

## THE IMMUNE SYSTEM

The immune system is a group of cells, molecules, and tissues that help defend the body against diseases and other harmful invaders. The immune system provides protection against a variety of potentially damaging substances that can invade the body. These substances include disease-causing organisms, such as bacteria, fungi, parasites, and viruses. The body's ability to resist these invaders is called immunity. A key feature of the immune system is its ability to destroy foreign invaders while leaving the body's own healthy tissues alone. Sometimes, however, the immune system attacks and damages these healthy tissues. This reaction is called an autoimmune response or autoimmunity.

The immune system is composed of many parts that work together to fight infections when pathogens or poisons invade the human body. Pathogens are disease-causing organisms such as bacteria and viruses. The immune system reacts to foreign substances through a series of steps known as the immune response. Any agent perceived as foreign by a body's immune system is called an antigen. Several types of cells may be involved in the immune response to antigens.

When an antigen enters the body, it may be partly neutralized by components of the innate immune system. It may be attacked by phagocytes or by performed antibodies that act together with the complement system. The human immune system contains approximately 1 trillion T cells and 1 trillion B cells, located in the lymphoid organs and in the blood, plus approximately 10 billion antigen-presenting cells located in the lymphoid organs. To maximize the chances of encountering antigens wherever they may invade the body, lymphocytes continually circulate between the blood and certain lymphoid tissues. A lymphocyte spends an average of 30 minutes per day in the blood and recirculates about 50 times per day between the blood and lymphoid tissues.

Lymphocytes are special types of white blood cells. Like other white blood cells, lymphocytes originate in the bone marrow, the blood-forming tissue in the center of many bones. Some lymphocytes mature in the bone marrow and become B lymphocytes, also known as B cells. The B stands for bone marrow derived. Some of these cells develop into plasma cells, which produce antibodies. Antibodies are proteins that attack antigens. They are carried in the blood, in tears, and in secretions of the nose and the intestines. Other lymphocytes do not mature in the bone marrow. Instead, they travel through the

bloodstream to the thymus, an organ in the upper chest. In the thymus, the immature lymphocytes develop into T lymphocytes, also known as T cells. The T stands for thymus derived. The B lymphocytes are responsible for the production of the blood-serum components called immunoglobulins. The T lymphocytes are responsible for attacking and killing antigens directly. Both T and the B lymphocytes have the ability to remember previous exposure to a specific antigen, so that if the same antigen enters the body the T and B lymphocytes can take faster and better action against it.

There are many disorders that disrupt the immune system's operations. The most serious are the disorders called immunodeficiency diseases, such as AIDS. These diseases can lead to death. Immunodeficiency diseases are among the most severe disorders of the immune system. People afflicted with such conditions lack some basic feature or function of their immune system. As a result, their immune system fails to respond adequately to harmful invaders. For this reason, people with immune deficiency diseases suffer from different kinds of illness.

Allergies are mistaken and harmful responses of the body's immune system to substances that are harmless to most people. The substances that provoke an allergic reaction are called allergens. They include pollen, dust, mold, and feathers. Among the common allergic diseases are asthma, eczema, which is an itchy red swellings of the skin, hay fever, and hives.

If lymphocytes encounter an antigen trapped by the antigen-presenting cells of the lymphoid organs, lymphocytes with receptors specific to that antigen stop their migration and settle to mount an immune response locally. The process of inducing an immune response is called immunization. It may be either natural, through infection by a pathogen, or artificial, through the use of serums or vaccines. The immune system cannot protect the body from diseases by itself. Sometimes it needs help. Physicians give their patients vaccines to help protect them from certain severe, life-threatening infections. Vaccines and serums boost the body's ability to defend itself against particular types of viruses or bacteria.

