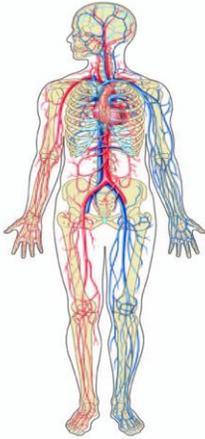


# THE CIRCULATORY SYSTEM



Your circulatory system's pretty great. The circulatory system, also called the **cardiovascular** system or the **vascular** system, is an organ system that permits blood to circulate and transport nutrients, oxygen, carbon dioxide, hormones, and blood cells to and from the cells in the body to provide nourishment and help in fighting diseases, stabilize temperature and pH, and maintain **homeostasis**.

## 1. FUNCTION

The vascular system carry out several functions with an important role to live.

- **TRANSPORT:** moving important component around the body in the bloodstream, like oxygen, nutrients and water to cells and organs, and waste product from this up to excretory systems to eliminate them.
- **BODY TEMPERATURE CONTROL:** more blood near the skin cools the body quicker. That's why your skin looks redder after exercise.
- **PROTECTION:** moving antibodies around the body to fight disease. Blood clotting seals cuts.

## 2. STRUCTURE

Heart, blood, blood vessels and lymphatic system compose human circulatory system. The lymphatic systems will be developed in biology.

### a. **Heart.**

Is one of the most important organs in human body.

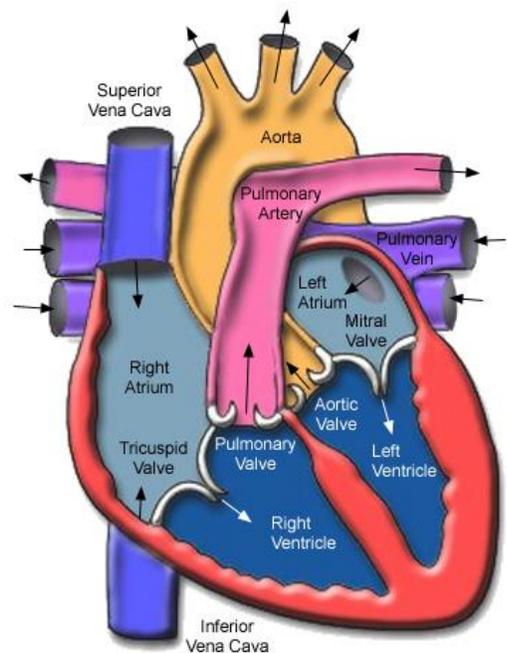
The heart is an organ with a special muscular tissue, which pumps blood through the blood vessels of the circulatory system between 60 and 100 times by minutes (**heart rate**). The heart is located in the middle compartment of the chest.

The heart is divided into four chambers: upper left and right **atria** (blood receptor); and lower left and right **ventricles** (receive blood from atriums and pump out throughout arteries. Commonly the right atrium and ventricle are referred together as the right heart and their left counterparts as the left heart.

In a healthy heart **blood flows one way from atrium to ventricles** due to the **heart valves**, which prevent backflow. **Mitral** valve in left side and **tricuspid** valve in right one. Another two valves prevent the blood return when goes out to the heart: **semilunar valves**, located in aorta and pulmonary artery.

The heart sends blood to the organs throughout blood vessels.

When blood go out of heart, it exhert a pressure over the vessels named **blood pressure**.



In each contraction, heart pump an amount of blood. This is the **stroke volume**.

The **cardiac output** is a good way to know the heart performance that is the total blood volume pumped by the heart during one minute.

To calculate it you need to multiply the stroke volume and the heart rate.

**NOW YOU!** To learn the heart structure you can draw it and indicate all chambers, valves and vessels that are connected.

**b. Blood vessels.**

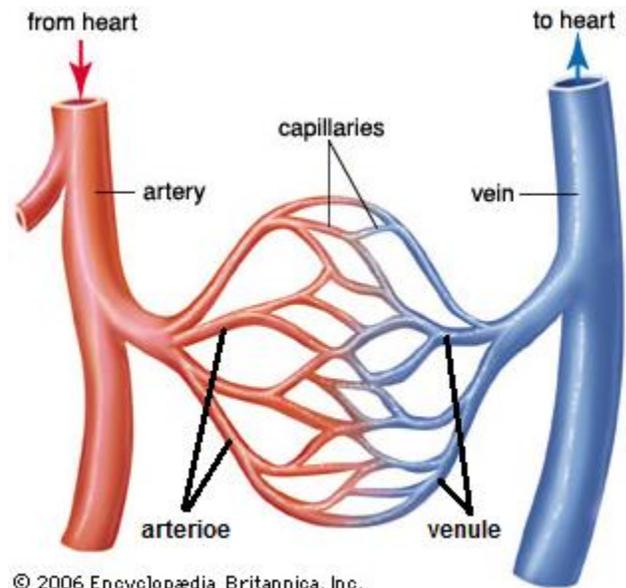
Heart is connected to the blood vessels that will lead blood from heart to organs.

There are different types of blood vessels.

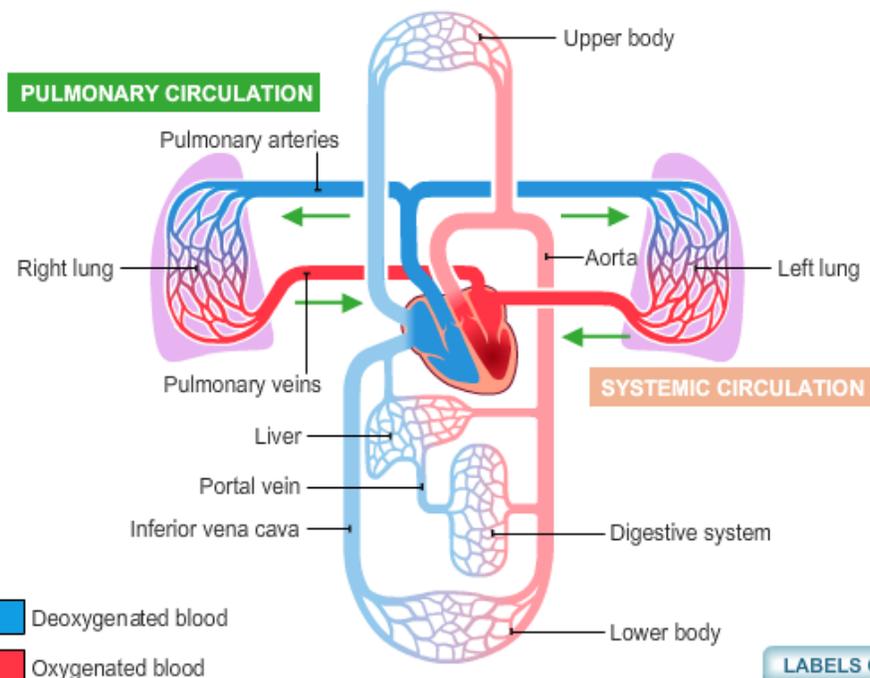
The vessels that carry blood away from the heart are called **arteries**, and their very small branches are **arterioles**. Very small branches that collect the blood from the various organs and parts are called **venules**, and they unite to form **veins**, which return the blood to the heart. **Capillaries** are minute thin-walled vessels that connect the arterioles and venules; it is through the capillaries that nutrients and wastes are exchanged between the blood and body tissues.

Arteries transport oxygenated blood from heart to the organs, except pulmonary artery that transport deoxygenated blood to lungs.

Veins transport deoxygenated blood from tissues and organs to the heart, except cava veins that transport oxygenated blood from lungs to heart.



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Blue box: Deoxygenated blood  
Red box: Oxygenated blood

LABELS OFF

Humans have a double circulation. Each time a blood cells goes right round your body, it goes through the heart twice, that's double circulation. It happens because there are two circuits:

**The systemic circuit** is the main circuit. It carries:

- Oxygenated blood around the body in the arteries
- Deoxygenated blood back to the heart along the veins, this then gets reoxygenated in the pulmonary circuit.

The pulmonary circuit includes the heart to the lungs to be oxygenated. The oxygenated blood then goes back to the heart to be pumped around the systemic circuit.

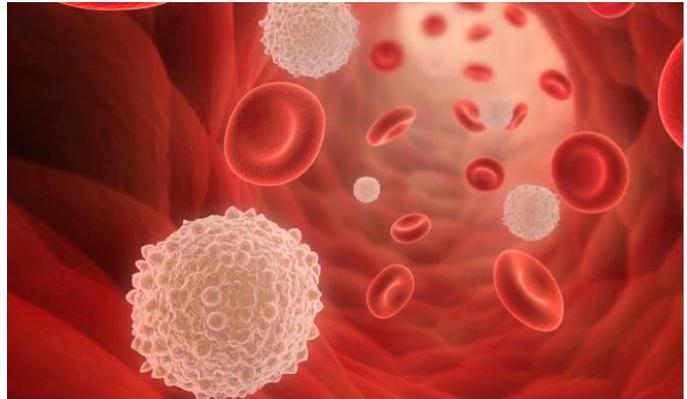
**c. Blood.**

Normally, 7-8% of human body weight is from blood. This essential fluid carries out the critical functions of transporting oxygen and nutrients to our cells and getting rid of carbon dioxide, ammonia, and other waste products. In addition, it plays a vital role in our immune system and in maintaining a relatively constant body temperature. The most important blood components are red cells, white cells, platelets, and plasma.

**Red cells**, or **erythrocytes** are cells without nuclei. Red cells normally make up 40-50% of the total blood volume. They **transport oxygen helped by hemoglobin** from the lungs to all of the living tissues of the body and **carry away carbon dioxide**. The red color of blood is primarily due to oxygenated red cells.

**White cells**, or **leukocytes**, exist in variable numbers and types but make up a very small part of blood's volume. They occur elsewhere in the body as well, most notably in the **spleen, liver, and lymph glands**. Leukocytes participate in different ways in our immune responses, helping our body to fight versus virus and diseases.

**Platelets** or **thrombocytes** are cell fragments without nuclei that work with blood clotting chemicals at the site of wounds. They do this by adhering to the walls of blood vessels, thereby plugging the rupture in the vascular wall.



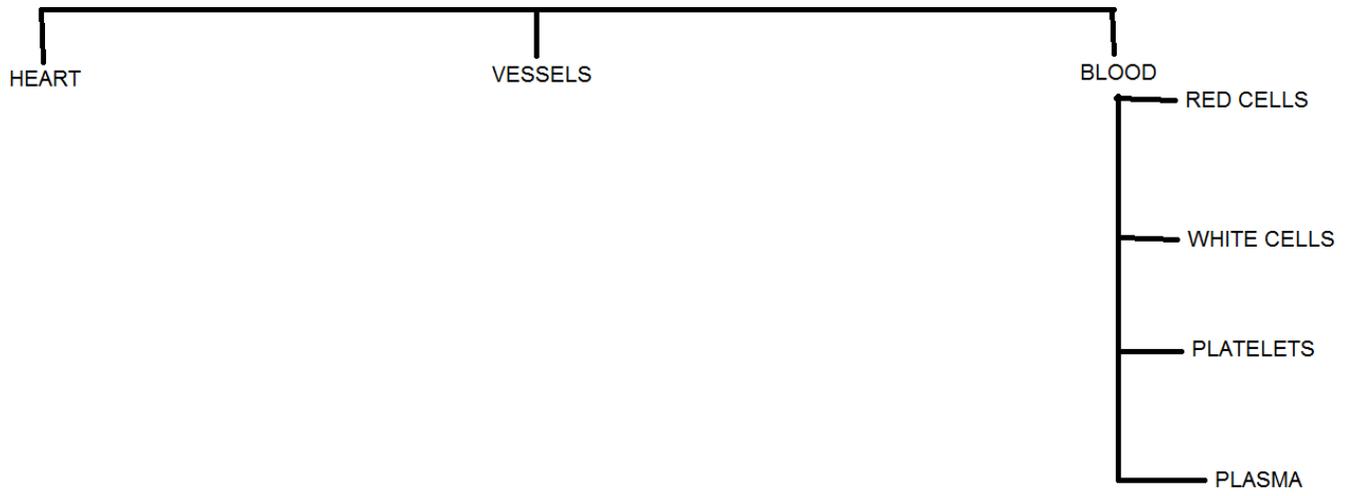
Red and white cells inside a blood vessel.

**Plasma** is the relatively clear, yellow tinted water (92+%), sugar, fat, protein and salt solution which **carries** the red cells, white cells, and platelets. Normally, 55% of our blood's volume is made up of plasma. As the heart pumps blood to cells throughout the body, plasma brings nourishment to them and removes the waste products of metabolism. Plasma also contains blood clotting factors, sugars, lipids, vitamins, minerals, hormones, enzymes, antibodies, and other proteins.

You can see a video about blood component following the next link: <https://www.youtube.com/watch?v=R-sKZWqsUpw>

**NOW YOU!** To learn all vascular systems components, you can create a diagram including the main aspects of each one (structure, functions ...).

CIRCULATORY SYSTEM



### 3. VASCULAR SYSTEM AND PHYSICAL ACTIVITY

Physical activity produce immediate effects over cardiovascular system, and if you practice physical activity at least 3 times per week (regular training), your vascular system will adapt and improve their performance, helping to you to get better health.

#### a. **Immediate effects when first exercising:**

- Heart contracts **more often** - increased **heart rate**.
- Heart contracts **more powerfully** - increased **stroke volume**
- **Blood diverted to muscles**, eg it is diverted from the digestive system to the muscles.
- **Blood temperature rises**.
- Blood vessels near skin open to allow **heat to be lost**.

#### b. **Effects of regular training:**

- **Heart muscle** increases in size and strength.
- **Cardiac output increases**. Cardiac means relating to the heart so this is the amount of blood that the heart pumps out to the body.
- Lower **resting heart rate**, quicker **recovery** from exercise.
- **Reduced** risk of heart disease.
- Increased number of **capillaries in muscles**.
- Increased volume of **blood and red blood cells**.

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