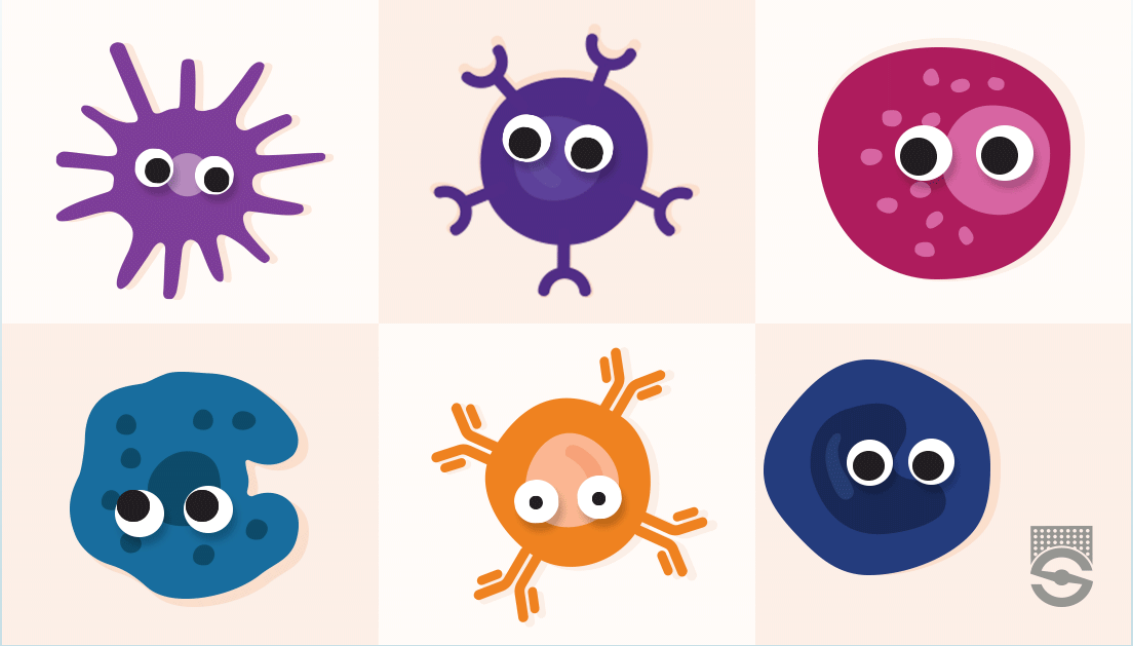
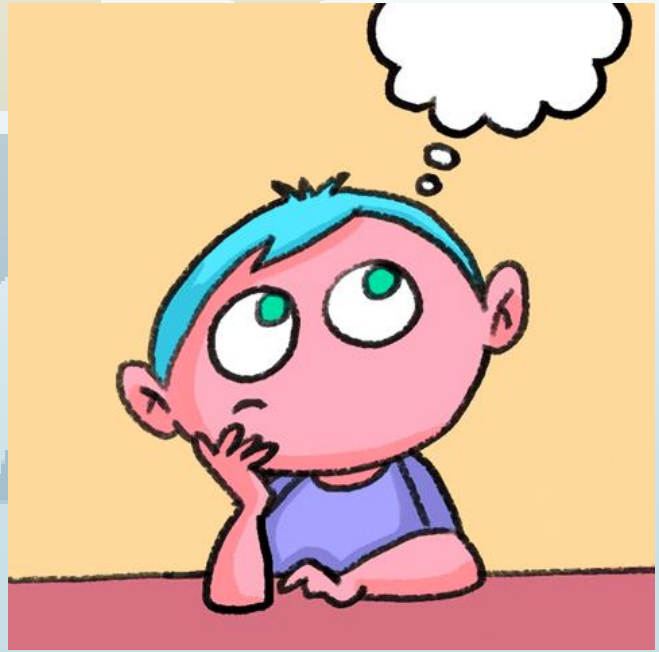
Document 4

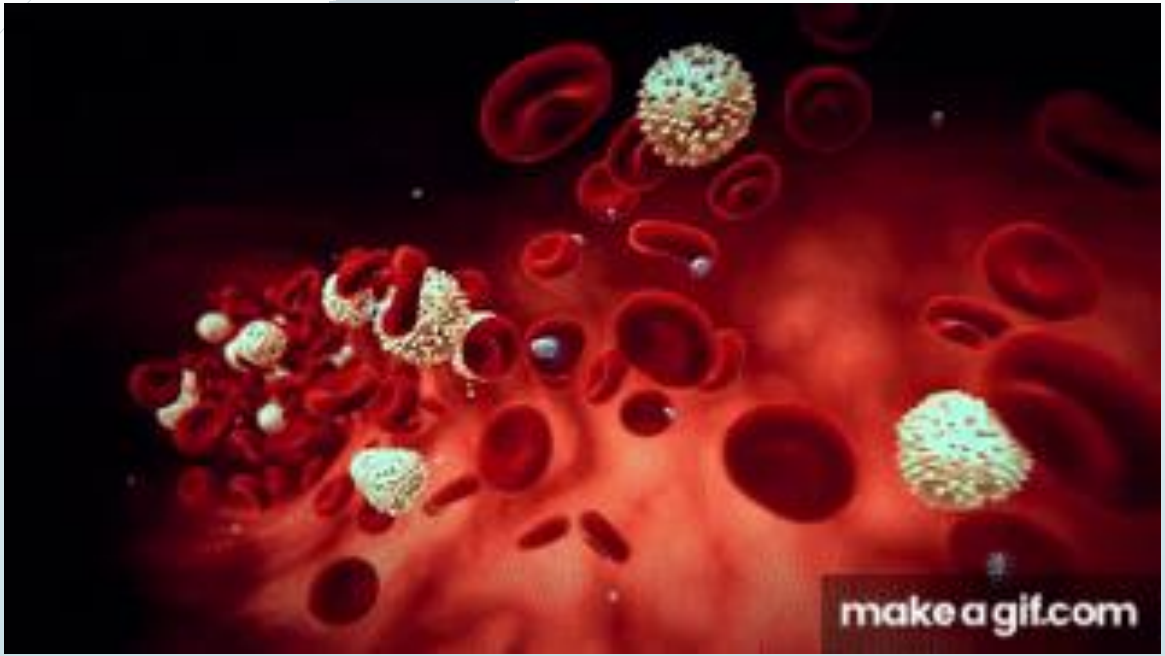
Cells of the Immune System



-What are the cells of the immune system and what are their characteristics?



Components of Blood



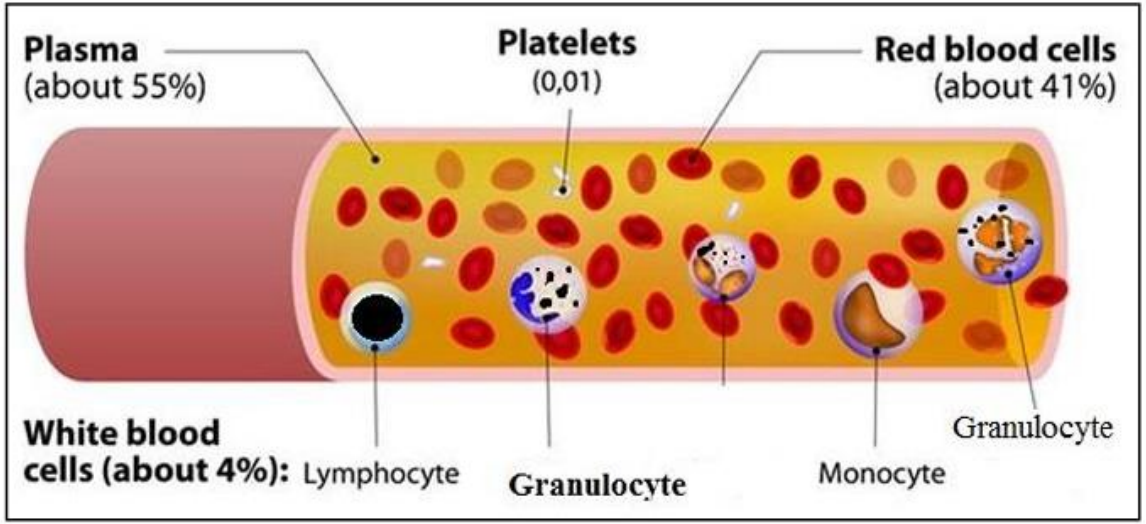
Be Smart ACADEMY

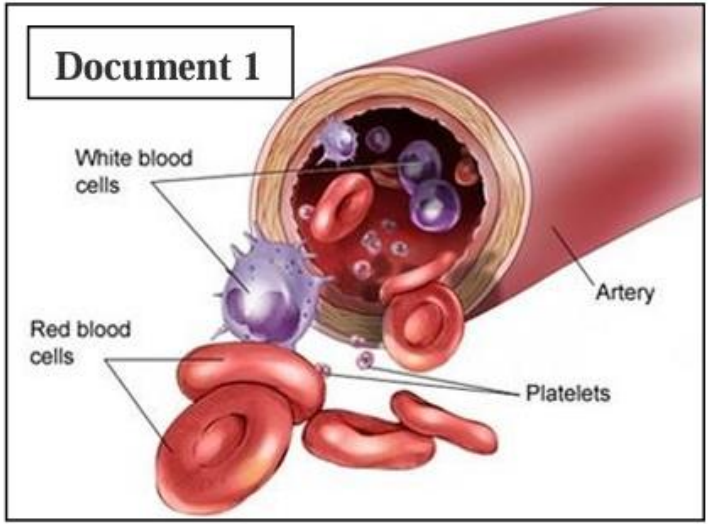
Video Time

Components of Blood

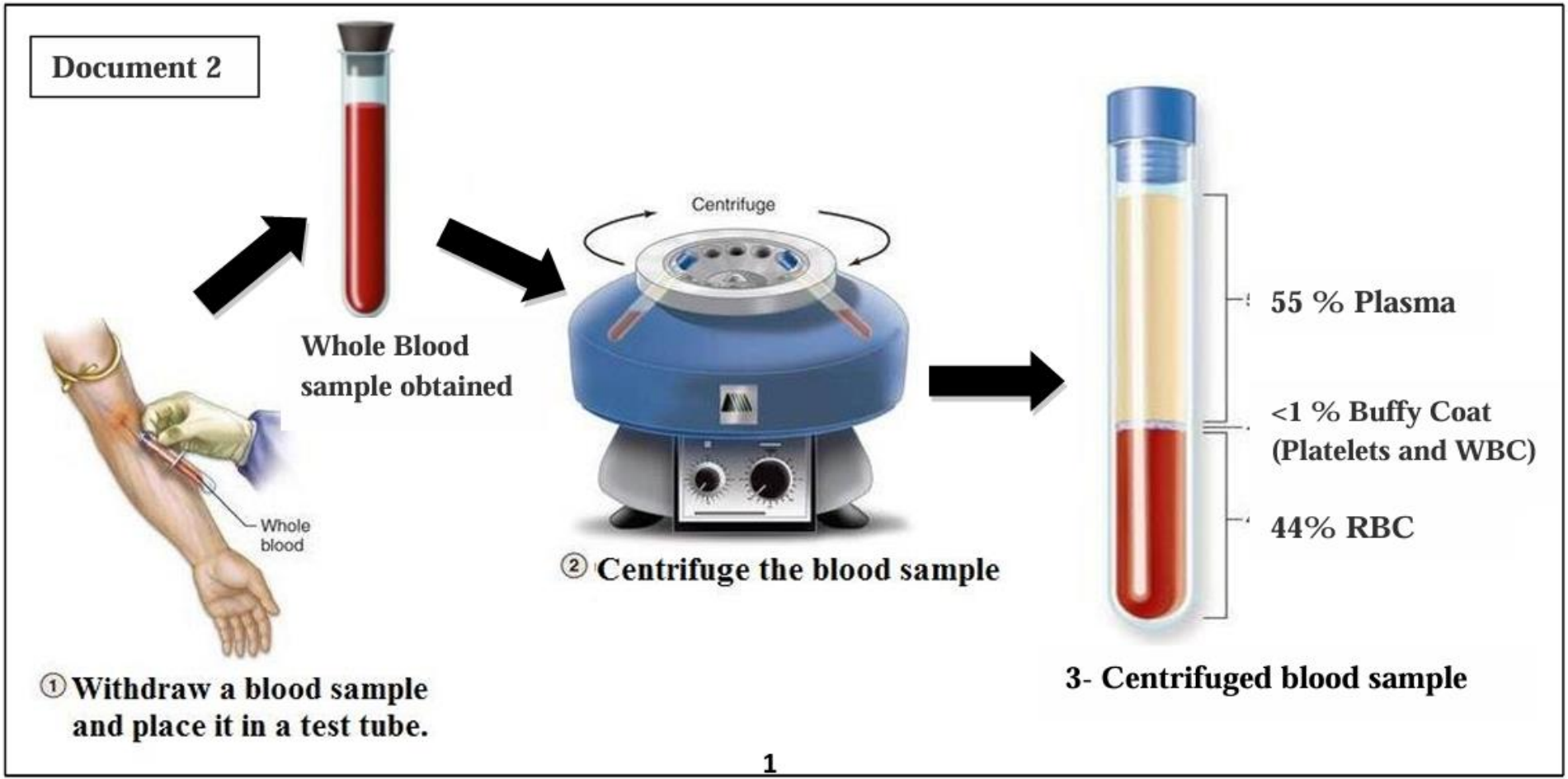
The blood circulates in blood vessels. It has **two components**: the **fluid (liquid) component** and the **cellular component**. The **liquid component**, called **plasma**, is made of water, nutrients, salts, and proteins. The **other component** contains **red blood cells (R.B.C)**, **white blood cells (W.B.C)**, and **platelets**.

Document 1 shows the components of the blood in the blood vessel.

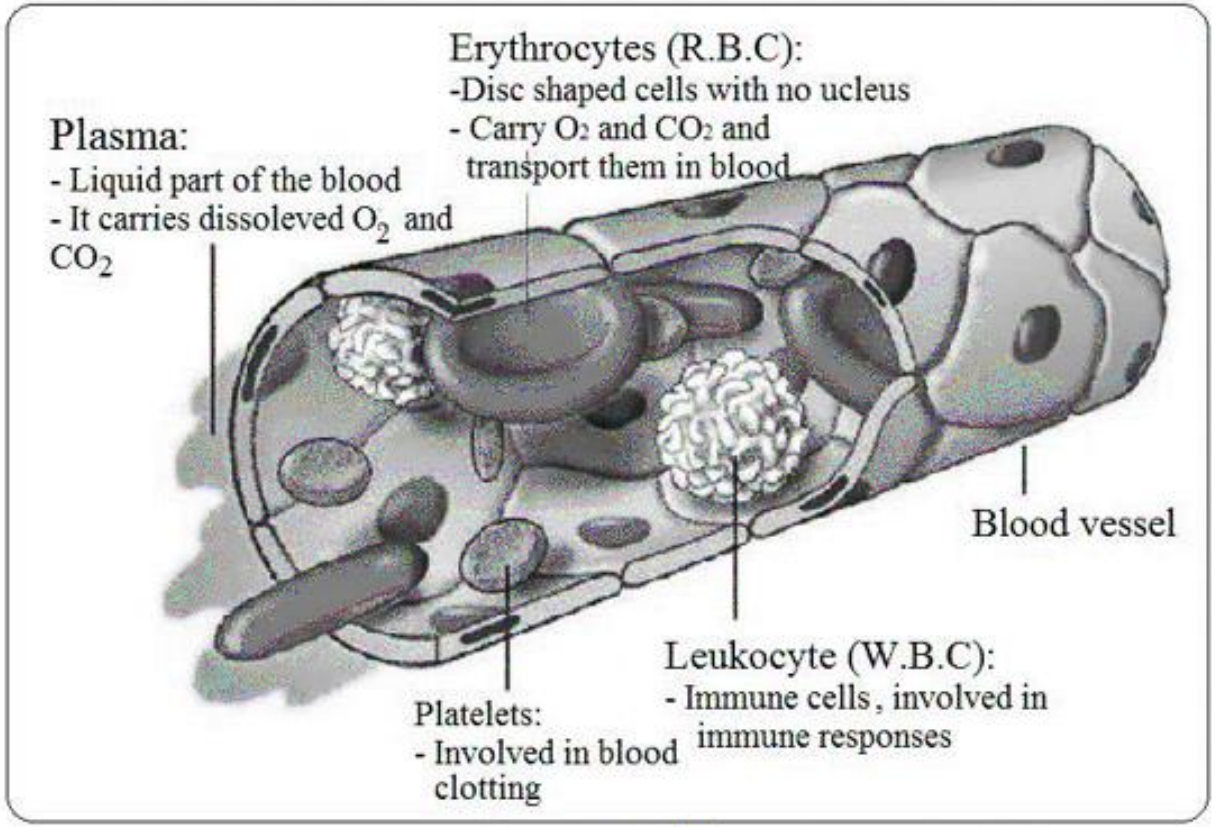




Document 2 shows the separation of blood components after centrifugation.



-Document 1 shows the role of different blood components.



Document (1)

- **The different blood components are:**

1. White blood cells (leukocytes):

- Are nucleated cells
- **Role:** They are immune cells, that protect our body from infections and diseases.

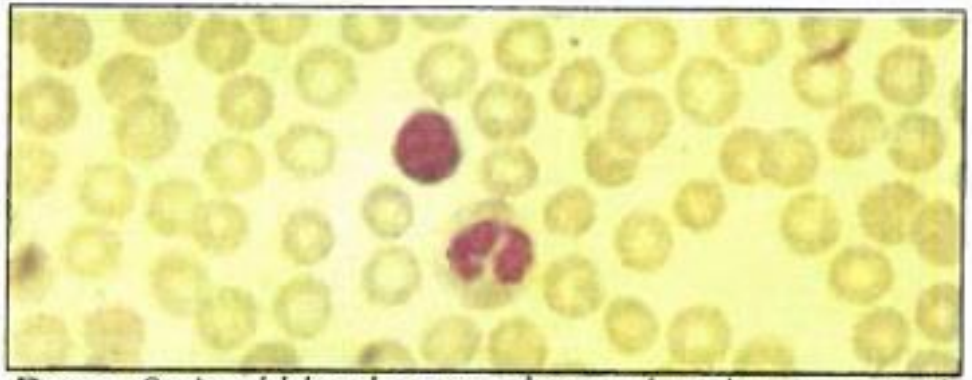
2. Red blood Cells (R.B.C) or Erythrocytes:

- Disc shaped with no nucleus.
- Role: transports O_2 & CO_2 to and from all the body cells

3. Platelets: Involved in blood clotting (prevent bleeding).

4. Plasma: liquid part of the blood.

- Doc.a, p.121 shows a stained blood smear.



Doc.a *Stained blood smear observed under an optical microscope.*

Immune System

I. Cells
(White blood cells or leukocytes)

- Monocytes
- Granulocyte
- Lymphocytes
  - B lymphoctes
  - T-lymphocytes

II. Molecules

- They are antibodies released by B lymphoytes

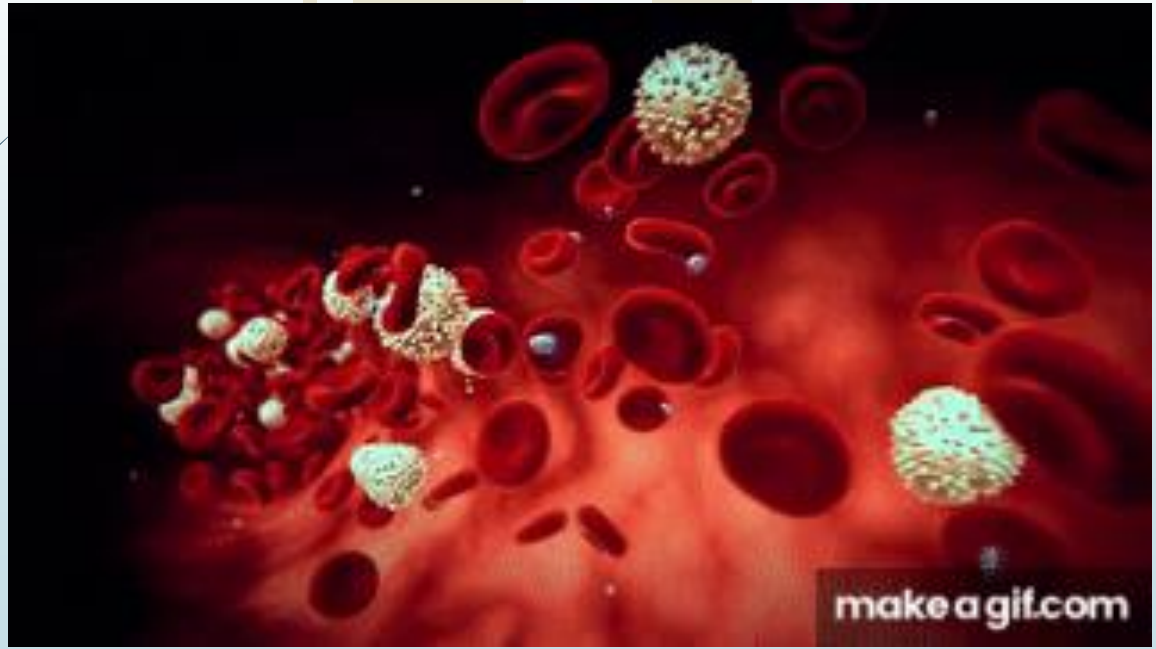
III. Organs

*Primary Organs:
- Red bone marrow
- Thymus

*Secondary organs:
- Spleen
- Lymph nodes

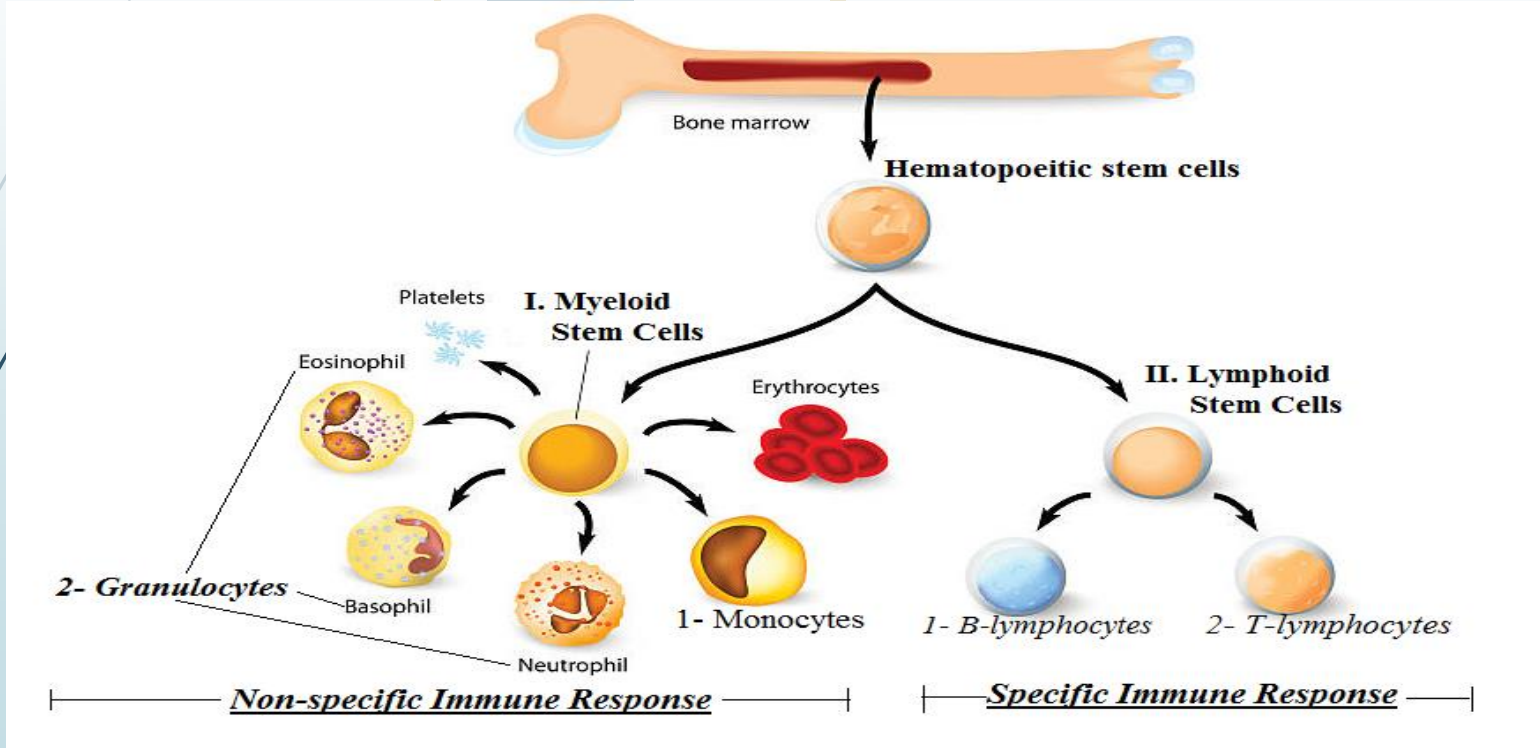
I. Cells of the Immune System:

White blood cells



➢ The Different Leukocyte Population

- Bone marrow is the site of production of all white blood cells.
- All leukocytes derive from the same progenitor.
- They belong to two different lineages: I. Myeloid or II. Lymphoid stem cells.



I. Myeloid Stem Cells:

- Leukocytes that derive from myeloid stem cells are:

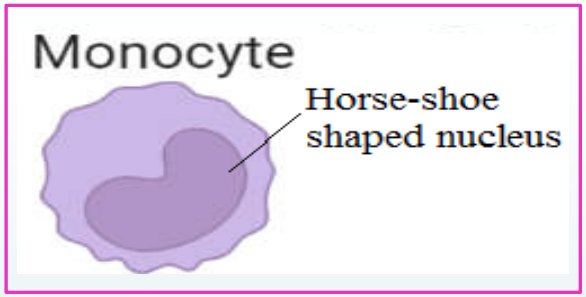
1- Monocytes

2- Granulocytes

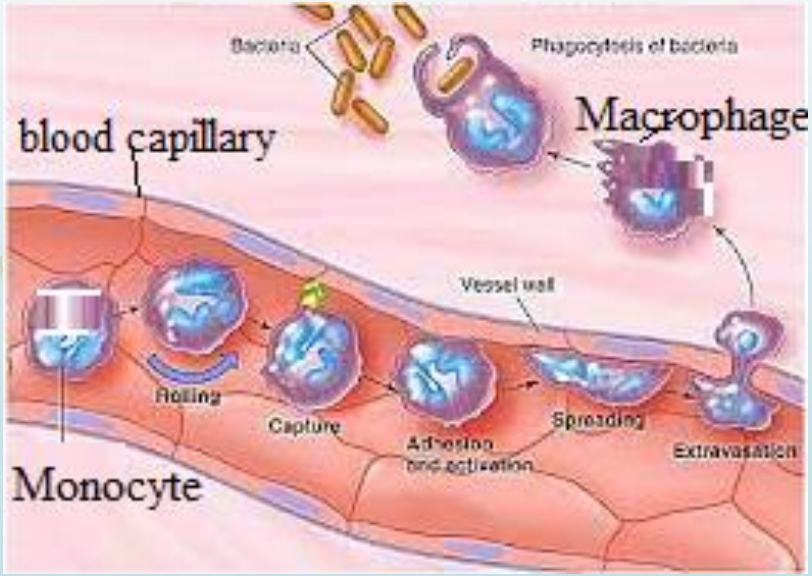
3- Mast cells.

1) Monocytes:

- **Structure:** They have horse-shoe shaped nucleus.

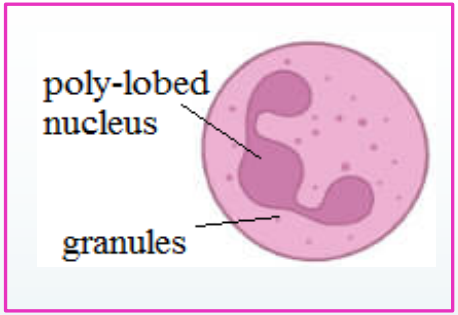


- **Role:** They play a role in non-specific immune response, where they attack all microbes in the same way by a process called phagocytosis.
- They can cross the capillary wall to the infected tissue.
- They differentiate into macrophages to be able to attack the non-self.



2) Granulocytes:

- **Structure:** They have polylobed nucleus.



- They represent 67% of all the leukocytes and live for 2-3 days.
- **Role:** They play a role in non-specific immune response, where they attack all microbes in the same way by a process called phagocytosis.
- They can cross the capillary wall to the infected tissue.

→ **Granulocytes have 3 subpopulations:**

2.1- Neutrophils: They perform phagocytosis and destruction of bacteria.

2.2- Eosinophils: They perform phagocytosis of antigen antibodies complex.

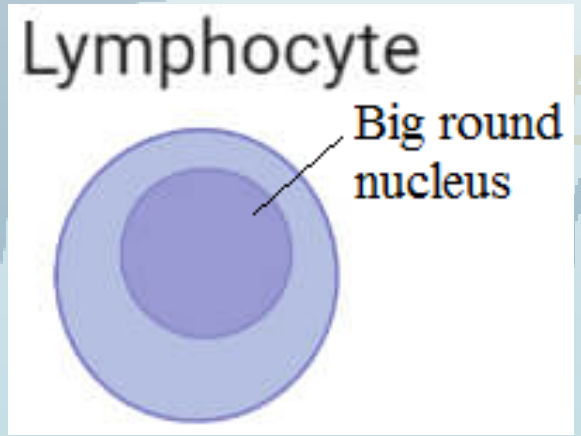
2.3- Basophils: They play a role in allergic reaction.

3) Mast cells:

They play a role in allergic reaction (release of histamine).

II. Lymphoid Stem cells:

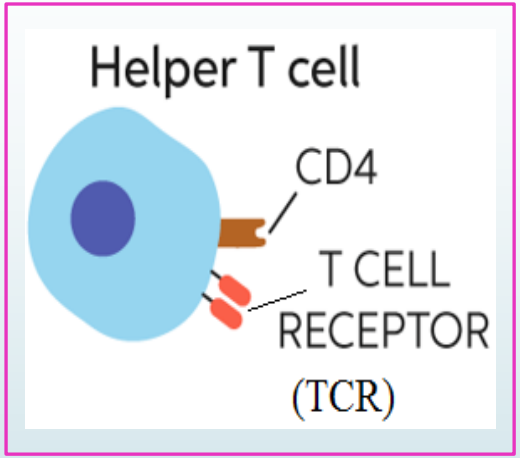
- They are B-cells and T-cells.
- **Structure:** They have big round nucleus.
- Both B and T-cells are involved in specific immunity.
- B and T lymphocytes can be distinguished by their receptors.



1) T-lymphocytes: They are T4 and T8

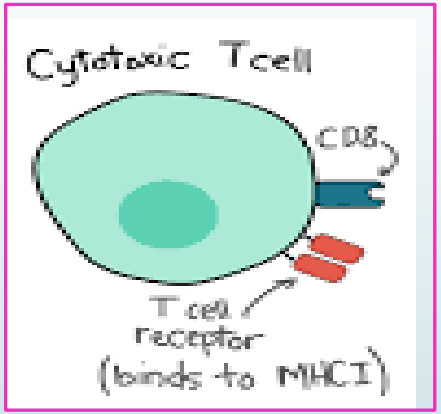
1.1- T4:

- They are T Helper cells.
- They help in all immune responses: they activate B-cells and TC cells.
- They have receptor molecules on their membrane called TCR.
- They carry specific proteins on their membrane called CD4 (that's why they are called T4).



1.2- T8

- They are the effector cells of Specific Cell Mediated Immune Response.
- They have receptor molecules called TCR and protein on their membrane called CD8 (that's why they are called T8 lymphocytes).
- They are activated by TH.
- Upon activation, T8 cells become cytotoxic killer cells Tc that attack specific target.

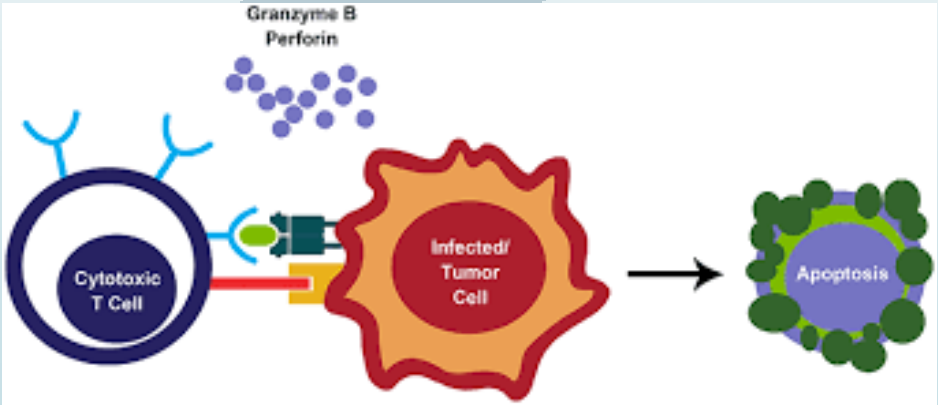


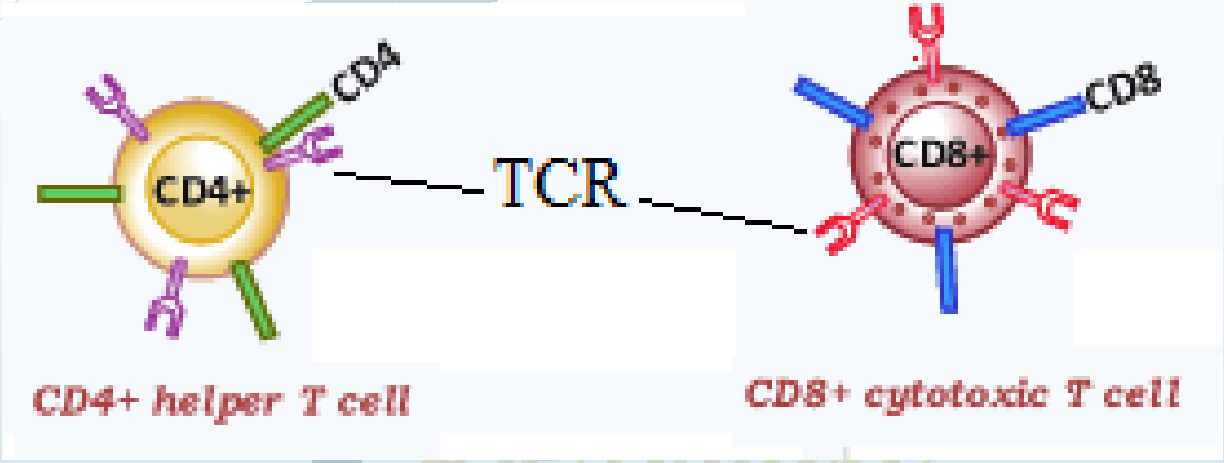
→ *Target of Tc –cells:*

1- Infected cells (by virus)

2- Self-modified cells (cancer cells)

3- Rejected graft.

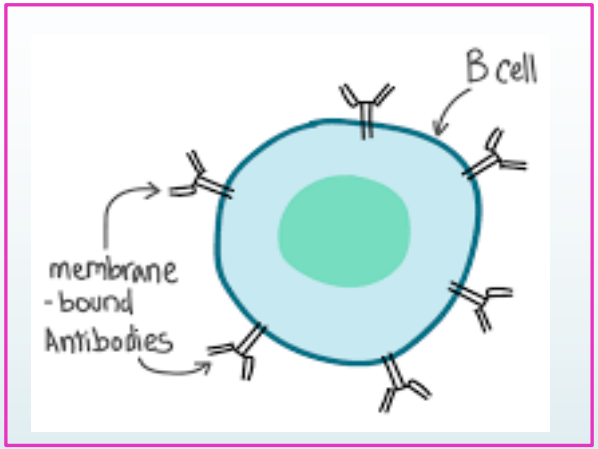


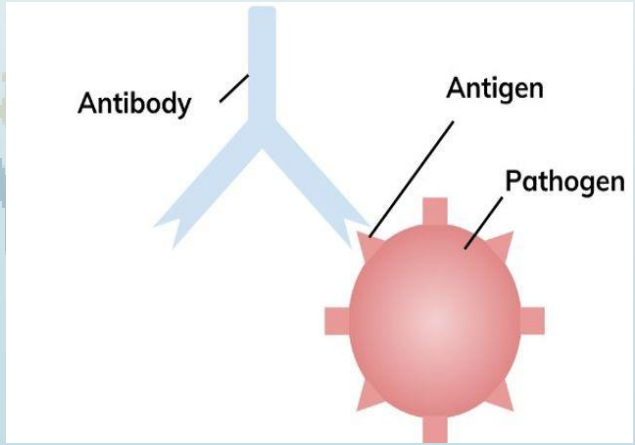

CD4
CD4+
TCR
CD8
CD8+
CD4+ helper T cell
CD8+ cytotoxic T cell

2) B-lymphocytes:

- **Role:** They can recognize free or soluble antigens. ex: bacteria
- They have receptor molecules on their membrane called antibodies (Y-shaped).
- Antibodies are specific, they bind to antigens in a key and lock manner.

- There are million types of B-cells, each is specific to a certain antigen.





⇨ ***They play a role in the specific humoral immune response.***

- When they are activated by TH cells, B-cells differentiate into antibody secreting cells called plasma cells that secrete antibodies that circulate in plasma.