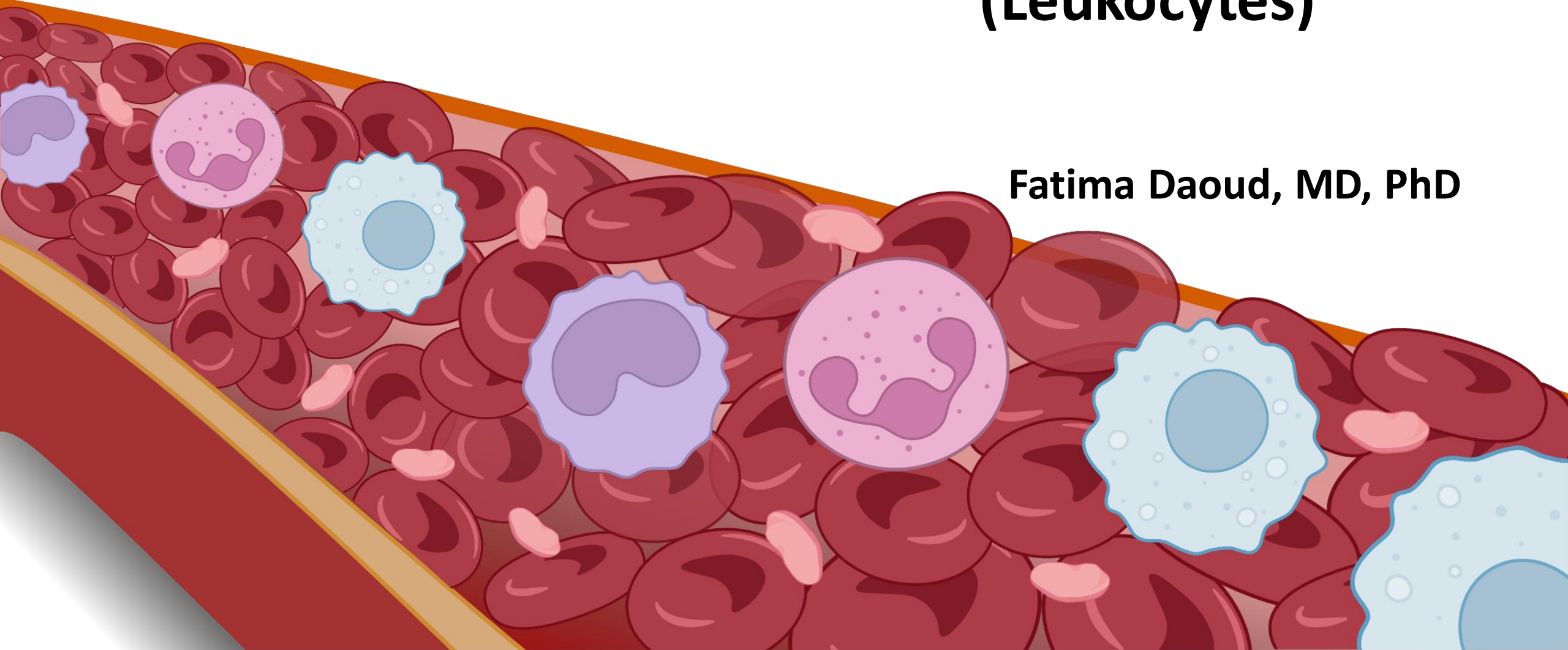


Hematology

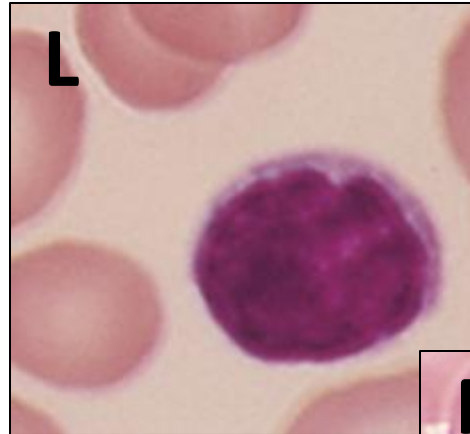
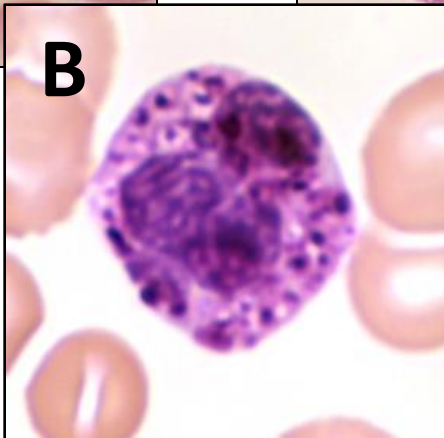
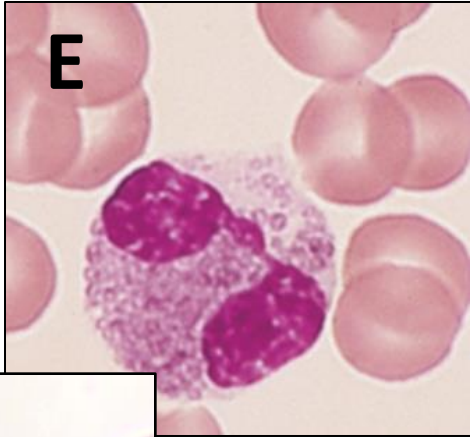
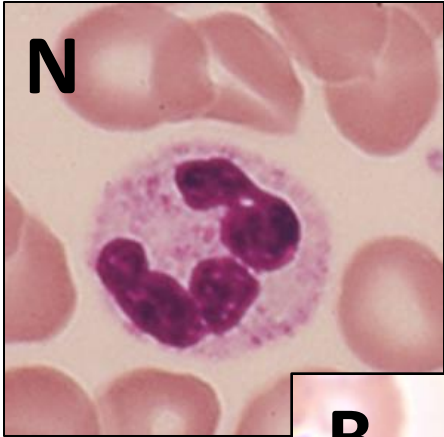
WBC

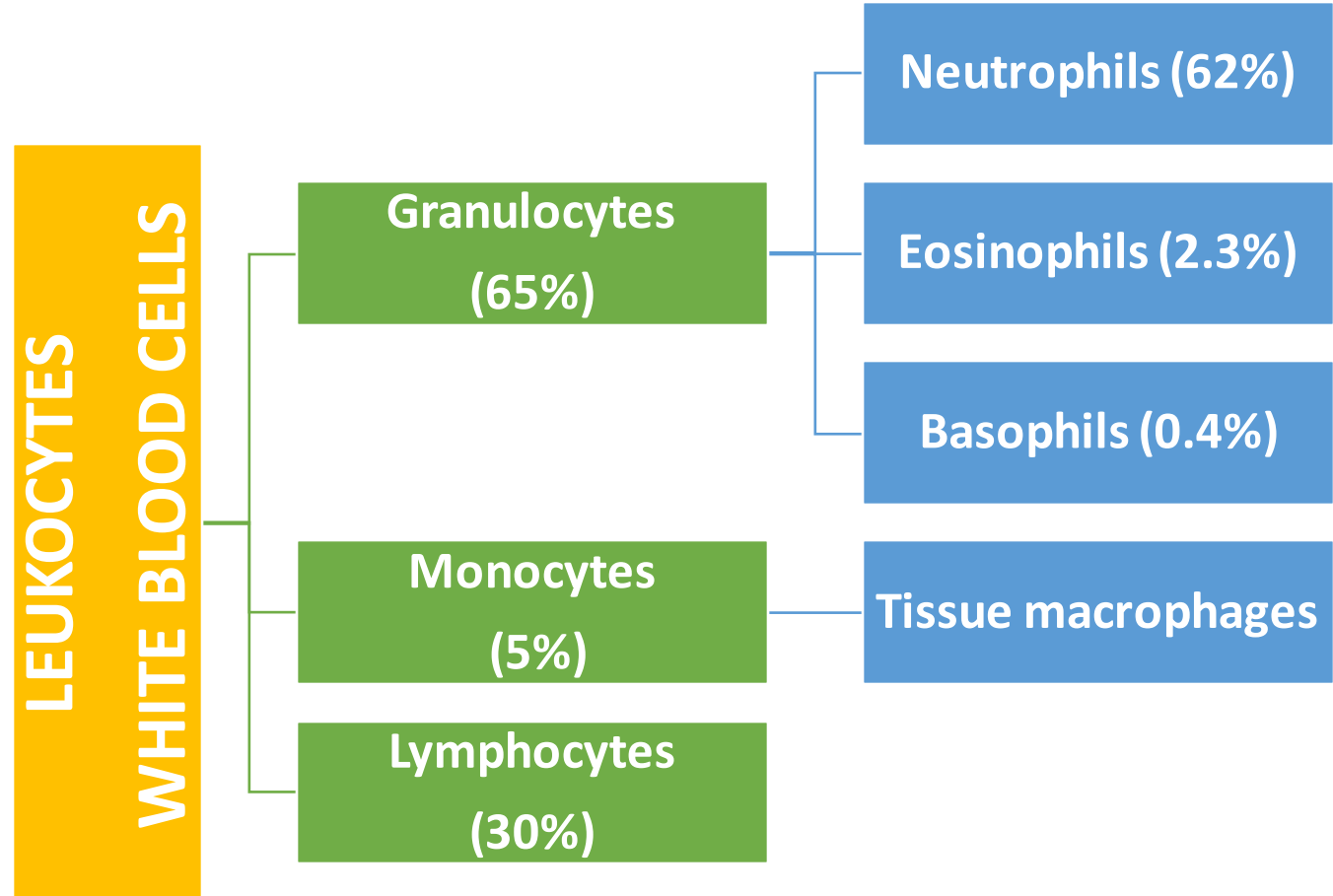
White Blood Cells (Leukocytes)

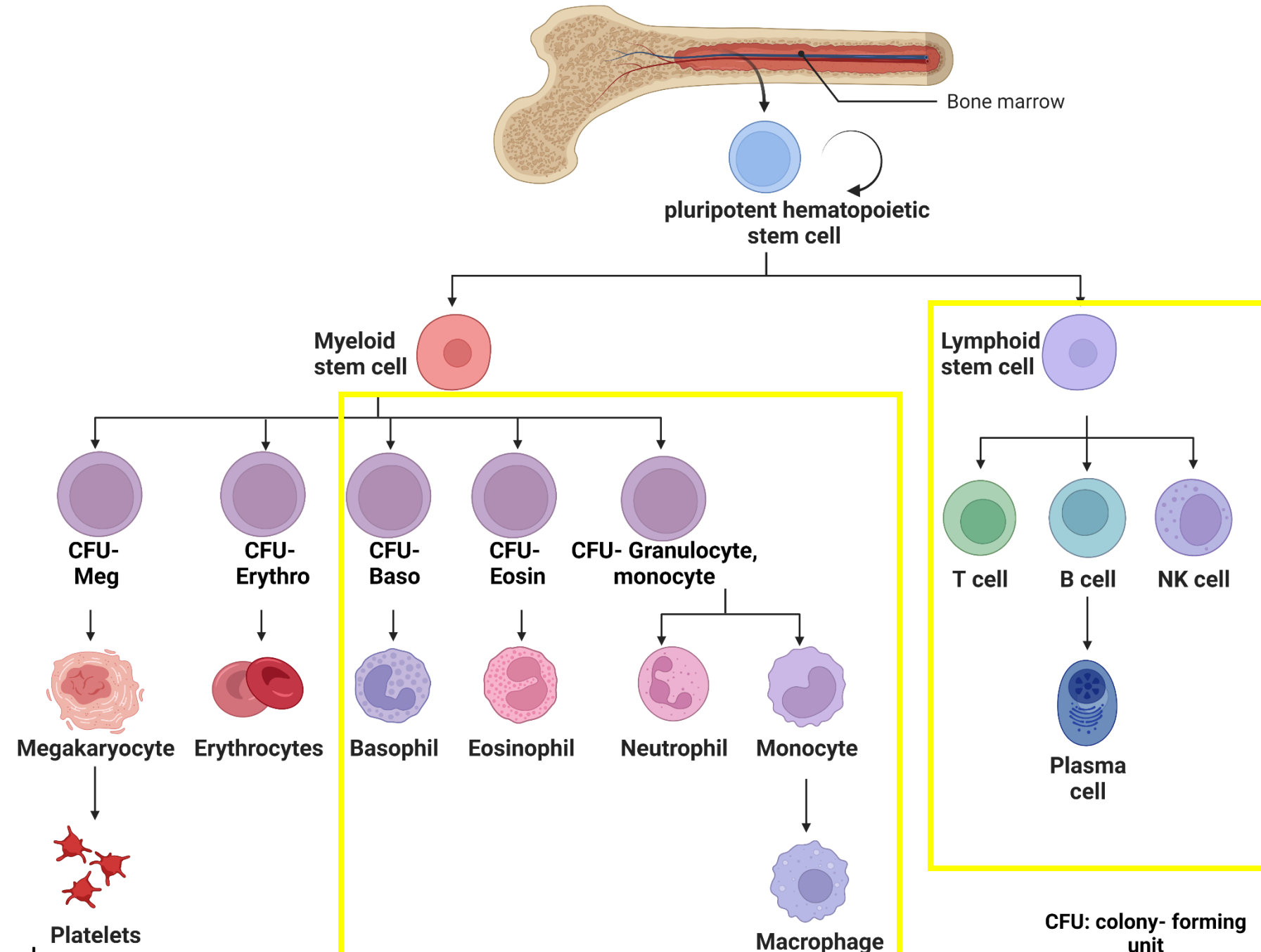
Fatima Daoud, MD, PhD



Granulocytes	Non- Granulocytes
Neutrophils	Monocytes
Eosinophils	Lymphocytes
Basophils	





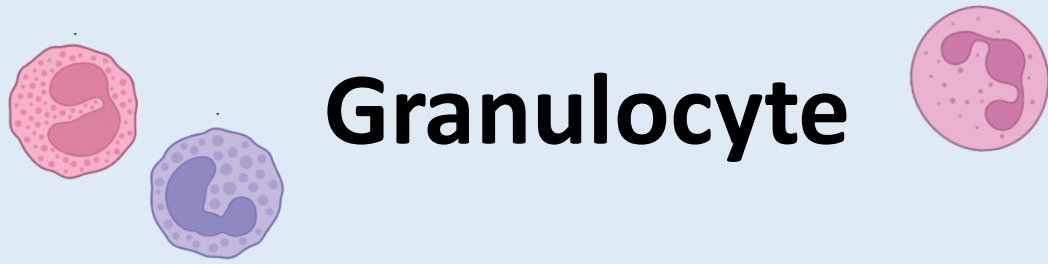


CFU: colony-forming unit

Blood function: Protection

White blood cells work together in two ways to prevent disease:

- (1) by actually destroying invading bacteria or viruses by **phagocytosis**.
(Neutrophils and macrophages)
- (2) by forming antibodies and sensitized lymphocytes, which may destroy or inactivate the invader.



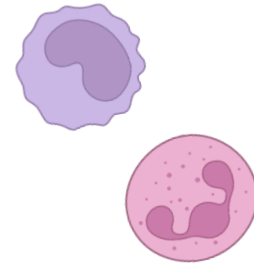
- The granulocytes are formed only in the bone marrow.
- They stored within the marrow until they are needed in the circulatory system.
- The life of the granulocytes after being released from the bone marrow is normally 4 to 8 hours circulating in the blood and another 4 to 5 days in tissues where they are needed.
- In times of serious tissue infection, this total life span is often shortened.

Monocyte/macrophage



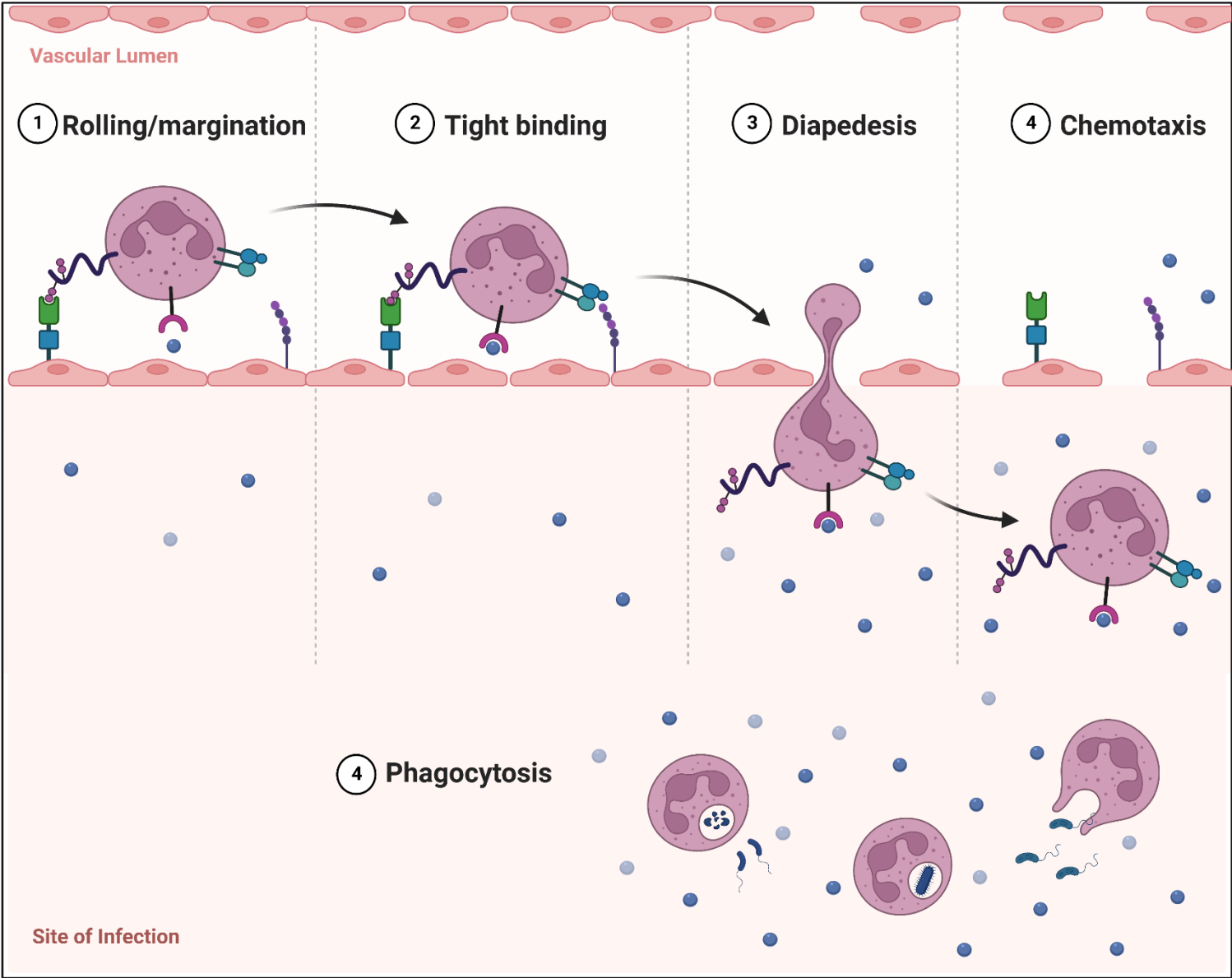
- The monocytes are formed only in the bone marrow.
- The monocytes also have a short transit time, 10 to 20 hours in the blood.
- Once in the tissues, they swell to much larger sizes to become tissue macrophages (can live for months).

Actions of Phagocytic Cells



- 1. Margination**
- 2. Tight binding**
- 3. Diapedesis**
- 4. Chemotaxis**
- 5. Ameboid Motion (pseudopodia)**
- 6. Phagocytosis**

Actions of Phagocytic Cells

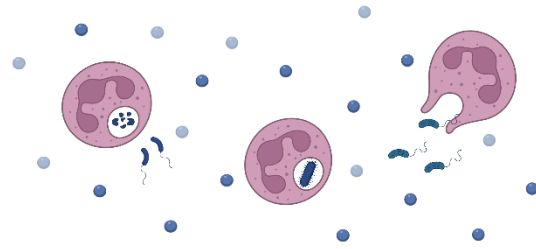




Neutrophil



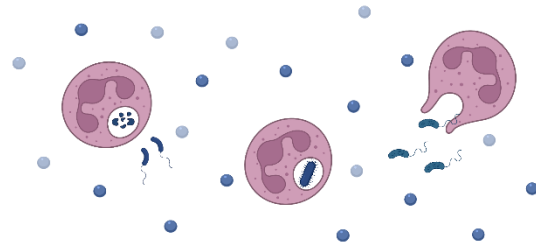
Phagocytosis



Phagocytes must be **selective** and likelihood of phagocytosis is increased when :

1. If the surface is rough, the likelihood of phagocytosis is increased.
2. Most dead tissues and foreign particles have no protective protein coats.
3. The antibodies adhere to the bacterial membranes and thereby make the bacteria especially susceptible to phagocytosis (opsonization)

Phagocytosis

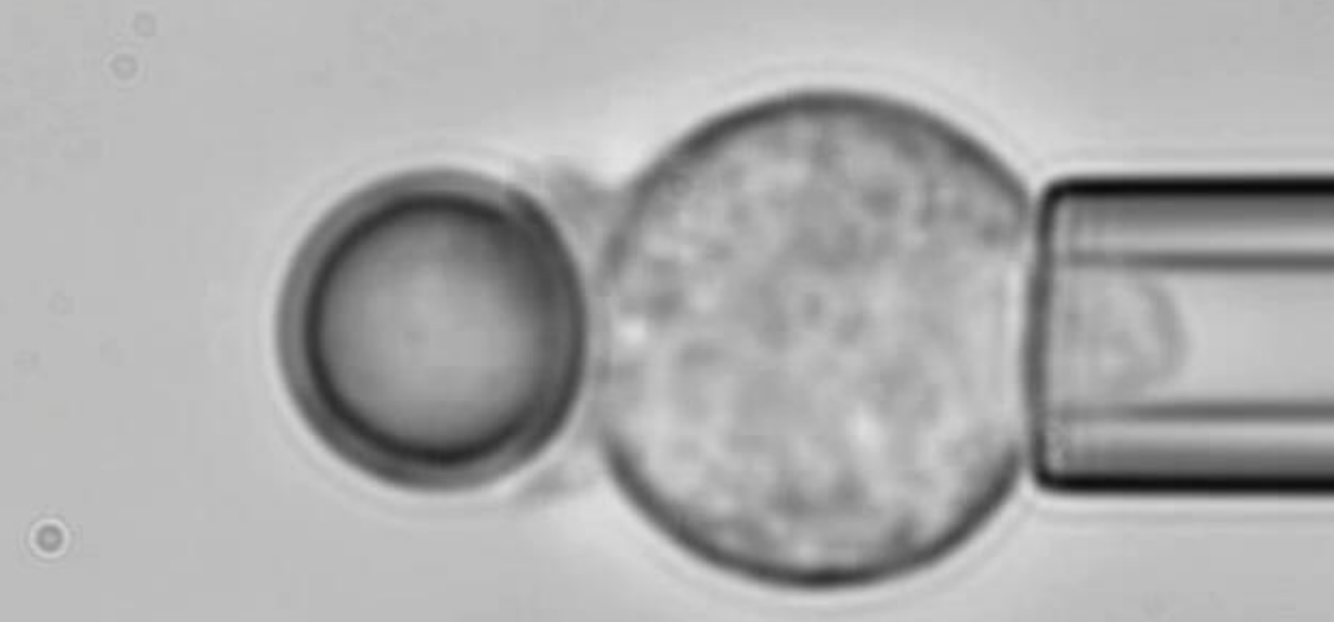


How does a phagocytic cell kill a microorganism?

- Enzymatic digestion
- Hypochlorite (myeloperoxidase)
- Reactive oxygen metabolites
 - superoxide anion
 - hydrogen peroxide
 - hydroxyl radicals

09/11/05 21:26:44
0.42 cm H2O

Neutrophil Phagocytosis of a 4.6 um Bead



10 um

Herant - Heinrich - Dembo



Question

Neutrophil



- Mature cells that can attack and destroy bacteria even in the circulating blood.
- Not capable of phagocytizing particles much larger than bacteria.

Monocyte/macrophage



- Monocyte are immature cells while still in the blood and have little ability to fight infectious agents at that time.
- They have the ability to engulf much larger particles (RBC).
- Macrophages are much more powerful phagocytes.
- Can extrude the residual products and often survive and function for many more months.

Eosinophils



- They form about 2 percent of all the blood leukocytes.
- Eosinophils are weak phagocytes.
- They are often produced in large numbers in people with parasitic infections.
- Eosinophils attach themselves to the parasites by way of special surface molecules and release substances that kill many of the parasites.
- Eosinophils also have a special propensity to collect in tissues in where allergic reactions occur.

Basophils



- ~ 0.5% of total white blood cells
- Similar to the large tissue mast cells located immediately outside many of the capillaries in the body.
- They express IgE antibody on the surface and antigen binding causes rupture of basophil and release large quantities of intracellular granules.
- The mast cells and basophils release *histamine*, *heparin*, as well as smaller quantities of *bradykinin* and *serotonin*.