The Respiratory System

Before You Read
Prepare Note Cards. On separate index cards, list the various organs of the respiratory system. On the reverse side of each card, write the function of the organ.

New Vocabulary
- diaphragm
- trachea
- bronchi
- asthma
- tuberculosis
- emphysema

Breathing Easy. Allison is helping her dad build shelves for the family room. When they are ready to sand the wood, Allison’s father asks her to wear a mask like his over her mouth and nose. He explains that sanding sends tiny particles of sawdust into the air that could get into her lungs. The mask blocks the dust so that she can breathe safely.

Think about a time when you should have worn a mask to protect your respiratory system. Write a paragraph describing the situation. What kind of activity were you doing? How did it affect your mouth, nose, and lungs?

What Happens During Respiration

The main function of the respiratory system is respiration, the exchange of gases between the body and the environment. In Lesson 1, you learned that carbon dioxide is delivered to the lungs. Your respiratory system removes carbon dioxide from the body and provides it with fresh oxygen. Inhaling and exhaling causes the lungs to expand and deflate slightly.

The process of respiration can be divided into two parts. In external respiration, oxygen moves from the lungs into the blood, and carbon dioxide moves from the blood into the lungs. In internal respiration, oxygen moves from the blood into the cells, and carbon dioxide moves from the cells into the blood. The continual exchange of gases in both external and internal respiration is essential for survival. Oxygen fuels the brain and allows your body to metabolize food for energy to move muscles.
How Respiration Works

Main Idea The respiratory system consists of the lungs, trachea, and diaphragm.

Your lungs automatically fill with air and are emptied in a rhythmic way. This rhythm changes with the level of your activity. You’ve probably noticed that when you do aerobic exercises, like running or fast walking, you tend to breathe harder than when you’re sitting still. Breathing is regulated by the brain, which sends impulses to stimulate the muscles involved in respiration. This process provides your body with the oxygen it needs to keep going. It also removes carbon dioxide from the lungs. The lungs are found within the chest cavity and are protected by the ribs. In the base of the chest cavity is the diaphragm (DI-uh-fram), a muscle that separates the chest from the abdominal cavity.

As you inhale, the diaphragm and the muscles between your ribs contract. This contraction expands your chest cavity and your lungs. The pressure inside your lungs is lower than the pressure outside your body, so air naturally flows into your lungs to equalize the pressure. As you exhale, these same muscles relax and your chest cavity decreases. Pressure inside your lungs is higher, so air naturally flows out of your lungs to the outside, the area of lower pressure.

The Lungs

The structure of the lungs can be compared to the structure of a branching tree. Air moves into the lungs through the trachea (TRAY-kee-uh), or the windpipe. The trachea branches out into two bronchi (BRAHN-ky), the main airways that reach into each lung. The airways become smaller as they branch out deeper into the lungs. A network of tubes called bronchioles brings air closer to the site of external respiration. At the end of each bronchiole are groups of microscopic structures called alveoli. Shown in Figure 15.5 on page 418, alveoli are thin-walled air sacs covered with capillaries. Gas exchange takes place as oxygen and carbon dioxide spread across the walls of the capillaries and alveoli.

Other Respiratory Structures

The respiratory system also includes structures in the upper airways. Air enters and exits your body through the nose and mouth. The membranes of the nose are lined with hairlike structures, called cilia, and with cells that produce mucus. The cilia and mucus work together to help prevent foreign particles such as dust, bacteria, and viruses from moving deeper into the respiratory system.
The lungs are the principal organs of the respiratory system. Which structures in the diagram are also parts of the cardiovascular system?

The epiglottis is a flap of tissue that closes over the trachea when you swallow.

The larynx, the voice box, contains the vocal cords.

The trachea is the windpipe.

The bronchi are the passages through which air spreads through the lungs.

The diaphragm is a dome-shaped muscle that separates the thoracic and abdominal cavities. The diaphragm contracts and relaxes, causing the chest cavity to expand and contract.

An alveolus is a tiny air sac through which the gas exchange of external respiration takes place.

A capillary is a tiny blood vessel through which gas exchange takes place.

A branch of the pulmonary artery brings blood from the heart into the lung.

The bronchioles are tubes that carry air closer to the site of external respiration.

A branch of the pulmonary vein takes oxygenated blood from the lung back to the left atrium of the heart.

The air that enters the respiratory system is filtered, warmed, and moistened. The air then moves into the pharynx, or throat, and then into the trachea, or windpipe. The tissue that lines the trachea is also lined with mucus and cilia to trap particles and prevent them from going deeper into the respiratory system.

Other structures that are not directly involved in respiration, but have important functions in the respiratory system, are the larynx and the epiglottis. The larynx, or voice box, connects the throat and the trachea. The larynx contains the vocal cords, two bands of tissue that produce sound when air forced between them causes them to vibrate.

The epiglottis is a flap of tissue located above the larynx. It folds down to close off the entrance to the larynx and trachea when you swallow. This is an involuntary action that keeps food or drink from entering the respiratory system. If you eat too quickly or talk or laugh while eating, your food may get past the epiglottis and "go down the wrong pipe." The piece of food stimulates the cough reflex to expel the material from your respiratory system.
Maintaining Your Respiratory Health

Main Idea: Caring for your lungs can prevent many respiratory disorders.

Respiratory problems can affect the functioning of other body systems and, in turn, many other aspects of your daily life. Imagine not being able to climb a flight of stairs without running out of breath. The single most important decision you can make for your respiratory health is not to smoke. Smoking damages all parts of the respiratory system and is the main cause of lung cancer. Smoking can also cause bronchitis and emphysema, and increase the likelihood of asthma in children. Tobacco use also reduces the rate of lung growth in teens. Avoiding tobacco use and exposure to secondhand smoke will decrease your risk. Air pollution also increases the risk of respiratory health problems and certain types of cancers.

Regular physical activity is also important for a healthy respiratory system. Increased respiration during exercise improves the capacity of the lungs to pass oxygen into the blood. Exercise also increases the total amount of air that is moved into and out of your body.

Washing your hands regularly can help prevent infection. Bacteria and viruses can be easily transmitted to the respiratory system when contaminated hands touch the nose or mouth. Limiting your exposure to pollutants in the air, including secondhand or environmental tobacco smoke, can also reduce your risk of developing respiratory disorders.

Respiratory System Problems

Main Idea: Problems of the respiratory system can be mild, such as a cold, or serious and even life threatening.

Problems of the respiratory system range from mild infections to disorders that can damage lung tissue and alveoli and prevent proper ventilation. Colds and influenza are common infections of the upper respiratory system. Other infections and disorders affect the lower respiratory tract.

- **Sinusitis** is an inflammation of the tissues that line the sinuses, air-filled cavities above the nasal passages and throat. The inflammation can result from allergies or an infection. Symptoms include nasal congestion, headache, and fever. Treatment includes nasal decongestant drops or sprays and antibiotics.

READING CHECK

Extend: How might a friend's smoking habit affect your respiratory health?

FITNESS ZONE

I like to work out with a friend. During our workouts, we talk. My PE teacher said that when we do aerobic exercises, we should be a little winded but still able to talk or sing. For more fitness tips, visit the Online Fitness Zone at glencoe.com.
The Effects of Smoking

Ari’s health teacher, Mrs. Gilcrest, held up a jar filled with a brown, gooey substance. Mrs. Gilcrest told the class that the jar represented the lungs of smokers. The brown sludge represented the amount of tar that gets into a smoker’s lungs each year from smoking one pack of cigarettes a day. Ari thought about his Uncle Stan, who wears an oxygen tank because he has emphysema and has trouble breathing. “No wonder,” thought Ari. “Uncle Stan smoked about a pack of cigarettes a day for as long as I can remember.”

- Bronchitis is an inflammation of the bronchi caused by infection or exposure to irritants such as tobacco smoke or air pollution. In bronchitis, the membranes that line the bronchi produce excessive amounts of mucus in the airways. This blocks the airways and leads to symptoms such as coughing, wheezing, and shortness of breath that worsen with physical activity. Treatment includes avoiding exposure to the irritant and taking antibiotics.

- Asthma (AZ-muh) is an inflammatory condition in which the trachea, bronchi, and bronchioles become narrowed, causing difficulty breathing. During an asthma attack, an involuntary contraction of smooth airway muscles leads to chest tightness and breathing difficulty. Acute asthma attacks can be relieved with an inhaler that dispenses medication to dilate, or widen, the airways.

Figure 15.6 An inhaler can relieve an asthma attack. Long-term treatment of asthma includes using medication that reduces inflammation and avoiding substances that can trigger an attack, such as pollen, dust, animal dander, and tobacco smoke. Why is it important for an asthmatic person to avoid air pollution?
• Pneumonia is an inflammation of the lungs commonly caused by a bacterial or viral infection. In a common type of pneumonia, the alveoli swell and become clogged with mucus, decreasing the amount of gas exchange. Symptoms include cough, fever, chills, and chest pain. Bacterial pneumonia is treated with antibiotics.

• Tuberculosis is a contagious bacterial infection that usually affects the lungs. When a person is infected with tuberculosis, the immune system surrounds the infected area and isolates it. In this inactive stage, which can last for many years, a person doesn’t show symptoms. However, if the immune system is weakened by illness or age, the infection can become active. During this active stage, symptoms include cough, fever, fatigue, and weight loss. Treatment includes antibiotics and hospitalization.

• Emphysema is a disease that progressively destroys the walls of the alveoli. Symptoms include breathing difficulty and chronic cough. Although the symptoms of emphysema can be treated, the tissue damage is permanent. Emphysema is almost always caused by smoking.

**LESSON 2 ASSESSMENT**

**After You Read**

**Reviewing Facts and Vocabulary**

1. What causes the lungs to fill with air?
2. Which problems with the respiratory system can be caused by smoking?
3. How can washing your hands protect your respiratory system?

**Thinking Critically**

4. Compare. How do internal respiration and external respiration differ?
5. Apply. A friend wants to quit smoking. You notice that just walking to school with you leaves her breathing hard. How can you encourage her to quit smoking?

**Applying Health Skills**

6. Communication Skills. Imagine you have a close family member who bicycles to work on major streets during rush hour. During this time, air pollution is at its worst, and a cyclist inhales a lot of it. Write a dialogue in which you encourage the family member to consider the negative effects of this practice. Explain the problems that can result.

**Writing Critically**

7. Expository. Write a paragraph explaining how oxygen and carbon dioxide are exchanged through the respiratory system.

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