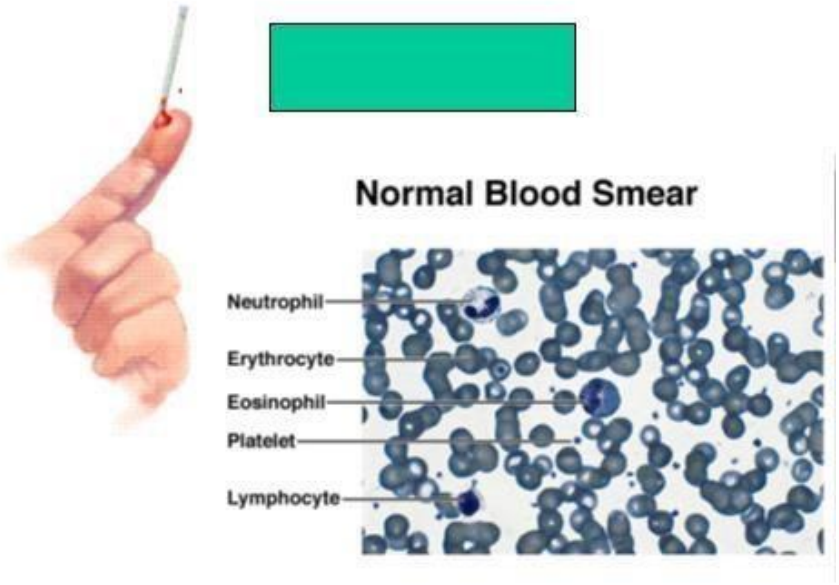
White blood cells

The W.B.C., count is from (4000-11000) cells/mm³, if the count less than 4000, the condition is called leukopenia, if it's more than 11000, the condition is leukocytosis. W.B.C. are involved in the body defense mechanism against mircoorganisms and other foreign materials. W.B.C. are classified according to the type of cytoplasm into the following:



1. ***Granular leukocytes***: in which the cytoplasm contain granules, these are classified into polymorphonuclear leukocytes which include:

   A. ***Neutrophils:*** multilobed nucleus, 2-5 lobes depending on the age of the cell. The percent is 65%.

   B. ***Eosinophils:*** multilobed nucleus (usually bilobed). The percent is 1-3%.

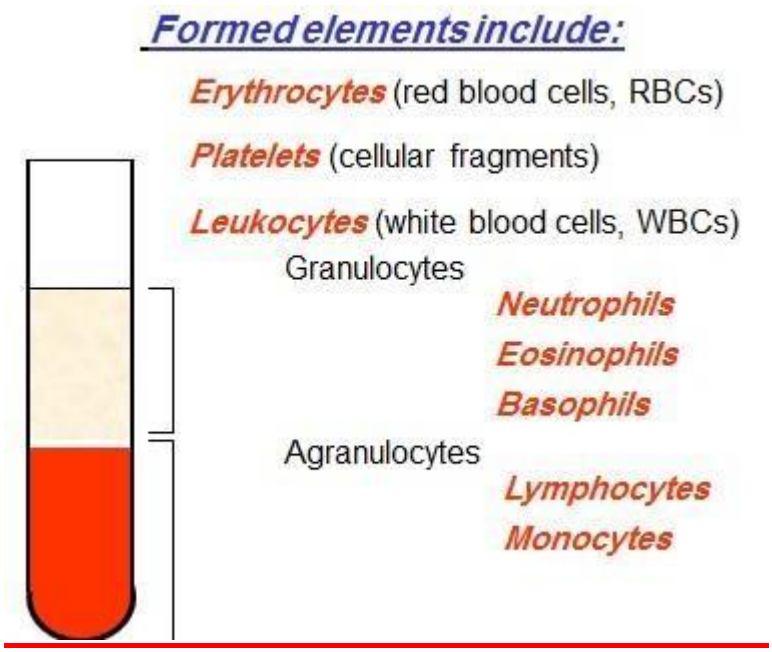
   C. ***Basophils:*** in this type, the nucleus take the (S) shape. The percent less than 1%.

2. ***Agranular leukocytes:*** in which is no granules in the cytoplasm, these are classified into:

   A. ***Monocytes:*** the nucleus is kidney shaped and they are the largest cells in the body. The percent is 7%.

   B. ***Lymphocytes:*** they are large lymphocytes and a small lymphocytes which depend on the age, the percent is 30%.

The granulocytes and monocytes protect the body against invading organisms mainly by ingesting them, that is, by phagocytosis. The lymphocytes and plasma cell function mainly in connection with immune system.



~~Genesis of the leukocytes~~

The granulocytes and monocytes are formed only in the bone marrow, lymphocytes and plasma cells are produced mainly in the various lymphogenesis organs, including the lymph gland, spleen, thymus…etc.

Life span of the W.B.C.

The main reason W.B.C., are present in the blood is to be transported from the bone marrow or lymphoid tissue to the areas of the body where they are needed.

The life of the granulocytes, once released from the bone marrow is normally 4-8 hours, circulating in the blood and another 4-5 days in the tissues. In times of serious tissue infection, this total life span is often only a few hours, because the granulocytes proceed rapidly to the infected area.

The monocytes also have a short time, 10-20 hours, in the blood before wandering through the capillary membrane into the tissue. They can live for months or even years unless they are destroyed by performing phagocytic function. The lymphocytes have life span of weeks, months, or even years, but this depends on the body's need for these cells.

Our bodies have a special system for combating the different infections and toxic agents. This composed of W.B.C., and tissue cells. These cells all work together to prevent diseases by actually destroying invading agents by phagocytosis and by forming antibodies and sensitized lymphocytes.

Phagocytosis:

The most important function of the neutrophils and macrophages is phagocytosis which mean cellular ingestion of the offending agent.

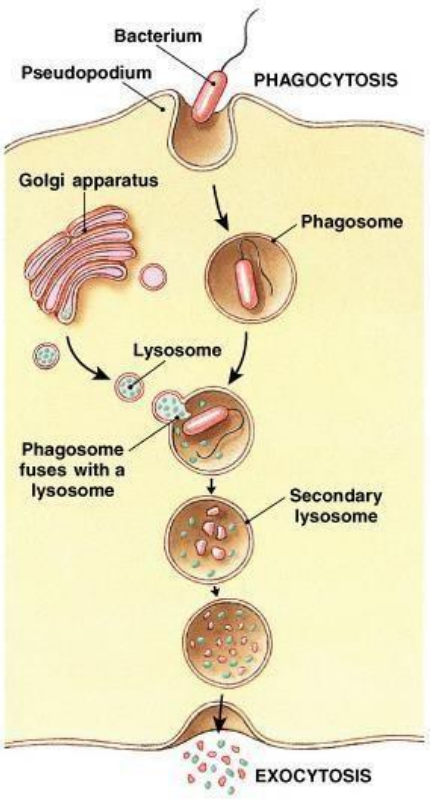
Phagocytes must be selective of the material that is phagocytosed, otherwise, some of the normal cells and structure of the body would be ingested. Whether or not phagocytosis will occur depends especially on three selective procedures: **1.** Most natural structures in tissue have smooth surface, which resist phagocytosis. But if the surface is rough, the likelihood of phagocytosis is increased.

2. Most natural substances of the body have protective protein coats that they repel the phagocytes, on the other hand, dead

tissues and most foreign particles frequently have no protective coats, which also make the subject to phagocytosis.

3. The body has a specific means of recognizing certain foreign materials.

The immune system develops antibodies against infectious agents like bacteria. The antibodies adhere to the bacterial membrane and there by make the bacteria especially susceptible to phagocytosis.



Inflammation:

When tissue injury occurs, whether caused by bacteria, trauma, chemicals, heat or any other phenomenon, multiple substances that cause dramatic secondary changes in the tissues are released

by the injured tissues. The entire complex of tissue changes is called **INFLAMMATION**.

Inflammation is characterized by:

1. Vasodilation of the local blood vessels.
2. Increased permeability of the capillaries.
3. Often clotting of the fluid in the interstitial spaces because of the excessive amounts of fibrinogen and other protein leaking from the capillaries.
4. Migration of large number of granulocytes and monocytes in the tissue.
5. Swelling of the tissue cells.

Leukemias

Uncontrolled production of W.B.C. is caused by cancerous mutation myelogenous and lymphogenous cell.
Leukemias are divided into:

1. Lymphogenous leukemia.
2. Myelogenous leukemia.

The effect of leukemia is metastatic growth of leukemic cells in abnormal areas of the body. Almost all leukemias spread to the spleen, lymph nodes, liver, and other especially vascular regions. In myelogenous leukemia, the cancerous process produces partially differentiated cells, resulting in what might called:

1. Neutrophilic leukemia.
2. Eosinophilic leukemia.

3. Basophilic leukemia.
4. Monocytic leukemia.

More frequently, however, the leukemia cells are bizarre and undifferentiated and not identical to any of the normal W.B.C.. usually the more undifferentiated the cells, the more acute is the leukemia, often leading to death within few months if untreated.

Leukopenia or Agranulocytosis:

A clinical condition known as leukopenia occurs in which the bone marrow stops producing W.B.C. leaving the body unprotected against bacteria and other agents that might invade the tissues. Without treatment, death often is less that a week after acute total leukopenia begins. This result from different cases:

1. Irradiation of the body by gamma rays caused by a nuclear explosion.
2. Exposure to drugs and chemical that contain benzene or other is likely to cause aplasia of the bone marrow.