LESSON 2 What Happens When You Breathe? ==========

Objectives

When students have completed this lesson, they will be able to:
- distinguish between cell respiration and breathing (respiration);
- explain the action of the diaphragm and of the rib muscles in the mechanics of breathing;
- measure the carbon dioxide that they exhale during breathing.

Exploring Science / Historical Steps

Jimmy Tontlewicz survived without brain damage. The key to his survival was the temperature of the water in which he almost drowned. He is just one of a number of people of all ages who have recovered from near-drowning in cold water, thanks to the special methods used by rescuing medical teams and hospital staff - and thanks to the mammalian diving reflex. The CPR method (Cardio-Pulmonary Resuscitation) is standard for any emergency in which breathing and/or heartbeat has stopped. In addition, doctors used drugs to keep Jimmy in a coma temporarily so that his brain could gradually return to a normal level of functioning.

Student answers to the inference question should be somewhat as follows: Jimmy stayed alive without breathing, so his body must have been using stored oxygen.

The mammalian diving reflex is fascinating, but complex; the bottom line is that submersion in cold water initiates this reflex, after which the body needs much less oxygen to survive.

Respiration and Breathing

A review of cell respiration, studied in Unit 3, Lesson 3 ("How Do Living Things Get Energy?"), is in order at this point. You might want to post a large version of the equation in a semi-permanent location in the classroom. It is important that students fully understand the distinction between cell respiration and breathing (commonly called respiration).

Have students place their hands on their ribs and breathe deeply. Ask which way the ribs move when they inhale? (upward and outward). When they exhale? (downward and inward).

Models are available (from biological supply houses) that demonstrate the breathing process. Adequate versions of the model are easily made as follows: Hold a 9" balloon and roll the neck down until it "disappears"; it now has the appearance of a round balloon with a fat "collar." Cut a plastic straw in half; one straw is long enough to build two models. Through the balloon "collar," insert about 1.5 cm of the straw. Secure the balloon to the straw with a small rubber band, but not so tightly as to crush the end of the straw. Melt a hole (about the size of the straw) into the base of a plastic cocktail cup. (Most glass rods will serve well for this step). From the open end of the cup, slide the long end of the straw (the end that is not attached to the balloon) through the hole in the cup, such that the balloon's collar is snug against the inside of the cup's base. If the straw does not fit the hole well, simply add tape around the opening (from the outside). Finally, obtain a second 9" balloon. Cut off the neck and an additional 1 cm from this balloon. This cut is more easily completed if the area on either side of the cut is firmly stretched. Now, expand and attach this balloon's "bottom half" around the open end of the cup. You now have one balloon (representing a lung) suspended inside of a clear cup (representing the ribs), and a taught rubber sheet (representing the diaphragm) stretched and covering the cup's opening. Pinching this sheet and pulling downward will inflate the inner balloon; pushing on the sheet will deflate the inner balloon. The process can be enhanced somewhat by gently squeezing and unsqueezing the cup (representing movement by the ribs).

To Do Yourself

Just as student lung capacity varies with the individual, the amount of exhaled carbon dioxide will vary.

Questions

1. Student answers vary. **2.** Student answers vary.

Review

Please note: I have not made the answers available online, in the small chance that a student might discover them. Of course, the answers to these questions will be included in the version of the Teacher's Guide provided to teachers who purchase the text.