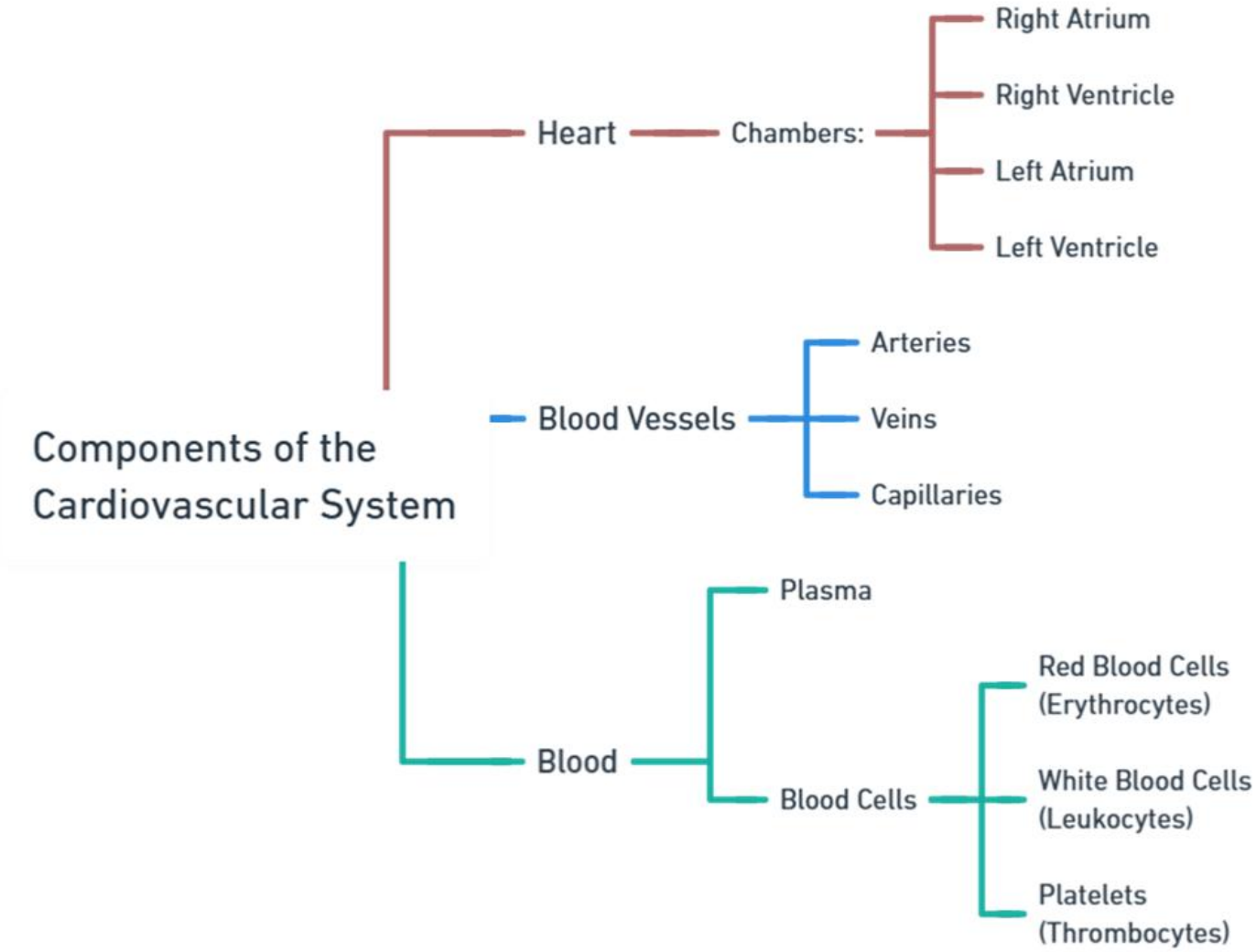
Cardiovascular System

Cardiovascular System

- The cardiovascular system, also known as the circulatory system, is a complex network consisting of the heart, blood vessels, and blood.
- Its primary function is to transport oxygen, nutrients, hormones, and waste products throughout the body, maintain body temperature, and help fight infections.
- The cardiovascular system plays a vital role in maintaining homeostasis and overall health.

Components of the Cardiovascular System



1. Heart

- The heart is a muscular, four-chambered organ that acts as a pump, responsible for circulating blood throughout the body.
- The four chambers of the heart are:
  - Right Atrium
  - Right Ventricle
  - Left Atrium

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- Left Ventricle

➢ The heart's contraction (systole) and relaxation (diastole) generate blood pressure, which propels blood through the blood vessels.

2. Blood Vessels

➢ Blood vessels are a network of tubes that transport blood throughout the body.

➢ There are three main types of blood vessels:

A. Arteries

- Arteries carry oxygen-rich blood away from the heart to the body's tissues and organs.
- The largest artery, the **aorta**, originates from the left ventricle and branches into smaller arteries that supply various parts of the body.

B. Veins

- Veins return oxygen-poor blood from the body's tissues and organs back to the heart.
- Veins contain valves that prevent the backflow of blood.
- The largest veins, the superior and inferior vena cava, deliver blood to the right atrium of the heart.

C. Capillaries

- Capillaries are the smallest blood vessels, connecting arteries to veins.
- Their thin walls facilitate the exchange of oxygen, nutrients, and waste products between the blood and the body's cells.

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3. Blood

➢ Blood is a fluid connective tissue that transports oxygen, nutrients, hormones, and waste products. It consists of:

A. Plasma:

- The liquid component of blood.

B. Blood Cells:

- These include:

I. Red Blood Cells (Erythrocytes)

- Red blood cells contain **hemoglobin**, a protein that binds to oxygen and enables the transport of oxygen from the lungs to the body's tissues and organs.

II. White Blood Cells (Leukocytes)

- White blood cells are part of the immune system and help protect the body against infections and diseases.

III. Platelets (Thrombocytes)

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- Platelets are involved in blood clotting, helping to prevent excessive bleeding and promote wound healing.

Heart – Anatomy of heart

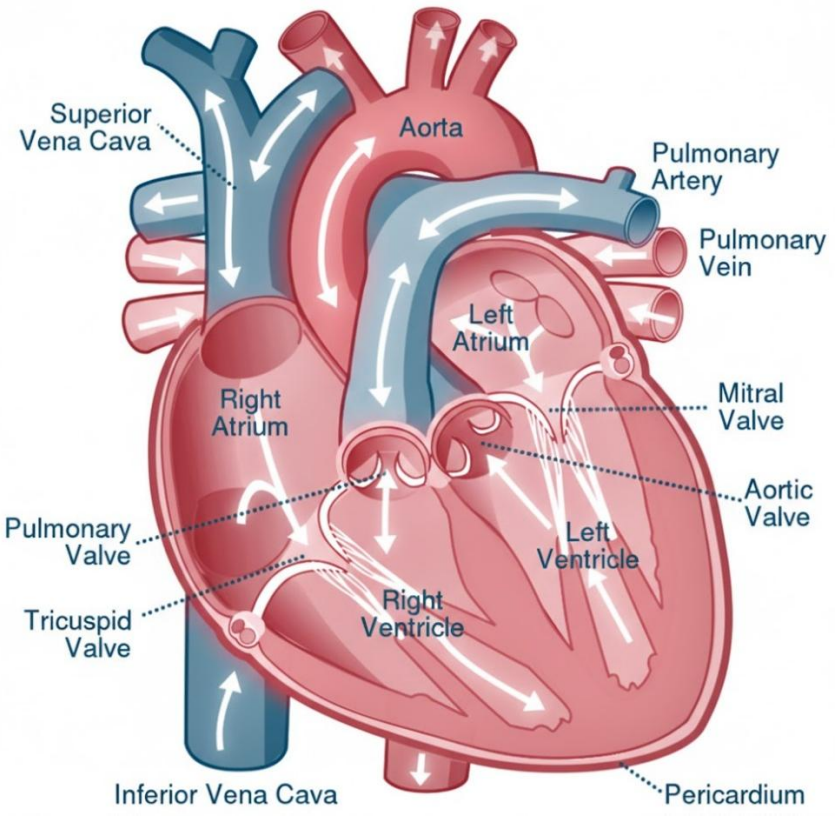
- The heart is a muscular, four-chambered organ responsible for pumping blood throughout the body.
- It is located within the thoracic cavity, specifically in the mediastinum, behind the sternum and between the lungs.
- The heart's anatomy can be described in terms of its position, wall structure, chambers, and valves.

Position

- The heart is positioned slightly to the left of the midline in the mediastinum, with about two-thirds of its mass to the left of the body's midline.
- The base of the heart is directed upward, backward, and to the right, while the apex points downward, forward, and to the left, resting on the diaphragm.

Structure of the Heart Wall

The wall of the heart consists of **three** layers:



1. Epicardium:

- The outermost layer of the heart wall, also known as the visceral layer of the serous pericardium, is composed of a thin layer of connective tissue and a layer of epithelial cells.

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- It covers the heart and the outer surfaces of the great vessels.

2. Myocardium:

- The myocardium is the middle and thickest layer of the heart wall, composed of cardiac muscle tissue.
- This layer is responsible for the heart's contraction and relaxation, which generates the pumping action necessary for blood circulation.

3. Endocardium:

- The endocardium is the innermost layer of the heart wall, consisting of a thin layer of endothelial cells that line the heart chambers and the valves.
- This smooth layer minimizes friction as blood flows through the heart.

Chambers of the Heart:

The heart has **four** chambers – **two atria and two ventricles:**

1. Right Atrium:

- The right atrium is the upper right chamber of the heart.
- It receives oxygen-poor blood returning from the body via the superior and inferior vena cava.

2. Right Ventricle:

- The right ventricle is the lower right chamber of the heart.
- It pumps the oxygen-poor blood received from the right atrium to the lungs through the pulmonary artery, where the blood picks up oxygen and releases carbon dioxide.

3. Left Atrium:

- The left atrium is the upper left chamber of the heart.
- It receives oxygen-rich blood from the lungs via the pulmonary veins.

4. Left Ventricle:

- The left ventricle is the lower left chamber of the heart.
- It pumps the oxygen-rich blood received from the left atrium to the rest of the body through the aorta.
- The left ventricle has the thickest walls among the heart chambers, as it needs to generate enough pressure to push blood through the entire body.

Valves of the Heart

The heart has four valves that regulate the flow of blood between the chambers and prevent backflow:

1. Tricuspid Valve:

- The tricuspid valve is located between the right atrium and the right ventricle.

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- It has three leaflets or cusps and prevents the backflow of blood from the right ventricle to the right atrium when the ventricle contracts.

2. **Pulmonary Valve:**
   - The pulmonary valve is located between the right ventricle and the pulmonary artery.
   - It prevents the backflow of blood from the pulmonary artery to the right ventricle after the ventricle contracts.
3. **Mitral Valve (Bicuspid Valve):**
   - The mitral valve is located between the left atrium and the left ventricle.
   - It has two leaflets or cusps and prevents the backflow of blood from the left ventricle to the left atrium when the ventricle contracts.
4. **Aortic Valve:**
   - The aortic valve is located between the left ventricle and the aorta.
   - It prevents the backflow of blood from the aorta to the left ventricle after the ventricle contracts.

Blood Circulation Through Heart

- Blood circulation through the heart is a continuous process that transports oxygen-rich blood from the lungs to the body and returns oxygen-poor blood back to the heart and lungs.
- This process involves the heart's four chambers and is divided into two main circulatory pathways: **pulmonary circulation** and **systemic circulation**.

Step-by-Step Blood Circulation

1. **Return to the Heart:**
   - Oxygen-poor blood enters the **right atrium** via the **superior vena cava** (upper body) and **inferior vena cava** (lower body).
2. **Right Atrium to Right Ventricle:**
   - The **right atrium** contracts, pushing blood through the **tricuspid valve** into the **right ventricle**.
3. **Right Ventricle to Lungs:**
   - The **right ventricle** contracts, sending blood through the **pulmonary valve** into the **pulmonary artery**.
   - Blood travels to the **lungs** to receive oxygen and release carbon dioxide.
4. **Return to the Heart:**
   - Oxygen-rich blood returns to the **left atrium** via the **pulmonary veins**.
5. **Left Atrium to Left Ventricle:**

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