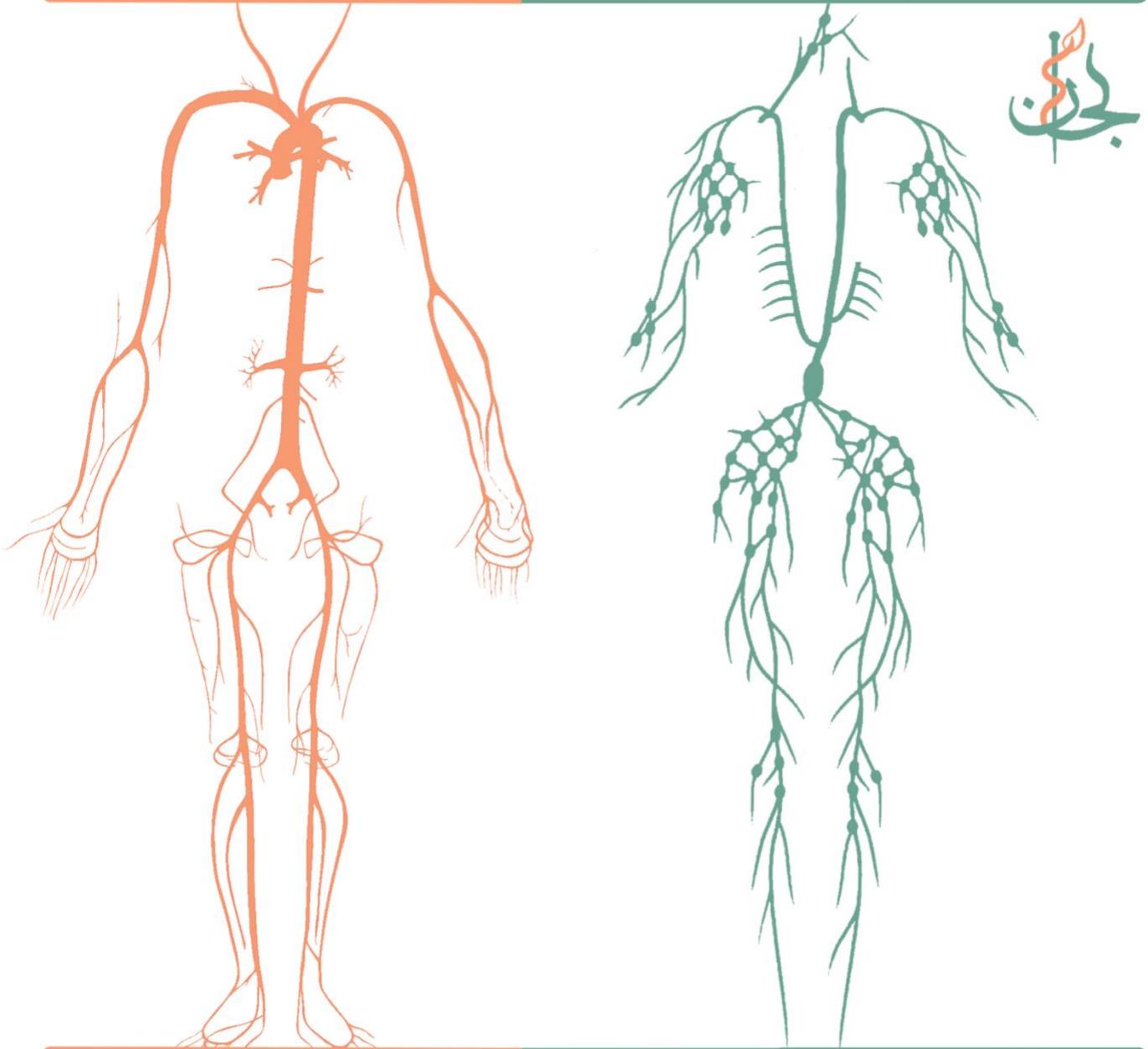


# Physiology HematoLymphatic



**Title:** Sheet 7 – leukocytes

**Writer:** Ruba alshawabkeh

**Scientific Correction:** Nadeen Al-Falooji

**Final Correction:** Ameen Alsaras

**Doctor:** Saleem Kh.

# Leukocytes

Unlike red blood cells, white blood cells or leukocytes have a nucleus, do not contain hemoglobin and they are larger in size.

WBCs are classified as either granular or agranular, depending on whether they contain conspicuous chemical-filled cytoplasmic vesicles (called granules) that are made visible by staining.

Granular leukocytes include neutrophils, eosinophils, and basophils.

Agranular leukocytes include lymphocytes and monocytes.

■ The normal total white blood cells count ranges from 5,000-10,000/mm<sup>3</sup> or 4,000-11,000/mm<sup>3</sup>.

Low levels of WBCs is termed **leukopenia**.

High level of WBCs is termed **leukocytosis**.

- Healthy individuals might still have a count that is slightly out of the normal range (whether higher or lower).

- Gender has no effect on the WBC count, but even in the same individual the count changes physiologically, for example:

1- WBCs count is high in the evening and low in the morning.

2- It increases after meals, exercises, excitement and during pregnancy.

- WBCs move from capillaries to tissues to perform their functions.

- WBCs have short half-lives ranging from hours (6 hours for neutrophils) to months (like in monocytes) to years (like in lymphocytes)

■ Average WBC count/mm<sup>3</sup>:

Neutrophils: 5,400 (60%)    Eosinophils: 275 (4%)    Basophils: 35 (1%)

Lymphocytes: 2750 (30%)    Monocytes: 540 (5%)

- *In general* neutrophils are the most abundant followed by Lymphocytes then monocytes, eosinophils and finally basophils.

- The leukocytes we count (4000-11000) make up only 50% of the total number of leukocytes as the remainder adhere to the inner surfaces of the blood vessels. These adhering leukocytes are referred to as the marginal pool and they are only released in some conditions like hemorrhage or lysis of WBCs.

- **Leukopoiesis** → is the production of white blood cells.

- The duration required for the production of WBCs via leukopoiesis is 6 days, which is the same amount of time needed for the production of RBCs, but WBCs remain in the bone marrow for 6 more days after they're produced so that they can be "computerized" and activated to do their functions before being released to the circulation.

- All WBCs are only produced in the bone marrow, except the lymphocytes, which are produced and mature in both the bone marrow and thymus. Therefore, if there's a problem in the bone marrow all WBCs will significantly decrease except lymphocytes (they will decrease but not as much as other WBCs)

- **WBCs contents** → All WBCs have enzymes to kill foreign bodies. However, basophils have extra chemicals such as: **Heparin, Histamine and Serotonin.**

\*Normally 75% of the bone marrow cells are WBC-producing myeloid cells and only 25% are maturing red cells even though they are much more evident than WBCs in the circulation. This reflects the fact that the average life span of WBCs is short compared to that of RBCs.

- **The process of leukopoiesis** → is the most complicated process in the body because:

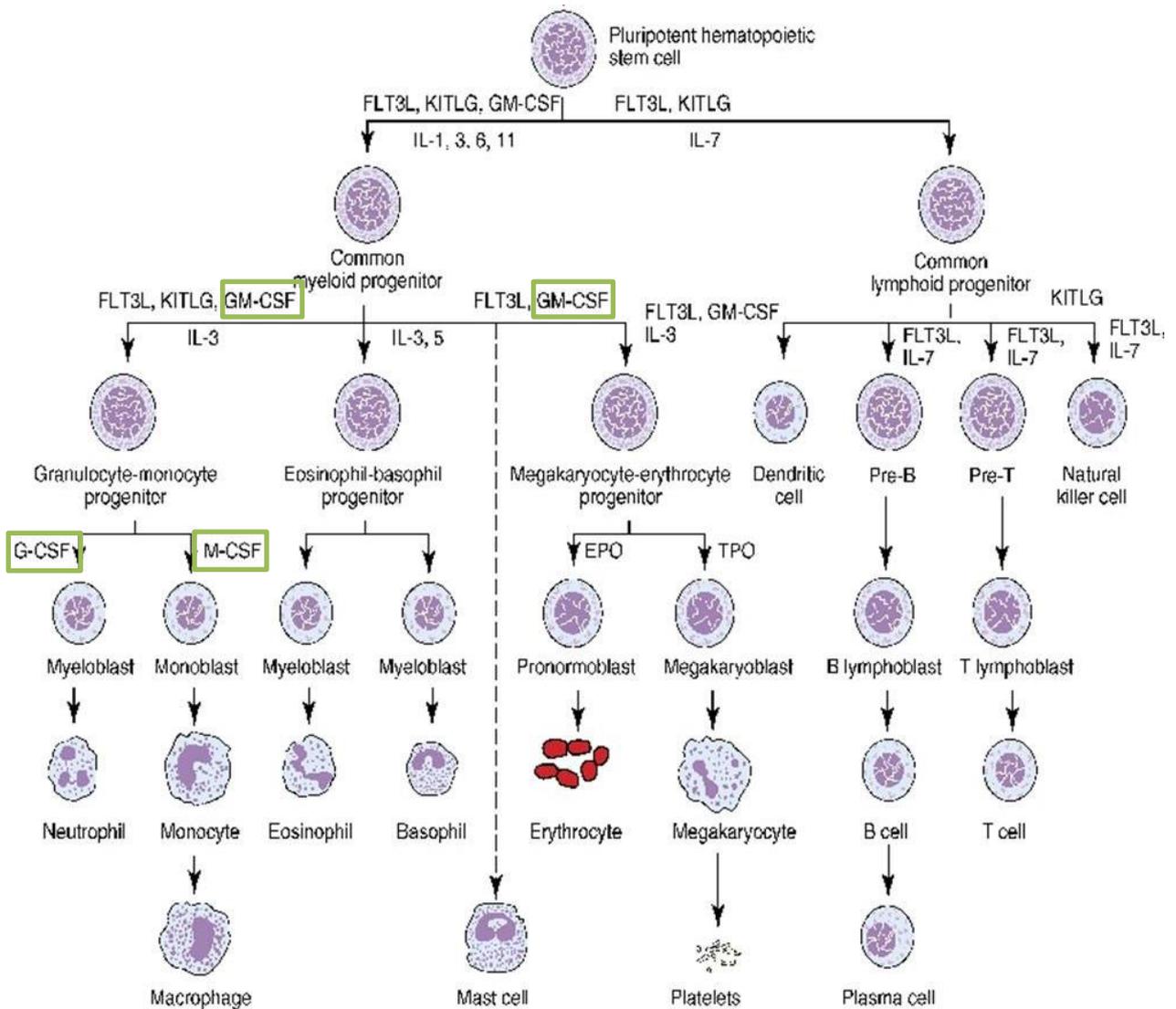
1- There are many factors involved in the production of WBCs. These factors include:

IL-1, IL-3, IL-6, and CSFs (colony stimulating factors)

2- Each one of these factors is produced by many sources

3- There is an overlap between factors, and each factor affects more than one cell lineage as you can see in the figure.

4- The process has many stages. And in each stage many cell types are produced.



**Note:**

Colony stimulating factors are called like that because if you add any of them to a stem cell in the lab you'll find many cells produced (colony)

*Good Luck!!*