WHITE BLOOD CELLS

Key Players of the Immune System

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White blood cells are often referred to as the immune system's army. Each type of white blood cell has a specific role or immune function that it's destined to carry out.

What are White Blood Cells?

Blood is a liquid tissue. When the red blood cells are removed from blood, a watery plasma or serum remains. White blood cells (WBCs), which are also known as leukocytes, are suspended in this watery liquid. White blood cells are the key players of the immune system. As the immune system’s scouts, WBCs defend the body against infectious organisms and foreign substances. In autoimmune diseases, white blood cells mistakenly target the body’s own proteins, attacking these proteins as if they were foreign substances.

Production of White Blood Cells

White blood cells are produced in the bone marrow, a pulpy tissue found inside bone. All white blood cells arise from a type of cell called a hematopoietic stem cell. These stem cells are very rare, representing only one of every 10,000 bone marrow cells. White blood cells divide by a process of mitosis, forming either more stem cells or white blood cells that can differentiate into specific white cell types, such as lymphocytes. The type of cell formed is influenced by immune system chemicals known as cytokines and by hormones. The cytokine interleukin-7 (IL-7) stimulates hematopoietic stem cells to form lymphocytes, primarily T and B lymphocytes.

The White Blood Cell Count

The white blood cell count, which is included in the complete blood count (CBC), is a measurement of the number of WBCs present in one milliliter of blood. White blood cells proliferate, increasing dramatically, in response to bacterial infection. An increased count, which is called leukocytosis, can be seen in infection, stress, and in various blood disorders and malignancies including leukemia.

A low white blood cell count (leukopenia) is seen in viral infection, toxic reactions, and as a result of certain medications, such as immunosuppressive and chemotherapeutic medications. Leukopenia is also seen in certain medical conditions such as autoimmune neutropenia. In leukopenia, the immune system is unable to effectively fight infection. The WBC count can be used to monitor recovery from infection and a response to treatment.

WBC Classifications
White cells are classified into cells with a multi-lobed nucleus or a mononuclear nucleus. Cells with a multi-lobed nucleus are called polymorphonuclear leukocytes (granulocytes) and include poly-segmented neutrophils, eosinophils, or basophils. The latter two types of WBC are primarily seen in allergies, parasitic disorders and hypereosinophilic disorders. Mononuclear leukocytes include monocytes and lymphocytes.

Monocytes can be further classified into macrophages and dendritic cells. Monocytes are effective in engulfing and removing infected, dead, and dying cells.

Lymphocytes can be further divided into B-lymphocytes, which produce antibodies and T-lymphocytes. T-lymphocytes have several subsets including inflammatory T cells that recruit other white blood cells when infection or tissue injury occurs; cytotoxic T lymphocytes that kill cells infected by viruses and damaged by cell mutations; CD8 suppressor T-lymphocytes, and CD4 helper T-lymphocytes that enhance the ability of B cells to produce antibodies.

Early immature cells, including band, metamyelocytes, myelocytes, promyelocytes, and blast cells are not normally seen in the blood. In some conditions, particularly conditions in which white blood cell production increases dramatically, these early cells may be detected.

**WBC Differential**

The WBC differential count represents the five basic types of white blood cells in percentages. Normally, 50-60% of the white blood cells are neutrophils; 0.5-2.0% are eosinophils and basophils; 20-40% are lymphocytes; and 2-9% are monocytes. The absolute count is calculated by multiplying the percentage of a specific cell type by the total WBC count. For instance, a WBC of 10,000 with 70% neutrophils counted on the automated or manual differential count results in an absolute neutrophil count of 7,000.

**Resources:**


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