

## Northwestern Medicine Cochlear Implant Program for Adults

# FREQUENTLY ASKED QUESTIONS

### Cochlear Implants

The following information refers to cochlear implants for adults. Although many parts of the discussion are also applicable to children, the evaluation process and expected outcomes sections are specifically geared toward adults.

**What is a cochlear implant?**

**How does a cochlear implant work?**

**How is a cochlear implant different from a hearing aid?**

**Who is a candidate for a cochlear implant?**

**What is the evaluation process for getting a cochlear implant?**

**Who manufactures cochlear implants?**

**What do I do if I think I'm a cochlear implant candidate?**

**Who does the surgery for a cochlear implant?**

**What risks are associated with cochlear implant surgery?**

**How soon after surgery does the patient hear with a cochlear implant?**

**What happens during device "activation?"**

**How much benefit does a patient receive from a cochlear implant?**

**What if a better implant is developed after I get mine?**

**Do people with cochlear implants continue to use a hearing aid on the non-implant side?**

**What about two cochlear implants—one for each ear?**

**Does a cochlear implant user ever stop learning to hear better?**

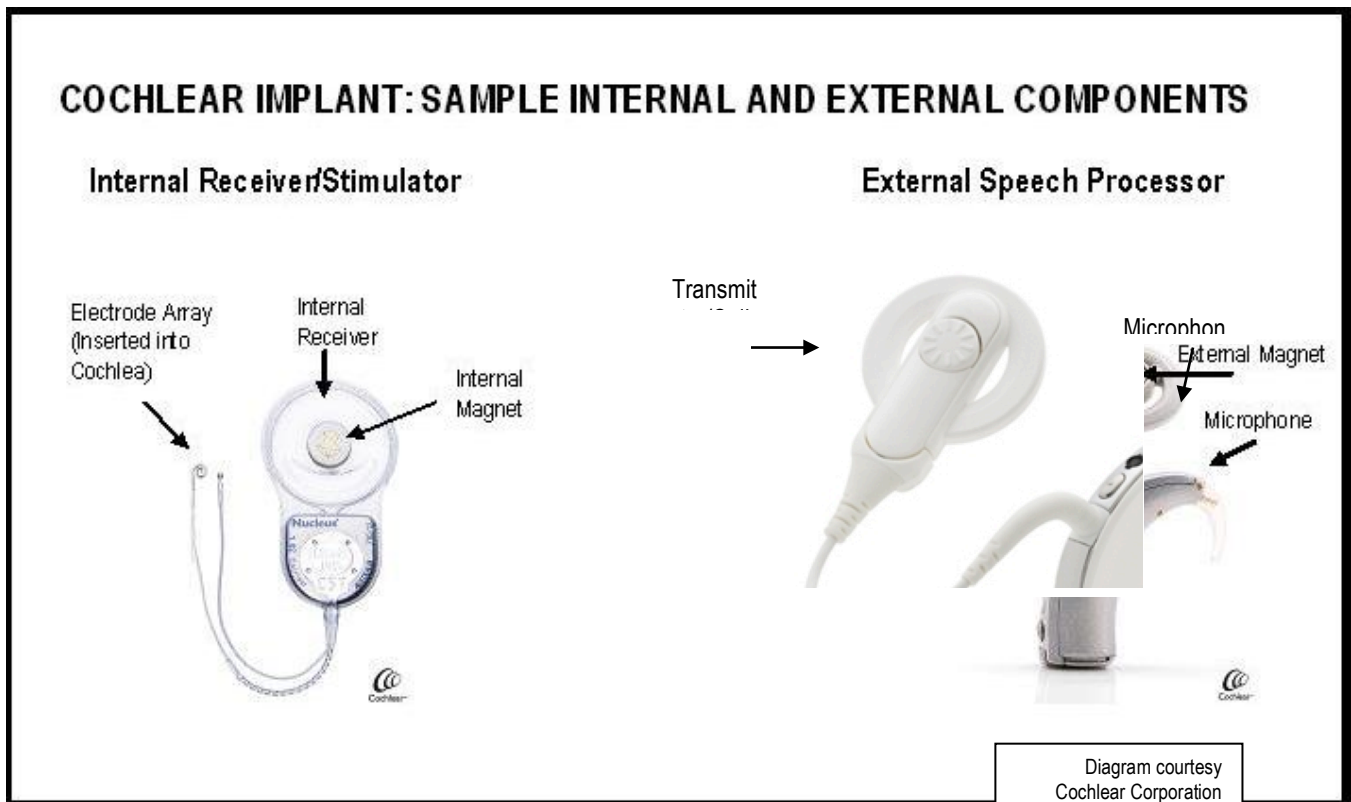


**What is a cochlear implant?**

A cochlear implant provides a perception of sound to those who would not otherwise have access to sound. The implant changes sounds into electrical pulses which stimulate

the auditory (hearing) nerve directly. The auditory nerve sends these coded electrical pulses to the brain, which is where we really “hear.”

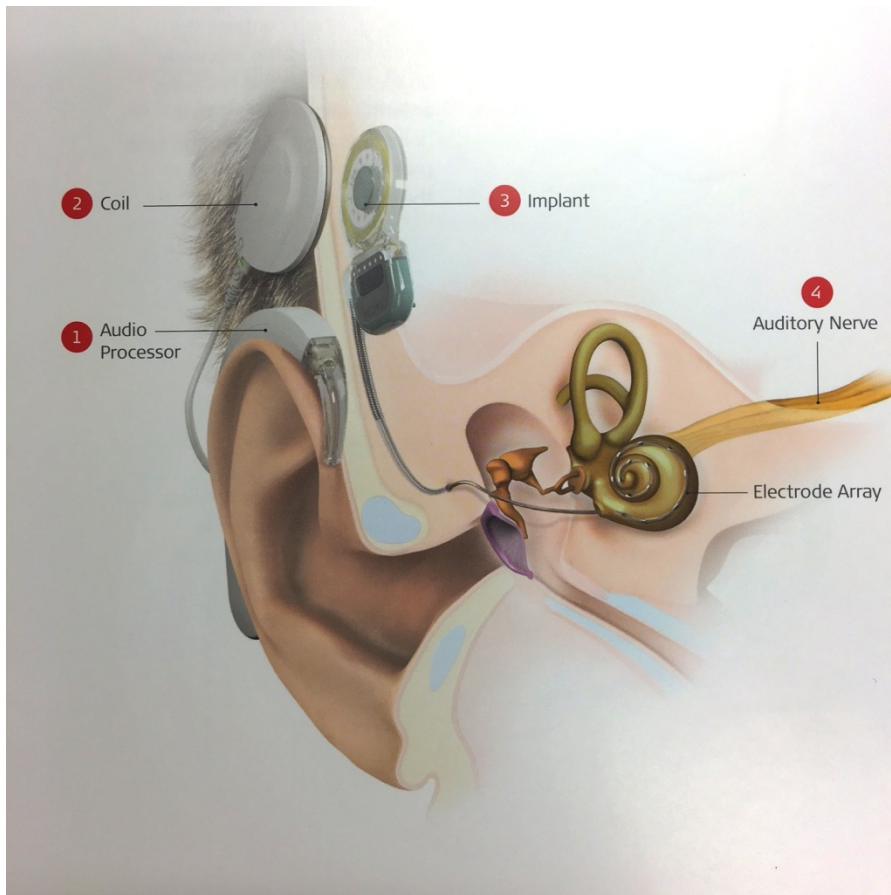
The cochlear implant device has two pieces. One piece (internal receiver/stimulator) is implanted into the inner ear during a surgical procedure. The other piece, the speech processor and transmitter/coil, is worn on the outside. Each piece has a magnet. The two magnets attract across the skin, and communicate via radio signals sent across the skin.



### How does a cochlear implant work?

Sound goes into the microphone of the speech processor. Features of sound (pitch, loudness, and timing) are converted into digital signals. These signals are coded into electrical pulses which are sent via the transmitting coil across the scalp to the internal receiver/stimulator. Pulses then move on to the tiny electrode array inside the cochlea where nerve fibers then send this coded message up to the brain. Please see the following diagram for more information.

## How a Cochlear Implant



1. Sounds are picked up by the microphone in the audio processor. The processor analyzes and codes sounds into a special pattern of digital information.
2. This information is sent to the coil

Diagram courtesy



### How is a cochlear implant different from a hearing aid?

Hearing aids deliver wonderful, clear sound through the “normal” auditory pathway. But hearing aids rely on the cochlea (inner ear) to transmit sound to the auditory nerve and on to the brain. Sometimes the sensory cells in the cochlea are simply not able to transmit clear sound; instead the cochlea adds distortion so that words are not clear. Words may sound garbled and render speech unintelligible to the listener. A cochlear implant candidate can often hear when someone is talking, but they cannot distinguish the talker’s words.

A cochlear implant can be thought of as a cochlear bypass. It replaces the function of the sensory cells in the cochlea and sends auditory information up the auditory pathway beyond the distortions of the cochlea. Auditory nerve fibers are directly stimulated by electrodes implanted into the cochlea.

### **Who is a candidate for a cochlear implant?**

Children and adults who have significant hearing loss and receive little or no benefit from traditional hearing aids may be cochlear implant candidates. In general, an adult who cannot understand speech well enough to use the telephone or someone who uses the phone with difficulty may be a cochlear implant candidate. (The telephone transmits only auditory information and does not provide access to visual cues so it is a quick estimate of someone's speech understanding.)

### **What is the evaluation process for getting a cochlear implant?**

A CT and/or MRI scan is done to determine if the channels of the cochlea are open so that a cochlear implant can be easily inserted. If there is narrowing or obliteration of these channels, a special electrode array may be necessary. The surgeon needs to know if there is anything unique about an individual's anatomy that would affect the surgery or possible outcomes.

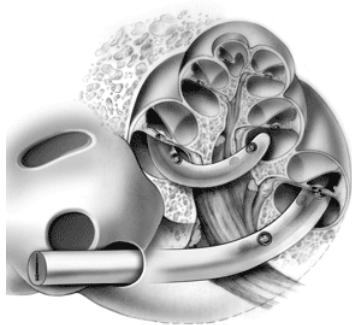


Diagram illustrating electrode array of cochlear implant inserted into the open channels of a cochlea

The audiologist does a hearing test in a sound-treated room that includes evaluation of sensitivity to tones, and word recognition under earphones. S/he will also do testing while hearing aids are worn. These tests are often very frustrating to cochlear implant candidates because listening to and repeating words and sentences is very difficult. This testing is necessary to determine for sure that test scores meet the candidacy requirements for a cochlear implant. In addition, these scores will serve as a baseline to measure post-implant improvement.

Cochlear implant surgery is done under general anesthesia. A candidate must be healthy enough to go through the surgery, and may require clearance from a primary care physician.

**What do I do if I think I'm a cochlear implant candidate?**

Ask your audiologist or physician if they think you might be a candidate. If your audiologist or physician isn't sure about candidacy criteria, contact an audiologist on Northwestern's Cochlear Implant Team via email; Pamela Fiebig, AuD [pfiebig@nm.org](mailto:pfiebig@nm.org) or Lindsay Weberling, AuD [lweberli@nm.org](mailto:lweberli@nm.org)

## Who manufactures cochlear implants?

There are currently (February, 2016) three FDA-approved cochlear implant systems:

- Advanced Bionics 90K Advantage implant and Naida CI Q90 Sound Processor
- Cochlear Corporation Nucleus Freedom Contour Advance, CI 522, or L24 Hybrid implant and Nucleus 6 Sound Processor
- Med-El Corporation Concert or Synchrony implant and Rondo or Sonnet Sound Processor

Northwestern has excellent working relationships with all three of the manufacturers. For more information about individual products, the manufacturers' websites have a wealth of information:



Advanced Bionics®

[www.advancedbionics.com](http://www.advancedbionics.com)

[www.medel.com](http://www.medel.com)



Cochlear™

Hear now. And always

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## Who does the surgery for a cochlear implant?

Cochlear implant surgery is done by a physician who specializes in ear surgery, an otologist (a subspecialty of otolaryngology). The surgery is performed under general anesthesia and takes approximately 90 minutes. For most patients this is an outpatient procedure; there is no overnight stay.

## What risks are associated with cochlear implant surgery?

Specific risks should be discussed with the surgeon. In general, cochlear implant surgery is considered to have minimal risks. In many cases, the residual hearing in the operated ear(s) is

lost; however, surgeons at Northwestern have been successful with residual hearing preservation in some cases. Many patients are dizzy for a few hours or days after surgery. Pain levels associated with the surgery are very individual—some patients require nothing more than a simple over-the-counter pain killer, some require prescription pain medication.

### **What about meningitis?**

The risk of meningitis in cochlear implant patients is slightly higher than in the general population. Because of this, surgeons recommend that patients obtain a vaccine to guard against the bacteria that is associated with meningitis prior to surgery. For more information from the FDA about meningitis and cochlear implants, go to:

<http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/PatientAlerts/ucm064737.htm>

[http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6140a4.htm?s\\_cid=mm6140a4\\_w](http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6140a4.htm?s_cid=mm6140a4_w)

### **How soon after surgery does the patient hear with a cochlear implant?**

At least a week is allowed after surgery for healing so that wearing the external equipment is comfortable. This is the initial “activation” of the device.

### **What happens at “activation?”**

First, the audiologist figures out what strength magnet is necessary to secure the headpiece to the patient’s head and make connection with the internal device. Next, s/he will connect the speech processor to the programming computer and place the speech processor on the patient’s head. S/he will then test the internal device to make sure all of the electrodes are functioning.

Next s/he will create a listening “map”. Usually the patient will listen to some beeping sounds which are generated by the computer. The patient is asked to give the audiologist information about when the sounds become audible and how the loudness of the sounds changes as the amount of electrical current is increased. At some point the audiologist will activate the microphone of the speech processor and external sound will be heard through the device for the first time!

The goal for the map(s) on the initial day of stimulation is to have sound that is comfortable--a listening map that the patient can use without physical discomfort.

### **What does a patient hear when the microphone is first turned on?**

Results vary from hearing buzzing noises to hearing and understanding speech. Most

people report that speech is not clear on the first day; speech can sound robotic or like Daffy Duck. These perceptions change very quickly as the brain becomes accustomed to its new input source. How quickly sound becomes “natural” through an implant varies greatly from person-to-person. The brain learns to match these new auditory sensations with auditory memories and combines that with visual cues. Patience, persistence and practice are necessary and will provide great rewards!



### **How much benefit does a patient receive from a cochlear implant?**

No one can predict the specific hearing outcome with a cochlear implant. It is extremely rare (much less than 1%) for no benefit to be realized with a cochlear implant. There are some general statements that can be made about outcomes based on data collected from groups of past adult implant recipients:

- People who have once had hearing and have lost it have better outcomes than people who have never had hearing. People who have fully-developed speech and language skills have auditory memory which can be stimulated with the new input source of a cochlear implant.
- People who have more residual hearing at time of surgery have better outcomes than people with very little measurable hearing at the time of implant. Although not a guarantee, the presence of measurable hearing suggests that there are viable neural elements present to be stimulated by the implant.
- People who have been deaf for a short period of time have better outcomes than people with long-term deafness. Recent auditory memory is typically more efficient at learning to interpret sound through a cochlear implant.
- Younger people do better than older people. As we age, our brains do not learn as quickly as when we are younger.

It is important to remember that the above statements regarding outcome are general and there are always exceptions!

### **Are cochlear implant users able to use the telephone?**

Many cochlear implant users are able to use the telephone. The telephone requires excellent listening skills. One has to be able to understand without access to visual cues and often the sound quality of a telephone is not as good as face-to-face communication. It is also important to remember that telephone communication requires both hearing and speaking. Not only do listening skills have to be well-developed, the user's speech production must be good enough to be intelligible to the other caller. Today's cochlear implants have many accessories which can assist in developing effective telephone skills.

### **What if a better implant is developed after I get mine?**

Remember—there are two components to a cochlear implant: the part that is actually implanted and the external speech processor. No one is going to remove a working internal device to “upgrade” to a new system. However, many new *external* upgrades

with either programming software and/or newly designed speech processors are made to be “backward-compatible”. That is, upgrades to external equipment are very common, and these upgrades can often be applied to older internal devices. All three manufacturers of cochlear implants are committed to providing as much improvement possible to recipients who already have their internal devices.

### **Which cochlear implant is best?**

Choosing a cochlear implant system is an important decision. Features of both the internal and external components should be considered. The choice should be discussed with both the surgeon and the audiologist who will be involved in your cochlear implant care.

### **Do people with cochlear implants continue to use a hearing aid on the non-implant side?**

Some people do and some don't. This is an individual decision that needs to be made by the cochlear implant user. Many patients find that having some sound input from a hearing aid on the opposite side is very beneficial. Others feel that the hearing aid does not provide any additional information, so they choose not to wear the hearing aid.

### **What about two cochlear implants—one for each ear?**

As technology has improved, bilateral (one for each ear) implants have become more common. Bilateral implant users report better overall sound quality, better hearing in background noise, and improved ability to locate where sounds are coming from. The possibility of two cochlear implants should be discussed with your implant team. Two implants can be done simultaneously (at the same surgery) or sequentially (first one surgery and then at a later date, the second). Most bilateral recipients have gone the sequential route.

### **Does a cochlear implant user ever stop learning to hear better?**

NEVER! The period of greatest learning and hearing improvement is typically during the first 6 months after activation. However, patients report that learning to hear more and in more different listening situations is a life-long process. Patience! Perseverance! Practice!

For more information about cochlear implants at Northwestern, please contact one of the audiologists on the implant team: Pamela Fiebig, AuD [pfiebig@nm.org](mailto:pfiebig@nm.org) or Lindsay Weberling, AuD [lweberli@nm.org](mailto:lweberli@nm.org)