UNIT 3

Drugs

CHAPTER 9
Understanding Drugs and Medicines

CHAPTER 10
Alcohol

CHAPTER 11
Tobacco

CHAPTER 12
Illegal Drugs
Which of the statements below are true, and which are false? Check your answers on p. 642.

1. Side effects of over-the-counter medicines are rare.

2. Cold medicines can cause drowsiness when they are taken with antihistamines.

3. Not following doctor’s orders while taking a prescription medicine can be dangerous.

4. Generic drugs work equally as well as brand-name drugs.

5. Nutritional supplements are not approved by the Food and Drug Administration, as are medicines.

6. Drugs that come from natural products are safer than drugs made from chemicals.

7. People cannot become addicted to prescription drugs.
SECTION 1
Drugs

SECTION 2
Drugs as Medicines

SECTION 3
Drugs and the Brain

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What do aspirin, caffeine, cortisone, and cocaine all have in common? They are all drugs. You encounter some drugs every day. Some drugs help sick people feel better. Some of these drugs you can get only from a doctor. Still, other drugs are taken for their effect on the brain.

What Are Drugs?

How can one class of substances be so many different things? A drug is any substance that causes a change in a person’s physical or psychological state. Thousands of different drugs exist and they can have many different kinds of effects. Some drugs have one specific effect, while other drugs have many effects. Some drugs kill invading organisms. Other drugs, like the ones used for treating cancer, may even make someone who has cancer feel sick while they are helping the person to get better.

Some Drugs Are Medicines

Any drug that is used to cure, prevent, or treat illness or discomfort is called a medicine. For example, the antibiotic penicillin is considered a medicine because it kills certain types of bacteria that can infect us and make us sick. To be a good medicine, a drug must have the following qualities:

- **Effectiveness** When a medicine is good at carrying out its task, doctors say it is effective. For example, penicillin is effective at killing certain types of bacteria.

- **Safety** Good medicines also have to be safe. For example, penicillin wouldn’t be very useful if it damaged the heart while it was killing bacteria. But penicillin does not damage the heart. So for most people, penicillin is safe to use.
No medicine is perfectly safe for everyone. Any effect that is caused by a drug and that is different from the drug’s intended effect is called a side effect. Common side effects of medicines include headache, sleepiness, or diarrhea. Most drugs have very minor side effects. If a medicine has too many side effects or if the side effects are too severe, the medicine may not be safe to use, at least not by everyone. For example, some people can have an allergic reaction to penicillin. The reactions to penicillin can range from a rash to a fever and, very rarely, to death.

Drugs that are not medicines, such as cocaine, nicotine, alcohol, and marijuana, change the way the brain works in ways that are not healthy. A person takes drugs like these to change how he or she feels or how he or she senses the world. The person may want to feel happier, or less sad or less anxious. Drugs that people take for mind-altering effects that have no medical purpose are called drugs of abuse.

Drugs that dramatically change your mood can be very dangerous. Over time, any drug that affects the brain can change your behavior so that you can’t control your behavior. This loss of control can lead to serious long-term health problems.

Despite their differences, all drugs have one thing in common—they are all chemicals. In the past, all drugs came from natural sources such as plants, animals, and fungi. For example, opium, which has been used for thousands of years to treat pain and diarrhea, comes from the unripe seed capsules of the opium poppy. Figure 1 shows a willow tree, the bark of which is the source of salicin, the chemical from which aspirin was developed.

Many drugs are now created by scientists working in laboratories. Scientists can work on the structure of chemicals to change existing drugs or develop new drugs. Every year, drug companies test thousands of new chemicals to see if the chemicals might be effective as drugs.
Types of Medicines

Medicines can be classified in many ways. One useful way is to classify them by what they do. This is how you will find medicines organized in the drugstore or pharmacy. **Table 1** lists some common kinds of medicines. Among the most common medicines are analgesics, antihistamines, and antacids. Some of these medicines require a prescription (pree SKRIP shuhn), while over-the-counter medicines do

<table>
<thead>
<tr>
<th>Classification</th>
<th>Example</th>
<th>Effect</th>
<th>Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analgesic</td>
<td>acetaminophen</td>
<td>relieves pain</td>
<td>OTC</td>
</tr>
<tr>
<td>Antihistamine</td>
<td>diphenhydramine</td>
<td>helps relieve minor allergy symptoms</td>
<td>OTC</td>
</tr>
<tr>
<td>Antacid</td>
<td>aluminum hydroxide</td>
<td>neutralizes stomach acid for relief from heartburn</td>
<td>OTC</td>
</tr>
<tr>
<td>Antibiotic</td>
<td>amoxicillin</td>
<td>kills bacteria to help cure infections</td>
<td>prescription</td>
</tr>
<tr>
<td>Bronchodilator</td>
<td>salmeterol</td>
<td>opens airways to make breathing easier for people with asthma</td>
<td>prescription</td>
</tr>
<tr>
<td>Steroid anti-inflammatory</td>
<td>cortisone cream</td>
<td>reduces inflammation and itching of skin</td>
<td>OTC</td>
</tr>
<tr>
<td>Hormone</td>
<td>insulin</td>
<td>different hormones work differently; insulin lowers blood glucose levels to help treat diabetes</td>
<td>prescription</td>
</tr>
<tr>
<td>Stimulant</td>
<td>methylphenidate</td>
<td>increases alertness; methylphenidate helps people with attention deficit hyperactivity disorder (ADHD) to focus their attention</td>
<td>prescription</td>
</tr>
<tr>
<td>Antianxiety</td>
<td>alprazolam</td>
<td>helps people who are excessively nervous or panicked to calm down</td>
<td>prescription</td>
</tr>
<tr>
<td>Vaccine</td>
<td>meningitis vaccine</td>
<td>prevents infections in people exposed to the infectious agent</td>
<td>prescription</td>
</tr>
<tr>
<td>Sedative</td>
<td>temazepam</td>
<td>causes sleepiness</td>
<td>prescription</td>
</tr>
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</table>
not require a prescription. A **prescription** is a written order from a doctor for a specific medicine. **Over-the-counter (OTC) medicines** are medicines that can be bought without a prescription.

*Analgesics* are medicines that relieve pain. Three common types of OTC analgesics are aspirin, acetaminophen, and ibuprofen. However, some very powerful analgesics may be bought only with a prescription. Examples of such analgesics are the opiates codeine and morphine. **Antihistamines** are medicines that block the action of the body chemical histamine, which can cause allergy symptoms. **Antacids** are medicines that work against stomach acids which can cause heartburn.

### How Drugs Enter Your Body
Most drugs are taken orally as capsules, liquids, or tablets. But Figure 2 shows many other ways that drugs can be taken into the body. These methods include

- **Implanted pumps** Surgically implanted specialized pumps inject drugs directly into a specific part of the body.
- **Inhalation** The drug enters the body through blood vessels in the lungs when it is inhaled.
- **Injection** The drug is injected by using a hypodermic needle.
- **Transdermal patches** The drug is packaged into patches that are placed on the skin.
- **Ingestion** The drug is swallowed and absorbed through blood vessels in the intestines.
- **Topical application** The drug is applied directly to certain areas of the body and absorbed into the skin.

Drugs can enter the body in many different ways. The need to keep the correct concentration of a drug at the right place for the right amount of time is the reason behind the many delivery methods.

### Using Key Terms
1. Compare the term *drug* with the term *medicine*.
2. State the term used to describe an effect that is caused by a drug and that is different from the drug’s intended effect.
3. Compare prescription medicines to OTC medicines.

### Understanding Key Ideas
4. List three characteristics that make a drug useful as a medicine.
5. Name the two sources of all medicines and drugs.
6. Name four medicines and their effects on the human body.
7. Identify the delivery method of a drug that enters the body through the intestine.
   a. inhalation  
   b. ingestion  
   c. transdermal patches  
   d. topical application
8. State the reason why some drugs are considered drugs of abuse.

### Critical Thinking
9. Identify the best method for a doctor to give a medicine to a patient if the medicine is required to act very quickly. Explain your answer.
A century ago, anyone could put some chemicals in a bottle and call it a medicine. Men traveled across the country selling cures they had created themselves. Most of the time these cures did nothing but cost people money. On occasion the cures hurt or killed people.

**Approving Drugs for Medical Use**

Fake and dangerous drugs became such a problem that in the early part of the 20th century, the U.S. government started to make laws to help ensure that drugs were safe to use. In 1906, a government agency called the Food and Drug Administration (FDA) was created to control the safety of food, drugs, and cosmetics.

**Testing a Drug**  The FDA has developed an approval process for companies that want to sell a drug in the United States. This process is needed to prove the drug is safe and effective. After scientists develop or discover a new drug, they test it. Initial testing takes place in laboratories and may include chemical tests or tests on cell cultures (cells grown in a lab). After the initial tests are completed, all drugs are tested again on animals to be sure that they work and are safe.

If the animal testing shows that the drug is safe, then testing for safety may begin on healthy human volunteers. If the drug passes these first tests on humans, the drug is then tested on humans who have the illness that the drug is meant to treat. These larger tests are called **clinical trials**. During clinical trials, the new drug is compared to existing drugs to see if it is safe and effective.

If the clinical trials show that the drug is effective and safe, then the drug company can apply to the FDA for approval of the drug. The FDA then approves or rejects the drug for sale to the public.
Prescription Medicines

Even though the FDA has approved a drug or medicine as safe, some medicines can be bought only with a prescription. Such medicines often treat serious health conditions or are very powerful medicines. Prescription medicines should only be taken on recommendation by a doctor.

**Why Do I Need to Follow a Prescription?**  Prescriptions are always for a limited amount of a medicine, and they contain instructions on when and how often the medicine should be taken. If you don’t follow the instructions for prescription medicines, the medicine may not work or the medicine may be harmful.

Antibiotics are examples of prescription medicines. You must continue taking antibiotics for a bacterial infection for as long as your doctor instructs. Even though you may start to feel better after a few days, the bacteria that caused the infection may not be completely eliminated. If you stop taking the antibiotic too soon, the remaining bacteria can cause the infection to return. Because not all antibiotics work against all bacteria, your doctor will prescribe a specific antibiotic for a specific illness.

**What Information Does a Prescription Have?**  When the doctor writes a prescription, the following information is included:

- the dose (how much of the medicine you should take)
- when you should take the medicine
- how often you should take the medicine
- the length of time you should take the medicine

When the prescription is filled at the pharmacy, the pharmacist should make sure you receive the correct medicine. Specific instructions are printed on the container. The pharmacist should also tell you the information you need in order to take your medicine safely.

Many pharmacies will also give you a *drug information sheet*. This sheet has all the information about the medicine, such as possible side effects and known interactions with other medicines. You should ask for this drug information sheet if you do not get it with your medicine.

**Misuse of Prescription Medicines**  The only person who should take a prescription medicine is the person whose name appears on the label. For example, even if you and your friend think you have the same illness, never take your friend’s prescription medicine. You may not have the same illness, or the strength of your friend’s medicine may be more or less than you need, or you could be allergic to the medicine.

Many prescription drugs are abused. This abuse can involve taking medicine when it is not needed, taking too much medicine, or mixing more than one kind of medicine. Drugs and medicines that affect the brain and change how we perceive, think, or feel, are called *psychoactive*. Psychoactive medicines and drugs are especially likely to be abused. You should take a psychoactive medicine only if it has been prescribed for you by a doctor.

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Questions to Ask When Your Doctor Prescribes a Medicine

- Why do I need to take this medicine?
- When should I take the medicine?
- For how long should I take the medicine?
- Are there any side effects?
- What should I do if a side effect occurs?
- Should I avoid any other medications, dietary supplements, foods, drinks, or activities while I take the medicine?
- What do I do if I miss a dose?
- What are the brand names and generic names of this medicine?
- Can I take the generic medicine?
Over-the-Counter (OTC) Medicines

Most grocery stores and drugstores have at least one aisle of OTC medicines. You can buy OTC medicines without a prescription. Over-the-counter medicines include analgesics, cold remedies, antacids, and medicines to treat rashes and other skin problems.

Benefits of OTC Medicines  Most OTC medicines are used for common illnesses, injuries, and disorders. For example, you can treat a headache with acetaminophen (as i tuh MIN uh fuhn), a seasonal allergy with diphenhydramine (die fen HIE druh meen), an itchy skin rash with a cortisone cream, and a stuffy nose with pseudoephedrine (soo doh e FE drin). If you use OTC medicines carefully, they can help relieve your minor illnesses.

Choosing an OTC Medicine  A wide variety of OTC medicines are available. But there are often many different brands of medicines that have different prices and that are used to treat the same problem. How should you choose one medicine over another?

1. Decide what kind of OTC will work for you. Read the list of uses to find out if the medicine can relieve your illness. Some OTC drugs may sound like they do the same thing but they have very different effects on the body. Take cough suppressants and cough expectorants for example. Both are called cough medicines, but a cough suppressant stops a dry, tickly cough whereas a cough expectorant loosens up chest congestion in a person with a chest infection.

2. Decide whether you want generic or a brand-name medicine. There are both brand-name and generic formulations of many OTC medicines. A generic medicine is a medicine that is made by a company other than the company that developed the original medicine. Generic drugs are chemically identical to the original drug. Both generic medicines and brand-name medicines contain the same active ingredient. The active ingredient is the chemical

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**Beliefs vs. Reality**

<table>
<thead>
<tr>
<th>Belief</th>
<th>Reality</th>
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<tr>
<td>&quot;OTC medicines are sold without a prescription, so they must be completely safe.&quot;</td>
<td>OTC medicines can be dangerous when used improperly or if you are allergic to them.</td>
</tr>
<tr>
<td>&quot;OTC medicines can cure diseases so that you don’t have to go to the doctor.&quot;</td>
<td>OTC medicines treat symptoms but cannot cure an illness.</td>
</tr>
<tr>
<td>&quot;Herbal medicines are safe because they’re natural.&quot;</td>
<td>Herbal medicines are not regulated by the FDA, so they’re not proven safe or effective.</td>
</tr>
<tr>
<td>&quot;I should take more of a medicine if my symptoms get worse.&quot;</td>
<td>You should never increase your dose of medicine without first checking with your doctor.</td>
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component that gives a medicine its action. For example, ibuprofen is made by many companies and is the active ingredient in many products that relieve pain. The difference between generic and brand-name medicines is mainly in the inactive ingredients. These ingredients include fillers that give pills their size, shape, color, and coating and that add to the color and flavor of liquid medicines.

3. **Read the label.** All medicines can be dangerous if they are not taken properly. Because of this, all OTC medicines have very specific warnings on their labels. These warnings, as shown in **Figure 3,** alert you to potential dangers. The label also tells you what dose of medicine you should take.

**Misuse of OTC Medicines** In general, OTC medicines treat symptoms, not the disease that causes the symptoms. For example, you may use ibuprofen for a headache that lasts an evening. Or you may use a decongestant, such as pseudoephedrine, to help you breathe easier for a few days while you have a cold.

However, long-term use of OTC medicines can cover up pain or discomfort that is your body’s way of telling you something is wrong. Treating a chronic headache or any other pain with regular use of painkillers may delay the diagnosis of a more serious condition. If symptoms last longer than a few days you should consult a doctor. Examining your daily habits may help you find the reasons for some of your symptoms. Chronic stress, for example, can lead to headaches and stomachaches. A change in lifestyle could solve those problems.
Herbal Remedies and Dietary Supplements  Most pharmacies now sell herbal remedies and dietary supplements. The makers of these products may claim their product prevents or treats certain diseases and conditions. However, dietary supplements and herbal remedies do not have to be approved by the FDA. Therefore, they do not have to be proven to be safe and effective as OTC and prescription medicines do.

The health claims made about prescription and OTC medicines are supported by scientific research that has been evaluated by the FDA. The only way claims about a dietary supplement can be similar to health claims about OTC medicines is if supplement makers put on the label a disclaimer that says, “This statement has not been evaluated by the FDA. This product is not intended to diagnose, treat, cure, or prevent any disease.” Evidence from scientific research, especially well-designed clinical trials, is the best way to know if a drug works and if it is safe.

Many people think that products derived from plants and animals—natural products—are purer and safer than products that are made in a laboratory. However, anything, including a plant, that is put into a bottle to be sold as a supplement has been purified in a laboratory. Also, even though something is a natural product, it does not mean it is safer. Some of the most toxic compounds known to science are completely natural!

Possible Problems with Medicines

When taken as directed, most medicines are safe. However, problems can occur when using medicines. These problems include allergic reactions, side effects, and drug interactions.

Allergic Reactions  Allergic reactions are the most serious risks to taking medicines. Medicines such as penicillin and some related antibiotics are known to cause allergic reactions in some people. Insulin derived from animals, medicines used to treat epilepsy, and some sleeping pills are also known to cause allergic reactions.

Allergic reactions can range from mild itchiness to severe skin rashes, as shown in Figure 4. A life-threatening condition called anaphylactic shock (AN uh fuh LAK tik SHAHK) is the most serious kind of allergic reaction. Anaphylactic shock is a severe allergic response of almost the entire body that includes the following conditions:

- itching all over the body
- swelling, especially in the mouth or throat
- wheezing or difficulty in breathing
- a pounding heart
- fainting and unconsciousness

These symptoms signal a life-threatening medical emergency that needs immediate medical attention. If you or anyone you know develop these symptoms shortly after taking a medicine, emergency medical help should be sought right away.
The first place to spot most allergic reactions is on your skin. So if you start to itch or if you get a rash after taking a medicine, stop taking it immediately and call your doctor. Be sure to tell your doctor about your allergic reaction before the doctor prescribes any kind of medicine for you again or before you decide to take an OTC medication.

**Side Effects** Another potential problem with medicines is that they may produce side effects. While medicine allergies are rare, side effects are common. Antibiotics, for example, not only kill invading bacteria, but they also kill bacteria that normally live in your intestines and help keep you healthy. When these helpful bacteria are killed, you can get diarrhea. Drowsiness is a common side effect of many antihistamines and cough medicines.

Aspirin is another example of a frequently used medicine that can have side effects. One of its side effects is to cause damage to the lining of the stomach. This side effect can lead to bleeding or ulcers. So if you get pains in your stomach while taking aspirin, you should stop taking the drug right away. Drugs that contain ibuprofen and related pain relievers can also cause stomach ulcers.

In addition, any child or teen who has symptoms of a cold, the flu, chickenpox, or a disease that causes a fever should never take aspirin. The combination of aspirin and these diseases can cause or increase the risk for a dangerous condition called Reye’s (RIEZ) syndrome. Reye’s syndrome is a relatively rare disease that primarily affects children and teens under the age of 16. Reye’s syndrome can cause liver failure and brain damage, and the syndrome can sometimes be fatal.

**Drug Interactions** Drug interactions are another potential problem with medicines. Drug interactions occur when a drug reacts with another drug, food, or dietary supplement to increase or decrease the effect of one of the substances. Drug interactions are described on the label on any OTC package or the drug information sheet that comes with a prescription medicine.

For example, sedatives, tranquilizers, alcohol, and some antihistamines cause drowsiness. Taking any combination of these drugs at the same time could make you very drowsy and decrease your coordination. At that point, driving a car or doing anything else that requires concentration and coordination could be dangerous.

You must know about drug interactions before you start mixing medicines. Always check the label or drug information sheet before you take any medicine. You should tell your doctor and pharmacist if you are taking any other medicines or herbal remedies or dietary supplements before you start to take a new prescription or OTC medicine. By volunteering information about yourself and asking questions about new medicines, you can reduce your risk of drug allergies, side effects, and drug interactions.

“I took an antihistamine with my cold medicine before I read the label. The cold medicine had an antihistamine too. I couldn’t stay awake for the rest of the day.”
Using Medicines Wisely

Taking the correct amounts of the correct medicine is very important. There are several important things you can do to make your medicines as safe and as effective as possible.

1. **Make yourself a part of your own healthcare team.** This team includes you, at least one parent or guardian, and any healthcare providers. Once you realize that you are part of the team, and not just a passive recipient of care, you have taken a big step towards ensuring your own health and safety. You must speak up. Your healthcare team can only do its best job caring for you if it knows all about you. Tell members of the team your complete medical history and be especially careful to mention any previous drug reactions or known allergies. Also, be sure to note any medicines and dietary supplements you already take. Your parents can help with your childhood medical history.

2. **Be prepared to ask questions.** Make sure you know and understand what is going on with your health. You may want to write down important questions ahead of time. You can also take notes or have a parent or other adult with you to hear what the doctor or healthcare professional is saying.

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**Analyzing DATA**

**Reading a Prescription Label**

1. Patient’s name and address
2. Prescription number and dates prescription was written and filled
3. Instructions for taking medicine
4. Quantity of medicine provided, name and strength of medicine, and doctor’s name
5. Side-effect warnings
6. Refill information and expiration date

**Your Turn**

1. How often should this patient take her medicine?
2. When the patient finishes the medicine, will she be able to get a refill?
3. What is a possible side effect of this medicine?
4. How many days will it take for the person to finish the medicine provided?
5. **CRITICAL THINKING** Do you think it’s safe for this person to stop taking this medicine once she begins to feel better?
3. **Learn the facts about any medicine you are going to take.** If you are considering an OTC medicine, talk to the pharmacist about drug interactions and side effects.

4. **Listen to your body.** Once you have the medication, make sure that you read the label and drug information sheet carefully. Be sure to follow the instructions completely. You must pay attention to your own body. If you notice anything strange (like itching or headaches) or anything your doctor didn’t warn you about, tell your parents and talk to your doctor right away.

5. **It’s not always safe to suddenly stop taking a drug.** Try to get your doctor’s advice before changing your dosage or intervals between doses, unless you have symptoms of an allergic reaction.

6. **Speak up and enlist your parents’ help.** If you feel uneasy about your medicine, speak up. Even though a medicine is effective, it may be the wrong medicine for you. It’s your job to protect yourself by being careful about how you use medicines and by becoming an active member of your healthcare team.

   Remember, when you take medicines, knowledge is power. You can get the best results from your medicine and take your medicine in the safest way by knowing about the medicine you have to take and by following the tips in Figure 5. If you’re not sure about something, ask your doctor or pharmacist.

### Using Key Terms

1. **Name** the term that describes a drug that changes how a person perceives, thinks, or feels.
2. **Define** the term *generic medicine*.
3. **Distinguish** the active ingredient from other ingredients in medicines.
4. **Name** the term for what can happen if you take an antihistamine and cold medicine together.

### Understanding Key Ideas

5. **Summarize** the role of the FDA in the drug approval process.
6. **List** three reasons you need a prescription to get certain medicines.

### Do vs. Don’t

<table>
<thead>
<tr>
<th>Do</th>
<th>Don’t</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tell your doctor your health history and any drug reactions you have.</td>
<td>Don’t hide health information from your doctor—even the embarrassing stuff.</td>
</tr>
<tr>
<td>Pay attention to warning labels.</td>
<td>Don’t mix medicines that cause drowsiness.</td>
</tr>
<tr>
<td>Ask your doctor or pharmacist before combining medicines.</td>
<td>Don’t take medicines that are prescribed for someone else.</td>
</tr>
<tr>
<td>Call your doctor immediately if you notice signs of an allergic reaction.</td>
<td>Don’t continue to take medicines that make you feel worse.</td>
</tr>
<tr>
<td>Complete the whole prescription of antibiotics.</td>
<td>Don’t stop taking your antibiotics when you feel better.</td>
</tr>
</tbody>
</table>

**Figure 5**

Failing to use prescription medicines correctly can have very serious consequences.

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Your brain creates all of your thoughts, perceptions of the world, feelings, personality, and physical responses. Drugs that affect your brain can change all of these things.

How Drugs That Affect the Brain Work

Your brain is made up of billions of nerve cells called neurons. Each neuron makes many connections with other neurons. The brain uses all these neurons and their billions of connections to process information.

How Messages Are Sent in the Brain

The information processing in the brain takes place at the connections between neurons. These connections are called synapses. Synapses are tiny spaces between two neurons. What happens in these tiny spaces is very important. As shown in Figure 6, for the brain to send a message, one neuron releases a special chemical messenger, called a neurotransmitter, into the synapse. There are many different types of neurotransmitters. The neurotransmitter moves across the synapse and attaches to the neuron that is to receive the message. This attachment, called binding, is the actual receiving of the chemical message. Examples of neurotransmitters are serotonin (SIR uh TOH nin), dopamine (DOH puh MEEN), and epinephrine (EP uh NEF rin).

Drugs Can Change How Messages Are Sent

Some drugs can change the way neurons communicate with each other. These drugs act like neurotransmitters, block neurotransmitters, or change the amount of a neurotransmitter in synapses. Changing the communication between neurons by interfering with neurotransmitters changes the way we sense, feel, and respond to the world around us. Changing chemical messages between neurons by use of drugs can in some cases benefit health but in other cases is harmful.

OBJECTIVES
Describe how drugs that affect the brain work.
State how drugs can affect a person’s emotions.
Describe how addiction can develop from experimentation.
Summarize the role of withdrawal in maintaining a drug addiction.
Describe why addiction is considered a treatable and avoidable disease.

KEY TERMS
addiction a condition in which a person can no longer control his or her drug use
drug tolerance a condition in which a user needs more of a drug to get the same effect
physical dependence a condition in which the body relies on a given drug in order to function
withdrawal uncomfortable physical and psychological symptoms produced when a physically dependent drug user stops using drugs

LIFE SKILL
People abuse drugs that affect only the brain. No one abuses a drug because of what it does to his or her stomach, lungs, or liver.
**Messages in the Brain Determine Our Moods**  When you are feeling relaxed, having your dog nuzzle you and lick your face is fun. When you are feeling rushed and stressed, her playfulness is annoying, so you push her away. The action of certain neurotransmitters is the basis for our different moods and emotions. How you view your dog’s behavior on those two different days depends on which neurotransmitters are released in your brain. Serotonin, for example, is a neurotransmitter that greatly affects our actions and reactions to the outside world. People who are depressed may have a reduced amount of the neurotransmitter serotonin to activate neurons.

**Drugs Can Affect Emotions**  Antidepressants are examples of drugs that change the way the brain works in a beneficial way. By correcting the levels of serotonin in synapses, certain antidepressant medicines can help reduce depression. Other mood-altering medicines work by changing the levels or effectiveness of other neurotransmitters.

Drugs of abuse, such as marijuana, cocaine, and nicotine, interrupt the balance between the many neurotransmitters needed for normal brain functioning. These drugs alter our judgment in ways that affect our ability to understand and deal with reality. If drugs like these are taken over a long period of time, they can create the powerful changes in feelings and behavior that lead to addiction. **Addiction** is a condition in which a person can no longer control his or her drug use. When a person becomes addicted to a drug, he or she has developed a physical need for the drug, and can’t function without it.
The Path to Addiction

Almost all drugs of abuse activate one set of brain structures. These parts of the brain are together called the **brain reward system**. This system serves to reinforce healthy behavior, such as eating when you are hungry. To encourage the body to repeat such healthy behaviors, the neurons of the brain reward system release the neurotransmitter dopamine. Dopamine lets us feel pleasure.

The pleasure or “reward” we get from activities like eating is relatively small. But when drugs of abuse, such as cocaine or alcohol, turn on the brain reward system, the reward or pleasure can be very powerful. The pleasure that these drugs produce tricks the brain into believing that taking the drug is good for the body.

The Dangers of Drug Use  Getting pleasure is one reason why people repeatedly abuse drugs. But the pleasure alone does not explain how people get addicted. No one starts using drugs to become an addict. But every addict starts as someone experimenting with drugs. At some point, people who become addicts move from experimentation to a more regular pattern of abuse.

Drug use produces biological changes in the brain that change the way the brain works—possibly permanently. Adolescent brains are more vulnerable to the effects of drugs than adult brains are. This is because the adolescent brain, along with the adolescent personality and body, is still growing and developing. Taking drugs interferes with the normal changes that occur at this important time of life.

Tolerance  The first change in a drug user’s body is a condition called **drug tolerance**. Drug tolerance develops after repeated drug use when the user finds that it takes more of a drug to get the same effect. Because drug tolerance requires a person to take more drug to get the same effect, it sets the stage for another biological response to continue drug use—physical dependence.

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Behavioral Warning Signs of Addiction

- Loss of interest in schoolwork
- Dramatic change of appearance
- Change of friends
- Unexplained mood swings
- Absences from school
- Dramatic change in eating habits
- Excessive secretiveness or lying
- Unexplained need for money
Physical Dependence  After repeated high-dose drug use, a person finds that he or she cannot function properly without taking the drug. The condition in which the body relies on a given drug in order to function is known as **physical dependence**. When people become dependent, the brain neurons and body cells respond to the presence of the drug by changing how they work. The body cells of a drug-dependent person need the drug in order to work normally. Because drugs of abuse interfere with the production of certain neurotransmitters, the neurons then try to “cancel out” such effects by becoming more or less responsive to those neurotransmitters.

Addiction  While drugs are changing the abuser’s brain, he or she is also learning drug abuse behaviors and attitudes. When people become addicted to drugs, they lose control of their behavior. They stop doing almost everything else and need to seek and use drugs. Addicts even use drugs when drug use leads to severe consequences such as dropping out of school or being arrested.

An addict learns how to get drugs, how to take them, and, sometimes, how to lie and steal to get drugs. Also, an addict learns to be distrustful and paranoid. But most of all, addicts learn to use drugs to deal with their emotional problems. This way of dealing with problems prevents the development of normal coping skills that are a part of growing up. An addict’s brain is not like a normal brain. This is why drug addiction is now known as a brain disorder. **Figure 7** outlines how this complex disorder develops.

Withdrawal  Neurons can keep the working balance that has been established during physical dependence as long as the person keeps taking the drug. But if the drug is suddenly removed, the neurons work abnormally. The uncomfortable physical and psychological symptoms produced when a physically dependent drug user stops using drugs is called **withdrawal**.

Withdrawal is characterized mostly by symptoms that are opposite of the drug’s effect. Withdrawal keeps addiction going because the distressing symptoms drive the addict to take more drug to alleviate the symptoms. Craving the drug is the brain’s way of telling the body it needs more of the drug. By now, the addict feels normal only when he or she has the drug in his or her body.
Understanding Drugs and Medicines

Addiction Is a Treatable Disease

Many people believe that when a person becomes addicted, he or she will use drugs for the rest of his or her life. This belief is not true. Many drug abusers and addicts free themselves from drug dependency every day. However, fighting an addiction to any drug is not easy because all people who are addicted to drugs are both physically and psychologically dependent on drugs.

Most communities offer a variety of treatment programs. In treatment, patients receive help in getting off the drug to which they are addicted, as well as counseling to understand why they have become addicted. Counseling also helps the addict cope with life without the drug. The sooner treatment is started, the easier it is to do. So the sooner an addict, or a drug abuser who is on his way to becoming an addict, starts treatment, the better. And despite all the brain changes that happen and behaviors that addicts learn, they can recover.

There is one foolproof way to avoid addiction—don’t use drugs of abuse. Nicotine and alcohol, both of which are highly addictive, are illegal for teens to use. So you don’t need an excuse not to use them. And despite the way it may seem, everybody is not doing drugs. Three-quarters of 16-year-olds don’t drink alcohol or use marijuana, and 98 percent don’t use cocaine or heroin. Fifty percent of 16-year-olds have never smoked a single cigarette. You can find friends who don’t do drugs because you know it’s the smart thing to do.

### Section 3

#### Using Key Terms

1. **Define** the term addiction.
2. **Differentiate** drug tolerance from physical dependence.
3. **Name** the term that means “the uncomfortable physical and psychological symptoms produced when a physically dependent drug user stops using drugs.”

#### Understanding Key Ideas

4. **Describe** how drugs can change the way the brain works.
5. **Describe** how drugs can affect your emotions.
6. **Identify** the term that is *not* a stage in the path to addiction.
   a. tolerance
   b. dependence
   c. drug use
   d. side effect
7. **State** reasons why addiction can be difficult to overcome.
8. **Describe** the relationship between physical dependence and withdrawal.
9. **Using Community Resources** Using Community Resources What resources are available to a drug addict to help him or her begin recovery from a drug addiction?

#### Critical Thinking

10. **Practicing Wellness** Why is it important to avoid starting to take drugs?
Key Terms

SECTION 1

drug (218)
medicine (218)
side effect (219)
prescription (221)
over-the-counter (OTC) medicine (221)

SECTION 2

psychoactive (223)
generic medicine (224)
active ingredient (224)
drug interaction (227)

SECTION 3

addiction (231)
drug tolerance (232)
physical dependence (233)
withdrawal (233)

The Big Picture

✔ A drug is any substance that causes a change in a person’s physical or emotional condition.
✔ The term drug can refer either to a medicine or to a drug of abuse.
✔ Drugs come from nature and are also created in laboratories.
✔ Good medicines are safe and effective and have few side effects.
✔ Drugs are classified by what they do.
✔ Drugs can enter the body in many ways, including by inhalation, ingestion, transdermal application, injection, as well as topically and through implanted pumps.

✔ The Food and Drug Administration (FDA) is the government agency that regulates the safety and effectiveness of medicines.
✔ A doctor’s prescription is needed to get medicines that treat serious health conditions or that are very powerful drugs.
✔ Over-the-counter medicines usually treat symptoms rather than cure diseases. When choosing an OTC medicine, you should consider whether the OTC medicine is best suited to treating your illness.
✔ Some medicines can cause allergic reactions or side effects or can react negatively with other medicines.
✔ To use a medicine properly, safely, and effectively, be sure you are informed about the medicine before you take it.
✔ Health claims made about herbal remedies and dietary supplements do not have to be backed by scientific research.

✔ Drugs that affect your emotions do so by changing the way neurons send and receive neurotransmitters.
✔ Areas of the brain called the brain reward system are involved in feelings of pleasure. These areas are stimulated by almost all drugs of abuse.
✔ Becoming addicted to a drug over time involves drug use, tolerance, and physical dependence on the drug.
✔ The unpleasant physical and mental effects of withdrawal can keep an addiction going.
✔ Addiction is a brain disorder. Treating an addict involves helping the addict get over his or her physical dependence, learning new behaviors to stay drug free, and understanding the reasons that the drug use started.
✔ The majority of teens do not use illegal drugs.
Using Key Terms
active ingredient (224)
adiction (231)
drug (218)
drug interaction (227)
drug tolerance (232)
generic medicine (224)
medicine (218)
over-the-counter (OTC) medicine (221)
physical dependence (233)
prescription (221)
psychoactive (223)
side effect (219)
withdrawal (233)

1. For each definition below, choose the key term that best matches the definition.
   a. a medicine that can be obtained only with a written order from a doctor
   b. a term used for a drug or medicine that has a specific effect on the brain
   c. a medicine that is made by a company other than the company that developed the medicine
   d. an unintended and sometimes harmful effect of a drug
   e. condition in which a drug user needs more of a drug to get the same effect

2. Explain the relationship between the key terms in each of the following pairs.
   a. physical dependence and withdrawal
   b. drug and medicine
   c. drug tolerance and addiction
   d. over-the-counter medicine and prescription
   e. active ingredient and drug interaction

Understanding Key Ideas
Section 1
3. Why are all drugs not medicines?
4. What are three key characteristics of a good medicine?
5. From what two sources do all drugs and medicines come from?

6. Analgesics
   a. relieve allergy symptoms.
   b. kill harmful bacteria.
   c. relieve pain.
   d. soothe itchy skin.

7. List the ways that drugs can enter the body.
8. Explain why some drugs are called drugs of abuse. LIFE SKILL

9. CRITICAL THINKING How do you think medicines have affected how long you will live?

Section 2
10. What is the role of clinical trials in the drug approval process?
11. Why are some medicines available only by prescription?
12. Which of the following is the least important to consider when choosing an OTC medicine?
   a. active ingredient
   b. possible side effects
   c. brand name
   d. drug interactions

13. List four side effects of some medicines.
14. List the things you should ask your doctor about any medicine she or he prescribes to you. LIFE SKILL

15. CRITICAL THINKING Explain the advantages of being an active member of your healthcare team.

Section 3
16. Describe how messages are sent in the brain.
17. How do some drugs affect emotions?
18. Identify four behaviors that could be warning signs of drug abuse and addiction.
19. Describe the role of withdrawal in maintaining a drug addiction.

20. CRITICAL THINKING Evaluate the following statement: “Drug addiction is preventable.” LIFE SKILL
Interpreting Graphics

Study the figure below to answer the questions that follow.

### Misuse of Prescription Drugs in the U.S.

- **Stimulants**
- **Antianxiety medicines**
- **Pain relievers**

Source: National Household Survey on Drug Abuse.

21. What are the most commonly abused prescription drugs?

22. Using the data in the graph, estimate the total number of people who abuse prescription drugs.

23. **CRITICAL THINKING** Why do you think these particular drugs are the most commonly abused?

### Activities

24. **Health and You** Select an advertisement for an OTC drug. Analyze the claims and benefits given in the advertisement. How does the advertisement try to sell the drug? Rewrite the advertisement, and give suggestions for relieving the problem without use of the drug.

25. **Health and Your Community** Long-term self-medication with OTC medicines is becoming more common. Write a one-page report that presents possible reasons for this trend. Explain possible health problems the overuse of OTC medicines can lead to.

26. **Health and You** Write a reply to the following statement: "Just try it once; one try won’t harm you. It’s not like you’ll become an addict overnight!"

### Action Plan

27. **LIFE SKILL Setting Goals** You have a choice about how much you rely on drugs to relieve symptoms brought on by stress. Create a plan to restrict your reliance on drugs.

### Standardized Test Prep

Read the passage below, and then answer the questions that follow.

**We have created a product to blast your body with pure energy. Star Energy is an all-natural substance made from the flowers of Grameninis energicium. We have now harnessed the natural goodness of Grameninis for you to enjoy its health benefits. Star Energy is the most complete and dynamic natural energy formula ever developed. You’ll instantly feel the difference in your energy levels. Many nutrition experts use Star Energy as a part of their weight-training program to boost muscle development. Just one tablet a day!**

28. In this passage, the word *harnessed* means
   A. made.
   B. promoted.
   C. captured.
   D. distributed.

29. What can you infer from reading this passage?
   E. Star Energy will work for you.
   F. This is an advertisement.
   G. Star Energy is an OTC medicine.
   H. Star Energy has been approved by the FDA.

30. Write a paragraph on the methods that are used in this advertisement to make the product sound effective.

31. Because it is natural, is Star Energy any safer or more effective than a drug made in a laboratory? Explain.

32. Do you think this product could be abused?
Prescription Drugs and the Media

In 1555, the Royal College of Physicians in London declared that no doctor could tell a patient anything about a medicine, including its name. Doctors in those days were concerned that patients would hurt themselves by using medicines unwisely. This cautious attitude persisted in the medical community for more than 450 years, but things have changed in modern times.

Direct-to-Consumer Advertising

Prescription drugs are now so widely advertised in magazines, on the Internet, on the radio, and especially on TV that they affect every person living in this country. This kind of advertising is called direct-to-consumer (DTC) advertising. In 2001, the pharmaceutical industry spent $2.5 billion on DTC advertising in the United States. Pharmaceutical companies spent $1.5 billion on TV advertising alone.

Drug Advertising Affects People’s Actions

In 1999, one national newsmagazine contained more than 18 pages of advertisements for prescription drugs. Does all of this advertising affect people’s choices about medicine? The answer appears to be yes. Thirty percent of all people who see these ads and then go to a doctor ask for an advertised product. More astoundingly, almost half of the doctors give the patient a prescription for the specific drug requested. Only one in four doctors recommends another drug. In short, people are motivated by the ads, and their doctors are likely to give them requested drugs.
Advertising Prescription Drugs Has Benefits

Many people in the drug and medical field suggest that these ads provide great benefits to you, the consumer. They argue that a consumer has a right to learn about the drugs that are available to treat a symptom. Advertising, they say, is a form of education. If you have asthma, for example, shouldn’t you have a right to know which asthma drugs you can use? Why should only a doctor have access to such information?

Another argument in favor of DTC advertising is that it makes money for the pharmaceutical industry. This money, supporters of DTC argue, helps pay for the costly development of current drugs and for the development of new drugs.

Drug Advertising Has Drawbacks

Along with the growth in drug advertising has come a steady growth of criticism. Consumer groups and physicians have complained that advertising sometimes causes people to make bad choices. One argument is that drug ads blur the distinction between providing information and promoting good healthcare. When doctors tell patients that the specific drug they asked for may not be good for them, the patients often react with anger and frustration. They may demand a specific drug even when another is as good, better, or even cheaper. Many doctors say that they feel pressured by patients who had read ads.

Being Aware of the Media’s Influence

The media—TV, radio, Internet, newspapers, and magazines—affects everybody’s life. The sudden growth in DTC advertising of prescription drugs means that all of us must become wise consumers. Advertising should not be accepted without question.

Your best course of action is to use your physician as a partner in your healthcare. Ask your doctor questions, and listen responsibly to the answers and suggestions. Likewise, all of us must bring skepticism to what we see and hear, especially when someone is trying to sell us something. Drug advertisements may indeed help us make better choices, but if used unwisely, they may compromise our health.

YOUR TURN

1. Summarizing Information Give one argument for and one argument against advertising prescription drugs.

2. Analyzing Methods Check some current magazines in terms of numbers and types of drug advertisements. How does each ad attempt to sell the drug? Discuss your findings.

3. CRITICAL THINKING How can you determine if a drug advertisement is telling you all of the facts about treating a specific illness or using a specific drug?