

Have you ever wondered about... the ear and how people hear?

Imagine it's morning. You are just beginning to wake up. You're wondering how late it is and if you can stay in bed just a few more minutes ... or if it's time for you to get up and get ready for school. You hear the shower running, so someone's already in the bathroom. The dog is scratching on the back screen door to be let in the house. Someone's opening the front door to get the newspaper, and your clock radio just came on. Upstairs your sister is running her hair dryer. All these familiar morning sounds tell you it's time to get up!

Now imagine that you're walking to school. Your best friend yells to you, "Hey, wait for me!" The safety patrol raises her hand and says, "Don't cross the street yet. " Suddenly you hear your friend yelling and honking his bike horn signaling you to move aside. But the garbage pickup truck is rumbling slowly down the street and you can't cross to the other side just yet. The crossing guard blows her whistle and beckons. Now you can hurry on to school.

My Morning Sound Map



These many words and sounds signaling warnings, friendship, and daily routine are a natural part of the day for people who hear.

- Can you think of all the sounds you heard from the time you woke up until you reached school today? Create a sound map of your early morning activities. Tomorrow, borrow a cassette recorder to tape all the sounds you hear in one hour's time. Discuss in your class how certain sounds have meaning for you.

HOW WE HEAR

- Sounds surround us everyday. We pay attention to some of them-the alarm clock, mother or father's call to breakfast, the ringing of the telephone, music on the radio, a whispered secret, the bell on the ice cream truck, friends talking at recess, the teacher's words in class, an ambulance siren! Other sounds we may choose to Ignore- a neighbor's baby crying across the street, a squirrel running across the roof, birds chirping in the early morning, the scratching of pencils on paper, or cars passing down the street.
- Our ears and our brain work together to allow us to hear sound . We choose to pay attention to some sounds, and we ignore others.

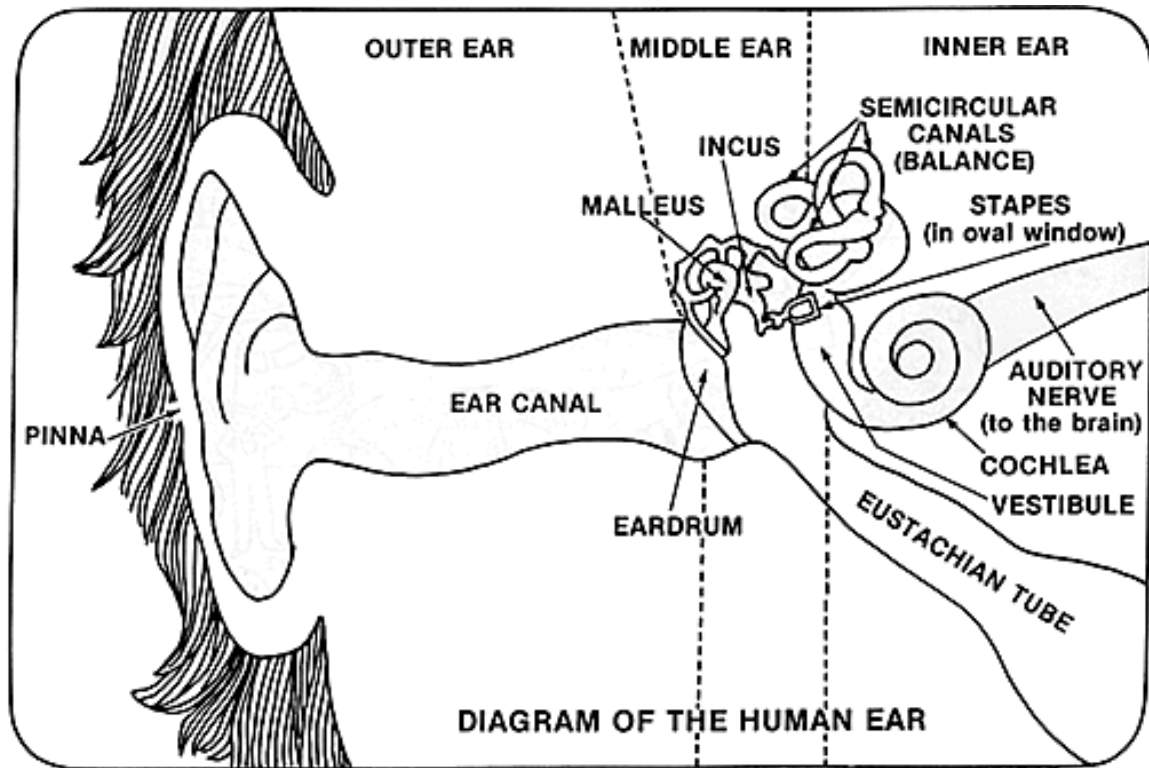
THE PARTS OF THE EAR

Many people think our ears are the parts we see attached on the outside of our head. Would you be surprised to learn that the ear actually has three main parts? They are:

- the outer ear
- the middle ear
- the inner ear

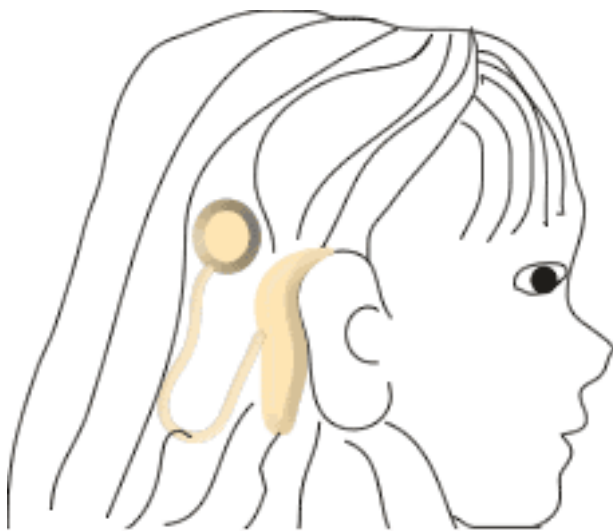
To learn how these three parts help us hear, look at the drawings and read the following discussion.

First we'll talk about each of the parts of the ear.



- The *outer ear* is shaped like a funnel. The part you can see is called the pinna (pin'-uh). Inside the outer ear is the ear canal, a tunnel which ends at a round membrane called the eardrum. The eardrum separates the outer ear from the middle ear.
- The *middle ear* is a small air-filled space containing the Eustachian tube and a bridge of three bones. The Eustachian tube connects your ear and your throat and helps to keep a supply of fresh air in the middle ear. The three bones, called ossicles (ah'-sikuls), are the smallest in your body, and each has a name:
 - malleus (mal'-ee-us) or hammer;
 - incus (in-kus) or anvil;
 - stapes (stay-pee-z) or stirrup.
- The bridge of ossicles hangs across the air space in the middle ear. This bridge starts with the malleus which is attached to the eardrum and ends with the stapes which is attached to the oval window, another kind of eardrum.

- The *inner ear* is the organ in our body responsible for hearing and balance. In the inner ear we find the cochlea (coke'-lee-a). The cochlea, which is spiral-shaped like a snail's shell, is made of three coils of bone. The coils are filled with special fluids (liquids). You already know that the stapes fits into the oval window on one side of the cochlea. Below the cochlea is the round window. It has no attachments.
- If we slice across the bony shell of the cochlea to look inside, we can see a thin flexible membrane, the basilar membrane, suspended in the center. This membrane is surrounded by fluid. Attached to the membrane are 15,000 to 20,000 tiny hair cells. These cells connect to nerve fibers that make up the nerve of hearing. The nerve of hearing is also called the eighth nerve in our body.



This illustration shows the important parts of the inner ear in cross section. You can see only a few hair cells here. Imagine this membrane and the hair cells as a continuous ribbon through the entire cochlea. The shaded areas represent the special cochlear fluids

SOUND AND THE EAR

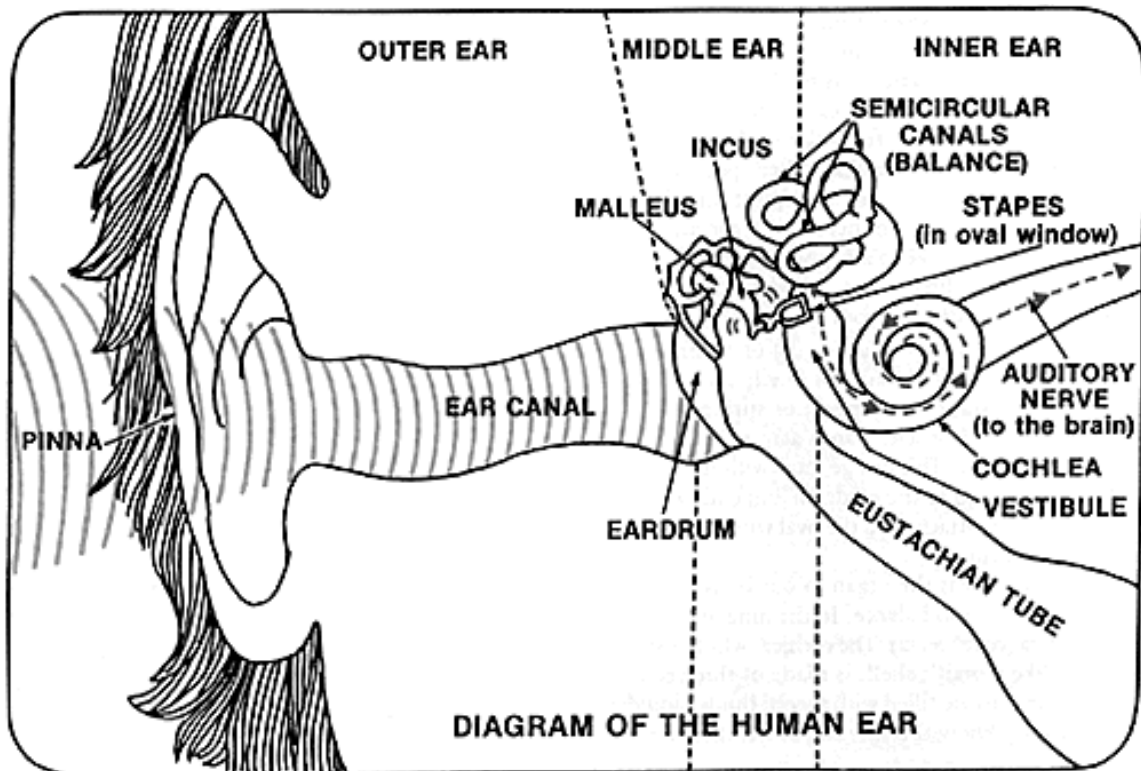
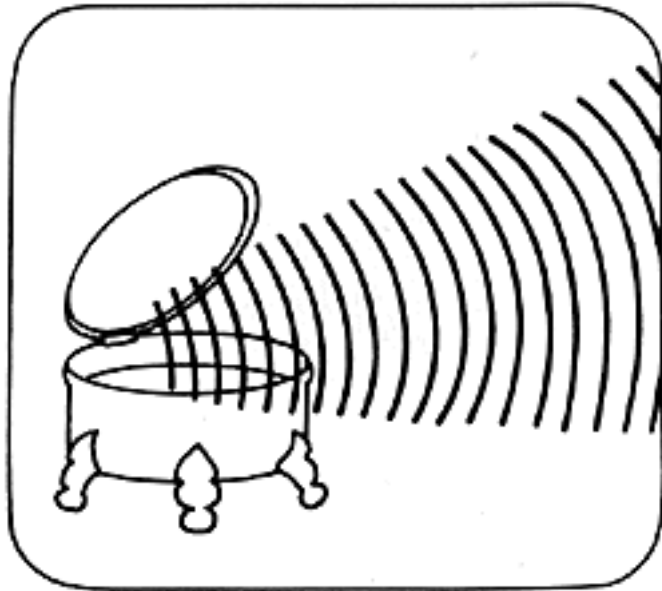
Each part of the ear has a special role to play in the hearing process. It's a process that begins only when sound reaches the ear.

Sound is created when an object vibrates (moves back and forth), pushing the air around it. The sound of thunder on a

stormy night or the song on a music box sets the air in motion until the air molecules (ma'-le-kyools) closest to you begin the journey through your ear and up to your brain.

Think of your favorite sound. Let's follow what happens when the sound moves through each of the parts of your ear until you "hear" it.

The pinna of the outer ear functions like a baseball catcher's mitt to "catch" the sound waves and direct them down through the ear canal to the eardrum. The eardrum vibrates with the rhythm of the air molecules (sound waves) pushing against it.



As the sound waves move the eardrum, the bridge of three ossicles vibrates back and forth. This vibration moves the oval window, carrying the rhythm of your favorite sound into the inner ear.

When the sound waves move the inner ear fluid, the basilar membrane and the hair cells float in rhythm like a boat on the water. Next the hair or cilia (sil'-ee-uh) on top of the cell bend. This bending sends patterns of electrical signals through the nerve fibers of the nerve of hearing. A loud sound moves the hair cells much more than a soft sound. High pitch sounds, such as whistles or the speech consonants /t/ or /s/, cause a movement of the membrane and hair cells in a different place than low pitch sounds like drums or vowels.

The inner ear fluid needs some room for its movement. The round window bumps in and out as the fluid moves.

The electrical signals travel from the hair cells to the nerve of hearing up to the brain. The brain makes sense of the electrical patterns sent across the nerves and you "hear" your favorite sound.

MORE THAN HEARING

The ear is not just for hearing. Some parts have other functions as well. Wax in your ear canal protects the other parts of the ear from dirt and bugs. But, too much wax in your ear canal can block sound from traveling further, cause you to hear less, and might require some attention from your doctor.

Have you noticed that your ears sometimes tickle or hurt when you have a cold? The Eustachian tube makes it possible for a cold to cause this discomfort. It's through this passageway that cold germs travel from your nose and throat to your ears. The Eustachian tube has another helpful function: it can clear your ears when you yawn or swallow.

FIND THE WORDS:

In the grid of letters below are names of parts of the ear and

other related words. Circle the twelve words hidden in the puzzle.

Ear Eardrum Pinna Noise Ossicles Haircells Wax Cochlea WORD FIND Canal Stapes Brain Inner Ear														
C	B	K	H	M	L	J	X	C	O	C	H	L	E	A
E	A	R	A	Y	O	I	Z	Q	S	C	A	N	A	L
T	R	A	I	D	S	N	F	I	H	M	O	B	N	P
S	T	B	R	A	S	N	C	E	A	R	D	R	U	M
T	J	I	C	L	I	E	B	N	P	K	M	A	N	Z
A	A	I	E	L	C	R	U	O	V	X	W	I	Y	W
P	M	N	L	Q	L	E	P	I	N	N	A	N	Z	A
E	O	W	L	Y	E	A	L	S	S	O	V	X	T	X
S	Z	Y	S	B	S	R	O	E	Y	L	A	C	Q	J

by Jennifer Skalka

If you've ever had an ear infection, you may have noticed that you didn't hear as well. This change in hearing happens when the space in the middle ear fills with liquid. The liquid keeps the eardrum and ossicles from moving freely, and thus your hearing may change. After you take some medication, the liquid usually dries up, and your middle ear parts are again set in motion by sound.

Have you ever visited an amusement park and gone on a ride that spins you around fast? If you have, you probably know what it feels like to be dizzy. Maybe you even closed your eyes so that-you would feel less dizzy. Let's find out why.

Two other parts of your inner ear, the semicircular canals and the vestibule (ves'-ti-byool), have nothing to do with hearing. These two parts of the inner ear provide information to the brain about your balance and the position of your body in space.

As you turn your body and head, different hair cells in the vestibule and semicircular canals change direction. When this happens, electrical signals are sent through the nerve fibers which connect to your eye muscles. Your eyes move in different directions depending on how your body is twisting and turning. These signals send information to the brain that lets you know if you are standing on your head, doing a somersault, or simply jumping rope.

FILL IN THE BLANKS:

Choose the correct answers from the answer box below.

Answers:	ossicles	balance	3	movement	wax	2
	sound waves	fluid	8th	pinna	eardrum	body position

- The ear consists of _____ main parts.
- Vibrating air molecules moving in rhythm are called _____.
- The _____ gathers the sound waves and directs them through the ear canal.
- _____ in the ear canal protects our middle and inner ears from injury.
- The outer ear ends at the _____.
- The smallest bones in our body, the _____, form a bridge between the eardrum and the oval window in the middle ear.
- There are _____ windows into the cochlea.
- The inner ear is filled with _____.
- _____ of the hair cells causes the nerves to send a signal about sound to the brain.
- The nerve of hearing is known as the _____ nerve.
- The vestibule and semicircular canals send information to our brain about our _____ and _____.

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