Lecture three

The Blood

Blood is a connective tissue, made of fluid (plasma) and cellular elements (RBC, WBC and platelets).

Components of Blood:

I. Formed elements:

a. Red blood cells [RBCS] = **Erythrocytes**

b. White blood cells [WBCS] = **Leucocytes**

c. Platelets = **Thrombocytes**

Blood cells become packed at the bottom of the test tube when whole blood is centrifuged, leaving the fluid plasma at the top of the tube.
Red blood cells are the most abundant of the blood cells. White blood cells and platelets form only a thin, light-colored —buffy coat at the interface between the packed red blood cells and the plasma.

II. Plasma: Viscous fluid obtained from the blood which is prevented from clotting.

Its accounts for about **55%** of blood; the formed elements make up about 45**%**of the total volume of blood.
It is composed of: a.

a. Water: about 97% of plasma is water, which form the intravascular component of the extracellular fluid.

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c. **Plasma proteins :** dissolved proteins that serve for different functions as follows :

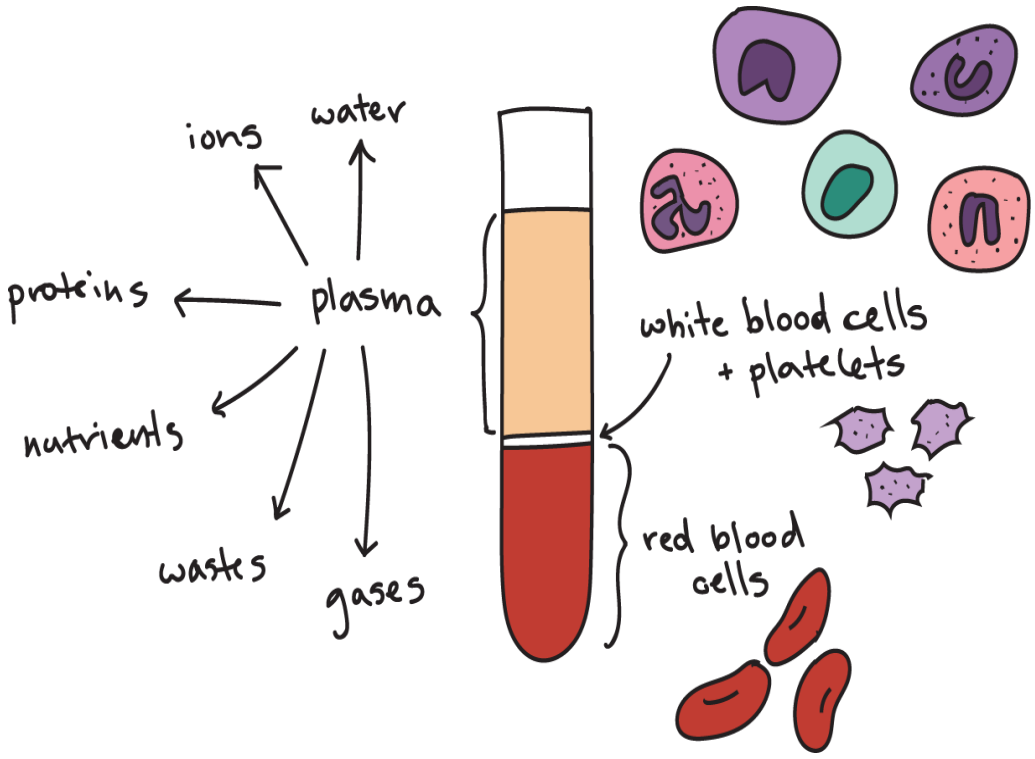
Albumin: the most numerous plasma proteins that serve mainly for **transport** of hormones, drugs, and biologically active substances. Plus its regulatory effect on **blood volume** (osmotic pressure –oncotic pressure).
Globulin: that serves for **immune** functions.

Fibrinogen: That serves for **blood clotting** and homeostasis.

Serum: **Is plasma without the clotting proteins.**

Plasma–Fibrinogen = Serum.

d. Organic materials: such as glucose, amino acids, and fats.
e. Nonorganic materials: such as ions (sodium, potassium, calcium, Chloride & bicarbonate)
f. Others: hormones & blood gases.



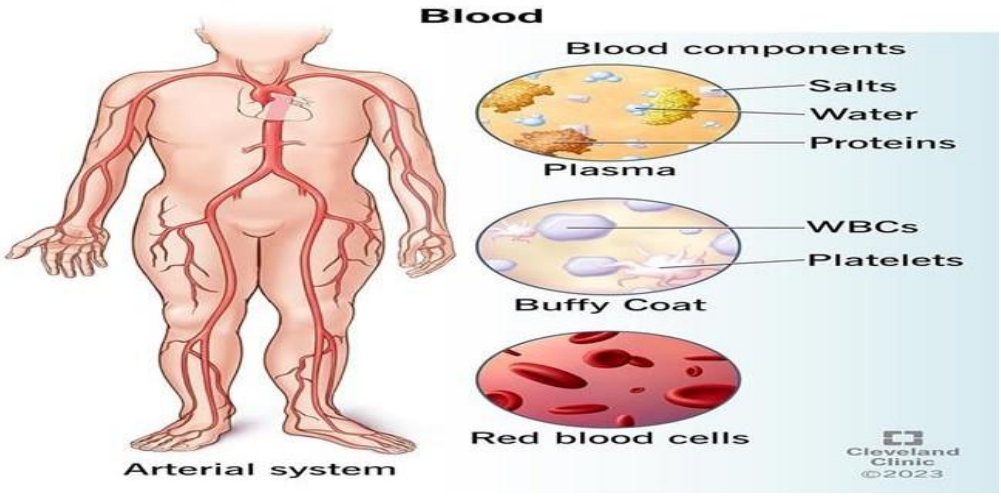
Functions of Blood:

1. **Transportation**:
   a. **Oxygen** from lungs to body cells
   b. **Carbon dioxide** from body cells to lungs
   c. **Nutrient** from GI tract to body cells
   d. **Nitrogenous wastes** from body cells to kidneys
   e. **Hormones** from glands to body cells

2. **Regulation (Maintenance of homeostasis)**
3. **Protection**

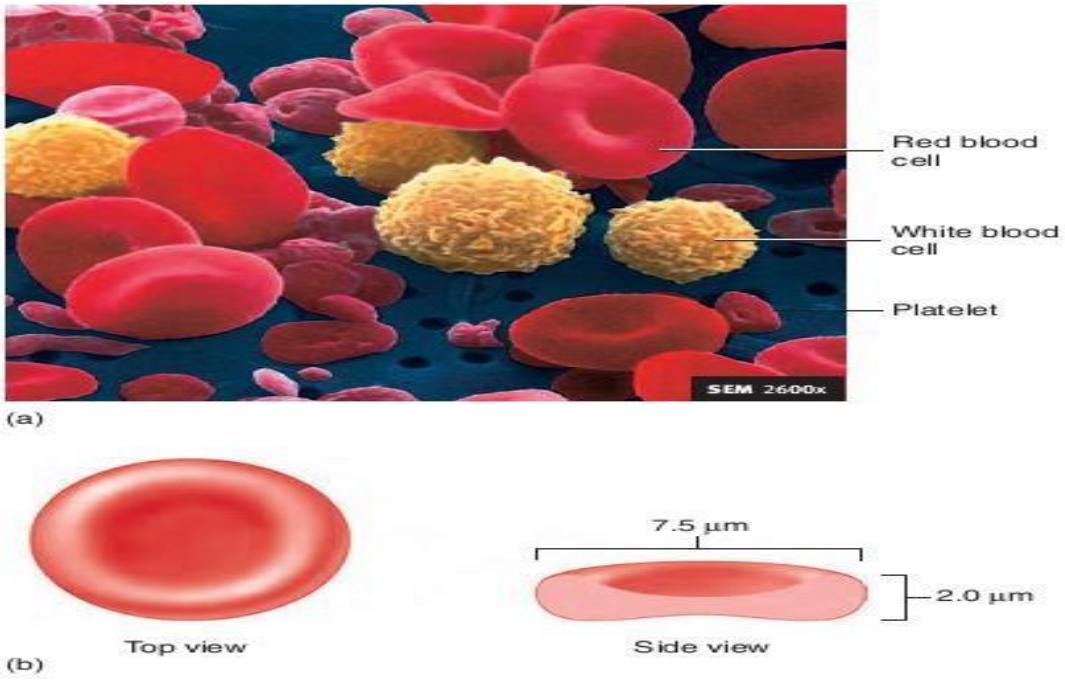
   a. **Clotting** against blood loss by (platelets and clotting proteins)

   b. **Immunity** against many disease-causing agentsby (leukocytes, antibodies, complement proteins)



Lecture four:

Erythrocytes (Red blood cells):



Erythrocytes: (General features):

1- Erythrocytes are flattened, biconcave discs about **7 µm** in diameter and **2.2** µm thick. Their unique shape relates to their function of transporting oxygen.
2- The average volume of the RBC is **90 to 95 cubic micrometers**.
3- Each erythrocyte contains approximately **280 million hemoglobin molecules,** which give blood its **red color**.
4- A healthy man has **5.4 million RBCs/ mm^3** of blood and a healthy woman has 4.8 million RBCs/mm^3 of blood.
5- Erythrocytes **lack nuclei** and **mitochondria** (they obtain energy through anaerobic metabolism).

6- Erythrocytes have a relatively short circulating life span of only about **120** days.

7- The **shapes** of RBCs can **change** remarkably as the cells **squeeze** through capillaries. Actually, the RBC is a (bag) that can be deformed into almost any shape.

8- Older erythrocytes are removed from the circulations by phagocytic cells in the liver, spleen, and bone marrow.

9- Persons living at high altitudes have greater red blood cells.

Majors Functions of RBCs:

1- Transport hemoglobin, which, in turn, carries oxygen from the lungs to the tissues.

2-They contain a large quantity of carbonic anhydrase, an enzyme that catalyzes the reversible reaction between carbon dioxide (CO2) and water (H2O) to form carbonic acid **(H_2CO_3)**.
Reaction makes it possible for the water of the blood to transport enormous amount of CO2.

3-The RBCs are responsible for most of the acid- base buffering power ofwhole blood.

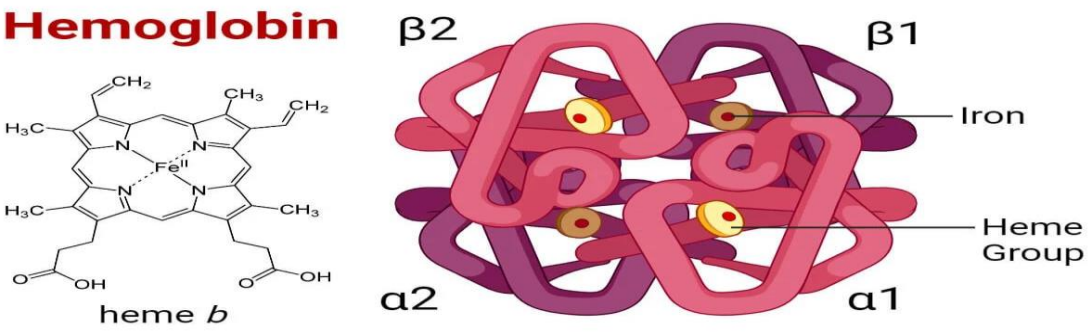
Hemoglobin molecule:

Hemoglobin is a pigment found only in red blood cells (that is naturally colored because of its iron content)

It appears reddish when combined with **O_2** and bluish when deoxygenated. Thus, fully oxygenated arterial blood is red, and venous blood, loaded at the tissue level, has a bluish color.
Cause it has lost some of its **O_2**.

The structure:

Hemoglobin comprises four subunits, each having one polypeptide chain and one heme group.



ABO system:

A system to identify the antigen on the surface of the blood cell of human being , also called **the blood type**.

ABO system (General observation):

1- There are several groups of red blood cell antigens, but the major group is known as the **ABO system**.
In terms of the antigens present on the red blood cell surface, a person may be **type A (with only A antigens), type B (with only B antigens), or type O (with neither A nor B antigens).**

2- Each person's blood type A, B,or O denotes the antigens present on the red blood cell surface.

3- Each person inherits two genes (one from each parent) that control the production of the ABO antigens.

4- The genes for A or B antigens are dominant to the gene for O.

5- The **O** gene is recessive, simply because it doesn't code for either the A or the B red blood cell antigens.

6- The genes for A and B are often shown as $\mathbf{I^A}$ **and** $\mathbf{I^B}$, and the recessive gene for **O** is shown as the lower-case **i**.