

White blood cells: structure and functions



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Often times, our bodies are attacked and battered by infections, diseases, bacteria, and other foreign materials which can cause great harm to our organs and bodily functions. Fortunately God has designed us with a strong and efficient system of defense. Our immune system. Among our many forms of defense within the immune system are the leucocytes, or white blood cells. They act as the body's guards by patrolling the blood stream, seeking out any invading pathogens, and quickly alerting other leucocytes of the threat or swiftly destroying the threat themselves.

In the average adult body, there are normally around seven thousand to twenty-five thousand leucocytes per drop of blood. When an infection is present, this number greatly increases in order to defeat the illness. This increase in leucocyte number is also a sign used by doctors when they look for infections. A constantly large number of leucocytes is a sign of leukemia, a type of blood cancer. One who has leukemia can have up to fifty-thousand leucocytes in a single drop of blood. Leucocytes may attack the body's invaders by either producing antibodies to overpower and overwhelm their target or by surrounding, devouring, and digesting the entire pathogen itself.

Unlike regular red blood cells, white blood cells have nuclei, mitochondria, and all other normal cellular structures. Also, because white blood cells have no hemoglobin, they lack the red color of their red counterparts. White blood cells also have a significantly greater size than red blood cells but lack equality in numbers.

There are five major types of leucocytes each with a different job.

Neutrophils, which make up fifty-eight percent of leucocytes and are one of

the body's main forms of defense, completely ingest bacteria and destroy any cells which have been infected or turned cancerous. Eosinophils, which account for two percent of the white blood cell's population, destroy parasites and play a role in allergic reactions. Basophils, one percent of leucocytes' population, help with allergic reactions by releasing histamine and heparin. Monocytes, making up 4 percent of the population of white blood cells, turn into macrophages and are designed to phagocytize and digest bacteria and get rid of old, dead, and damaged cells. They are found in the liver, spleen, lymph nodes, lungs, skin, and intestine. Lymphocytes, which make up 4 percent of white blood cells, direct the body's immune system, identify foreign bodies, and produce antibodies and cells that are specifically designed to target them. Lymphocytes, unlike other leucocytes, are produced in the lymphatic system.

White blood cells are found not only in blood, but in the lymphatic system. Most of them are produced in the marrow of the bone but a few, like lymphocytes, are manufactured in the lymph nodes. The cells are rapidly produced because they have a very short life span living only a few days to a few weeks.

One disease involving white blood cells is neutropenia. This condition is defined by a significant decrease in the production of neutrophils. Common symptoms of neutropenia include fevers and periodic infections. This disease decreases the body's chance of successfully defending against an attack and increases its chance of being harmed by invading pathogens. Treatment of this disease includes treatment with antibiotics, granulocyte (white blood cell) transfusions, and treatment with anti-fungal medications to defend

against disease, infection, and bacteria. Another deadly illness involving white blood cells is leukemia. This cancer of the blood, and one of the most dangerous of blood diseases, is characterized by a deadly over abundance in white blood cells. Symptoms of leukemia include swollen lymph nodes, high fevers, night sweats, frequent infections, feeling weak or tired, weight loss for no apparent reason, and pain in the bones and joints. Treatment of leukemia includes chemotherapy, radiation therapy, and stem cell transplant. The risk in chemotherapy is the reduction of white blood cells raising the risk of serious bacterial and viral infection. Another disease involving leucocytes is agranulocytosis. This disease, far less dangerous than leukemia, is brought on by the destruction of neutrophils. Symptoms include fatigue, sleeplessness, headache, chills, and high fever. Treatments for this disease include antibiotics, blood transfusions, and injections of fresh bone marrow.

Recent studies of white blood cells have given us more insight on the details surrounding their functions. Research has also shown how the leucocytes navigate through the body's blood stream. According to recent discovery, when organs or tissue are infected with a virus, they send out chemical beacons to the specific leucocytes which register them as a call for help. They then move towards the infected area. Further studies have also shown that white blood cells have the ability to sprout "leg-like" structures with adhesive points and crawl along the inside of a blood vessel like a millipede to get to an infected area. About ten of these legs attach and detach rapidly. This allows the cell to maintain constant movement along the vessel walls. It also uses these legs to grip the inner walls of the blood vessel to avoid being

swept away by the blood stream. When scientists put these “ legs” under further research, they found that they dig themselves into the wall of the blood vessel. This also suggests that they are used as probes to search for holes and exits in the blood vessels. Scientists believe these legs have many functions such as gripping, moving, and sensing distress signals from damaged tissue.

Even though we live in a world full of bacteria and pathogens, we can rest easy because we know that our Creator has designed for our bodies a strong defense against outside invaders. The complex and efficient white blood cells act as soldier cells and spear head our immune system keeping us safe, comfortable, and healthy. Without our white blood cells, we would be quite susceptible to hundreds of thousands of forms of destructive bacteria, lethal diseases, and vulnerable to many potentially deadly infections.

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