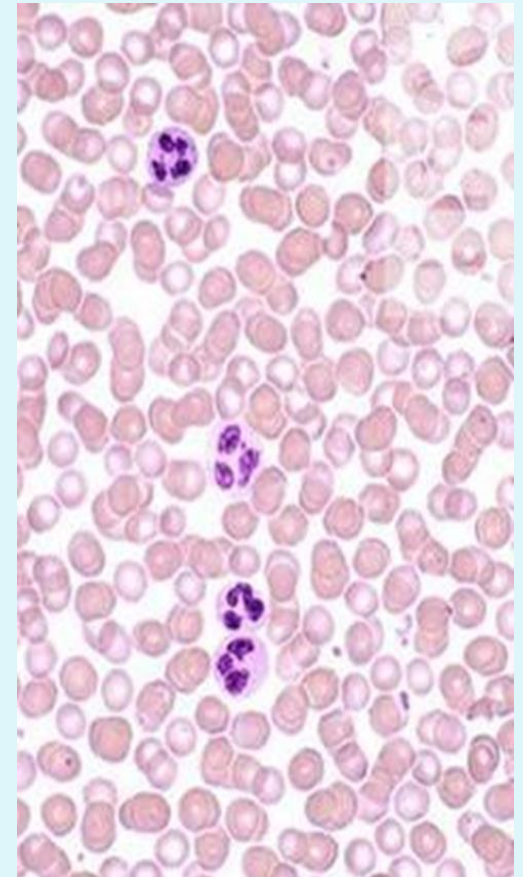


# BLOOD

White blood cells

## White blood cells (WBCs)

- Leucocytes: The bodies defense (part of the immune system)
- Much larger than RBCs
- Have a nucleus
- Normal count of WBC: 4000 – 10000 per mm<sup>3</sup>
- They make up approximately 1 % of the total blood volume in a healthy adult
- They live for about three to four days in the average human body.

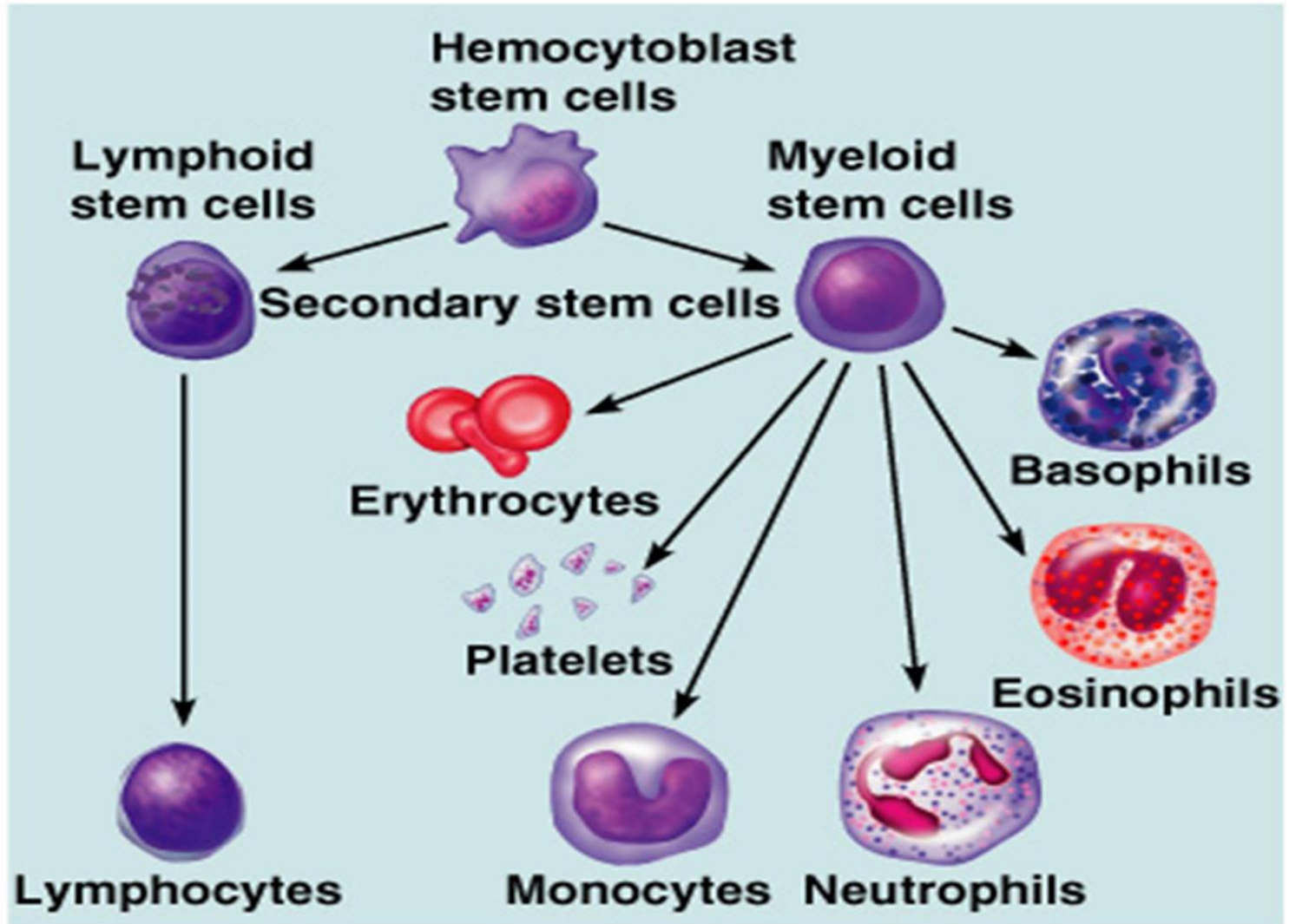


- The major function of leucocytes is protective function: It provides immunity and thus defends the body.
- Leucocytes can squeeze through capillary walls (diapedesis), The chemical attraction of WBCs to a disease or injury site (chemotaxis) and amount increases in response to infection.

### **Leucopoiesis (production of leucocytes)**

Leucocyte is produced from pluripotent hemopoietic stem cells ,which is present in the bone marrow.

Leucopoietins: It is a hormone produced by liver and kidney regulate leucopoiesis.



## Granulocytes

**Myeloblast**

**Promyelocyte**

**Myelocyte (neutrophilic, eosinophilic, basophilic)**

**Metamyelocyte (neutrophilic, eosinophilic, basophilic)**

## Monocyte

**Monoblast**

**Promonocyte**

**monocyte**

## Lymphocyte

**Lymphoblast**

**prolymphocyte**

**Lymphocyte, end differentiation in the lymphoid tissue  
(thymus )**

# **Types of Leukocytes**

## **Granulocytes**

**Granules in their cytoplasm can be stained.**

**Include neutrophils, eosinophils, and basophils.**

## **Agranulocytes**

**Lack visible cytoplasmic granules.**

**Include lymphocytes and monocytes.**

# Neutrophils

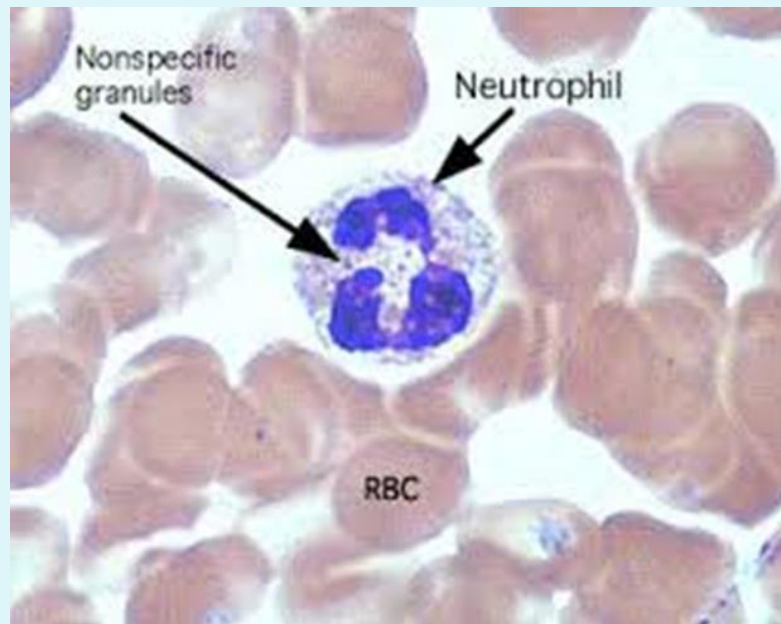
40-75%

## Functions:

- First line of defense (first cells that come to the area of inflammation).
- Multifunctional cells that attack and destroy viruses and bacteria.
- Phagocytosis-cellular ingestion of bacteria with enzymes proteases, peroxidases, cationic proteins.
- Microphagocyte – up to 15 or 20 only.



- **Respiratory burst—also called oxidative burst is the rapid release of chemicals from immune cells when they encounter with a bacteria or fungi. It is a crucial reaction that occurs in phagocytes to degrade internalized particles and bacteria.**



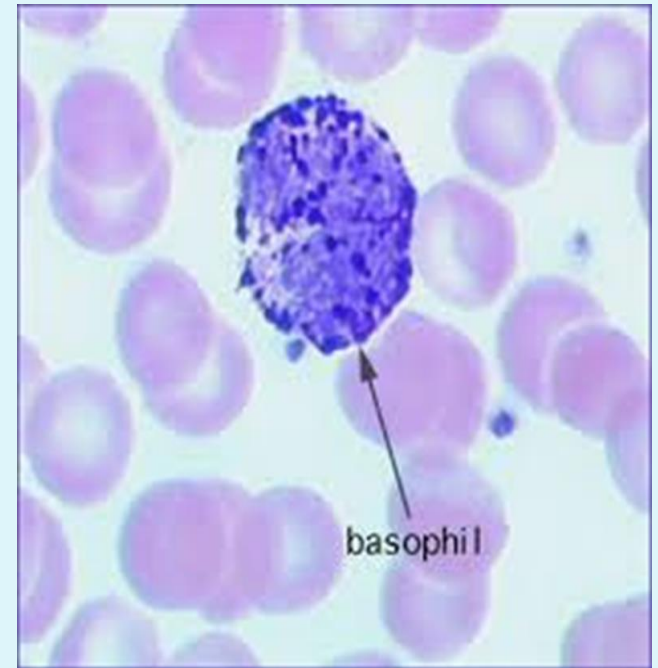


## Basophils

- 0-1%

### Basophils contain:

- Histamine – for vasodilation
- Heparin – anticoagulant
- Has IgE and thus participates in allergic reaction along with mast cells in tissues.
- Promotes functions of other leucocytes



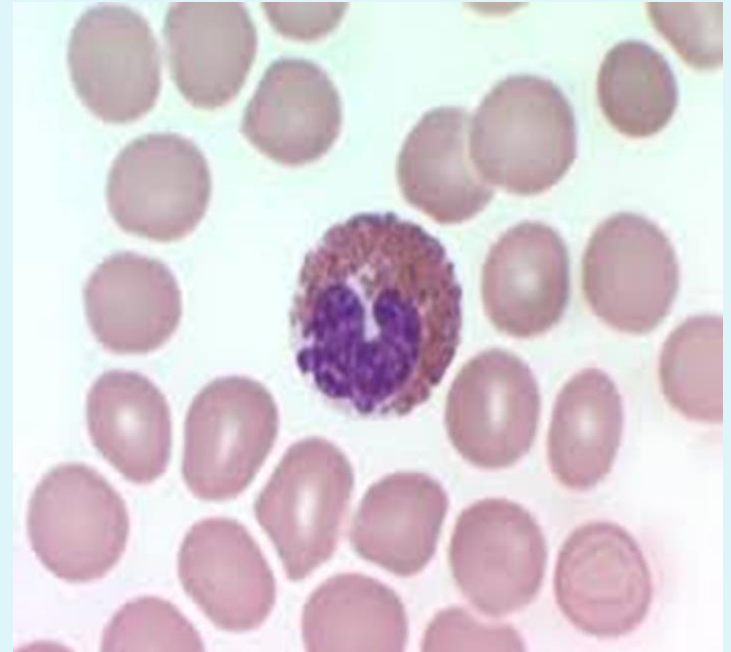
# Eosinophils

- 1-6%

## Eosinophils-Functions:

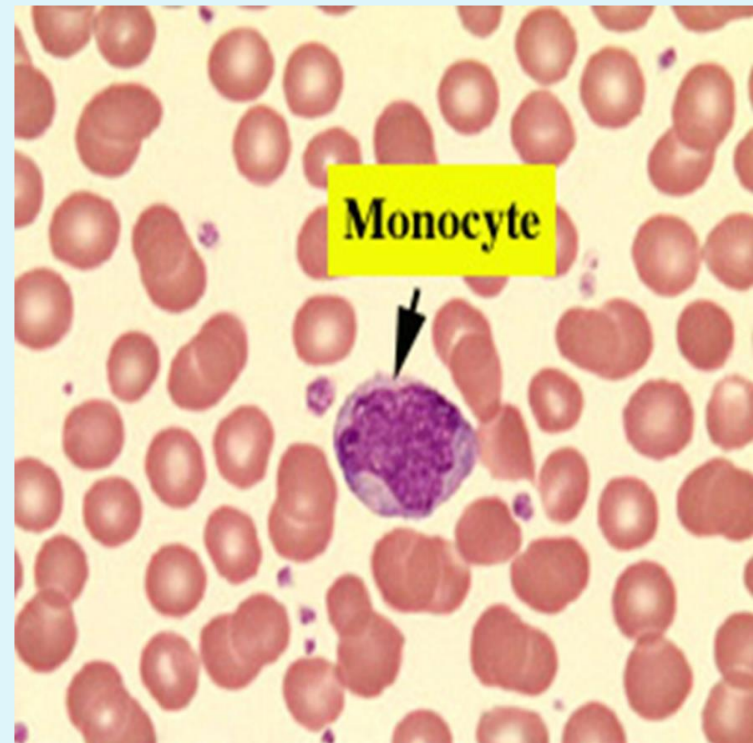
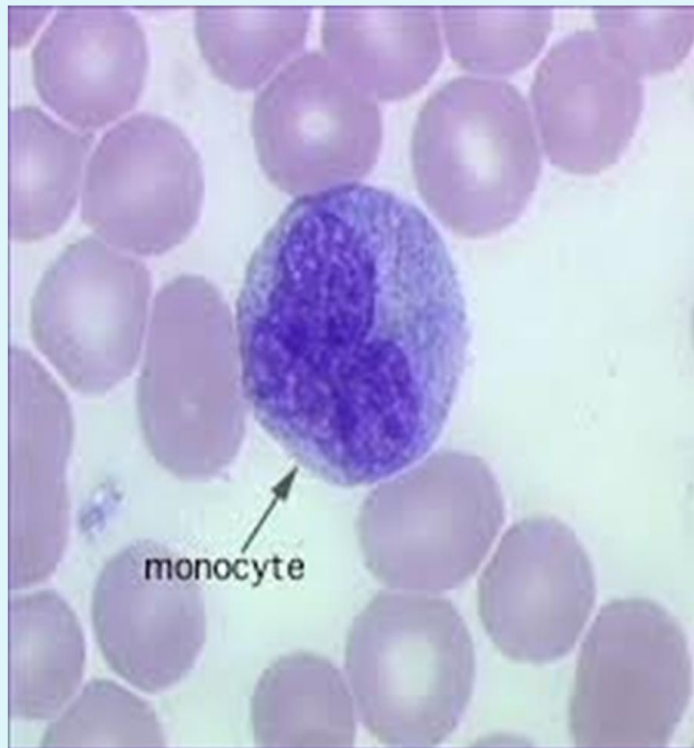
- They migrate to the site of infection.
- Weak phagocytes.
- Antiparasitic (kills parasites including worms).
- Contains histaminase – and so it reduces allergic reaction.

**Eosinophilia – increased level of eosinophils in the blood.**



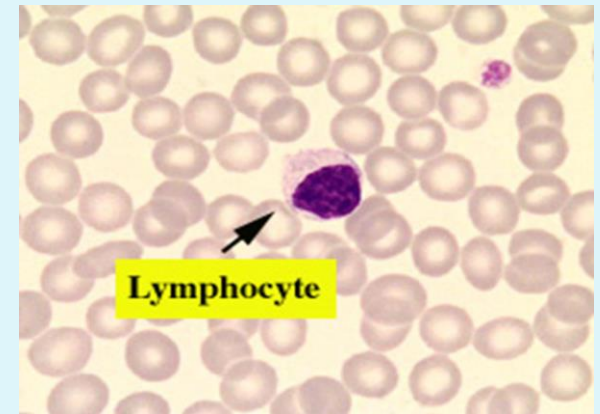
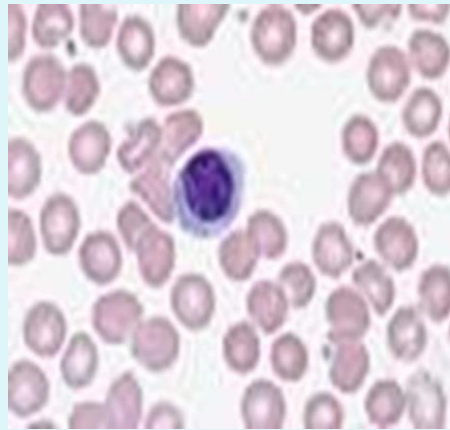
# Monocytes

- 2-10 %
- They differentiate into macrophages which can phagocytose up to 100 bacteria.



# Lymphocytes

- 20 - 45 %
- Provides immunity.
- Two types: B-lymphocytes and T-lymphocytes.
- B – lymphocytes provide humoral immunity.
- T – lymphocytes provides cell-mediated immunity.
- B – cells differentiate into plasma cells which further produces 5 classes of antibodies that provides immunity.
- T- cytotoxic cells aims to eliminate: Virus-infected cells, cancer cells and also causes graft rejection.



## Diagnostic importance

- **↑ Neutrophils – inflammation**
- **↑ Eosinophils – allergy, parasitic infections**
- **↓ Eosinophils – stress**
- **↑ Lymphocytes – cancer (leukemias – cancerous production of lymphoid cells)**

## Normal count

	Total no. of leucocytes	Eosinophils	Basophils	Segmented neutrophils	Lymphocytes	Monocytes
Normal Range	4000-10000 / mm <sup>3</sup>	1-6%	0- 1%	40-75%	20-45%	2-10%

## Leucocytosis

Increased amount of leucocytes in blood.

It may be:

### Physiological

Food intake

Exercises

Emotion

Stress

### Pathological

Inflammation

Cancer

## Leucopenia

**Abnormally low concentration of leucocytes in blood.**

**pathological**

**Severe viral infections**

**Autoimmune disease**

**Chemotherapy**

**Radiation injury**



# Leukemia

## Cancer of the blood

**Leukemia is a type of cancer of the blood or bone marrow characterized by an abnormal increase of immature white blood cells called "blasts". Leukemia is a broad term covering a spectrum of diseases. In turn, it is part of the even broader group of diseases affecting the blood, bone marrow, and lymphoid system, which are all known as hematological neoplasms. Leukemia is a treatable disease. Most treatments involve chemotherapy, medical radiation therapy, or hormone treatments.**

## Causes of Leukemia

- **Working with certain chemicals: Benzene – Formaldehyde**
- **Very high levels of radiation: People exposed to very high levels of radiation are much more likely than others to develop leukemia.**
- **Chemotherapy: Alkylating agents are associated with the development of leukemia.**
- **Smoking: Tobacco products are the single, major avoidable cause of cancer.**
- **Some diseases caused by abnormal chromosomes may increase the risk of leukemia.**

**Chronic leukemia:** The leukemia cells come from mature, abnormal cells. The cells grow well for too long and accumulate. The cells grow slowly. It is not unusual in chronic cases for symptoms to take along time to even appear.

**Acute leukemia:** Develop from early cells, called "blasts". Blasts are young cells, that divide frequently. They target immature cells, causing symptoms to appear quickly. In acute leukemia cells, they don't stop dividing like their normal cells do.

**Lymphocytic leukemia:** Begins from white blood cells called lymphocytes or immature types of lymphocytes. It commonly affects lymph nodes in the body but can invade all body tissues.

**Myelogenous leukemia:** Involves the other 3 common types of white blood cells known as granulocytes. They are the neutrophils, eosinophils, or basophils.

## **Lymphomas**

- **Definition: malignancy of lymphoid tissue Can be T or B cells**
- **2 main types: Hodgkins and Non-Hodgkins.**

## **Multiple Myeloma**

- **Malignancy of plasma cells from B cells**
- **10 – 15 % of all hematologic cancers**
- **Bence – Jones protein in urine**
- **Produces bone lysis by OAF (Osteoclast Activation Factor)**