



Curiosity Guide #407

Sense of Hearing

Accompanies Curious Crew, Season 4, Episode 7 (#407)

Hearing Can

Investigation #1

Description

Hear ye, hear ye!

Materials

- Can or small piece of PVC pipe
- Can opener
- Latex balloon
- Tape
- Scissors
- Glass of water
- Flexible straw
- Piece of foam
- Empty box

Procedure

1. Use the can opener to remove both ends from the can. Throw away the ends.
2. Use scissors to cut off the neck of the balloon. Throw away the neck of the balloon.
3. Stretch the remaining balloon over one open end of the can and secure with tape if necessary.
4. Fill the glass with water.
5. Place the straw in the water. Bend the flexible part of the straw so that it sticks out away from the edge of the glass.

6. Place the empty box beside the glass.
7. Turn the can on its side so the balloon membrane is in line with the end of the flexible straw.
8. Tape the can in place to the box so it doesn't move.
9. Add a small piece of tape to attach the end of the straw to the center of the balloon membrane.
10. Snip the bottom of the straw going into the glass and insert it into the piece of foam so that it can float on top of the water.
11. Make noises in the open can and observe.
12. What do you notice with the straw and foam?

My Results

Explanation

This is a model of the ear itself. The can acts as the outer ear, or the pinna. The pinna captures sound, amplifies it, and directs it into the ear canal. Sound waves move through the ear canal and strike the ear drum. The balloon is like the ear drum, which really is a membrane only about 10 millimeters in diameter and is the boundary to the middle ear.

The energy moves into the middle ear, where there are three bones, called the malleus, incus, and stapes, named for their shape: hammer, anvil, and stirrup. As the sound waves move into the middle ear, these bones begin to move with the sound waves. The straw in this model acts as the malleus and incus bones, while the foam represents the stapes. They all move as the balloon membrane moves and transfers the energy into the water. In our ears, the sound moves through the malleus first, which touches the ear drum itself. The malleus acts like a lever and transfers the energy to the incus and finally the tiny stapes, which causes amplified pressure waves to travel through the cochlea.

The sound energy moves through the fluid and fibers in the cochlea, which resonate when they match the incoming frequencies. The resonance is identified by tiny hair cells beside the fibers, which begin to move and send an electrical signal to the cochlear nerve and then to the brain. The glass of water represents the fluid in the cochlea.

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