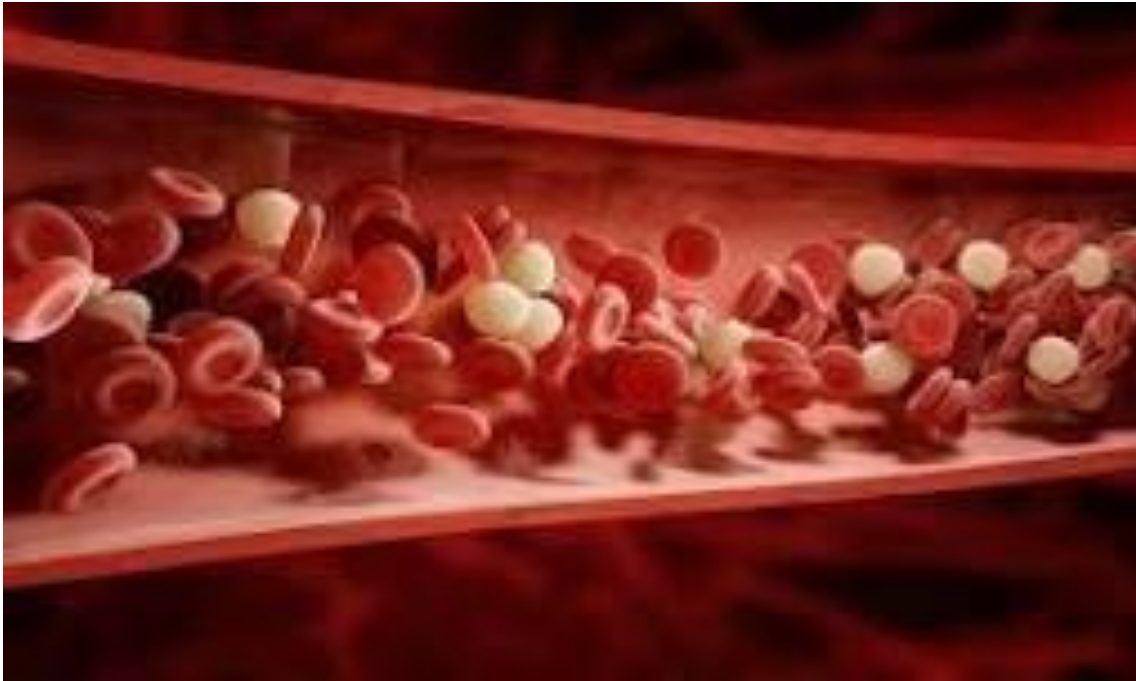


Blood, Lymph, and Immune Systems



Blood is a specialized body fluid in the circulatory system of humans and other vertebrates.

It has four main components:

- plasma
- red blood cells (RBC)
- white blood cells (WBC)
- platelets.

Blood has many different functions, including transporting oxygen and nutrients to the cells and tissues.

Blood is **made up of liquid and solids**. The liquid part, called plasma, is made of water, salts, and protein. Over half of blood is plasma. The solid part of blood contains red blood cells, white blood cells, and platelets. Red blood cells (RBC) deliver oxygen from the lungs to the tissues and organs.

Blood	<p>hem/o or hemat/o</p> <p>55% is liquid = plasma</p> <p>45% is solid = cells</p> <p>Cells containing fluid that circulates through the heart, arteries, veins, and capillaries, carrying nourishment, electrolytes, hormones, vitamins, antibodies, heat, and oxygen to the tissue and taking away waste matter and carbon dioxide.</p>
Liquid plasma	<p>55% of the total blood volume.</p> <p>92% water and contains the plasma proteins (albumin, globulins, and fibrinogen), as well as gases, nutrients, salts, hormones, and excretory products.</p>
Blood serum	<p>serum: ser/o</p> <p>product of blood plasma that does not contain fibrinogen (fibrinogen is responsible for clotting of blood).</p>
Red blood cells	<p>Erythrocytes: Erythr/o = red</p> <p>Function: carry oxygen to tissues and carbon dioxide to the lungs.</p> <p>The average life cycle of a red blood cell is 120 days</p> <p>Hemoglobin gives the RBC's color.</p>
White blood cells	<p>1 ½ times larger than RBCs.</p> <p>Function: Protects the body against infection by bacteria and foreign substances.</p> <p>The white blood cells have a rather short life cycle, living from a few days to a few weeks. A drop of blood can contain anywhere from 7 000 to 25 000 white blood cells at a time.</p>

Neutrophils:	<p>(50-70%) most numerous of the WBCs.</p> <p>Responsible for body's protection against infection.</p>
Eosinophil	<p>(1-4%) greatest in numbers when there is an allergic reaction or parasitic infection.</p>
Lymphocytes	<p>(20-40%) smallest of the WBCs.</p> <p>Involved with the immune system and the production of antibodies.</p>
Blood groups	<p>four groups: ABO system: discovered in 1901.</p> <p>Discovered because physicians were trying to learn why blood transfusions sometimes caused death and at other times save a patient.</p>
Platelets	<p>Function: Small cells which aid in blood clotting when an injury occurs. The human body does not handle excessive blood loss well. Therefore, the body has ways of protecting itself. If, for some unexpected reason, sudden blood loss occurs, the blood platelets kick into action.</p>

A, B, AB, and O:

system of classifying blood according to differences in antigen makeup. There are two **antigens** and two **antibodies** that are mostly responsible for the ABO types.

Type A: second most common blood type.

Type B: third most common blood type.

Type AB: least common blood type.

Type O: most common.

Antigen

(identifier) foreign materials that when introduced into the body stimulate the production of an antibody. Antigens include toxins, bacteria, foreign blood cells, and the cells of transplanted organs.

Naturally occurring antigens are the blood type factors A and B that are present at birth in some individuals.

Antibodies:

(destroyer) a Y-shaped protein on the surface of B cells that is secreted into the blood or lymph in response to an antigenic stimulus, such as a bacterium, virus, parasite, or transplanted organ, and that neutralizes the antigen by binding specifically to it, an immunoglobulin.

An antibody then helps to neutralize or inactivate the antigen.

Lymph

The lymphatic system or lymphoid system is **a network of delicate tubes throughout the body**. It drains fluid (called lymph) that has leaked from the blood vessels into the tissues and empties it back into the bloodstream via the lymph nodes. The main roles of the lymphatic system include managing the fluid levels in the body.

What is lymph and where it is present?

Lymph is a clear to white fluid made of White blood cells, especially lymphocytes, the cells that attack bacteria in the blood and body tissues.

Where does lymph come from?

Lymph is a fluid similar in composition to **blood plasma**. It is derived from blood plasma as fluids pass through capillary walls at the arterial end. As the interstitial fluid begins to accumulate, it is picked up and removed by tiny lymphatic vessels and returned to the blood. Lymph is part of the lymphatic system,

The main functions of the lymphatic:

There are three primary functions of the lymphatic system:

First is the maintenance of fluid balance.

Second is the facilitation of the absorption of dietary fats from the gastrointestinal tract to the bloodstream for metabolism or storage.

Third is the enhancement and facilitation of the immune system, it helps in invading the entry of pathogenic infections caused by microbes.

Lymph

lymph/o clear, watery fluid that surrounds body cells and flows in a system of lymph vessels that extend throughout the body. Originates from blood plasma. Blood circulates through the capillaries, small amounts of plasma seep through the capillary wall, (now called interstitial fluid), this fluid either returns to the capillary or enters the lymph capillary and is then called lymph.

Lymph passes from lymph capillaries to larger vessels and to lymph nodes.

Lymph vessels: lymphangi/o begin as closed-ended capillaries in tissue spaces and terminate at the right lymphatic duct and the thoracic duct in the chest cavity.

Lymph nodes: lymphaden/o small filtering stations which help fight infection. Serve as depositories for cellular debris. Lymph is filtered and replenished with lymphocytes and antibodies. The macrophages lining the lymph nodes destroy bacterial and debris. Lymph nodes become larger in size when there is an infection due to the increase in the number of bacteria.

**Lymph
circulation**

lymph vessels from the right chest and arm join the right lymphatic duct which drains into the right subclavian vein.

All other sites enter the thoracic duct and drain into the left subclavian vein.

Lymph is now in the blood and will circulate and become plasma.

**Three Lymphatic
organs:**

Spleen: splen/o blood formation, storage, and filtration. Destroys old RBCs Forms red and white blood cells prior to birth.

After birth, lymphocytes (involved with immune response and production of antibodies) and monocytes (defense for inflammation, become macrophages). Repository for healthy RBCs.

Splenectomy

Splenectomy is rather infrequently needed to help lymphoma patients. From the time the spleen has been removed, however, you are at risk from severe infections. Without protection, there is a risk of harmful infections with *Streptococcus pneumoniae* (pneumococcus), *Haemophiles influenzae*, *Neisseria meningitidis* (meningococcus), and malaria. Also, tick-borne babesiosis, *Capnocytophaga canorans* from dog bites and, to a lesser extent, other streptococci, *E. coli*, *Pseudomonas*, and staphylococci.

Tonsil

a mass of lymphatic tissue located in the depressions of the mucous membranes of the causes (opening form mouth and oral pharynx and pharynx.

Function: produces lymphocytes (involved with immune system and production of antibodies) and monocytes (first line of defense in the inflammation process, become macrophages) and contains. macrophages that phagocytize pathogens that get through epithelium. Also aid in the development of WBCs.

Tonsillectomy provides a reduction in the episodes of sore throat, days of school absence associated with sore throat, and upper respiratory infections

Immune system:

is responsible for identifying invaders and destroying the invaders and then retreating with the memory of the invader and how to destroy the invader. Antigens are identifiers and antibodies are destroyers.

WBC's role in the immune system

Monocytes and lymphocytes are WBCs used in the immune system. Monocytes leave the vascular system, enter the tissue, and become macrophages. The macrophages then consume large numbers of bacteria and other antigens. The monocytes process these bacteria and place their antigenic property on their cell surface and become antigen-presenting cells (APCs). APCs will encounter lymphocytes (involved with immune system and production of antibodies) and initiate immune response. Macrophages are found in spleen and lymph. nodes, alveoli, and tonsils.

Anemia	a decrease in the number of circulating RBCs per cubic mm of blood. This decrease will reduce the oxygen-carrying capacity of the blood. Exists when hemoglobin content is less than that required to provide the oxygen demands of body. Not a disease but a symptom for a disease.
Acquired Immunodeficiency Syndrome (AIDS):	the final stage of infection by the HIV virus. This virus destroys the immune system and compromise patient's health.
Allergy	are inappropriate or exaggerated reactions of the immune system. An acquired abnormal immune response to a substance (allergen) that does not normally cause a reaction.
Autoimmune disease:	disease produced when the body's normal tolerance of its own antigenic (identifiers) markers on cells disappear. Body produces antibodies (destroyer) against antigens found on its own cells.

Edema	<p>local or generalized condition in which the body tissues contain an excessive amount of tissue fluid. Results from increased permeability of capillary walls, increased capillary pressure due to venous obstruction or heart failure, lymphatic obstruction, disturbances in renal function, reduction of plasma proteins, inflammatory condition, fluid and electrolyte disturbances, etc.</p>
Hemophilia:	<p>a hereditary blood condition marked by prolonged coagulation time with consequent failure of blood to clot and abnormal bleeding.</p>
Infectious mononucleosis	<p>acute infectious disease that affects primarily lymphoid tissue. May be caused by Epstein-Barr virus however can be caused by other viruses. Symptoms: incubation period of 4-7 weeks, flu-like, fever, sore throat, fatigue, enlarged and tender lymph nodes, enlarged spleen and increase in the number of atypical or abnormal mononuclear leukocytes in the blood (having one nucleus). Recovery ensures a lasting immunity.</p>
Leukemia	<p>a malignancy of the blood forming cells of the bone marrow. Malignant cells replace healthy bone marrow cells. Most common in adults is acute myelogenous leukemia (AML). Survival rate is poor. Death within one year.</p>
Hodgkin's disease	<p>malignant disease that affects the lymph nodes. Lymph nodes enlarge. The spleen, GI tract, or bone marrow may be involved.</p>