

The Immune System and Disease

Chapter 40

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The function of the immune system is to fight infection through the production of cells that inactivate foreign substances or cells. This process is called immunity.

Terms To Know

disease - any change, other than injury, that disrupts the natural function of the body

~~x~~
pathogens - disease-causing agents (bacteria, fungus, viruses)

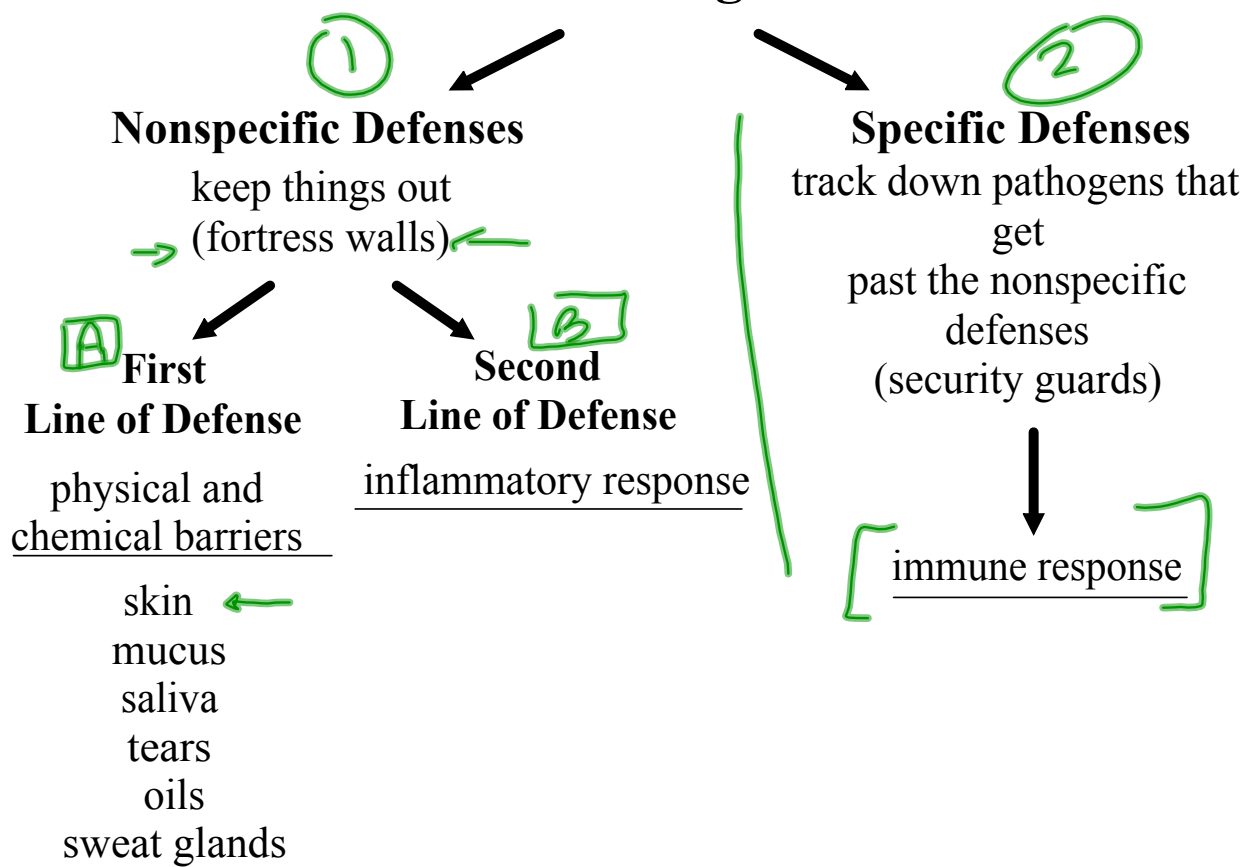
infectious disease - diseases caused by pathogens

Video

Link



Defense Mechanisms Against Infection



Inflammatory Response

2nd line

The inflammatory response is a nonspecific defense reaction to tissue damage caused by injury or infection.

When pathogens are detected, the immune system produces millions of white blood cells which fight the infection. Blood vessels near the wound expand, and white blood cells move from the vessels to enter the infected tissues. The infected tissue may become swollen and painful.

The immune system also increases the core body temperature resulting in a fever. Many pathogens can only survive within a narrow temperature range. An elevated temperature slows down or stops the growth of such pathogens. The higher body temperature also increases the heart rate so that white blood cells get to the site of the infection faster.

Immune Response

Specific Defense

If pathogens get past the nonspecific defenses, the immune system reacts with a series of specific defenses called the immune response. A substance that triggers the immune response is called an antigen. Viruses, bacteria and other pathogens may serve as antigens.

The reaction to a second infection by a particular pathogen is much faster.

✓ WBC white blood cell (Thymus)

T cells provide a defense against abnormal cells and pathogens inside living cells. This process is called cell-mediated immunity.

B cells provide immunity against antigens and pathogens in the body fluids. This process is called humoral immunity.

WBC



(bone marrow)

Antibodies

✓
Virus, bacter.

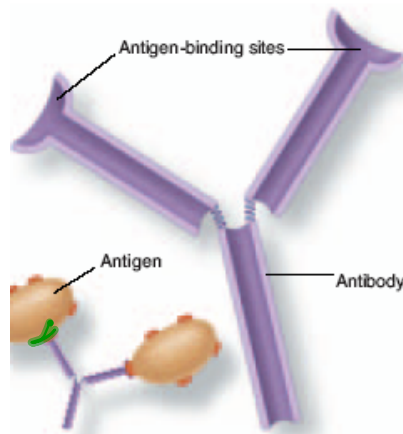
Antibodies are proteins that recognize and bind to antigens.

An antibody is shaped like the letter Y and has two identical antigen binding sites. Small differences in amino acids affect the shapes of the binding sites.

building blocks of protein

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▼ **Figure 40-8** An antibody molecule has two identical antigen-binding sites. It is at these sites that one or two specific antigens bind to the antibody. **Applying Concepts** How do antibodies help in the immune response?



Acquired Immunity

1. Active Immunity

The body makes its own antibodies in response to an antigen.

Active immunity may develop as a result of natural exposure to an antigen or from deliberate exposure to the antigen.

The injection of a weakened form of a pathogen to produce immunity is known as vaccination.

Edward Jenner -> fluid from cowpox sore

- > put into a cut he made in the arm of a farm boy
- > boy developed a mild cowpox infection
- > boy was injected with fluid from smallpox infection
- > cowpox infection made boy immune to smallpox

2. Passive Immunity

If antibodies produced by other animals against a pathogen are injected into the bloodstream, the antibodies produce a passive response. This lasts only a short time because eventually the body destroys the foreign antibodies.

Immune System Disorders

Sometimes disorders occur in the immune system itself.

Allergies are the most common overreactions of the immune system to antigens. Antigens that cause allergic reactions are called allergens (dust, pollen, mold, bee stings).

When allergens enter the body, histamines are produced.

Histamines increase the flow of blood and fluids to the surrounding area. They also increase mucus production in the respiratory system. The increased mucus production brings on the sneezing, watery eyes, runny nose and other irritations.

If you have allergies you may have taken an antihistamine - a drug used to counteract the effects of histamine.

Asthma is a chronic respiratory disease in which the air passages become narrower than normal. This causes, wheezing, coughing, and difficulty in breathing. Heredity and environmental factors play a role in the onset of symptoms of asthma.

Asthma can be triggered by respiratory infections, exercise, emotional stress and certain medications. Cold air, pollen, dust, tobacco smoke, pollution, molds and pet dander are other triggers.

Autoimmune diseases are produced when the immune system makes a mistake and attacks the body's own cells. "Antiself" antibodies are produced. Some of these diseases include Type I diabetes, rheumatoid arthritis and multiple sclerosis (MS).

Type I diabetes - antibodies attack the insulin-producing cells of the pancreas

Rheumatoid arthritis - antibodies attack connective tissue around the joints

Multiple sclerosis - antibodies destroy the functions of the neurons in the brain and spinal cord

Immunodeficiency Disease

During the 1970's, doctors noted that some of their patients were dying from infections produced by microorganisms that didn't normally cause disease. People began to suffer from *Pneumocystis carinii* (kind of pneumonia), Kaposi's sarcoma (rare form of skin cancer) and severe fungal infections of the mouth and throat.

AIDS - Acquired Immune Deficiency Syndrome

AIDS is caused by HIV (human immunodeficiency virus). HIV is a retrovirus. The virus is deadly and efficient. It evades the defenses of the immune system and attacks key cells in the immune system, destroying the body's defenses and leaving the body with no protection against other pathogens.

HIV can only be transmitted through the exchange of blood, semen, vaginal secretions or breast milk.

There are four main ways that HIV can be transmitted:

- through any form of sexual intercourse with an infected person;
- through shared needles or syringes that are contaminated with the blood of an infected person;
- through contact with blood or blood products of an infected person; and
- from an infected mother to child, either during pregnancy, during birth, or during breast-feeding.

There is no cure for AIDS. Progress has been made in developing drugs that make it possible to survive HIV infection for years.