



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A Survey of Blood and Blood Types

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Abstract :

Blood Liquid Matrix, Plasma, Forming Elements. Red blood cells (RBC), white blood cells (WBC), and platelets (platelets) constitute the building blocks. Human blood is classified into A, B, AB, and O systems based on the presence or absence of two surface antigens A, B on RBCs. Another blood grouping is also based on the presence or absence of another antigen called rhesus factor (Rh) on the surface of RBCs. The spaces between cells in tissues contain a blood-derived fluid called interstitial fluid. This fluid, called lymph, is almost identical to blood, except for the protein content and the elements it forms.

Key words: Blood, Plasma, Blood Groups, Rh Factor.

Introduction :

Blood is the most commonly used bodily fluid by most higher organisms. This is a specialized connective tissue composed of a liquid matrix, plasma and shaping elements. It is the main circulating fluid of the human body. The study of blood is called hematology. Pale red, slightly alkaline (pH 7.4), saline, viscous liquid, heavier than water. An average sized adult has about 5 liters of blood, which is about 8% of body weight. Blood carries all nutrients and oxygen to all cells. The system in which blood circulates throughout the body is called the circulatory system. The closed circulatory system was discovered by William Harvey (1628). Some animals, such as crustaceans and mollusks, use hemocynin instead of hemoglobin to carry oxygen.^[4] Insects and some mollusks use a fluid called hemolymph instead of blood. However, hemolymph is not included in the closed circulatory system. In most insects, this "blood" does not contain oxygen-carrying molecules such as hemoglobin. This is because the body is small enough for the tracheal system to supply enough oxygen.^[6]

Composition of blood : ^[1]

Blood is made up of two major components - plasma 55% and formed matter. 45%

1) Plasma :

Plasma is a straw-colored, slightly alkaline, viscous liquid. It contains 90-92% water and 8-10% solutes, mostly protein (7%). The average human plasma volume is 2.7 to 3.0 liters (2.8 to 3.2 quarts). Plasma proteins are serum albumin, serum globulin, heparin, fibrinogen, and prothrombin. Plasma also contains trace minerals such as Na⁺, Ca⁺⁺, Mg⁺⁺, HCO₃⁻ and Cl⁻. Glucose, amino acids, lipids, etc. are also present in plasma. Plasma contains blood clotting or clotting factors. Plasma that does not contain clotting factors is called serum.

2) Formed elements :

Formed elements are suspended in plasma and consist of three types: red blood cells (RBC), white blood cells (WBC) and platelets (platelets).

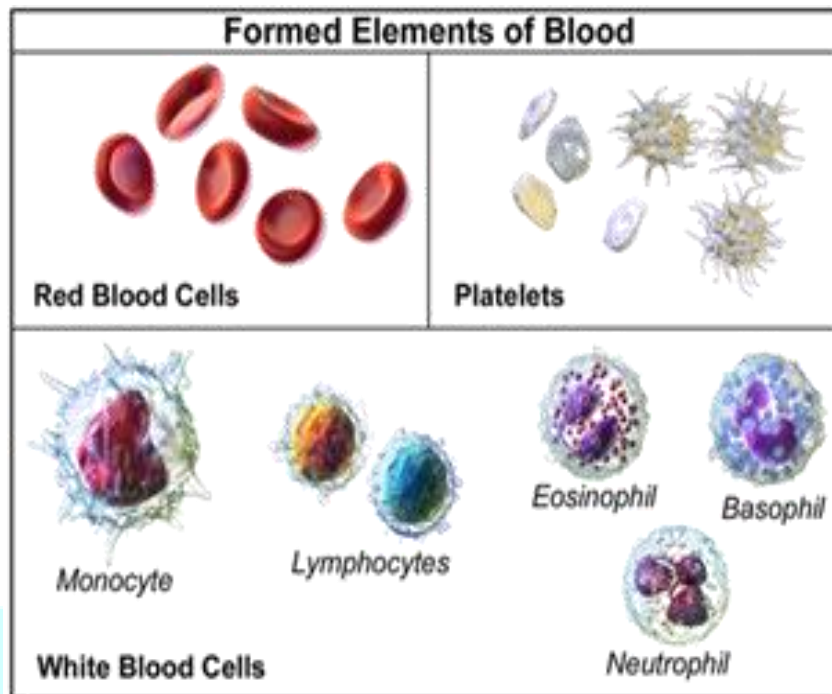
A) Erythrocytes :

Erythrocytes are round, biconcave, anucleated cells. The size is about 7 µm in diameter and about 2.5 µm in thickness. An adult male has about 5.1 to 5.8 million red blood cells per mm³ of blood, and an adult female he has 4.3 to 5.2 million red blood cells per mm³. Red blood cells have an average lifespan of about 120 days. The formation of red blood cells is called erythropoiesis. A high red blood cell count is called polycythemia, and a low red blood cell count is called erythropenia. The cytoplasm of red blood cells contains the respiratory pigment hemoglobin. Hemoglobin helps transport oxygen and carbon dioxide. The normal range of hemoglobin in an adult male is 13-18 g per 100 mL of blood, in adult females he is 11.5-16.5 g / 100 mL. Low hemoglobin leads to anemia [2].

B) Leucocytes :

Leukocytes are colorless, nucleated, amoeboid phagocytic cells. The size is about 8 to 15 µm. There are approximately 5000-9000 white blood cells per mm³ of blood. Average lifespan is about 3-4 days. The formation of white blood cells is called leukemia. An increased number of white blood cells is called leukocytosis. A decrease in the number of white blood cells is called leukopenia. Leukemia is a pathological increase in the number of white blood cells, commonly referred to as blood cancer. There are two main white blood cell categories: granulocytes and agranulocytes. Neutrophils, eosinophils, and basophils are different types of granulocytes, while lymphocytes and monocytes are agranulocytes. Neutrophils are the most abundant cells (60-65%) of all leukocytes, and basophils are the least abundant of them (0.5-1%). Neutrophils and monocytes (6-8%) are scavenger cells that destroy foreign substances that enter the body. Basophils secrete histamine, serotonin, and heparin. They are involved in inflammatory responses. Eosinophils (2-3%) resist infection and are associated with allergic reactions. Lymphocytes (20-25%) are responsible for the body's immune response.

Table 1.1 Diagrammatic representation of formed elements in blood [5]



C) Platelets :

Platelets are also called platelets. These are cell fragments produced by megakaryocytes (specialized cells in the bone marrow). Blood normally contains between 1,50,00 and 3,50,00 platelets per mm³. Platelets can release various substances, most of which are involved in blood clotting or clotting.

Blood Group ABO: [2]

A, B and O blood groups were discovered by **Karl Landsteiner** in 1900. In 1902, the AB blood type was discovered by Landsteiner's disciples, **Desctaro** and **Sturli**. Landsteiner won the Nobel Prize in 1930 for this discovery. He discovered two antigens or agglutinogens on the surface of human red blood cells, which he named antigen A and antigen B. He also named the corresponding antibodies in the serum as 'a' and 'b'. In the ABO system, blood type is determined by the presence or absence of A and B antigens, and people's blood types are divided into four groups: A, B, AB, and O.

Table 1.2 Blood groups and Donor compatibility

Blood Groups	Antigen on RBCs	Antibodies in Plasma	Donor Group
A	A	Anti-B	A, O
B	B	Anti-A	B, O
AB	A, B	Nil	AB, A, B, O
O	Nil	Anti-A,B	O

1) Blood Type A :

People with A blood type have antigens on the surface of their red blood cells and 'b' antibodies in their plasma.

2) Blood Type B :

People with blood type B have antigens on the surface of their red blood cells and 'a' antibodies in their plasma.

3) Blood Type AB :

People with blood type AB have antigens on the surface of their red blood cells and no antibodies in their plasma.

4) Blood Type O :

People with blood type O lack the A and B antigens on the surface of their red blood cells and show the presence of "a" and "b" antibodies in their plasma.

Only compatible blood can be used during transfusion. The person who donates blood is the donor and the recipient is the person who receives the blood. People with blood type O can donate blood to anyone (**universal donor**), and people with blood type AB can donate blood from anyone (**universal recipient**). [2]

Rh Factor : [3]

Is an antigen (antigen D) present on the surface of red blood cells. It is called rhesus or Rh factor because it was first discovered on the surface of her RBC in rhesus monkeys by **Landsteiner and Wiener (1940)**.

People with Rh factor (D antigen) are called Rh positive (Rh+ve), and people without D antigen are called Rh negative (Rh-ve). The Rh factor is important in blood transfusions. Rh antigens induce potent immunogenic responses when introduced into Rh-ve individuals. A fetus with **hemolytic disease of the newborn (HDN)** or **erythroblastosis** occurs when a Rh-ve mother delivers her Rh+ve fetus.

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