

# The Role of Medicines

Sometimes, even the healthiest person becomes sick. A person may sustain a painful injury while playing sports or may develop a chest cold accompanied by a hacking cough. To help overcome these ailments, some people turn to medicines. **Medicines** are substances that, when taken internally or applied to the body, help prevent or cure a disease or other medical problem.

## HEALTH TERMS

**medicines**  
**vaccine**  
**analgesics**  
**side effects**  
**additive interaction**  
**synergistic effect**  
**antagonistic interaction**  
**tolerance**  
**withdrawal**

## HEALTH CONCEPTS

- A medicine helps prevent or cure a disease or medical problem.
- Medicines are classified according to their effect on the body.
- Safe and healthful use of medicines includes knowing how different substances behave when present in the body at the same time.



## Classification of Medicines

Although there are countless medicines that treat a wide range of health problems, all may be classified into four broad categories—medicines that

- prevent disease,
- fight pathogens (microorganisms that enter the body and attack its cells and tissues),
- relieve pain,
- help the heart and regulate blood pressure.

## Medicines That Prevent Disease

The first line of defense in modern medicine is to prevent diseases before they ever occur in an individual. There are two main types of preventive medicines:

- **Vaccines.** Your **immunization** schedule shows a record of what shots or vaccines you were given as an infant, child, and teen. A **vaccine** is a preparation, containing weakened or dead pathogens that cause a particular disease, given to prevent one from contracting that disease. Vaccines stimulate your body to produce specific antibodies against those pathogens. Once the antibodies are produced, they give your body long-lasting protection against these specific pathogens, should these enter your body in the future. Current vaccine research is geared toward developing a safer, less painful vaccine against **rabies** and vaccines against hepatitis B and pneumonia-causing bacteria. A major effort, as noted in Chapter 30, is being conducted toward isolating a vaccine to combat **HIV**.
- **Antitoxins.** Antitoxins are extracts of blood fluids that contain antibodies and act more quickly than vaccines. Antitoxins are produced by inoculating animals—such as horses, sheep, or rabbits—with specific toxins that stimulate the animal's immune system to produce antibodies against the toxins. When antitoxins are injected into a human being, they neutralize the effect of toxins, such as those that cause tetanus and diphtheria.

## Medicines That Fight Pathogens

Virtually unknown before the twentieth century, antibiotics are a class of chemical agents that destroy disease-causing microorganisms while leaving the patient unharmed. The best known and earliest antibiotic—penicillin—was discovered by accident in 1928 by the British scientist Sir Alexander Fleming. Depending on the type of medicine and the dosage, antibiotics either kill harmful bacteria in the body or prevent them from reproducing. Each antibiotic has a different chemical composition and is effective against a particular range of bacteria, though none is effective against viral infections.



## hot link

**immunization** For more on immunization and its role in disease prevention, see Chapter 28, page 633.

**rabies** For more information on rabies and actions to take when someone is bitten by a suspected rabid animal, see Chapter 35, page 786.

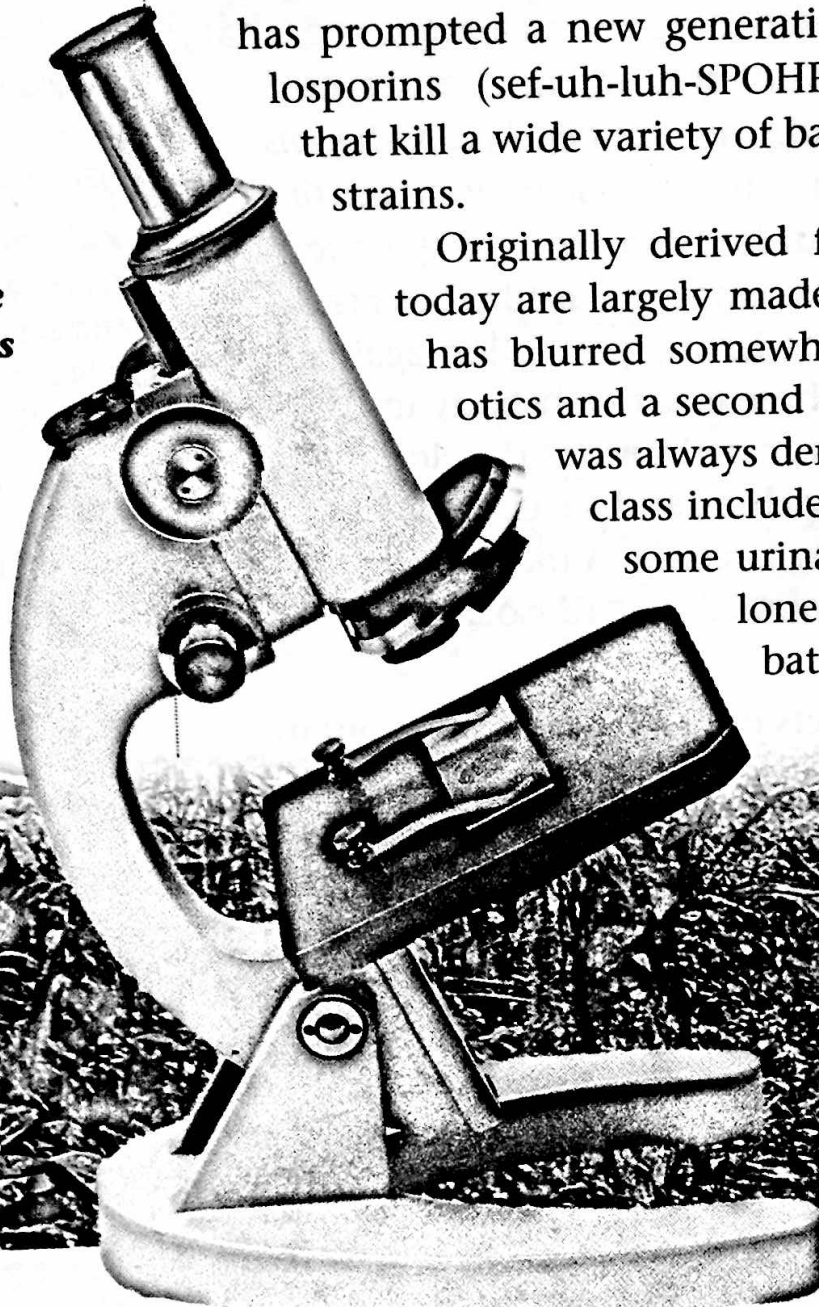
**HIV** For more information on HIV and ways of reducing the risk of infection, see Chapter 30, page 656.

◀ **Immunization against once common diseases such as measles and tetanus has made instances of these diseases rare.**

**ACTIVITY** Explain why it is important to adhere to the immunization schedule your physician has set for you.

In recent years, strains of bacteria have emerged that are resistant to penicillin and other commonly prescribed antibiotics. This resistance occurs when a bacterial strain undergoes a change in genetic structure as a result of overexposure to an antibiotic, making the bacterium essentially "immune" to the medicine. This development has prompted a new generation of antibiotics, including cephalosporins (sef-uh-luh-SPOHR-unz)—broad-spectrum antibiotics that kill a wide variety of bacteria, including penicillin-resistant strains.

Originally derived from molds and fungi, antibiotics today are largely made synthetically, in laboratories. This has blurred somewhat the distinction between antibiotics and a second class of antibacterial medicines that was always derived through synthetic means. This class includes the sulfa family, still used to treat some urinary tract infections, and the quinolones, still used to some extent to combat hospital-derived infections.



**In one acre of rain forest there can be more than 250 species of trees and 20,000 different kinds of insects.**

**ACTIVITY Explain how this biodiversity can be important in the search for new medicines.**

## Cardiovascular Medicines

There are five main kinds of medicines that help the heart and regulate blood pressure:

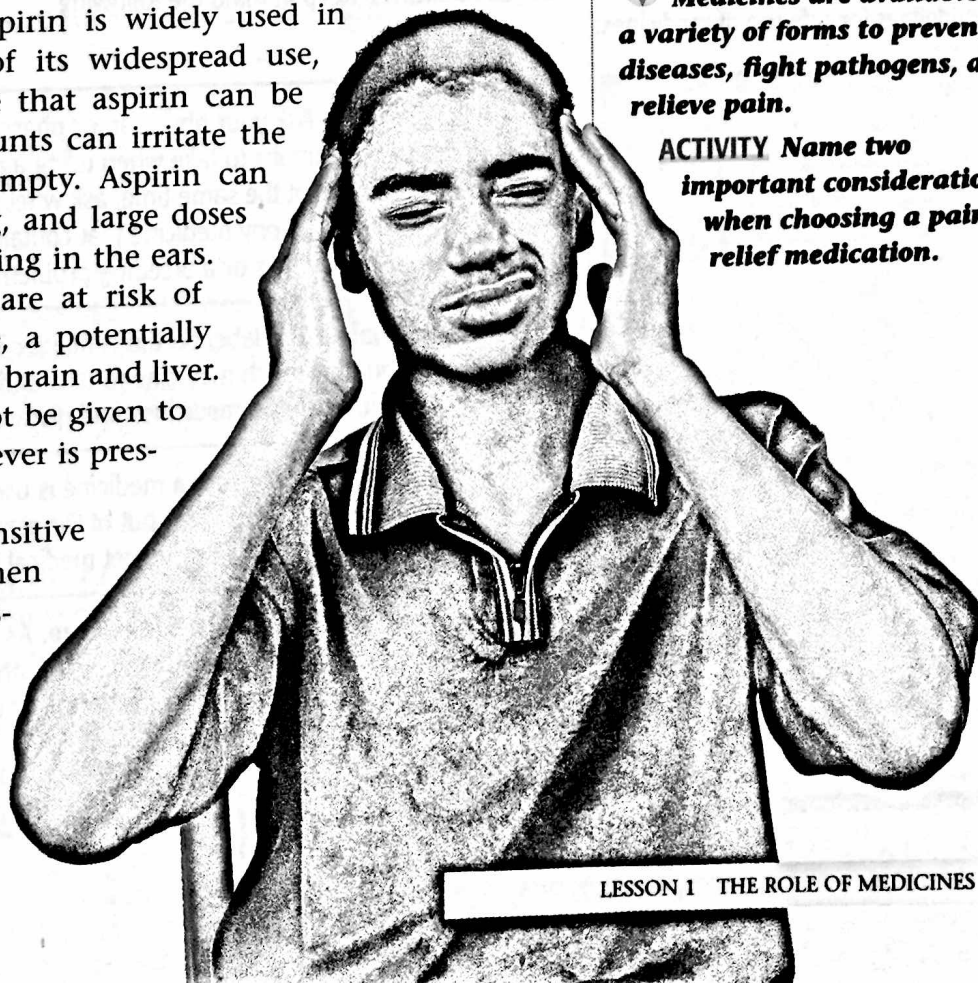
- Beta blockers block the action of nerves that constrict blood vessels. This helps slow heartbeat and lower blood pressure.
- Diuretics (dy-uh-RET-iks) increase urine production to reduce the amount of water and sodium in a person's body. Removing water from the blood vessels helps reduce blood fluid volume. This is especially important after heart failure.
- Vasodilators (VAH-zo-DY-layt-uhr) dilate the veins and arteries to increase blood and oxygen flow.
- Antiarrhythmics (AN-tee-uh-RITH-miks) are used to treat arrhythmia—any disturbance in the rhythm of the heart.
- Clot-dissolving medicines lower high blood pressure and help prevent blood clots.

## Medicines That Relieve Pain

"What do you take for a headache?" This advertising slogan has been answered again and again over the years as researchers look for new *pain relievers*, or *analgesics*. This class of medicines ranges from narcotics, such as the opium derivatives morphine and codeine, to comparatively mild medicines such as aspirin.

Aspirin is by far the most widely used non-prescription analgesic medicine in the United States. In common use since 1899, aspirin contains a chemical, acetylsalicylic (uh-SEE-tuh-sal-uh-SIL-ik) acid, that relieves pain and reduces fever. One of the most effective anti-inflammatory medicines, aspirin is widely used in treating arthritis. Because of its widespread use, many people do not realize that aspirin can be dangerous. Even small amounts can irritate the stomach, especially when empty. Aspirin can interfere with blood clotting, and large doses can cause dizziness and ringing in the ears. Children who take aspirin are at risk of developing Reye's syndrome, a potentially life-threatening illness of the brain and liver. Aspirin, therefore, should not be given to children when illness with fever is present and undiagnosed.

Some people who are sensitive to aspirin take acetaminophen or ibuprofen instead. Like aspirin, both these substances serve as analgesics. Ibuprofen is an anti-inflammatory agent, but acetaminophen is not.



## Antibiotics: Serious Medicine

If you or someone you know is taking an antibiotic to combat a bacterial infection, it is important to:

- *Avoid skipping a dose.* Doing so may cause antibiotic-resistant bacteria to develop.
- *Finish the entire supply prescribed.* Do not stop taking the medicine even if you are feeling better.
- *Familiarize yourself with the do's and don'ts.* The label will tell you whether to take the medicine with food or on an empty stomach, and which foods to avoid while on the medication.

▼ **Medicines are available in a variety of forms to prevent diseases, fight pathogens, and relieve pain.**

**ACTIVITY** Name two important considerations when choosing a pain relief medication.

# Medicines and the Body

**M**edicines can have different effects on or cause different reactions in different people. A person's reaction to a given medicine depends on how the medicine mixes with the chemicals in his or her body. Most medicines cause some **side effects**—*reactions to medicine other than the one intended*. It is important to be aware of your reactions to medicines and report these to your physician.

When two different medicines are taken together or when a medicine is taken in combination with certain foods, the combination may produce effects different from those produced when the medicine is taken alone. In many cases, interactions are beneficial. Physicians often make use of interactions to increase the effectiveness of a treatment. Other interactions, however, are unwanted and may be harmful.

- **Additive interaction** occurs when *medicines work together in a positive way*. For example, both an anti-inflammatory and a muscle relaxant may be prescribed to treat someone with joint pain.
- **Synergistic effect** is *the interaction of two or more medicines that results in a greater effect than when the medicines are taken*

*independently*. It occurs when one medicine increases the strength of the other. For example, one medicine may speed the rate at which the stomach empties and thereby increase the rate at which another medicine is absorbed and takes effect.

- **Antagonistic interaction** occurs when *the effect of a medicine is canceled or reduced when taken with another medicine*. For example, someone who receives an organ transplant must take anti-rejection medicines. If this person is diabetic and takes insulin, the effectiveness of the insulin may be decreased.

## Other Problems

Sometimes people develop a dependence on a particular medicine. Physiological dependence is a chemical need for a medicine. Physiological dependence is determined when a person experiences tolerance and withdrawal.

- **Tolerance** is *a condition in which the body becomes used to the effect of a medicine*. The body then requires increasingly larger doses of the medicine to produce the same effect. In the case of some substances and individuals' chemical makeups, a person will experience "reverse tolerance." In this condition, less of the substance is required to be effective.
- **Withdrawal** is *the process that occurs when a person stops using a medicine or other substance to which he or she has a physiological dependence*. Withdrawal symptoms include nervousness, insomnia, severe nausea, headaches, vomiting, chills, and cramps. Symptoms gradually ease after a period of time off the medicine. Withdrawal from certain medicines may require medical attention.