

# The Respiratory System

**Key Concept** The respiratory system is responsible for taking in oxygen and releasing carbon dioxide.

## What You Will Learn

- The respiratory system includes the diaphragm, lungs, bronchi, trachea, larynx, pharynx, and nose.
- The respiratory system and the cardiovascular system work together to supply oxygen and remove carbon dioxide.
- Respiratory disorders include asthma, emphysema, and SARS.

## Why It Matters

Learning about the respiratory system will help you understand how your organ systems work together.

## Vocabulary

- respiration
- larynx
- respiratory system
- trachea
- bronchus
- pharynx
- alveolus

## READING STRATEGY

**Clarifying Concepts** Take turns reading this section out loud with a partner. Stop to discuss ideas that seem confusing.

**respiration** (RES puh RAY shuhn) in biology, the exchange of oxygen and carbon dioxide between living cells and their environment; includes breathing and cellular respiration

### respiratory system

(RES puh uh TAWR ee SIS tuhm) a collection of organs whose primary function is to take in oxygen and expel carbon dioxide

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

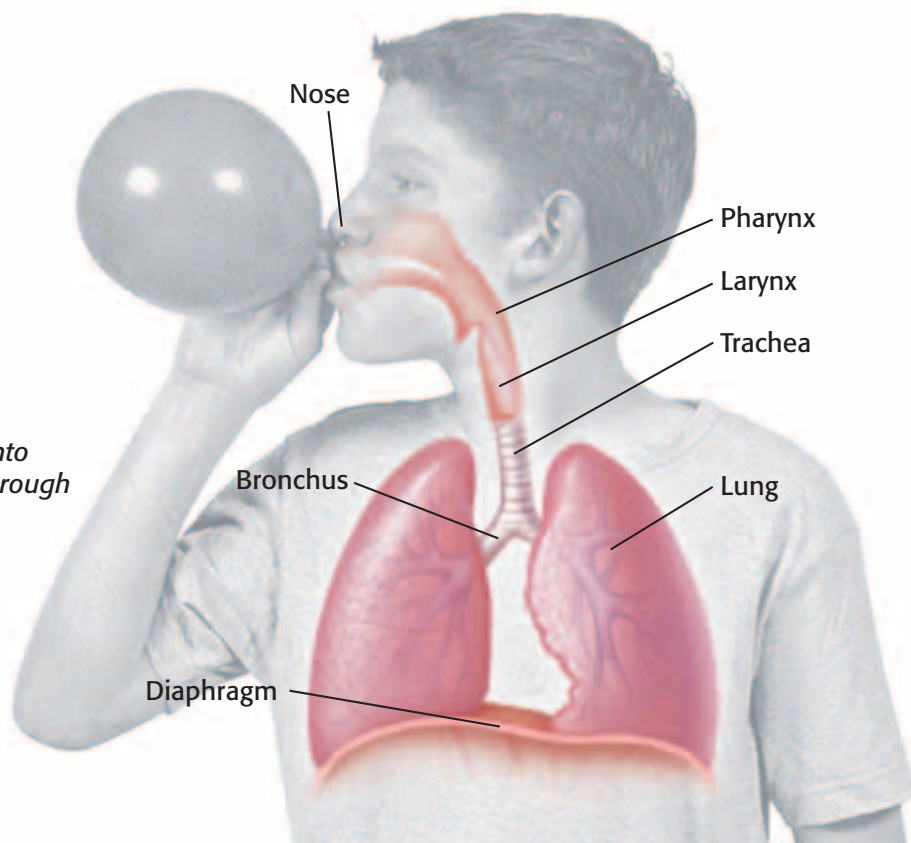
▶ Breathing—you do it all the time. You’re doing it right now. But you hardly ever think about it, unless you suddenly can’t breathe.

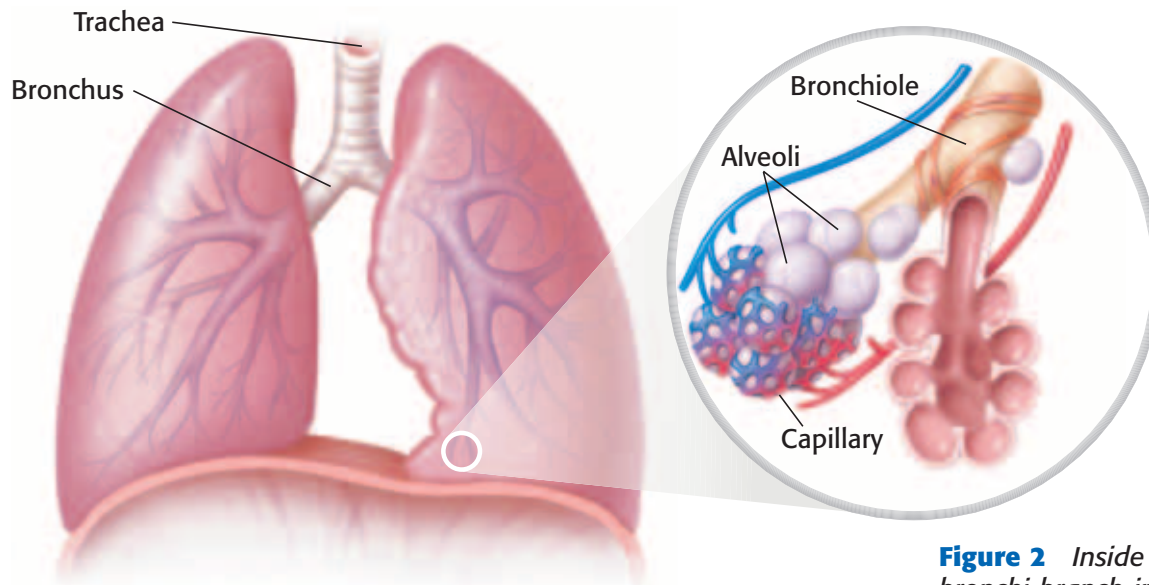
Then, it becomes very clear that you have to breathe in order to live. But why is breathing important? Your body needs oxygen in order to get energy from the foods you eat. Breathing makes this process possible.

## 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 gains and uses oxygen and gets rid of 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 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 through the **pharynx**, or throat. Food and drink also move 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 leads to the lungs. The larynx sits at the beginning of this tube.


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**, or windpipe. Your body has two large, spongelike lungs. The trachea, shown in **Figure 2**, is the passageway for air traveling from the larynx toward the lungs.

## Bronchi and Alveoli

The trachea splits into two branches called **bronchi** (singular, *bronchus*). One bronchus connects to each lung. Each bronchus branches into smaller and smaller tubes. They eventually form a smaller series of airways called *bronchioles* (BRAHNG kee OHLZ). In the lungs, each bronchiole branches to form tiny sacs that are called **alveoli** (singular, *alveolus*).

**Standards Check** Describe the structure and function of the pharynx and larynx.  **7.5.a**

**pharynx** (FAR ingks) the passage from the mouth to the larynx and esophagus

**larynx** (LAR ingks) the area of the throat that contains the vocal cords and produces vocal sounds

**trachea** (TRAY kee uh) the tube that connects the larynx to the lungs

**bronchus** (BRAHNG kuhs) one of the two tubes that connect the lungs with the trachea

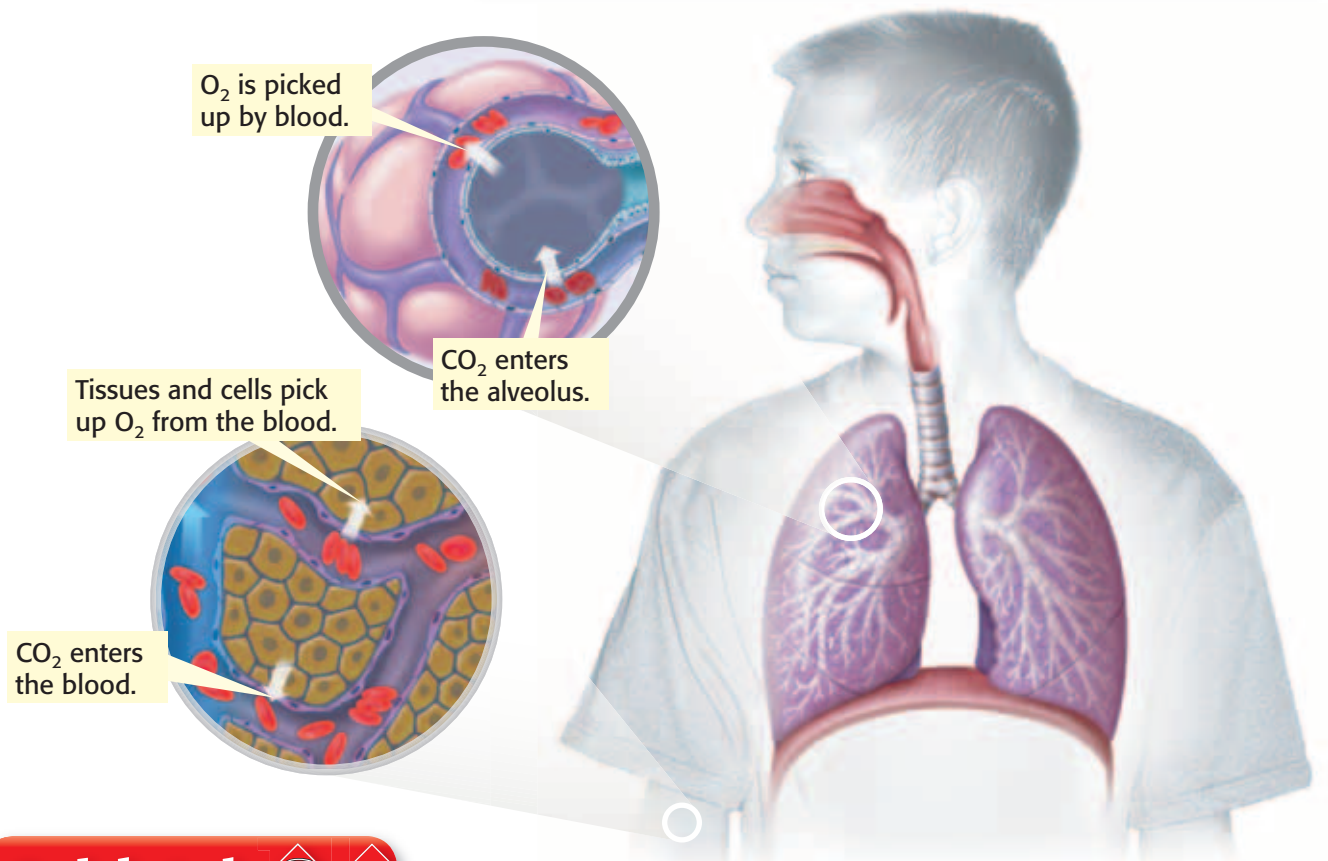
**alveolus** (al VEE uh luhs) any of the tiny air sacs of the lungs where oxygen and carbon dioxide are exchanged



**7.5.a** Students know plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism.

**7.5.b** Students know organ systems function because of the contributions of individual organs, tissues, and cells. The failure of any part can affect the entire system.

**Figure 3** The Role of Blood in Respiration



## Quick Lab



### Replicate Respiration



7.5.a

1. Use **scissors** to cut the bottom off an empty **1 liter soda bottle**.
2. Stretch a **latex glove** over the open bottom of the bottle. Secure with **tape**.
3. Insert a **balloon** into the top of the bottle. Pull the lip of the balloon to fit over the mouth of the bottle. Secure with tape.
4. Pull on the fingers of the glove. What happens to the balloon?
5. How does this activity relate to respiration and the diaphragm?



15 min

## Breathing

When you breathe, air is sucked into or pushed 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 the diaphragm contracts and moves down, you inhale. The chest cavity's volume gets larger. 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

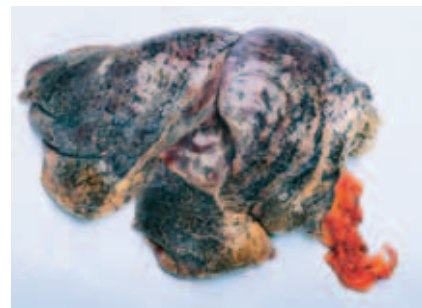
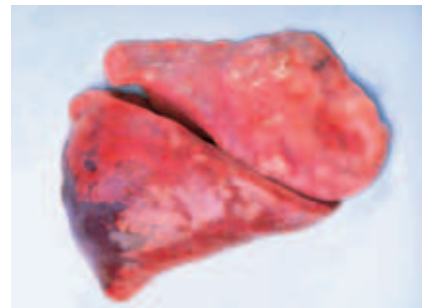
In *cellular respiration*, oxygen is used by cells to release energy stored in molecules of the sugar glucose. Where does the oxygen come from? When you inhale, you take in oxygen gas. This gas moves into red blood cells and is carried to tissue cells. The oxygen then moves out of the red blood cells and into each cell. Cells use the oxygen to release energy. During this process, carbon dioxide ( $\text{CO}_2$ ) and water are made. Carbon dioxide is exhaled from the lungs. **Figure 3** shows how breathing and blood circulation are related.

## Respiratory Disorders

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

People who have respiratory disorders have trouble getting the oxygen they need. Cells need oxygen for cellular respiration. They can't efficiently free energy stored in glucose without oxygen. If a person's cells are not able to free this energy, the person may feel tired all the time. People with respiratory disorders may also have problems getting rid of carbon dioxide. It may build up inside the body to a toxic level.

**Standards Check** How does asthma affect bronchioles?  7.5.b



**Figure 4** The photo at the top shows a healthy lung. The photo at the bottom shows the lung of a person who had emphysema.

### SECTION Review



7.5.a, 7.5.b

### Summary

- Air enters through the nose or mouth, then travels to the pharynx, larynx, trachea, and bronchi. 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, emphysema, and SARS.

### Understanding Concepts

- 1 **Describing** Describe the causes of SARS, emphysema, and some asthma attacks.
- 2 **Summarizing** How does breathing happen?
- 3 **Applying** Describe how your cardiovascular and respiratory systems work together.

### Critical Thinking

- 4 **Predicting Consequences** If a respiratory disorder causes lungs to fill with fluid, how could this affect a person's health?
- 5 **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?

### Math Skills

- 6 **Making Calculations** Usable lung capacity is about 6 L. A person can exhale about 3.6 L. What percentage of the lung capacity cannot be exhaled?

### Challenge

- 7 **Identifying Relationships** Emphysema often occurs in people who smoke cigarettes. How could smoking damage alveoli? How could emphysema affect the rest of the body?

### Internet Resources

For a variety of links related to this chapter, go to [www.scilinks.org](http://www.scilinks.org)

Topic: **The Respiratory System;  
Respiratory Disorders**

SciLinks code: **HY71307; HY71306**

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