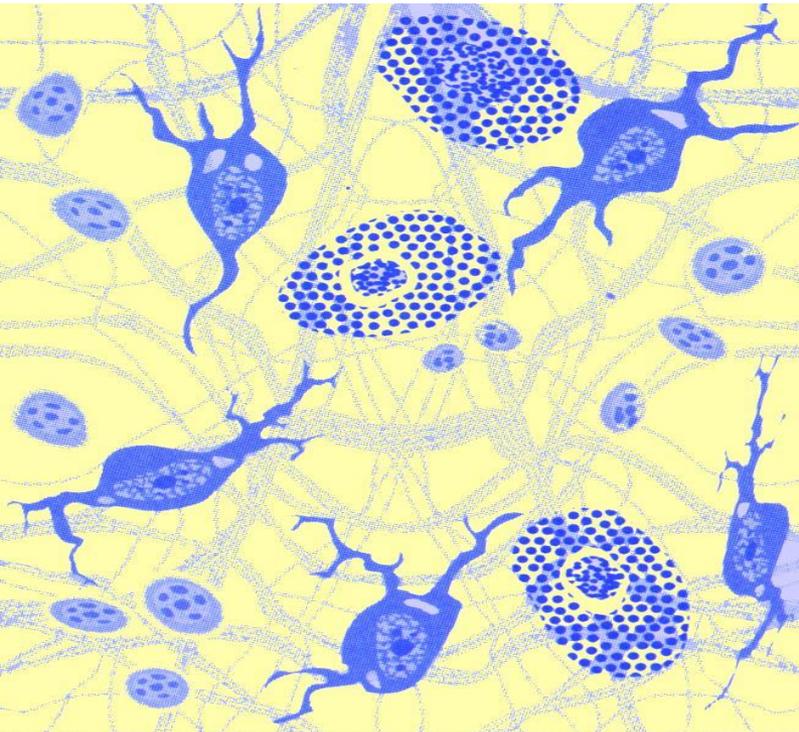




Medical Biology – Year 1



Chapter 2: **The Blood Tissues**

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Objectives

- Identify the blood tissue.
- Identify the component of blood tissue.
- Identify the blood cells types, characterization and function



Blood tissue

The blood is a specialized fluid connective tissue, circulates through the cardiovascular system, composed of connective tissue cells, **erythrocytes and leukocytes, fluid ground substance (plasma), and strands of C.T fibers (fibrin)**.

Functions of the blood:

- 1- Carry the nutrient and oxygen molecules directly or indirectly to all the cells of the body.
- 2- Carry the waste products and carbon dioxide molecules away from the body cells.
- 3- Carry the hormones and other regulatory agents from a secretory cells to the tissues of the body.
- 4- Play a thermo-regulatory role and a buffering medium to maintain the homeostasis (balance of the elements) in the body.
- 5- Transports a protecting agents and a defense cells to different parts of the body.



Components of Blood

Centrifugation of a volume of blood in a hematocrit tube consists of heparin (anticoagulants substance) results in separation of the blood into three distinct layers.

1- Plasma :- 58% of whole blood volume

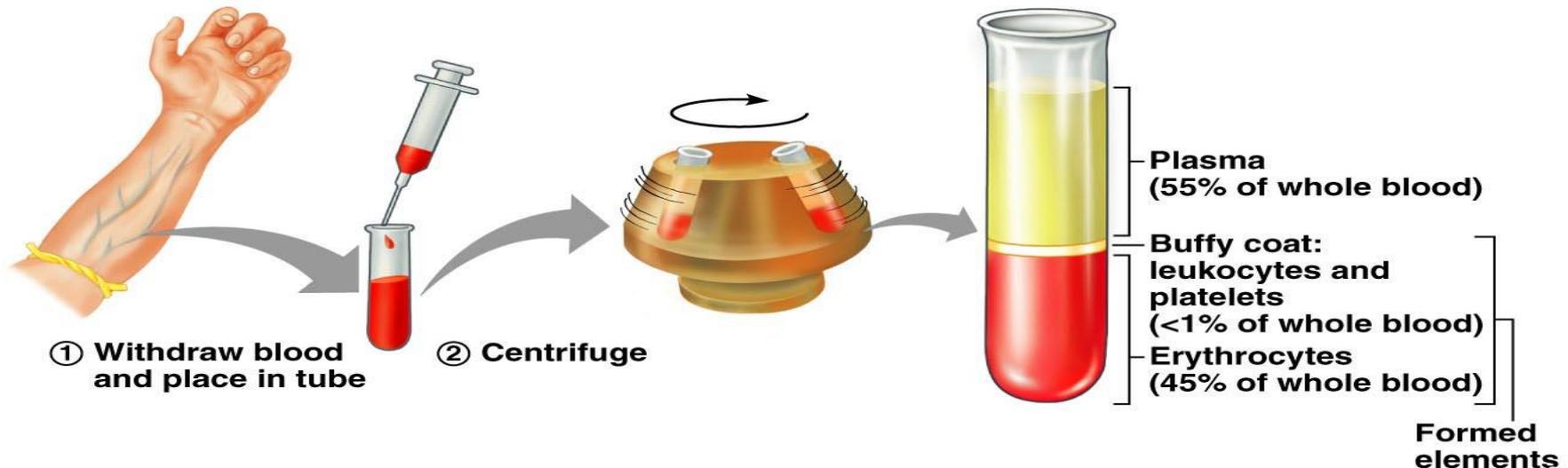
92% H₂O, 7% Proteins, 1% dissolved substances (organic molecules, ions, gasses)

2-Buffy coat :- (platelets and leukocytes (WBCs))

less than 1% of whole blood volume

3- Erythrocytes :- (red blood cells (RBCs))

42% of whole blood volume

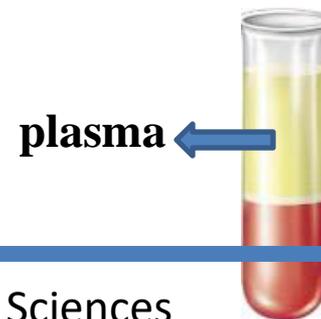


Blood plasma:

- ❑ The liquid in which peripheral blood cells are suspended.
- ❑ Composed of **water, electrolytes** such as Na^+ and Cl , (0.9%), **7% plasma proteins** (such as **albumin, fibrinogen, globulins**), **hormones, fats, amino acids, vitamins carbohydrates, lipoproteins** as well as other substances. The normal plasma volume is 40 ml/kg of body weight.

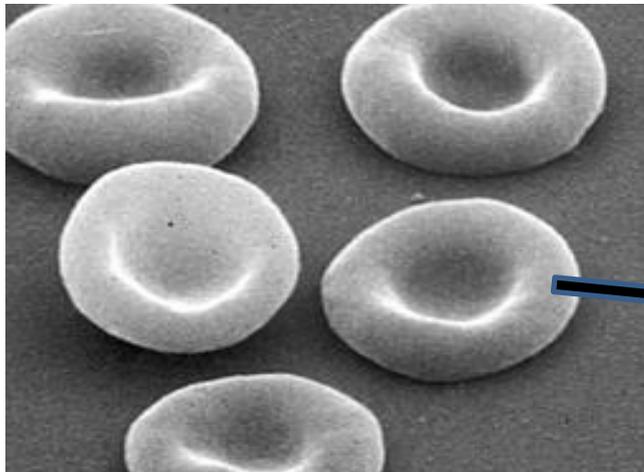
Functions:

- The plasma carries the nutrient materials, metabolites, antibodies, hormones, proteins of blood clotting system and other molecules, throughout the body.
- Blood plasma plays an important role in regulating the body temperature.

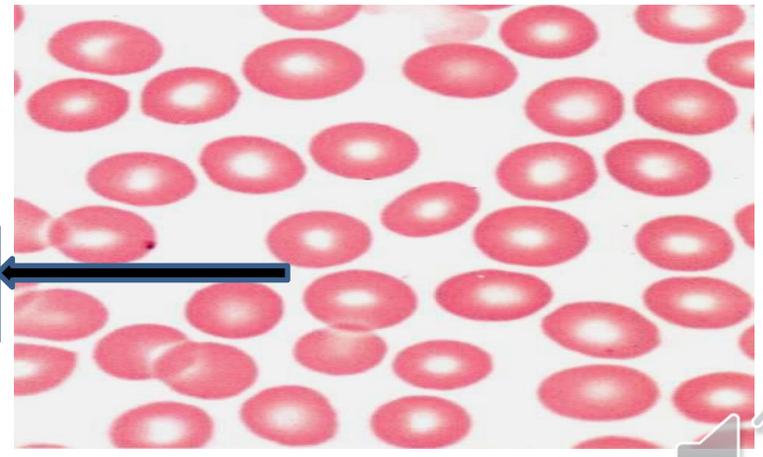


The red blood cells (The erythrocytes):

- **A normal red blood cell** is a biconcave disk to achieve a maximum surface area to cytoplasmic volume ratio, to facilitate gas exchange.
- In addition to the **nucleus**, the mature erythrocyte also **loses its Golgi apparatus, centrioles, ER** and most of its **mitochondria** to become a sac-like structure contains 34 % solution of hemoglobin, the oxygen carrier protein, and special enzymes to direct the metabolic pathway of the cell.
- The erythrocytes are with quite flexible cell membranes to adapt small and irregular shape capillaries to transport O₂ and Co₂ to and from the lungs.

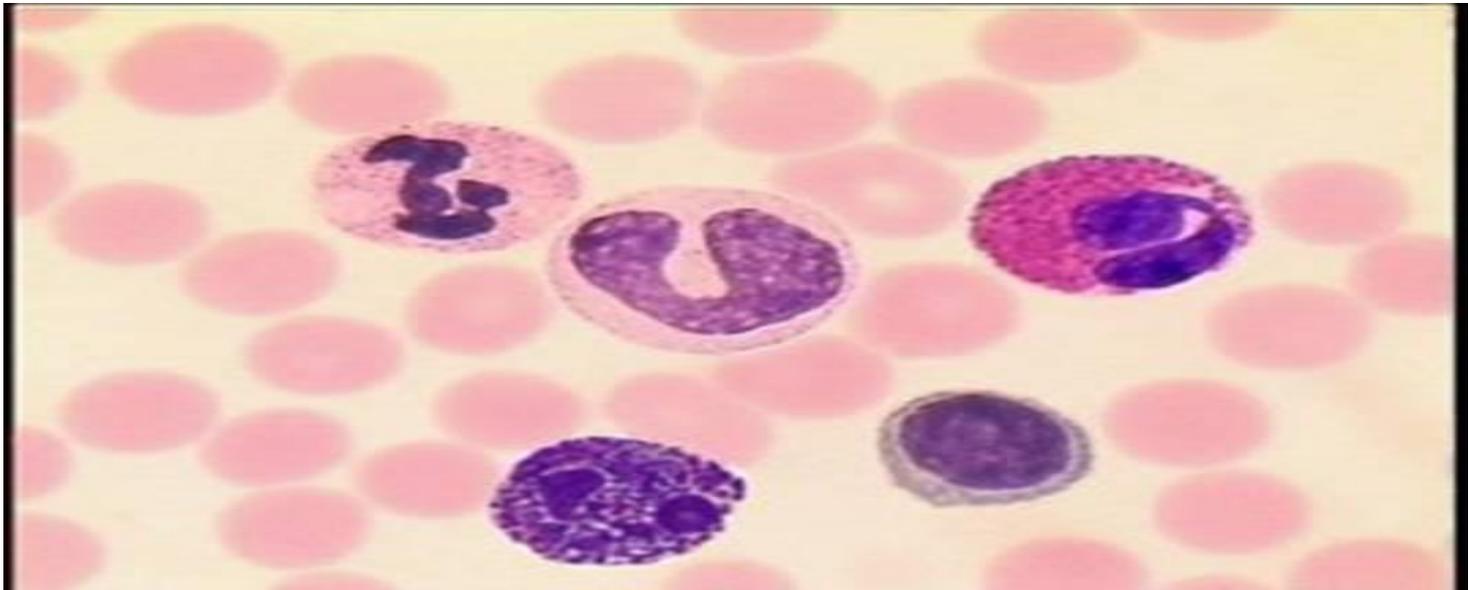


erythrocyte



The white blood cells (The Leukocytes:):

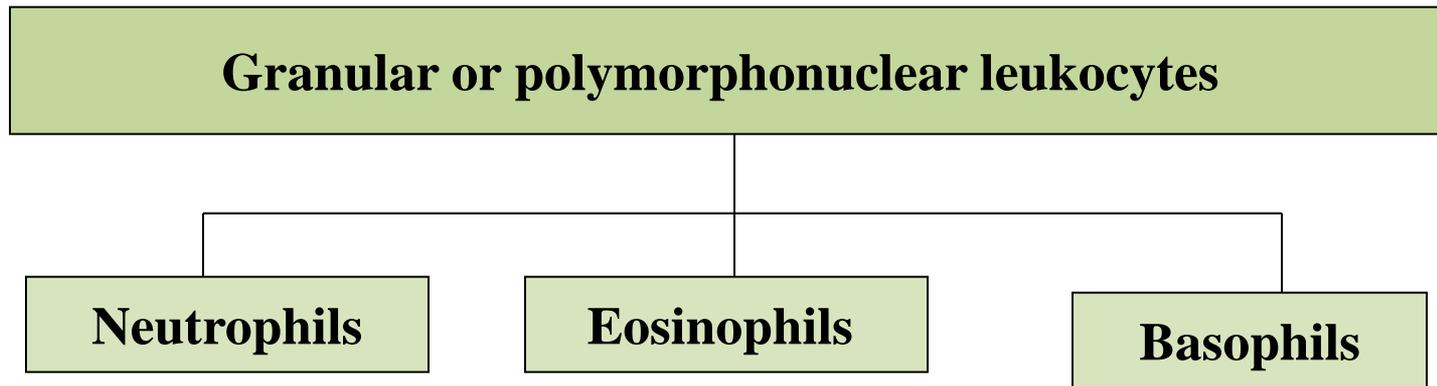
- **The leukocytes** or the white blood cells are **colourless cells**, have **nuclei and cytoplasmic organelles**, accounts < 1% of the total blood volume, have a number of 4800-10800 per ml, arise in the bone **marrow and lymphoid tissue** to enter the blood stream during their maturation process.
- **leukocytes** are cells of the immune system which defend the body against both infectious disease and foreign materials.



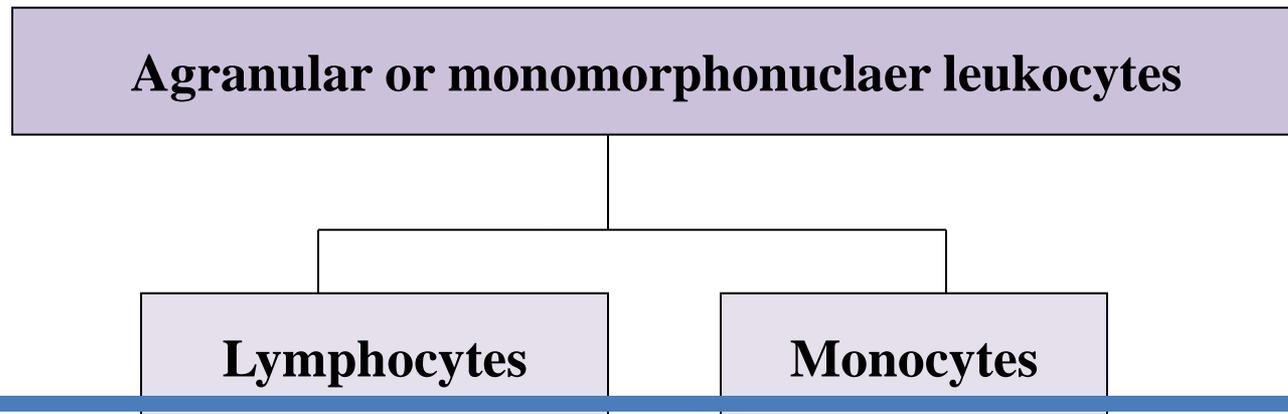
Classification of leukocytes:

The leukocytes can be classified according to their cytoplasm consistency of specific granules, and the morphology of their nuclei into different types:

1-



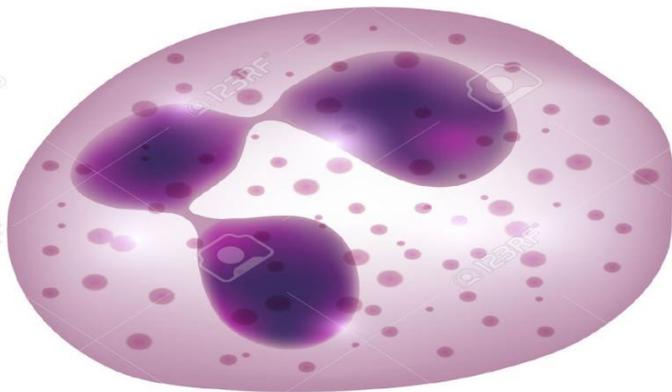
2-



Neutrophils:

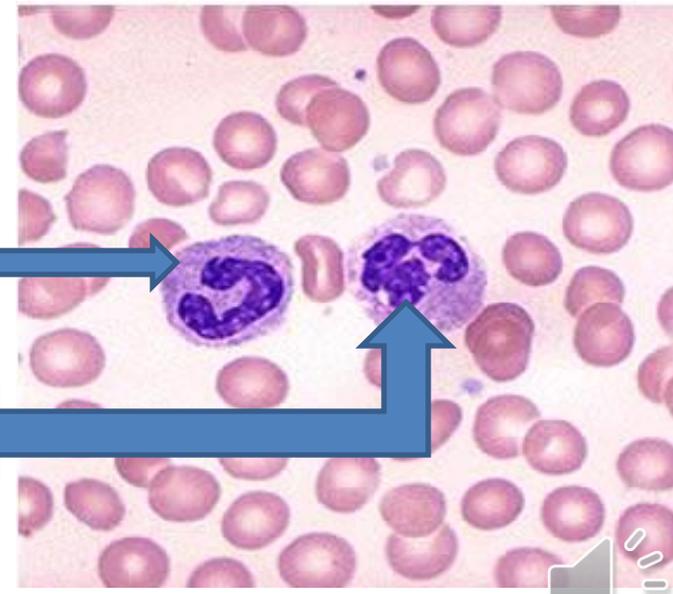
- ❑ It is characterized by a **prominent nucleus segmented into 2-5 lobes** joined by extremely **fine nuclear strands**, while the **immature neutrophils have non-segmented S – shaped or horse shoe like nuclei**.
- ❑ The **cytoplasm** is filled with specific **fine granules**, take up both the basic (**blue**) and acidic (**red**) dye, giving a violet colour. Some of these granules have a hydrolyzing role and others contain antibiotic-like proteins.
- ❑ **Neutrophils** are the first line of defense against microorganisms, especially bacteria.

NEUTROPHIL



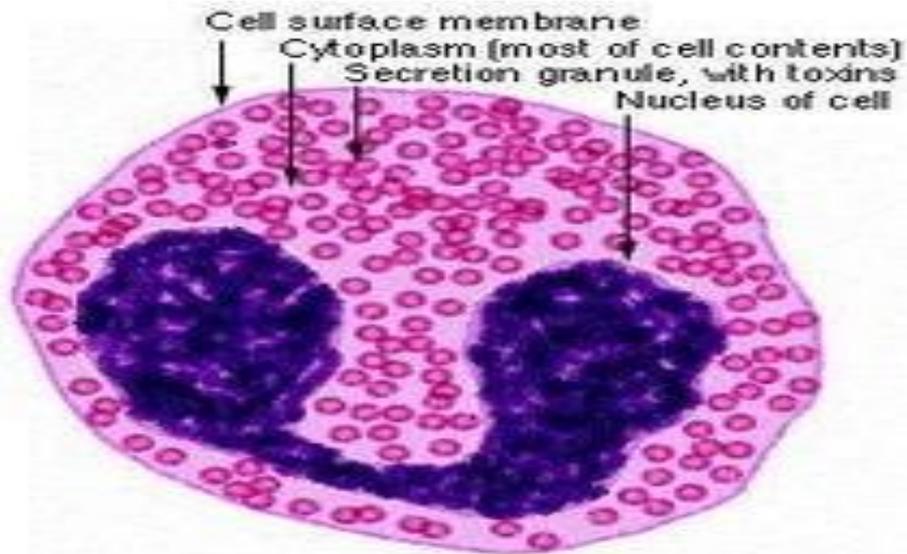
immature
neutrophils

mature
neutrophils



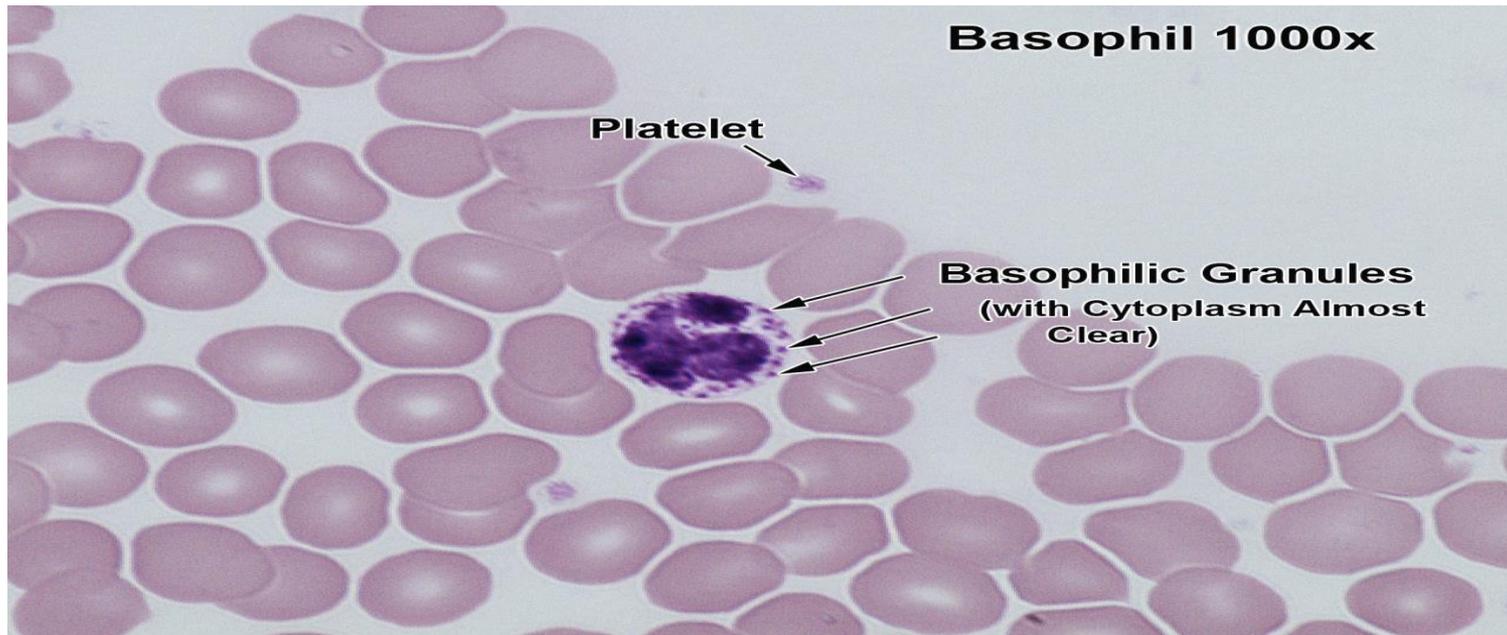
Eosinophils

- ❑ The cells contain a **bilobed nuclei connected** by a band of nuclear material.
- ❑ The **cytoplasm** is packed with large specific **pink granules**, acidophilic granules are lysosomes which contain peroxidase, histaminase, and other hydrolytic enzymes.
- ❑ They are increased in some parasitic infections, in allergic responses to a variety of stimuli including pollen, some drug reactions.



Basophils:

- ❖ **Basophils** has a **nucleus containing 2-3** lobes which are often difficult to see because of the large, **dark-staining specific granules**.
- ❖ The **cytoplasm** contains **large, coarse, purple, histamine-containing granules**, have an affinity for the basic dyes and have a vasodilator effect to attract other WBCs for the inflammatory areas.
- ❖ **Basophils** are phagocytic cells, are increased at inflamed and infected sites and play allergic role control.

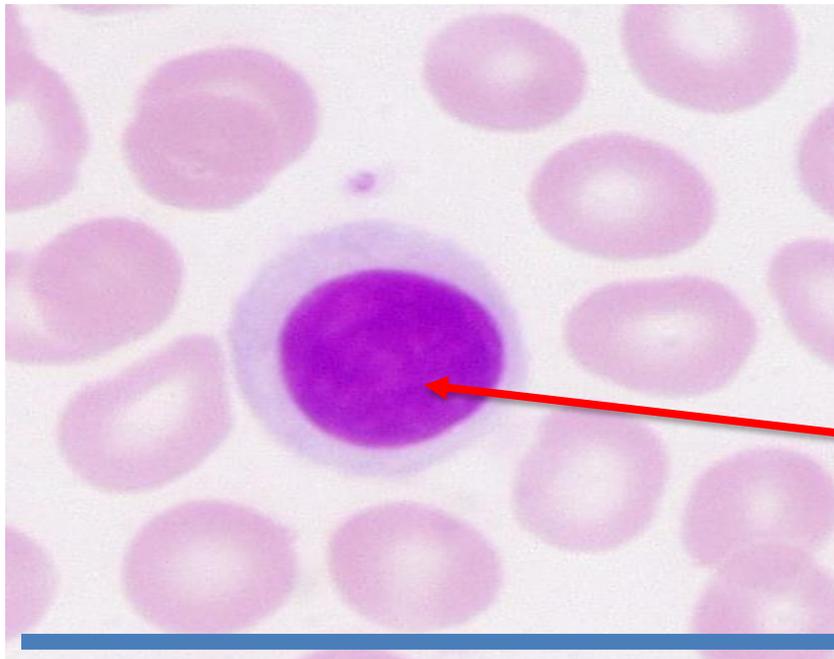


Basophil



Lymphocytes

- ❑ **Lymphocyte** contain a **single, deeply-stained, spherical nucleus**, the chromatin in the nucleus is condensed into coarse clumps. The nucleus is surrounded by a thin rim of lightly basophilic cytoplasm in the smaller types.
- ❑ The **cytoplasm** is more abundant in the larger lymphocytes.
- ❑ The **cytoplasm** may contain a few **nonspecific granules (lysosomes)**, a few **mitochondria, many ribosomes, and a Golgi apparatus**.
- ❑ The **lymphocytes** have immune responses in the body against the bacterial or viral invasion .



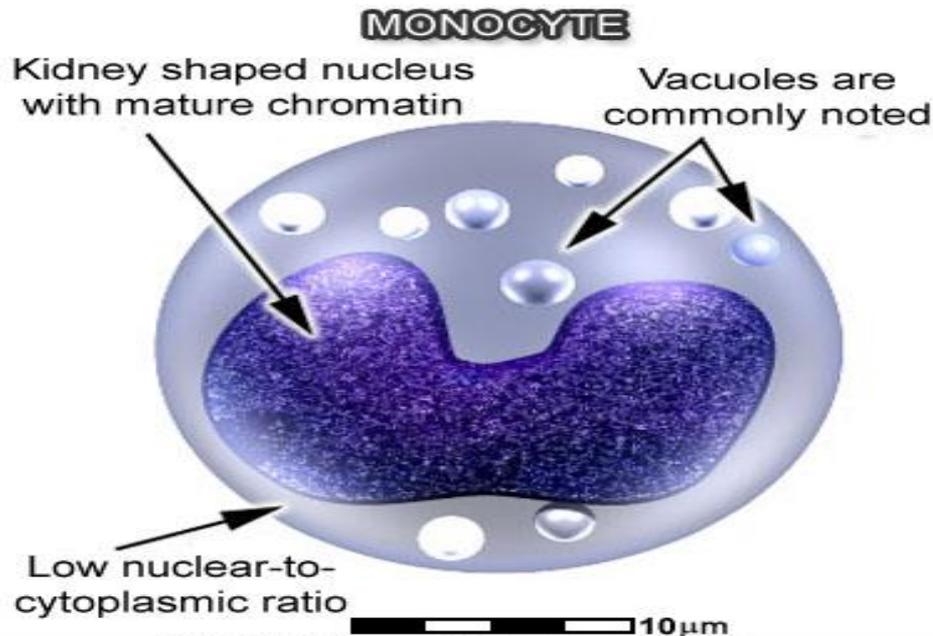
Nucleus



Monocytes:

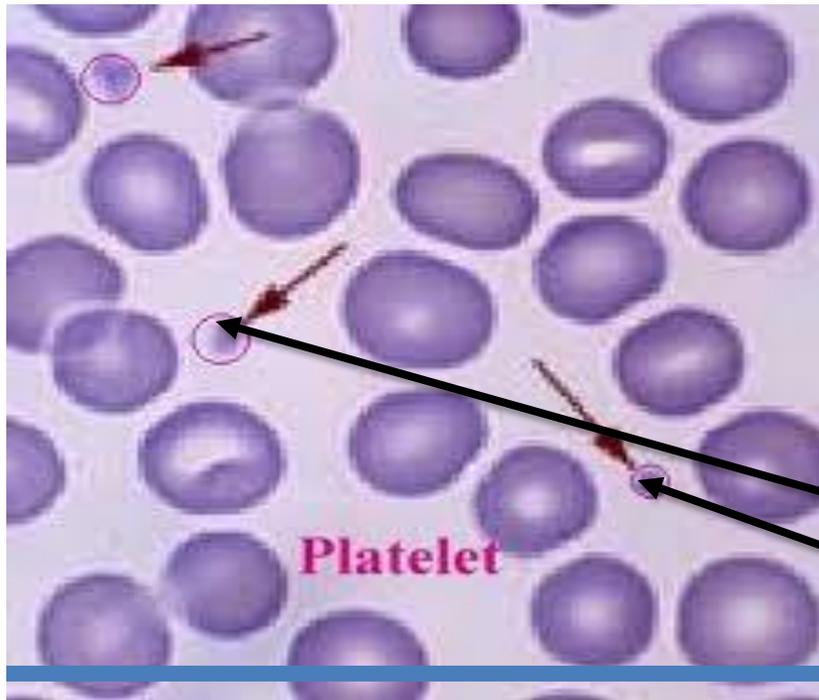
- ❑ They are the largest cell in the peripheral blood. They contain **Eccentric kidney-shaped nuclei have less condensed chromatin material.**
- ❑ The cytoplasm is **pale** and may contain fine **nonspecific granules (lysosomes)**, small amounts of RER, free ribosomes, polyribosomes, and a well-developed Golgi apparatus.

Monocytes belong to the monocuclear-phagocyte system. These cells leave the blood and enter the tissue, differentiating into macrophages or tissue histiocytes.



Platelets (Thrombocytes) :-

Platelets are non-nucleated flat, biconvex, round or ovoid disks (2-5 μm diameter); derived from bone marrow **megakaryocytes**. Platelets are involved in hemostasis (stopping bleeding). Platelets aggregate on damaged endothelium to fill the gaps in the wall of the blood vessels, that help in stop leakage of the blood by formation of fibrin from the plasma proteins.



Platelets

