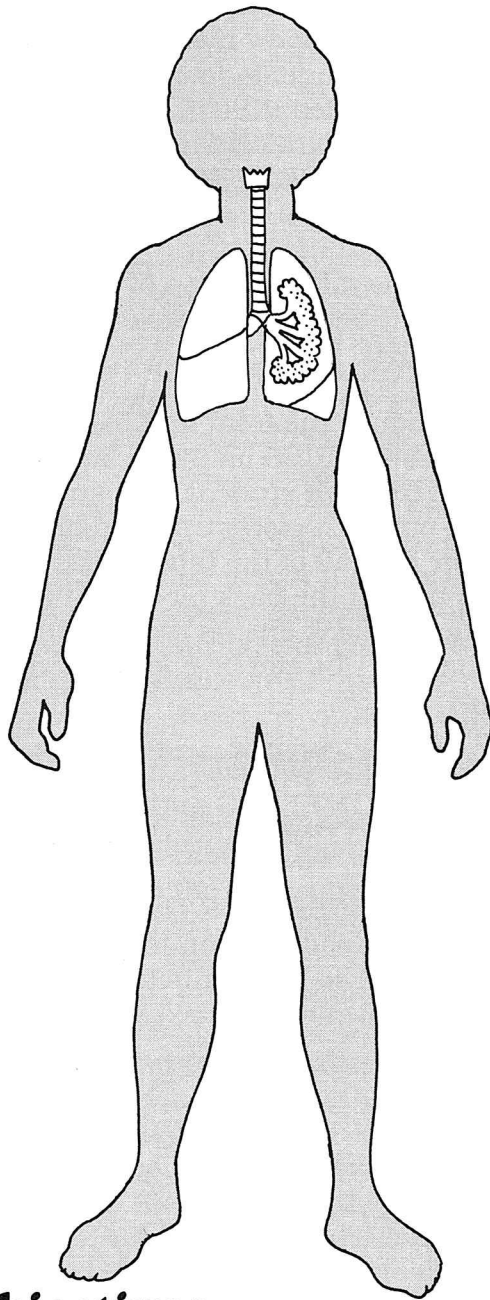


The Respiratory System



Objectives

Students will:

- Identify the parts of the respiratory system
- learn how the parts work together to move air in and out of the body
- understand how the epiglottis keeps food from entering the windpipe.

Materials

- thermometer
- beaker
- empty paper towel roll

Building Understanding

1. Ask students to brainstorm everything they know about breathing and list their responses on the board. (Answers may include: we breathe in oxygen; we breathe to stay alive; we breathe through our nose and/or mouth; we breathe faster when we exercise; air goes into our lungs, etc.)

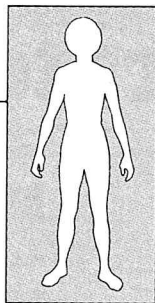
Explain that during breathing we take air into our lungs so oxygen can be absorbed into our blood and waste carbon dioxide can be removed from our body.

Ask students to take a deep breath, then cup their hand lightly over their nose and mouth to feel the air they breathe out.

Ask students if the breathed-out air feels warm or cool and why they think it feels so warm. If you have a thermometer and a beaker, take the air temperature. Then place the thermometer in the beaker and ask a student to exhale into it. Ask students how the temperature of the exhaled air compares to room temperature.

2. Ask students to count the number of times they breathe in as you time one minute. Students can multiply this number by 60 and the result by 24 to discover how many times they breathe during one day. Then ask students to run in place for two minutes and recount as you time one minute. Ask

The Respiratory System

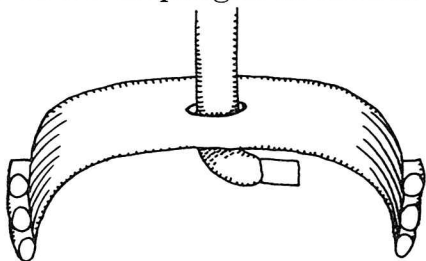


students how their breathing rates change. Then ask students why they think they have to breathe faster when they exercise (to supply their muscles with enough oxygen and to get rid of waste carbon dioxide). Explain to students that just as a burning log gives off heat and light energy, the cells in their body produce energy by breaking apart sugar. Cells need energy to carry out chemical reactions and to work properly. For energy production to take place, cells need oxygen. Teach students that the parts of the body that work together to breathe air in and out make up the respiratory system.

Making The Model

1. NOTE: This model is best put together on top of the digestive and skeletal systems as part of "Building The Human Body." To do this, alter the instructions below by:

- using the part labeled **INSIDE THE FACE** (page 104) in place for the digestive system
- cutting off the tab at the top of the part labeled **WINDPIPE AND INSIDE THE LEFT LUNG** and taping or gluing the top of the windpipe itself to the top of the (esophagus) to indicate that both sit in the throat
- gluing the lungs to the ribcage already in place on the skeleton
- cutting out the section inside the diaphragm and positioning the piece around the esophagus as shown:



2. Reproduce a set of pages 104—107 for each student.

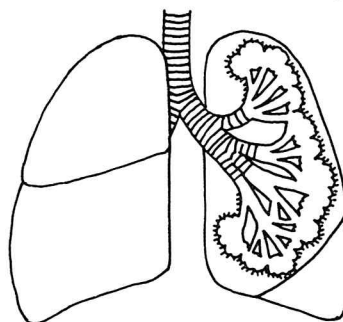
3. Ask students to cut out the part labeled **INSIDE THE FACE** and the part labeled **WINDPIPE AND INSIDE THE LEFT LUNG** on page 104.

4. Tape the tab at the top of the **WINDPIPE** behind the throat on the **INSIDE THE FACE** piece.

5. Reproduce the front and back of the parts labeled **RIBS** on pages 55 and 58 for each student. Ask students to cut out both pieces and fold and glue or tape all of the tabs on the front piece behind the back piece. Cut along the heavy black line on the breastbone so that the ribs can be opened from the front.

6. Cut out the part labeled **OUTSIDE OF THE RIGHT LUNG** and the outline of the **LEFT LUNG** on page 105.

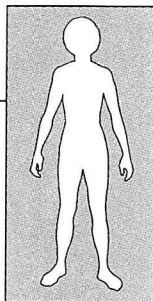
7. Tape the **INSIDE OF THE LEFT LUNG** from page 104 on top of the **LEFT LUNG** so that it fits into the top lobe as shown on the next page:



8. Place glue on the **TAPE BEHIND RIGHT LUNG TAB** and tape the **RIGHT LUNG** on top of it so that the two lungs sit at the same level.

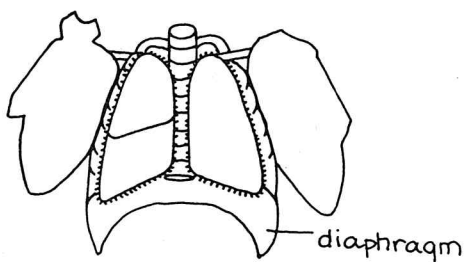
9. Open the **RIB CAGE** and place the

The Respiratory System



model inside so that the top of each lung peeks over the rib cage about half an inch when the cage is closed.

10. Reopen the RIBS and fold back the tab at the top of each lung and tape it to the back of the RIB CAGE.



11. Cut out the DIAPHRAGM on page 105 and position it so it fits over the lowest three tabs on each side. Fold back the tab and tape or glue to the back of the RIBS.

Using The Model

1. Have students follow along on their model as you explain that air is breathed into the nose where it is cleaned, warmed, and moistened in the nasal cavity. The air enters the throat where it flows into the windpipe, or trachea. At the top of the trachea the air passes through the voice box, or larynx. Then it flows down the trachea which divides into two tubes called *bronchi*. One tube directs air into the right lung, the other into the left lung. Only the outside of the right lung is shown on the model. Students can see inside the left lung noting how the bronchus branches and rebranches into smaller and smaller bronchial tubes. At the end of the smallest tubes are tiny air sacs called *alveoli*. Each air sac is surrounded by blood vessels called *capillaries*. Oxygen in the air passes through the wall of the air sac and into the blood flowing through the

capillaries. Carbon dioxide passes out of the blood and into the air sacs to be breathed out. Ask a student to follow on his or her model the path of air as it is breathed out of the body.

The dome-shaped sheet of muscle called the *diaphragm* helps move air into and out of the lungs (see below).

2. You may wish to mention the following to older students:

a. Hairs that line each nostril trap dust and germs in the air.

b. Mucus produced by the lining inside the nasal cavity moistens air and also traps dust, dirt, and germs.

c. Blood flowing in tiny capillaries inside the nasal cavity helps warm breathed-in air.

d. The lungs are divided into sections called *lobes*. The right lung is divided into three lobes, the left into two.

e. There are more than 300 million air sacs in each lung.

f. The esophagus, aorta, and vena cava pass through the diaphragm.

More To Do And Learn

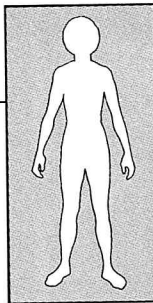
1. Color the Model

Invite students to color the model.

2. Breathe In, Breathe Out

Explain to students that even though their lungs are elastic, they contain little muscle. To do the work of moving air in and out of the body, the lungs are assisted by the diaphragm and the rib muscles. Invite students to draw in muscles that criss-cross between the ribs. Then, reproduce page 106 for each student. Ask students to cut out the parts labeled DIAPHRAGM/AIR and LUNG/TO MOUTH. Cut open the slit under the word LUNG and above

The Respiratory System



the words TO MOUTH. Thread the end labeled AIR into the lung slit from above and back out through the mouth slit. When the model is complete, ask students to breathe in, or inhale, deeply. Does their chest expand or get smaller? (expand). Ask students to pull down on the DIAPHRAGM/AIR TAB and explain that when they inhale, their diaphragm contracts, moves down, and flattens. At the same time their rib muscles contract, pulling the ribs up and out. These contractions enlarge the chest cavity causing the air pressure inside the lungs to lower. Since the air pressure outside the body is now greater than that inside the lungs, air rushes in.

Ask students to focus on exhaling, or breathing out. What happens to their chest? (It gets smaller.) Have students push up on the DIAPHRAGM TAB and explain that when we exhale, the diaphragm relaxes and returns to its dome shape while the rib muscles relax, moving the rib cage down and in. This reduces the size of the chest cavity and increases the pressure. Air is forced out of the lungs because the air pressure inside is greater than the air pressure outside the body.

3. Don't Hold Your Breath

Ask students what would happen if they tried to hold their breath for as long as they could. Explain that carbon dioxide would build up in their blood. The brain, detecting the dangerous buildup, would send electrical signals to the breathing muscles, causing them to relax and forcing the body to exhale. Ask students what their brain does to their breathing rate when they exercise and carbon dioxide is produced more rapidly by cells. (The brain speeds up the breathing rate.)

4. Heart And Lung

When students have put together the model of the heart, review with them how oxygen-poor blood is pumped to the lungs from the right side of the heart and how oxygen rich blood is returned to the left side of the heart to be pumped throughout the body.

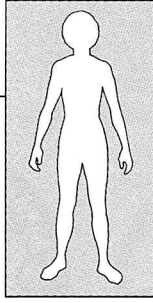
5. The Trapdoor

Ask students to cut out the remaining pieces on page 107. Wrap the long piece—wavy side up—around one end of an empty paper towel roll and tape in place. Fold the smaller piece, the EPIGLOTTIS, toward its tab along the dotted line and tape the tab inside the tube. When the model is complete, explain that the tube with the wavy edge at the top represents the windpipe, or trachea, which is held open by rings of cartilage. The flap is the epiglottis, also made of cartilage, which opens and closes like a trapdoor. Focus on the respiratory system in place on top of the digestive system in the whole body model and point out that the esophagus is behind the trachea at the bottom of the throat. Ask students what they think happens to the epiglottis when food is swallowed. (it flips down automatically over the to keep food from blocking air from reaching the lungs. At all other times it is open so breathing can take place.)

6. Speak the Speech

The larynx, or voice box, at the top of the trachea (windpipe) contains flexible bands of stretched tissue that make up the vocal cords. When we speak, larynx muscles cause the bands to tighten so that they vibrate when we exhale. Ask students to hum softly and feel their vocal cords vibrating by gently placing

The Respiratory System



their fingers on their larynx. The sounds produced by the vibrating cords are shaped into words by the throat muscles, tongue, teeth, and lips. Ask students why they think they shouldn't eat and speak at the same time. (For a person to speak, air has to pass through the larynx with the epiglottis open; with the epiglottis open, food can enter the trachea and cause choking.)

Making Connections

1. Divide students into groups and ask them to prepare the following to present to the class:

a. A skit in which one member is air and the others are the parts of the respiratory system doing their job.

b. A report on the Heimlich Maneuver, with a demonstration of how it works.

c. A report on what happens when we have a cold.

d. A report on what asthma is.

e. A report on gills and how they compare to lungs.

Healthy Choices

1. Teach students that any drug that impairs a person's ability to breathe can be life threatening. Glues, paint thinners, and other inhalants give off vapors that can not only slow down breathing but also prevent oxygen from being absorbed into the blood. If they coat the lungs and cool the air passages, they can cause death.

2. People addicted to cigarettes breathe smoke into their respiratory system, which irritates the nose, throat, and bronchial tubes, causing smokers to cough often. Nicotine, tars, and many other substances in tobacco line the

lungs, damage air sacs, and interfere with oxygen reaching the blood. Over time, the walls of a smoker's air sacs can break down, creating spaces for air to be trapped and turn stale. Breathing

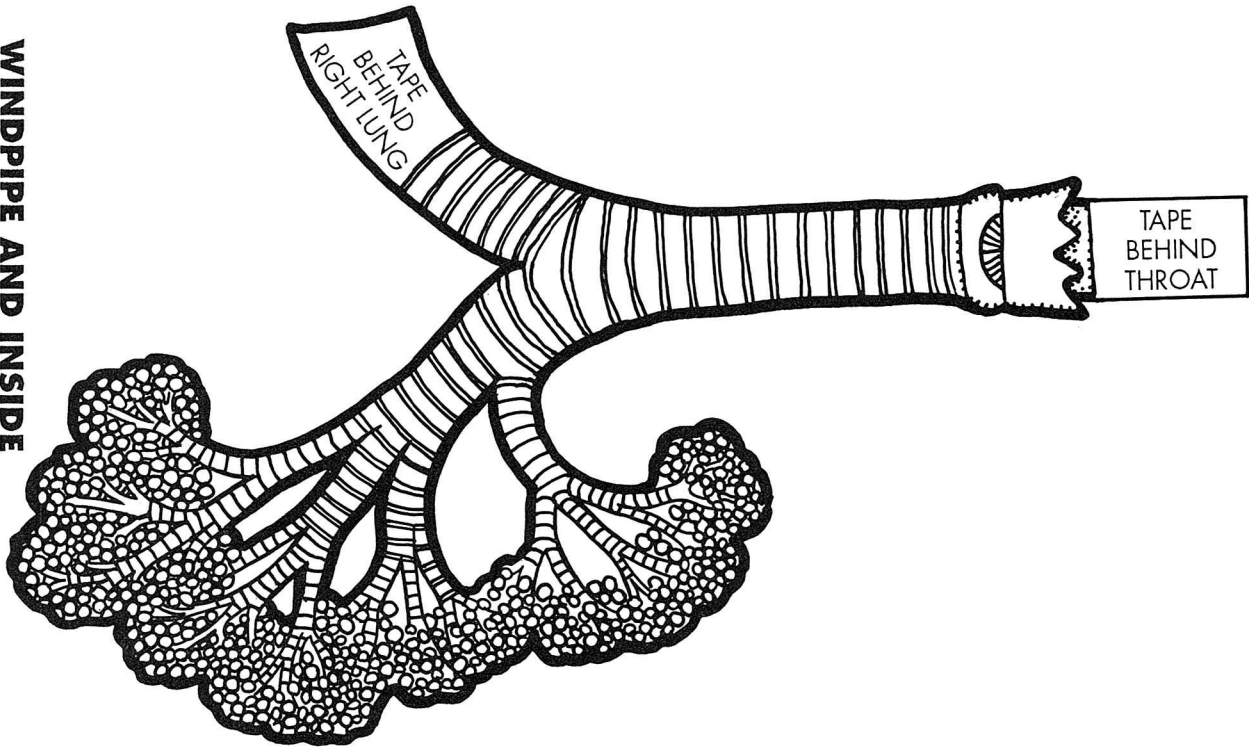
itself becomes difficult. Once addicted, smokers have to smoke more and more to get the same effects from nicotine.

3. The chemicals in tobacco and the carbon monoxide produced when tobacco is burned have been linked to lip, mouth, throat, and lung cancer. Nonsmokers exposed to cigarette smoke are at risk, too. Point out the health warnings required by law on cigarette packages and in advertisements.

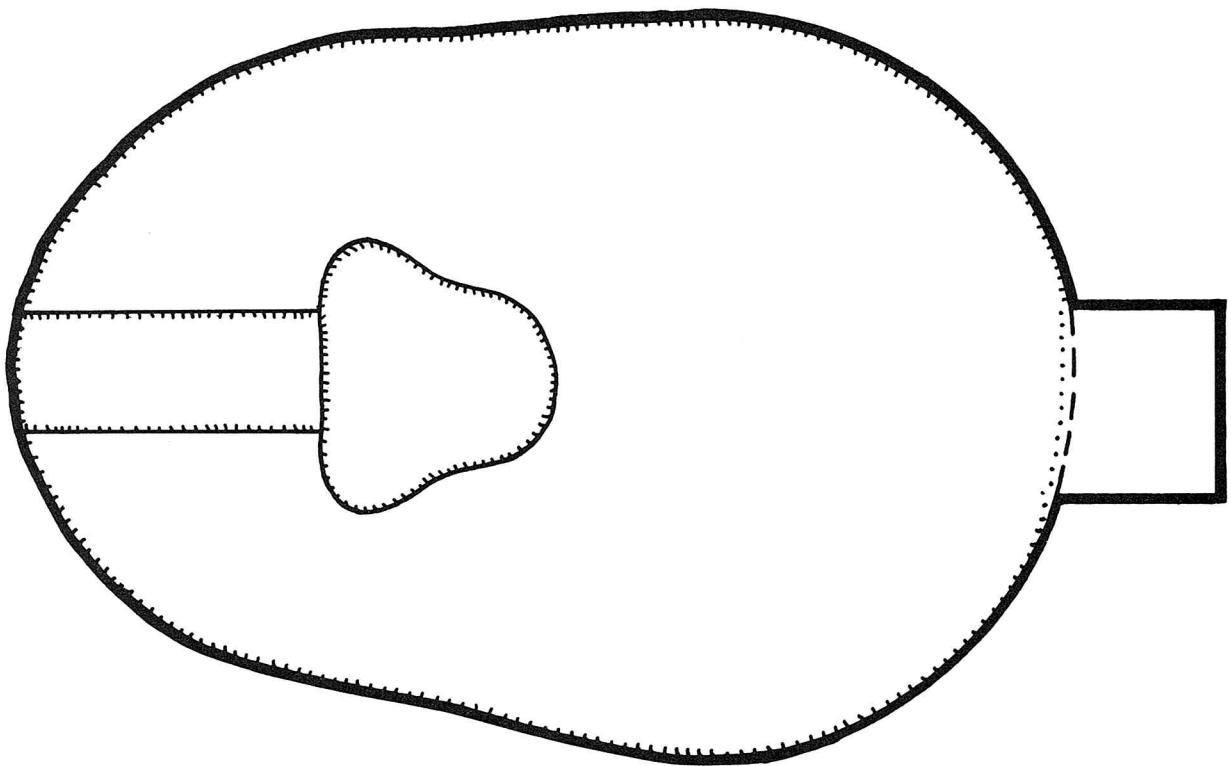
Ask students how they feel about smoking being banned in restaurants, on airplanes, etc.

4. Drugs such as uppers increase the breathing rate while downers and other depressants slow it down. An overdose of cocaine or narcotics can cause breathing to stop.

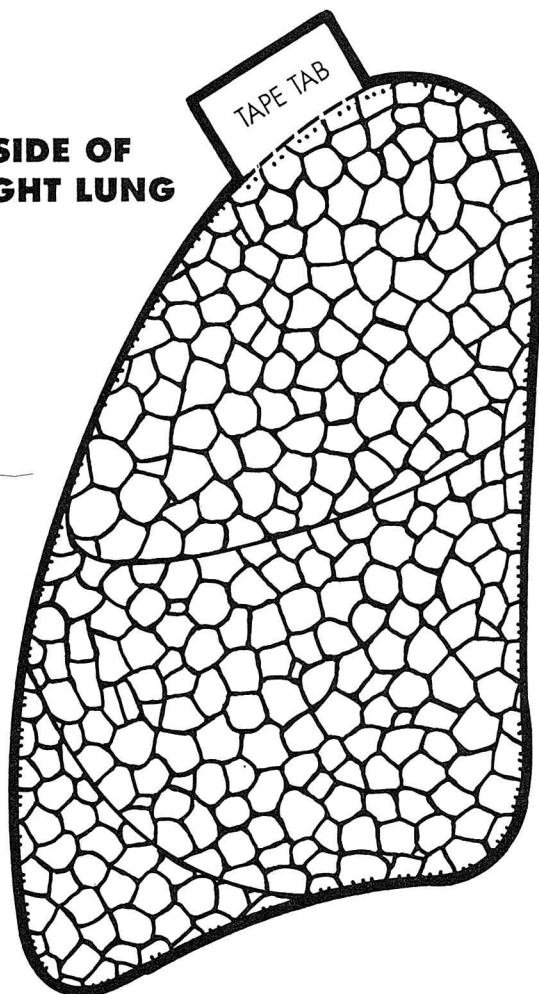
**WINDPIPE AND INSIDE
THE LEFT LUNG**



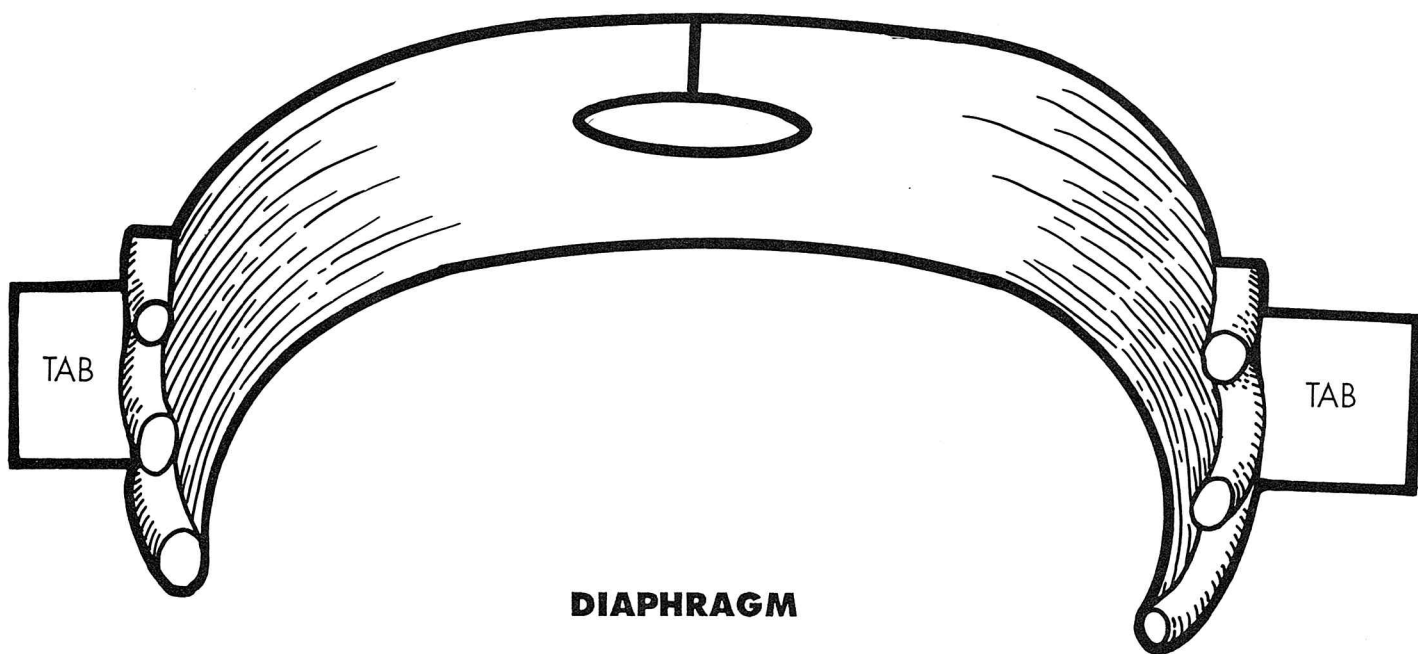
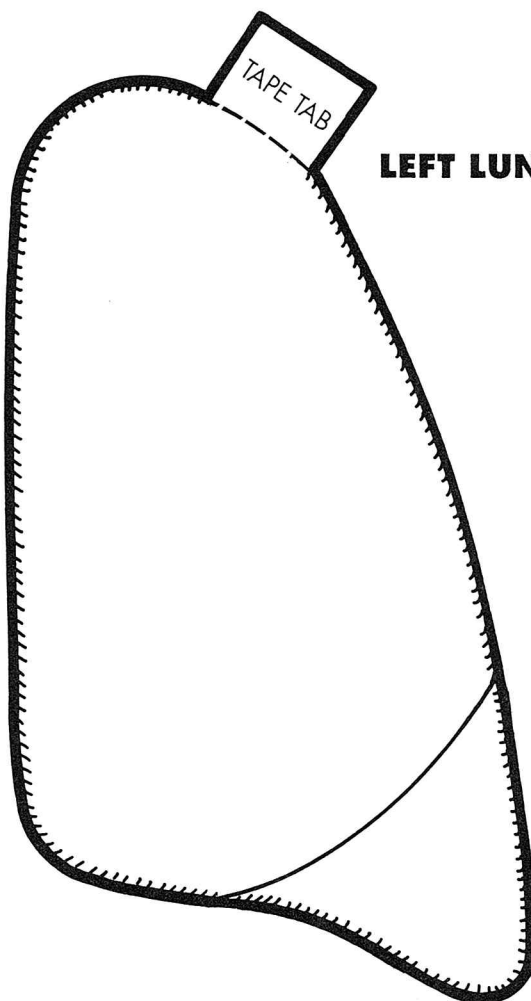
INSIDE THE FACE



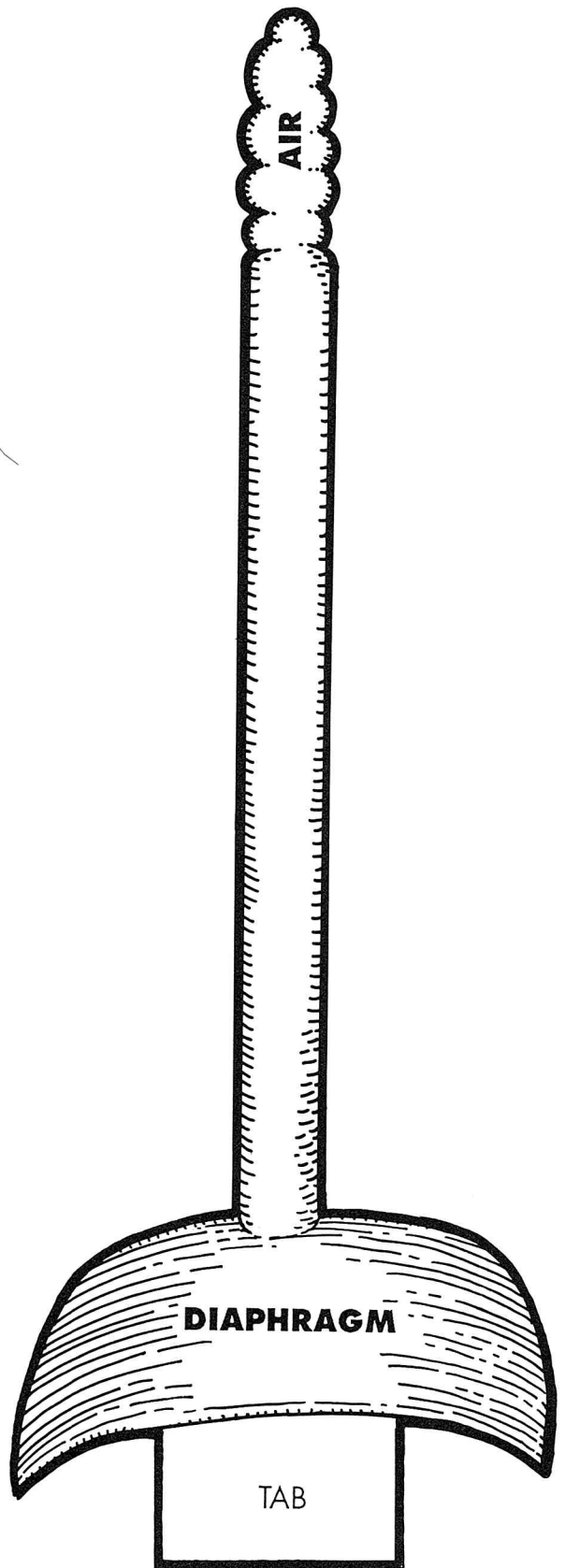
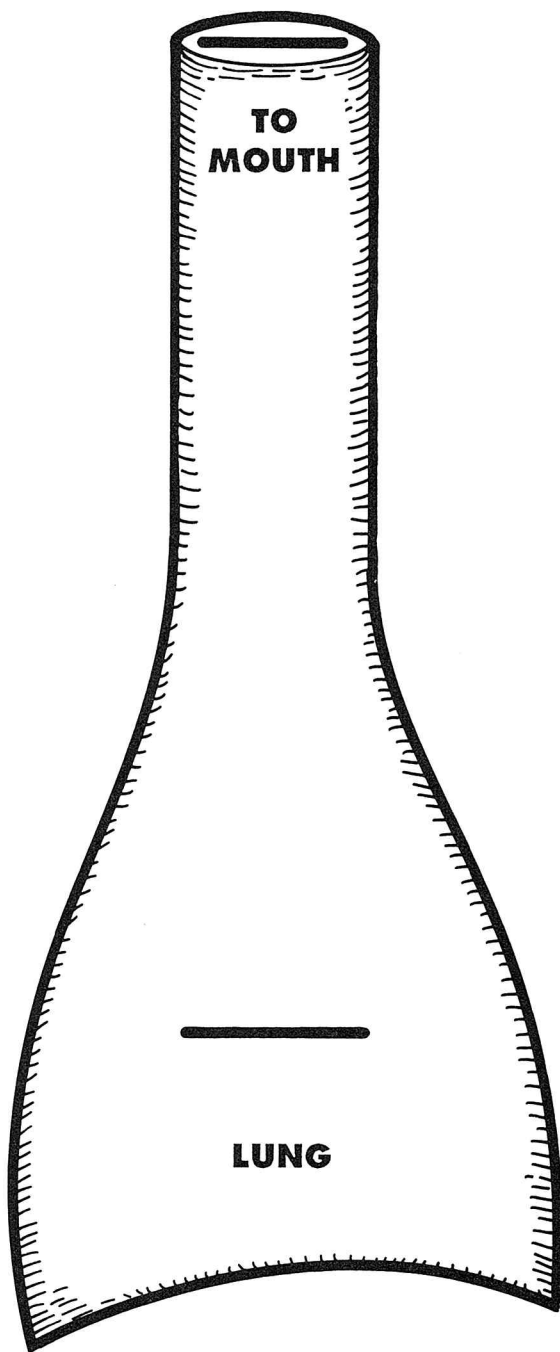
**OUTSIDE OF
THE RIGHT LUNG**

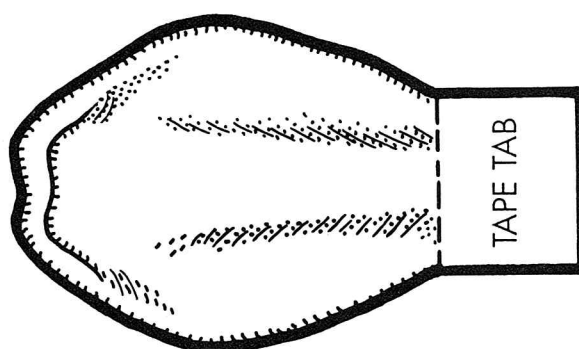
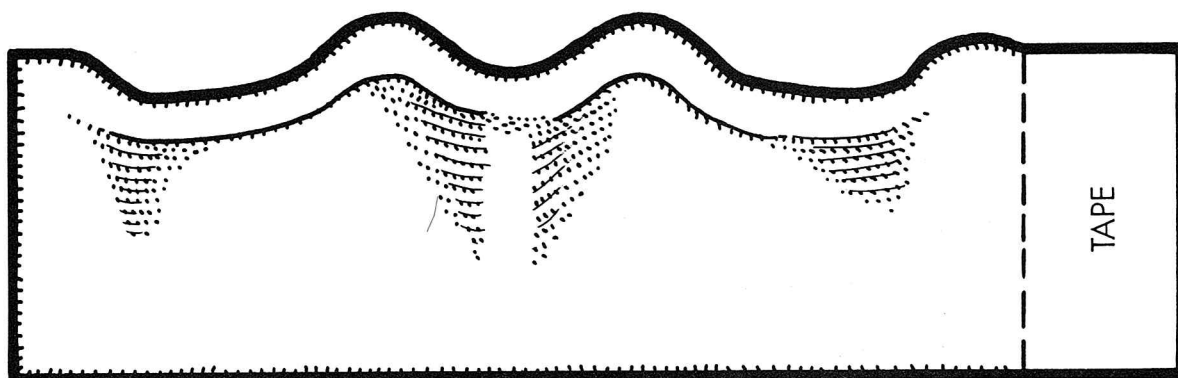


LEFT LUNG



DIAPHRAGM





EPIGLOTTIS