

Fact Sheet

Hearing Aids

A hearing aid is a small electronic device worn in or behind the ear that makes sounds louder to someone with hearing loss. Hearing aid technology has improved significantly over the years and hearing aids that are worn today are vastly different from what they used to be even 10 years ago. Nevertheless, only 20 percent of people who could benefit from hearing aids wear them. NIH researchers are seeking ways to advance hearing aid technology to help improve the listening experience and quality of life for millions of Americans who have hearing loss.

Yesterday

- Although hearing devices have been used for centuries, the first electronic hearing aid was developed in the early 1950s. These devices became smaller and more sophisticated over time.
- In the 1970s, directional microphones were incorporated into hearing aids to help a wearer focus on one-to-one conversations in noisy environments. However, early models proved to be of limited benefit, and many manufacturers discontinued their use until the 1990s, when the technology began to improve.
- In 1992, the NIH and Department of Veterans Affairs (VA) began an innovative collaboration to support the development of more advanced hearing aids. Initiatives included grant funding to determine how hearing aids affect speech understanding in noisy and quiet environments as well as how to measure and predict the benefits of hearing aids. In addition, the NIH and VA awarded a contract to support the design and evaluation of creative new technologies and strategies for hearing aids.
- In 1995, the NIH, VA, and National Aeronautics and Space Administration (NASA) joined forces to survey all federal laboratories for acoustic or electronic technology that might be applicable to the improvement of hearing aids. This multi-agency initiative resulted in productive partnerships between neuroscientists, clinicians, engineers, federal laboratories, and industry.
- The first completely digital hearing aids became available commercially in the mid-1990s. Digital aids can be programmed to amplify some frequencies more than others and can be adjusted to the wearer's needs and to certain listening environments. They also can be programmed to focus on sounds coming from a specific direction.
- In 1996, NIH and the VA initiated the Hearing Aid Clinical Trial, the first large-scale double-blind, multicenter clinical trial to demonstrate the efficacy of three types of analog hearing aids in both quiet and noisy environments for a wide range of individuals with hearing loss. The study showed that all three types provide substantial improvement for people both in quiet and noise.

Today

- An estimated 15 percent of American adults report having some form of hearing loss. Nearly half of adults ages 75 years and older have hearing loss.
- A vast array of hearing aid technologies is currently available, from simple and relatively inexpensive analog circuits to complex and expensive digital devices that require sophisticated fitting procedures. The average price of a digital hearing aid is about \$1500, with top-of-the-line devices costing \$3000-\$5000.

- For the past decade, the NIH and VA have cosponsored a biennial conference to facilitate the flow of information among researchers on recent findings and advances in hearing aid technology. The current series, titled the International Hearing Aid Research Conference (IHCON), is a meeting of national and international importance in fields related to hearing aid research and development.
- Scientists continue to search for ways to improve a hearing aid wearer's ability to understand speech in a noisy background, such as a crowded room.
- A partnership supported by NIH and NASA, borne out of the 1995 survey of federal agencies, could potentially revolutionize the technology used for directional microphones. The technology is based on the ears of a parasitic fly, *Ormia ochracea*. Despite their small size and the short distance between them, *Ormia's* ears are able to rapidly pinpoint the location from which the sound of a potential host—a cricket—is coming, even in a noisy environment. The intriguing mechanism that enables *Ormia* to accomplish this feat has provided a model for scientists and engineers to use in developing miniature directional microphones for hearing aids that can better focus on speech in a single conversation, even when surrounded by other voices.
- *Predicting hearing loss and the benefit of hearing aids.* Scientists are studying the genes that cause deafness to predict which individuals are at risk of losing some or all of their hearing. In addition, researchers are conducting studies to determine which individuals can most benefit from hearing aids and the best ways to select and fit hearing aids in children and other people whose hearing ability is difficult to test.
- *Personalized treatments.* Scientists are continuing to develop treatments for hearing loss that can be tailored to individuals' unique needs. The combined use of a hearing aid and a variation of the cochlear implant is one treatment being explored. A hearing aid in one ear combined with a shortened electrode array inserted into a portion of the cochlea of the other ear have proven to be effective in allowing individuals with hearing loss in the high frequencies to improve hearing. More work needs to be done to determine which individuals should receive these combined devices and which devices yield the most benefit.
- *Preemptive approaches.* Researchers continue to conduct studies to determine the age at which hearing aids provide maximum success in early language development.

Tomorrow

- The NIH is positioned to continue making major discoveries in *predicting* the benefit of hearing aids, *personalizing* individual treatments through the use of hearing aids, and *preempting* difficulties associated with hearing loss, such as language problems, through early treatment with hearing aids.

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