

Lecture Notes

Underlined words are included on the “Vocabulary Words” list for this lesson.

The immune system protects the body against disease. The roles of the immune system include:

- 1) recognizing the presence of an infection;
- 2) containing the infection and working to eliminate it;
- 3) regulating itself so that it does not damage the body; and
- 4) remembering pathogens to prevent disease from recurring.

Introduction to the Immune System

1. The immune system is a dynamic communication network of cells, tissues and organs that defend the body against attacks by foreign organisms. Some of these organisms can cause disease and are known as pathogens.
2. The responses our bodies make against potential pathogens are known as immune responses.
3. Cells of the immune system are found in the bone marrow, lymph nodes, spleen, thymus and tonsils.
4. Nonspecific defense mechanisms, known as innate immunity, are the first line of defense in the immune system. They can be physical or chemical. Examples of physical defenses are skin and nasal hairs. Chemical defenses include enzymes in perspiration and saliva, acids in the stomach, and inflammatory reactions that cause heat, redness, swelling and pain.
5. When potential pathogens such as bacteria, viruses, parasites or fungi get past the nonspecific defense, the specific defense mechanisms are alerted. This is adaptive immunity.
6. The immune system can remember millions of pathogens it has encountered before. Parts of pathogens that cause an immune response are called antigens.
7. The two parts of the adaptive immune system are the humoral immune system and the cell-mediated immune system.
8. The humoral immune system, also known as antibody-mediated response, protects against micro-organisms present in the fluids of the body. The main component of the humoral immune response is B cells.
9. The cell-mediated immune system protects against micro-organisms that have infected cells. Infected cells will have identifying molecules on their surface that trigger the cell-mediated immune system to respond. The cell-mediated immune system also protects the body by fighting cancerous cells. The main component of the cell-mediated immune response is T cells.
10. There are many different kinds of cells that work as part of the immune system. Most immune system cells are white blood cells or leukocytes. The five types of white blood cells are neutrophils, eosinophils, basophils, monocytes and lymphocytes.

continued

White Blood Cells

There are five types of white blood cells, each of which performs a different function.

1. Neutrophils: Phagocytose, or ingest, bacteria and fungi.
2. Eosinophils: Kill parasites and destroy cancer cells. Eosinophils are also involved in allergic responses.
3. Basophils: Release histamine in response to pathogens, which increases blood flow. Basophils also act in blood clotting by releasing heparin, which limits the size of blood clots.
4. Monocytes: Leave the blood and become macrophages, which are large phagocytic cells that ingest dead or damaged cells and pathogens.
5. Lymphocytes: One type of white blood cell with two major classes.
 - a. T cells: T lymphocytes originate in the bone marrow and migrate to and mature in the thymus gland. They are part of the cell-mediated immune response and they coordinate the overall immune response.

T cells have many jobs:

 - Activate B cells to produce antibodies.
 - Activate macrophages to destroy antigens that have been tagged by antibodies.
 - Kill our own cells that are infected with viruses or other intracellular pathogens.
 - b. B cells: B lymphocytes are produced in the bone marrow. The primary role of B cells is to produce antibodies.
 - Antibodies are programmed to recognize and bind to the antigen posing a threat to the body so that it can be recognized and destroyed.
 - Antibodies are proteins produced by B lymphocytes to neutralize antigens and prepare them for destruction by phagocytes. They can also be known as immunoglobulins (Igs).
 - Antibodies are Y-shaped molecules with two distinct regions: a constant region and a variable region. The variable region allows different antibodies to recognize different pathogens. Antibodies are specific to antigens.
 - In addition to directly neutralizing antigens, antibodies can also activate a group of proteins, called complement, that assist in killing pathogens or infected body cells.

Immunologic Memory

After an infection, some immune cells, such as B cells, specific for that antigen will remain and patrol the body for future encounters. These “memory cells” are able to recognize and rapidly respond to antigens on subsequent exposures. Vaccination is the deliberate initiation of adaptive immunity so that the immune system develops immunologic memory of a pathogen. The benefit of vaccination is that the person does not have to experience the illness to gain this immunologic memory, whereas during natural infection the person experiences the signs, symptoms and possibly long-term complications of the disease caused by the pathogen.