Anatomy and Physiology

For

The First Class

2nd Semester

HEMATOLOGIC SYSTEM

Leucocytes = White blood cells (WBC)

Leucocytes = White Blood Cells (WBC)

- Leucocytes are the largest blood cells.
- They account for only about 1% of the blood volume.
- **Leucocytes are different from erythrocytes in several ways**:

1. They are true cells, each leucocyte having a nucleus, mitochondria, and other organelles.
2. They do not contain Hb.
3. Leucocytes can actively move while erythrocytes do not have mobility of their own.
4. Normally erythrocytes do not leave the vascular system but leucocytes can leave vessels and enter the surrounding tissue.
5. Most leucocytes have a relatively short life span.

Types of WBC

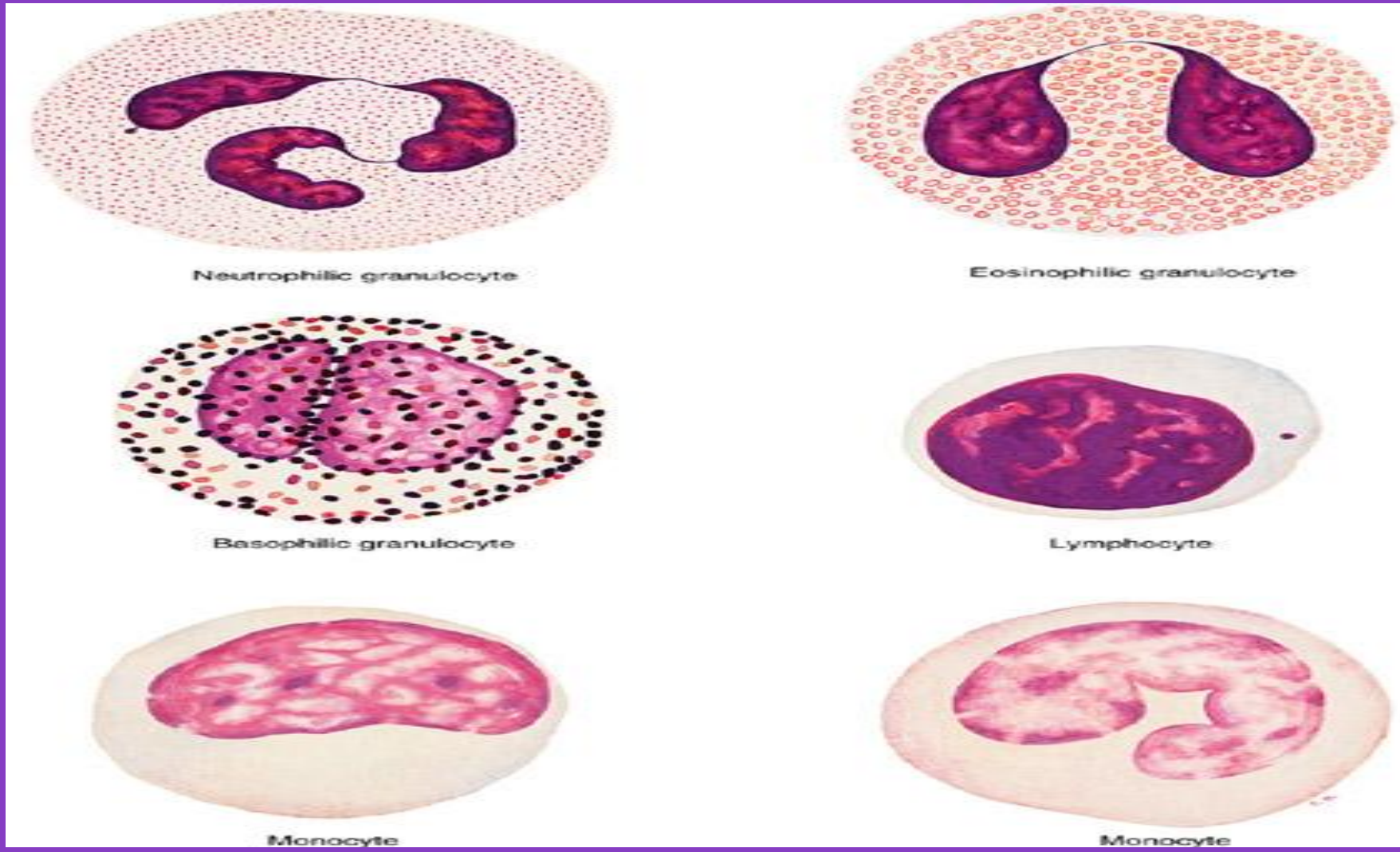
- There are two main types:

1. **Granulocytes** which contain granules in their cytoplasm and they *Neutrophils*, *easinophils* and *basophils.*

2. **Agranulocytes**
   - *Monocytes* and *lymphocytes*.

- There are about 7500 µl (range 5000-10000 µl).
- **Neutrophils** represent **60-70%** of total WBC. And about **20-30% lymphocytes**. While **eosinophils** are about **3%**, **basophils 1%** and **monocytes** about **5%**.

The 5 types of human leukocytes. Neutrophils, eosinophils, and basophils have granules that stain specifically with certain dyes and are called granulocytes. Lymphocytes and monocytes are agranulocytes; they may show azurophilic granules, which are also present in other leukocytes.

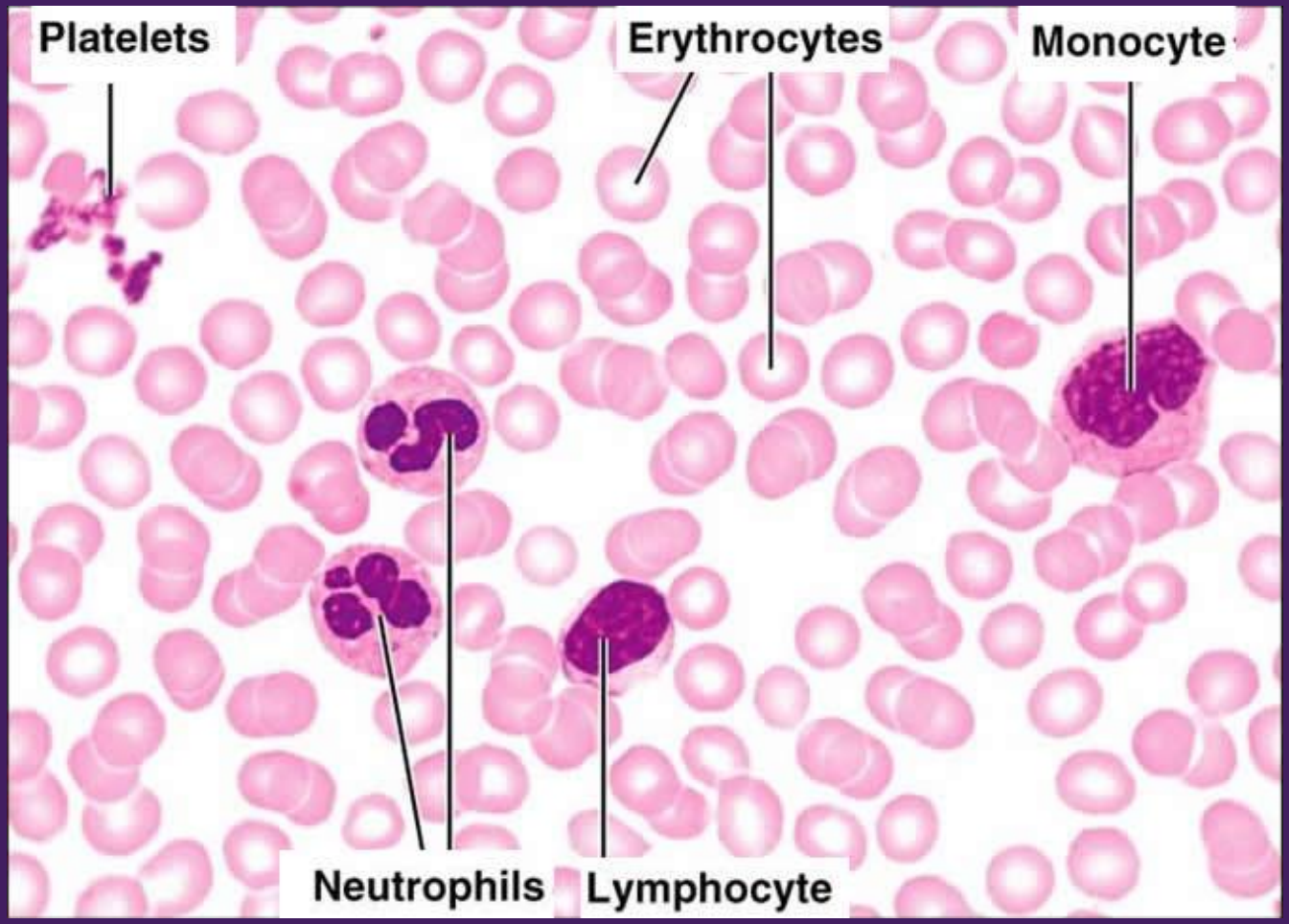


Granulocytes

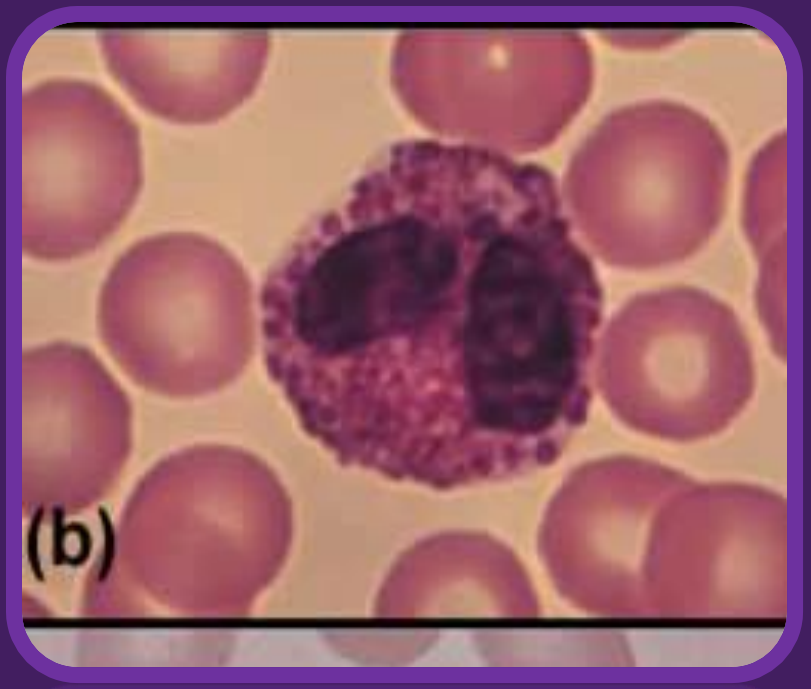
1. Neutrophil

Neutrophils (Polymorphonuclear leukocytes)

- Constitute 60-70% of circulating leukocytes.
- They are 12-15 μm in diameter with nucleus consisting of 2-5 lobes.
- The cytoplasm of the neutrophil contains 2 main types of granules (**specific granules** and **azurophilic granules**).
- **Specific granules** are small granules and contain *alkaline phosphatase*, *collagenase, lactoferrin*, *lysozyme* and several *non enzymatic antibacterial* proteins.
- **Azurophlic granules** are lysosomes and contain *acid phosphatase, α-monosidase, myeloperoxidase, lysozyme, cationic antibacterial proteins, collagenase, elastase, nucleotidase and others.*
- Neutrophils have short half life 6-7 hours in blood and 1-4 days in the tissues.
- Neutrophils have phagocytic activity against bacteria and other small particles.
- During phagocytosis, superoxide (O_2^-) and hydrogen peroxide ($H_2O_2^-$)are formed that kill microorganisms.
- Myeloperoxidase with O_2^- form a powerful killing system.


Platelets
Erythrocytes
Monocyte
Neutrophils
Lymphocyte

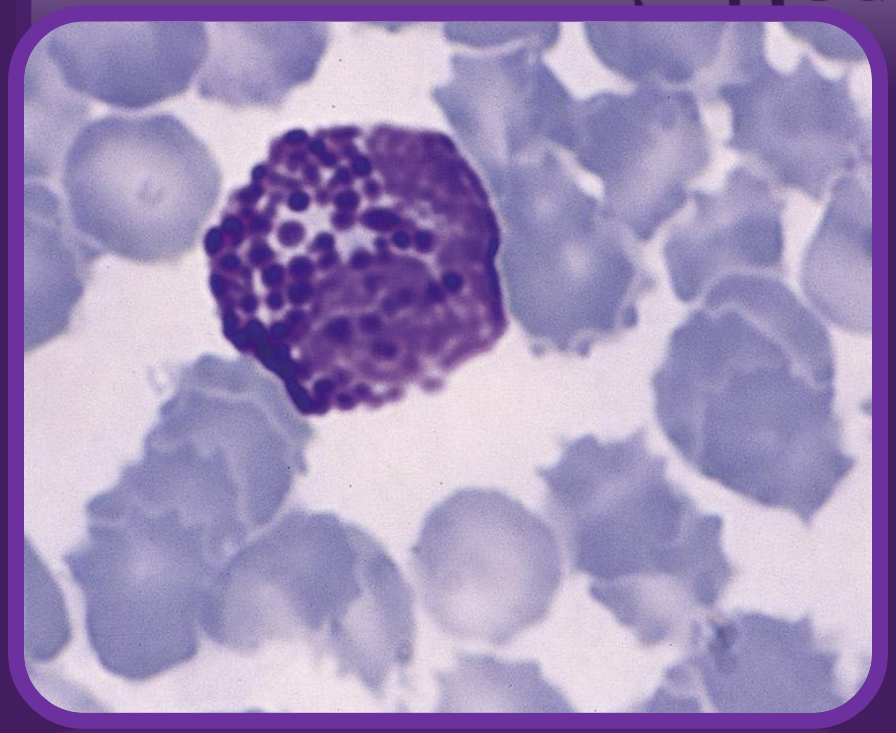
2.Eosinophil

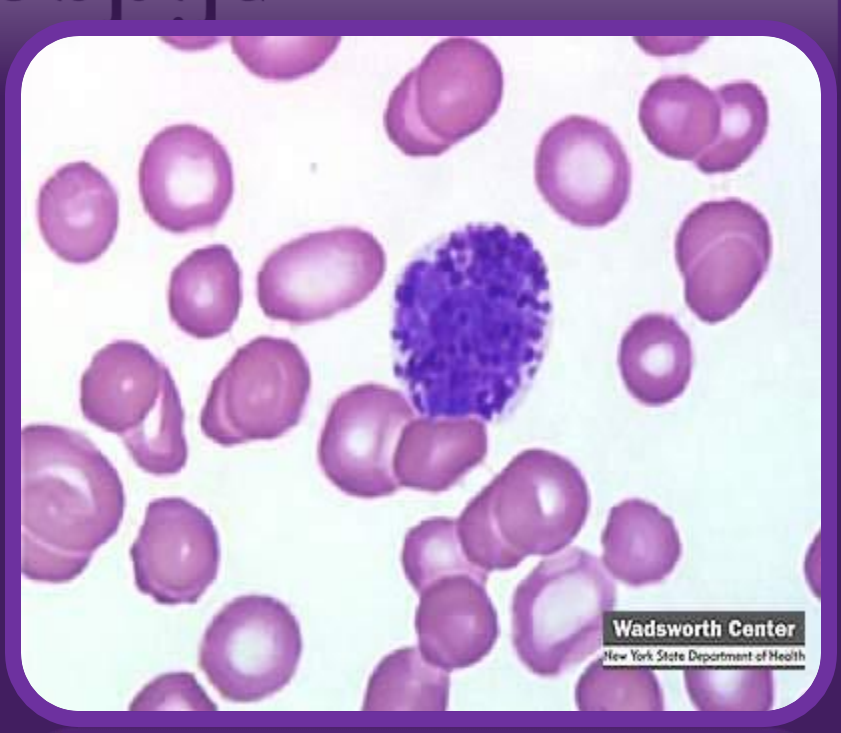


Eosinophils

- Eosinophils constitute 2-4% of leukocytes in normal blood.
- Life spine in circulation is about 10 hours and 10 days in tissues.
- These cells have bilobed nucleus.
- The cytoplasm of eosinophil contains large granules that are stained by eosin.
- The granules contain many types of enzymes e.g. *peroxidase, RNAase, phospholipase*, and others, additionally the granules contain a protein called the **major basic protein**. **This protein has ability to kill parasitic worm**.
- An increase in the number of eosinophils in the blood is associated with **allergic reaction** and **parasitic infection**.

3. Basophils



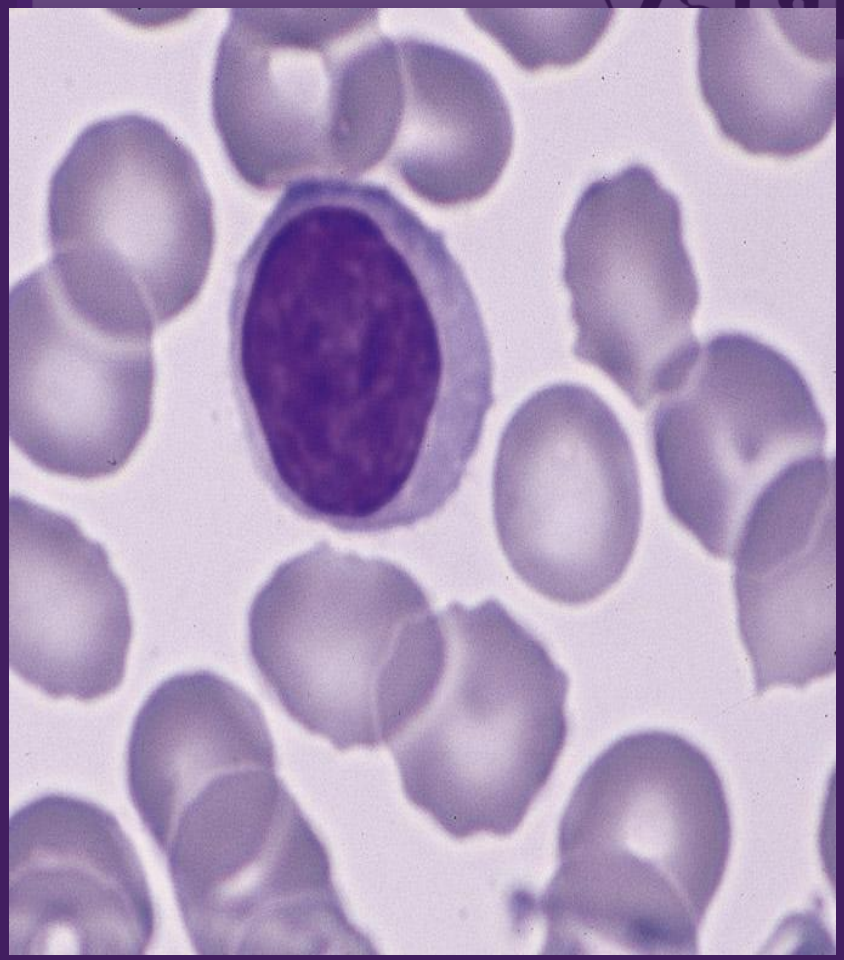


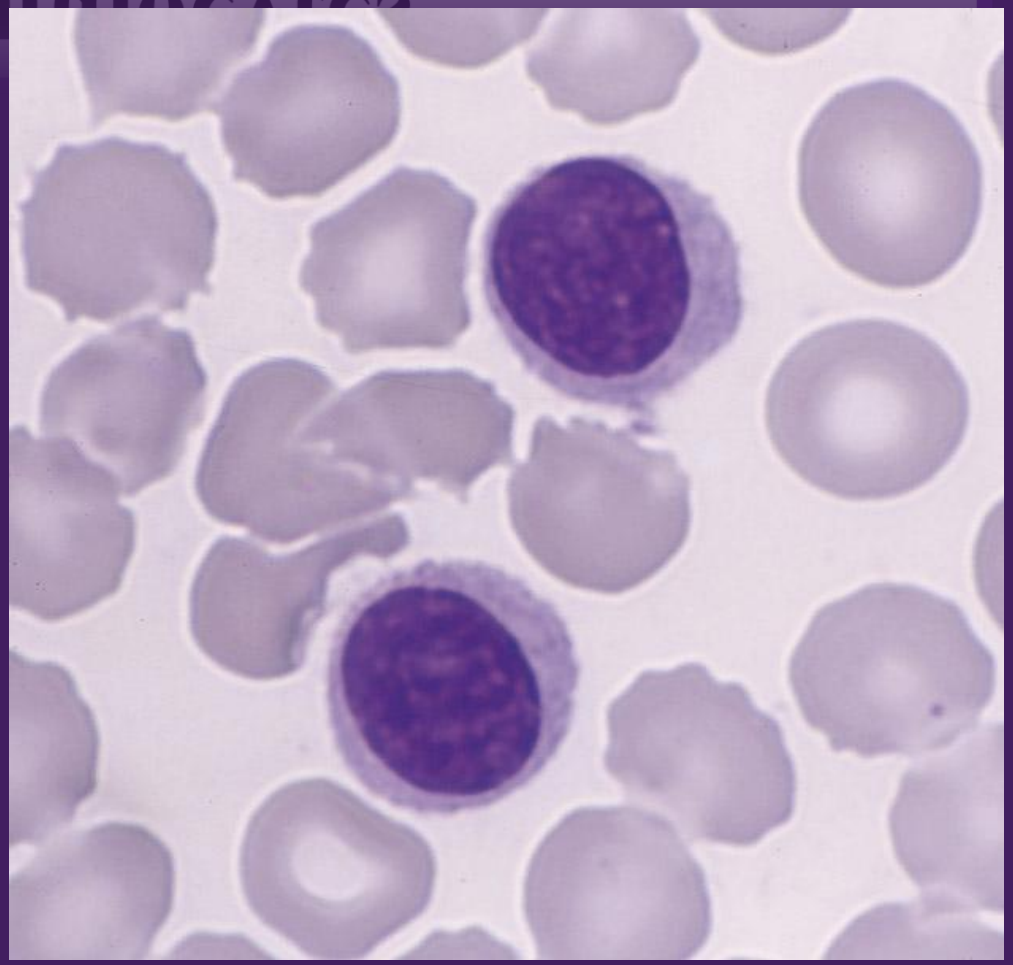
Basophils

- Basophils make up less than 1% of blood leukocytes.
- There are about 12-15 μm.
- The nucleus is divided into irregular lobes or S shaped.
- The cytoplasm contains very large granules that are stained with basic dye.
- The granules contain mainly **histamine** and **heparin**.
- These cells play an important role in the **allergy**.

Agranulocytes

1. Lymphocyte

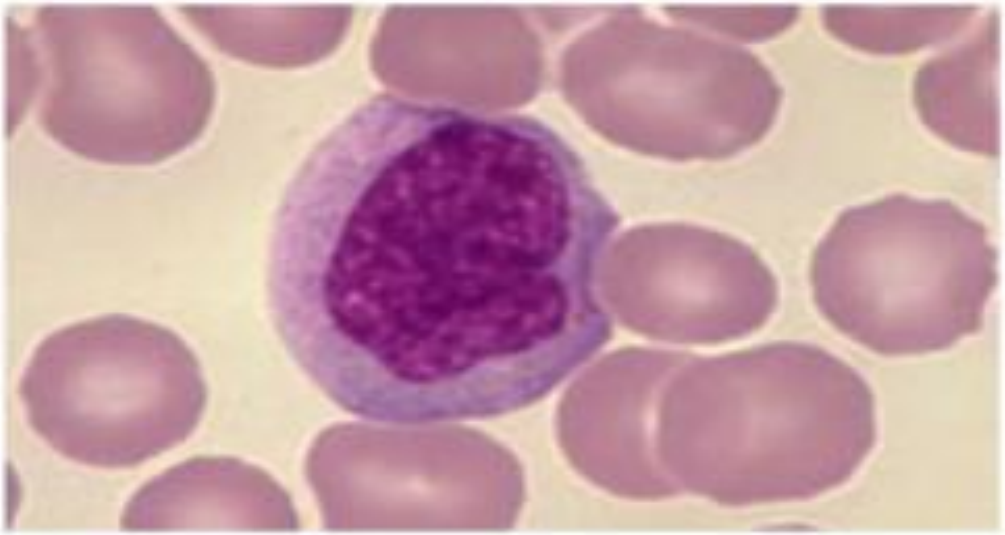




Lymphocytes

- Lymphocytes are spherical cells
- There are small lymphocytes with diameter of 6-8 μm and large lymphocytes with diameter up to 18 μm.
- The nucleus of lymphocyte are large and rounded.
- The cytoplasm of the small lymphocytes is scanty and in blood smear it appears as a thin rim rounded the nucleus. And it is slightly basophilic.
- Lymphocytes vary in life span; some live only a few days and other survive for many years.
- Lymphocytes are classified according to their function to; **B lymphocyte**, **T lymphocyte,** and **Natural Killer cell.**
- All types of lymphocytes are related to immune reactions in **defending against invading microorganisms**, **foreign macromolecules,** and **cancer cells.**

2. Monocyte



(e)

Monocytes

- These are the largest of the white blood cells.
- The nucleus is horseshoe- or kidney-shaped.
- The cytoplasm of monocyte is basophilic and contains very fine azurophilic granules (lysosomes).
- Blood monocytes migrate into the tissues and develop into macrophages.
- Macrophages engulf large particles and pathogens (large cell eater).
- The life span in the circulation is few days but 60-120 days in the tissues.
- They account 4-11%
- The main function monocyte is phagocytosis but also has ability to secret certain substances like interlukins e.g. interlukin 1 (IL-1).
- Macrophages have important functions in inflammation and immunity.

Leukopoiesis