

**Chapter 40 The Immune System and Disease****Summary****40–1 Infectious Disease**

A disease is any change, other than an injury, that disrupts the normal functions of the body. Diseases are produced by agents such as bacteria, materials in the environment such as cigarette smoke, or inherited conditions. Disease-causing agents are called pathogens. Diseases caused by pathogens are called infectious diseases.

In the 1800s, scientists concluded that infectious diseases are caused by microorganisms, or germs. This idea is now known as the germ theory of disease. A scientist named Robert Koch developed rules to identify the microorganism that causes a specific disease. These rules, known as Koch's postulates, are still used.

Pathogens cause disease by destroying cells, releasing toxins, or disrupting body functions. Types of pathogens include viruses, bacteria, protists, worms, and fungi. Infectious diseases can be transmitted in several ways. Many are spread from one person to another through coughing, sneezing, or physical contact. Some are spread through contaminated water or food. Others are spread by infected animals. Vectors are animals that carry pathogens from person to person.

Antibiotics are drugs that kill bacteria without harming the cells of the host. Antiviral drugs fight certain viral diseases. The best treatment for most infections includes rest, a balanced diet, and fluids.

**40–2 The Immune System**

The immune system is the body's main defense against pathogens. It produces cells that recognize, attack, destroy, and "remember" each type of pathogen that enters the body. This process is called immunity. The immune system has both nonspecific and specific defenses.

The skin is the most important nonspecific defense. It forms a barrier that few pathogens can get through. Mucus, saliva, and tears trap pathogens and contain an enzyme that kills bacteria. If pathogens manage to enter the body, other nonspecific defenses go to work. The inflammatory response occurs when tissue is damaged by injury or infection. Blood vessels near the site expand, and white blood cells enter the tissues to fight infection. The immune system also releases chemicals that cause a fever. The higher body temperature slows the growth of many pathogens. In addition, cells infected with a virus may produce proteins called interferons, which interfere with the growth of the virus.

If a pathogen is able to get past the nonspecific defenses, the immune system reacts with specific defenses against that particular pathogen. This is called the immune response. A substance that triggers the immune response is known as an antigen. Pathogens may serve as antigens.

There are two types of immune response: humoral immunity and cell-mediated immunity. In humoral immunity, white blood cells, called B cells, produce antibodies that travel through the bloodstream and attack pathogens in the blood. Antibodies are proteins that recognize and bind to specific antigens. In cell-mediated immunity, white blood cells, called T cells, track down and destroy abnormal or infected cells. T cells also attack the cells of transplanted organs. This is called rejection. It can be prevented with drugs. After a pathogen is destroyed, certain B cells or T cells, called memory cells, remain in the body. Memory cells can quickly respond to the same pathogen if it enters the body again. This greatly reduces the chance that the disease develops again.

Besides having a disease, immunity can be acquired in other ways. Vaccination is the injection of a weakened or mild form of a pathogen to produce immunity. This type of immunity is called active immunity. Active immunity appears after exposure to an antigen. Another type of immunity is called passive immunity. It is produced when antibodies enter the body. Antibodies may be injected to fight an infection. Antibodies also pass from mother to fetus. Passive immunity lasts only as long as the antibodies remain in the body.

### 40–3 Immune System Disorders

There are three types of immune system disorders: allergies, autoimmune diseases, and immunodeficiency diseases. Allergies are overreactions of the immune system to antigens such as pollen. Antigens that cause allergic reactions are called allergens. In response to allergens, the body produces chemicals called histamines, which cause symptoms such as sneezing and watery eyes. Some allergic reactions lead to asthma. Asthma is a chronic respiratory disease in which the air passages become narrower than normal. This may cause coughing and difficulty breathing.

Autoimmune diseases occur when the immune system attacks the body's own cells. For example, in Type I diabetes, the immune system attacks cells of the pancreas that make insulin. Other examples of autoimmune diseases are rheumatoid arthritis, myasthenia gravis, and multiple sclerosis (MS).

Immunodeficiency diseases occur when the normal immune response breaks down. The most common immunodeficiency disease is AIDS. It is caused by the human immunodeficiency virus (HIV). HIV can be transmitted through the exchange of body fluids such as blood. The only no-risk behavior with respect to HIV and AIDS is abstinence. At present, there is no cure or vaccine for AIDS.

### 40–4 The Environment and Your Health

Anything that increases the chance of disease or injury is a risk factor. Risk factors in the environment include poor air quality and solar radiation. Air quality refers to the number and type of dangerous gases and particles in the air. Water, like air, can carry dangerous substances. For example, human or animal wastes can pollute water with bacteria. Bioterrorism is a new health threat. Bioterrorism is the intentional use of biological agents, such as viruses, to disable or kill people.

Cancer is a life-threatening disease in which cells multiply uncontrollably and destroy healthy tissue. Cancer may cause a tumor. A tumor is a mass of cells growing out of control. Some tumors are not cancerous. All forms of cancer are ultimately caused by harmful mutations. Mutations may be inherited or caused by viruses, chemicals, or radiation. Chemicals that cause cancer are called carcinogens. Sources of potentially harmful radiation include sunlight and radon gas, which is found in rocks and can leak into buildings. Protecting the body from radiation and carcinogens can help prevent cancer. Other ways of maintaining health include eating a healthful diet, getting plenty of exercise and rest, abstaining from harmful activities, and having regular checkups.