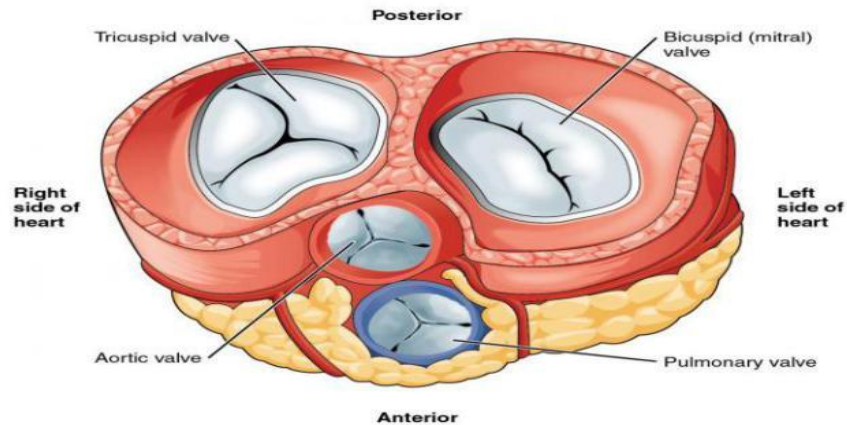
## Heart Valves

### A- Atrioventricular (AV) valves

1. are two (right and left) valves between atria and ventricles.
2. They prevent backflow into atria.
3. They are closed during ventricular contraction (systole).
4. 1-Right AV valve is tricuspid (with three cusps)
5. 2-Left AV valve is bicuspid (or mitral valve).

**B. Semilunar valves (SL)** are also two.

- 1 - Aortic valve : between left ventricle and aorta
- 2- Pulmonary valve: between right ventricle and pulmonary trunk.



## Blood Vessels

Blood is carried through the body by blood vessels.

An **artery** is a blood vessel that carries blood away from the heart, where it branches into ever-smaller vessels.

the smallest arteries, vessels called **arterioles**, further branch into **tiny capillaries**, where nutrients and wastes are exchanged, and then combine with other vessels that exit capillaries to form **venues**, small blood vessels that carry blood to a **vein**, a larger blood vessel that returns blood to the heart

## They are three types of blood vessels

### A- Arteries

Structure:

- 1-Thick, elastic
- 2-Contain layers of connective, and smooth muscle tissues
- 3-Do Not Contain Valves

Function: Carry Blood away from the heart.

Arteries divide to form very small arteries called arterioles

### B-Veins

Structure

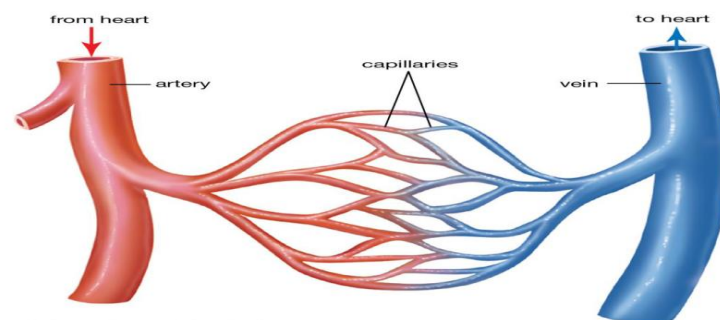
- 1-Thin and slightly elastic.
- 2-Contain Valves for one-way flow of blood.

Function: return blood to the heart Veins divide to become venules .

### C -capillaries

- 1-Microscopic blood vessels that connect arterioles and venules.
- 2-Thin walled and narrow
- 3-Blood cells pass through them in single file

Function: Allows material and gas exchange between the body and the blood cell



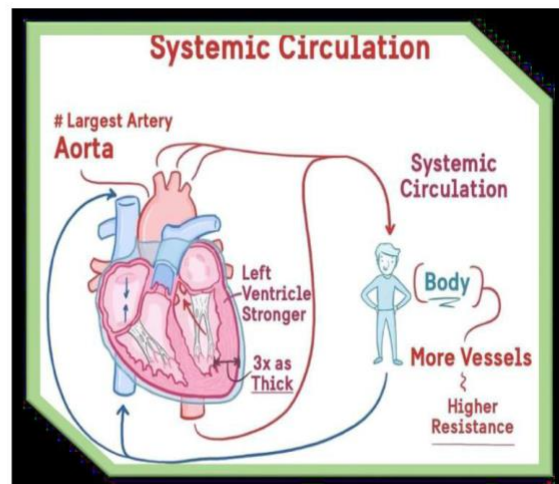
## Cardiac Cycle

### (systemic circulation)

-Superior vena cava collect blood from regions superior to diaphragm

-inferior vena cava collect blood from regions inferior to diaphragm

Both pour their blood into the right atrium



### (pulmonary circulation)

Pulmonary trunk carries blood from the right ventricle to the lungs. Four pulmonary veins return blood from the lungs back to the left atrium

### (coronary circulation)

Right and left coronary arteries provide blood supply to the heart and coronary sinus drains blood from the heart and pours into the right atrium

## Cardiac output (CO)

Cardiac output is the amount of blood pumped by each ventricle per minute.

$CO = \text{Stroke volume} * \text{Heart rate}$

**Stroke volume (SV)** = volume of blood pumped from out of each ventricle per beat = 70 ml.

**Heart rate (HR)** is the number of heart beats per minute (BPM) = 72 BPM

$CO = 70 \text{ ml} * 72 \text{ BPM} = \text{about } 5 \text{ L/min}$

## Blood pressure

Is force exerted by blood on walls of a vessel, caused by contraction of the ventricles, highest in aorta 120 mm Hg during systole & 80 during diastole

- **Systolic Blood Pressure** is defined as the maximum pressure exerted in the arteries during systole of the heart. The normal systolic pressure is 120 mmHg. It ranges between 110 and 140 mmHg.

- **Diastolic Blood Pressure** is the minimum pressure in the arteries during diastole of the heart. The normal diastolic pressure is 80 mmHg. It varies between 60 and 80 mmHg.

- **Pulse Pressure**

is the difference between the systolic pressure and diastolic pressure. Normally, it is 40 mmHg