



HUMAN BLOOD

Human Blood

- Blood is a fluid connective tissue.
- The pH value of blood is 7.4. Blood is basic in nature
- There is an average of 5-6 litres of blood in human body.
- **It also fights infection and regulates temperature.**
- Study of blood = HEMATOLOGY

Components of Human Blood

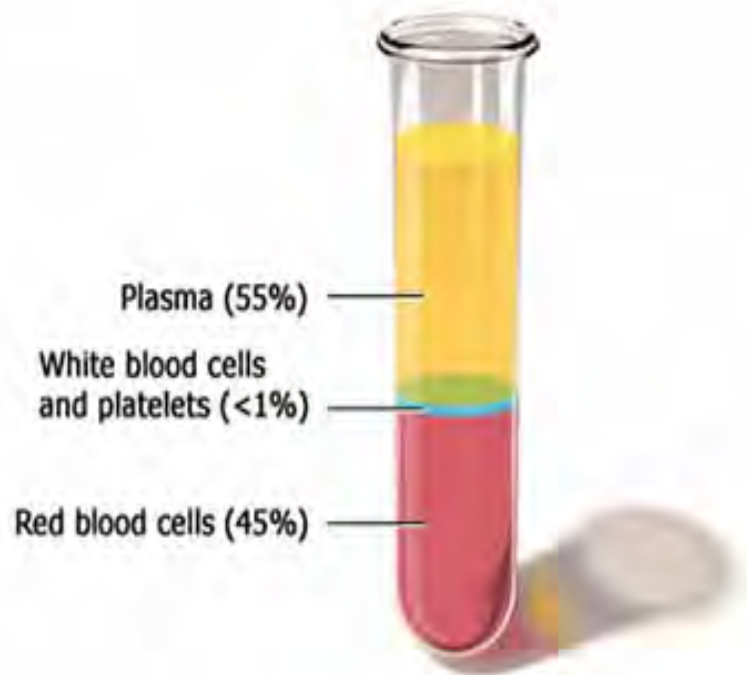
- Plasma. It is the largest component comprising of 55%
- Blood cells. Makes up the remaining 45%

Plasma

- Liquid portion of Blood (55% of blood)
 - Blood plasma contain 90% water, and the remaining 10% is a mix of protein, minerals, carbohydrates, and other essential minerals.
- ⇒ The proteins present in plasma play an important role in the human body.
- **Fibrinogen** - Helps in blood coagulation.
 - **Albumin** - maintains osmotic pressure of plasma, transports lipids, and steroid hormones.
 - **Globulin** - Participates in Immune System.

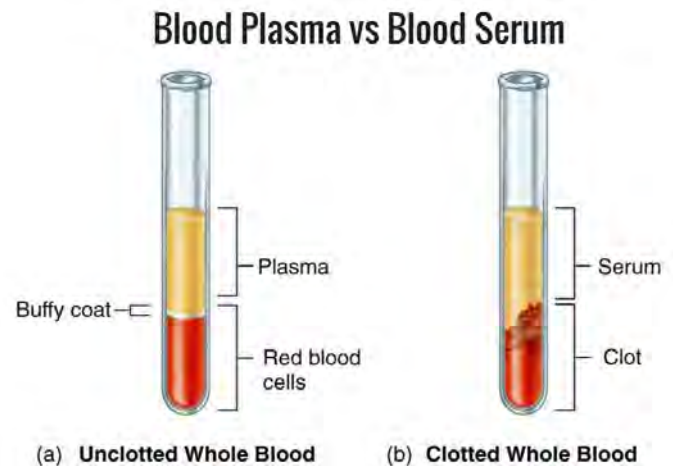
Functions of Plasma

- Maintaining a satisfactory blood pressure
- Volume to supplying critical proteins for blood clotting and immunity.
- Medium for exchange of vital minerals such as sodium and potassium
- Helps to maintain a proper ph (acid-base) balance in the body, which is critical to cell function.

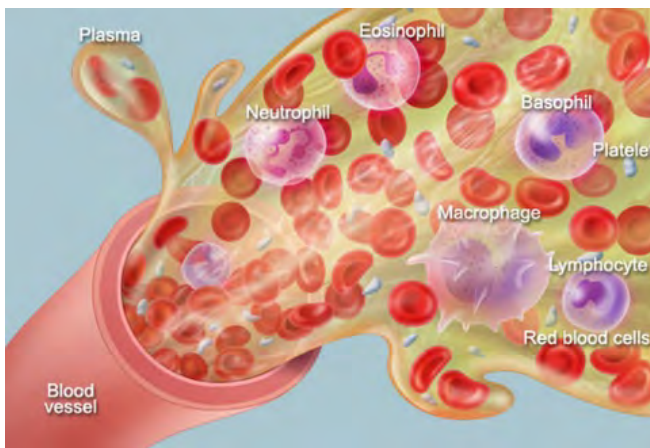


Serum

- Serum is similar to plasma, but without blood cells or a clotting factor.
- Serum will contain a lot of proteins, but not fibrinogen.
- Serology is the branch of medical science that is involved in study of blood serum.
- Serum is often used to identify blood groups, and for diagnosis of different types of diseases.



Human Blood Cell



- Red Blood Cell (RBC)
- White Blood Cell (WBC)
- Platelets

Human Red Blood Cell

From Greek erythros for "red" and kytos for "hollow vessel", with -cyte translated as "cell" in modern usage.

The most important function of red blood cells is the transport of oxygen to the tissues.

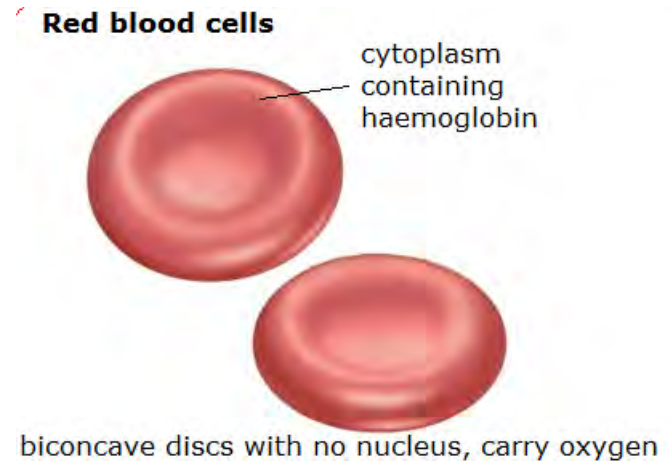
Nearly half of the blood's volume (40% to 45%) is red blood cells.

RBCs contain haemoglobin, an important pigment that absorbs oxygen in the lungs, and delivers it to tissues.

Red Blood cells collect oxygen from the lungs, travels via the heart to deliver oxygen to all the cells in the body.

Red blood cells are doughnut-shaped, but without the hole. This shape is called a bi-concave disc.

The red blood cells in mammalian vertebrates like humans do not have a nucleus when they mature.



Human Red Blood Cell – Production & Life Cycle

RBC are produced in the liver of the foetus during its embryonic life, but then is succeeded by the bone marrow for adults.

The cells develop in the bone marrow and circulate for about 100–120 days in the body before their components are recycled by macrophages.

Death: The red blood cells & platelets die in the spleen which is why it is called the “Graveyard of RBCs”

Haemoglobin

Haemoglobin is a protein which contains iron.

Red blood cells get their red colour because of the presence of haemoglobin

Haemoglobin abbreviated Hb or Hgb

Standard amount of Hb : 14.5mg of haemoglobin in every 100 ml of blood.

If the amount of Hb is lesser than this standard, it is considered anaemic.

Bilirubin

- Bilirubin is the by-product you get when red blood cells are broken down.
- It is brownish yellow in colour.
- The yellow colour of bruises, and brown colour in faeces is due to Bilirubin.
- The liver secretes bilirubin, which then goes into the bile, gallbladder, and finally into the intestines to be excreted.

- Bilirubin is excreted from the body in urine & faecal matter.
- The levels of Bilirubin are usually monitored to check for diseases.
- High levels of bilirubin in the body indicates Jaundice, which is caused when red blood cell levels are high. It causes yellow skin & eyes.

⊕ Point to Remember

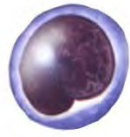
Packed red blood cells, also known as red cell concentrate and packed cells, are red blood cells that have been separated for blood transfusion.

Human White Blood Cell(WBC)

- WBCs are also called **leukocytes**.
 - From Greek leuko-, comb. form of leukos "white" (see light (n.)) + -cyte (see cyto-).
 - They are very important as they are cells of the immune system, which is responsible for fighting infections & foreign bodies.
 - They are produced in the Bone Marrow, and are present in every part of the body, in the blood & lymphatic system.
 - WBC are nucleated, meaning their cells have a nucleus.
 - They have a short lifespan of 2 – 5 days,
- ⇒ WBC are irregular in shape, and thus distinguished based on their structure and function. They are broadly classified in 5 types, namely:
- Neutrophils
 - Eosinophils
 - Basophils
 - Lymphocytes
 - Monocytes



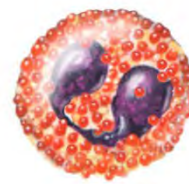
Monocyte



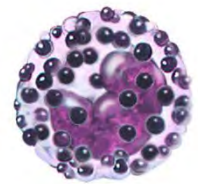
Lymphocyte



Neutrophil



Eosinophil



Basophil

- The above five can be further classified based on their structure:

Granulocytes –

Granules in their cell cytoplasm

- Neutrophils
- Eosinophils
- Basophils

Agranulocytes –

No granules in their cell cytoplasm

- Lymphocytes
- Monocytes

Lymphocytes

These are vital for producing antibodies that help the body to defend itself against bacteria, viruses, and other threats.

Neutrophils

These are powerful white blood cells that destroy bacteria and fungi.

Basophils

These alert the body to infections by secreting chemicals into the bloodstream, mostly to combat allergies.

Eosinophils

These are responsible for destroying parasites and cancer cells and they are part of an allergic response.

Monocytes

These are responsible for attacking and breaking down germs or bacteria that enter the body.

Platelets

- Platelets are irregular in shape
- Nucleus is absent
- They are produced in the bone marrow.
- The average lifespan of platelets is 3-5 days.

Function

Platelets, also called thrombocytes are a component of blood whose function (along with the coagulation factors) is to react to bleeding from blood vessel injury by clumping, thereby initiating a blood clot.

Human Blood Types

- Landsteiner discovered the common blood types A, B and O in 1901.
- Alfred von Decastello has discovered AB blood group in the year 1902.
- The term "Rh" was originally an abbreviation of "Rhesus factor."
- It was discovered in 1937 by Karl Landsteiner and Alexander S. Wiener who, at the time, believed it to be a similar antigen found in rhesus monkey red blood cells
- RH factor is present then blood will be positive and absent then it will be negative.
- When the Rh factor is present in blood, then it indicates a positive blood type, and a negative blood type when Rh factor is absent.

Blood group	Antigen(s) present on the red blood cells	Antibodies present in the serum	Genotype(s)
A	A antigen	Anti-B	AA or AO
B	B antigen	Anti-A	BB or BO
AB	A antigen and B antigen	None	AB
O	None	Anti-A and Anti-B	OO

⊕ Erythroblastosis Fetalis

Haemolytic disease of the Foetus and Newborn (HDFN) is called, “Erythroblastosis Fetalis.” It is a blood disorder that occurs when the blood types of a mother and baby are incompatible.

When two people whose blood groups have different Rh Factors, viz the father has a positive blood group, and the mother has a negative blood group.

If the conceived baby has a positive blood group, this baby is born safely. However, the mother’s body develops antibodies against the Rh factor (positive blood group)

When this happens, if the mother becomes pregnant again and the baby has a positive blood group, her WBC perceive the baby’s RBC as a foreign body, and attacks them. This baby is at serious risk of dying.

☑ At a glance: Blood Compatibility Chart for Donation

Blood Type	Donate Blood To	Receive Blood From
A+	A+ AB+	A+ A- O+ O-
O+	O+ A+ B+ AB+	O+ O-
B+	B+ AB+	B+ B- O+ O-
AB+	AB+	Everyone
A-	A+ A- AB+ AB-	A- O-

O-	Everyone	O-
B-	B+ B- AB+ AB-	B- O-
AB-	AB+ AB-	AB- A- B- O-

Blood Clotting

- A blood clot is a clump of blood that has changed from a liquid to a gel-like or semisolid state.
- Clotting is a necessary process that can prevent you from losing too much blood in certain instances, such as when you're injured or cut.
- Average time for blood clotting: 2-5 minutes.
- Thromboplastin is a plasma protein aiding blood coagulation through catalyzing the conversion of prothrombin to thrombin.
- Thrombin is a serine protease that converts fibrinogen into fibrin in blood coagulation.
- Heparin is a protein produced in the liver. It is an anti-blood clotting agent. It keeps blood in liquid form.
- Heparin becomes deactivated when thrombin is formed
- Thrombin + Fibrinogen in presence of Vitamin K makes Fibrin.
- It is an insoluble protein formed from fibrinogen during the clotting of blood.
- It forms a fibrous mesh that impedes the flow of blood.