

READING WARM-UP

Objectives

- Describe the parts of the respiratory system and their functions.
- Explain how breathing happens.
- Discuss the relationship between the respiratory system and the cardiovascular system.
- Identify two respiratory disorders.

Terms to Learn

respiration	trachea
respiratory system	bronchus
pharynx	alveoli
larynx	

READING STRATEGY

Reading Organizer As you read this section, make a flowchart of the steps of the process of respiration.

respiration the exchange of oxygen and carbon dioxide between living cells and their environment; includes breathing and cellular respiration

respiratory system a collection of organs whose primary function is to take in oxygen and expel carbon dioxide

The Respiratory System

Breathing—you do it all the time. You’re doing it right now. You hardly ever think about it, though, unless you suddenly can’t breathe.

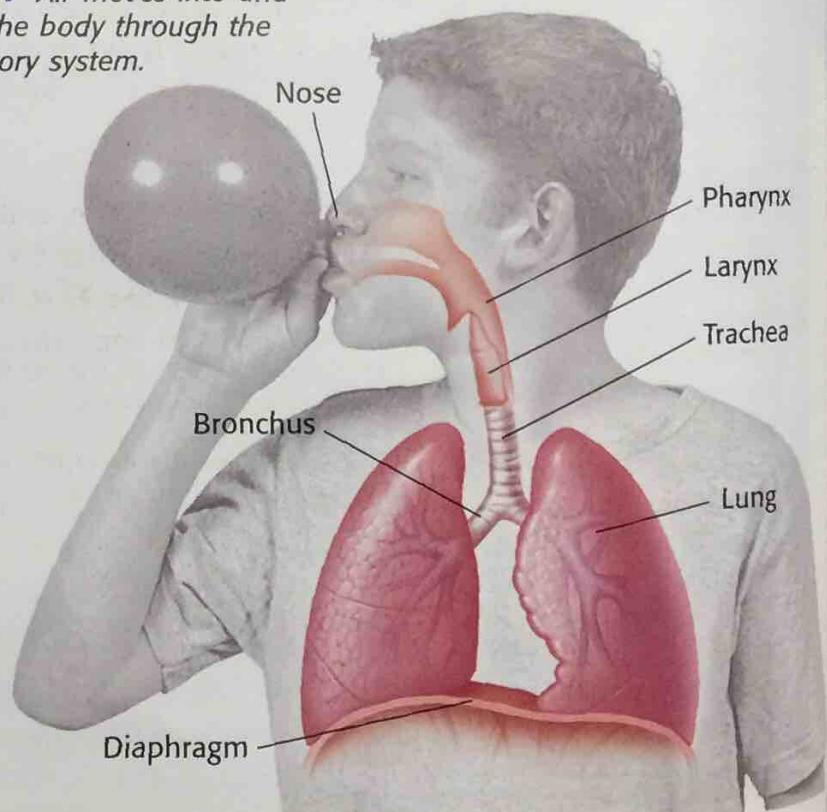
Then, it becomes very clear that you have to breathe in order to live. But why is breathing important? Your body needs oxygen in order to get energy from the foods you eat. Breathing makes this process possible.

Respiration and the Respiratory System

The words *breathing* and *respiration* are often used to mean the same thing. However, breathing is only one part of respiration. **Respiration** is the process by which a body gets and uses oxygen and releases carbon dioxide and water. Respiration is divided into two parts. The first part is breathing, which involves inhaling and exhaling. The second part is cellular respiration, which involves chemical reactions that release energy from food.

Breathing is made possible by your respiratory system. The **respiratory system** is the group of organs that take in oxygen and get rid of carbon dioxide. The nose, throat, lungs, and passageways that lead to the lungs make up the respiratory system. **Figure 1** shows the parts of the respiratory system.

Figure 1 Air moves into and out of the body through the respiratory system.



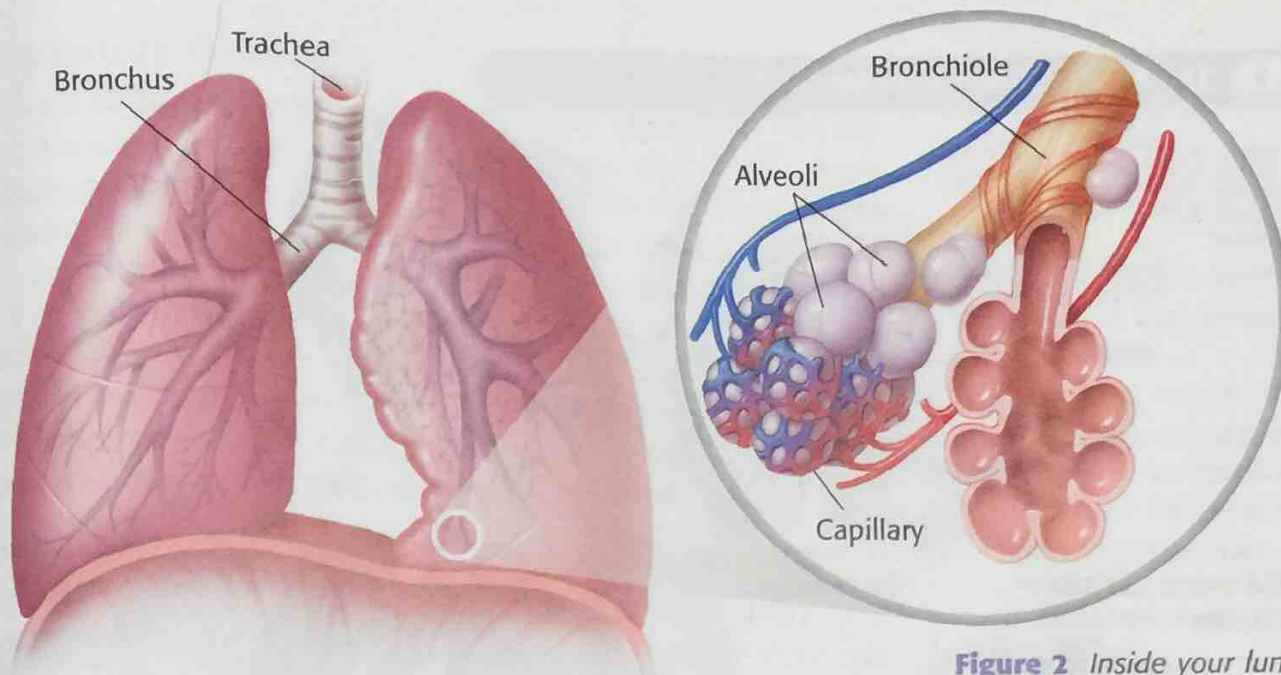


Figure 2 Inside your lungs, the bronchi branch into bronchioles. The bronchioles lead to tiny sacs called alveoli.

Nose, Pharynx, and Larynx

Your **nose** is the main passageway into and out of the respiratory system. Air can be breathed in through and out of the nose. Air can also enter and leave through the mouth.

From the nose, air flows into the **pharynx** (FAR ingks), or throat. Food and drink also travel through the pharynx on the way to the stomach. The pharynx branches into two tubes. One tube, the *esophagus*, leads to the stomach. The other tube is the larynx (LAR ingks). The larynx leads to the lungs.

The **larynx** is the part of the throat that contains the vocal cords. The *vocal cords* are a pair of elastic bands that stretch across the larynx. Muscles connected to the larynx control how much the vocal cords are stretched. When air flows between the vocal cords, the cords vibrate. These vibrations make sound.

Trachea

The larynx guards the entrance to a large tube called the **trachea** (TRAY kee uh), or windpipe. Your body has two large, spongelike lungs. The trachea, shown in **Figure 2**, is the passageway for air traveling from the larynx to the lungs.

Bronchi and Alveoli

The trachea splits into two branches called **bronchi** (BRAHNG KIE) (singular, *bronchus*). One bronchus connects to each lung. Each bronchus branches into smaller tubes that are called *bronchioles* (BRAHNG kee OHLZ). In the lungs, each bronchiole branches to form tiny sacs that are called **alveoli** (al VEE uh LIE) (singular, *alveolus*). The alveoli provide a large amount of surface area.

Reading Check Describe how the lung's structure relates to its function. (See the Appendix for answers to Reading Checks.)

pharynx the passage from the mouth to the **larynx** and esophagus

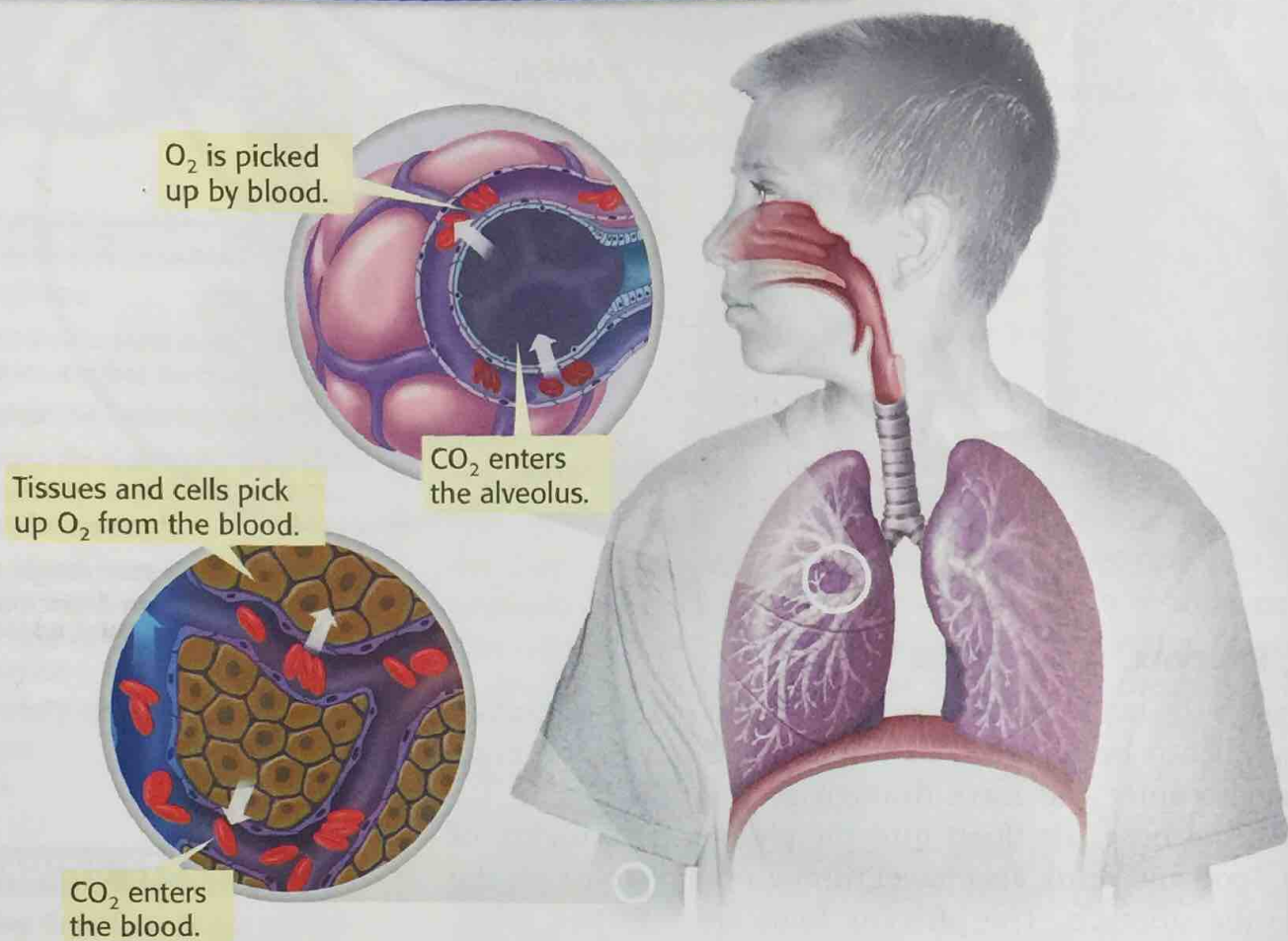
larynx the area of the throat that contains the **vocal cords** and produces vocal sounds

trachea the tube that connects the **larynx** to the lungs

bronchus one of the two tubes that connect the lungs with the trachea

alveoli any of the tiny air sacs of the lungs where oxygen and carbon dioxide are exchanged

Figure 3 The Role of Blood in Respiration



Breathing

When you breathe, air is sucked into or forced out of your lungs. However, your lungs have no muscles of their own. Instead, breathing is done by the diaphragm (DIE uh FRAM) and rib muscles. The *diaphragm* is a dome-shaped muscle beneath the lungs. When you inhale, the diaphragm contracts and moves down. The chest cavity's volume increases. At the same time, some of your rib muscles contract and lift your rib cage. As a result, your chest cavity gets bigger and a vacuum is created. Air is sucked in. Exhaling is this process in reverse.

Breathing and Cellular Respiration

In *cellular respiration*, oxygen is used by cells to release energy stored in molecules of glucose. Where does the oxygen come from? When you inhale, you take in oxygen. This oxygen diffuses into red blood cells and is carried to tissue cells. The oxygen then diffuses out of the red blood cells and into each cell. Cells use the oxygen to release chemical energy. During the process, carbon dioxide (CO_2) and water are produced. Carbon dioxide is exhaled from the lungs. **Figure 3** shows how breathing and blood circulation are related.

Reading Check What is cellular respiration?

CONNECTION TO Chemistry

Oxygen and Blood When people who live at low elevations travel up into the mountains, they may find themselves breathing heavily even when they are not exerting themselves. Why might this happen?

Respiratory Disorders

Millions of people suffer from respiratory disorders. Respiratory disorders include asthma, emphysema, and severe acute respiratory syndrome (SARS). Asthma causes the bronchioles to narrow. A person who has asthma has difficulty breathing. An asthma attack may be triggered by irritants such as dust or pollen. SARS is caused by a virus. A person who has SARS may have a fever and difficulty breathing. Emphysema happens when the alveoli have been damaged. People who have emphysema have trouble getting the oxygen they need. **Figure 4** shows a lung damaged by emphysema.

Figure 4 The photo on the left shows a healthy lung. The photo on the right shows the lung of a person who had emphysema.



QUICK LAB

Why Do People Snore?

1. Get a 15 cm² sheet of wax paper.
2. Hum your favorite song.
3. Then, take the wax paper and press it against your lips. Hum the song again.
4. How was your humming different when wax paper was pressed to your mouth?
5. Use your observations to guess what might cause snoring.

SECTION Review

Summary

- Air travels to the lungs through the nose or mouth, pharynx, larynx, trachea, and bronchi.
- In the lungs, the bronchi branch into bronchioles, which branch into alveoli.
- Breathing involves lungs, muscles in the rib cage, and the diaphragm.
- Oxygen enters the blood through the alveoli in the lungs. Carbon dioxide leaves the blood and is exhaled.
- Respiratory disorders include asthma, SARS, and emphysema.

Using Key Terms

For each pair of terms, explain how the meanings of the terms differ.

1. *pharynx* and *larynx*

Understanding Key Ideas

2. Which of the following are respiratory disorders?
 - a. SARS, alveoli, and asthma
 - b. alveoli, emphysema, and SARS
 - c. larynx, asthma, and SARS
 - d. SARS, emphysema, and asthma
3. Explain how breathing happens.
4. Describe how your cardiovascular and respiratory systems work together.

Math Skills

5. Total lung capacity (TLC) is about 6 L. A person can exhale about 3.6 L. What percentage of TLC cannot be exhaled?

Critical Thinking

6. **Interpreting Statistics** About 6.3 million children in the United States have asthma. About 4 million of them had an asthma attack last year. What do these statistics tell you about the relationship between asthma and asthma attacks?
7. **Identifying Relationships** If a respiratory disorder causes lungs to fill with fluid, how might this affect a person's health?

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Topic: The Respiratory System;
Respiratory Disorders

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