

Lymphocytes and Platelets

Lymphocytes are complex cells that direct the body's immune system. T lymphocytes start in the bone marrow from pluripotent hematopoietic stem cells, then travel to and mature in the thymus gland. The *thymus* is located in the chest between the heart and sternum (breastbone). B lymphocytes mature in the bone marrow.

T lymphocytes (T cells) are responsible for cell-mediated immunity. *B lymphocytes* are responsible for humoral immunity (antibody production). Seventy-five percent of lymphocytes are T cells.

Lymphocytes are different from the other WBCs because they can recognize and have a memory of invading bacteria and viruses.

Lymphocytes continually pass back and forth between lymph tissue, lymph fluid and blood. When they are present in the blood, they stay for several hours. Lymphocytes can live for weeks, months or years.

There are many types of T cells that have specific functions, including:

- *Helper T cells* - Helper T cells have proteins on their cell membranes called CD4. Helper T cells direct the rest of the immune system by releasing cytokines. Cytokines stimulate B cells to form plasma cells, which form antibodies, stimulate the production of cytotoxic T cells and suppressor T cells and activate macrophages. Helper T cells are the cells the AIDS virus attacks -- you can imagine that destroying the cells that direct the immune system has a devastating effect.
- *Cytotoxic T cells* - Cytotoxic T cells release chemicals that break open and kill invading organisms.
- *Memory T cells* - Memory T cells remain afterwards to help the immune system respond more quickly if the same organism is encountered again.
- *Suppressor T cells* - Suppressor T cells suppress the immune response so that it does not get out of control and destroy normal cells once the immune response is no longer needed.

B cells become plasma cells when exposed to an invading organism or when activated by helper T cells. B cells produce large numbers of antibodies (also called immunoglobulins or gamma globulins). There are five types of immunoglobulins (abbreviated *Ig*): IgG, IgM, IgE, IgA and IgD. These are Y-shaped molecules that have a variable segment that is a binding site for only one specific antigen. These bind to antigens, which causes them to clump, be neutralized or break open. They also activate the *complement system*.

The complement system is a series of enzymes that help or complement antibodies and other components of the immune system to destroy the invading antigen by attracting and activating neutrophils and macrophages, neutralizing viruses and causing invading organisms to break open. Memory B cells also remain for prolonged periods, and if the same antigen is encountered it causes a more rapid response in producing antibodies.

Platelets (thrombocytes) help blood to clot by forming something called a *platelet plug*. The other way the blood clots is through coagulation factors. Platelets also help to promote other blood clotting mechanisms. There are approximately 150,000 to 400,000 platelets in each microliter of blood (average is 250,000).

Platelets are formed in the bone marrow from very large cells called *megakaryocytes*, which break up into fragments -- these cellular fragments are platelets. They do not have a nucleus and do not reproduce. Instead, megakaryocytes produce more platelets when necessary. Platelets generally last for an average of 10 days.

Platelets contain many chemicals that assist clotting. These include:

- Actin and myosin, to help them contract
- Chemicals that help the coagulation process to begin
- Chemicals that attract other platelets
- Chemicals that stimulate blood vessel repair
- Chemicals that stabilize a blood clot