



# Cochlear Implants: How Does a Cochlear Implant Work?

**Northern Virginia Resource Center for Deaf and Hard of Hearing Persons**

3951 Pender Drive, Suite 130 • Fairfax, VA 22030  
703-352-9055 (V) • 703-352-9056 (TTY) • 703-352-9058 (FAX)  
www.nvrc.org • info@nvrc.org

## How We Hear

Sound travels through the air as vibrations or waves. The eardrum is similar to a drum; it is a membrane that stretches across the ear canal at the threshold between the outer ear and middle ear. When sound waves hit the eardrum, the eardrum vibrates and sends the vibrations to the middle ear, where they pass through, in order, the hammer, anvil, and stirrup.

These three bones are the tiniest bones in the human body. The stirrup passes the vibrations along the cochlea, in the inner ear. The inner part of the cochlea is lined with thousands of hair cells, called cilia. When the cochlea vibrates, the cilia move, stimulating the auditory nerve, which sends the vibrations to the brain. The brain then interprets them as sound.

## How a Cochlear Implant Enables You to Hear

A cochlear implant has both internal and external components:

The external component consists of a sound processor in the form of either a behind-the-ear (BTE) or box-shaped device. This device is connected by a cable to a headpiece that rests on the scalp above the ear. The sound processor is sometimes called a speech processor.

The internal component consists of the actual “cochlear implant”, which nests within the mastoid bone.

- The implant’s magnet connects from beneath the skin with a magnet in the headpiece outside the skin. The implant contains a computer chip and an electrode array, a very thin wire that is lined with electrodes and threaded through the cochlea.
- A microphone in the headpiece detects sound and sends it to the sound processor.
- The sound processor’s computer “processes” the sound and sends the signals to a transmitter and receiver/stimulator, where they are converted into electric impulses.
- The electric impulses are collected by the electrode array inside the cochlea. The electrodes then stimulate different areas of the auditory nerve.
- The stimulated auditory nerve sends the signals to the brain, which recognizes what it has received as sound - speech, environmental sounds, music.

Thus, you can see that a cochlear implant bypasses the damaged or missing cilia and directly stimulates the auditory nerve, enabling the implant user to hear sound.

Hearing aids, by contrast, depend on whatever cilia are present and capable of being stimulated. If there are no cilia, or if they all are damaged, the auditory nerve cannot be stimulated. In this event no hearing aid will enable an individual to hear. The person can then consider the option of a cochlear implant.

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