

The Immune System

The human immune system is a complex and powerful defense mechanism.

The primary function of the immune system is to defend the body from **pathogens**, which are disease-causing organisms such as viruses and bacteria. Tissues, cells, and proteins in the immune system work together to achieve this function.

How Immunity Works

To fight infections, the immune system must be able to identify pathogens. Pathogens have molecules called **antigens** on their surface. Antigens provide a unique signature for the pathogen that enables immune system cells to recognize different pathogens and distinguish pathogens from the body's own cells and tissues. When a pathogen gets into the body, the immune system reacts in 2 ways.

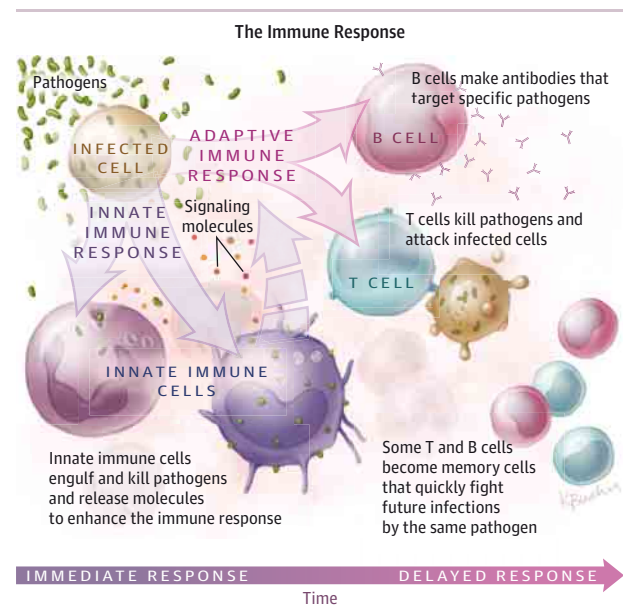
- The **innate immune response** is a rapid reaction. Innate immune cells recognize certain molecules found on many pathogens. These cells also react to signaling molecules released by the body in response to infection. Through these actions, innate immune cells quickly begin fighting an infection. This response results in inflammation. The cells involved in this reaction can kill pathogens and can also help activate cells involved in adaptive immunity.
- The **adaptive immune response** is slower than the innate response but is better able to target specific pathogens. There are 2 main cell types involved in this response: T cells and B cells. Some T cells kill pathogens and infected cells. Other T cells help control the adaptive immune response. The main function of B cells is to make **antibodies** against specific antigens. Antibodies, also known as immunoglobulins, are proteins that attach themselves to pathogens. This signals immune cells to destroy the pathogen.

It takes time for T and B cells to respond to the new antigens when a pathogen causes an infection. Once exposed to the pathogen, these cells develop a memory for the pathogen so that they are ready for the next infection. As part of the adaptive immune response, some T and B cells change into memory cells. Memory cells mostly stay in the lymph nodes and the spleen and "remember" particular antigens. If a person becomes infected with the same pathogen again, these cells are able to quickly and vigorously begin fighting the infection.

Disorders of the Immune System

Immunodeficiency results when the body does not have enough of certain kinds of immune cells or the cells do not function properly. When that happens, a person is more vulnerable to infections. Immunodeficiency can be primary (genetic) or secondary (due to other conditions). Secondary immunodeficiency can be caused by

- Medications: steroids, chemotherapy drugs, other drugs that suppress the immune system



- Medical conditions: diabetes, kidney disease, liver disease
- Infection: HIV, which can lead to AIDS
- Other conditions: malnutrition, surgery, trauma, extremes of age (newborn and elderly)

Autoimmune disease occurs when the immune system overreacts against the body's own cells and tissues. Lupus, multiple sclerosis, rheumatoid arthritis, and celiac disease are all types of autoimmune disease.

FOR MORE INFORMATION

- National Institute of Allergy and Infectious Diseases
www.niaid.nih.gov/topics/immunesystem/pages/features.aspx
- National Library of Medicine
www.nlm.nih.gov/medlineplus/ency/article/000818.htm

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Haynes BF, Soderberg KA, Fauci AS. Introduction to the immune system. In: Longo DL, Fauci AS, Kasper DL, et al, eds. *Harrison's Principles of Internal Medicine*. 18th ed. New York, NY: McGraw-Hill; 2012:2650-2685.

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