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## KEY CONCEPT

# The respiratory system gets oxygen and removes carbon dioxide.



## BEFORE, you learned

- Cells, tissues, organs, and organ systems work together
- Organ systems provide for the body's needs
- Organ systems are important to the body's survival



## NOW, you will learn

- About the structures of the respiratory system that function to exchange gases
- About the process of cellular respiration
- About other functions of the respiratory system

## VOCABULARY

respiratory system p. 37  
cellular respiration p. 38

## EXPLORE Breathing

## How do your ribs move when you breathe?

## PROCEDURE

- ① Place your hands on your ribs.
- ② Breathe in and out several times, focusing on what happens when you inhale and exhale.
- ③ Record your observations in your notebook.

## WHAT DO YOU THINK?

- What movement did you observe?
- Think about your observations. What questions do you have as a result of your observations?



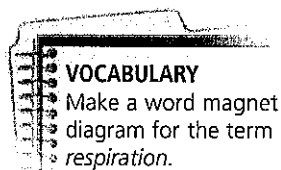
## Your body needs oxygen.

During the day, you eat and drink only a few times, but you breathe thousands of times. In fact, breathing is a sign of life. The body is able to store food and liquid, but it is unable to store very much oxygen. The **respiratory system** is the body system that functions to get oxygen from the environment and remove carbon dioxide and other waste products from your body. The respiratory system interacts with the environment and with other body systems.

The continuous process of moving and using oxygen involves mechanical movement and chemical reactions. Air is transported into your lungs by mechanical movements and oxygen is used during chemical reactions that release energy in your cells.



What are the two main functions of your respiratory system?



## VOCABULARY

Make a word magnet diagram for the term *respiration*.



## Exchanging Oxygen and Carbon Dioxide

Like almost all living things, the human body needs oxygen to survive. Without oxygen, cells in the body die quickly. How does the oxygen you need get to your cells? Oxygen, along with other gases, enters the body when you inhale. Oxygen is then transported to cells throughout the body.

The air that you breathe contains only about 20 percent oxygen and less than 1 percent carbon dioxide. Almost 80 percent of air is nitrogen gas. The air that you exhale contains more carbon dioxide and less oxygen than the air that you inhale. It's important that you exhale carbon dioxide because high levels of it will damage, even destroy, cells.

In cells and tissues, proper levels of both oxygen and carbon dioxide are essential. Recall that systems in the body work together to maintain homeostasis. If levels of oxygen or carbon dioxide change, your brain or blood vessels signal the body to breathe faster or slower.

The photograph shows how someone underwater maintains proper levels of carbon dioxide and oxygen. The scuba diver needs to inhale oxygen from a tank. She removes carbon dioxide wastes with other gases when she exhales into the water. The bubbles you see in the water are formed when she exhales.



What gases are in the air that you breathe?

### Gas Exchange

This scuba diver breathes the same mixture of gases present in air.

Carbon dioxide is part of the mixture of gases the diver exhales.

Oxygen is in the mixture of gases the diver inhales.



# INVESTIGATE Lungs

## How does air move in and out of lungs?

### PROCEDURE

- 1 Create a model of your lungs as shown. Insert an uninflated balloon into the top of the plastic bottle. While squeezing the bottle to force out some air, stretch the end of the balloon over the lip of the bottle. The balloon should still be open to the outside air. Tape the balloon in place with duct tape to make a tight seal.
- 2 Release the bottle so that it expands back to its normal shape. Observe what happens to the balloon. Squeeze and release the bottle several times while observing the balloon. Record your observations.

### WHAT DO YOU THINK?

- Describe, in words, what happens when you squeeze and release the bottle.
- How do you think your lungs move when you inhale? when you exhale?

**CHALLENGE** Design an addition to your model that could represent a muscle called the diaphragm. What materials do you need? How would this work? Your teacher may be able to provide additional materials so you can test your model. Be sure to come up with a comprehensive list of materials as well as a specific diagram.



### SKILL FOCUS Modeling

#### MATERIALS

- one medium balloon
- 1-L clear plastic bottle with labels removed

**TIME**  
15 minutes



## Cellular Respiration

Inside your cells, a process called **cellular respiration** uses oxygen in chemical reactions that release energy. The respiratory system works with the digestive and circulatory systems to make cellular respiration possible. Cellular respiration requires glucose, or sugars, which you get from food, in addition to oxygen, which you get from breathing. These materials are transported to every cell in your body through blood vessels. You will learn more about the digestive and circulatory systems later in this unit.

During cellular respiration, your cells use oxygen and glucose to release energy. Carbon dioxide is a waste product of the process. Carbon dioxide must be removed from cells.

### CHECK YOUR READING

What three body systems are involved in cellular respiration?

### VOCABULARY

Add a magnet diagram for *cellular respiration* to your notebook. Include the word *energy* in your diagram.



## Structures in the respiratory system function together.

### OUTLINE

Add *Structures in the respiratory system function together* to your outline. Be sure to include the six respiratory structures in your outline.

- I. Main idea
  - A. Supporting idea
    - 1. Detail
    - 2. Detail
  - B. Supporting idea

The respiratory system is made up of many structures that allow you to move air in and out of your body, communicate, and keep out harmful materials.

**Nose, Throat, and Trachea** When you inhale, air enters your body through your nose or mouth. Inside your nose, tiny hairs called cilia filter dirt and other particles out of the air. Mucus, a sticky liquid in your nasal cavity, also helps filter air by trapping particles such as dirt and pollen as air passes by. The nasal cavity warms the air slightly before it moves down your throat toward a tubelike structure called the windpipe, or trachea (TRAY-kee-uh). A structure called the epiglottis (EHP-ih-GLAHT-ihs) keeps air from entering your stomach.

**Lungs** The lungs are two large organs located on either side of your heart. When you breathe, air enters the throat, passes through the trachea, and moves to the lungs through structures called bronchial tubes. Bronchial tubes branch throughout the lungs into smaller and smaller tubes. At the ends of the smallest tubes air enters tiny air sacs called alveoli. The walls of the alveoli are only one cell thick. In fact, one page in this book is much thicker than the walls of the alveoli. Oxygen passes from inside the alveoli through the thin walls and is dissolved into the blood. At the same time, carbon dioxide waste passes from the blood into the alveoli.

### CHECK YOUR READING

Through which structures does oxygen move into the lungs?

**Ribs and Diaphragm** If you put your hands on your ribs and take a deep breath, you can feel your ribs expand. The rib cage encloses a space inside your body called the thoracic (thu-RHAS-ihk) cavity. Some ribs are connected by cartilage to the breastbone or to each other, which makes the rib cage flexible. This flexibility allows the rib cage to expand when you breathe and make room for the lungs to expand and fill with air.

A large muscle called the diaphragm (DY-uh-FRAM) stretches across the floor of the thoracic cavity. When you inhale, your diaphragm contracts and pulls downward, which makes the thoracic cavity expand. This movement causes the lungs to push downward, filling the extra space. At the same time, other muscles draw the ribs outward and expand the lungs. Air rushes into the lungs, and inhalation is complete. When the diaphragm and other muscles relax, the process reverses and you exhale.

### CHECK YOUR READING

Describe how the diaphragm and the rib cage move.

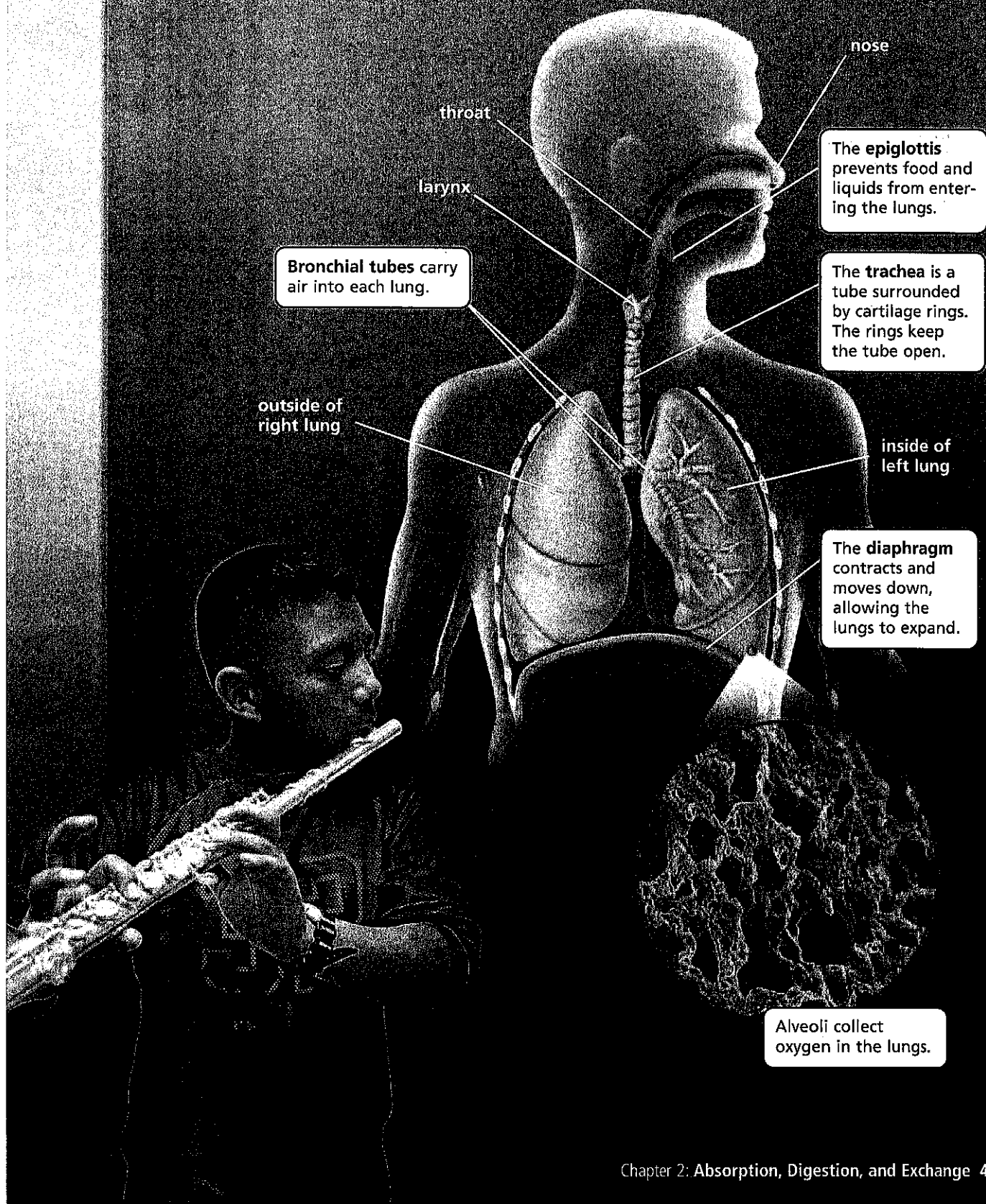


### RESOURCE CENTER CLASSZONE.COM

Explore the respiratory system.

## Respiratory System

The structures in the respiratory system allow this flutist to play music.



## The respiratory system is also involved in other activities.

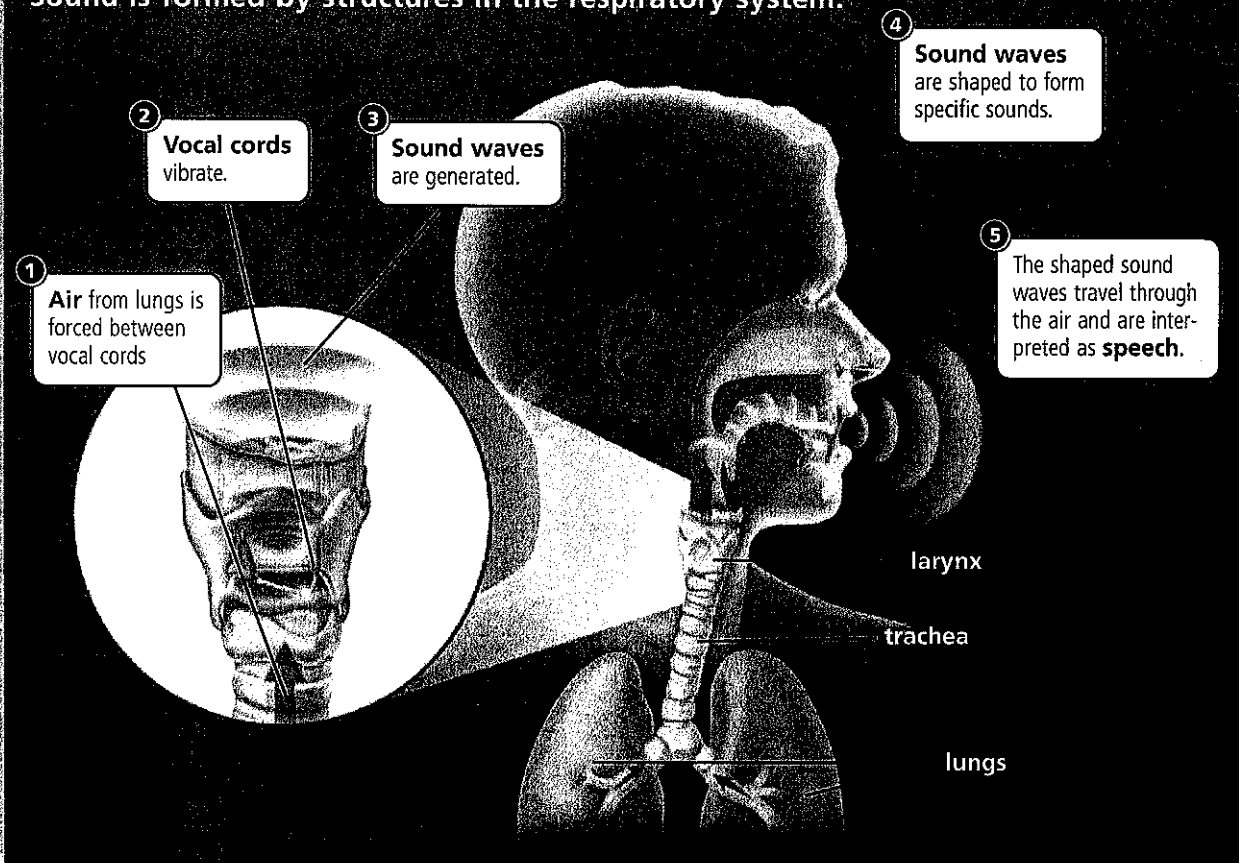
In addition to providing oxygen and removing carbon dioxide, the respiratory system is involved in other activities of the body. Speaking and singing, along with actions such as sneezing, can be explained in terms of how the parts of the respiratory system work together.

### Speech and Other Respiratory Movements

If you place your hand on your throat and hum softly, you can feel your vocal cords vibrating. Air moving over your vocal cords allows you to produce sound, and the muscles in your throat, mouth, cheeks, and lips allow you to form sound into words. The vocal cords are folds of tissue in the larynx. The larynx, sometimes called the voice box, is a two-inch, tube-shaped organ about the length of your thumb, located in the neck, at the top of the trachea. When you speak, the vocal cords become tight, squeeze together, and force air from the lungs to move between them. The air causes the vocal cords to vibrate and produce sound.

#### How Speech Works

Sound is formed by structures in the respiratory system.



Some movements of the respiratory system allow you to clear particles out of your nose and throat or to express emotion. The respiratory system is involved when you cough or sneeze. Sighing, yawning, laughing, and crying also involve the respiratory system.

Sighing and yawning both involve taking deep breaths. A sigh is a long breath followed by a shorter exhalation. A yawn is a long breath taken through a wide-open mouth. Laughing and crying are movements that are very similar to each other. In fact, sometimes it's difficult to see the difference between laughing and crying.

The respiratory system also allows you to hiccup. A hiccup is a sudden inhalation that makes the diaphragm contract. Several systems are involved when you hiccup. Air rushes into the throat, causing the diaphragm to contract. When the diaphragm contracts, the air passageway between the vocal cords closes. The closing of this passageway produces the sound of the hiccup. Hiccups can be caused by eating too fast, sudden temperature changes, and stress.

## Water Removal

Hiccups, coughs, yawns, and all other respiratory movements, including speaking and breathing, release water from your body into the environment. Water is lost through sweat, urine, and exhalations of air. When it is cold enough outside, you can see your breath in the air. That is because the water vapor you exhale condenses into larger droplets when it moves from your warm body to the cold air.



Water leaves your body through your breath every time you exhale.

## 2.1 Review

### KEY CONCEPTS

1. How is oxygen used by your body's cells?
2. What are the structures in the respiratory system and what do they do?
3. In addition to breathing, what functions does the respiratory system perform?

### CRITICAL THINKING

4. **Sequence** List in order the steps that occur when you exhale.
5. **Compare and Contrast** How is the air you inhale different from the air you exhale?

### CHALLENGE

6. **Hypothesize** Why do you think a person breathes more quickly when exercising?