Lung Model

Objective
Students will discover the function of various parts of the body's respiratory system.

Materials

*For each student*
- 20 ounce or 2 liter plastic bottle
- balloon
- piece of plastic from a trash bag or shopping bag (cut in a 30-cm-diameter circle)
- rubber band
- poster or reference books with lung diagrams
- scissors
- marker
- masking tape

*For teacher's use only*
- craft knife
Advance Preparation
Collect plastic bottles. Cut a small starter slit in the bottle about one-fourth of the way up from the bottom and parallel to the bottom. Collect enough plastic trash and shopping bags to supply each student with a 30 cm diameter circle of plastic.

Procedure
1. Using scissors, carefully cut off the bottom of the plastic bottle starting at the precut slit.

2. Push the end of the balloon through the mouth of the bottle. Stretch the mouth of the balloon over the mouth of the bottle.

3. Fold the 30-cm-diameter circle in half twice. Twist about 2.5 cm of the folded corner around and secure it with a short piece of masking tape to make a handle.

4. Cover the open bottom of the bottle with the plastic circle so the handle is on the outside of the bottle. Secure the plastic tightly to the bottle with a rubber band. There should be some slack in the plastic. The rubber band may need to be doubled if using the smaller plastic bottle. See diagram below.
5. Gently push and pull on the handle to move the plastic in and out. What do you observe?
6. Hold the bottle so the mouth is near your cheek and move the surface of the plastic in and out. What do you feel?
7. Describe what happens to the balloon as the plastic moves in and out. Explain your observations.
8. Using posters or reference books, compare the lung model to that of the human lung. Stimulate discussion by asking students to discuss which parts of the model represent the lungs, chest cavity, and diaphragm? (Answer: The balloon represents the lung, the bottle represents the chest cavity, and the plastic represents the diaphragm).

Notes to the teacher: The Respiratory System
Oxygen is needed for most life to exist. Without oxygen, the cells in the body would not be able to release the energy in food for power, and they would die within minutes.
The parts of the body responsible for supplying oxygen---the nose, nasal passages, windpipe, lungs, and breathing muscles---make up what is called the respiratory system. In the nose and nasal passages, incoming air is warmed, moistened, and cleaned of foreign particles. Then the air travels down through the windpipe, or trachea, which divides into two branches called bronchial tubes, one entering each lung. The bronchi branch again and again inside the lungs, similar to the branching pattern of a tree, finally
becoming hair-like tubes called terminal bronchioles. At the end of the terminal bronchioles are microscopic bubble-like structures called alveoli. Each lung contains 300 million alveoli. If the surface of all the alveoli were spread out flat it would cover a tennis court.

It may be useful to encourage students to think of other things in nature that branch out to increase surface area, such as tree roots. This greatly increases the surface area where oxygen can be absorbed; much more than if the lungs were one hollow chamber. Tiny thin-walled blood vessels called capillaries surround each alveolus. Oxygen passes through the walls of the alveoli and into the capillaries and is carried throughout the body. At the cellular level, oxygen is used to burn food in the form of simple sugars, to release energy. This is called cellular respiration. The waste products of this process are carbon dioxide and water, which diffuse from the cells through the capillary walls and into the blood. They are carried back to the alveoli and exhaled from the lungs.

The lungs are two football-sized spongy bags filled with millions of smaller recesses, where oxygen enters the blood and carbon dioxide leaves the blood. The lungs fill the chest cavity between the neck and the bottom of the rib cage. The lungs contain no muscles and are not able to expand and contract on their own. The size of the lungs is controlled by a sheet of muscles called the diaphragm that forms the floor of the chest cavity and the intercostal located between pairs of ribs. When inhaling, the diaphragm contracts and drops down. The ribs expand outward, making the chest cavity larger. This causes the pressure in the cavity to decrease, resulting in air being drawn into the lungs which causes them to expand. During exhalation, the diaphragm relaxes and moves up, and the ribs settle down. The cavity is made smaller, causing the pressure to increase and results in the lungs contracting and forcing carbon dioxide-laden air out of the lungs. Therefore, breathing air in and out is simply a mechanical process related to pressure changes caused by the increase and decrease of the chest cavity size.

The nose and air passages produce a slippery liquid called mucus, which helps to warm and moisten the air and allows it to travel the airways more easily. Mucus also helps to trap dirt and dust particles and some bacteria. Tiny hairs called cilia, located on the inner walls of the air passages, slowly move the mucus up toward the throat and nose, carrying with it any foreign particles. If particles irritate the nose, a sneeze may occur. If the particles are located deeper in the air passages a hearty cough will move them out. Much more mucus is produced when the body is fighting a cold.