Ministry of Higher Education and Scientific Research

Al-Mustaqbal University

College of Health and medical Techniques

Radiology Technique Department

Subject: Theoretical Physiology

Class: 1st

Lecture Number: 1

Lecture Title: Blood Physiology I

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(Blood physiology)Or "Haematology "

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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.

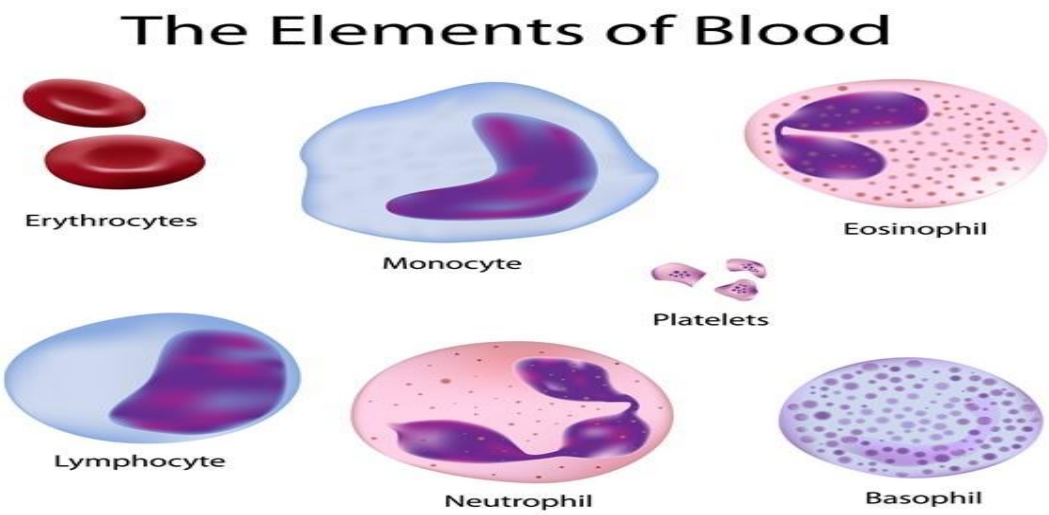
-Normal peripheral blood is composed of **three** types of cell, red blood cells, white blood cells & platelets, suspended in a pale yellow fluid called plasma.

(1) The cellular elements:-

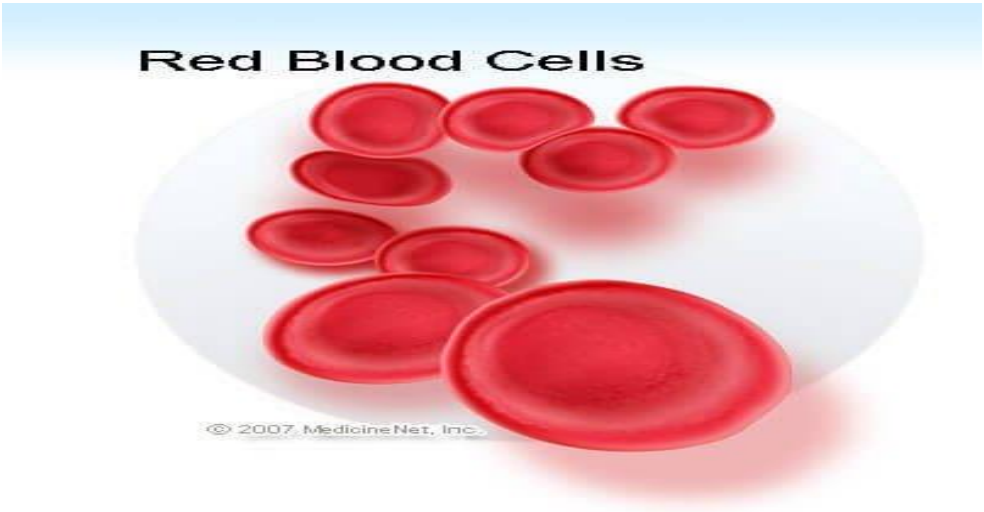
A- **Red blood cells (erythrocytes)**

B- White blood cells (leucocytes)

C- Platelets.



(A) Red blood cells (RBCs) :-



-Mature RBCs, or erythrocytes, are the most numerous of the blood cells: about $5x10^{12}$ 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..

-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 CO_2 from tissues back to the lungs.

-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 (leucocytes) :-

-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 :-

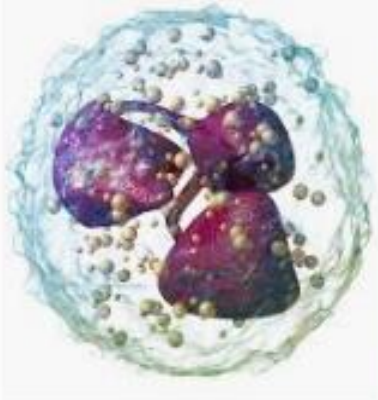
(a):-Neutrophils (b):-Eosinophils (c):-Basophils.

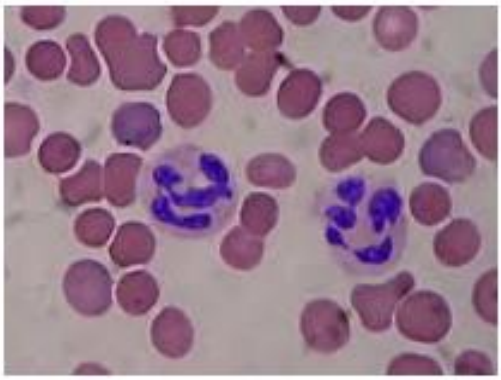
(a):-Neutrophils :-

-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.

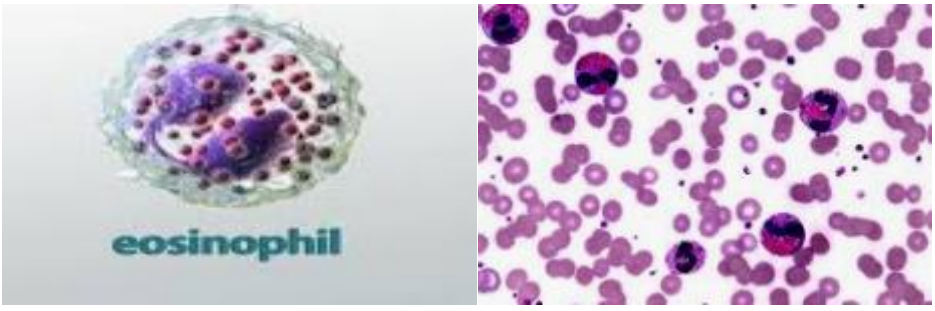
-Neutrophils are highly mobile, highly phagocytic, & are attracted out of the blood into tissue areas where tissue destruction is occurring by a process called chemotaxis, which means attraction by the destruction products from the damaged tissues.

(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.

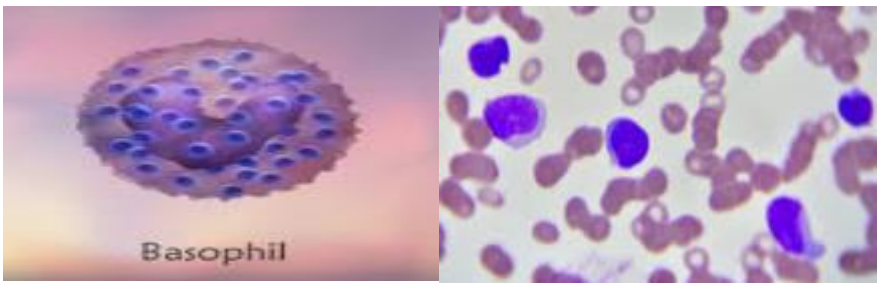
-Large numbers of eosinophils also appear in the blood in allergic conditions & may help detoxify toxins that are released by allergic reactions.

(c) <u>Basophils :-</u>

-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 no phagocytic.