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Blood And Its Functional Structure

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Abstract: The work examines the composition of human blood. It is shown that white cells are divided into agranulocytes and granulocytes. Lymphocytes play a decisive role in the formation of antibodies and other protective reactions. Neutrophils (70%) contain enzymes in the cytoplasm that destroy bacteria, so their accumulations are found in those areas of the body where the infection is localized. The functions of blood are much more complex than just the transport of nutrients and metabolic waste. Hormones that control many vital processes are also transported with blood; blood regulates body temperature and protects the body from damage and infection in any part of it.
Key words: blood, human, blood white cells, agranulocytes, granulocytes, lymphocytes, neutrophils, cytoplasm, enzyme, bacteria, infection.

Blood (lat. *sanguis* (ancient Greek: α ἷμ α) is a liquid and mobile connective tissue of the internal environment of the body . It consists of a liquid medium - plasma - and formed elements (cells and cell derivatives) suspended in it: erythrocytes , leukocytes and thrombocytes .

Circulates in a closed loop the vascular system under the action of the force of the rhythmically contracting heart and does not communicate directly with other tissues bodies due to the presence of histohematic barriers .

In vertebrates, blood is red (from pale to dark red) due to the presence of hemoglobin in the red blood cells , which carries oxygen . In humans, oxygen-saturated blood (arterial) is bright red, while blood deprived of oxygen (venous) is darker. In some mollusks and arthropods, the blood (more precisely, hemolymph) is blue due to hemocyanin .

1-Fig. Venous (dark red) and arterial (bright red) human blood

On average, men have a normal blood volume of 5.2 liters , women - 3.9 liters , and newborns - 200-350 ml . The mass fraction of blood in the body of an adult is 6-8% .

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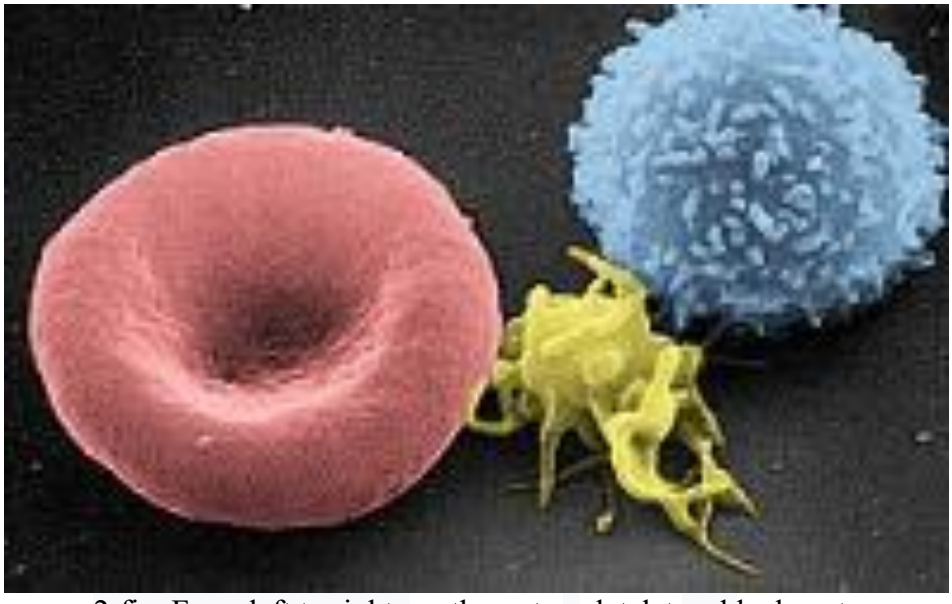
In humans, blood is formed from hematopoietic stem cells , of which there are about 30,000, mainly in the bone marrow , but also in the Peyer's patches of the small intestine , thymus , lymph nodes and spleen [2] .
The study of blood is carried out by a branch of medicine called hematology .
Blood is a connective tissue with a liquid intercellular substance, plasma, which makes up slightly more than half of the total volume of blood. Plasma contains the protein fibrinogen , which, when exposed to air or when a blood vessel is damaged, forms a fibrin clot in the presence of calcium and blood clotting factors, consisting of fibrin threads.
The clear yellowish liquid remaining after the clot has formed is called whey.
Plasma contains various proteins (including antibodies), metabolic products, nutrients (glucose, amino acids, fats), gases (oxygen, carbon dioxide and nitrogen), various salts and hormones.
Red blood cells (erythrocytes) contain hemoglobin, an iron-containing compound with a high affinity for oxygen. The bulk of the oxygen is carried by mature erythrocytes, which, due to the absence of a nucleus, do not live long - from one to four months. They are formed from the nuclear cells of the bone marrow, and are destroyed, as a rule, in the spleen. In 1 mm ^{3} of a woman's blood there are about 4,500,000 erythrocytes, in a man - 5,000,000.
Billions of red blood cells are replaced daily by new ones. In highlanders In some areas, the red blood cell count is increased as an adaptation to the lower concentration of oxygen in the atmosphere. The number of red blood cells or the amount of hemoglobin in the blood is reduced in anemia. White blood cells (leukocytes) lack hemoglobin. There are approximately 7,000 white cells per 1 mm3 ^{of} blood , i.e. there are approximately 700 red cells per one white cell.
White cells are divided into agranulocytes (lymphocytes and monocytes) and granulocytes (neutrophils, eosinophils and basophils). Lymphocytes (20% of all white cells) play a decisive role in the formation of antibodies and other protective reactions. Neutrophils (70%) contain enzymes in the cytoplasm that destroy bacteria, so their accumulations are found are found in those areas of the body where the infection is localized.



2-fig. From left to right: erythrocyte , platelet and leukocyte
(scanning electron microscopy)

The functions of eosinophils (3%), monocytes (6%) and basophils (1%) are also mainly protective. Normally, red blood cells are found only inside blood vessels, but white blood cells can leave the bloodstream and return to it. The life span of white blood cells is from one day to several weeks. The formation of blood cells (hematopoiesis) is a complex process.

All blood cells, including platelets, originate from bone marrow stem cells. The red color of blood is determined by the presence of the red pigment hemoglobin in erythrocytes. In the arteries, through which blood that has entered the heart from the lungs is carried to the tissues of the body, hemoglobin is saturated

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with oxygen and is colored bright red; in the veins, through which blood flows from the tissues to the heart, hemoglobin is practically devoid of oxygen and is darker in color.

Blood is a fairly viscous liquid, and its viscosity is determined by the content of erythrocytes. erythrocytes and dissolved proteins. The speed with which blood flows through arteries (semi-elastic structures) and blood pressure depend to a large extent on the viscosity of the blood. The fluidity of the blood is also determined by its density and the nature of the movement of various types of cells. Leukocytes, for example, move individually, in close proximity to the walls of blood vessels; erythrocytes can move both individually and in groups like coins stacked in a pile, creating an axial flow, i.e., concentrated in the center of the vessel.

The blood volume of an adult male is approximately 75 ml per kilogram of body weight; for an adult female, this figure is approximately 66 ml.

Accordingly, the total blood volume of an adult male is on average about 5 liters; more than half of the volume is plasma, and the rest is mainly erythrocytes.

Functions of blood. Primitive multicellular organisms (sponges, sea anemones, jellyfish) live in the sea, and sea water is their "blood". Water washes them from all sides and freely penetrates the tissues, delivering nutrients and carrying away metabolic products.

Higher organisms cannot ensure their vital functions in such a simple way. Their bodies consist of billions of cells, many of which are united into tissues that make up complex organs and organ systems.

In fish, for example, although they live in water, not all cells are close enough to the surface of the body for water to effectively deliver nutrients and remove waste products.

The situation is even more complicated with land animals, which are not washed by water at all. It is clear that they must have developed their own liquid tissue of the internal environment - blood, as well as a distribution system (heart, arteries, veins and a network of capillaries) that provides blood supply to each cell.

The functions of blood are much more complex than simply transporting nutrients and waste products. Blood also carries hormones that control many vital processes; it regulates body temperature and protects the body from injury and infection in any part of it.

Transport function. Almost all processes related to digestion and respiration, two functions of the body without which life is impossible, are closely connected with blood and blood supply.

The connection with breathing is expressed in the fact that the blood ensures gas exchange in the lungs and the transport of the corresponding gases: oxygen - from the lungs to the tissues, carbon dioxide (carbon dioxide) - from the tissues to the lungs.

The transport of nutrients begins in the capillaries of the small intestine; here the blood takes them from the digestive tract and transports them to all organs and tissues, starting with the liver, where the modification of nutrients (glucose, amino acids, fatty acids) occurs, and the liver cells regulate their level in the blood depending on the needs of the body (tissue metabolism).

The transition of transported substances from the blood to the tissues occurs in the tissue capillaries; at the same time, end products enter the blood from the tissues, which are then excreted through the kidneys with urine (for example, urea and uric acid). The blood also transports the secretion products of the endocrine glands - hormones - and thereby ensures communication between various organs and coordination of their activities.

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