

CIRCULATION AND EXCRETION





The CIRCULATORY SYSTEM consists of:

- **The blood**
- **The blood vessels**
- **The heart**

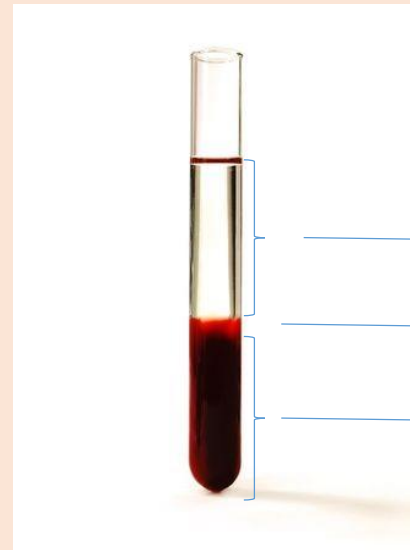
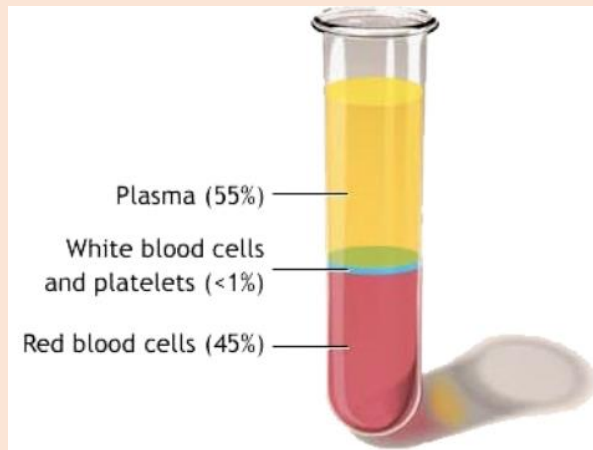


THE CIRCULATORY SYSTEM

THE BLOOD

Type of connective tissue as cells are surrounded by abundant extracellular material but the extracellular material of the blood is a liquid.

The blood is composed of blood plasma and blood cells.



THE BLOOD

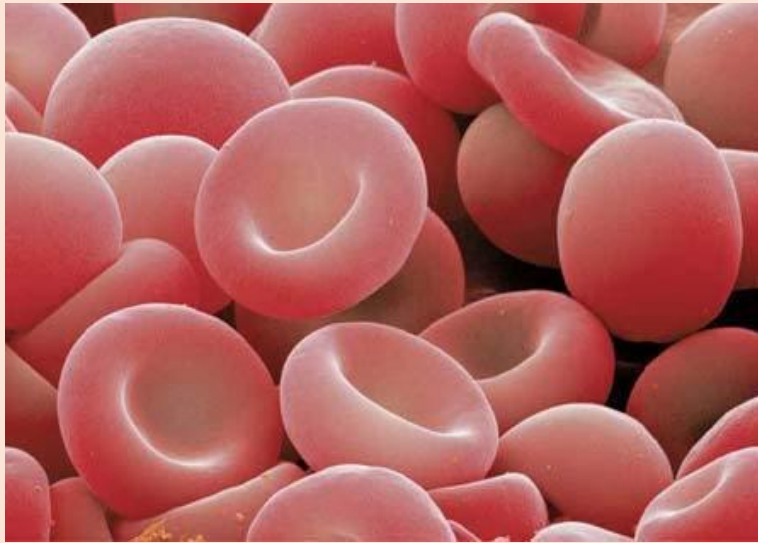
THE CIRCULATORY SYSTEM



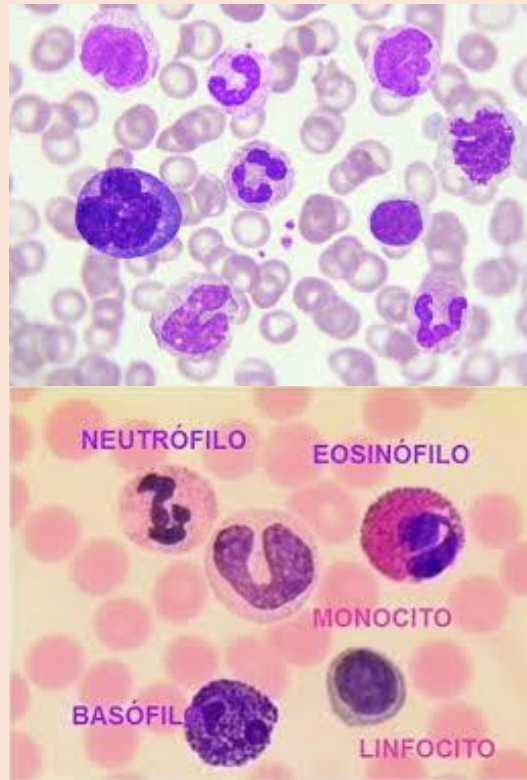
- ❖ **Blood plasma (plasma sanguíneo):** Liquid part with yellow appearance. It is mostly water (91%) but contains a great variety of dissolved molecules (urea, salts, lipids, proteins and carbohydrates).
- ❖ **Blood cells (células sanguíneas):** They are formed by the red bone marrow (médula ósea roja), a tissue found within larger bones. There are three basic types.
 - **White blood cells (glóbulos blancos):** There are various types, but all of them contain a nucleus. There are 8000/ mm³ of blood with a lifespan of a 1 day. Their function is the defense of our organism.
 - **Red blood cells (glóbulos rojos, eritrocitos o hematías):** Cells that don't have a nucleus and have the appearance of doubly-concave sacs.. There are 5 million / mm³ of blood with a lifespan of 4 months. They are filled with a red protein, called haemoglobin, whose function is the transport of oxygen.
 - **Platelets (Plaquetas):** Cells fragments that form small groups. There are 250000/ mm³ with a lifespan of 1 week. Its function is to control hemorrhages.

THE BLOOD CELLS

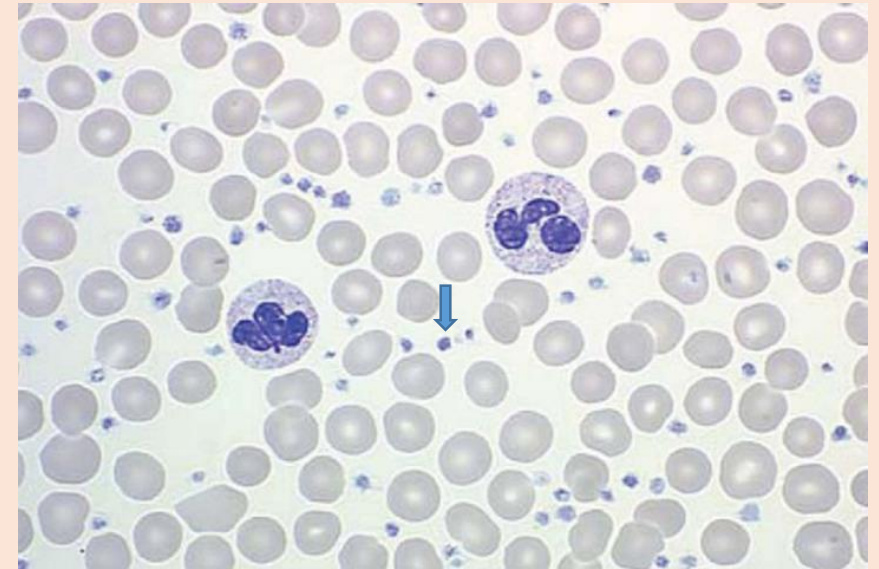
THE CIRCULATORY SYSTEM



RED BLOOD CELLS



WHITE BLOOD CELLS



PLATELETS

THE BLOOD'S FUNCTIONS

THE CIRCULATORY SYSTEM

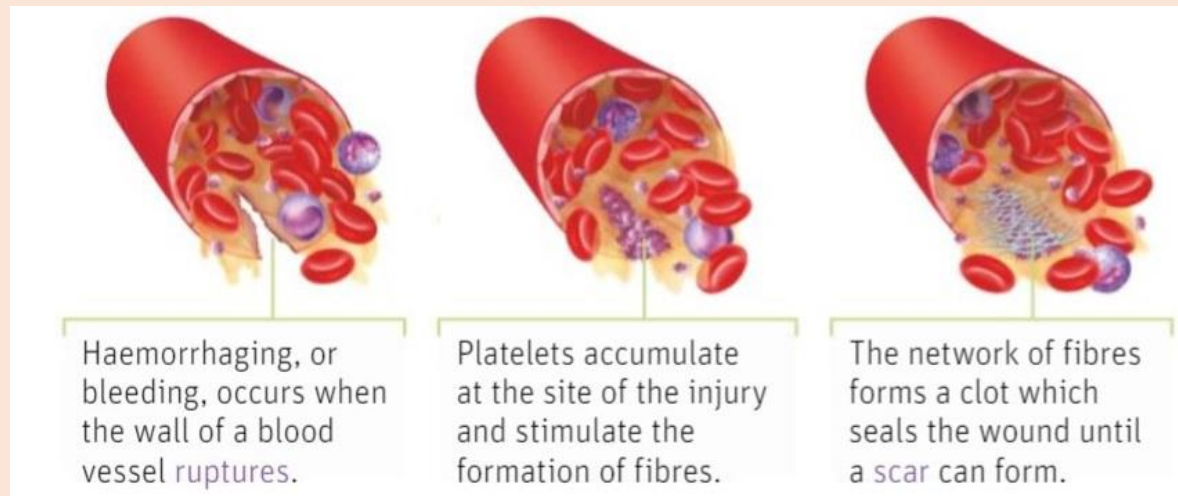


- Transports nutrients and waste → Plasma
- Contain haemoglobin which transports oxygen → Red blood cells

If the concentration of oxygen in the blood plasma is low, haemoglobin loses oxygen and takes on a dark red color.

If the concentration of oxygen in the plasma is high, oxygen molecules combine with haemoglobin, giving it a bright red color

- Protect the body from infection → White blood cells
- Help to stop bleeding → Platelets



THE BLOOD VESSELS

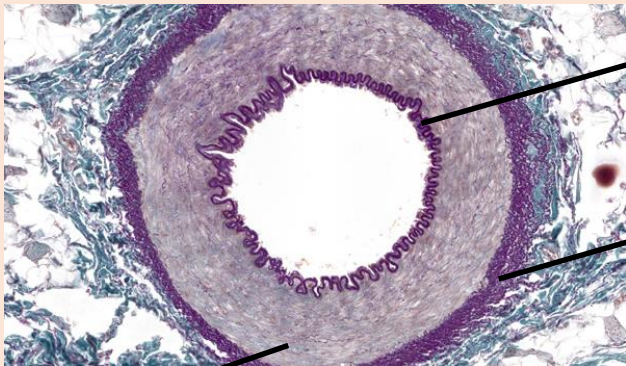
THE CIRCULATORY SYSTEM



The blood vessels are the passage ways through which the blood travels. Human beings, along with all vertebrates, have a closed circulatory system.

★ Types of blood vessels

Arteries



Túnica intima

Túnica adventitia

Túnica media

Carry blood from the heart to the organs and other body structures. Their walls are strong and highly elastic as the arterial blood circulates at high pressure

Veins



muscular artery

nerve

vein

Carry blood back to the heart from the organs. Have thinner walls than the arteries, as the blood they carry isn't under high pressure. The veins have valves that prevent the retraction of blood.

Capillaries



vein

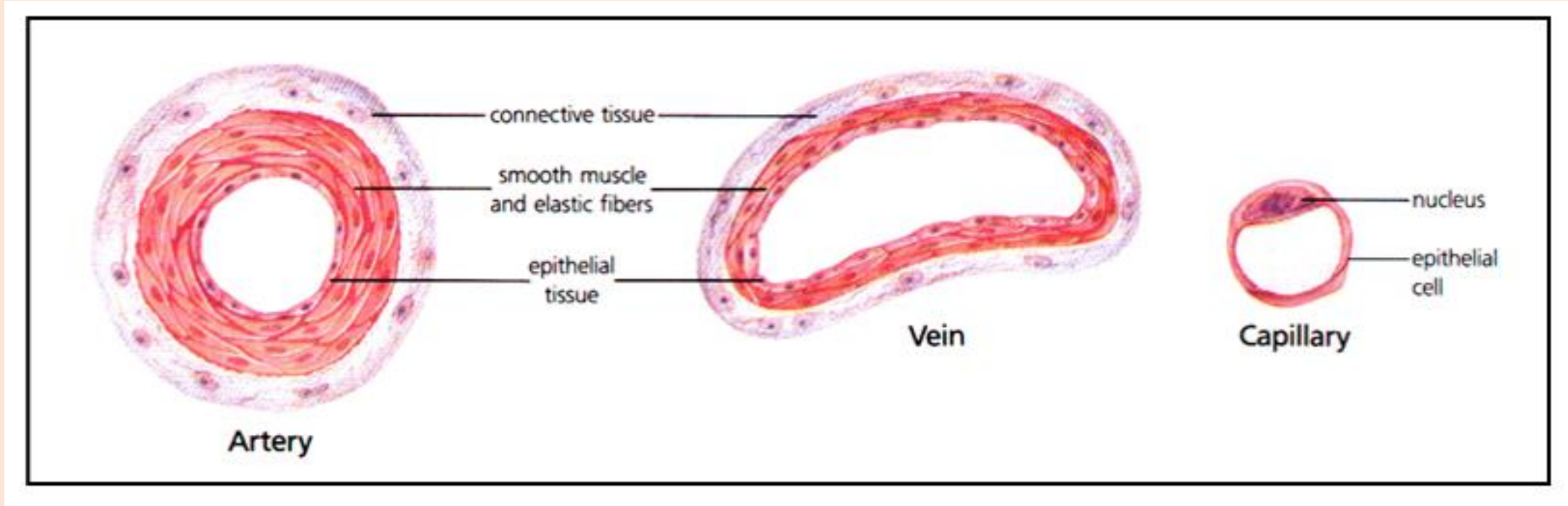
capillary

artery

Have a very small diameter, form dense networks within organs and have extremely thin walls, which allow substances to be exchanged between the blood and the cells.



THE BLOOD VESSELS

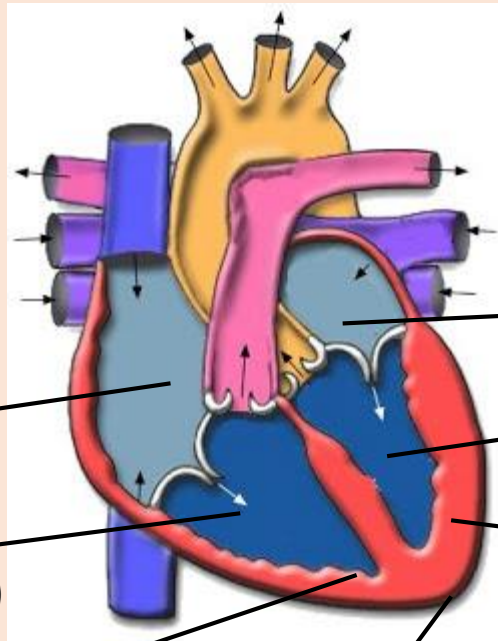




THE HEART

The heart is the pump which circulates the blood. It is about the size of the person's fist. It is located in the chest, slightly left of centre

★ Structure of the heart



Right atrium
(Aurícula derecha)

Right ventricle
(Ventrículo derecho)

Endocardium
(Endocardio)

Pericardium
(Pericardio)

Left atrium
(Aurícula izquierda)

Left ventricle
(Ventrículo izquierdo)

Myocardium
(Miocardio)

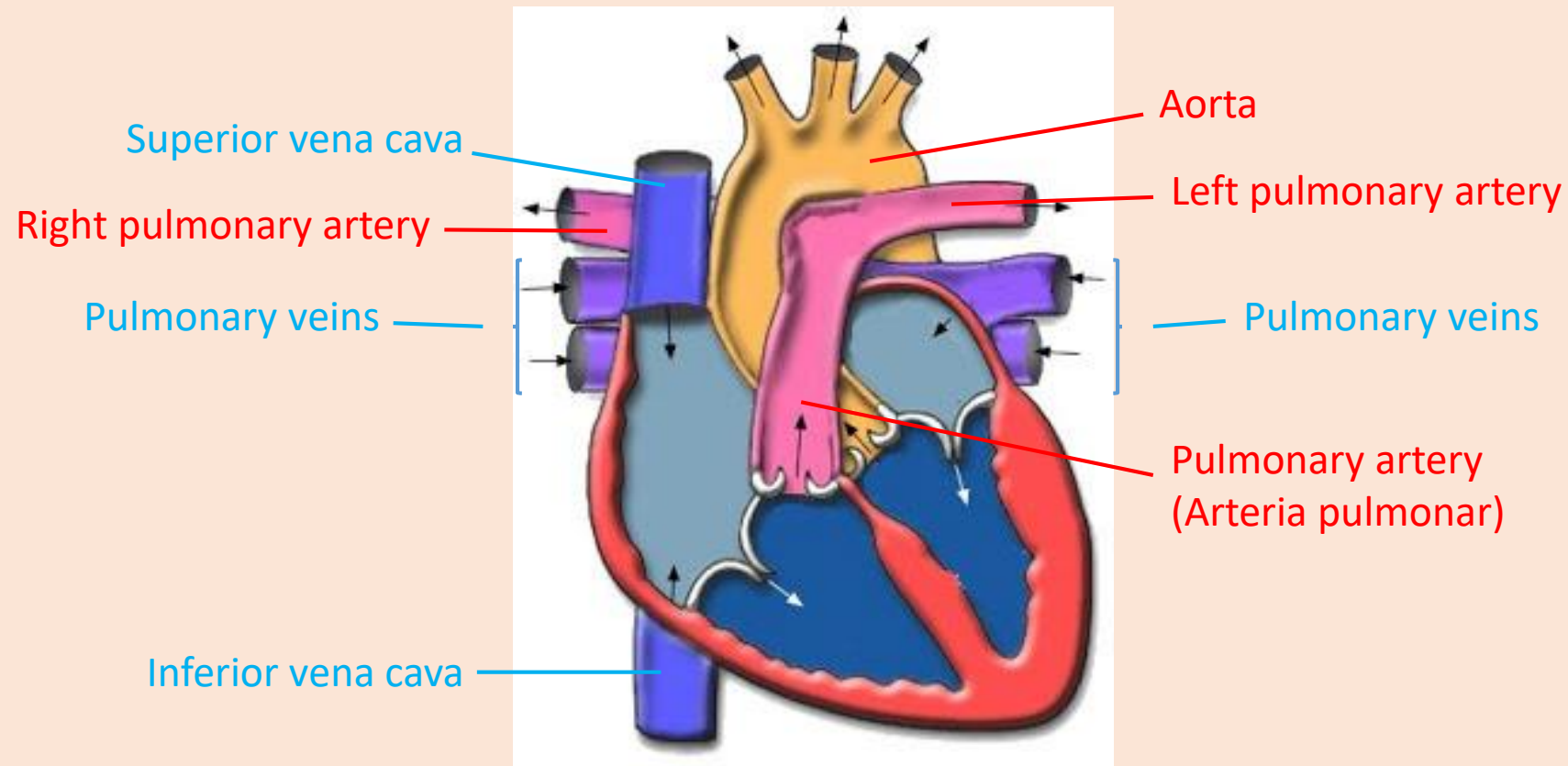
The heart has:

- **Two atria:** These chambers have thinner, more flexible walls. Blood returning to the heart enters the atria through veins.
- **Two ventricles:** They have thick, powerful walls. They pump blood out of the heart through the arteries
- **Myocardium:** The muscular wall of the heart.



THE HEART

★ Structure of the heart. Arteries and veins



[anatomia 3D](https://youtu.be/hLW4rD8AFgE)

<https://youtu.be/hLW4rD8AFgE>



THE HEART

★ Structure of the heart. Arteries and veins

Right half of the heart

Vena cavae: Carry blood back to the heart (right atrium) from the organs.

Pulmonary artery: Blood exits the heart (right ventricle) to the lungs

Left half of the heart

Pulmonary veins: Bring blood from the lungs to the heart (Left atrium)

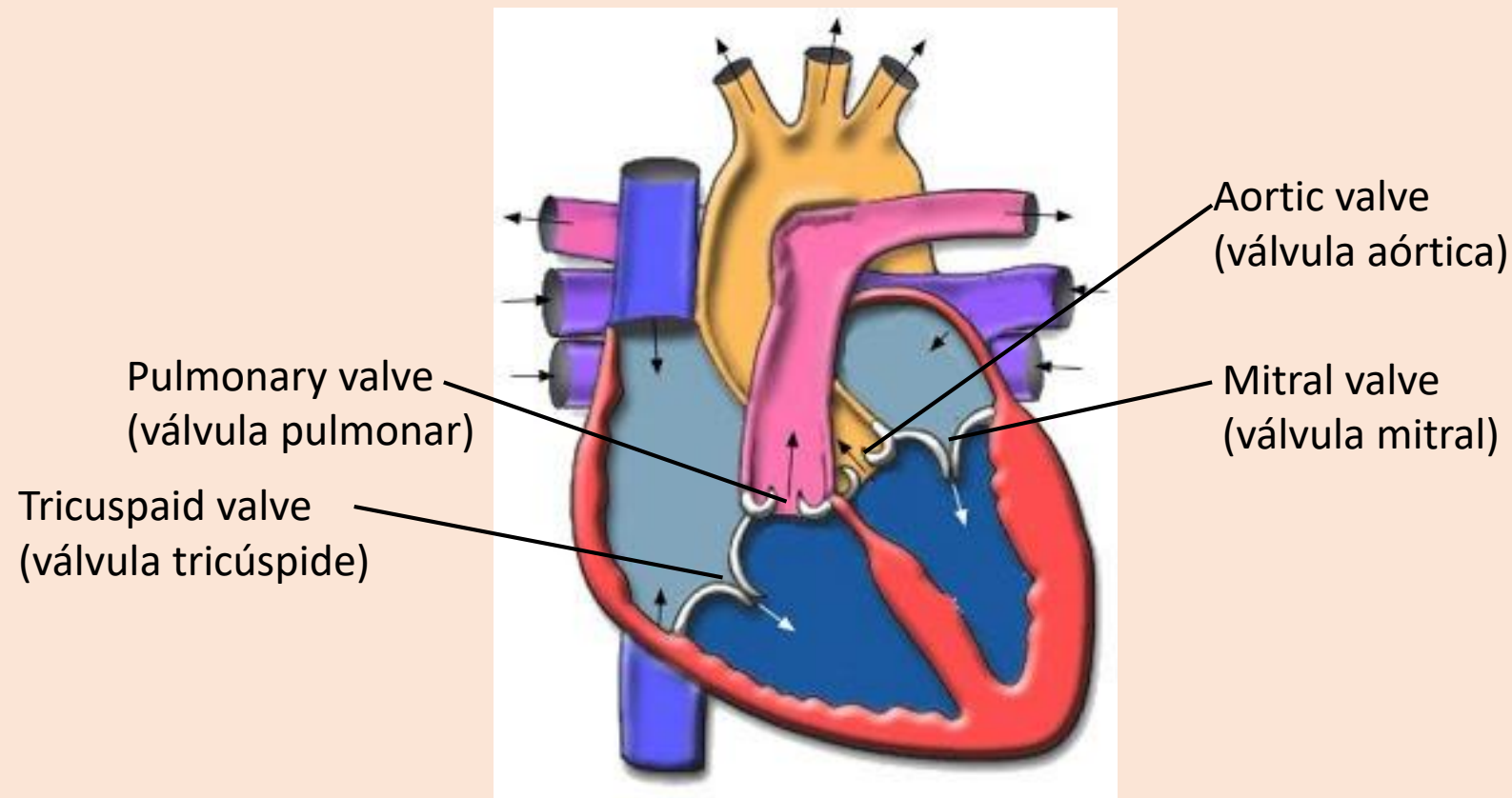
Aorta: Blood exits the heart (left ventricle) and goes toward each of the body's organs



THE CIRCULATORY SYSTEM

THE HEART

★ Structure of the heart. Valves.



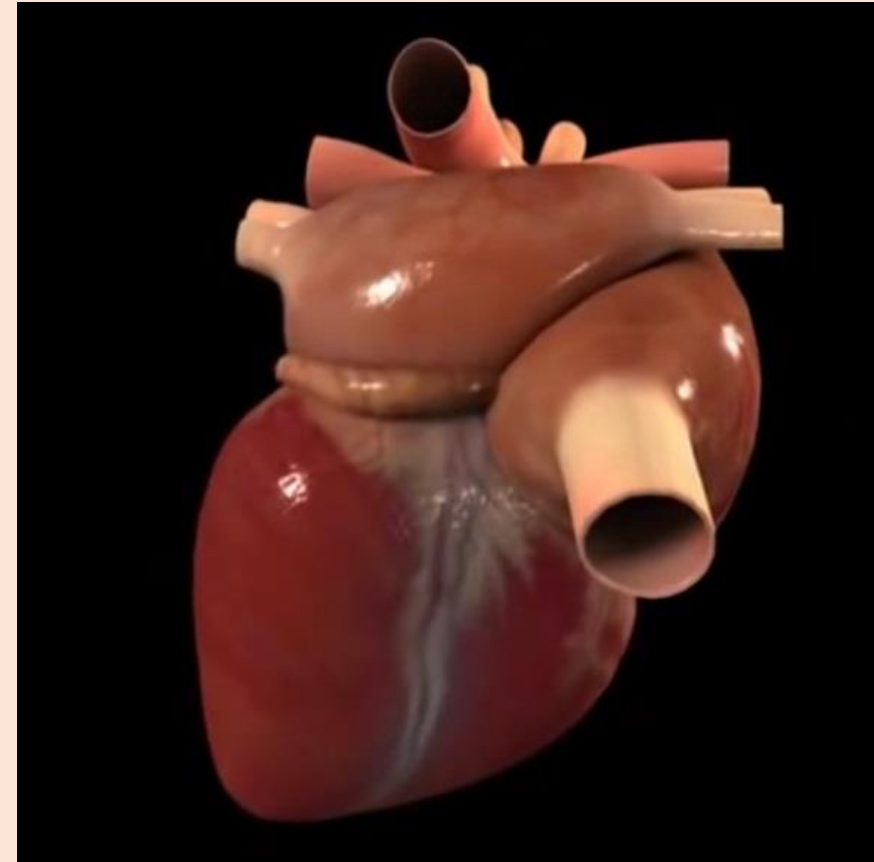
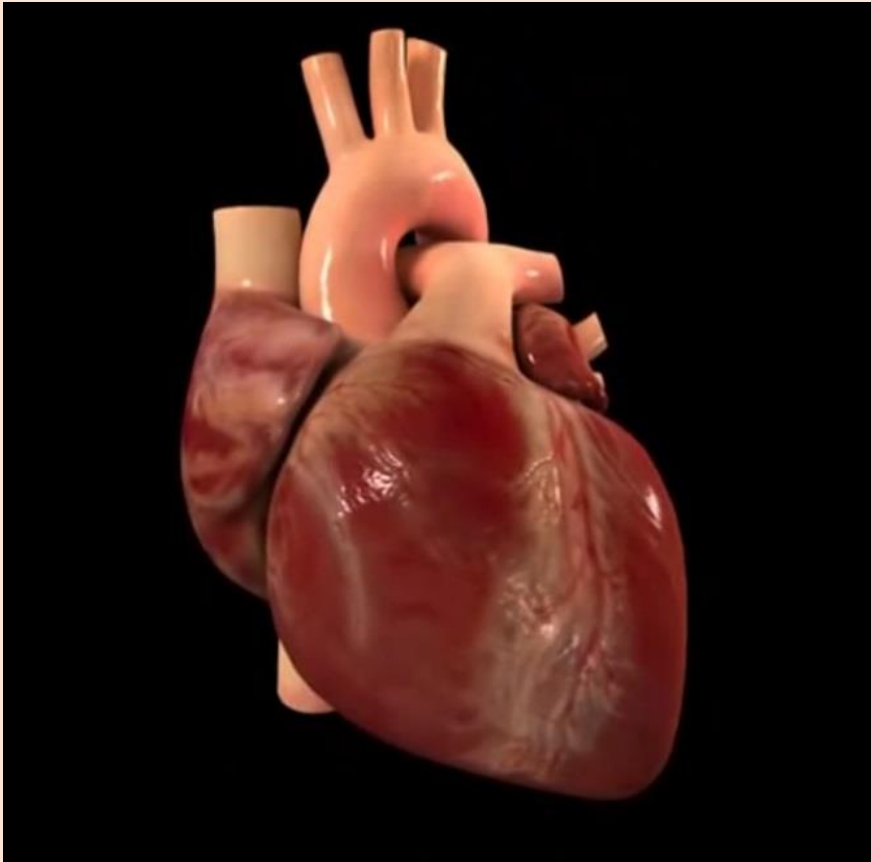
Blood always flow in the same direction, due to the work of the valves in the heart. There are two types:

- **Atrioventricular valves (válvulas auriculoventriculares)**. This valves link each atrium with the ventricle directly beneath it, on the same side of the heart. (Tricuspid and mitral valve).
- **Semilunar valves (válvulas arteriales semilunares)**. These valves link each ventricle to its corresponding artery. (Pulmonary valve and aortic valve)

THE HEART

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APP: Heart Anatomy Pro.



THE CIRCULATORY SYSTEM



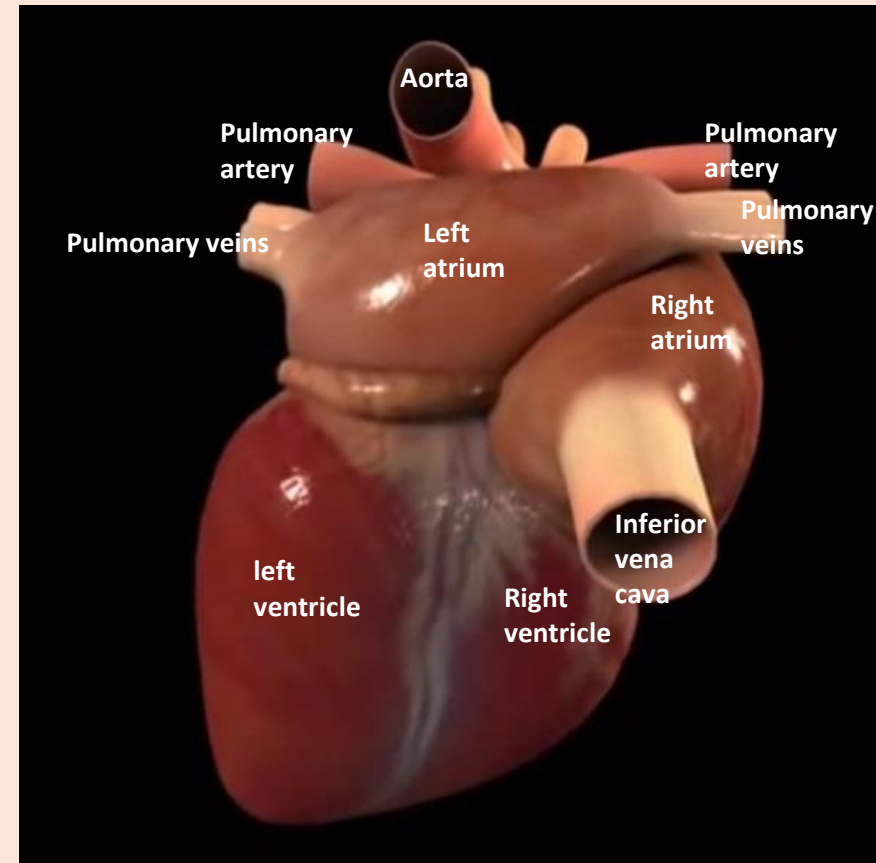
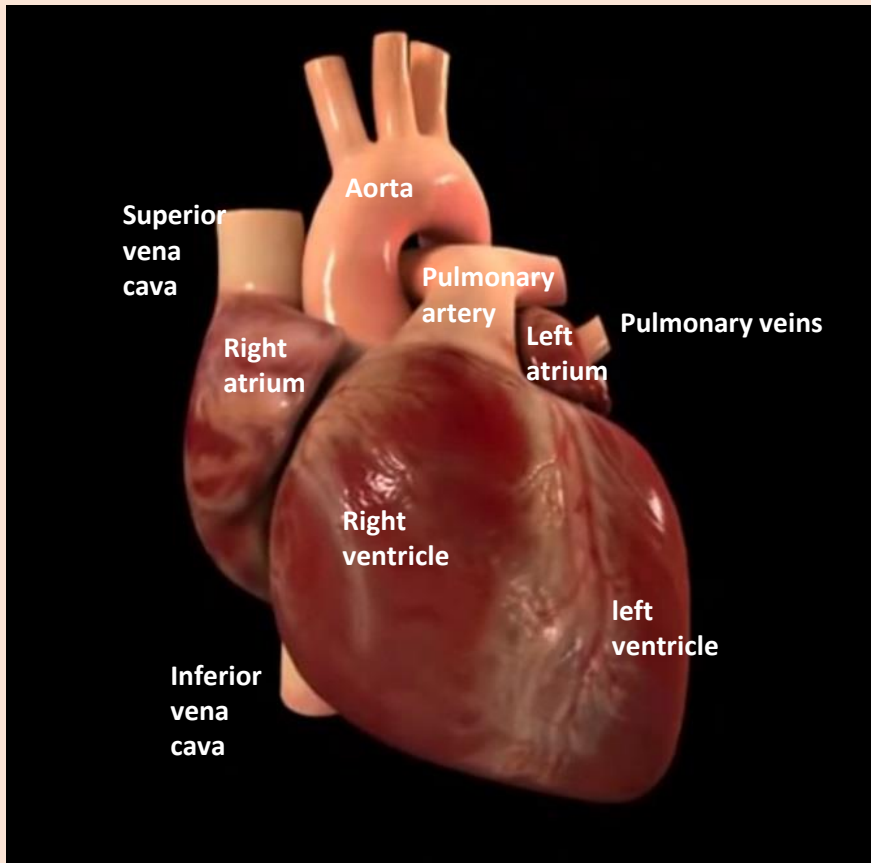
THE HEART

THE CIRCULATORY SYSTEM



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THE HEART

★ The heartbeat (el latido cardiaco)

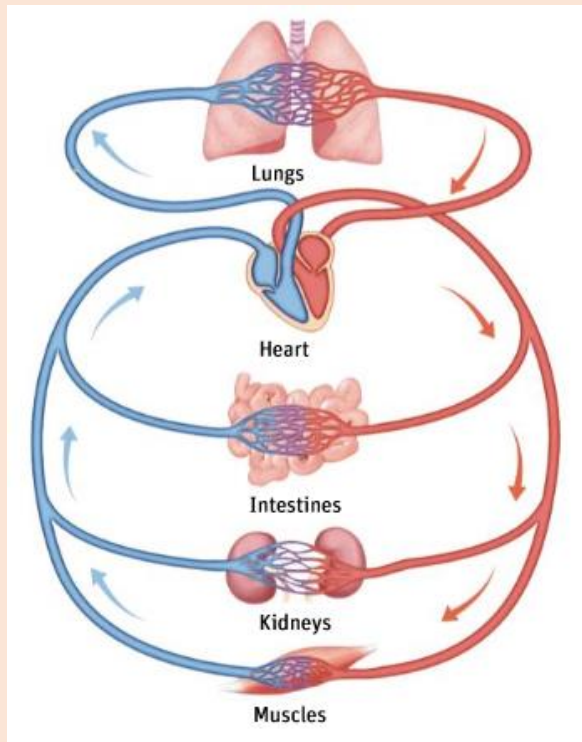
The heartbeat refers to the rhythmic sounds that the heart makes as it pumps the blood. During the heartbeat, the left and right halves of the heart function as two separate but synchronised pumps, pumping at the same time. Each heartbeat consists of the series of events known as the **cardiac cycle**.

1. **Atrial systole (sístole auricular):** The atria contract, forcing the blood into their respective ventricles. Atrioventricular valves open during atrial contraction.
2. **Ventricular systole (sístole ventricular):** The blood in the ventricles is ejected from the heart through the arteries, causing the semilunar valves to open. The blood cannot flow backwards as the atrioventricular valves are closed. The closure of these valves creates the first sound of the heartbeat.
3. **Diastole:** The muscular walls of the heart relax. The pulmonary and aortic valves close, generating the second sound of the heartbeat. This prevents the blood that has just been pumped into the arteries from flowing back into the ventricles. Finally, during this step, the atria fill with blood from the vein.



THE FLOW OF BLOOD WITHIN THE BODY

Due to its structure the heart Works like a double pump and the blood has to go through a double circuit:



1. **Pulmonary loop (circuito pulmonar):** Poor oxygen blood exits the heart from the right ventricle and travels to the lungs through the pulmonary arteries. The blood pick up oxygen and releases carbon dioxide. After that, the blood returns to the heart through the pulmonary veins, entering the heart at the left atrium.
2. **Systemic loop (circuito sistémico):** Blood in the left ventricle is pumped out of the heart through the aorta, which leads to all of the body´ s organs. The arteries branch into smaller and smaller vessels, eventually reaching capillaries, within particular tissues. While moving through the capillaries, oxygen and nutrients move from the blood into the surrounding cells while waste molecules move into the blood. As capillaries exit the organs, they converge into larger blood vessels, the veins, which eventually return the blood to the heart at the right atrium from superior and inferior vena cavae.



THE CIRCULATORY SYSTEM AND OUR HEALTH

★ Vessels diseases

1. **Hypertension (Hipertensión arterial):** Occurs when the blood pressure exceeds the values that are cBlood considered normal (120-70 mmHg). Blood pressure is a measure of the strength of the force exerted against the walls of the arteries as the heart pumps blood to the body. The causes that cause it are unknown, although the influence of tobacco and excessive consumption of salt has been demonstrated.
2. **Arterioesclerosis: Arteriosclerosis** is the thickening, hardening, and loss of elasticity of the walls of arteries. This process gradually restricts the blood flow to one's organs and tissues and can lead to severe health risks brought on by **atherosclerosis**, which is a specific form of arteriosclerosis caused by the buildup of fatty plaques, cholesterol, and some other substances on the artery walls. It can be brought on by smoking, a bad diet, or many genetic factors.
3. **Aneurysm (Aneurisma):** Abnormal dilatation of a blood vessel, usually of an important artery, whose rupture produces a leak that can have fatal consequences. They can be caused by atheromas.
4. **Varicose veins (Varices):** Abnormal dilations of the veins. The return of blood to the heart slows down



THE CIRCULATORY SYSTEM AND OUR HEALTH

★ Heart diseases

1. **Myocardial infarction or heart attack (Infarto de miocardio):** Death of a part of the heart muscle due to lack of blood supply due to obstruction or rupture of one of the arteries that supply the myocardium (coronary arteries). The tamponade occurs because of a clot or plaque of atheroma.
2. **Angina pectoris (Angina de pecho):** Lack of oxygen in the myocardium. It is due to atherosclerotic plaques in the coronary arteries that do not cause the death of myocardial cells.
3. **Heart failure (Insuficiencia cardiaca):** Inability of the heart to provide adequate blood flow to the body's needs.
4. **Heart valve alterations (Alteraciones de las válvulas cardiacas):**
 - a) **Narrowing (stenosis):** The blood passes with difficulty through the valves and a part of the heart must make a greater effort.
 - b) **Defective closure:** A part of the blood reflux backwards so that the contraction of the myocardium is less effective.



THE CIRCULATORY SYSTEM AND OUR HEALTH

★ Blood diseases

1. **Anaemia (Anemia):** Decrease in the number of red blood cells in the blood or the amount of hemoglobin present in them. When receiving tissues less oxygen causes fatigue, fatigue and palpitations. The causes are usually lack of iron or vitamins B9 and B12, chronic blood losses or alterations of the bone marrow.
2. **Leukaemia (Leucemia):** Type of cancer which affects the bone marrow, the tissue which produces the blood cells. Blood tests show high numbers of nonfunctional White blood cells and a reduction in the number of red blood cells and platelets.
3. **Haemophilia (Hemofilia):** Hereditary disease that consists of the lack of proteins of the blood plasma (coagulation factors) necessary for blood coagulation.
4. **Thrombosis (Trombosis):** Formation of a blood clot inside an artery. The clot may be adhered to the vessel wall or be detached and be pushed by the bloodstream to a smaller artery (**embolism**), where it can block the passage of blood and prevent the irrigation of any organ or tissue.