

Lesson 3

What Does the Respiratory System Do?

Objectives

Students will

- identify the parts of the respiratory system
- explain the functions of the parts of the respiratory system
- describe how the respiratory system takes in oxygen and expels carbon dioxide

Vocabulary

air sac—one of the tiny pouches in the lungs where oxygen and carbon dioxide are exchanged

bronchial tube (BRON-kee-uhl toob)—one of the two tubes that leads from the trachea to the lungs

lungs—the organs that provide our cells with oxygen

respiration (res-per-AY-shuhn)—the process of taking in oxygen and removing carbon dioxide

respiratory system (RES-per-uh-tor-ee sis-tuhm)—the body system that takes oxygen from the air and removes carbon dioxide from the body

trachea (TRAY-kee-uh)—the tube that leads from the throat toward the lungs; the windpipe

Preparation/Materials

Demonstration: How Do the Lungs Work?

- ✓ small, clear plastic bottle with cap
- ✓ sharp knife
- ✓ hammer
- ✓ large nail
- ✓ straw
- ✓ small balloon
- ✓ twist tie or string
- ✓ modeling clay
- ✓ large balloon
- ✓ scissors
- ✓ large rubber band
- ✓ Make a model lung. Cut away the base of a small, clear plastic bottle. Punch a straw-sized hole in the bottle cap with a large nail. Insert the end of a straw into the neck of a small balloon, and use a twist tie or string to fasten the balloon to the straw. Push the straw up halfway through the hole in the cap, and seal the space between the straw and the cap with modeling clay. Screw the cap on the bottle so that the balloon is hanging down inside the bottle. Cut the neck off a large balloon, and stretch the balloon over the cut end of the bottle. Secure the balloon with a rubber band.

Let's Find Out: Do You Breathe the Same Air In and Out?

- ✓ clear plastic cups, one per team
- ✓ distilled or bottled water

- ✓ red cabbage juice. Prepare the cabbage juice indicator by chopping up half a head of red cabbage, bringing the pieces to a boil, and stirring the mixture well. Allow the juice to sit for 20 minutes, and pour it through a strainer.
- ✓ droppers, one per team
- ✓ straws, two per team
- ✓ funnels, one per team
- ✓ modeling clay
- ✓ hair dryers, one per team

Let's Find Out: How Much Air Do Your Lungs Hold?

- ✓ beakers, one per team
- ✓ water
- ✓ clean, empty gallon jugs with caps, one per team
- ✓ permanent markers, one per team
- ✓ large, clear tubs, one per team
- ✓ clean plastic tubing, one long piece per student

Background

The body's currency is energy, which is obtained from foods and drinks. The catalyst for converting food into energy is oxygen. The body needs a constant supply of oxygen to convert nutrients into energy. The respiratory system collects oxygen for the body and rids the body of waste gases.

Breathing is only one part of the respiration process. Breathing is the process of inhaling and exhaling to exchange gases in and out of the body. Cellular respiration is the process by which the body uses a series of chemical reactions that make food energy available to cells.

Every cell in the body needs a constant supply of oxygen. The circulatory and respiratory systems work together to meet this need. The respiratory system takes in air and directs it to the air sacs (alveoli) in the lungs. Oxygen diffuses through the walls of the air sacs and into capillaries; this is the point at which oxygen is transferred from the respiratory system to the circulatory system.

Red blood cells in the capillaries absorb the oxygen and transport it throughout the body. Oxygen in red blood cells diffuses into every cell in the body. The cells use oxygen for cellular respiration, in which oxygen is used to release energy from molecules of carbohydrates, fats, and proteins. Oxygen breaks these molecules down into energy and waste products such as carbon dioxide and water. These waste products leave the cells by passing back into the bloodstream. The circulatory system carries carbon dioxide back to the lungs, where the respiratory system takes the gas and exhales it.

The respiratory system functions automatically, although we can control our breathing process when we are underwater or when harmful gases are in the air. We can't hold our breath indefinitely; eventually an involuntary action takes over and forces us to breathe in. Although lungs don't contain muscles for breathing, a muscle called the diaphragm beneath the lungs controls the breathing process.

Help students appreciate the wonder of the structures that God gives us for sustaining each tiny cell.

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How long can you hold your breath? It doesn't take long until you start to feel very uncomfortable. You need to take regular breaths because the cells in your body need oxygen. Your cells also need to get rid of carbon dioxide. You take in oxygen and get rid of carbon dioxide when you breathe.

The process of taking in oxygen and removing carbon dioxide is called **respiration** (res-per-AY-shuhn). The body system that takes oxygen from the air and removes carbon dioxide from the body is called the **respiratory system** (RES-per-uh-tor-ee sis-tuhm).

Your body does many things each day. To do them, your body needs energy. You get energy from food. But your cells need oxygen to turn your food into energy. As your cells turn food into energy, they also make carbon dioxide. Carbon dioxide acts like poison to your cells, so your body must get rid of it. That's why you breathe.



Intersection with Science

Deep Diving Mammals

Ocean mammals such as dolphins, whales, and seals can dive very deep. They can stay underwater for a long time. A sperm whale can hold its breath for 75 minutes. Some seals can hold their breath for 70 minutes. Most people can't hold their breath for longer than 2 minutes.



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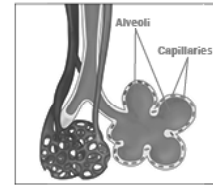
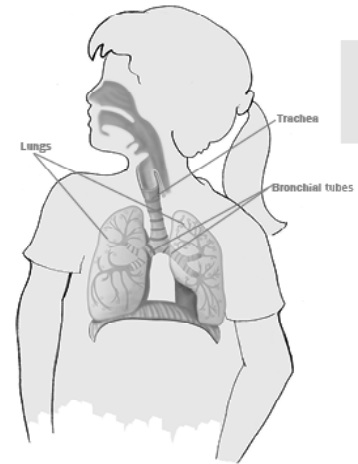
Respiratory System

To learn how respiration works, look at the picture. Can you trace the path that air takes when you breathe?

Air goes in through your nose and mouth. It flows down your throat and into the **trachea** (TRAY-kee-uh), the tube that leads from the throat toward the lungs. The trachea is often called the windpipe. From there it moves to another tube. A **bronchial tube** (BRON-kee-uhl toob) is one of the two tubes that leads from the trachea to the lungs. You have one bronchial tube for each lung. Finally, the air reaches the **lungs**, the organs that provide our cells with oxygen. The lungs are large, spongy organs. The lungs have many air sacs called **alveoli**. The alveoli are tiny pouches in the lungs where oxygen and carbon dioxide are exchanged.

The alveoli are surrounded by capillaries. The blood in the capillaries takes the oxygen from the lung's alveoli. As you learned, the capillaries send this oxygen-rich blood through arteries to the rest of your body. At the same time, the blood in the capillaries picks up the carbon dioxide waste from your other body cells. The veins carry this blood back toward your heart and drop the waste gases off in your lungs. You breathe these waste gases out of your body.

Your respiratory system is a great gift. It works all of the time, even when you sleep. You never



Capillaries surround alveoli. Cross-section of alveoli and capillaries.

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Discover

- Demonstration: How Do the Lungs Work?** Make a model lung (see Preparation/Materials). Push on the balloon covering the bottom of the bottle, and then let go of it to model what happens to the lungs when a person exhales and inhales. When the balloon covering the base of the bottle is stretched down, the balloon inside the bottle inflates, modeling inhaling. When the balloon is released, the balloon in the bottle shrinks, modeling exhaling.
- Have student teams complete **Let's Find Out: Do You Breathe the Same Air In and Out?** (page 34) in the student text.

Review the following safety precautions with students before the activity.

- ✓ Don't use each other's straws.
 - ✓ Keep the hair dryers and cords away from the water. If water spills, unplug the hair dryer and any other nearby appliances.
- Add a few drops of red cabbage juice to the water. What color is the water now? (It's purple.)
 - Blow air from a hair dryer into the funnel so that air goes through the straw. (Have someone hold the cup steady while you do this.) What color is the water now? (It's still purple.)
 - Take the straw and funnel out of the glass. Use a second straw to blow bubbles in the water. What color is the water now? (It's red.)


Let's Find Out

Do You Breathe the Same Air In and Out?

Take in a deep breath. Now breathe out. What is in the air you just breathed out of your lungs? Is it the same as the air you breathe into your lungs? Find out by doing this experiment.

You will need

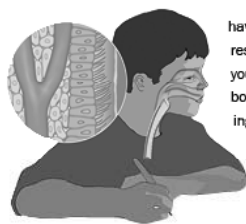
- ✓ clear plastic cup
- ✓ distilled or bottled water
- ✓ dropper
- ✓ red cabbage juice
- ✓ two straws
- ✓ funnel
- ✓ modeling clay
- ✓ hair dryer



Do this

1. Fill a cup three-fourths full with distilled or bottled water.
2. Add a few drops of red cabbage juice to the water. What color is the water now?
3. Insert a straw into the funnel, and place the straw in the water. Seal the gaps with modeling clay.
4. Blow air from a hair dryer into the funnel so that air goes through the straw. (Have someone hold the cup steady while you do this.) What color is the water now?
5. Take the straw and funnel out of the cup. Use a second straw to blow bubbles in the water. What color is the water now?
6. Compare the color of the water when air from the hair dryer was blown into it to the color of the water when you blew bubbles into it. Why did the water change color? What does this suggest about the air that you breathe in and the air that you breathe out?

Tiny hairs clean the air as it enters your body.



have to think about breathing. Your respiratory system always supplies you with oxygen and gets rid of carbon dioxide. God gives you an amazing respiratory system!

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Let's Find Out

How Much Air Do Your Lungs Hold?

Each time you take a breath, your lungs fill with air. How much air can your lungs hold? Find out with this activity.

You will need

- ✓ beaker
- ✓ water
- ✓ clean, empty gallon jug with cap
- ✓ permanent marker
- ✓ large, clear tub
- ✓ plastic tubing



Do this

1. Fill the beaker with 100 mL of water. Empty the water into the jug, and mark the water level. Label the level "100 mL."
2. Continue to add 100 mL of water at a time to the jug. Mark and label the levels. Continue doing this until the jug is full of water.
3. Put the cap on the jug.
4. Fill the tub about half full of water.
5. Holding the cap on the jug, carefully place the neck of the jug into the water.
6. Carefully take the cap off the jug. The jug should remain full of water.
7. Have one teammate hold the jug very steady.
8. Insert one end of the plastic tubing into the jug. Make sure that enough tubing is in the jug so that it won't slip out.
9. Have one teammate take a deep breath and breathe into the tube. How much water leaves the jug? That's the same volume of air that your lungs can hold.
10. Fill the jug with water again, and repeat steps 3-9 with the other teammates blowing into the jug. Clean the tubing with rubbing alcohol between students.
11. Repeat the activity. This time, instead of measuring how much air you breathe during a big breath, measure how much air you breathe during a regular breath.

Think Back

1. What are the two jobs of the respiratory system?
2. Explain how your body gets energy.
3. Imagine that you are an oxygen molecule. Trace the path you would take from the air to a cell in the body.

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6. Compare the color of the water when air from the hair dryer was blown into it to the color of the water when you blew bubbles into it. Why did the water change color? What does this suggest about the air that you breathe in and the air that you breathe out? (The colors are different. Something in the exhaled air changed the color. The air that we breathe in and the air that we breathe out is not the same.)

Develop

Have students complete **Let's Find Out: How Much Air Do Your Lungs Hold?** (page 35) in the student text.

Reinforce/Assess

Have students read **What Does the Respiratory System Do?** (page 32) in the student text and answer the **Think Back** questions (page 35).

1. What are the two parts of respiration? (The two parts are inhaling, which takes in oxygen, and exhaling, which gets rid of carbon dioxide.)
2. Explain how your body gets energy. (The cells use oxygen obtained through respiration to convert food into energy.)
3. Imagine that you are an oxygen molecule. Trace the path you would take from the air to a cell in the body. (The oxygen would flow through the nose or mouth, down into the throat, trachea, bronchial tube, lung, air sac, capillary, artery, and another capillary to a cell.)

Extend

- ▶ Have students time how many normal breaths they take in one minute. Then have them calculate the number of times they breathe in an hour, day, week, and year.
- ▶ Have students make a model of the lung. Have them place a sponge in a plastic bag and tie the mouth of the bag tightly over a vacuum cleaner hose. Then have them suck air out of the bag with a vacuum cleaner and observe what happens to the sponge. Have students compare the model with real lungs.
- ▶ Have students mix a spoonful of baking soda with about 50 mL of white vinegar to create a vigorous reaction of bubbles. The bubbles are carbon dioxide gas produced by a chemical reaction between the two substances. Explain that this is the same gas that we exhale.

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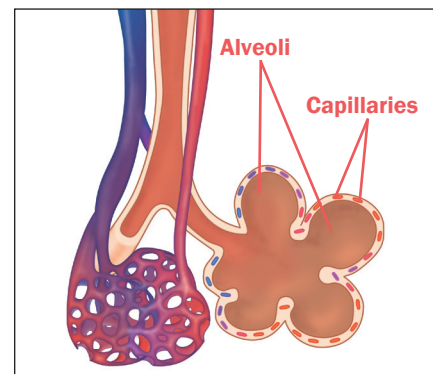
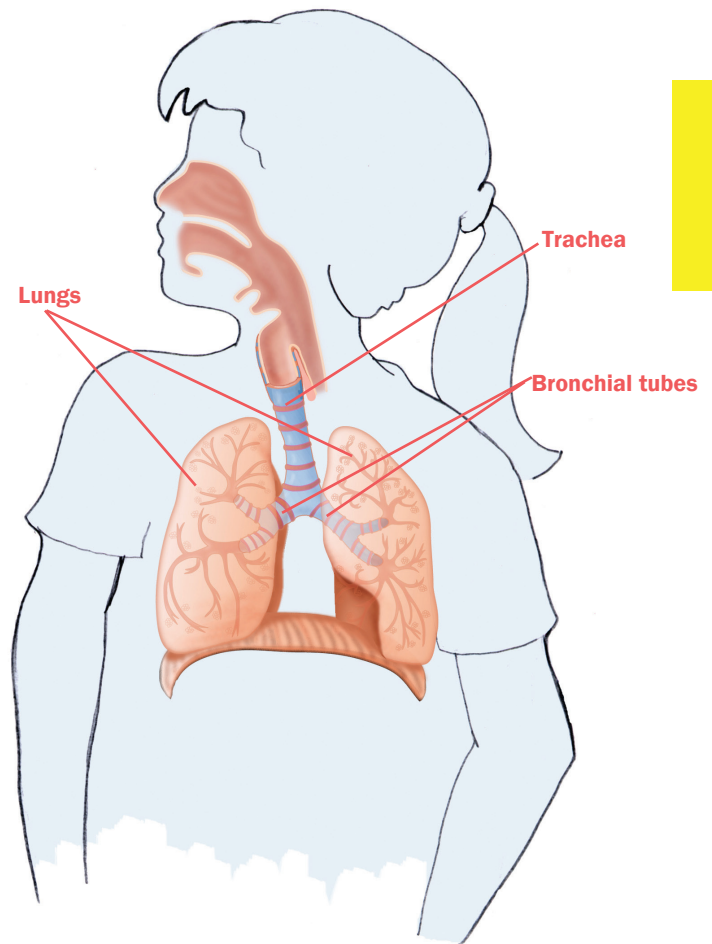
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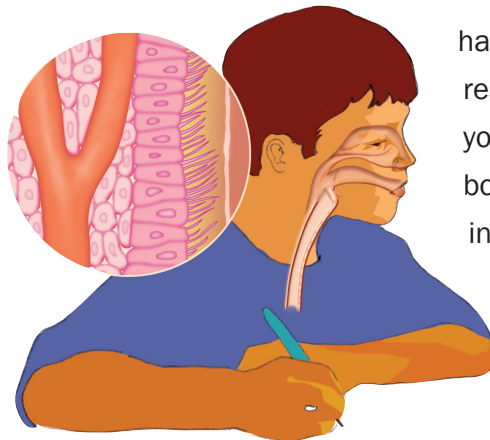
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