Specialised Connective Tissue

Blood: Components and their functions

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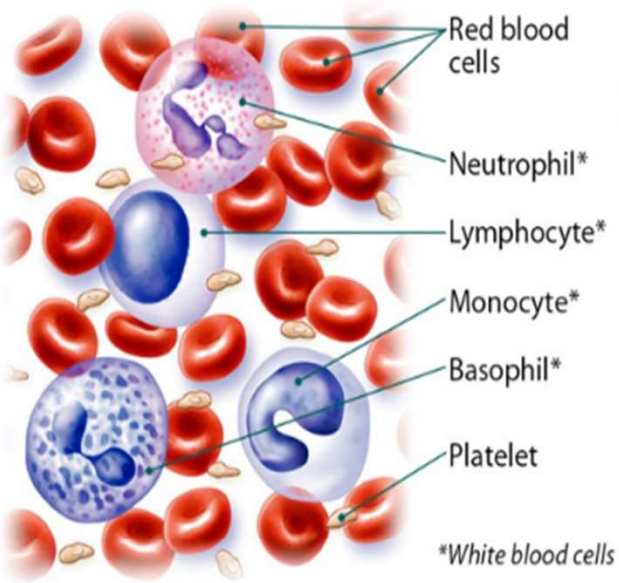
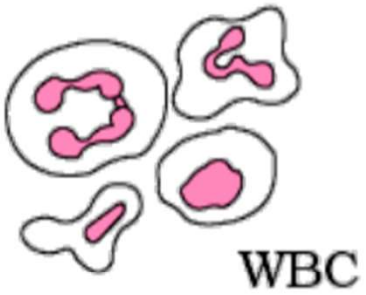
3. Specialized Connective Tissue

C. Blood





- A fluid connective tissue containing plasma, red blood cells (RBC), white blood cells (WBC) & platelets.
- Helps in the circulation of various substances.

Blood is a connective tissue consisting of cells separated by a liquid called the ground substance or plasma matrix or simply as plasma (Fig.1.11a). Blood is a sticky fluid connective tissue with a slightly salty taste. It is fluid present almost everywhere and is distributed by means of blood vessels: arteries, veins, arterioles, venules and capillaries. It has a bright red or scarlet colour when it flows in the arteries but a dark red or purple colour when it flows in the veins. It is slightly alkaline (pH 7.4). The plasma of the blood is a watery fluid and transports dissolved glucose, wastes, carbon dioxide and hormones. The plasma also regulates the water balance for the blood cells. Several types of cells are present in the plasma which are as follows (Fig.1.11):

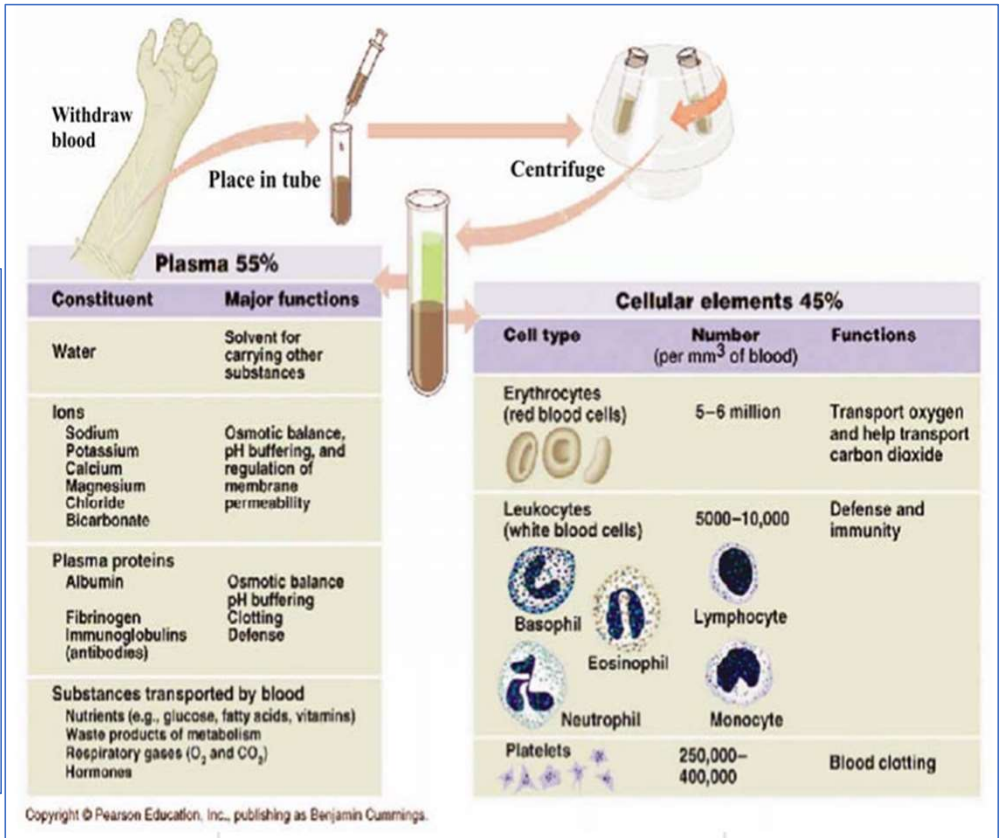


Fig.1.11: a) Components of human blood and their function (a) Non cellular components forming the plasma, b) cellular components

Composition of blood

Blood has of two parts (i) fluid or **plasma** that constitutes 55% of the blood, and (ii) suspended solid component of cells (Fig. 1.11 b) that make up upto 45% of the blood.

i) **Plasma**

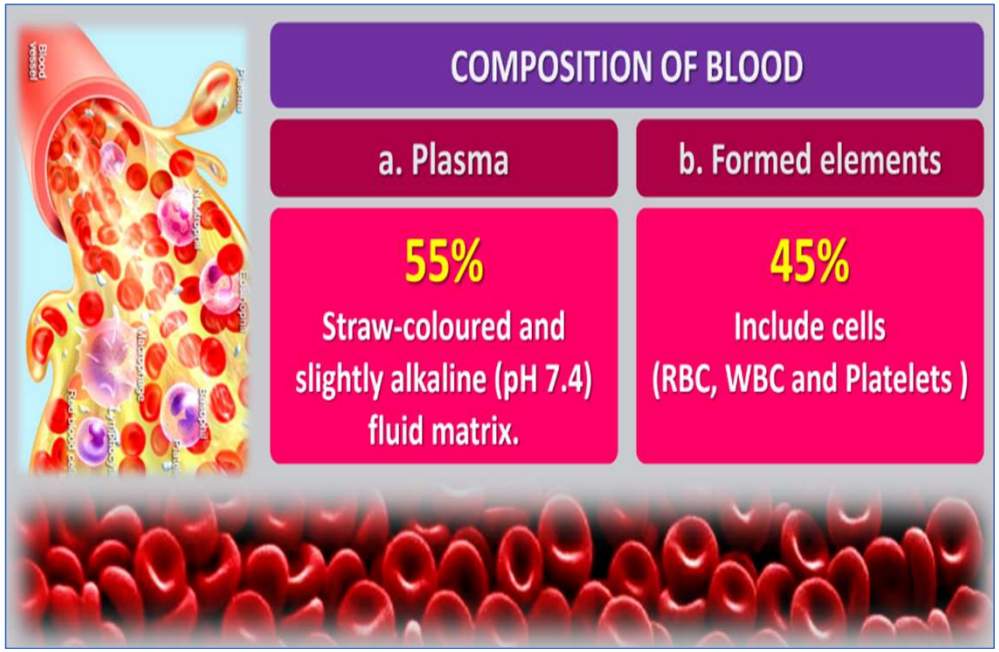
The plasma (Fig. 1.11 (a)) is composed of water (90-92%) and solids (8-10%). The solids are in turn made up of electrolytes, plasma proteins, fats, hormones, colouring substances like bile pigments, etc. The important plasma proteins are serum albumin, serum globulin and serum fibrinogen. Serum albumin and fibrinogen are derived from the liver, whereas the serum globulins are derived from lymphocytes.

ii) **Blood Cells**

The cells (Fig. 1.11 b) present in the blood are:

- **White Blood Corpuscles**

The **white blood corpuscles** are also called **white blood cells or WBCs,** or **Leukocytes**. These cells, unlike RBCs are nucleated (have nucleus) and do not carry the oxygen carrying pigment haemoglobin. WBC function in the immune system. The total WBC count of blood in humans is 4000-11,000/mm^3. The WBCs are further subdivided, based

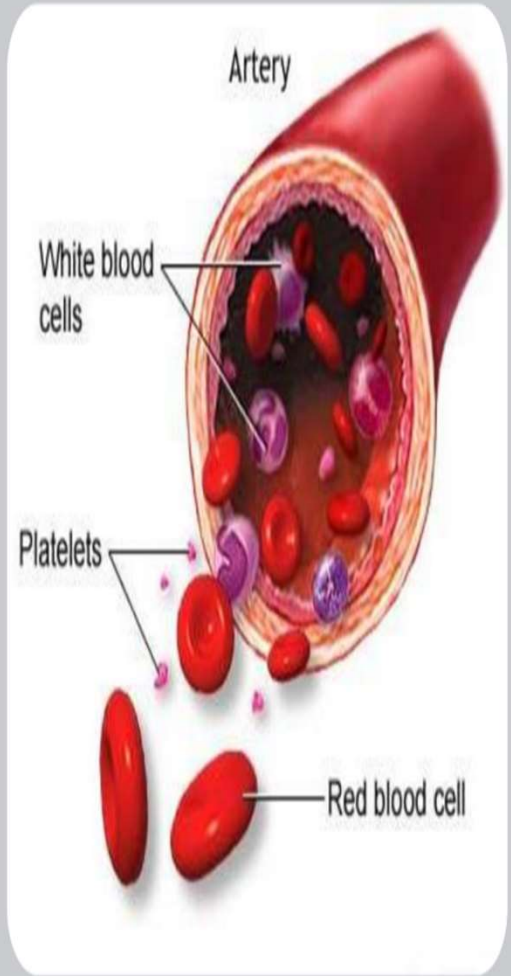


Constituents of plasma		Functions
Water (90-92%)		Good solvent.
Plasma proteins (6-8 %)	Fibrinogen	For blood coagulation (clotting)
	Globulins	Act as antibodies (for defense of the body)
	Albumins	Osmotic balance. Regulates blood pressure.
Glucose, amino acids, lipids, cholesterol		For energy production and growth.
Inorganic: Na^+, Mg^{2+}, Cl^-, HCO_3^-, Ca^{2+}		Regulation of osmosis etc.
Gases (CO_2, O_2, N_2 etc)		For transport

Plasma without clotting factors is called *Serum*.

FORMED ELEMENTS

- Red Blood Cells (RBC) or Erythrocytes
- White Blood Cells (WBC) or Leucocytes
- Platelets (Thrombocytes)



on the presence of granules in their cytoplasm into the following categories (Fig. 1.11b and 12 a):

a) **Agranulocytes**

Agranulocytes are characterized by the absence of granules in their cytoplasm. There are two types of agranulocytes (i) Lymphocytes and (ii) Monocytes (Fig. 1.12a).

b) **Granulocytes**

Granulocytes (Fig.1.12b) are white blood cells that are characterized by the presence of granules in their cytoplasm. They are also called polymorphonuclear leukocytes (PMN or PML) because of the varying shapes of the nucleus, which is usually lobed into three segments. Granulocytes are released from the bone marrow and are further divided into Neutrophils, Eosinophils and Basophils.

The WBCs in the body act as the first line of defence (especially neutrophils and monocytes) against invasion by microbes. These cells engulf (take inside) the invading organism through the process of phagocytosis and so destroy them.

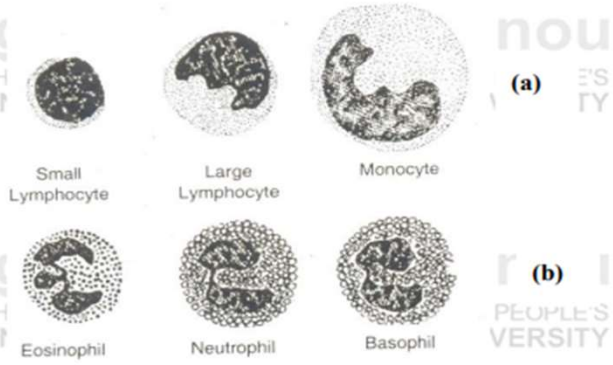
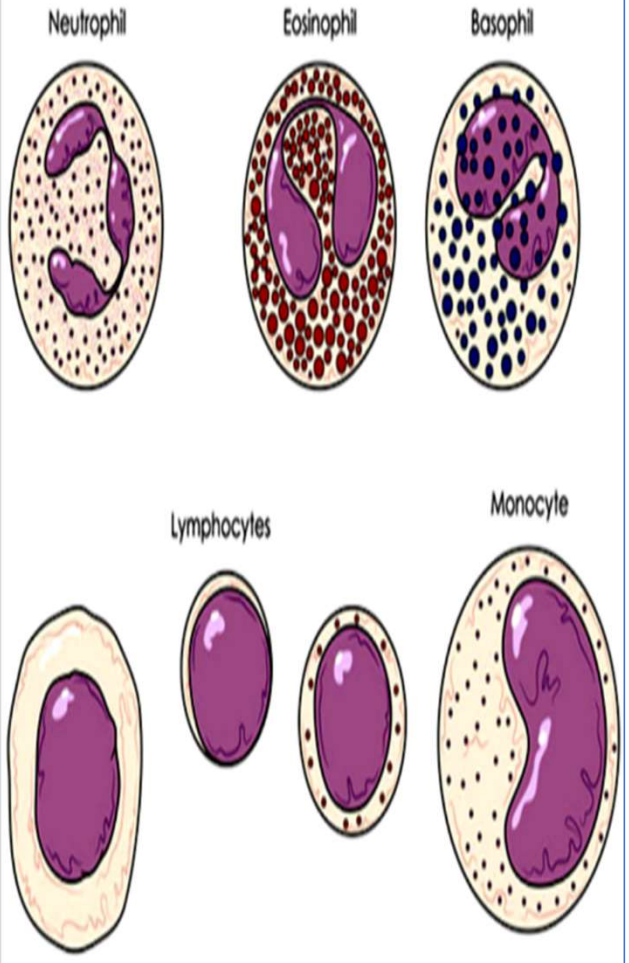


Fig.1.12: White blood corpuscles (a) agranulocytes (b) granulocytes

Features of WBC (Leucocytes)	
Colour	Colourless
Lifespan	1-15 days
Count	6000-8000 /mm^3
Formed in	Bone marrow, lymph glands, spleen
Structure	Nucleated. Different types
Functions	Part of immune system

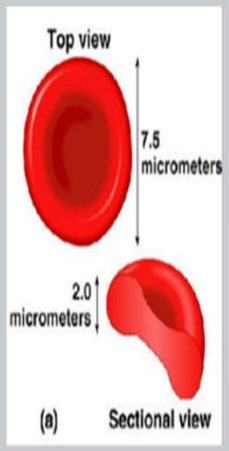


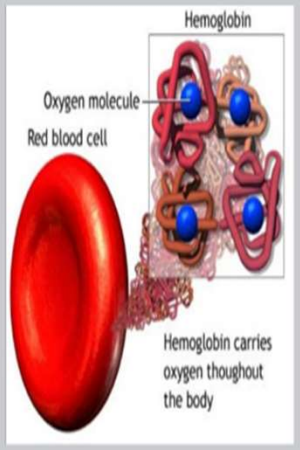
	Types of WBC		%	Functions
Granulocytes	Neutrophils (Heterophils)		60-65%	Phagocytosis. Soldier of the body.
	Eosinophils (Acidphils)		2-3%	Resist infections. Cause allergic reactions.
	Basophils (Cyanophils)		0.5-1%	Secrete histamine, serotonin, heparin. Cause inflammatory reactions.
Agranulocytes	Monocytes (Largest WBC)		6-8%	Phagocytosis
	Lymphocytes (Smallest WBC, largest nucleus)	B- lymphocytes	20-25%	Immune responses of the body. Secrete antibodies.
		T- lymphocytes		

- **Red Blood Corpuscles**

The red blood corpuscles are also referred to as red blood cells or as RBCs or erythrocytes. The human the red blood corpuscles are circular, biconcave, disc shaped, non-nucleated cells which contain the oxygen carrying pigment haemoglobin (Fig. 1.13). The normal RBC count is 5 million/mm^3 of blood in adult males and 4.5 million/mm^3 in adult females. The function of RBCs is the transport of oxygen (O_2) and carbon dioxide (CO_2), maintenance of viscosity of blood and maintenance of acid-base balance since the haemoglobin (Hb) which is part of RBC acts as a buffering agent.

Features of RBC (Erythrocytes)	
Colour	Red (due to haemoglobin). Normal Hb level in blood: 12-16 gm/ 100 ml
Lifespan	120 days
Count	5 - 5.5 millions/mm^3
Formed in	Red bone marrow
Structure	Biconcave in shape. No nucleus, mitochondria, Golgi complex etc.
Functions	CO_2 and O_2 transport



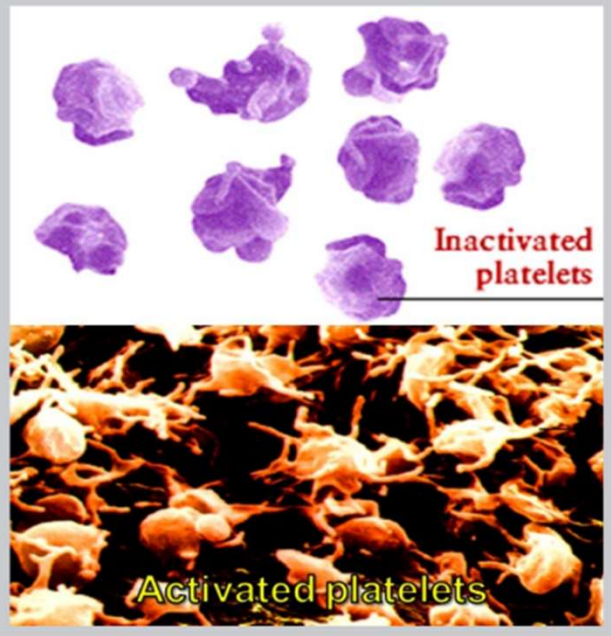


Worn-out RBCs are destroyed in spleen (graveyard of RBCs).

- **Platelets (Thrombocytes)**

  Platelets are small cytoplasmic bodies derived from cells (Fig.1.11b). The platelets are cell fragments that function in blood clotting. The platelets are round or oval, non-nucleated bodies of varying size. The platelets circulate in the blood in the blood. They are one fourth the size of RBCs. They are non-nucleated with the presence of distinct granules in their cytoplasm. In normal adults the platelet count is 2, 50,000-5,00,000/mm^3. They are required for the process for initiation blood clot formation, repair of capillary leaks, clot retraction, etc.

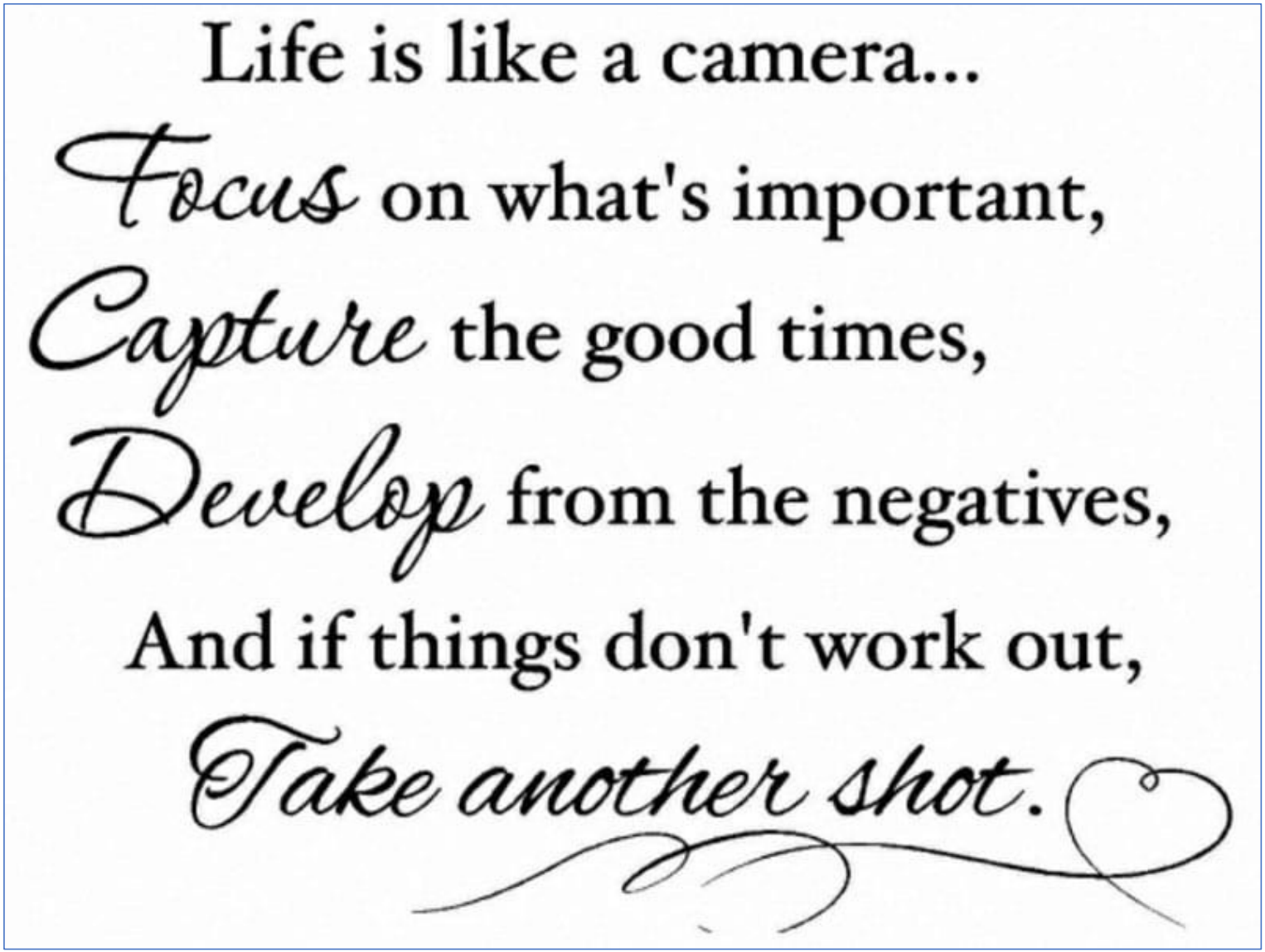
Features of Platelets (Thrombocytes)	
Colour	Colourless
Lifespan	7 days
Count	1.5 - 3.5 lakhs/mm^{-3}
Formed in	Megakaryocytes in Bone marrow
Structure	Non-nucleated cell fragments.
Functions	Blood clotting



General Functions of Blood

Blood is an essential component of the body. It performs various functions in the body. The important functions of blood are listed below:

1. Blood transports oxygen by means of Red Blood Corpuscles (also called red blood cells or RBCs), from the lungs to the tissue and transport of carbon dioxide (CO_2) from the tissue back to the lungs.
2. It transports nutrients from the digestive tract to various tissues of the body.
3. Blood acts as a vehicle for the movement of hormones, vitamins, pigments form their source to various parts of the body.
4. It maintains the fluid, electrolyte and acid-base balance in the body.
5. Blood helps in regulation of the body temperature.
6. It helps in the excretion through urine of waste products that form in the cells.
7. The white blood corpuscles (also called white blood cells or WBCs) present in the blood help in the body's defence mechanism against infection.


Life is like a camera...
Focus on what's important,
Capture the good times,
Develop from the negatives,
And if things don't work out,
Take another shot.