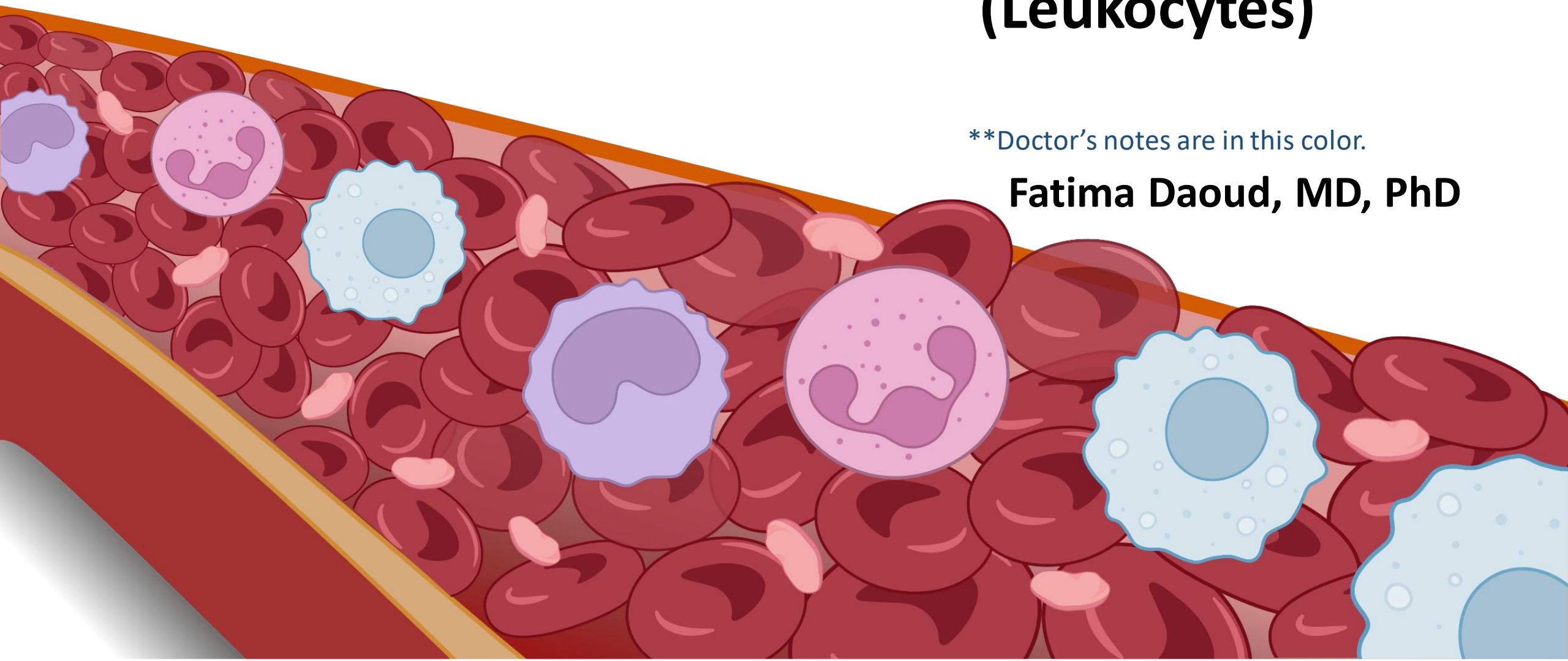
Hematology WBC

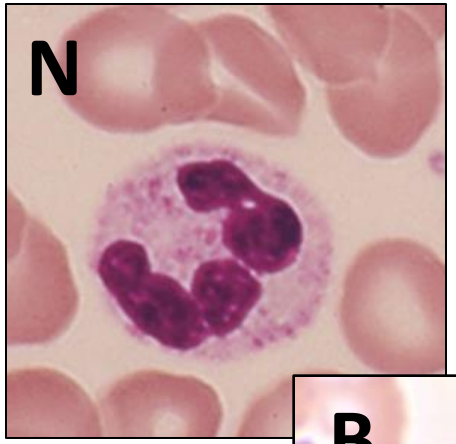
White Blood Cells (Leukocytes)

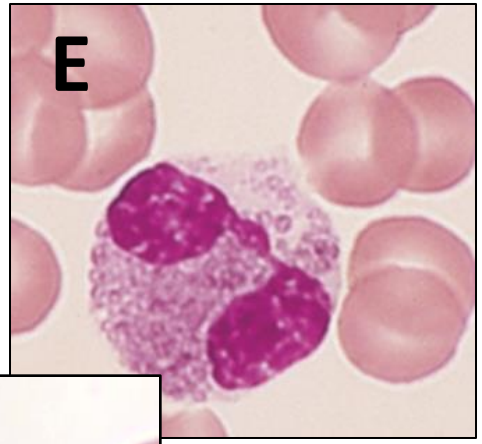


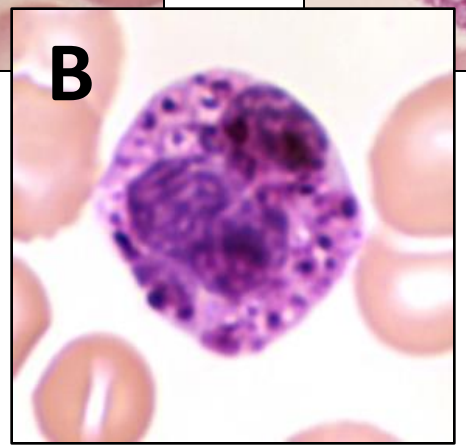
**Doctor's notes are in this color.

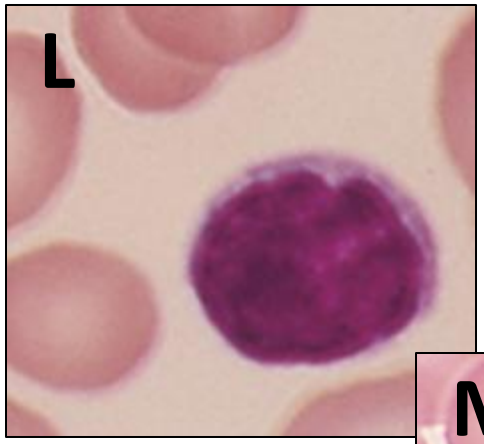
Fatima Daoud, MD, PhD

Granulocytes	Non- Granulocytes
Neutrophils	Monocytes
Eosinophils	Lymphocytes
Basophils	



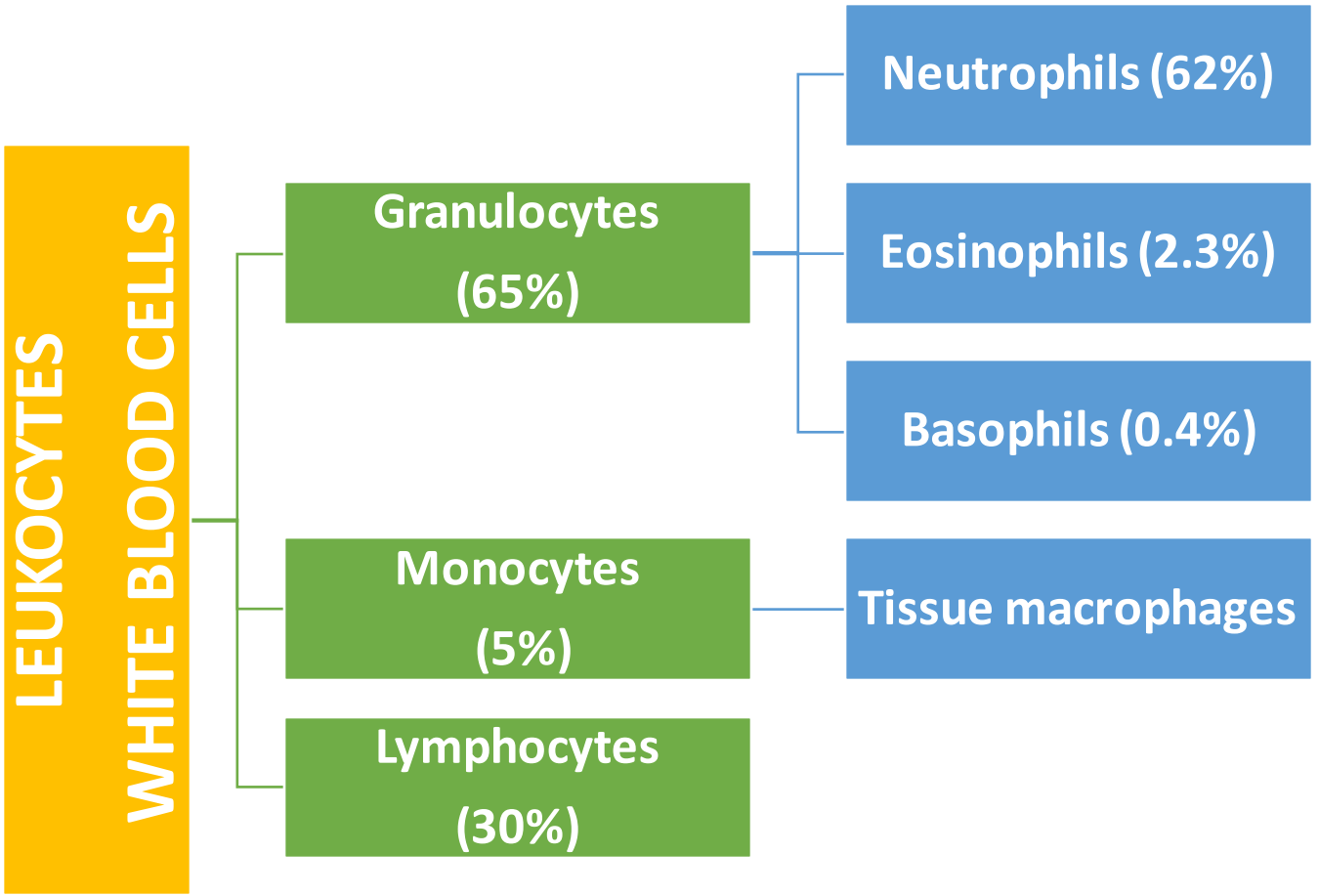




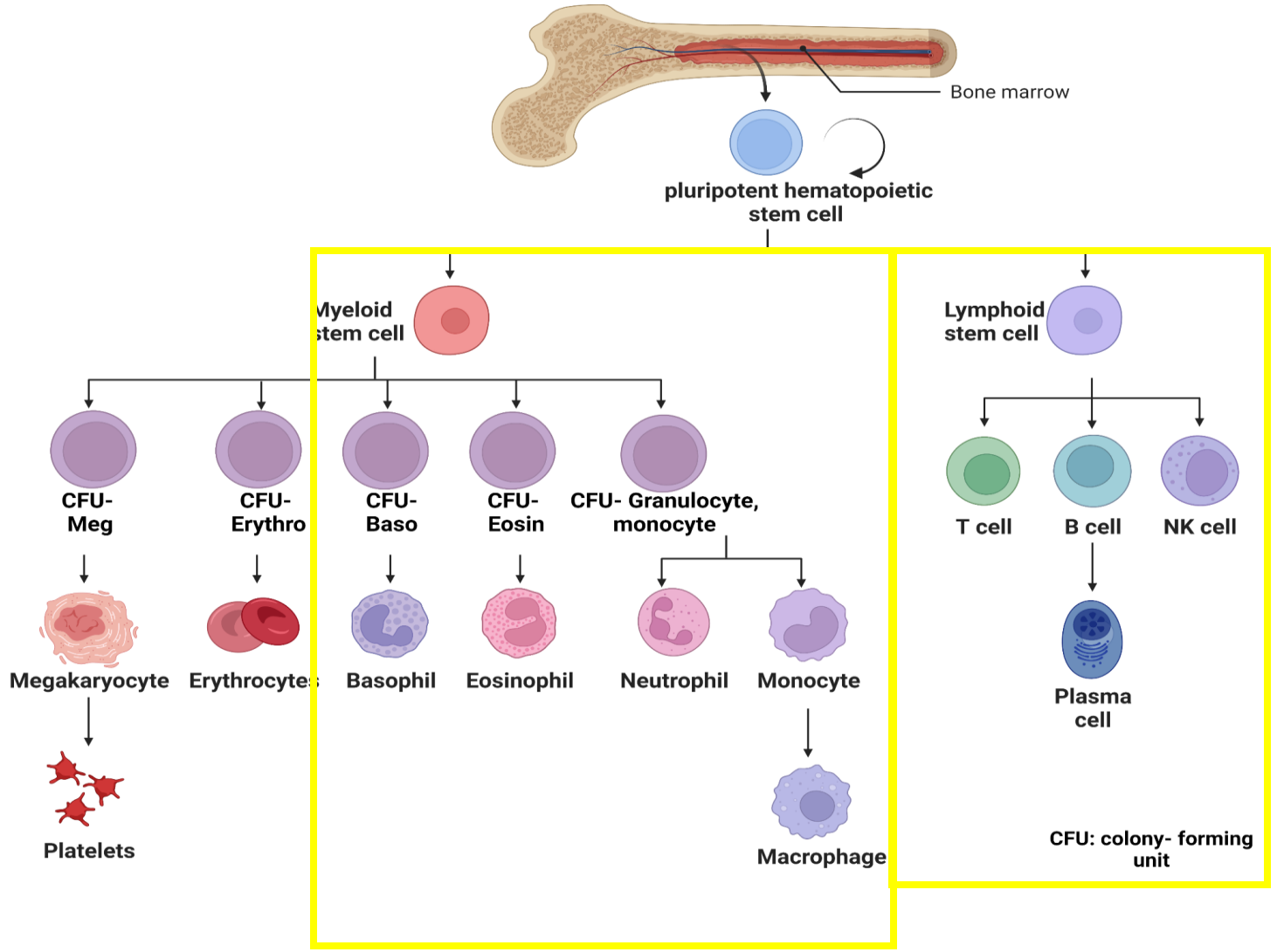


Hematology

WBC CLASSIFICATION



**The granulocytes and monocytes are formed only in the bone marrow.
**Lymphocytes and plasma cells are produced mainly in the various lymphogenous tissues—especially the lymph glands, spleen, thymus, tonsils, and various pockets of lymphoid tissue elsewhere in the body, such as in the bone marrow.
**The white blood cells formed in the bone marrow are stored within the marrow until they are needed in the circulatory system. when the need arises, various factors cause them to be released.
**Normally, about three times as many white blood cells are stored in the marrow as circulate in the entire blood. This represents about a 6-day supply of these cells
**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

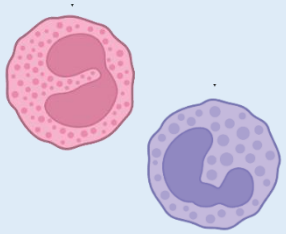


Blood function: Protection

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.



Granulocyte

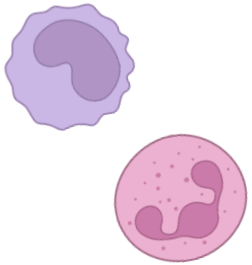
- The granulocytes are formed only in the bone marrow.
- They stored within the marrow until they are needed in the circulatory system.
- The life of the granulocytes after being released from the bone marrow is normally 4 to 8 hours circulating in the blood and another 4 to 5 days in tissues where they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

**In times of serious tissue infection, this total life span is often shortened to only a few hours because the granulocytes proceed even more rapidly to the infected area, perform their functions, and, in the process, are themselves destroyed.

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

**The neutrophils are mature cells that can attack and destroy bacteria even in the circulating blood. Conversely, the tissue macrophages begin life as blood monocytes, which are immature cells while still in the blood and have little ability to fight infectious agents at that time. However, once they enter the tissues, they begin to swell—sometimes increasing their diameters as much as fivefold—to as great as 60 to 80 micrometers, a size that can barely be seen with the naked eye. These cells are now called *macrophages,* and they are extremely capable of combating disease agents in the tissues.
**

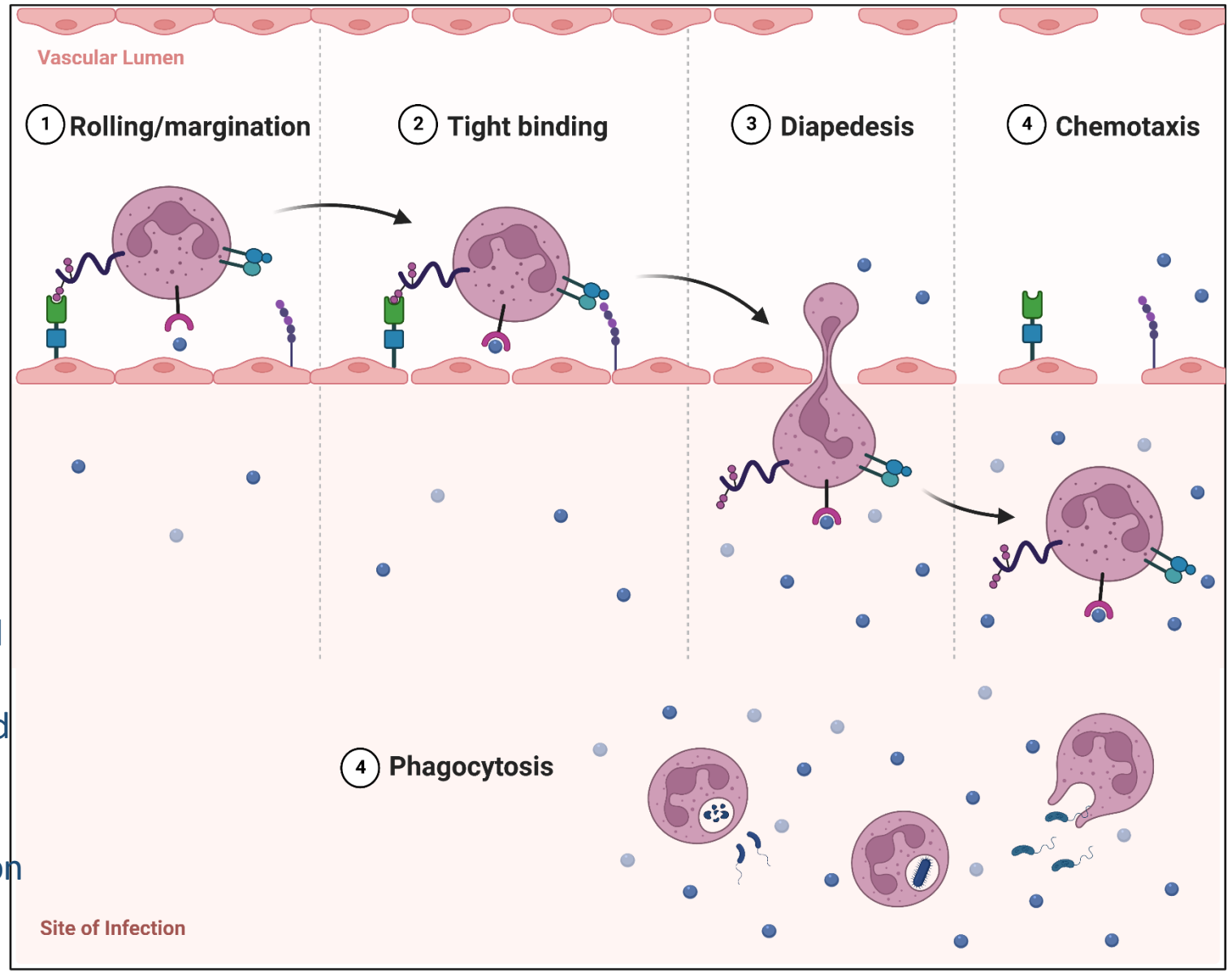
Actions of Phagocytic Cells

**Neutrophils and monocytes can squeeze through the pores of the blood capillaries by *diapedesis.*

**Both neutrophils and macrophages can move through the tissues by ameboid motion.

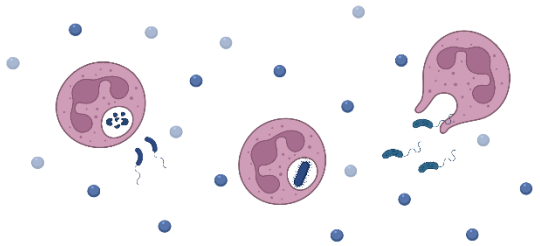
**Many different chemical substances in the tissues cause both neutrophils and macrophages to move toward the source of the chemical. This phenomenon is called *chemotaxis.*

***phagocytosis,* which means cellular ingestion of the offending agent




Neutrophil
© Katie Bergdale 2016

Phagocytosis



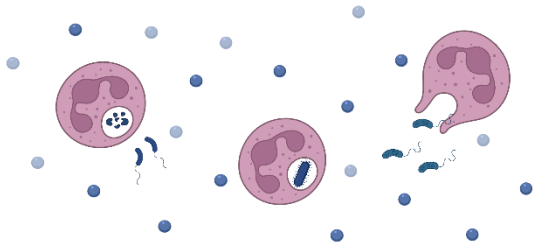
Phagocytes must be **selective** and likelihood of phagocytosis is increased when :

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.

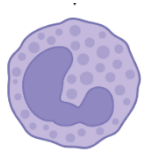
Monocyte/macrophage

- 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.*