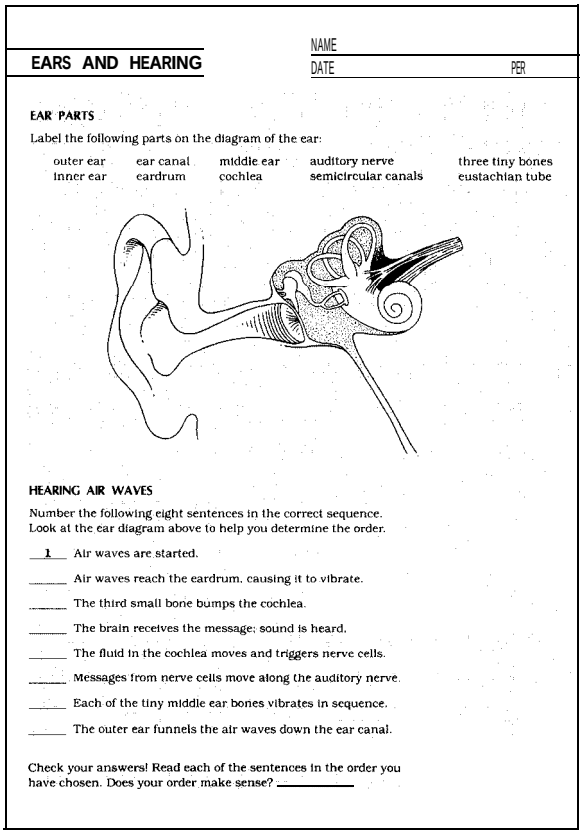
16-3 EARS AND HEARING

Hearing is a complex process. If you could inspect the parts of an ear, it would help you understand how the ear works. The best way to do this would be to dissect one. However, this is very difficult to do since most of the ear is encased in bone. When you remove the bone, you ruin the ear.

Since it is not possible to dissect an ear, you can learn about its parts by reading. As you read this section, label the diagram on your worksheet. (See Figure 16-6.)



EARS AND HEARING

NAME
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EAR PARTS

Label the following parts on the diagram of the ear:

outer ear, ear canal, middle ear, auditory nerve, three tiny bones, inner ear, eardrum, cochlea, semicircular canals, eustachian tube

HEARING AIR WAVES

Number the following eight sentences in the correct sequence. Look at the ear diagram above to help you determine the order.

1 Air waves are started.
____ Air waves reach the eardrum, causing it to vibrate.
____ The third small bone bumps the cochlea.
____ The brain receives the message; sound is heard.
____ The fluid in the cochlea moves and triggers nerve cells.
____ Messages from nerve cells move along the auditory nerve.
____ Each of the tiny middle ear bones vibrates in sequence.
____ The outer ear funnels the air waves down the ear canal.

Check your answers! Read each of the sentences in the order you have chosen. Does your order make sense? _____

Figure 16-6

Ear Parts

There are three areas of the ear: outer ear, middle ear, and inner ear. You may already know the parts of the **outer ear.** These are the parts of the ear you see. The

Capra, J. (1991). *Middle school life Science,* Dubuque, IA: Kendall/Hunt

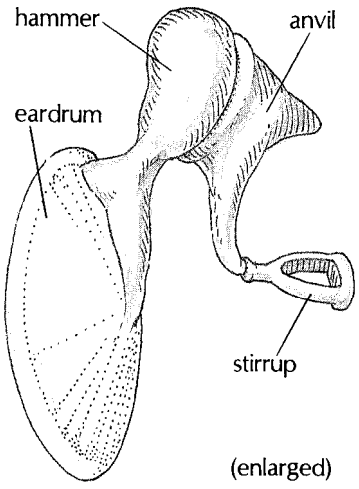

Figure 16-7 These three bones are the tiniest ones in the body. Their shapes give you clues to their names — hammer, anvil, and stirrup.

most obvious one is the cartilage structure that we call the **ear.** It funnels sound into the **ear canal.** If you could look down the ear canal, you would see that it leads to the **eardrum.** The eardrum separates the outer ear from the middle ear.

Three tiny bones make up the **middle ear.** These bones are shown in Figure 16-7. They bridge the space between the eardrum and part of the inner ear—the cochlea.

The **inner ear** is a delicate structure; it is enclosed by the bones of the skull. While both the outer and middle parts of the ear are filled with air, the inner ear is filled with fluid. The easiest part of the inner ear to recognize is the **cochlea** because it is shaped like a snail. The cells that line the cochlea are very sensitive. They can be damaged by loud sounds. Three **semicircular canals** attach to the cochlea. Even though these semicircular canals are located in the ear, we think of them as being important for balance instead of hearing. Like the rest of the inner ear, they are filled with fluid. The movement of this fluid triggers nerve messages that make us aware of our positions. A person may have trouble walking or standing if the semicircular canals are damaged. If the fluid in a person's canals moves all of the time, a type of motion sickness may result.

The **auditory nerve** carries sound messages from the cochlea to the brain. It is not really a part of the ear but, without it, you could not hear.

Hearing Air Waves

Together, the outer ear, middle ear, inner ear, and auditory nerves allow us to hear. To understand how this happens, imagine that someone has just blown a note on a trumpet. This causes air molecules to move. If you could see the molecules move, they would look like waves. For this reason, we say that sound travels in sound waves. The outer ear collects these waves and directs them to the middle ear. This causes the bones in the middle ear to vibrate. In the inner ear, the vibrations are changed into a nerve message. Your brain then "interprets" the message so you can hear the trumpet.

Take a break from reading and see if you can decide how your ear works. Put the sentences at the bottom of your copy of Figure 16-6 in the correct order.

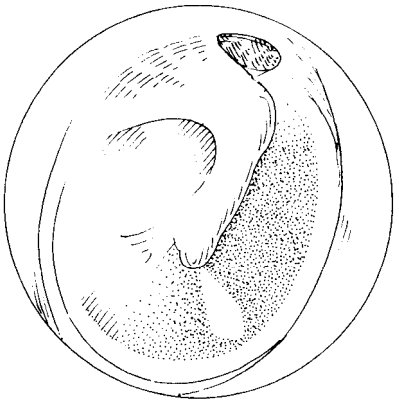

Figure 16-8 This is an eardrum as it appears when viewed through an otoscope.

Eardrums

Even though all parts of the ear are important for hearing, people talk most about eardrums. Figure 16-8 shows what an eardrum looks like when you look down the ear canal at it with an otoscope. It is a thin membrane that separates the outer ear from the middle ear. You can picture the eardrum as being like a piece of a balloon stretched over a ring. Like this balloon, a real eardrum can move in and out. If you close your mouth, plug your nose, and try to breathe, you can feel your eardrums move. When air pressure changes, the eardrums move. This is illustrated in Figure 16-9.

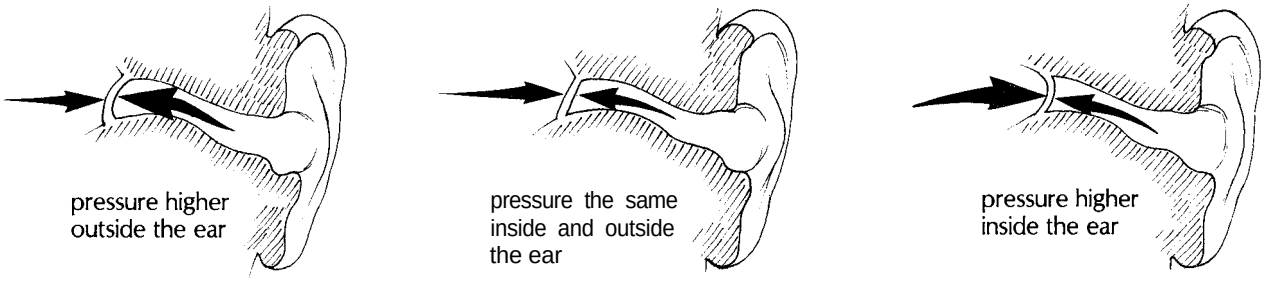

Figure 16-9 The eardrum moves when air pressure changes.

When an eardrum stretches too much, it tears. You protect your eardrums from tearing without realizing it. When your ears start to feel uncomfortable, you try to "make them pop" by yawning, chewing gum, or swallowing. By doing this, you are moving the air in your **eustachian tubes** to make the air pressure equal on both sides of your eardrum. The eustachian tubes are openings from the middle ear into the throat. *(Remember to label the eustachian tubes on the ear diagram on your worksheet.)*

Infections

Sometimes, bacteria or viruses travel up a eustachian tube from the throat into the middle ear. When this happens, a middle ear infection can develop. If, however, bacteria settle in the ear canal, an outer ear infection results. Thus, the treatment for an ear infection depends on which part of the ear is involved.

CHECK YOUR UNDERSTANDING

1. Imagine that you have a cold and your ear starts to ache. Are you more likely to have an infection in your ear canal or middle ear? Explain.
2. "Don't put cotton swabs, hairpins, fingernails, or anything else into your ears." When people say this, what are they afraid you could do to your ear?
3. What kind of infection do you think could be treated with ear drops—an infection in the ear canal or middle ear? Explain.
4. Suppose you know someone who has a hearing loss in one ear. Look at the ear diagram on your worksheet. Think of the things that happen in the ear to allow you to hear. Explain at least 2 things that could go wrong with the structure of the ear that could explain your friend's hearing problem.

EXTENSION ACTIVITIES

1. Ask the school nurse if you can look at an eardrum with his or her otoscope. Find out how you can tell if someone has an infection by inspecting an eardrum.
2. The ear is important for balance. Demonstrate this by walking a log three times. The first time just walk the log. The second time use headphones to listen to music while you walk the log. The third time adjust the headphones to play music into one ear only. How does the music affect your ability to walk the log?

Different Pitches

Different animals can hear different pitches. Frogs can hear sounds much lower than we can hear. We hear low sounds better than dogs, cats, and birds: they, however, can detect high sounds that we never hear.

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