U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES · National Institutes of Health

National Institute on Deafness and Other Communication Disorders

NIDCD Fact Sheet | **Hearing and Balance**

Cochlear Implants

What is a cochlear implant?

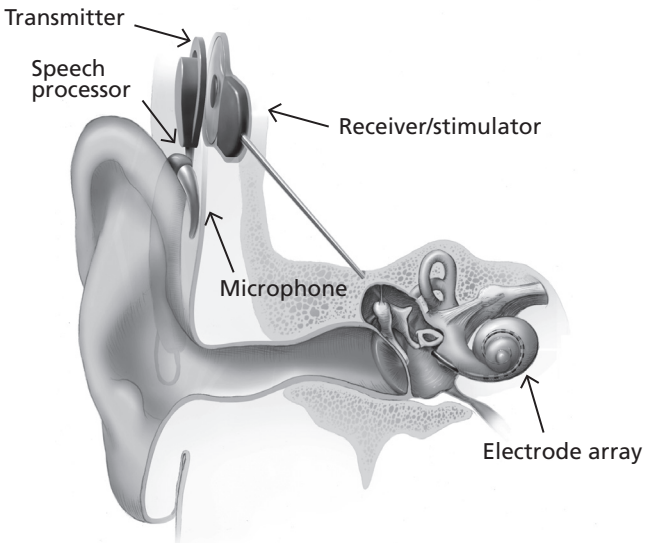
A cochlear implant is a small, complex electronic device that can help to provide a sense of sound to a person who is profoundly deaf or severely hard-of-hearing. The implant consists of an external portion that sits behind the ear and a second portion that is surgically placed under the skin (see figure). An implant has the following parts:

- A microphone, which picks up sound from the environment
- A speech processor, which selects and arranges sounds picked up by the microphone
- A transmitter and receiver/stimulator, which receive signals from the speech processor and convert them into electric impulses
- An electrode array, which is a group of electrodes that collects the impulses from the stimulator and sends them to different regions of the auditory nerve

An implant does not restore normal hearing. Instead, it can give a deaf person a useful representation of sounds in the environment and help him or her to understand speech.

How does a cochlear implant work?

A cochlear implant is very different from a hearing aid. Hearing aids amplify sounds so they may be detected by damaged ears. Cochlear implants bypass damaged portions of the ear and directly stimulate the auditory nerve. Signals generated by the implant are sent by way of the auditory nerve to the brain, which recognizes the signals as sound. Hearing through a cochlear implant is different from normal hearing and takes time to learn or relearn. However, it allows many people to recognize warning signals, understand other sounds in the environment, and understand speech in person or over the telephone.



Ear with cochlear implant
Source: NIH/NIDCD

Who gets cochlear implants?

Children and adults who are deaf or severely hard-of-hearing can be fitted for cochlear implants. As of December 2019, approximately 736,900 registered devices have been implanted worldwide. In the United States, roughly 118,100 devices have been implanted in adults and 65,000 in children. (Estimates provided by the U.S. Food and Drug Administration [FDA], as reported by cochlear implant manufacturers approved for the U.S. market.)

The FDA first approved cochlear implants in the mid-1980s to treat hearing loss in adults. Since 2020, cochlear implants have been FDA-approved for use in eligible children beginning at 9 months of age. For young children who are deaf or severely hard-of-hearing, using a cochlear implant while they are young exposes them to sounds during an optimal period to develop speech and language skills. Research has shown that when these children receive a cochlear implant followed by intensive therapy before

they are 18 months old, they are better able to hear, comprehend sound and music, and speak than their peers who receive implants when they are older. Studies have also shown that eligible children who receive a cochlear implant before 18 months of age can develop language skills at a rate comparable to children with normal hearing, and many succeed in mainstream classrooms.

Some adults who have lost all or most of their hearing later in life can also benefit from cochlear implants. They learn to associate the signals from the implant with sounds they remember, including speech, without requiring any visual cues such as those provided by lipreading or sign language.

How does someone receive a cochlear implant?

Use of a cochlear implant requires both a surgical procedure and significant therapy to learn or relearn the sense of hearing. Not everyone performs at the same level with this device. The decision to receive an implant should involve discussions with medical specialists, including an experienced cochlear-implant surgeon. The process can be expensive. For example, a person's health insurance may cover the expense, but not always. Some individuals may choose not to have a cochlear implant for a variety of personal reasons. Surgical implantations are almost always safe, although complications are a risk factor, just as with any kind of surgery. An additional consideration is learning to interpret the sounds created by an implant. This process takes time and practice. Speech-language pathologists and audiologists are frequently involved in this learning process. Prior to implantation, all of these factors need to be considered.

What does the future hold for cochlear implants?

NIDCD supports research to enhance the benefits of cochlear implants. Scientists are exploring whether using a shortened electrode array, inserted into a portion of the cochlea, for example, can help individuals whose hearing loss is limited to the higher frequencies while preserving their hearing of lower frequencies. Researchers also are looking at the potential benefits of pairing a cochlear implant in one ear with either another cochlear implant or a hearing aid in the other ear.

Where can I find additional information about cochlear implants?

NIDCD maintains a directory of organizations providing information on the normal and disordered processes of hearing, balance, taste, smell, voice, speech, and language. Visit the NIDCD website at *https://www.nidcd.nih.gov/directory* to search the directory.

More NIDCD fact sheets on Hearing and Balance:

- American Sign Language
- Assistive Devices for People with Hearing, Voice, Speech, or Language Disorders
- Auditory Neuropathy
- Captions For Deaf and Hard-of-Hearing Viewers
- Hearing Aids
- Your Baby's Hearing Screening

Visit the NIDCD website at *https://www.nidcd.nih.gov* to read, print, or download fact sheets.

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NIDCD supports and conducts research and research training on the normal and disordered processes of hearing, balance, taste, smell, voice, speech, and language and provides health information, based upon scientific discovery, to the public.

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