

PRACTICAL HISTOLOGY

LAB.4

Blood

Blood consists of blood plasma and cells. Every tissue in the body needs a blood supply. Many of the white blood cells leave the blood vessels and migrate into the connective tissue and epithelia.

Functions of blood.

Transports gases, nutrients, waste, cells and hormones throughout the body. ○

Transports O₂, CO₂, nutrients, hormones, heat and wastes. ○

Regulates pH, temperature, water content of cells. ○

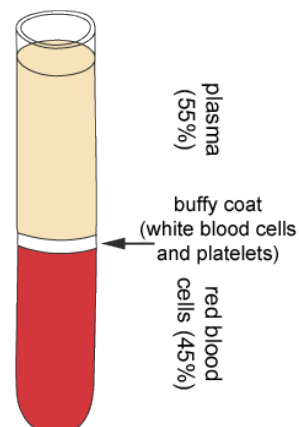
Protects against blood loss through clotting. ○

Protects against disease through phagocytic white blood cells and antibodies. ○

Blood Constituents

Blood consists of blood **cells** and **plasma**.

If blood is treated with an anticoagulant and centrifuged, the blood cells sediment leaving a supernatant of clear plasma.



Blood Cells

The sedimented blood cells account for 35-50% of the volume of blood and are of three basic types.

erythrocytes or [red blood cells](#) ◦

leucocytes or [white blood cells](#) ◦

platelets or [thrombocytes](#). ◦

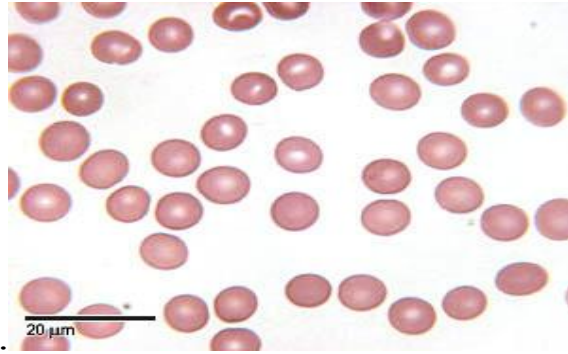
Red Blood Cells - Erythrocytes ◦

Red blood cells are the most numerous type of cell found in blood. One microlitre of blood contains around 5 million cells. They are essential for transport of carbon dioxide and oxygen. They are 'born' and mature in the bone marrow around the body.

When they mature, they make haemoglobin, the protein that binds oxygen. Haemoglobin can also bind carbon dioxide, but at a different site to that for oxygen. Eventually around 90% of the dry weight of the cell is made up of this protein. The nucleus is lost from the cell, phagocytosed by macrophages, and the DNA broken down. The red blood cells can then enter the circulation.

These cells only live for about 120 days. However, the iron in the haemoglobin is extracted from the erythrocytes by the liver and spleen, and the remaining heme is excreted by the liver as bile pigments.

Around 3 million RBCs die and are scavenged by the liver each second.



White blood cells

White blood cells are much less common than red blood cells. There are five types of white blood cell (leucocyte). These are divided into two main classes

Granulocytes (includes Neutrophils, Eosinophils and Basophils)

Agranulocytes (includes Lymphocytes and Monocytes).

This classification depends on whether granules can be distinguished in their cytoplasm using a light microscope and conventional staining methods).

All the white blood cells are able to move like an amoeba, and can migrate out of blood vessels into the surrounding tissues.

Granulocytes:

Neutrophils

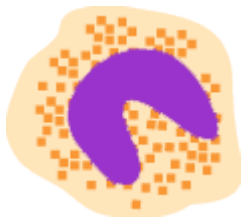


Neutrophils are the commonest type of white blood cell found in a blood smear. They make up 60-70% of the total amount of white blood cells

Function:

Neutrophils are born in the bone marrow. They circulate in the blood for 6-10 hours, and then enter the tissues. They are motile, and phagocytic and will destroy damaged tissue and bacteria. They self destruct after one burst of activity.

They are important in [inflammatory reactions](#).

Eosinophils

Eosinophils are fairly rarely found in blood smears - making up 1-6% of the total white blood cells.

Function :

These cells are born in the bone marrow, and migrate from the peripheral blood system after a few hours, into loose connective tissue in the respiratory and gastrointestinal tracts. They phagocytose antigen-antibody complexes. They also produce histaminase,. A high eosinophil blood count may indicate an allergic reaction. Eosinophils are also important in killing parasitic worms.

Basophils

Basophils are the rarest type of white blood cell, making up only 1% of the white blood cells found in a blood smear.

Function:

These cells are involved in immune responses to parasites. These cells also accumulate at sites of infection, and the release of prostaglandins, serotonin and histamine help to increase blood flow to the area of damage, as part of the inflammatory response. The degranulation - release of histamine also plays a role in allergic reactions such as hay fever.

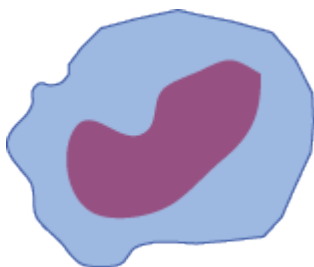
Agranulocytes:**Lymphocyte**

These are the second most common white blood cell (20-50%), and are easy to find in blood smears. Although the cells look similar there are two main types, B-cells and T-cells.

B-cells develop in the bone marrow. T cells are born in the bone marrow, but are matured in the Thymus.

Function:

The B-cells develop into plasma cells which make antibodies, The T-cells attack viruses, cancer cells, and transplants.

Monocyte

Monocytes are the third most common type of white blood cell; about 2-10% of leucocytes are monocytes.

Function:

Monocytes in the circulation are precursors of tissue macrophages that are actively phagocytic. Monocytes circulate in the blood for 1-3 days, and then migrate into body tissues, where they transform into macrophages. They will phagocytose dead cells and bacteria. Some monocytes can also transform into osteoclasts.

Monocytes are important in the [inflammatory response](#).

Plasma

The plasma accounts for 55% of the blood volume. It consists of a solution of water (92%), proteins, lipids, inorganic ions (salts) and glucose. The proteins include hormones. The salts include urea, that are waste products of cells.

The proteins make up 6-7 % of blood and are made up mostly of serum albumin, and serum globulins. Serum albumin is made in the liver, and helps to maintain the osmotic pressure of blood.

Cholesterol is also found in the blood, in a mixture of high density and low density forms (HDL and LDL). High LDL levels are linked with atherosclerosis, where plaques can form on the inside of arteries. This can lead to cardiac disease and/or strokes. In contrast, high levels of HDL may protect against heart disease.

Platelets

Platelets are not true cells, but are in fact cytoplasmic fragments from large cell found in the bone marrow call megakaryocytes.

There are around 150 to 400 thousand platelets in a millilitre of blood, and they are essential for haemostasis. They adhere to collagenous tissue at the edges of wounds to form plugs, helping to seal the wound. They also promote the formation of clots, and secrete factors involved in vascular repair.

