Name of student: …… **Stage: First**

Lecture Name: White Blood Cells count **Number: 3**

Date: 7 / 4 / 2025 **Time: 8:30 AM** **Place: BC 208**

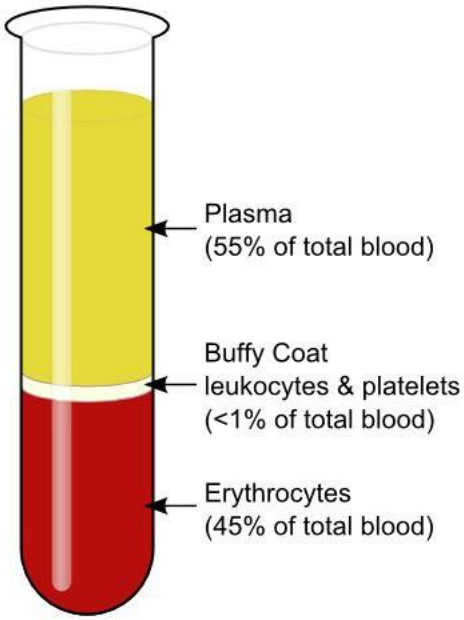
White blood cell (WBC) count

White blood cells (WBCs) or leukocytes are the round shaped, colorless and nucleated formed elements of blood (leuko = white or colorless) They are found throughout the body including the blood and lymphatic system. Compared to RBCs, the WBCs are larger in size and lesser in number. they are much fewer in number than red blood cells. A condition with WBCs level more than normal level is called leukocytosis, **and the abnormally low WBCs level in number is called** leukopenia.

The scientific term leukocyte directly reflects this description, derived from Greek leuko- white, and cyte- cell.

- **WBCs makeup approximately 1% of the blood volume in a healthy adult.**
- **Normal Value = 4000 – 11000 cells/1mm^3 of blood**
- **Leucopoiesis is the process of WBCs/leucocytes production**
- **The lifespan of WBCs varies from few days to few weeks.**

Components of Blood Samples



The name "White Blood Cell" derives from the fact that after centrifugation of a blood sample, the WBCs are found in the Buffy coat, a thin layer of nucleated cells between the sedimentation RBCs and the blood plasma, which is typically white in color.

Types of White Blood Cells

Based on structure, all white blood cells are classified into five types, which are further grouped into two major types, **based on the presence of granules in their cytoplasm as follows**:

1- Granulocytes: with granules are of three types:

A- Neutrophil

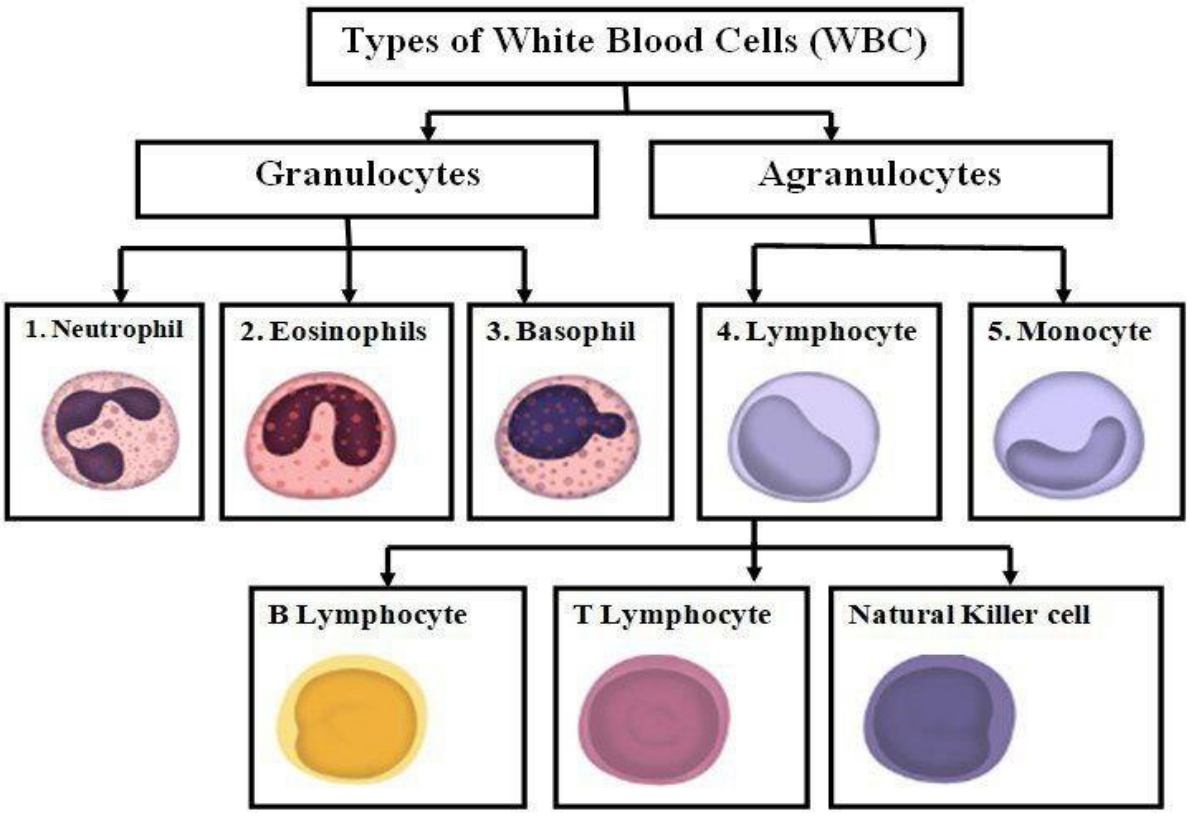
B- Eosinophil

C- Basophil

2- A granulocyte: without granules are of two types:

A- Lymphocyte (B- cell and T- cells)

B- Monocyte.



The white blood cell count: denotes the number of white blood cells per unit volume of whole blood, White blood cell (WBC) count measures the number of white blood cells in your blood. These cells are crucial for the immune system, helping fight infections, inflammation, and other diseases.

Aims of White blood cells Count Experiment

1- WBCs count is part of the complete blood count (CBC) test that is used to evaluate the overall health and detect a wide range of disorders such as anemia, infection and leukemia.

2- To know whether or not subjects/patients are suffering from Leukocytosis (the increase in the no. of WBCs to more than 11000/mm^3)

or Leucopenia (the decrease in the no. of WBCs to less than 4000 or 1500 /mm^3).

3- To learn how to use the manual method in the lab to get the number of white blood cells.

The methods of white blood cells count

1-Manual method

2-Electronic cell counting

The Manual Method of White Blood Cells Materials and Instruments

1. Anticoagulated whole blood (using EDTA or heparin as an anticoagulant) or capillary blood can be used.

2. Turk's solution (diluting fluid) composed of:

- Glacial acetic acid 2 ml
- Gentian violet (1 % w\v) 1ml

  (it stains the WBCs nuclei so it can be easily seen)
- Distilled water 97 ml

3. WBC pipette, which is composed of a stem, mixing chamber, white bead inside the mixing chamber, aspiration tube (rubber sucking tube)

4. Haemocytometer / “Neubauer” chamber is the counting chamber with a coverslip.

5. Microscope

6. Lancet, Alcohol 70%, and Cotton.

Procedure:

• Obtain a drop of blood in the same manner as in RBC count. Draw blood up to the mark 0.5 using WBC pipette.

• Aspirate diluting fluid up to mark 11. the dilution is 1:20.

• Remove blood from outside of the pipette with clean gauze.

• Gently rotate the pipette horizontally with your hand to ensure a proper amount of mixing for 3 minutes.

• After mixing discard the first four drops of the mixture.

• Fill the counting chamber with diluted blood by holding the pipette at 45 with the slide and allow the mixture to seep under the cover slip, the filled chamber should be allowed to stand for a minute prior to counting.

• Count the WBC using the lowpower10x objectives.

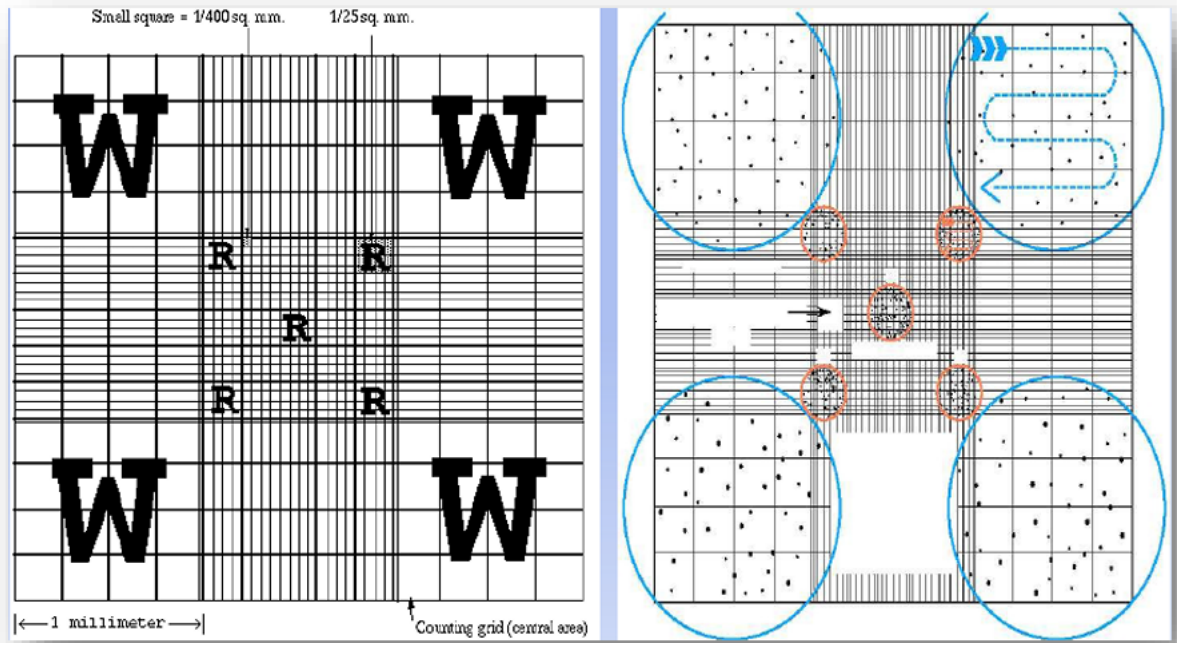
WBC Diluting Fluid

Microscope

WBC Pipette

Neubauer Chamber

Alcohol Pad



How to count and calculate White blood cells

Count the number (N) of cells in 4 large squares located at the four corners of the chamber. The size 4 large squares in which "N" numbers of cells are found is: 1x1x1/10x4= 4/10 mm^3

Where 1mm: - is the sideline of the large square

1/10: - is the depth of the counting chamber between cover slip and the ruling

4: - is the number of large squares used to count

The total numbers of cells in $1mm^3$ are =

Nx10/4 (before dilution of the sample) The actual total numbers of cells after dilution should be =

Nx10/4x20=Nx50

Medical consideration

• Leukocytosis is the increased number of White Blood Cells this condition occurs in such as:

1- infection

A- **Bacterial infection** **B- viral infection** **C- fungal infection**

2- Leukocytosis could also be physiological. People who have had their spleen removed (spleenctomy) will always have a slightly higher number of WBCs

3- Eating, physical activity and stress can cause an increased WBC

4- Pregnancy in the final month and labor may be associated with increased in WBC level.

5- Average, normal newborns and infant have higher WBC counts than adults.

6-The WBC counted to be lower in the morning and higher in the late afternoon.

• Leucopenia is the decreased number of White Blood Cells This condition occur in infections such as:

A- Human immunodeficiency virus (HIV)

B- Hepatitis, Pneumonia and typhoid fever

C- Bone marrow disorder (aplastic anemia).

D- Nutritional deficiency such as (vitamin B12, folate deficiency)

The compare between red blood cells RBCs and White Blood Cells WBCs:

Feature	RBCs	WBCs
Scientific name	Erythrocytes	Leukocytes
Function	Transport of O2 and CO2	Defend the body against infection and disease
Shape	Biconcave disc	round shaped in shape
Color	Red (due to hemoglobin)	Colorless
Nucleus	No nucleus	Has nucleus
Lifespan	120 days	varies from few days to few weeks
Production site	Bone marrow	Bone marrow and lymphatic organs
Numbers in blood	**- Adults male: 4.8-7.2** million cells per µL **- Adult female :4.9-5.5** million cells per µL	**4000 – 11000 cells per µL**
Types	Only one type	Several types: **1- Granulocytes** (Neutrophil, Eosinophil, Basophil) **2- A granulocytes** (monocytes and lymphocytes)