

**Ministry of Higher Education and Scientific Research**

**Al-Mustaqbal University College**

**Intelligent of Medical Systems Department**

**Subject: General Biology**

**Class: 1<sup>st</sup>**

**Lecture Number: 4**

**Lecture Title: The Blood**

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## **The blood:-**

-Blood is specialized connective tissue consisting of cellular elements suspended in plasma.

-The cells make up approximately 45% of the total blood volume.

-The blood is one of the largest organs of the body, which a volume of about 5 liters & a weight of 5.5 kg an average 70 kg man.

-Normal peripheral blood is composed of three types of cell, red blood cells, white blood cells & platelets, suspended in a pale yellow fluid called plasma.

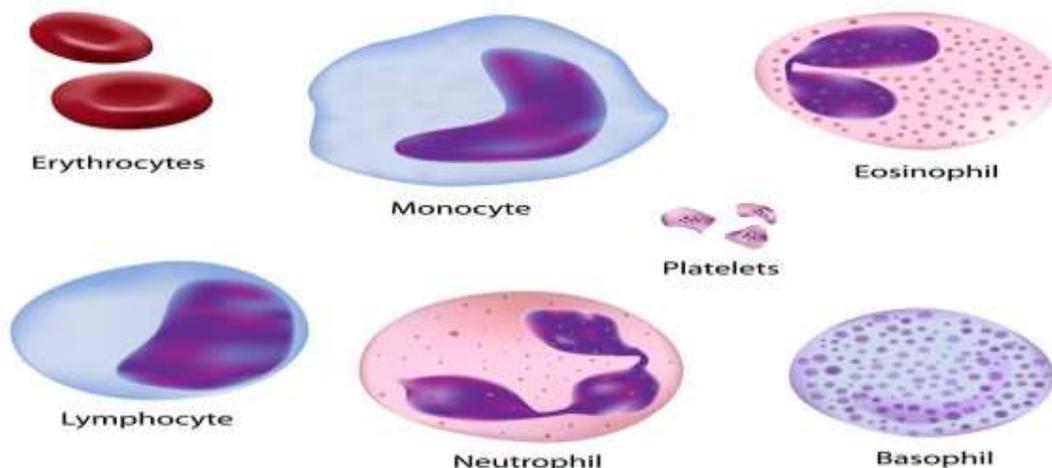
### **(1) The cellular elements:-**

A- Red blood cells (erythrocytes)

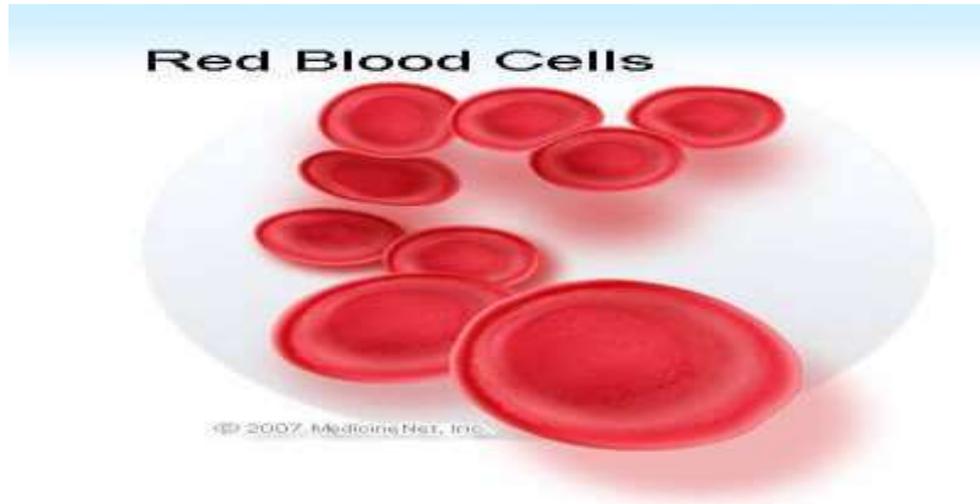
B- White blood cells (leucocytes)

C- Platelets.

## **The Elements of Blood**



### (A) Red blood cells (RBCs) :-



- Mature RBCs, or erythrocytes, are the most numerous of the blood cells: about  $5 \times 10^{12}$  normally are present in each liter of blood.
- RBCs are biconcave discs approximately 7.5 micron in diameter and 2 micron thick, but their extreme pliability allow them to squeeze through capillaries less than 5-micron diameter.
- Red blood cells survive in the circulation for about 120 days before being sequestered in the spleen & consumed by the phagocytic cells of the reticuloendothelial system.
- Less than 1% of RBCs are the newly formed reticulocytes, which take 1-2 days to develop into mature red cells.
- The red cell membrane is freely permeable to water & anions (chloride & bicarbonate) transverse the membrane in less than second, & is relatively impermeable to cations.
- The major function of red cells is to transport hemoglobin, which in turn carries oxygen from the lungs to the tissues & transport  $\text{CO}_2$  from tissues back to the lungs.

-Red blood cells contain a large quantity of carbonic anhydrase, which catalyzes the reaction between  $\text{CO}_2$  & water, increasing the rate of this reaction many thousand fold.

-The rapidity of this reaction make it possible for the water in blood to react with large quantities of  $\text{CO}_2$  & thereby transport it from the tissues to the lungs in the form of the bicarbonate ion ( $\text{HCO}_3^-$ ).

-The percentage of the total blood volume comprised of red blood cells is called the hematocrit, & this is normally about 40% in women & about 45% in men.

### **(B):-White blood cells ( leukocytes ) :-**

-The leucocytes are the mobile units of the body's protective system.

-They are formed partially in the bone marrow (the granulocytes & monocytes, & a few lymphocytes) & partially in the lymph tissue (lymphocytes & plasma cells), but after formation they are transported in the blood to the different parts of the body where they are to be used.

-The number of white blood cells in the blood is normally only 1/600 the number of red blood cells.

### **-Leucocytes are of two main types :-**

- (1) Granular leucocytes.
- (2) A granular leucocytes.

(1):- Granular leucocytes :-

-Are the most numerous. Always contain specific granules, & they are characterized by the presence of many lobed nucleus for this reasons they are referred to as Polymorphonuclear leucocytes.

**There are three types of granular leucocytes :-**

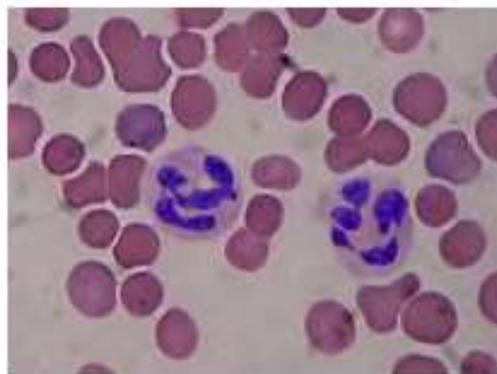
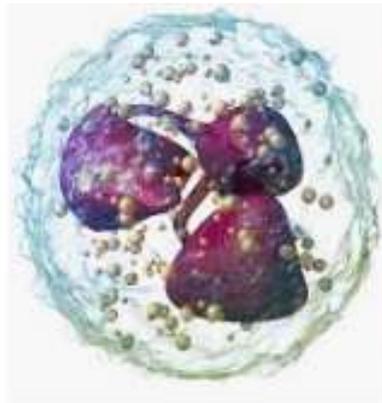
(a):-Neutrophils (b):-Eosinophils (c):-Basophils.

**(a):-Neutrophils :-**

-They are the most numerous of the leukocytes in human blood, which constitute 50-70% of the total white blood cells.

-The neutrophil nucleus is highly polymorphous Which usually consist of from **3 to 5** irregular ovoid lobes connected by a thin chromatin strand.

-Neutrophil cytoplasm contains numerous fine neutrophil granules, which are special types of lysosomes that contains principally hydrolytic enzymes.



-Neutrophils constitute the first line of defense against invading organism so the main function of neutrophils is bacterial killing by phagocytosis.

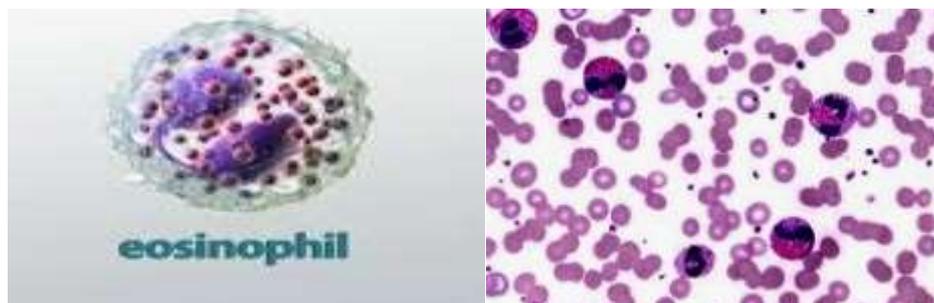
-Neutrophils are highly mobile, highly phagocytic, & are attracted out of the blood into tissue areas where tissue destruction is occurring by a process called chemotaxis, which means attraction by the destruction products from the damaged tissues.

**(b):-Eosinophil :-**

-They normally constitute about 1 to 4 percent of the total white blood cells.

-The nucleus is usually **bilobed**.

-This name is derived from the staining Characteristic of the large cytoplasmic granules of uniform sized which stain strongly with the acidic dye eosin.



-Eosinophils are produced in large numbers in persons with parasitic infections.

-The parasites are usually too large to be phagocytized, but the eosinophils attach themselves to the surface & release lethal substances that can kill many of the parasites.

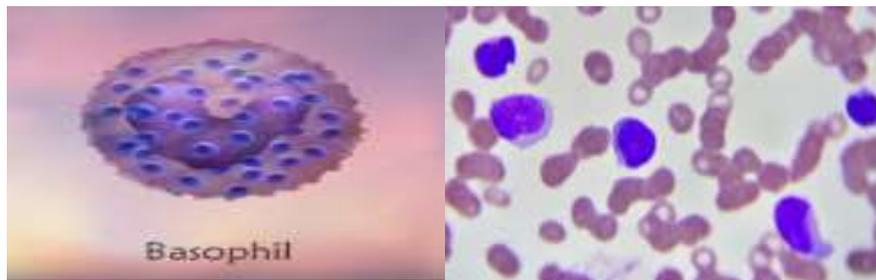
-Large numbers of eosinophils also appear in the blood in allergic conditions & may help detoxify toxins that are released by allergic reactions.

**(c) Basophils :-**

-These cells are difficult to find in human blood, since they constitute only about 0.5 to 1 percent of the total number of leucocytes.

-The nucleus often is irregular in outline & partially constricted into two lobes (**S shape like**).

-The cytoplasmic granules are round & variable in size, which stain with basic dyes.



-The basophils are very similar to mast cells located immediately outside many of the capillaries in the body.

-Basophils & mast cells are important for allergic reaction.

-Also, basophils & mast cells liberate heparin into the blood, a substance that can prevent blood coagulation. As well as histamine.

-Basophils differ from neutrophils in that they are not phagocytic.