

## Exploring Science / Historical Steps

**The Boy Who Did Not Drown** On a cold January day in 1984, **Jimmy Tontlewicz** went sledding with his dad along the shore of Lake Michigan. Four-year-old Jimmy threw his sled onto the frozen lake. His dad walked on the ice to bring back the sled. Jimmy followed. He jumped onto the ice ... and both of them fell through!

Jimmy's dad was rescued by passersby. It was at least 20 minutes before divers finally pulled Jimmy out, and there were no signs of life.

A few years before this happened, Jimmy would have been another boy who drowned. For many years scientists thought that no one could survive for more than 4 minutes under water. Fortunately, by 1984 it was known that some people survive even after an hour in cold water!

So the rescue team did not give up. They immediately used **CPR** (a method that anyone can learn) to help restart Jimmy's heart and to get him breathing again. In the hospital, doctors put to use special methods that they had recently learned. Soon, Jimmy was on his way to being well again.



**A woman learning CPR on a baby manikin**

- Explain how Jimmy's case shows that the body can store oxygen for use at a later time.
- Want more? Search the "mammalian diving reflex" to learn why some "drowned" people are able to survive.

## ➤ To Do Yourself

### How can you measure your exhaled carbon dioxide?

*You will need:*

Bromothymol blue solution, straw, glass jar, timer (stopwatch)

1. Fill the jar half full with bromothymol blue solution.
2. Take a deep breath and exhale through the straw into the solution.
3. When enough carbon dioxide is bubbled through the bromothymol blue solution, it turns green, then olive. Have a partner time how long it takes for the blue to disappear.



*Questions*

1. How long did it take for the blue color to disappear? \_\_\_\_\_
2. How did this time compare to other students (or family members)? \_\_\_\_\_

# Respiration and Breathing

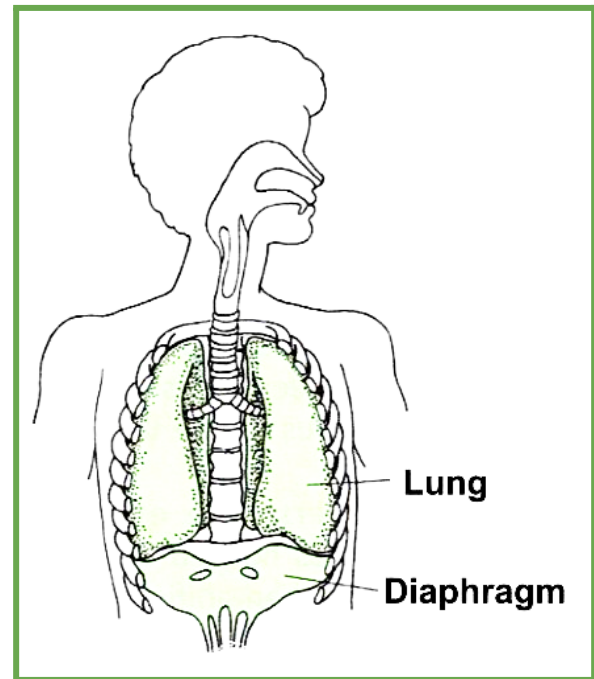
When Jimmy went under the water, he could no longer take oxygen into his lungs. But there was already enough oxygen in his body to keep him alive for a while. His breathing and even his heartbeat had stopped. But the process that keeps the cells alive had not stopped. Have you guessed what this important process is called? **Cell respiration!** (Look back at page 71).

As a reminder, here are the major steps of cell respiration - the process used by nearly all living things: The cells take in both oxygen and food. When the food (a simple sugar) combines with oxygen (burns), energy is released. Carbon dioxide and water are given off.

Moment by moment, so that your cells receive and remove molecules, you breathe. This moves air into and out of your lungs. Recall that the single word **respiration** means **breathing**. Muscles in your chest help you breathe. One of your breathing muscles is the **diaphragm** (DY-uh-fram). The diaphragm is like an elastic sheet. It lies below the lungs. At rest, the diaphragm is curved upward, like an upside-down bowl. When you **inhale** (breathe in), your diaphragm moves down and becomes less curved. At the same time, rib muscles move your ribs up and out. As a result, the space

inside of your chest gets larger. To fill this larger space, air rushes (from the outside) into your mouth and nose, and then into your lungs.

When you **exhale** (breathe out), your diaphragm moves up, becoming more curved. At the same time, your ribs move down and in. The space inside of your chest gets smaller. The air is pushed from your lungs to the outside.



The sheet-like diaphragm helps you breathe.

## REVIEW

U-5 L-2

I. In each blank, write the word that fits best. Choose from the words below.

**breathing      respiration      CPR      diaphragm      ribs      bronchi**

In cell \_\_\_\_\_, sugar combines with oxygen. The common term for the process of moving air into and out of your lungs is \_\_\_\_\_.

Muscles move your \_\_\_\_\_ up and out when you breathe in. When your \_\_\_\_\_ moves up, air is pushed out of your lungs.

II. Circle the word or phrase (between the brackets) that makes each statement correct.

- A. The diaphragm becomes [more / less] curved when you inhale.
- B. When you exhale, your ribs move [up and out / down and in].
- C. A process that takes place in all body cells is [breathing / cell respiration].

III. You may be surprised to learn that some bacteria can live only in areas without oxygen. Do you think that these bacteria carry out cell respiration? If not, how do you think that they survive? [Note: No need to worry. Just make a thoughtful guess.]