Blood pathology 2

White Blood Cells

LEC 1

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- **WBCs**
- The second important type of blood cell components, called leukocytes, they are important to **body defense** against pathogenic agents; they are containing nuclei and the usual organelles.

- **Classification**

- WBCs are classified into two groups depending upon the presence or absence of **granules** in the cytoplasm:

- 1- **Granulocytes** – with granules
- 2- **Agranulocytes** – without granules.

- 1. **Granulocytes:** cytoplasm of WBCs contain granules, and they have lobed nuclei, the granulocytes are classified into three types.

- i- **Neutrophils** – granules take both acidic and basic stains
- ii- **Eosinophils** – granules take acidic stain
- iii- **Basophils** – granules take basic stain.

- 2- **Agranulocytes**: granulocytes lack visible cytoplasmic granules.

Their nuclei are spherical oval or kidney-shaped.

Agranulocytes include :

- **i- Monocytes**
- **ii- Lymphocytes.**

TYPES OF WHITE BLOOD CELLS

Granulocytes

1. Neutrophil

Helps in phagocytosis

2. Eosinophil

Fights against parasitic infection

3. Basophil

Produces inflammatory and allergic reactions

Agranulocytes

4. Lymphocyte

Produces specific immune responses

B Lymphocyte

T Lymphocyte

Natural Killer Cell

5. Monocyte

Fights off bacteria, viruses and fungi

- **Functions WBCs**

- These cells generally fit into one of three modes of function :-

- **1- Phagocytosis:**
- Means that the cell ingests materials to destroy them or remove them. Another type of phagocytosis would be to phagocytize bacteria.

- **2- Secretion:**

- Means that some white blood cells tend to secrete chemicals to cause local (not blood-borne) signals. A white blood cell could secrete a chemical to cause inflammation in a particular tissue, or to stop inflammation.
- Inflammations help us get blood (and white blood cells) to damaged tissues.
- **3-Immunity:** They help the body fight infection and other diseases.

- **1) Neutrophil**
- Neutrophils are non-specific immune cells and comprise approximately 55 to 70 % of the total white blood cells. Neutrophils are the first line of defense against invading antigens and are first to arrive at the site of infection or injury. Commonly referred to as polymorphonuclear (PMN) leukocytes, present in large amount in the pus of wounds. Neutrophils are the most common cell type seen in the early stages of acute inflammation.
- **Lifespan:** It can vary widely between 5 to 135 hours.
- **Functions:**

Engulfing pathogens like bacteria by a process called phagocytosis.

- **2) Eosinophil**
- Sometimes referred to as acidophils. Comprises about 2-4% of the total WBCs. Their number is found to increase in response to a parasitic infection. Eosinophils develop in the bone marrow before migrating out into the bloodstream. They are rare in the blood, but numerous in the mucous membranes of the respiratory, digestive, and lower urinary tracts.
- **Lifespan:** Tissue life of about 2 to 6 days.
- **Functions**
- □ Destroying large parasites such as hookworms and tapeworms, by secreting specific chemicals such as peroxides, nucleases and lipases.
- □ Found to cause allergic reactions such as asthma

- **3) Basophils:**
- Comprising less than 1% of the total white blood cell count, basophils play role in promoting blood flow and preventing coagulation.
- **Lifespan:** About 60–70 hours
- **Functions**
- Producing inflammatory reactions during an **immune response** by releasing immune-complexes like histamine, and heparin.
- Producing the body's response to **allergic reactions** during asthma.

- The **Basophils** excrete two chemicals that aid in the body's defenses: histamine and heparin.
- **Histamine** is responsible for widening blood vessels and increasing the flow of blood to injured tissue.
- **Heparin** is an anticoagulant that inhibits blood clotting and promotes the movement of white blood cells into an area.
- Basophils can also release **chemical signals** that attract eosinophils and neutrophils to an infection site.

- **4) Monocytes:**
- Monocytes comprise 2 to 8 % of the total white blood cells. Monocytes originate in the bone marrow and develop into large macrophages in the bloodstream. Macrophages are the largest of the white blood cells, resembling amoeba . Macrophages attack microbes by extending pseudopodia (feet-like extensions) around the cells and then destroy the microbe by releasing enzymes from inside the macrophage.
- **Lifespan:** About 24 hours.
- **Functions:**

 Responsible for engulfing cell debris, waste and harmful bacteria.

 Producing cytokine, a specific group of small chemicals that help to kill pathogens.

 Helping in antigen presentation using specific receptors.

- **5) Lymphocytes**
- Lymphocytes are one main type of immune cells produced by the immune system. They are white blood cells present in the blood, which comprise 25 to 33% of the total white blood cell count There are three types of lymphocytes named

T lymphocytes, **B** lymphocytes, and natural killer cells.

- **Natural killer cells** destroy altered cells or cells that have been infected by viruses.
- **B cells** produce antibodies which work on bacteria and viruses and neutralize them.

- **T lymphocytes;** there are two types of T cells.

- **helper T cells (CD4+ T cells) and cytotoxic T cells , or killer T cells (CD8+ T Cells).** Lymphocytes, mainly T and B cells, produce memory cells which provide long lasting immunity against that specific pathogen.

- All three cells work together too quickly and efficiently rid the body of harmful invading particles

- **What are the Similarities Between Phagocytes and Lymphocytes?**

- Phagocytes and lymphocytes are white blood cells present in the blood stream.

- Both fight against foreign particles which enter into the body.

- Both are parts of the immune system

- **What is the Difference Between Phagocytes and Lymphocytes?**

Phagocytes vs Lymphocytes	
Phagocytes are a type of white blood cells capable of engulfing and absorbing bacteria and other small cells and particles.	**Lymphocytes** are a small form of white blood cells occurring especially in the lymphatic system.
Types	
There are different types of phagocytes including neutrophils, monocytes, macrophages, and dendritic cells.	There are three main types of lymphocytes named T lymphocytes, B lymphocytes, and natural killer cells.
Phagocytic Nature	
Phagocytes are phagocytic.	Lymphocytes are nonphagocytic.

- **Lymphocytosis**, or a high **lymphocyte count**, is an increase in white blood cells called lymphocytes. Lymphocytes are an important part of the immune system. They help fight off diseases.

- Lymphocyte count is high in one of the following conditions
- Infection (bacterial, and viral)
- Cancer of the blood
- An autoimmune disorder causing (chronic) inflammation

- The normal range of WBCs in CBC is 4000 to 11.000 WBCs/mm3, when increase that may refer to inflammation or Patients with acute or chronic leukemia may come in with a white blood cell count up into the 100,000-400,000 range .

- **Leukopenia**
- **Leukopenia** (also known as leukocytopenia, or leucopenia, : is a decrease in the number of **white blood cells** (leukocytes) found in the blood, which exposes individuals to increased risk of infection.

- **Neutropenia,** a subtype of leukopenia, refers to a decrease in the number of neutrophil granulocytes, the most abundant white blood cells.

- **Causes of Leukopenia :**
- Medical conditions causing leucopenia :
- Low white cell count may be due to a new infection such as a cold or influenza.
  chemotherapy, radiation therapy,
  aplastic anemia,
  HIV
- **Other causes of low white blood cell count include some types of cancer,**
  typhoid,
  malaria,
  tuberculosis,
  folate deficiencies,
- Many other causes, such as **deficiency** in certain minerals, such as copper and zinc.

- **Drugs causing leucopenia :**
- Some drugs can cause leukopenia include

  Clozapine,

  bupropion HCl can also cause leukopenia with long-term use.

  Minocycline,

  Metronidazole

- Chemotherapy **targets** cells that **grow rapidly**, such as tumors, but can also impact white blood cells, because they are characterized by bone marrow as rapid growing.