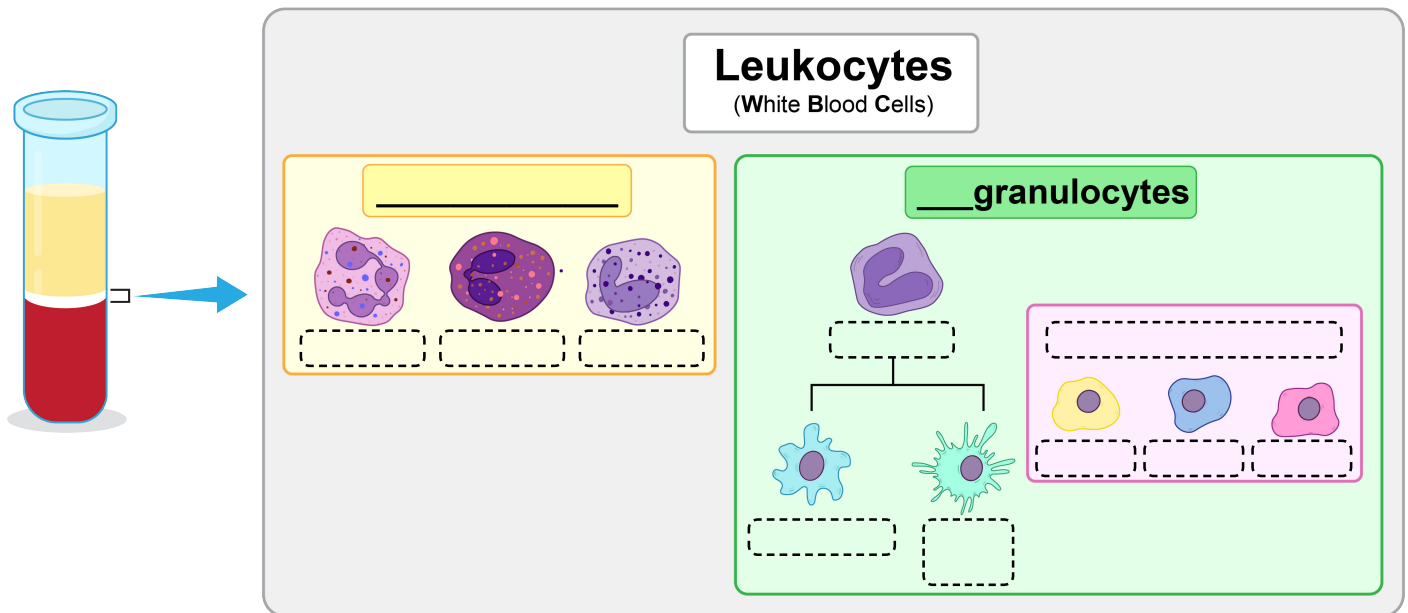


TOPIC: LEUKOCYTES

Introduction to Leukocytes

- ♦ **Leukocytes (White Blood Cells, WBCs):** defend body against _____.
 - ▶ Unlike RBCs, WBCs are _____ confined to blood; many use bloodstream to travel where they are needed.
- ♦ Leukocytes can be broadly categorized into _____ groups:
 1. **Granulocytes:** contain cytoplasmic _____ that are easily observed under a microscope.
 2. **Agranulocytes:** do _____ contain easily visible cytoplasmic granules.



EXAMPLE

Which of the following statements about erythrocytes and leukocytes is false?

- a) Leukocytes are significantly larger than erythrocytes.
- b) Leukocytes and erythrocytes are both confined to the bloodstream during normal function.
- c) Erythrocytes' primary function is transport, while leukocytes' primary function is protection.
- d) All of the above are true.

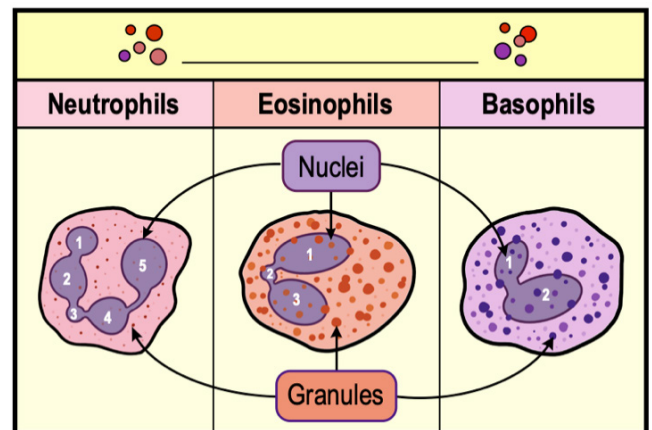
PRACTICE

What differentiates granulocytes from agranulocytes?

- a) Granulocytes contain cytoplasmic granules, but agranulocytes do not.
- b) Granulocytes contain cytoplasmic granules that can be easily visualized under a microscope after staining.
- c) Granulocytes are larger.
- d) Granulocytes are smaller.

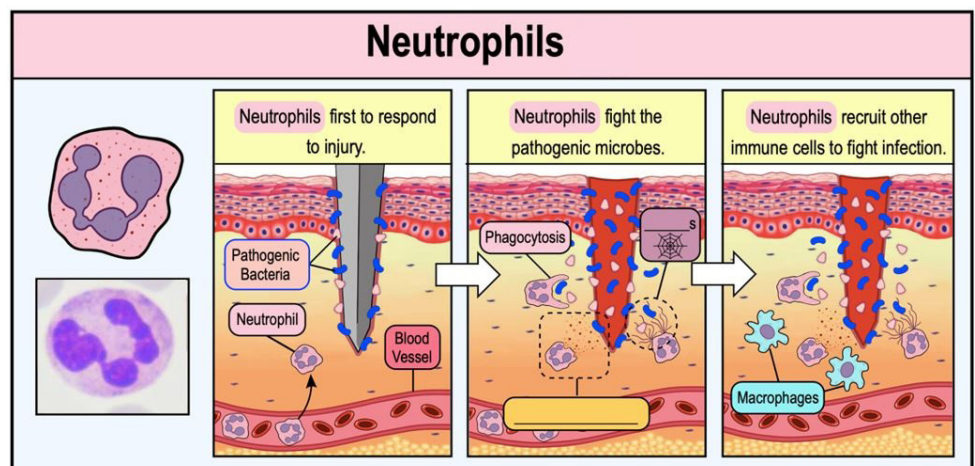
TOPIC: LEUKOCYTES

- ♦ **Granulocytes:** white blood cells with visible cytoplasmic _____.
- **Granules:** contain compounds used for protective functions & are visible under a light microscope..
- ♦ There are _____ types of granulocytes named based on the staining properties of their granules:
 - 1) **Neutrophils:** have a nucleus with 5 lobes & small granules which do _____ stain well.
 - Also known as: **PolyMorphonuclear Neutrophils** (_____)s).
 - 2) **Eosinophils:** have 2-3 lobes in the nucleus & large granules that stain a _____/orange color.
 - 3) **Basophils:** have a two-lobed nucleus & large granules that stain a dark _____/purple color.



Neutrophils

- ♦ **Neutrophils** are the most _____ type of leukocyte in the blood (can make up to 70% of all leukocytes).
- Migrate to different locations via _____ stream & are often *first* to respond to infection or tissue damage.
- Granules contain variety of defensins & hydrolytic enzymes that _____ microbes.
- Granules can be _____ from the cell (**degranulation**) or used to destroy microbes during phagocytosis.
 - **Phagocytosis:** process of _____ & digesting material including invading microbes (cell “eating”).
- Can also release neutrophil extracellular traps (NETs) or webs of chromatin that _____ infecting microbes.



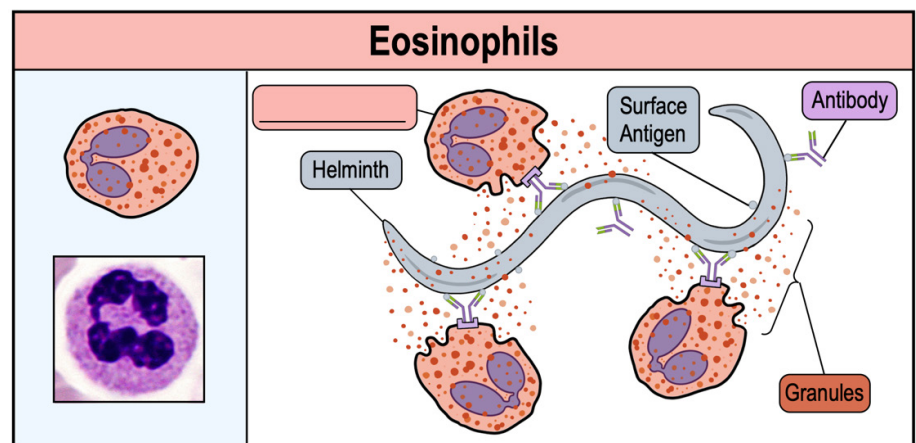
TOPIC: LEUKOCYTES

PRACTICE: Which granulocyte is the first to respond to an infection, has hydrolytic enzymes in its granules, and possesses the ability of phagocytosis?

- a) Basophil.
- b) Eosinophil.
- c) Neutrophil.
- d) Macrophage.

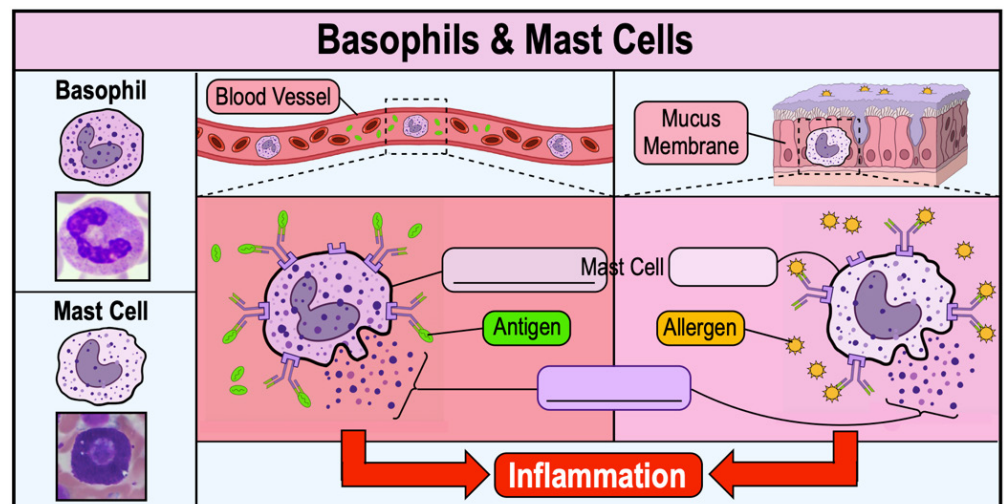
Eosinophils

- ♦ Primary role of **Eosinophils** is to protect against parasitic _____ (helminths).
 - Granules have antimicrobial substances that bind parasites & enzymes that disrupt membrane permeability.
 - Can also cause some symptoms associated with _____.



Basophils

- ♦ **Basophils:** are also involved in allergic reactions & inflammation response during infection.
 - Produce _____ that are released during inflammation to increase *capillary permeability*.
 - Allows other defense cells to easily _____ the bloodstream & enter an infected area of the host.
 - _____ **Cells:** similar in function to basophils but are found inside *tissues* rather than circulating the blood.
 - Detects tissue damage, *degranulates* to release *histamine*, which induces *inflammation*.



TOPIC: LEUKOCYTES

PRACTICE: Which of the following is a phagocytic cell found in the human body?

- a) Eosinophil.
- b) Neutrophil.
- c) Basophil.
- d) T cell.

PRACTICE: Which of the following answers are characteristics or roles of granulocytes?

- a) Release of hydrolytic enzymes that damage bacterial cell membranes.
- b) Production and release of histamines which increases capillary permeability.
- c) Release antimicrobial substances that damage the membranes of parasites.
- d) Phagocytose invading microorganisms.
- e) All of the above.

PRACTICE: White blood cells are referred to as _____.

- a) Platelets.
- b) Erythrocytes.
- c) Leukocytes.
- d) Megakaryocytes.

PRACTICE: Two immune cells have very similar functions. Both immune cells release histamine and induce inflammation. However, _____ cells reside in specific tissues, while _____ cells travel through the blood stream.

- a) Mast cells; Basophil cells.
- b) Basophil cells; Neutrophil cells.
- c) Granulocyte cells; Basophil cells.
- d) Eosinophil cells; Dendritic cells.

TOPIC: LEUKOCYTES

PRACTICE: In type I allergic reactions, antibodies are produced and bind to:

- a) Mast cells.
- b) Neutrophils.
- c) Eosinophils.
- d) Monocytes.

PRACTICE: Granulocytes:

- a) Travel through the lymphatic system.
- b) Are the most numerous leukocyte in circulation.
- c) Develop in the thymus.
- d) Do not contain distinct granules in their cytoplasm.

TOPIC: LEUKOCYTES

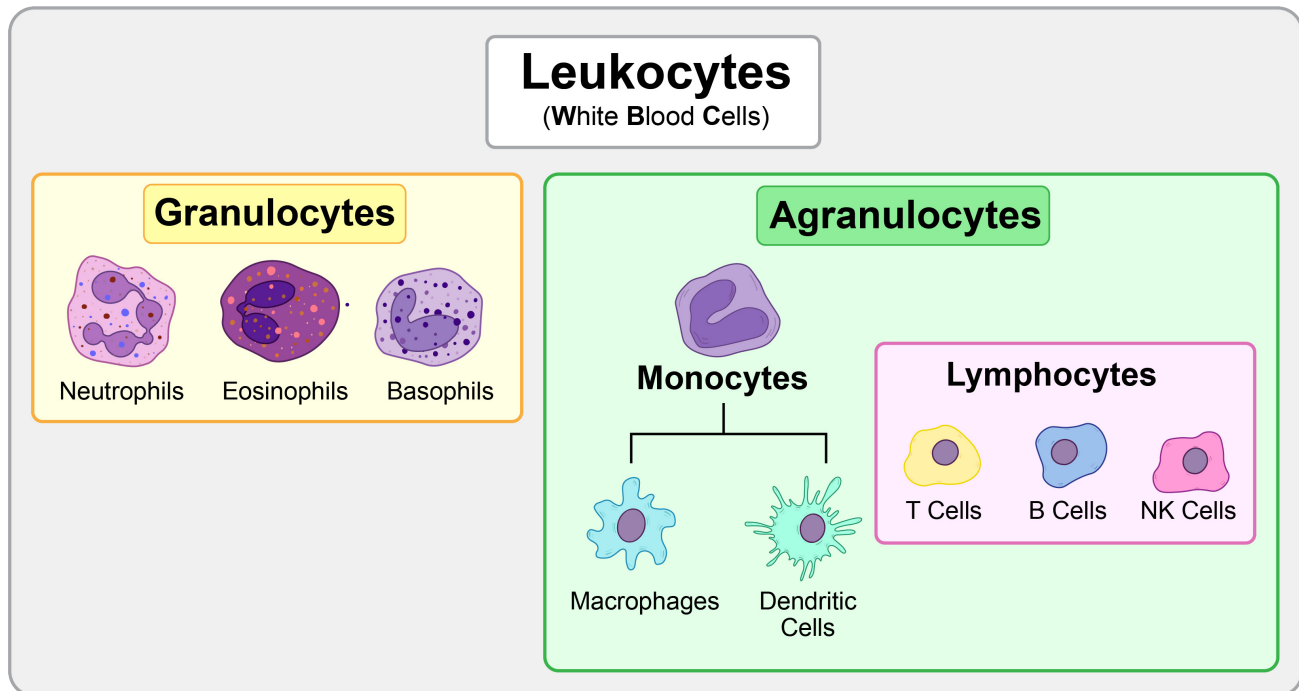
Agranulocytes

♦ **Agranulocytes:** leukocytes with cytoplasmic granules that are _____ visible under a light microscope.

♦ Agranulocytes include:

1. _____: circulate the bloodstream & can develop into *macrophages* or *dendritic cells*.

2. **Lymphocytes:** includes B & T cells, which are involved in _____ immunity (covered in later videos).



TOPIC: LEUKOCYTES

Monocytes

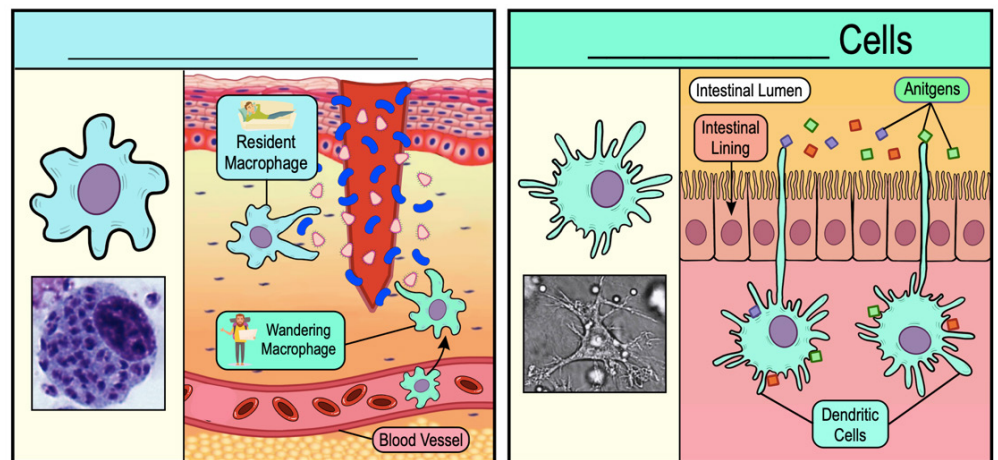
♦ Monocytes develop into one of _____ types of *phagocytic cells*:

1) **Macrophages**: phagocytic, sentinel cells that respond *directly* to an infection & can alert other host defenses.

- ▶ _____ **Macrophages**: *reside* permanently in specific tissues (remain stationary in tissues).
- ▶ **Wandering Macrophages**: _____ through the blood to *other* sites of infection.
- ▶ **Giant Cells**: macrophages fused together to increase their destructive ability.

2) **Dendritic Cells**: sentinel cells with long appendages that reside in tissues & alert/initiate *adaptive immunity*.

- ▶ _____ pathogens in tissues, then present them to cells of the *adaptive immune system*.



PRACTICE: All of the following are major differences between macrophages & neutrophils except which of these answers?

- Macrophages can perform phagocytosis while neutrophils cannot.
- Macrophages kill microbes by “eating” them. Neutrophils kill microbes with hydrolytic enzymes and/or phagocytosis.
- Neutrophils circulate the bloodstream while resident macrophages reside in tissues.
- Neutrophils are granulocytes while macrophages are agranulocytes.

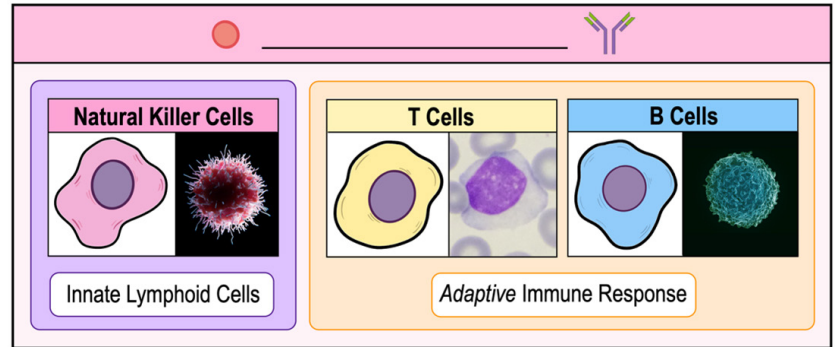
PRACTICE: Monocytes can differentiate into which types of immune cells?

- Basophils & macrophages.
- Neutrophils & dendritic cells.
- Macrophages & dendritic cells.
- Mast cells & macrophages.

TOPIC: LEUKOCYTES

Introduction to Lymphocytes

- ◆ Recall: **Lymphocytes**: includes leukocytes involved in _____ immunity (covered in other videos).
 - 2 major groups of lymphocytes: 1) _____ cells & 2) _____ cells
 - Both respond to _____ antigens of invading microbes.



- ◆ HOWEVER, a group of lymphocytes (*innate lymphoid cells*) differ from B & T cells since they are part of *innate* immunity.
 - **Innate Lymphoid Cells (ILCs)**: differ from B & T cells due to a _____ of specificity in antigen recognition.
 - An example of ILCs are **Natural Killer Cells** (____s) that kill a variety of cell types.

PRACTICE: Why is a bone marrow transplant used to replace defective lymphocytes in a patient?

- Bone marrow creates common myeloid progenitor cells which differentiate into lymphocytes.
- Bone marrow creates monocytes which differentiate into lymphocytes.
- Bone marrow creates hematopoietic stem cells which differentiate into all immune cells including lymphocytes.

TOPIC: LEUKOCYTES

PRACTICE: Which of the following immune cells is NOT a professional phagocyte?

- a) NK cell.
- b) Neutrophil.
- c) Macrophage.
- d) Dendritic cell.

PRACTICE: Which of the following are referred to as mononuclear phagocytes?

- a) Lymphocytes and basophils.
- b) Mast cells and eosinophils.
- c) Basophils and eosinophils.
- d) Monocytes and macrophages.