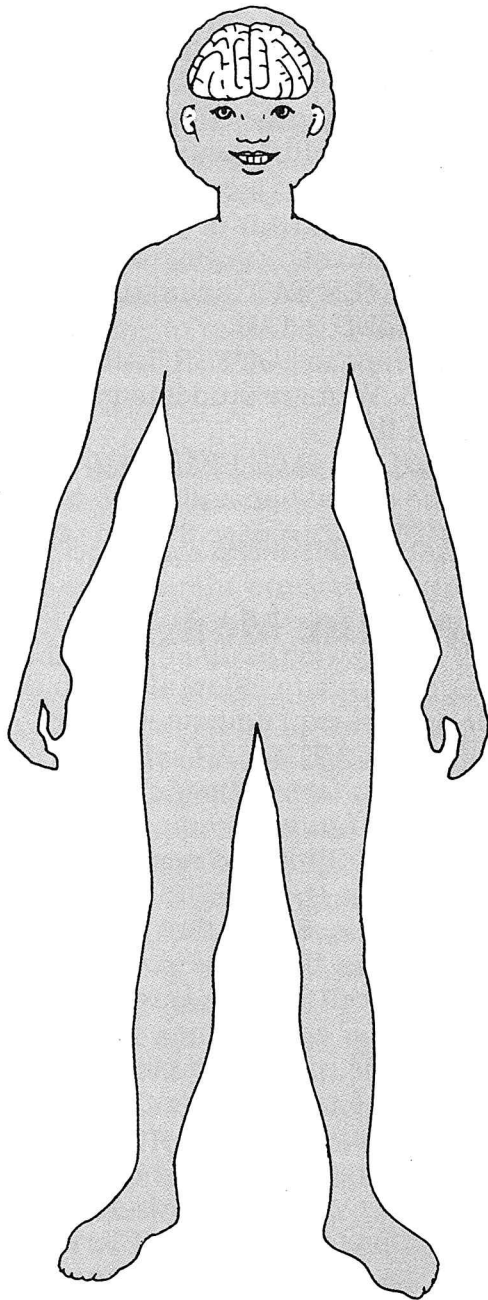


The Ear



Objectives

Students will:

- identify the parts of the ear
- discover how the parts work together
- learn what sound is.

Building Understanding

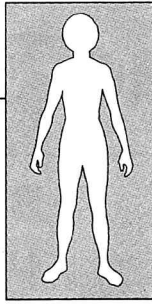
1. Ask students:

- Which sense organ does the job of hearing?
- How do you depend upon your sense of hearing in your daily life?
- What do you find out about by listening?
- Which sounds are most important to you? Which are most enjoyable?
- How do you react when you hear sirens? Thunder? The doorbell? The school bell?

2. Ask the class to sit quietly for a few minutes, and then on the blackboard list the sounds they heard. Ask students:

- Have you ever been in a place where there were no sounds?
- How would your lives be different if you could not hear?

3. Stretch an elastic between your fingers and pluck it to produce sounds. Strike a tuning fork if you have one. Then explain that sounds are produced when things move back and forth, or vibrate, creating sound waves, which are a form of energy. Sound waves can travel through solids, liquids, or gases such as the air but not through empty space. The sound waves coming from the plucked elastic or from the struck tuning fork caused molecules in the air to vibrate. Ask students which part of their body the sound waves must reach in order for them to hear.



Making The Model

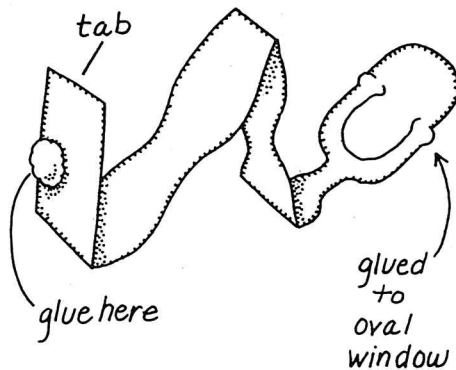
1. Reproduce a set of pages 35—38 for each student.

2. Have each student locate page 35. Point out where parts are to be glued or taped. Call attention to the names of the different ear parts labeled on page 35 and have students note the OVAL WINDOW and the ROUND WINDOW.

3. Have students find page 36 and along the cut line cut out the parts labeled HAMMER, ANVIL, AND STIRRUP as one piece. Do *not* throw page 36 away.

a. Tape the STIRRUP on top of the OVAL WINDOW.

b. Fold the ANVIL over the STIRRUP and the HAMMER over the ANVIL so it opens like an accordion. The last fold will place the GLUE ONTO BACK OF EARDRUM tab on top of the HAMMER.



4. Have students find page 37 and cut out the oval opening at the end of the EAR CANAL along the cut line.

a. Fasten the two TAPE 1 boxes on page 37 to the TAPE 1 boxes on page 35 by folding the tape to form a hinge.

b. Find page 36 and cut out the EARDRUM with its two GLUE HERE TABS.

c. Turn over page 37 and glue the

EARDRUM by its tabs to the back of page 37 so that it covers the hole.

d. Put glue on the underside of the tab folded over the HAMMER.

e. Turn page 37 back over and press the EARDRUM onto the glued HAMMER TAB.

5. Have students find page 38 and cut out the OUTER EAR including the TAPE BEHIND 2 TAB.

a. Cut out the OUTER EAR OPENING. Younger students may need help with this.

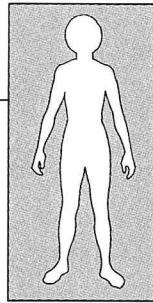
b. Fold the TAPE BEHIND 2 TAB along the dotted line and hinge it behind TAPE 2 on page 37 and tape.

Using The Model

1. Ask students to follow along on their model as you explain how the ear works. The OUTER EAR, which students can feel on their own body, gathers and funnels sounds into the EAR CANAL. Stretched across the end of the canal is the EARDRUM, a thin sheet of tissue. Stress that when students open the outer ear on their model they will find the eardrum at the end of the ear canal. When sound waves hit the eardrum it vibrates. Ask students to turn page 3 over to see how three tiny ear bones stretch from the eardrum to the snail-shaped cochlea. The vibrating eardrum passes the vibrations to the HAMMER, which causes the ANVIL to vibrate. The anvil, in turn, causes the STIRRUP to vibrate.

Ask students to focus on the stirrup, which rests on a thin sheet of tissue called the OVAL WINDOW that covers an opening in the COCHLEA. The vibrating stirrup passes the vibrations to the oval window, which sets a fluid

The Ear



inside the cochlea moving. This moving fluid pushes and pulls on cells in the cochlea that change the energy in the movements into electrical energy signals sent to nerves. All of the nerves join up to form the main HEARING, or auditory, NERVE that carries the signals to the hearing center in the brain (refer to the model of the brain). The brain tells us what we hear and decides if we should do anything in response, such as sing, dance, or find shelter before it starts raining.

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

a. Scientists divide the ear into three main sections: the outer ear (the part on the outside and the ear canal), the middle ear (the three bones), and the inner ear (the cochlea, semicircular canals and nerves). The eardrum separates the outer from the middle ear.

b. The skull protects most of the ear. Tiny hairs and wax in the ear canal trap dirt that could damage the eardrum. Two glands produce ear wax. Ask students why they should never poke anything into their ear canal, which is just an inch long. (It might damage the eardrum.)

c. The HAMMER is the malleus bone, the ANVIL is the incus bone, and the STIRRUP is the stapes bone. These three bones are the tiniest in the human body.

d. The COCHLEA is a fluid-filled tube that coils around a core of bone. As cochlear fluid moves, waves ripple from the oval window to the round window, which is also covered by a thin sheet of tissue or membrane. The EARDRUM and the ROUND AND OVAL WINDOWS are all membranes.

e. The SEMICIRCULAR CANALS, which look like a three-loop pretzel,

have nothing to do with hearing but help us keep our balance. The three canals are filled with fluid that touches cells able to sense how we move our head. These cells send electrical signals along nerves to the balance center in the brain. Along with signals from our eyes, muscles, and joints the brain helps us keep balanced as we move.

More To Do And Learn

1. Color the Model

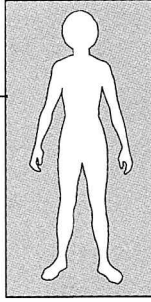
Suggest that students color the skin on the outer ear and the parts inside the ear.

2. Sound Chart

Do students know that people can distinguish more than 250,000 different sounds? Students can create a chart of sounds they hear, such as dogs barking, jets roaring, bells ringing, etc. They can also add to their chart a section of sounds they would like to hear, such as an elephant bellowing or a crowd cheering at a football game, and a section of sounds they would like to avoid, such as a rattlesnake hissing. Note that language is full of "sound words" such as *hiss*. Which other examples can they think of?

3. Turn It Down

Make a soft sound by whispering to your class and then make a loud noise by shouting. Ask students which sound waves you made they think had more energy (the loud). Ask students to list the sounds on their chart in order of loudness. Stress that sounds such as a jet plane taking off can be so loud that they can damage the eardrum and hearing nerves. That's why airport employees who work outdoors wear



protective headphones. Ask students why it is dangerous for them to listen to music at full volume through headphones.

4. Sound Experiment

Set up the following experiment: Ask a student to stand in the middle of the room and close his or her eyes. Point to a seated student and ask that student to clap once. Ask the first student to open his or her eyes and guess who clapped. Now ask the guesser to again close his or her eyes and cover one ear. Repeat the clapping by choosing another student. Ask the guesser if it was easier or harder to determine where the sound came from with both ears open or with just one open.

Making Connections

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

- a. A skit in which one member of the group is sound waves vibrating and the other members are the parts of the ear hearing the sounds.
- b. A report on sign language with word demonstrations.
- c. A report on how sounds help different animals hunt, escape danger, find mates, and warn other animals to stay away.
- d. A report on how bats and dolphins use sounds to navigate and hunt and how ships use reflected sounds to map the sea floor.
- e. A skit in which a group of students makes sounds that are clues to a place such as an airport or a jungle and the rest of the class has to figure out what the place is.

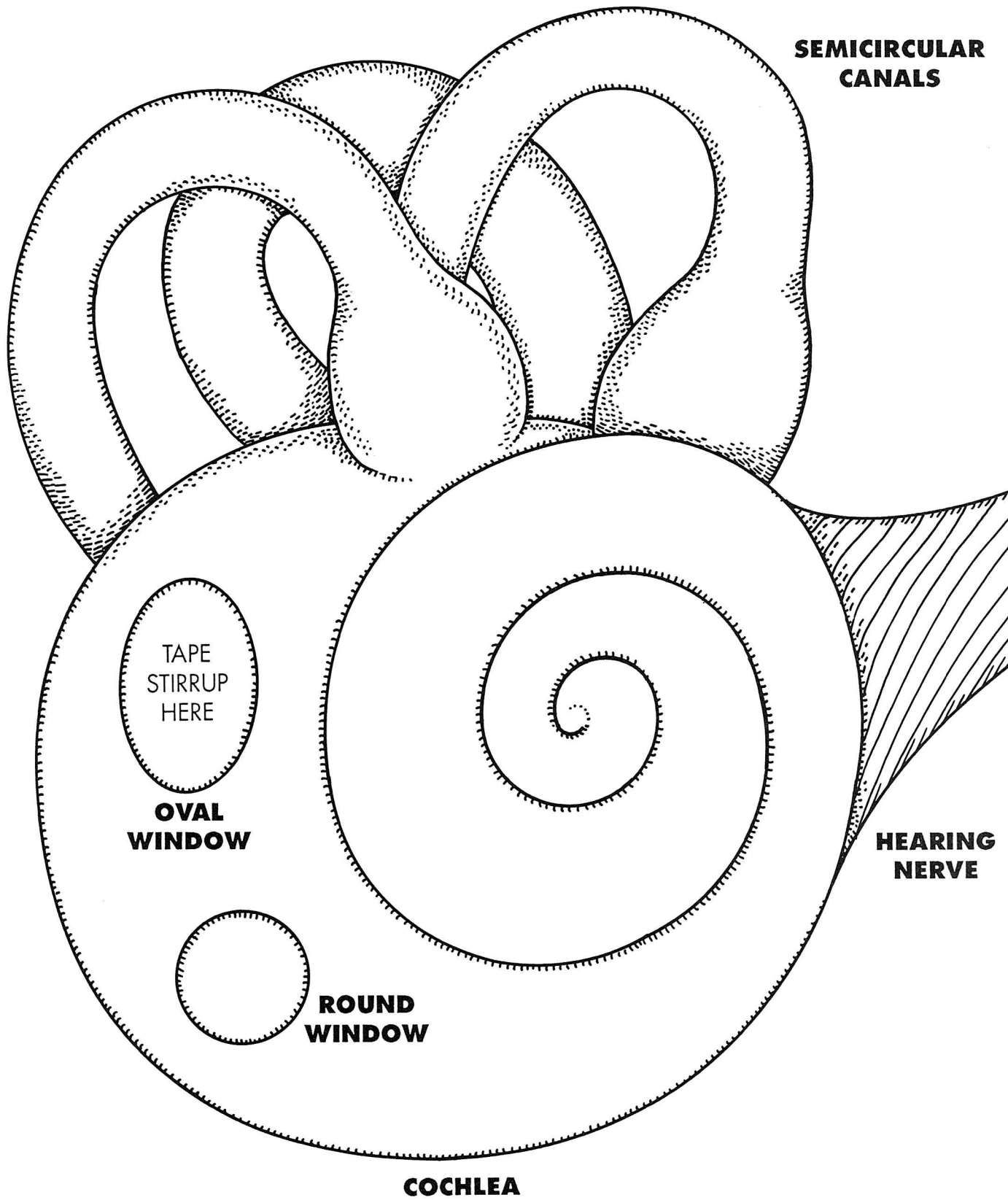
Healthy Choices

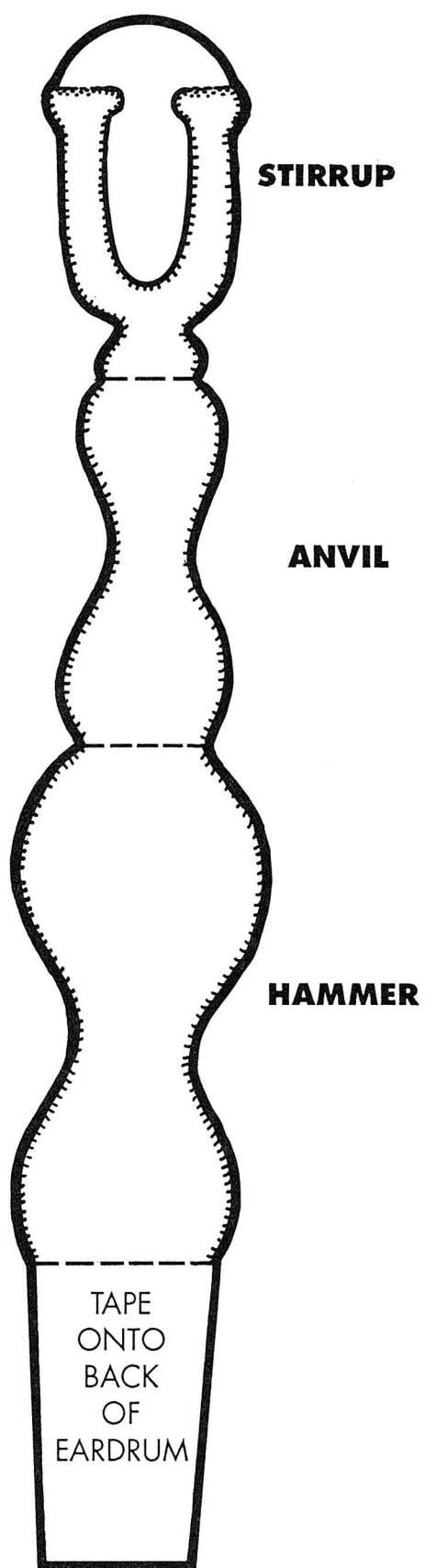
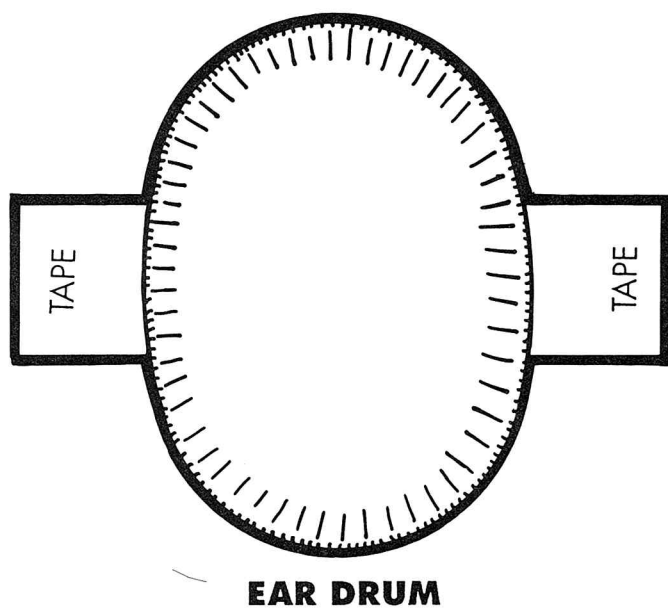
Teach students that abuse of hard drugs can interfere with the ears' ability to pick up sounds and send electrical signals to the brain. Ask how crossing the street would become dangerous for a drug abuser who wasn't hearing sounds as they really are.

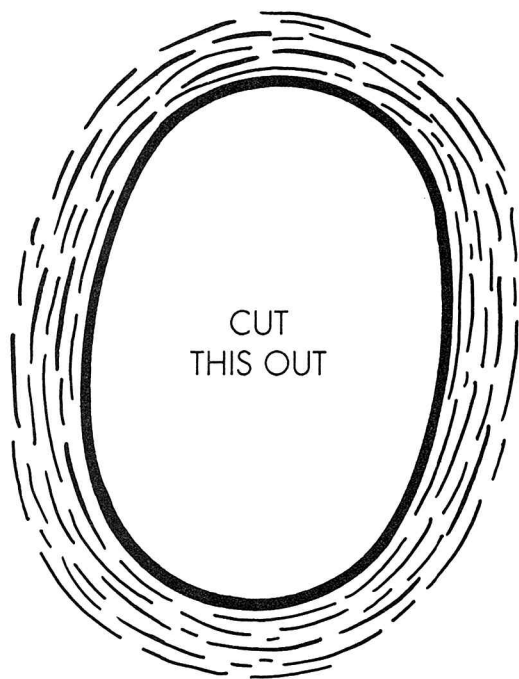
TAPE 1

TAPE 1

**SEMICIRCULAR
CANALS**







**OPENING AT END
OF EAR CANAL**

FOLD AND TAPE BEHIND 2

CUT
THIS
OUT

**OUTER EAR
OPENING**