

# Cochlear Implants

## Navigating a Forest of Information...One Tree at a Time

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

by [Debra Nussbaum](#), M.A., CCC-A/March 2003

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## Getting Started—An Introduction

Growing numbers of children and families from a variety of backgrounds and using a variety of communication methodologies are choosing use of cochlear implant technology.

During its early history, a cochlear implant was felt to be most beneficial for adults, especially adults who had lost their hearing later in life. As the technology has improved and the risks related to the surgery have lessened, use of this technology is increasing for a growing population of persons with hearing loss, specifically young children who are implanted prior to learning language.

More than 700 professionals involved with cochlear implants attended the February 2001 symposium on Cochlear Implants in Children, hosted by the House Ear Institute in Los Angeles. Of note is the fact that just five years before, this conference attracted only 20 people.

As the number of implanted children has increased, so has the variability in student outcomes related to the use of spoken language. Many long-term outcomes continue to be unknown due to the changing characteristics of both the cochlear implants themselves and the children who are receiving them. Cochlear implants are improving in their potential to provide implant users with increasingly sophisticated sound-processing systems. In addition, the pool of children receiving cochlear implants is growing quickly in number and diversity and now includes greater numbers of students implanted at younger ages than in the past. All of these factors make early research difficult to apply to the outcomes for the new generation of students obtaining cochlear implants.

Variability in student outcomes with cochlear implants necessitates a look at educational and communication programming for these students through the same lens that we look at variability in the population of deaf children who do not use cochlear implants. Just as there is no single profile of a “deaf” child, there is no single profile of a deaf child with a cochlear implant. As professionals provide information and families make decisions about cochlear implant technology, there are many things to consider ranging from the medical aspects of the procedure and educational and communication aspects of the technology, to the practical, day-to-day life issues surrounding the implant.

As coordinator of the [Cochlear Implant Education Center](#) at Gallaudet University’s Laurent Clerc National Deaf Education Center and an audiologist by training, I have been working since 1977 with deaf children and their families. Through my direct experiences and the opportunities to network—with families, audiologists, doctors, speech-language pathologists, school administrators, teachers, and cochlear implant users throughout the country—I have had the opportunity to discover and evaluate the wealth of excellent (and not so excellent) available resources on cochlear implants for children and adolescents.

This document is designed to assist parents and educators in navigating the way through this extensive “forest” of information. It additionally provides insights into topics where

the Web has limited information—specifically educational considerations related to the diverse group of children with cochlear implants now assimilating into our schools. As you read this document, keep in mind that while cochlear implants provide a range of opportunities, they are not appropriate for every deaf child. It is important that decisions to utilize this technology be made looking at the whole child within the family unit and with respect for individual choice.

Hopefully, my hours of investigating resources can cut down on the time needed for others to find their way through the often dense forest of information on cochlear implants, as well as provide a few new insights into this topic. Let's navigate the path one tree at a time.

*Note: These modules are not in a specific order.*



### **What is a Cochlear Implant?**

Includes:

Components of the Device

How a Cochlear Implant Works



### **Cochlear Implant Candidacy**

Includes:

Who is a Candidate?

Who is Not a Candidate?

Other Factors Impacting Candidacy



### **Factors Influencing Performance**

Includes:

The Benefits and Limitations of Cochlear Implants

Performance: Things to Keep in Mind

Factors Impacting Performance

In Summary



### **The Decision-Making Process**

Includes:

Realistic Expectations

Level of Commitment

Looking at the Whole Deaf Child

Including Older Students

Gathering Information



### **Considerations in the Implantation Process**

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Beginning the Process

What's Involved in the Process?

Choices During the Implantation Process

Things to Ask the Cochlear Implant Center

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Issues Related to Coverage  
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 **Surgical Considerations**


Includes:  
During Surgery  
After Surgery  
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Includes:  
Placement Options  
Considerations for Making Decisions

 **Choosing a Communication Methodology**

Includes:  
Issues to Keep in Mind  
Communication Environment

 **Considerations for the Use of Sign Language**


Includes:  
The Debate  
Growing Support for the Use of Sign Language  
Basic Beliefs  
Reasons to Consider Sign Language Use for Children with a Cochlear Implant  
Varied Roles of Sign Language  
What Literature Reports About Sign Language and Cochlear Implants  
Considerations for Educational Placement  
Developing Spoken Language in Signing Environments

 **Cochlear Implants and the Deaf Community**

Includes:  
Definition of the Deaf Community  
Definition of Deaf Culture  
Deaf Community View on Cochlear Implants  
National Association of the Deaf Position Paper

 **Fitting the Speech Processor**

Includes:  
Setting a Map  
Speech-processing Strategies

 **Training the Ear to Listen**

Includes:  
Considerations for Training  
Equipment Troubleshooting

The Stages of Listening and Speaking Development  
Skill Assessment  
Curriculum Guides  
Adjusting Communication Variables  
Sign Language as a Support to Listening  
About Auditory-Verbal Therapy



## **Resources**

Includes:

Manufacturer Information

Agencies/organizations

Web Resources

Suggested Scales of Development and Assessment Tools

Computer Software for Developing Spoken Language Skills

Curricula/Training Programs

Books

Additional Resources

## What is a Cochlear Implant?

A cochlear implant is a technological device intended to enhance the hearing of persons who are deaf. There are more than 70,000 people (as of fall 2005) with cochlear implants worldwide—and about half are children. Experience and research suggest that a cochlear implant can bring a greater awareness to a broader range of sounds for many deaf children in comparison to traditional hearing aids. Use of this device requires participation in an often rigorous pre-implantation protocol to determine [candidacy](#), [surgery](#) to implant a portion of the device, an activation process to program an externally worn portion of the device, and participation in an intensive auditory training program, as well as an appropriate [educational program](#) to actualize benefit from the device.

There are three manufacturers of cochlear implants commonly used in the United States. Each of these manufacturers provides extensive (promotional) resources at no charge about their specific brand of cochlear implant, as well as general information about implants. (See the contact information for each of the manufacturers in the [Resources](#) section.)

- [Advanced Bionics Corporation](#) is the manufacturer of the body-worn Platinum Sound Processor and HiRes AURIA behind-the-ear device. Older generation devices include the CII BTE™ and Platinum BTE.™



- [Cochlear Corporation](#) is the manufacturer of the Nucleus<sup>®</sup> Freedom<sup>™</sup> body-worn and ear-level devices. Older generations of the device include the Spectra and Sprint body-worn processors and the Esprit and 3G BTE processors.



- [MED-EL Corporation](#) is the manufacturer of the TEMPO+ speech processor which provides a total of five wearing options. It has a modular design and four available battery packs.



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## Components of the Device

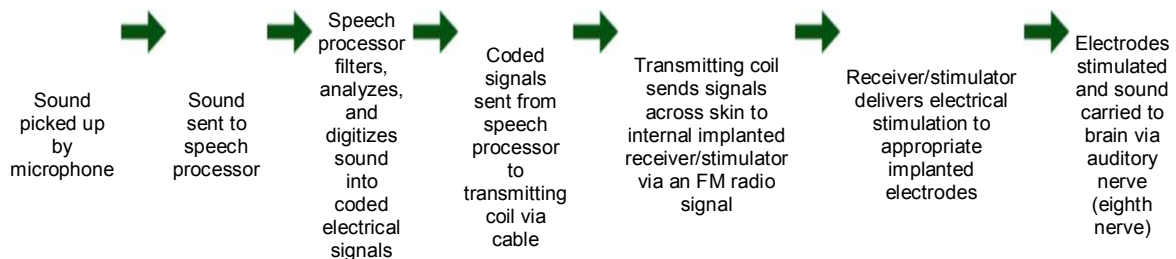
A cochlear implant is comprised of surgically implanted and externally worn components. The surgically implanted components include:

- a **receiver/stimulator** housed in a bio-compatible case, which is surgically implanted under the skin behind the ear, and contains a magnet, which couples to the magnet in the transmitter worn externally; and
- an **electrode array** inserted into the cochlea to provide direct electrical stimulation to remaining nerve fibers.

The externally worn, non-implanted components of the device include:

- a **microphone** similar to the microphone of a hearing aid,
- a **speech processor** that can be worn on the body (pager style, connected to the headpiece by a cable) or behind the ear (similar to a hearing aid), and
- a **transmitting coil**, a small disk about the size of a quarter, which adheres to the skin behind the ear via a magnet and is connected to the microphone by a small cable.

## How a Cochlear Implant Works



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For more information about how a cochlear implant works, see:

[MED-EL: How a Cochlear Implant Works](#)

Advanced Bionics: [How Implants Work](#) and [Bionic Ear Informational Videos](#)

[Cochlear Americas: How Cochlear Implants Work](#)

### **For More Information**

While it is unknown how any one person perceives sound through a cochlear implant, the following Web site provides sound simulations that approximate this experience:

<http://www.utdallas.edu/~loizou/cimplants/tutorial/>

Fact Sheets describing the basic components of a cochlear implant can be found at the following Web sites:

[The Alexander Graham Bell Association for the Deaf and Hard of Hearing \(AG Bell\)](#)

[AG Bell: Kids and Cochlear Implants: Getting Connected \(PDF\)](#)

[The American Speech-Language-Hearing Association \(ASHA\)](#)

[The Cochlear Implant Association, Inc. \(CIAI\)](#)

[Educational Resources Information Center \(ERIC\): Educating Children Who Are Deaf or Hard of Hearing: Cochlear Implants](#)

[The National Institute on Deafness and Other Communication Disorders \(NIDCD\)](#)

[U.S. Food and Drug Administration: Cochlear Implants](#)

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# Cochlear Implant Candidacy

A variety of requirements are considered for children in determining candidacy for a cochlear implant. These requirements continue to change, especially in relation to minimum age of implantation. Minimum age requirements continue to be reduced due to limited surgical risks and improved outcomes for children implanted at the youngest ages.

It is recommended that the candidacy process include a team approach that involves the family and professionals from both the medical and educational settings that are involved with the child. This will ensure that each child is an appropriate candidate for a cochlear implant, each family has realistic expectations regarding outcomes for the implant, and training and educational components are in place to assist in helping the child actualize benefit from the implant.

Obtaining accurate audiological information is at the core of making appropriate recommendations related to cochlear implant candidacy. While some audiological tests are more definitive and less objective than others, obtaining a precise description of a child's hearing level requires a comprehensive audiological test battery completed by an experienced pediatric audiologist. It is important that the audiologist on the implant team be experienced in fitting and facilitating hearing aid use, making recommendations related to cochlear implantation, and fitting of the implant device following implantation so that any decisions regarding implantation are made with complete information. For more information about hearing evaluations, see: [Hearing Screening](#) from the American Speech-Language-Hearing Association (ASHA) and/or ASHA's [Guidelines for the Audiologic Assessment of Children from Birth to 5 Years of Age](#) (PDF).

## Who Is a Candidate?

While each hospital implant center may have unique candidacy requirements, general candidacy issues for children are as follows:

- In 2002, the Food and Drug Administration (FDA) lowered the recommended age requirement to 12 months of age. While this is the FDA-recommended age, this age is not legally binding and some hospital centers are completing the procedure

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earlier based on expectations of improved outcomes for early implantation. In addition, specific circumstances may allow for earlier implantation. For example, if meningitis is the cause of hearing loss, it may be important for the child to be implanted as early as possible as this condition causes ossification (bone build up) in the cochlea, making it increasingly difficult to surgically insert the electrode array as time passes. *Note: There may be questions related to insurance payment for the procedure if it is completed prior to 12 months of age.*

- The FDA states that a child should have a bilateral (both ears), profound sensorineural hearing loss; however, increasing numbers of children with hearing loss in the severe range are being considered for cochlear implants.
- Negligible functional benefit (limited open-set speech recognition) from appropriate amplification is often mentioned as a criterion. When such measures cannot be obtained on young children, hospital centers make individual decisions regarding whether or not a child would be able to do well on such tests given documented hearing levels and traditional hearing aids. There are varied implant center requirements regarding the use of traditional hearing aids prior to implantation. Some centers waive an extended hearing aid trial requirement in the interest of time when it is clear that the child would perform better with a cochlear implant.
- A child who is failing to progress in speech, language, and listening development with traditional hearing aids based on parent reports and educational information, may be considered as a candidate.
- Family willingness to follow recommendations; enroll in speech, language, and listening therapy; and return for follow-up appointments are factors in candidacy.
- Having no medical contraindications to electrode insertion or receiver placement is a factor in candidacy.
- Educational and home environments that are supportive of cochlear implants are factors in candidacy.

## Who Is *Not* a Candidate?

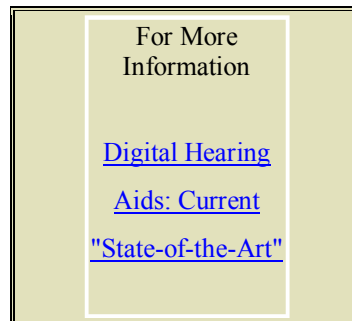
Some characteristics of a child who may not be a candidate for a cochlear implant include:

- a child that does not have the eighth nerve (auditory nerve) which carries sound from the cochlea to the brain as determined by a CAT scan (x-ray) and/or Magnetic Resonance Imaging (MRI) during the candidacy process. (See "[What's Involved in the Process?](#)" in [Considerations in the Implantation Process.](#)) and
- a child who has significant residual hearing levels and receives good benefit from traditional hearing aid devices.

## Other Factors Impacting Candidacy

Some hospital implant centers may also look at the following issues when determining candidacy:

- Some centers may not implant children with severe emotional, behavioral, or cognitive delays when it is perceived that these characteristics may prevent participation in the educational/training programs necessary to actualize benefit from the cochlear implant.
- Some children obtain substantial access to sound from the technology of state-of-the-art digital hearing aids or other hearing devices. Without surgical intervention, these devices may be an equally effective choice for some children.
- While cochlear implants are typically used with individuals with sensorineural hearing loss, use of a cochlear implant is also being considered as a possible intervention for children with auditory neuropathy/auditory dys-synchrony. The term "AN/AD" applies to patients who display auditory characteristics consistent with normal outer hair cell function and dys-synchronous responses of the eighth



nerve (Hood, L., February 2002, Auditory neuropathy/auditory dys-synchrony: New insights. *The Hearing Journal*.)

- Some cochlear implant centers strongly suggest participation in an oral educational setting. They may hesitate upon considering students and families that include sign language in their communication approach for their child. It's important that all involved persons are aware of the many factors in choosing a communication methodology/educational approach for children following cochlear implantation. (See [Choosing an Educational Setting](#) and [Choosing a Communication Methodology](#).)

For additional information on candidacy requirements, see the following:

- [Cochlear Implant Candidacy Expands \(ASHA Web site\)](#)
- [Candidacy Criteria](#) (Cochlear Americas Web site)

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## Factors Influencing Performance

"I'll try to make a visual picture that relates to the way sound is heard by a child with a cochlear implant. Suppose that you have to identify a four-legged animal, and you've not seen that animal before, but you have to figure out what it is. Maybe you have to draw it. Maybe you have to learn the name for it. Now, that animal is standing behind a bunch of trees. To see that animal, you have to look through tree trunks that are hiding big parts of that animal. Now, if you were looking through those trees with the equivalent of a hearing aid, you could probably only see the tail end of that animal, because you could only hear the low frequencies with that hearing aid. With a cochlear implant, though, you could see pieces of that animal's head, pieces of its neck, its legs, its body, and pieces of its tail end, but you still would be missing pieces in between each of those that you could see. The reason I'm bringing this up for you to think about is because it's important for us to realize that children who are using cochlear implants still don't see the whole animal. They see more of a range of that animal, but they have to use their brains. They have to use what they already know about the world. They have to use their cognitive abilities to fill in those gaps to be able to put together a picture of that whole animal. That's the kind of task that a child is facing using a cochlear implant."

*Dr. Patricia Spencer. Considerations for the Future: Putting It All Together, Presented at [Cochlear Implants and Sign Language conference, April, 2002.](#)*

### **Benefits and Limitations of a Cochlear Implant**

What does it mean when it is said that a child with a cochlear implant can "hear"?

A cochlear implant CAN:

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- provide access to sound by bypassing the damaged or destroyed hair cells in the cochlea, thereby enabling the user to perceive sound;
- convert sound into electrical signals and send these signals to the auditory nerve and then the brain;
- provide more access to speech information than traditional hearing aids (digital or transpositional);
- provide improved speech perception for many children with intensive training;  
and

A cochlear implant DOES NOT:

- interpret sound,
- provide guaranteed potential to understand complex connected spoken language ,  
or

The process and ultimate outcome of "making sense" of the sound available through a cochlear implant is individual to each child. Learning to listen and speak is sequential, one skill building upon another. Moving through the sequence happens more readily for some children than for others. In addition, some children move higher in the hierarchy of skill development than others.

### **Performance: Things to Keep in Mind**

*Outcomes will vary for each child.* Complete understanding of spoken language, similar to hearing children, may not be the outcome for all children with cochlear implants. Based on the factors discussed below, some children may obtain this outcome while others may not. Unfortunately, it is often not possible to predict how a child will function.

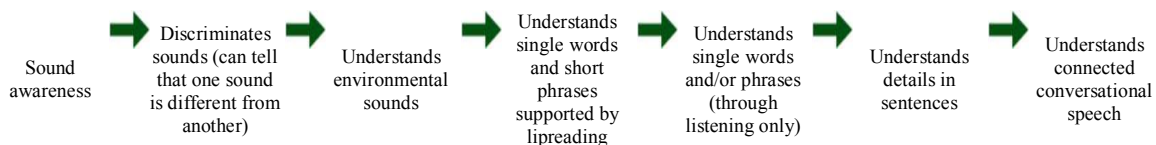
*Developing effective listening skills is a process.* The process of “making sense” of the sound available through a cochlear implant is individual to each child. It is unrealistic to think that each child will understand what he or she hears immediately or soon after his or her implant is “hooked up.” Even children who have listening experience prior to cochlear implantation may encounter an adjustment time learning to listen “electronically” as opposed to “acoustically.” In fact, some children with good listening skills through their hearing aids prior to cochlear implantation seem to regress temporarily as this adjustment occurs. Learning to listen is sequential, one skill building

upon another. Moving through the sequence happens more readily for some children than for others. In addition, some children move higher in the hierarchy of skills than others.

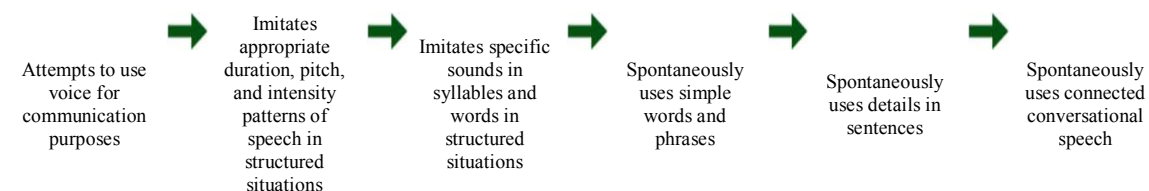
These hierarchies are examples of the levels of competency a child may obtain with his or her cochlear implant. Progress in moving through these hierarchies requires training by therapists, family, and teachers who understand how to facilitate these skills (see **Training the Ear to Listen**).

These hierarchies are examples of the levels of competency a child may obtain with his or her cochlear implant. Progress in moving through these hierarchies requires training by therapists, family, and teachers who understand how to facilitate these skills (see [Training the Ear to Listen](#)).

Receptive listening skill development:



Expressive skill development:



## Factors Impacting Performance

Performance outcomes related to listening and speaking depend on many complex and interactive factors. Each of the factors listed below should be taken into consideration as decisions are made for a child related to language and communication planning, educational placement, and listening and speech training. (See [Choosing a Communication Methodology](#), [Choosing an Educational Setting](#), and [Considerations for the Use of Sign Language](#).)

- [age of implantation](#),

- [pre-implant duration of deafness](#),
- [age-appropriate sign or spoken language competence](#),
- [previous listening experience](#),
- [status of cochlea](#),
- [cause of hearing loss](#),
- [family support and motivation](#),
- [consistency of usage](#),
- [cochlear implant technology](#),
- [appropriate programming of device](#),
- [additional special needs](#), and
- [quality and consistency of educational and habilitative environment](#).

### **Age of Implantation**

Research and observation suggest that spoken language performance outcomes are best for those who are implanted very young when language is typically developing. This is the time when the brain most readily masters language. For children implanted at the youngest ages (prior to 18 months), spoken language appears to emerge most naturally. As children are implanted at progressively later ages, outcomes and rate of development are varied. (McConkey Robbins, A., Burton Koch, D., Osberger, M.J., Zimmerman-Phillips, S., & Kishon-Rabin, L. (2004). Effect of age at cochlear implantation on auditory skill development in infants and toddlers. [Journal of Otolaryngology-Head & Neck Surgery](#), 130, 570-574.)

Based on the outcomes observed in many young implanted children, it appears that the simulated sense of hearing offered through a cochlear implant can offer an excellent opportunity for a child to progress in language "developmentally" rather than "remedially." Younger children with implants tend to acquire spoken language readily in natural listening environments. Even with early implantation and natural exposure to

spoken language, opportunities for structured auditory and speech-training may also be beneficial to promote optimal benefit from the cochlear implant.

For further discussion regarding implantation of young children, see:

[\*Cochlear Implantation Below 12 Months Of Age: Challenges And Considerations\*](#) and [\*Cochlear Implantation in Children Younger Than 12 Months\*](#).

For children who are implanted after the early language learning years, "success" may need a broader definition. For later implanted children, observation and research suggest that while there is increased benefit from a cochlear implant in comparison to traditional hearing aids, existing auditory delays at the time of implantation present a continued educational and rehabilitation challenge. Pre-lingually deaf children implanted beyond the language learning years may enjoy their implant, however, they may not progress to the highest levels in the hierarchy of auditory and speech development. This is not to say that a cochlear implant may not be an appropriate choice for an older pre-lingually child, it is just to say that expectations should be guarded and realistic related to outcomes.

### **Pre-implant Duration of Deafness**

The shorter the period of time from the identification of deafness to the time of cochlear implantation, the easier it tends to be to develop spoken language. It appears that the less time the auditory channels remain dormant and unused, the greater the chance for these pathways to be ready and open to accept the new incoming information available through the cochlear implant.

Research suggests the importance of keeping the auditory neural pathways stimulated prior to implantation or these pathways will be utilized by other senses and then become unavailable to benefit listening if implantation is chosen at a later time. For further information on the auditory plasticity of the brain, see the research being completed at the [\*Auditory Cortical Function Laboratory at the University of Texas at Dallas\*](#).

### **Language Competence**

As discussed in [Early Beginnings for Families with Deaf and Hard of Hearing Children: Myths and Facts of Early Intervention and Guidelines for Effective Services](#) by Marilyn Sass-Lehrer, "When parents and children communicate effectively with each other from the very start of a hearing loss identification, a foundation for language acquisition (both spoken and signed language) is established and language delays may be prevented or minimized (Yoshinaga-Itano, 2000)." This also applies to students who obtain cochlear implants. It appears that those children who have a strong language foundation (whether signed or spoken) prior to getting a cochlear implant have an easier time developing spoken language through their implant (Tait, M., Lutman, M., and Robinson, K., 2000). Pre-implant Measures of Preverbal Communicative Behavior as Predictors of Cochlear Implant Outcomes in Children, *Ear and Hearing*.)

### **Previous Listening Experience**

Children who lose their hearing after language has developed, and those children who have had meaningful auditory experiences with a hearing aid prior to implantation, typically demonstrate excellent outcomes with a cochlear implant. This appears to relate to past imprinting or memory for this information. Older children who have had limited listening experiences require more time and structured approaches to facilitating spoken language for sound to become meaningful.

### **Status of the Cochlea**

Sometimes the cochlea is insufficiently formed or may have developed an ossification (bony growth). These conditions may impede adequate insertion of all of the electrodes to make the cochlear implant most effective. In these situations, cochlear implantation may still be an option, but outcomes may vary.

### **Cause of Hearing Loss**

Some of the associated secondary conditions arising from varying causes of deafness may influence the degree of benefit a child may actualize from a cochlear implant. For example, some children with hearing loss from cytomegalavirus (known as CMV) have demonstrated additional auditory processing problems. If a child has problems decoding sound that is not specifically related to the listening mechanism, but rather the

interpretation of sound in the brain, the implant may not remedy this situation. Also, as mentioned before, meningitis produces ossification, causing inconsistent insertion of the electrodes into the cochlea and hence, inconsistent benefit may be actualized from an implant.

Increasing numbers of children with the diagnosis of auditory neuropathy or auditory dys-synchrony are obtaining cochlear implants. These conditions involve a type of hearing loss beyond the outer hair cells of the cochlea, either in the inner hair cells (responsible for converting sound vibrations into electrical signals), or at a higher neural level in the hearing system. Depending on where the dysfunction occurs in the auditory system, there appears to be differing degrees of benefit from implantation. It is important that a complete battery of diagnostic evaluations be completed prior to proceeding with a cochlear implant for individuals with this condition. For further information about the importance of including an Electrical Brainstem Response Evaluation (EABR) as part of a test battery to predicting cochlear implant success with this diagnosis, see: Gardner-Berry, K. , Gibson, W., & Sanli, H. (Nov. 2005). Pre-operative testing of patients with neuropathy or dys-synchrony. Emerging trends in cochlear implants. *The Hearing Journal*, No. 11.

For more information about auditory neuropathy, see:

[National Information Center on Deafness and Other Communication Disorders](#)

## **Family Support and Motivation**

Many doctors and educational professionals observe that the children who are most successful with their cochlear implants (regardless of many of the other discussed factors) have strong family involvement and support. Families who are integrally involved in providing a rich listening and language environment and helping a child to receive all of the necessary supports to promote use of the implant seem to positively impact on a child's potential to maximize implant outcomes.

## **Consistency of Usage**

The cochlear implant must be used consistently if a child is going to demonstrate ongoing progress with the implant. If periods of time pass without implant stimulation (even a few days), there appears to be a repeated need to adjust to incoming sound which will delay progress.

## **Cochlear Implant Technology**

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Implant manufacturers are continuing to refine and improve the technology of the cochlear implants themselves. In recent years, the internal device, surgical techniques, and speech-processing capabilities have greatly improved. Improvements in speech-processing computer software for the external parts of the cochlear implant have made the implant better able to approximate characteristics of true listening. Children who are implanted with the more current technology appear to have increased potential with their cochlear implants in comparison to children implanted during the early advent of cochlear implants when the devices had fewer channels and less sophisticated speech processing capabilities.

### **Appropriate Programming of Device**

The external components of each cochlear implant must be programmed specific to each individual. This program is referred to as a "map." (See [Fitting the Speech Processor.](#)) Obtaining an appropriate map takes numerous appointments and ongoing modifications. Especially with young children, determining an appropriate map is as much of an art as it is a science.

It is imperative that a child's functioning with a map be closely monitored or a child may not be able to "hear" at his or her potential. As the brain adjusts to sound, what may have at first been comfortable and "loud enough" becomes insufficient and "not enough." This acclimation to sound may be clearly apparent or can sometimes go unnoticed, similar to a light on a dimmer that grows dim so slowly as to almost be imperceptible until it becomes too dark. A child may also inadvertently have electrodes that have been set for too much stimulation causing discomfort. If this occurs and is not remedied, the child will see listening as a negative experience and may resist using the cochlear implant. If a child is functioning with an inadequate map, this will negatively impact on progress with the implant.

### **Additional Special Needs**

Children may have additional learning or behavioral issues that may impact on the rate of progress and outcomes with a cochlear implant. Some children may be implanted taking

these issues into consideration. Some children may be so young when they obtain a cochlear implant that it is impossible to know if additional issues will be a factor. When possible, it is important to look at additional special needs and to figure out to what degree they will impact a child's functioning with an implant as plans are made for appropriate educational programming. Families and specialists should always be on the look out for issues secondary to deafness and cochlear implants that may be impacting on a child's development.

### **Quality of Educational and Habilitative Environment**

Children with cochlear implants may be in a variety of educational environments using a variety of communication approaches. Regardless of program type and methodology, success with an implant will be positively impacted by the consistency and quality of spoken language use that is integrated into a child's program. Determining the best strategies to address integration and use of spoken language for each child should be individualized and based on the language and communication functioning of the child. (See: [Choosing a Communication Methodology](#) and [Choosing an Educational Setting](#).)

In Summary:

While the definition of “success” with a cochlear implant is unique to each child, the children with the most optimal prognosis for developing the highest levels of receptive and expressive spoken language development are children with:

- Early identification of hearing loss followed by early amplification, language stimulation (spoken or signed language), and early implantation (pre-lingually deaf children)
- good prior listening experience and speech perception skills (post linguually deaf children)
- at least average cognitive skills and good attention skills; and
- home and school environments that provide extensive exposure to spoken language.

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KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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# The Decision-Making Process

Families arrive at the point of considering a cochlear implant at various stages in a child's development and with varied degrees of information regarding the implant and expected outcomes. Some families have extensively researched cochlear implants and understand the level of commitment involved in the process and the range of benefits that may be obtained from an implant. Others arrive at the decision-making process with limited information and unclear expectations regarding the "miracles" of this technology. As professionals counsel families, and families make decisions about whether or not a cochlear implant is the right choice, the following considerations should be kept in mind.

For more information about factors in the decision making process, see:

[American Society for Deaf Children "Snapshot" on Decision Making \(PDF\)](#)

[American Society for Deaf Children "Snapshot" on Cochlear Implants \(PDF\)](#)

Chute, P., & Nevins, M. E. (2002). [The parent's guide to cochlear implants](#). Washington, DC: Gallaudet University Press.

[National Association For the Deaf: Position Paper on Cochlear Implants](#)

## Realistic Expectations

It is important for families to be realistic regarding their expected outcomes from cochlear implants. While the media often portrays cochlear implants as a "cure" for deafness, those directly involved in the educational process with implanted children are

### For more information:

[Setting Appropriate Expectations and Communication Goals](#)

[Auditory Benchmarks for Kids 1 To 4 Years](#)

keenly aware of how individualized the outcomes may be for each implanted child.

For families considering the option of a cochlear implant for their child, it is important to acknowledge that

although a cochlear implant provides an opportunity for a deaf child to develop spoken language skills, it is not a guarantee. While a cochlear implant provides the ability to "hear" sounds, it does not insure that a child will function as a "hearing" child. Deaf children present varied and wide-ranging characteristics related to their age, history,

progress, and development that will impact on their degree of success with a cochlear implant. While there may be some degree of benefit for all children obtaining a cochlear implant, it is important for those involved with the decision-making process to be realistic about the range of possible outcomes for any given child.

## **Level of Commitment**

Before deciding to pursue a cochlear implant, families need to be clear about the time, effort, and possible expenses involved in all components of the implantation process (before, during, and after), and understand that the surgery and initial "hook up" of the implant are only the beginning of a longer road to realizing the full benefits of implantation.

While protocols and time commitments vary among implant centers, families must be ready to frequently travel to implant centers that are sometimes quite a distance away from home, necessitating time off from work and other home responsibilities. The following questions should be asked of the implant center so that the time commitment required for implantation can be taken into consideration in the decision-making process:

- What medical appointments or other associated evaluations will be necessary prior to determination of candidacy?
- What is the policy regarding trial use of hearing aids prior to cochlear implantation?
- What is the protocol for mapping appointments post-implantation?
- What is the protocol for participation in an auditory and speech training program both pre-implantation and post-implantation?

An important issue for consideration is the amount of time and additional expense that may be involved in facilitating development of listening and speech skills following cochlear implantation. Many hospital implant centers require a commitment to participate in training sessions provided through the hospital implant center. A typical expectation

from the hospital implant center may be for the child to attend weekly sessions for at least one year. Some hospital programs may not provide on-site or satellite-site training, however, they collaborate with the child's school program to schedule the necessary training. Informally, families of implant users report that private auditory and speech habilitation training at least once a week (in addition to what is provided by the hospital implant center and/or school) is beneficial.

Regardless of where the training is obtained, insurance companies are inconsistent in the level of payment for these services that may average around \$75 to \$100 per hour. While obtaining sufficient training to help a child actualize benefit from their implant, it is important to be cautious not to schedule too much training at the expense of allowing a child's participation in other recreational activities (each family will need to be the judge of this!).

It is also important for families to understand their responsibility in facilitating spoken language development and use at home. While auditory and speech training sessions provided by professionals are beneficial in getting children on track, providing opportunities for a child to "successfully listen" at home requires family members to understand the auditory and speech training process. While families need to be cautious in maintaining their role as parents and not go overboard in becoming "trainers," it is important that they become natural facilitators of language, so newly developing skills can be incorporated in the child's daily life (see [Training the Ear to Listen](#)).

Another issue to consider as a commitment is made is some of the additional financial costs, outside of the surgery, that may be incurred. The cost of batteries and replacement parts can add up quickly and are not often covered by insurance. As discussed in [The Parent's Guide to Cochlear Implants](#), "Battery life varies with the type of speech processing program, the amount of wear time, and the volume settings on the processor. Certain speech processing programs require larger amounts of power. Battery life varies greatly among devices and within a particular device. It is best to discuss the issue of battery life with the implant team."

In addition, the external equipment parts may require replacement from loss or wear and tear. (i.e, cost of cords, headpieces/microphones). It may also be necessary to purchase additional assistive devices to enhance listening through a cochlear implant such as extra external microphones, TV/media connectors, and FM systems. Although the parts and devices may be small, they can be expensive and are rarely covered by insurance.

For more information about parts/accessories, see:

[Advanced Bionics; products](#)

[Cochlear Corporation's products](#)

[MED-EL's products](#)

## Looking at the Whole Deaf Child

The cochlear implant is one part of a deaf child. It is a tool he or she will use to access sound. Efforts focused on the end result of making the child a "spoken language communicator" should be kept in perspective in relation to the needs of the child in all areas of development. As decisions are made regarding cochlear implantation, the following should be kept in mind:

- the amount of time spent on auditory and speech training should be in proportion to the other activities in a child's life;
- if a child has developmental, learning, or social/emotional challenges separate from hearing loss, the cochlear implant will not resolve these issues; and
- for children obtaining cochlear implants during their elementary, middle school, or high school years, it is important to balance the focus on spoken language development within the context of considering the child's need to progress academically in a timely fashion.

## Including Older Students

Assure that students who are old enough are included in understanding all components of the cochlear implantation process as well as the expected outcomes given their age and previous listening experiences. If the cochlear implant is to be beneficial, it is important that the older child be motivated to participate in the entire process. Keep the following in mind related to keeping older students involved:

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<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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- it is important for students to have the opportunity to share their feelings in a safe environment, and
- it is important to acknowledge that there may be peer pressure and lack of peer understanding regarding cochlear implants. Peer workshops on the topic of implants may be beneficial.

For more information, see: [Teens and Cochlear Implants](#).

### **Gathering Information**

As information is gathered from a variety of sources and perspectives, the following should be kept in mind:

- A cochlear implant is not for every deaf child. Families may come to the decision not to obtain a cochlear implant for a variety of valid reasons including:
  - the belief that a cochlear implant will not significantly improve their child's quality of life at a level that leads them to want to consider surgical intervention;
  - the belief that other language, communication, and technology options will effectively meet their child's language, cognitive, social, and life success needs;
  - the knowledge that their child is past the age in which spoken language use will be a realistic outcome from cochlear implantation; or
  - their religious beliefs.
- Be cautious of the media portrayal of cochlear implants. Remember that success stories make good news. In addition, the stories in the news often involve a child in the beginning stages of the process. Yes, it is exciting to see a child as he or she "hears" for the first time. Just remember that much work must follow before sound may become meaningful.
- There are extremists on either end of the spectrum for cochlear implants—those who are strongly for or strongly against them. As families gather information, they must be prepared for both positive and negative feedback, and for both solicited and unsolicited opinions.

- Extended family members and friends may pressure parents to pursue an implant. Families may hear statements such as, "Don't you want to do everything you can for your child?" Family members must be prepared to help others understand the complex decision-making factors that are involved in this choice and that the choice not to implant their child is a legitimate one.

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# Considerations in the Implantation Process

## Beginning the Process

Once the decision is made to pursue a cochlear implant, there are a variety of steps involved in the process. The first thing that needs to happen is for the family to contact a hospital implant center. To locate an implant center, check the cochlear implant manufacturers:

- Advanced Bionics (<http://www.bionicear.com/clinics/clinics.html>)
- Cochlear Corporation (<http://www.cochlearamericas.com/Support/38.asp>)
- MED-EL (<http://www.medel.com/>)

For a discussion of issues to consider when selecting a cochlear implant center, visit the Cochlear Implant Association Web site at: <http://www.cici.org/select.html>.

## What's Involved in the Process?

Most implant centers utilize a team approach to providing a comprehensive assessment of a child's candidacy for cochlear implantation. The process usually involves medical, audiological, speech and language, education, and other support service professionals. Although each hospital center may have its own protocol, the following components of the process are typically included:

For a list of common components of the implantation process, see the [MED-EL Corporation](#) Web site.

- **Initial consult**—Professionals from the hospital implant center inform families of the cochlear implantation process. Topics for discussion may include pre-implantation testing and counseling, insurance coverage, the types of devices available, the surgery, programming of the external components of the device, and the training process.
- **Audiological services**—A current Auditory Brainstem Response (ABR) evaluation is necessary to confirm the degree of hearing loss. Behavioral testing should also be a part of the test battery to provide a functional assessment of a child's hearing level. For more information about understanding audiological evaluations, see <http://clerccenter.gallaudet.edu/SupportServices/series/5002.html>.

While a hearing aid trial is usually a part of the protocol, the length of the trial period may vary depending on a variety of factors. For example, a hearing aid

trial may be short for young children with confirmed profound hearing loss and limited observable benefit from a hearing aid to hasten implantation in the interest of the age of the child. A hearing aid trial may be longer for an older child who has proven to be a poor hearing aid user. An implant center may be trying to determine if an older child demonstrates responsibility and motivation to wear hearing aid technology.\*

*\*Note: The rationale for an increased trial sometimes backfires as a child with a profound loss may dislike and not be motivated to use his or her hearing aid as he or she obtains limited benefit from it. This same child may like a cochlear implant when he or she has increased access to sound. Similarly, a parent who is excited about obtaining a cochlear implant for the child may not devote sufficient time and energy to a hearing aid trial.*

The audiologist is the specialist who will program the external components of the device, which will be activated about one month following surgery after healing is complete. The modification of the external speech-processing device specific to each user is called “mapping.”

- **Speech-language, developmental, cognitive, and motor evaluations**—These evaluations provide information on a child’s functioning in a variety of areas. Some hospitals have on-site staff trained in the specialized evaluation tools, techniques, and test standardizations for deaf children. Some hospital programs collaborate with support service professionals in school programs serving deaf and hard of hearing children to obtain these evaluations. No matter where the evaluations are completed, it is important that the professionals completing them are trained in, and familiar with, the tools and standards of evaluating deaf children.
- **Medical evaluations**—Children are evaluated by an *otolaryngologist* (ear, nose, and throat doctor) to obtain a medical history, evaluate the structures of the ear system, and look for possible medical reasons why a child may not be a candidate for a cochlear implant. The otolaryngologist will also be the doctor completing the implant surgery. A CAT scan (x-ray) and/or Magnetic Resonance Imaging (MRI) of the inner ear will be completed to evaluate the anatomy of the cochlea. Some centers perform what is called a “promontory test.” This evaluation seeks to determine which ear stimulates best to an electrical signal. This may factor into determining which ear to implant.
- **Psychological/social consultation**—Family members and the children themselves (based on the age of the child) will be counseled about rationale and motivation for pursuing cochlear implantation. A comprehensive implant center will work closely with families and children to promote realistic expectations

related to the implantation process and the variable outcomes associated with implantation.

- **Rehabilitation consultation and training**—Prior to implantation, children and families may meet with a specialist from the hospital center who is trained in facilitating listening and speech skill development after implantation. Components of the habilitation process are shared so family members have a clear understanding of the training commitment that follows the surgery. Oftentimes, children participate in the habilitation process prior to surgery to get familiar with the activities and strategies that will be used after implantation.
- **Outreach with educational programs**—Most children and families in the implantation process are already enrolled in a school or educational program. Collaboration between the child’s educational program and the hospital implant center can facilitate the candidacy and habilitation process related to implantation. The educational professionals may bring a perspective to the candidacy process that may not otherwise be shared by the family or observed in the hospital setting. This collaboration will also facilitate development of appropriate educational goals and communication strategies for the child when he or she returns to his or her educational placement following implantation.

## Choices During the Implantation Process

Once the decision to implant has been made, there remain the choices of which manufacturer to use and which ear to implant.

### Choosing a Manufacturer

There are three manufacturers of cochlear implants commonly used in the United States: [Advanced Bionics](#), [Cochlear Corporation](#), and [MED-EL Corporation](#). For more information about these manufacturers, visit their Web sites.

Some hospital implant centers offer the option of choosing an implant from any of the three companies. Some hospital implant centers may only offer one brand of cochlear implant. Some implant centers may provide a preference for one manufacturer over another, while others may not. Most centers will help families compare characteristics of implants in order to make an appropriate choice. It may be helpful to speak with other families regarding their experience with a particular manufacturer as a decision is made.

The following Web site compares and contrasts the characteristics of implants:  
<http://www.geocities.com/cicentral/>.

Possible considerations in making this decision include:

- the casing of the internal component of the implant,

- the internal technology of the electrode positioners,
- the style of the external components of the implant,
- the speech-processing strategies offered by the manufacturer,
- the additional supports from the manufacturer (i.e., help obtaining insurance, ease of ordering spare parts),
- the differences in battery life, and
- the considerations related to the need for possible Magnetic Resonance Imaging Testing (MRI) in the future.

### **Deciding Which Ear to Implant**

There are a variety of factors involved in making a decision about which ear to implant, including:

- **Anatomy of the ear system**—CAT scans or MRIs, which indicate the condition of the cochlea and the auditory nerve, are utilized to determine the following impacting factors:
  - Is there ossification (bony growth) of the cochlea? If so, the insertion of the electrodes into the cochlea can be adversely impacted. Presence of ossification does not mean that cochlear implantation is not possible; however, the quality of sound may be diminished if a sufficient number of electrodes cannot be adequately inserted. If there is a difference in ossification levels between ears, this may influence which ear is chosen for implantation.
  - Is the auditory (eighth) nerve intact? Though the implant is placed within the cochlea, sound must be transmitted to the brain via the eighth nerve. If this nerve is not intact or is not present, the implant will not be possible in that ear.
  - Is the cochlea malformed? Though surgery may still be possible with a malformed cochlea, the ear with a better-formed cochlea is more likely to be chosen if all other factors are equal.
  - If x-rays indicate that the facial nerve is too close to the surgical area, this may impact the decision on which ear to implant.

- **Electrical stimulation**—If one ear is noted to respond better to the electrical stimulation of the cochlea as noted on the Promontory Test, this may influence which ear to implant.
- **Implantation of the better ear**—If there is a difference in hearing levels between ears, some centers may choose to implant the better ear. This choice reasons that because the better ear has been successful using a hearing aid, the auditory channels in this ear have been accustomed to receiving stimulation and, therefore, are ready to accept sound. Since this ear may already possess some “skill” in processing spoken language, it would more successfully acclimate and benefit from the cochlear implant.
- **Implantation of the worse ear**—If there is a difference in hearing levels between ears, some may choose to implant the worse ear. This choice reasons that the “better” ear could continue benefiting from a traditional hearing aid should the cochlear implant not be successful.
- **Pick the right ear**—If there is no difference between ears and everything else is equal, some centers may lean towards implantation of the right ear. This choice reasons that since the “speech centers” of the brain are on the left side and there exists a crossover effect (sound transferred from the right to the left side of the brain for processing), implantation on the right side may facilitate processing of speech and language information.
- **Listening in the car**—From a functional point of view, adults may choose the right side to facilitate listening to passengers in a car while driving. (This is really thinking ahead for the 1-year-old implantee!)

## Things to Ask the Cochlear Implant Center

Below are brief responses to some frequently asked questions. These issues can be discussed in further depth with a hospital implant center.

### What is the expected life of the device?

The manufacturers indicate that the internal components of the devices are designed to last a lifetime. The external components will face wear and tear issues similar to other hearing aids and technological devices. As newer external devices evolve, a user may need to update and/or replace the external components.

#### For More Information

The following Web site provides a list of further questions to ask an implant center:

<http://users.ccewb.net/lonerock/hearmemo/>.

The House Ear Institute also provides questions for implant centers:

[http://www.hei.org/children/services/consider\\_ci.html](http://www.hei.org/children/services/consider_ci.html).

## **What about implanting both ears?**

The use of two hearing aids improves sound localization, listening in noise, and reduction of listening stress. This may also be the case for cochlear implants. Bilateral implantation is being considered and completed in increasing numbers of centers, but this practice is still under investigation and not yet commonplace.

Questions to consider related to bilateral implantation include:

- Should the devices be mapped similarly in each ear?
- Can the sound from both sides be integrated and processed?
- Should one processor stimulate both ears?
- If both ears are implanted, will the person be a candidate for future new technologies should they emerge?

For further information about bilateral implantation, see the MED-EL Web site at: [http://www.medel.com/ENG/INT/30\\_Advanced\\_topics/999\\_bilat.asp](http://www.medel.com/ENG/INT/30_Advanced_topics/999_bilat.asp).

## **Will static electricity affect the cochlear implant?**

Electrostatic discharge can cause damage to any electronic device, however, implant manufacturers are improving the design of implants to provide greater resistance to this problem. Clarion indicates that their CII Bionic ear implant system is designed with special safeguards for greater resistance to electrostatic discharge.

## **What is the risk of internal device failure?**

While the risk of device failure is small, it is possible. In these situations, additional surgery may be required to replace the device or in some situations to reposition a device that has migrated from its intended placement.

## **Can implanted children participate in sports?**

Cochlear implantation should not interfere with most recreational activities. Judgment should be utilized in determining if the external portion of the implant should be used during sports. Of course, the external processor should be removed for participation in water sports. In addition, be aware that sweating and moisture can affect the device. The surgically implanted portions of the implant will not be damaged by water sports or diving into a swimming pool. The only restriction that seems to be made by implant companies is related to deep-sea scuba diving. This is based on severe pressure changes. For sports that involve particular risk of head injury, common sense indicates that head

protection be utilized. Clinics usually advise avoidance of activities like boxing, where a severe blow to the head is likely.

### **What about waiting for the technology to improve before choosing to implant?**

Research and observation suggest that early implantation in children is closely related to increased outcomes in spoken language development. Studies also suggest that shortened duration of deafness also positively impacts spoken language growth with an implant. Given these findings, waiting for new technology may negate the benefits of cochlear implantation. If early implantation and shortened duration of deafness are seen as primary impacting factors on cochlear implant success, then waiting for new technology would not be recommended.

In addition, as of early 2003, the three major implant manufacturers have introduced new technologies into the marketplace. It does not appear that there will be changes to the surgically implanted portion of the device in the near future. Changes to the devices, should they occur, will probably be related to external hardware and software of the systems. Persons obtaining cochlear implants at this time should therefore be able to take advantage of these advances without further surgery.

### **What are the surgical risks?**

In general, the surgical procedure is not considered risky. The risks reported are those associated with any surgery requiring anesthesia. The areas involved in surgery include the mastoid bone behind the ear (where the magnet portion of the implant is housed) and the cochlea housed in the inner ear (where the electrodes are implanted) . This is not “brain” surgery.

As the hearing system is close to the balance system, some patients report periods of dizziness following implantation. There are other possible, though uncommon, risks associated with surgery related to the facial nerve, sense of taste, and possible infection that should be discussed with the physician. (Also see the module, **Surgical Considerations.**)

### **What about the possible relationship between cochlear implants and the risk of meningitis?**

For further discussion on this issue, visit the Web sites of each cochlear implant manufacturer:

[Advanced Bionics](#)  
[Cochlear Corporation](#)  
[MED-EL](#)

On July 24, 2002, the FDA issued a Public Health notification highlighting the possible association between cochlear implants and subsequent bacterial meningitis. **While the FDA announcement discusses the possible association between implants and meningitis, it also explains that the implant has not been proven to be the cause of the meningitis in the**

**cases noted.** The full report, *Cochlear Implant Recipients May Be At Greater Risk For Meningitis*, can be found at: <http://www.fda.gov/cdrh/safety/020606-cochlear.html>.

Related to the possible risk of meningitis, the following should be taken into consideration:

- any surgery on the inner ear can increase the risk of infectious diseases like meningitis,
- some deaf individuals may have congenital abnormalities of the inner ear that make them more prone to meningitis with or without a cochlear implant, and
- some individuals who are deaf from meningitis may be at an increased risk for subsequent episodes of meningitis in comparison to the general population.

### **Is the residual hearing in the implanted ear destroyed as a result of surgery?**

The design of improved electrode arrays and implantation procedures seem to be increasing the chance that the cochlea may be preserved following implantation. There continues to be the potential loss of residual hearing following implantation, and implant companies continue to warn patients that implantation will probably result in the loss of residual hearing.

### **What about Magnetic Resonance Imaging (MRI) for persons with cochlear implants?**

Implants and MRIs are generally not compatible due to the magnetic component of the implant. The Nucleus 24 device designed by the Cochlear Corporation has a surgically removable magnet and a design feature to withstand some MRIs. If MRIs are an issue of concern, this should be discussed with your hospital implant center. The MED-EL Device, COMBI 40+, is under investigation for allowing MRIs under certain conditions.

# What About Insurance?

The costs for obtaining a cochlear implant, including pre-surgical testing, medical personnel services, surgery and hospital fees, and the implant device itself, can vary between \$30,000 and \$50,000. Most third party health insurance plans appear to provide some level of coverage for the implant process. The coverage and payment have greatly improved in recent years as use of this device is becoming more commonplace, especially for young children.

## Issues Related to Coverage

In reviewing Web sites and speaking with a variety of medical facilities and implant manufacturers, the following issues related to insurance coverage emerged:

- Commercial health plans, such as Aetna, Blue Cross and Blue Shield, and Prudential, continue to be the best payers for cochlear implants.
- Managed care plans, especially HMOs, remain among the most restrictive.
- Medicare, Medicaid, Children's Special Services, Tricare, Veterans Administration, and vocational rehabilitation agencies provide a range of coverage—partial to full.
- There may be problems with insurance payment when a child is younger than the FDA guidelines suggest.
- There are employees at the implant companies whose job is to handle insurance-related problems and secure payment.
- Only a few insurance companies pay for upgrades in technology (i.e., ear-level speech processor).
- Insurance payments vary by region.
- Insurance companies have varying policies regarding payment for batteries.

**For additional information on insurance coverage, see the following:**

[Information on Medicare and Cochlear Implants](#)

[The Cochlear Corporation's information on obtaining coverage](#)

[Advanced Bionics Web site's information on reimbursement support](#)

[Reimbursement and Financial Support for Cochlear Implants \(CiCi\)](#)

[The American Speech-Language-Hearing Association \(ASHA\): Getting Your Employer to Cover Speech-Language and Hearing Services](#)

## Six Services Associated with Cochlear Implantation

According to the Cochlear Corporation (<http://www.cochlearamericas.com/Support/42.asp>), there are six separate services associated with cochlear implantation. It is important to look for benefits to cover the following:

- **Assessment and evaluation**—Most health plans include benefits covering diagnosis of a disease or illness.
- **Cochlear implant system**—Some health plans will specifically cover cochlear implants, some will consider covering the implant under the insurance clause covering “prosthetics,” and a few will specifically exclude the device.
- **Hospital surgical services**—Most health plans cover inpatient and outpatient hospital surgical services.
- **Surgeon’s services**—Most health plans cover surgeons’ services.
- **Post-operative audiology services:**
  - Most health plans cover rehabilitation and generally limit, or “cap,” post-operative rehabilitation, treatment, or therapy. The plan may or may not specifically mention audiology as a covered service.
  - Mapping is more often paid for compared to auditory training and speech therapy; however, coverage is inconsistent.
  - Coverage for auditory training is inconsistent among insurers. Some people have had better success with coverage when they refer to auditory training and speech therapy instead as “prosthetic device training.”
- **Repairs and maintenance to external components:**
  - Most health plans do not specifically mention coverage for repairs and maintenance for the external components of the cochlear implant. However, not including a benefit does not necessarily mean it is excluded.
  - Information concerning this type of benefit may be found in the durable medical equipment (DME) or medical supplies section of a benefit book.
  - There are outside agencies specializing in the coverage, replacement, and repair of hearing aids and external components of cochlear implants should they be lost or accidentally damaged. For more information about this coverage, visit the Web sites of the [ESCO insurance company](#) or the [Midwest Hearing Industry insurance company](#).

## Surgical Considerations

Surgery for a cochlear implant is usually outpatient, is completed under general anesthesia, and lasts about three hours. Two parts of the implant are inserted during surgery: the FM receiver and the electrodes (see “Components of the Device” under **What is a Cochlear Implant?**). The FM receiver, which holds a magnet that attaches to external components of the implant, is set into the mastoid bone. The electrode array is inserted into the cochlea.

### During Surgery

- The hair around the incision is shaved.
- A post-auricular (behind the ear) incision is made.
- A small depression is created in the mastoid bone to hold the receiver so that it is flush with the skull.
- The surgeon drills through the mastoid bone to the inner ear and the electrode array is then inserted into the cochlea.
- The receiver is secured to the skull and the incision is closed with stitches.

### After Surgery

- The stitches are removed about two weeks after surgery.
- The patient returns to school or work as soon as he or she feels well enough to do so, usually within a week of surgery.
- The implant is activated four to six weeks after implantation, allowing enough time for the incision to heal properly.

### Associated Risks

- The greatest risks are those related to the general anesthesia.
- As the surgery is performed in the vicinity of the nerve that moves the face, there is the rare possibility that temporary or permanent facial paralysis may occur.
- The surgical site could possibly become infected, requiring removal of the device.

- There may be pain at the wound following surgery—this is typically temporary.
- There is a slight risk of taste disturbances, such as having a metallic taste.
- Residual hearing in the ear to be implanted will most likely be lost (although with improvements in the technology and surgical procedures, this is not always the case).
- Following surgery, dizziness is sometimes noted.

(See also “What are the surgical risks?” and “What about the possible relationship between cochlear implants and the risk of meningitis?” in **Considerations in the Implantation Process.**)

#### **Note: Possible Link Between Cochlear Implants and Meningitis**

On July 24, 2002, the FDA issued a Public Health notification highlighting the possible association between cochlear implants and subsequent bacterial meningitis. While the FDA announcement discusses the possible association between implants and meningitis, it also explains that the implant has not been proven to be the cause of the meningitis in the cases noted. Related to the possible risk of meningitis, the following should be taken into consideration:

- any surgery on the inner ear can increase the risk of infectious diseases like meningitis,
- some deaf individuals may have congenital abnormalities of the inner ear that make them more prone to meningitis with or without an implant, and
- some individuals who are deaf from meningitis may be at an increased risk for subsequent episodes of meningitis in comparison to the general population.

There were possible reported associations between meningitis and persons with cochlear implants from both the Cochlear Corporation and Advanced Bionics. It was only with Advanced Bionics that the design of an "electrode positioner" in the internal component of the Clarion CII implant was considered as a possible predisposing factor to meningitis. When this possible association was suspected, Advanced Bionics quickly and voluntarily removed their Clarion CII implant from the market while the necessary modifications were made to manufacture and distribute the CII without the positioner. The modified system is now available.

As stated on the Advanced Bionics Web site, a significant proportion of the reported meningitis cases with the CII implant (with the positioner) involved two centers in Europe. Increased incidence in Europe may possibly be due to lower vaccination rates there. The full report, *Cochlear Implant Recipients May Be At Greater Risk For Meningitis*, can be found at: <http://www.fda.gov/cdrh/safety/cochlear.html>.

## Choosing an Educational Setting

The task of choosing the most appropriate educational placement to facilitate language development, academic learning, and positive social-emotional development for deaf and hard of hearing children can be confusing. The choices are not always clearly defined as there are many factors that impact on a child's success with one setting over another, and there are varied professional recommendations related to one setting over another. The advent of the cochlear implant has made this decision-making process even more complex.

Each child arrives at the implant process with unique characteristics and potential outcomes. While the motivation and hopes of some families may be that their implanted child will participate in their neighborhood school with no additional educational support services, for some children this may not be an immediate outcome, and for some this may not be a realistic outcome.

As cochlear implant technology has become more common, so has the diversity in the types of children obtaining implants. During the early years when implantation first emerged as a choice for children, the children obtaining cochlear implants appeared to be a homogenous group. The group of implanted children was comprised primarily of Caucasian children with high levels of income that were enrolled in mainstream or oral environments. (*Parents' Perceptions and Experiences with Their Children's Cochlear Implants: A Report of the Results of the Survey of Parents of Pediatric Cochlear Implantees*, presented by Tom Allen, dean of the Graduate School and Research at Gallaudet University, in March 2000.)

In addition, many of the children selected as candidates were post-lingually deaf or were children with prior auditory experience and demonstrated aptitude for developing spoken language. As growing numbers of children are obtaining cochlear implants, however, observation suggests that the population of implanted children is changing. Children obtaining cochlear implants now appear to come from increasingly diverse cultural backgrounds, socio-economic groups, and a broader range of ages (specifically, more infants and toddlers).

The bottom line is that there is no single "right" educational placement for a child with a cochlear implant. In addition, placement and communication choices may need to change based on a child's development or success in any given placement. It is necessary that placement choices be monitored and evaluated on an ongoing basis to assure the appropriateness of a placement.

## Placement Options

The educational placement choices for a child with a cochlear implant include similar options available to other deaf and hard of hearing children. These placement options include:

- a neighborhood or private school with no additional supports,
- inclusion in a neighborhood or private school with supports integrated within the school (itinerant teachers, resource teachers, speech and language specialists, etc.),
- a self-contained classroom for children with hearing loss using:
  - an oral approach,
  - cued speech,
  - total communication, or
  - American Sign Language,
- a day school for deaf children that uses:
  - an oral only approach,
  - total communication, or
  - a bilingual approach (American Sign Language and English).

## Considerations for Making Decisions

As individual outcomes vary for students with cochlear implants similar to all deaf students, a student should not be defined/placed/planned for based solely on his or her cochlear implant. As choices are made regarding educational placement for implanted children, it is important to consider the following individual characteristics of the child:

- Background:
  - medical and developmental history
  - hearing loss etiology, onset, and age of identification
  - quality and quantity of family support
  - cultural background
- Intervention:
  - age that intervention was initiated
  - quality, quantity, and consistency of intervention prior to cochlear implantation
  - quality, quantity, and consistency of amplification use prior to implantation
  - type of language use prior to implantation (spoken or signed)

- quality, quantity, and consistency of language stimulation
  - language, cognitive, and academic functioning
  - learning profile, style, and characteristics
  - social/emotional development
- Implantation:
    - age at the time of implantation
    - pre-implant auditory experience
    - post-implant auditory experience
    - primary communication mode at age of implant
    - purpose of implant and expectancies of student and family
    - consistency in implant use

The following placement considerations should be kept in mind for children with cochlear implants as they would for any deaf child:

- **Choose a program that takes into consideration the whole child.** An appropriate educational program takes into consideration a child's overall functioning and goals in a variety of areas, not only development of listening and speech skills. A program that focuses solely on developing listening and speech skills at the exclusion of addressing other components of a child's education may not be in the child's best interest.
- **Program components should be individualized and based on the Individualized Family Service Plan (IFSP)/Individualized Education Program (IEP).** Don't assume that placement and services will be similar for any two students with a cochlear implant. Each child arrives at the implant process at a different stage in development. Placement and support service planning for each child should be driven by the IFSP/IEP process.
- **Collaboration with hospital implant centers is beneficial.** Ongoing collaboration between the implant centers and educational settings (i.e., observations between centers, workshops, teaming, attendance at IFSP/IEP meetings) is integral to promoting cohesive planning for students with cochlear implants. It is important that hospital implant centers understand the full range of issues involved in placement and communication planning, and the school understand the clinical and medical side of implantation so families are obtaining consistent guidance related to seeking services and placement after implantation.
- **Keep in mind current functioning levels and goals for language development.** Choose a program/classroom that is sensitive to the child's current language

**For More Information**

[How the Individuals with Disabilities Education Act \(IDEA\) Applies to Deaf and Hard of Hearing Students](#)

competency in spoken language, not only future hopes. While children may have similar abilities to be aware of sound with their cochlear implant, they have unique abilities to use this awareness for understanding spoken language. While it is beneficial to have the child in an environment that challenges him or her, it is not beneficial to have the child lost, overwhelmed, or frustrated.

- **What about the use of interpreters in the mainstream?** Interpreters should be considered for inclusion in a child’s program only if the child is already a “user” of sign language. If a child is having difficulty following spoken language in a mainstream classroom, interpreters should not be viewed as an answer for clarifying information for a deaf student who is not already familiar with sign language. Sign language cannot be effectively learned through use of an interpreter and is not recommended as a remedy to a child’s inability to learn through spoken language. If this situation arises, placement considerations should be carefully revisited.
- **What about the use of an FM system?** There are varying opinions related to the use of FM equipment for students with cochlear implants. Some hospital implant centers recommend initially having the child adjust to listening through his or her implant without adding the FM system. This allows the child the opportunity to learn to listen in an “implant only” situation. Increasing numbers of students are beginning to utilize and evaluate the use of FM systems as the technology continues to miniaturize and improve. Each student’s needs should be taken into consideration as the decision whether or not to use an FM system is made.
- **Varying ages of implantation means varying programming needs.** It is easier to design a program for young implanted children to facilitate development of spoken language since the goals of most early childhood programs revolve around the facilitation of language development. For students first obtaining cochlear implants when they are older, designing a program to balance spoken language development and academic needs becomes trickier. The focus of the school day revolves around obtaining academic information. When a child obtains an implant, it becomes necessary to expand attention to developing spoken language skills without sacrificing attention to learning.
- **Accessibility to information**—Keep in mind that the process of moving a child through the hierarchy of listening skill development, to the point where he or she has access to information through hearing, takes time. Each implanted child brings a different level of accessibility to information through his or her hearing. This means that he or she will have different levels of accessibility to academic information, social interactions, and incidental learning. It is important to determine if a setting provides an opportunity for the child to have sufficient access through his or her listening to be involved and active participants in the environment.

Even if the child can hear some sounds, it doesn't mean that the child can learn complex information auditorily. In addition, some children may be effective social communicators using spoken language, yet suffer communication breakdown when it comes to learning academic information through their listening. It is important that implanted children have sufficient access to all levels of information around them.

- **Least Restrictive Environment (LRE)**—It is important to determine if a placement is truly the “least restrictive environment” for a child with a cochlear implant. While the goal may be for an implanted child to ultimately reside in a neighborhood classroom, this may not be the best place for a newly implanted child. What may seem like the “least restrictive environment” without all of the necessary supports could result in insufficient attention to the comprehensive needs of the child.
- **Social interactions**—While placement choices for cochlear implanted children are often chosen for their opportunity to facilitate spoken language development, it is crucial that the placement be evaluated related to promoting positive social opportunities. It is important that implanted children be in an environment where they feel comfortable communicating with their peers to facilitate development of age-appropriate social skills, friendships, and behavior. These issues demand serious attention when evaluating a specific placement.
- **Sufficient support services**—It is crucial to assure that a child's educational placement provides comprehensive student assessments and necessary support services. As placement decisions are evaluated, make sure professionals qualified in evaluating children who are deaf are serving the child. In addition, make sure the child has access to technological devices that may be needed such as captioned materials, FM systems, or other assistive technologies (i.e., direct audio input from the computer to the cochlear implant).
- **Teacher/staff training**—Teachers and other involved faculty and staff members should have opportunities for ongoing professional development to facilitate effectively involving implanted children in their school. Many teachers and support staff, even those who have been involved for years in the education of deaf children, may be unfamiliar with the technology of cochlear implants, strategies for working with implanted students, and expected outcomes. It is

**For more information  
about educational placement  
considerations, see the  
following Web sites:**

[Evaluating School Programs for  
Deaf and Hard of Hearing  
Children](#)

["In the Classroom...Children  
with a Cochlear Implant."](#)

necessary that professionals be trained related to all components of planning and implementing a comprehensive program for implanted students.

- **Other learning issues**—While some children may have behavior and learning issues that resolve following cochlear implantation as a result of their improved communication skills, a cochlear implant is not going to remedy issues unrelated to hearing loss. Children with additional learning disabilities or emotional issues unrelated to deafness will continue to display these concerns. Placement decisions should be made taking all of the child’s learning issues into consideration, not only a child’s cochlear implant.
- **Family support**—Family involvement is integral to a child’s success with his or her cochlear implant and educational program. Look for a program that supports families in understanding the communication and training process following implantation. For families where English is a second language, assure that a program provides access to information in the family’s first language.

# Choosing a Communication Methodology

There are many misconceptions and much confusion surrounding communication methodology choices for deaf children. These choices become even more complex when a cochlear implant is added to the picture. Determining a methodology to use for implanted children usually centers on which approach will best support the acquisition and use of spoken English. While development of spoken language skills is the goal for all students with cochlear implants, the road to achieving the outcome of full use of spoken language for communication and learning will vary for each child. (See **Factors Influencing Performance with a Cochlear Implant.**)

As each implanted student and family is unique, communication choices should be made taking into consideration a range of communication, academic, and social/emotional goals.

While development of spoken language skills should be central to whichever communication approach is utilized, use of an approach that provides a student with support through visual modalities in addition to spoken language should also be considered (i.e., Sign Supported Speech, bilingual programs encouraging both ASL and spoken English, Cued Speech). As discussed in the [NAD position paper on cochlear implants](#), as a communication methodology is chosen, it is important to keep in mind that, “language and communication are not the same as speech, nor should the ability to speak and/or hear be equated with intelligence, a sense of well-being and lifelong success.” Communication and cognition are vital ingredients of every child’s development, regardless of the mode in which it is expressed (i.e., visual or auditory).

“Children may benefit from using cochlear implants regardless of the communication strategy/teaching approach employed by their school program...Recommendations concerning educational programming should be made in partnership with parents, with the individual child’s unique status in mind...”

Connor, C. M., Hieber, S., Arts, H.A., Zwolan, T. Speech, vocabulary, and the education of children using cochlear implants: oral or total communication? *Speech, Language, and Hearing Research*, vol. 43, October, 2000.

## The communication methodology choices typically considered for deaf children include:

**Bilingual approach:** A bilingual approach supports development of ASL as a child’s first language, with development of English as a second language through reading, writing, and spoken language (specific to each child’s potential and needs).

**Total Communication:** Total Communication (TC) includes use of all modes of communication—sign language (ASL or manually coded English), spoken language, mime, facial expression, gestures, etc., to facilitate language development and communication. Its intention is not that all modalities be equally weighted and utilized for all children. The most common embodiment of TC, however, has become simultaneous communication. Simultaneous communication is the use of the spoken word simultaneously with the signed version of all or part of the spoken utterance with the signs attempting to approximate the spoken message.

**Cued Speech:** Cued Speech is a system utilized to assist in clarifying speechreading information. Hand-based cues are provided to help a child differentiate the various phonemes of speech that look similar on the lips. The system includes eight handshapes, representing groups of consonant sounds and four locations of the handshapes near the face, each representing a group of vowel sounds. A combination of these hand configurations are coordinated with the natural movements of speech.

**Oral Approach:** The oral approach supports development of spoken language through use of a child’s residual hearing. Appropriate, consistently functioning hearing aids or other listening technology is integral to the success of this approach. Using this approach, the child is also trained to obtain as much information as possible from speechreading. Speechreading is the ability to watch the lips and face of a speaker to obtain information.

For more information, see: [Communication Choices with Deaf and Hard of Hearing Students](#).

## Issues to Keep in Mind

Deciding which methodology to use is dependent on a complex interaction of factors individual to each child and family. There is no one “right” decision for any child with a cochlear implant. While it is beyond the scope of this document to fully detail the issues related to choosing one methodology over another, the following issues should be kept in mind as decisions are made:

- a one-size-fits-all approach will not meet the needs of all children with cochlear implants,
- the communication methodology the child has used up until implantation should be considered in the decision-making process,
- the methodology chosen should not be frustrating to the child, and
- considerations for a young child obtaining a cochlear implant before language has been established will be different than those for a child obtaining an implant when he or she is older and at a later stage of language development.

**For more information on communication options:**

[Beginnings for Parents of Children Who Are Deaf or Hard of Hearing](#)

[Where Do We Go From Hear?](#)

[Oral Deaf Education](#)

[Communication Choices with Deaf and Hard of Hearing Students](#)

[National Cued Speech Association](#)

[Auditory-Verbal International, Inc.](#)

[My Baby's Hearing](#)

[American Sign Language: Quick Facts \(NIDCD\)](#)

## Communication Environment

Regardless of methodology, it is important to provide a communication environment that:

- is driven by individual communication goals/strengths/style,
- assures language accessibility while spoken language skills are developing,
- focuses on a child's communication strengths to facilitate cognitive and academic development,
- provides access to mature and fluent language models,
- provides opportunities to develop spoken language skills in meaningful ways during both structured and natural activities,
- acknowledges that language modality may change for students as they progress following implantation,

- acknowledges that student skills and preferences are important in making communication decisions,
- is structured to facilitate language/communication development and, at the same time, takes into consideration a child's overall educational and social needs,
- is child-centered with the child providing the lead in demonstrating communication preferences,
- does not allow the child to fall behind academically at the expense of focusing on spoken language development,
- provides the child with efficient communication for interacting with peers, and
- expects the deaf child to acquire language at the same rate as his or her hearing peers.

# Considerations for the Use of Sign Language

The following document addresses the issues surrounding the use of sign language for children who have a cochlear implant. It provides information to help families and professionals understand:

- the debate related to the use of sign language,
- the growing support for the use of sign language,
- the basic beliefs regarding the use of sign language,
- the reasons to consider using sign language,
- the varied role of sign language,
- what the literature is saying about the use of sign language,
- the considerations for educational placement, and
- the considerations and strategies for developing spoken language within signing environments.

## The Debate

Professional opinions in both medical and educational environments vary as to the reasons why sign language should or should not be used with children who have a cochlear implant.

Professionals who advise against the use of manual communication for children with a cochlear implant believe that promoting total reliance on, and immersion in, the use of the auditory channel maximizes the potential the implant provides to develop useable hearing and spoken language. These professionals warn that the use of sign language significantly reduces the amount and consistency of post-implantation spoken language stimulation for the child, promoting dependency on visual communication, and causing further delay in spoken language development.

Other professionals maintain that sign language and spoken language can be developed and used to complement and supplement each other. They believe that effective educational environments can be designed to facilitate and maximize a child's language and communication skills in both sign language and spoken language, and that these

approaches can work harmoniously to support a child's overall language, cognitive, social, and academic development.

## **Growing Support for the Use of Sign Language**

When cochlear implants first became available, the majority of families choosing this surgery appeared to be those families who were already strongly committed to oral education. As use of the technology has become more widespread, it appears that children who are obtaining implants have a broader range of education, communication, and family environments with a wider range of goals.

An “auditory only” approach to communicating with implanted children is often strongly recommended by hospital implant centers and is an effective choice for many. However, communication approaches involving the development and use of both spoken and signed language for implanted children are gaining support. The choice to implant a child is no longer solely associated with the desire to seek an “oral only” education for him or her.

Of 439 families of school-aged children with cochlear implants questioned in a 1997-1998 survey by the Gallaudet University Research Institute, two-thirds of the families continued to use sign language as a support for communication in the home.<sup>1</sup> Amy McConkey Robbins, in volume 4, issue 2, of *Loud and Clear*, a publication of the Advanced Bionics Corporation, states that “a substantial proportion of children with cochlear implants utilize sign language” and that “pediatric implantees” are about equally divided between those who use oral communication and those who use total communication.

While use of solely oral communication strategies may meet the needs of one segment of the population of implanted children, it appears that sign language can have a role in the language, communication, education, and identity of children who use cochlear implants.

## **Basic Beliefs**

In general, persons supporting the use of sign language in the lives of implanted children believe that:

- when parents and children communicate effectively with each other from the very start of hearing loss identification, a foundation for language acquisition (both spoken and signed language) is established and language delays may be prevented or minimized (Yoshinaga-Itano, C., & Sedey, A. (Eds.). 2000. Language, speech, and social-emotional development of children who are deaf or hard of hearing. *The Early Years*, 100(5). Washington, DC: Alexander Graham Bell Association.);

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<sup>1</sup> Parents' Perceptions and Experiences with Their Children's Cochlear Implants. Report of the results of a survey of parents of pediatric cochlear implantees, Gallaudet Research Institute, 1998.

- spoken language can be nurtured and developed in a signing environment when children are provided with the necessary supports;
- sign language and spoken language development are compatible and can support each other in the learning process;
- the use of sign language does not mean exclusion of spoken language development;
- children with a cochlear implant can benefit from interaction with the Deaf community to promote their identity as Deaf individuals;
- deaf children with a cochlear implant, while they may obtain greater access to sound in comparison to traditional hearing aids, are still “deaf” and may benefit from the use of sign language, similar to other deaf children; and
- children with a cochlear implant who are not exposed to sign language and then who do not develop spoken language skills in a timely fashion may become at risk for significant delay in the areas of communication, language, social, and academic development.

### **Reasons to Consider Sign Language Use for Children with a Cochlear Implant**

There may be a variety of reasons for considering using sign language with implanted children. Some of the reasons include:

- to provide an easily accessible shared language system to readily communicate desires, ideas, wants, and needs (see sidebar);

#### **How can sign language serve as a foundation for the development of spoken language?**

- As a supplement to early language development:

Sign language can provide babies and toddlers with a system to symbolically encode the experiences of their lives—through a sensory system that is intact—that is, vision. The auditory system of a profoundly deaf child (pre-implant) will provide very limited access to the auditory-based communication system of spoken language.

- As a clarifier in development of listening:

As a child’s auditory skills begin to develop through a cochlear implant, the world of sound can be overwhelming, especially the rapid, complex barrage of spoken language. As a child learns to associate sound with meaning, signs can be used to bridge the new experience of sound with the familiar experience of visual language.

- As a cataloging system for new experience:

A young child is constantly experiencing new things—people, places, things, concepts, emotions, etc. The fledgling auditory system is not capable of “capturing” and “filing” these new experiences through audition alone. New experiences can be encoded quickly through the mature system of vision, and can later be transferred—quickly and easily—to the auditory system.

*Mary Koch, from the handout “Sign Language as a Bridge to Spoken Language,” disseminated at the conference, [Cochlear Implants and Sign Language: Putting It All Together](#), held April 11-12, 2002, at Gallaudet University.*

- to promote language development through a child’s strong sense of vision, while the sense of audition develops to become functional and broad enough to shoulder the responsibility of facilitating spoken language;
- to safeguard overall language development related to inconsistent and unknown outcomes in development of spoken language for each implanted child;
- to provide a language foundation to facilitate a child’s ability to understand and utilize auditory information; and
- to support communication in different environments, as some implanted children (similar to some hard of hearing children) may be efficient oral communicators for social situations, however, sign language is a necessary support for critical or abstract thinking, problem solving, and assimilating new information in an academic environment.

### **Varied Roles of Sign Language**

While there is increasing support for the use of sign language, it should be acknowledged that the role of sign language might not be the same for each cochlear implanted child and his or her family. Some of the factors that may impact on the degree to which sign language may be used include:

- the extent and nature of sign language use prior to implantation,
- the individual functioning levels in spoken language prior to implantation,
- student preference and/or benefit from the addition of sign language,
- family motivation to include sign language use,
- auditory vs. visual learning styles,
- auditory/language processing skills,
- language development level at the time of the implant,
- family interest in using sign language,
- access to sign language models, and
- peer group identification (“fitting in”).

## What Literature Reports About Sign Language and Cochlear Implants

Limited research has been done in the area of cochlear implants and the use of sign language. As the earliest group of implanted students were mostly involved in oral environments, there has not been sufficient time to evaluate longitudinal outcomes for implanted students who use sign language. Some of the literature available on the topic of sign language use for implanted children includes the following statements supporting its benefit:

- “Continued use of a total communication approach might be the most effective means for facilitating language growth in a child with a cochlear implant. Nonetheless, it is essential that the child be exposed to an enriched auditory environment for as many hours a day as possible. There is a great need for a strong commitment to maximize the auditory component with a TC approach. In addition, it might be necessary for the school staff to adjust their expectations and teaching priorities, especially if manual communication is the focus of the child’s educational placement.”

McKinley, A., & Warren, S. (2000). The effectiveness of cochlear implants for children with prelingual deafness. *Journal of Early Intervention, 23*.

- “It seems that a child who is a good communicator before implantation, whether silently or vocally, is likely to have good speech discrimination ability in later years.”

Tait, M., Lutman, M. E., & Robinson, K. (2000). Preimplant measures of preverbal communicative behavior as predictors of cochlear implant outcomes in children. *Ear and Hearing, 21*, pp 18-24.

- “One observation seems equally sure: Being exposed to two languages from birth, by itself, does not cause delay and confusion to the normal processes of human language acquisition.”

Petitto, L. A., Katerlos, M., Levy, B., Gauna, K., Tétrault, K., & Ferraro, V. (2001, June). Bilingual signed and spoken language acquisition from birth: implications for the mechanisms underlying bilingual language acquisition. *Journal of Child Language, 28*, pp 453-496.

- “Children may benefit from using cochlear implants regardless of the communication strategy/teaching approach employed by their school program...other considerations, such as the age at which children receive implants, are more important.”

McDonald, C., Hieber, C., Alexander, S., Arts, H., & Zwolan, T. (2000, October). Speech, vocabulary, and the education of children using cochlear implants: Oral or Total Communication? *Journal of Speech, Language, and Hearing Research*, 43.

- "...it is important that guidelines be developed to identify children who are not benefiting from cochlear implants while they are still young enough to acquire language through other means...the overall cognitive and psychosocial development of children will be negatively affected if they do not have access to a shared language system with which to communicate with family members, other children, and other adults during their early years."

Spencer, P. (2002). Language development of children with cochlear implants. In I. Leigh & J. Christiansen, *Cochlear implants in children: Ethics and choices*. Washington, DC: Gallaudet Press.

## **Considerations for Educational Placement**

It is necessary for a child to have the opportunity to actively integrate spoken language into his or her educational and home environment if the implant technology is to be maximized for the development of spoken language skills. As placement decisions that include the use of sign language are made, keep in mind that environments that utilize signing vary in the type of sign language used and the extent and nature of spoken language in the environment.

You may encounter the following terminology used when describing educational programs that include sign language: Total Communication, Bilingual/Bicultural, or Dual Language.

- Bilingual/Bicultural (Bi-Bi)—A bilingual approach supports development of American Sign Language (ASL) as a child's first language, with development of English as a second language through reading, writing, and spoken language (specific to each child's potential and needs).
- Total Communication (TC)—Includes the use of all modes of communication—sign language (ASL or manually coded English), spoken language, mime, facial expression, gestures, etc.—to facilitate language development and communication. The intention of this methodology is to provide a child with any modality necessary to support the child in developing language. Its intention is not that all modalities be equally weighted and utilized for all children. The most common embodiment of TC, however, has become simultaneous communication. Simultaneous communication is the use of the spoken word simultaneously with

the signed version of all or part of the spoken utterance. The signs used are usually an attempt to match the spoken message.

- **Dual Language**—A Dual Language program focuses on the use of both ASL and English. English is modeled through Sign Supported Speech and through spoken English alone. First and second language acquisition and use: ASL or English depends on a variety of factors related to the child and family (see **Factors Influencing Performance**).

## **Developing Spoken Language in Signing Environments**

*The following considerations and strategies for supporting the development of spoken language in a signing environment are based on a list generated by 130 administrators, teachers, and support service specialists from throughout the United States and Canada during the conference, “Cochlear Implants and Sign Language: Putting It All Together,” sponsored by the Cochlear Implant Education Center at the Laurent Clerc National Deaf Education Center during April 2002. For the full proceedings of this conference, visit: <http://clerccenter.gallaudet.edu/Products/Sharing-Ideas/CI/index.html>.*

For educational environments that use either American Sign Language or other sign language systems to be appropriate environments to facilitate development of spoken language for students with cochlear implants, there must be an ongoing commitment of the program to value these skills and ensure ongoing opportunities for implanted students to develop and use spoken language.

The following list includes suggested strategies to consider for promoting spoken language development in signing environments:

- Develop individual language plans for each student with a cochlear implant—documenting a student’s language functioning in spoken and signed language and documenting goals for each of these areas of development. Monitor these goals on an ongoing basis.
- Specify times/activities to utilize either sign language only, spoken language only, or sign and speech together (Sign Supported Speech).
- Alert the child to modality use (i.e., “Now we are going to listen.”).
- Incorporate the use of the “sandwich technique” (“say it-sign it-say it,” or “sign it-say it-sign it”).
- Model and expand signs already known to the child into spoken language. For example, when a child signs *ball*, repeat back, “Yes, that’s a ball.”

- Introduce new spoken language in highly redundant and contextual situations. Once students experience familiarity with spoken language in a structured environment, provide opportunities for each child to use his or her listening skills in expanded environments.
- Provide activities that incorporate sound throughout the day. For example, use timers to designate the end of an activity or music to indicate when it is time to line up.
- For older students, help them make links between spoken language and ASL. For example, explain how a word or a sentence looks in ASL and how it sounds in English.

Further information regarding strategies to facilitate spoken language development with an implant will be discussed in the module, **Training the Ear to Listen** (coming soon).

**For more information on cochlear implants and sign language:**

[National Association of the Deaf: Position Paper on Cochlear Implants](#)

[Loud & Clear Newsletter, 2002, Volume 4, Issue 2, Advanced Bionics, "A Sign of the Times"](#)

[DawnSignPress; Sign Language Resources](#)

[Sound and Fury Web Site](#)

# Cochlear Implants and the Deaf Community

By Dennis Berrigan, Dr. Laurene Simms, and Francisca Rangel/March 2006

Watch this [10-minute video](#) of Dennis Berrigan, ASL Center Coordinator at the Laurent Clerc National Deaf Education Center, Dr. Laurene Simms, Associate Professor in the Gallaudet University Department of Education, and Francisca Rangel, ASL & Deaf Studies Coordinator at Kendall Demonstration Elementary School and Model Secondary School for the Deaf at the Clerc Center, in a discussion of the following issues related to the Deaf community perspective on cochlear implants:

- a definition of the Deaf community
- a definition of Deaf culture
- a Deaf community view on cochlear implants
- the National Association of the Deaf position paper on cochlear implants

**For further information about the Deaf community's perspective on cochlear implants, see:**

National Association for the Deaf position paper on cochlear implants:

<http://www.nad.org/site/pp.asp?c=foINKQMBF&b=138140>

Leigh, I., & Christiansen, J. The Deaf community: Perceptions of parents, young people, and professionals. In *Cochlear implants in children: Ethics and choices* (chap. 10). <http://gupress.gallaudet.edu/bookpage/CIICbookpage.html>

*Sound and Fury* website: <http://www.pbs.org/wnet/soundandfury/>

**For more information about Deaf culture, see:**

American Deaf Culture: <http://www.signmedia.com/info/adc.htm>

Information and resources related to American Sign Language (ASL), Interpreting, and Deaf Culture  
<http://www.aslinfo.com/printPage.cfm?page=deafculture%2Ecfm&title=Deaf%20Culture>

Last revised March 2006

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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## Fitting the Speech Processor

Following a four- to five-week post surgical healing process, it is time to be “hooked up” to the external component of the implant called the “speech processor.” There are body-worn and behind-the-ear (BTE) processors. Most adults and older children are fitted with a BTE processor. Body-worn processors may still be used with very young children as the ear level units may be too large to fit comfortably behind smaller ears and some ear level designs do not lend themselves to being easily monitored to assure sound transmission. Increasing numbers of young children are now beginning to use BTE devices more regularly, however, as newer speech processor designs provide greater ease of monitoring, more streamlined designs, and greater resistance to moisture. Some individuals may prefer a body-worn device if they do not want the speech processor to sit behind their ear.

Where small children are concerned, smaller devices can become more easily lost. See "[What About Insurance?](#)" for information about extended warranties and insurance.

Parent ingenuity has been helpful in finding ways (toupee tape, body glue, huggies, critter clips, etc.) to keep BTE processors securely behind small ears.

**More suggestions about keeping speech processor devices on a child:**

[If Your Child Won't Keep Their Hearing Aids In...](#)

[CI Holders, Pouches, Harnesses, Fanny Packs, Shirts...](#)

## Mapping

Each speech processor must be adjusted or “mapped” specific to each individual. This process requires an initial appointment with an audiologist at the hospital implant center where the surgery occurred. The initial mapping of the device may take about two hours. Several subsequent appointments are then usually required during the following weeks. These ongoing appointments are necessary to adjust the “map” as the brain adapts to incoming sound. What the brain perceives as initially loud may quickly become quiet or inaudible. During these sessions, the electrical stimulation must be adjusted until a good initial map is determined. Once a stable map has been obtained, children may then be seen once a month (at first), then every two to three months for the first year, and every six months for the second and third years, depending on the recommendation of the hospital implant center.

During the initial “hook up,” families anxiously await a child’s response to sound. Listening for the first time, however, may or may not be a positive experience. Some children may smile and demonstrate enjoyment of their early listening experiences through their cochlear implant while others may appear to dislike or be afraid of their new world of sound. If a child does not respond as hoped during early mapping sessions, it does not mean that the child will not ultimately like and benefit from the cochlear

implant. It is important that the audiologist adequately prepare the family about what to expect from a child's first listening experience and the weeks to follow.

**For more information about the mapping process, contact [Cochlear Corporation](#) to request a copy of:**

**What to Expect at a Child's Hook-up** (video-closed captioned, 60 minutes)

An in-depth explanation of issues integral to fitting the external components of a cochlear implant in the weeks following surgery are included in this videotape. Contents include the initial hookup, programming of the speech processor, including selecting the speech coding strategies and setting levels individual to each child, the child's first listening experiences, expectations for the implant, and troubleshooting of the implant system. This video covers many of the nitty-gritty questions families may have related to what goes into the fitting and the use of an implant.

## Setting a Map

The basic components of setting a map include determining threshold levels (T levels), comfort levels (C Levels), and "flagging" (turning off) electrodes that may cause problems. A map is determined by setting each of the electrodes to be loud enough for a person to be aware of a sound, but not too loud as to cause discomfort.

**For More Information:**

[Mapping for Dummies](#)

**For More Information:**

[ASHA Guidelines for Audiologic Assessment for Children From Birth to 5 Years of Age \(PDF\)](#)

Determining a map for a young child is as much of an art as it is a science. It is important that the audiologist doing the mapping has experience working with young children. Responses are typically obtained using pediatric hearing evaluation techniques appropriate to a child's age (i.e., Behavioral Observation Audiometry, Visual Reinforcement Audiometry, or Play Audiometry).

As young children may not cooperate for the long periods of time needed to set a map, the map may be set by generalizing responses obtained on a few electrodes to the full array of electrodes. The audiologist may also have a child try a map with similar characteristics to those used successfully by other children.

During the initial mapping session, an audiologist will seek to determine:

- the type of speech strategy to use (see descriptions of speech-processing strategies below),
- the volume setting,
- the sensitivity setting,
- program choices (more than one map may be set in a speech processor), and
- locks and controls (to prohibit children from changing settings inadvertently).

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Each of the cochlear implant manufacturers have noninvasive software programs to objectively monitor the integrity of the cochlear implant system and to assist with the mapping process.

The [Cochlear Corporation](#) has *Neural Response Telemetry (NRT)* for Nucleus 24 devices. This computer software objectively measures the response of individual nerve fibers to stimulation and determines a child's "T" and "C" levels. A map can then be set based on recording the responses of these fibers without expecting a verbal or behavioral response from a child. The process takes less than 10 minutes and can be used either during surgery to determine that the ear is responding appropriately with the implant, or during mapping sessions after implantation. When used during surgery, NRT assures the surgical team that the auditory nerve is responding to the stimulation provided by the implant. Not all hospital implant centers use NRT evaluations during surgery.

The Advanced Bionics software program which confirms that the hearing nerves are responding to electrical stimulation is called *Neural Response Imaging (NRI)*. Med-EI provides *Impedance and Field Telemetry* to monitor its device function.

### **Speech-Processing Strategies**

A speech-processing strategy is the code used to convert sound to electrical impulses that represent speech. The cochlea is "tonotopic" with the base or bottom of the cochlea responsible for processing the high-frequency sounds, and the apex of the cochlea responsible for processing the low-pitched sounds. The speech processor has the job of transforming sounds into electrical patterns to convey the sounds to the brain by stimulating the various parts of the cochlea.

A variety of sophisticated coding strategies are utilized to best approximate speech. For example, the processor may be set to stimulate the electrodes:

- simultaneously—all channels stimulated at the same time,
- partially simultaneously—some channels at the same time/some in sequence, or
- non-simultaneously—all channels in sequence.

There may also be different patterns and rates of speed at which the electrodes are stimulated as well. There is no one program suited to all persons with a cochlear implant.

There are varied speech processor names and speech coding strategies used by each implant manufacturer. The names of these coding strategies have changed over the years as new cochlear implant designs have emerged on the market. Below is a description of the cochlear implant speech processor models and speech-coding strategies available.

## **Cochlear Americas Corporation**

Cochlear Corporation's most current device is called the Nucleus Freedom™. This device is available in a lightweight [body-worn version](#) and a [behind-the-ear \(BTE\) version](#).

The Nucleus Freedom™ device offers the option of choosing from a variety of speech coding strategies including:

- Spectral Peak Strategy (SPEAK)—stimulates electrodes depending on the intensity and frequency characteristics of speech. It dynamically selects the number and location of electrodes to be activated.
- Continuous Interleaved Sampling (CIS)— a pulsatile (digital) speech coding strategy that stimulates channels at high rates to reproduce the fine temporal changes in the acoustic waveform. Each channel is stimulated sequentially.
- Advanced Combination Encoder (ACE)—stimulates electrodes using a combination of SPEAK, which looks at the spectral components of speech, and the high stimulation rate of CIS.

The Freedom devices also offer other sound technology features including:

**Adaptive Dynamic Range Optimization (ADRO):** An automatic feature that boosts soft sounds and makes loud sounds quieter and more comfortable in noise..

**Beam:** A dual microphone system (directional and omni-directional). This feature assists with helping the individual focus on the sounds coming from the front while softening the sounds from other directions. For more information, see:

<http://www.cochlearamericas.com/Products/383.asp>.

**Whisper:** A compression system that assists in listening to softer sounds. For more information, see: <http://www.cochlearamericas.com/Products/382.asp>.

Prior to the Freedom, the speech processors had various names. The earlier body-worn devices were called the *Spectra* and then the *Sprint*. The earlier BTE devices were the *Esprit* and *3G*.

## **Advanced Bionics Corporation**

**Advanced Bionics Corporation's** most current devices are the HiRes Auria (BTE device) and the Platinum body-worn device. Each of these external devices are compatible with the HiRes 90K internally implanted device and can be programmed with HiResolution Sound Technology. This system uses a wide sound window to capture as

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many sounds as possible and provides fast processing power which enables it to read, interpret, and utilize the detailed sound data. The signal processing in HiResolution preserves the original acoustic waveforms before they are delivered to the auditory nerve. For more information, see: [http://www.bionicear.com/tour/hi-res\\_sound.asp](http://www.bionicear.com/tour/hi-res_sound.asp).

Prior to the HiRes 90K internal device there were other generations of the body-worn device (Clarion 1.0, Clarion 1.2, S-Series, and Earlier Platinum Sound Processor-PSP) and BTE device (Platinum BTE, CII BTE). Earlier internal devices had the capability of being matched with the following speech coding strategies:

- Simultaneous Analog Stimulation (SAS)—stimulates all electrodes at the same time.
- Continuous Interleaved Sampling (CIS)—uses digital filters and channels are stimulated at high rates to reproduce the fine temporal changes in the acoustic waveform. Each channel is stimulated sequentially.
- MPS—presents pulses partially simultaneously/partially sequentially.

## **MED-EL**

The MED-EL device has an internal device called the Pulsar and a speech processor device called The TEMPO+ . When implanted, the recipient receives a total of five wearing options. It has a modular design and four available battery packs. Users can determine how they want to wear the speech processor.

The TEMPO+ Speech Processor uses CIS and the Hilbert Transform (a precise mathematical algorithm which simulates the shape of sound) to provide a MED-EL speech coding strategy referred to as CIS+. While there may be other manufacturers that use CIS, MED-EL notes that each may implement this strategy in a different way. It reportedly provides a wide frequency range and highly flexible stimulation parameters. For more information, see:

[http://www.medel.com/ENG/US/20\\_Products/20\\_Speech\\_Processor/999\\_tempo\\_5.asp](http://www.medel.com/ENG/US/20_Products/20_Speech_Processor/999_tempo_5.asp).

The TEMPO+ continuously self-monitors its programmed maps for data inconsistencies such as those that result from ESD or static electricity. If a problem is detected, the SoundGuard feature ceases stimulation and causes the Status Light to flash. In most cases, all mapping data can be restored by turning the system off and then on again, thus eliminating the need to visit an audiologist to reload the maps.

Revised by:  
[Debra Nussbaum](#)  
January 2006

## Training the Ear to Listen

The implant surgery is complete and the “map” has been set. Access to sound has been achieved, and it is time to begin the process of training the “new” sense of hearing to be functional for the purpose of understanding sounds in the environment and learning spoken language. The process and rate of attaching meaning to sound will differ for each child.

The following components will be addressed:

- considerations for training,
- equipment troubleshooting,
- the stages of listening and speaking development,
- skill assessment,
- curriculum guidelines,
- adjusting communication variables,
- sign language as a support to listening, and
- about auditory-verbal therapy.

### Considerations for Training

The process of “making sense of sound” will differ for each child. Some children will readily make connections between sound and the world around them in natural ways, while others may need structured, methodical practice to make the connections to understand sound. Regardless of the type of intervention—naturalistic, structured, or a combination of both—there are few who would dispute the importance of *training the ear to listen* to facilitate optimal outcomes with a cochlear implant.

Amy McConkey-Robbins describes the difference between training via a **didactic** (directly taught) approach to auditory training in comparison to a **generalization** (incidental learning in the natural environment) approach. In [“Two Paths of Auditory Development for Children with Cochlear Implants,” in \*Advanced Bionics’ Loud and Clear Newsletter \(Volume 1, Issue 1, 1998\)\*](#) (PDF), McConkey-Robbins discusses the following important considerations:

- a child’s potential for incidental learning and generalization is greatest in the early years and slowly decreases with age;
- all implanted children require a combination of didactic and incidental teaching;
- with all things being equal, the younger the child at the time of implantation, the greater the influence of incidental learning and the less the need for didactic instruction; and
- the older the child at the time of implantation, the greater the need for didactic instruction to foster auditory development.

While the hope is that children will learn to integrate sound through natural listening experiences, outcomes with many implanted children support the importance of structured listening training. Random, ongoing auditory input does not automatically translate to comprehension.

In addition, training alone is not a guarantee of similar “listening outcomes” for each child with an implant. It is important to keep in mind that, regardless of extensive training, outcomes will vary for each child based on the many variables that impact a child’s performance with an implant (see [Factors Influencing Performance](#)).

For example, the expectations and progress rate for a child who is implanted in the early years when language is typically emerging are observed to be significantly different than for a child who is implanted late, beyond the typical language learning years. A young child may learn to listen, in a developmental sequence, with only limited didactic training, while an older child, arriving at the implant process with minimal listening experience, may require extensive, structured listening training. Whether an individual is young or old, an experienced or inexperienced listener, the new sense of “electronic” listening does not automatically translate to understanding. The path to bringing meaning to sound is unique to each implanted individual and outcomes cannot be guaranteed.

## Equipment Troubleshooting

The first step to optimal listening with an implant is a consistently functioning device. It is imperative that a cochlear implant be in working order daily and have an appropriate “map” for a child to obtain maximum benefit from their implant. Ongoing opportunities should be scheduled with the hospital implant center to monitor the chosen map to assure that it continues to meet the child’s needs.

**For more information  
about mapping a child's speech  
processor:**

[Fitting the Speech Processor](#)

### Why Monitor the Map?

As the brain adjusts to sound, what may have at first been comfortable and “loud enough” becomes insufficient and “not enough.” This adjustment to sound may be clearly apparent or can sometimes go unnoticed, similar to a light on a dimmer that grows dim so slowly as to almost be imperceptible until it becomes too dark. A child may also inadvertently have electrodes that have been set for too much stimulation, causing discomfort. If this occurs and is not remedied, the child could possibly begin to see listening as a negative experience and may resist using the cochlear implant. If a child is functioning with an inappropriate map, this will negatively impact progress with the implant.

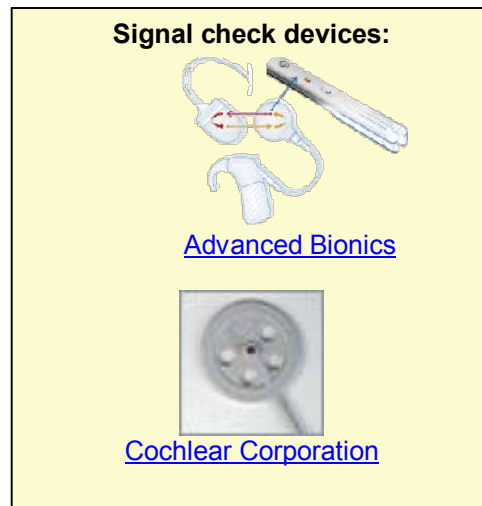
There are two types of checks that can be completed daily both at home and in school on a cochlear implant—an equipment check and a check of the child’s functional listening.

## Equipment Check

It is not possible for parents and teachers to listen to a child's cochlear implant as one would listen to a hearing aid; however, there are other checks of the equipment that should be completed daily.

Include the following in a daily check:

- Use a **signal check device** (available from the implant manufacturers) to check the integrity of the transmitted signal when connected. A light indicates that all systems are working when the implant is on the child.
- Check all batteries daily (a weak battery will make a difference).
- Check coils and cables for wear and tear.



For a more detailed description of daily equipment checks and instructions for when a problem occurs, refer to further troubleshooting guidelines available at the following Web sites:

- [The Parent's Guide to Cochlear Implants](#)
- [Equipment Check for Cochlear Corporation](#)
- [Johns Hopkins Listening Center: Troubleshooting Guide \(Cochlear, Advanced Bionics, Med El\)](#)

## Functional Listening Check

In addition to checking the equipment, it is important to check a child's performance with the equipment on a daily basis. One such check, familiar to many, is the **Ling Six Sound Test**. This check involves presenting a series of specific speech sounds at a consistent loudness and distance from a child to document his or her sound awareness. When a

### Instructions for making the listening hoop (from [Bringing Sound to Life—Principles and Practices of Cochlear Implant Rehabilitation](#))

Materials needed:

- 8-inch embroidery hoop
- speaker cloth (available from <http://www.radioshack.com/>)
- Directions for assembly:
- Cut a DOUBLE layer of fabric in a circle two to three inches larger than the hoop.
- Separate the two rings of the embroidery hoop.
- Place two layers of fabric over the smaller hoop.
- Place the larger hoop over the fabric and the smaller hoop, keeping the edges even.
- Keep the fabric taut as the rings are put together.
- Trim the edges of the fabric.
- Glue around the trimmed edge of the fabric and the edge of the hoop.
- Allow time for the glue to dry.

child demonstrates a change in sound awareness from an established baseline response, this may reflect:

- a possible change in a child's listening potential that may require attention to his or her map, or
- an equipment malfunction.

This quick and easy check involves the following steps:

- Have the student sit at a distance of about three feet wearing his or her implant.
- Cover your mouth with a listening hoop (a specially designed barrier to present sound without distortion). This hoop can be made using an embroidery hoop with two layers of acoustic speaker cloth.
- Individually present each of the following six sounds: "mm," "oo," "ah," "ee," "sh," and "s." (These sounds represent the variety of the frequencies present in speech.)
- Have the child respond to sound (raise a hand, place a block into a container, etc.) when it is audible.

*Note:* This task can be completed only after a child is old enough to produce a conditioned response to sound.

This task does not indicate that a child can identify or understand the sounds presented.

Notes about the Ling Six Sound Test:

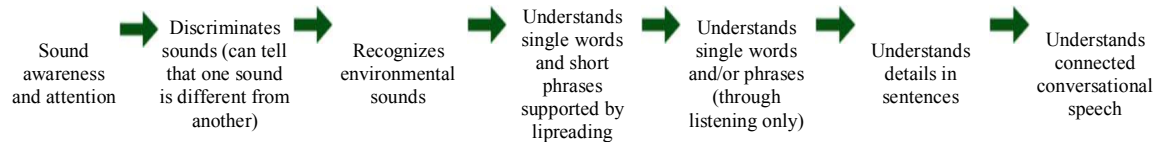
- Present each sound at a quiet level. If you present a sound too loud, it is difficult to determine when a mapping shift may have occurred. You want to confirm that the child is consistently aware of "very quiet" sounds.
- Be sure to vary the pause time between sounds. Children readily pick up on a pattern and false positive responses will occur. Occasionally intersperse "no sound" during the check to see if the child is responding appropriately. That is, signal "listen," hold up the listening hoop, and then say nothing. The child needs to feel confident saying that he or she doesn't hear anything.
- If you notice a change in response that does not appear to be related to behavior, contact the child's family or hospital implant center audiologist to discuss the issue.

## **The Stages of Listening and Speaking Development**

There are many stages that come before a child begins to understand his or her first word through an implant. He or she must first develop the pre-requisite skills that provide the foundations for word understanding. The child must first be aware of a range of sounds

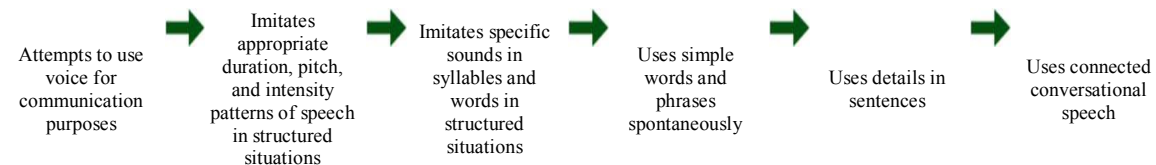
and be able to differentiate between those sounds before he or she will ever be able to understand them.

The following progression details a typical hierarchy a child may follow in learning to listen and understand. There are many aspects and components of each of these levels. Receptive listening skill development:



It is important to remember that a child's ability to use spoken language is closely tied to what he or she is hearing, and that listening and speaking skills development is intertwined. The following is a typical progression of spoken skill development.

Expressive skill development:



## Skill Assessment

It is necessary to determine a child's functioning level related to both receptive and expressive spoken language at the time of implantation and to develop a plan to facilitate the progression through the necessary stages to arrive at spoken language understanding and use.

Questions to determine a child's receptive functioning level:

- Which sounds is the child aware of and in which environments?
- Is the child conditioned to respond to sound?
- Is the child attending to sound naturally or does he or she need to be directed to listen?
- What does the child understand and in what conditions? (How loud? How far away? How many listening choices? How many times was it repeated?)

Questions to determine a child's expressive level:

- How does the child utilize spoken language to communicate?
- Does the child have intelligible speech? If so, in what situations?
- What specific sounds can the child say/imitate/produce spontaneously?

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There is a variety of formal and informal tools available to assist in gathering information about a child's functioning. For an explanation of suggested assessment tools and scales to consider, go to: <http://clerccenter.gallaudet.edu/CIEC/resources2.html#suggested scales>

Two popular tools that are readily available at no charge to document receptive listening integration skills are the Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS) and the Functional Auditory Performance Indicators (FAPI).

For young children, the IT-MAIS is a criterion-referenced test that utilizes a parent interview technique to determine how a young child is integrating sound into his or her life. Available through [Advanced Bionics](#), the IT-MAIS is based on a similar tool for older individuals called the Meaningful Auditory Integration Scale (MAIS). The questions document functioning in three areas: vocalization behaviors, sound alerting, and deriving meaning from sound. The responses can be used to guide planning for auditory training.

**For further information about the use of this scale:**  
[Advanced Bionics, Loud and Clear Newsletter, Volume 4, Issue 1, Infants and Implants: Listening Skills in Very Young Children](#) (PDF)

The FAPI: An Integrated Approach to Auditory Skill Development documents a child's listening skills in seven related areas: sound awareness, sound meaning, auditory feedback, sound localization, auditory discrimination, short-term memory, and linguistic auditory processing. This tool is available online at: [http://www.csdb.org/chip/resources/docs/fapi6\\_23.pdf](http://www.csdb.org/chip/resources/docs/fapi6_23.pdf) (PDF).

After assessment is complete, the next step is to set goals that address development of both listening and speaking skills. As a plan is initiated, it is always critical to balance development of these skills into the context of a child's overall language, communication, and educational experience. For further information, see [Choosing a Communication Methodology](#).

## Curriculum Guides

There are numerous curriculum guides designed to move a child through the hierarchy of listening skills using a structured, sequential approach. A description of and purchase information for the following commonly used guides can be found in the [Resources for Children and Families section](#) of the Laurent Clerc National Deaf Education Center's Cochlear Implant Education Center site.

- [Bringing Sound to Life: Principles and Practices of Cochlear Implant Rehabilitation](#)

- [Speech Perception Instructional Curriculum Evaluation \(SPICE\)](#)
- [Top Ten Strategies for Parents \(parent manual, professional manual, videotape\)](#)
- [Learn to Talk Around the Clock](#)
- [Classroom Goals: Guide for Optimizing Auditory Learning Skills](#)
- [Cottage Acquisition Scales for Listening, Language, and Speech](#)
- [St. Gabriel's Curriculum for the Development of Audition, Language, Speech and Cognition](#)
- [CHATS: The Miami Cochlear Implant, Auditory and Tactile Skills Curriculum](#)
- [Listen, Learn, and Talk \(Cochlear Corporation\)](#)
- [Spoken Communication for Students Who are Deaf or Hard of Hearing: A Multidisciplinary Approach](#)
- [AuSplan \(Auditory Speech Language\): A Manual for Professionals Working with Children Who Have Cochlear Implants or Amplification](#)

**Specifically for young children:**

- [My Baby and Me](#)
- [Listen Little Star \(A Listening Program\)](#)

## **Adjusting Communication Variables**

With careful attention, the listening difficulty of any communication experience can be adjusted. Learning how to adjust communication variables is at the core of helping a child derive meaning from sound and central to the concept of “auditory training.” *Bringing Sound to Life: Principles and Practices of Cochlear Implant Rehabilitation.* (Koch, M. <http://bionicear.com/professionals/rehabmaterials.asp>) describes this important concept as the “challenge factors.”

When the following factors related to content and presentation of information are modified during either a structured listening activity or in the natural environment, any listening situation can be controlled to be either readily accessible or challenging.

These content-related factors can be modified:

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- the familiarity of vocabulary,
- the number of items in a choice set (i.e., three choices, four choices, open set),
- the acoustic contrast of items in a choice set (i.e., shoe versus elephant), and
- the number of critical elements (i.e., big red shoe, ball under the bed).

These presentation-related factors can be modified:

- the rate of presentation,
- the acoustic highlighting (emphasis on key words),
- the visibility of a carrier phrase (a phrase leading up to a key word or words), and
- the number of repetitions.

Another important strategy to assist children in deriving meaning from sound is the “sandwich” technique. The sandwich technique involves linking information sequentially via auditory and visual modes.

*Note:* Depending on a child’s communication methodology, provision of visual information in the “sandwich” may be through either sign language or speechreading. Two examples of the sandwich technique are as follows:

**For more about the sandwich technique and the components of auditory training:**

[Advanced Bionics, Loud and Clear Newsletter, Volume 3, Issue 1, Bringing Sound to Life \(PDF\).](#)

- *Auditory-Visual-Auditory:* say it—sign it —say it **or** say it—say it adding speechreading—say it
- *Visual-Auditory-Visual:* sign it—say it —sign it —say it adding speechreading —say it —say it using speechreading

Through modification of the “challenge factors” and use of the sandwich technique, communication encounters and structured listening tasks can be designed specifically to the communication needs and goals of each child.

## Sign Language as a Support to Listening

Some children obtain their cochlear implant with established competencies and comfort levels with sign language use. Sign language will hold differing roles for each child with an implant and those roles may change over time. A child’s level of sign language use will impact educational and communication

**For further information about the role of sign language use for children with a cochlear implant:**

[Children with Cochlear Implants: Where Does Sign Language Fit In?](#)

choices as well as auditory and speech training strategies. Mary Pat Moeller, Ph.D., Director of the Center for Childhood Deafness at Boys Town National Research Hospital in Omaha, Nebraska (Advanced Bionics Workshop: Options For Success in Chicago,

American Speech-Language-Hearing Association pre-conference workshop, 2003), describes four levels of sign language use for children with implants:

- *foundational user*—sign language is used as a bridge to oral development (for the early identified infant)
- *transitional user*—sign language has been a part of the child’s life, yet the goal is to transition to an oral environment
- *strategic user*—the child continues to rely on a combination of spoken and signed language
- *dominant sign user*—the child is an established American Sign Language (ASL) user who receives an implant at a later age and who will develop useful skills, yet progress is usually observed to be slower than children implanted very young or children with strong early experiences using spoken language

With the appropriate supports, sign language can be used to facilitate spoken language development. For sign language to be a support of spoken language, attention must be given to the following.

- Make links between signed and spoken language.
  - Model and expand known signs into spoken language. For example, when a child signs *ball*, verbalize back, “Yes, that’s a ball.”
  - Incorporate the use of sequential language use/sandwich technique (say it—sign it—say it or sign it—say it—sign it).
  - For older students, help them make links between spoken language and ASL. For example, explain how a word or a sentence looks in ASL and how it corresponds to English.
- Adjust the degree of sign language use.
  - Determine how and when to utilize ASL, Sign Supported Speech, and speech only.
  - Control the degree of sign language use within the content/context of the situation.
  - Set up opportunities during which sign language is **not** available and alternative listening strategies are utilized (modification of the challenge factors).

*Note:* There is ongoing discussion regarding problems surrounding the use of signing and speaking at the same time. Historically, for deaf children with compromised access to sound, research has suggested that simultaneous communication negatively impacts the transmission of both the signed and the spoken message (Johnson, R., Liddell, S., Erting, C., Gallaudet Research Institute, 1989). For children with an implant, however, this discussion is being revisited in light of the increased access to the spoken message provided by the implant. Further research is needed to determine if sign language as a support to spoken

English can facilitate improved development of English as a complete language. How and when Sign Supported Speech may be appropriate should be closely monitored in light of the language and communication characteristics of other students in the environment, as it does not provide a clear language to many students who do not have sufficient access to auditory information either through a cochlear implant or through hearing aids.

- Provide opportunities for spoken language use.
  - Provide individualized training in specific listening skills (didactic instruction) based on the goals of each child. (See Curriculum Guides above.)
  - Provide information auditorily only in contextual, familiar environments.

### **About Auditory-Verbal Therapy**

“The Auditory-Verbal approach is based upon a logical and critical set of guiding principles which enable children who are deaf or hard of hearing to learn to use even minimal amounts of amplified residual hearing or hearing through electrical stimulation (cochlear implants) to listen, to process verbal language, and to speak,” according to [Auditory-Verbal International](#). An Auditory-Verbal approach includes utilization of a sequential structured system of strategies that rely only on the sense of hearing to provide access to language information. Listening skills are developed through individual training sessions as well as through a lifestyle of learning through listening.

Auditory-Verbal therapy differs from Auditory-Oral therapy in that the Auditory-Oral approach may include use of speechreading information to supplement the sense of listening for obtaining information. The Auditory-Verbal approach focuses solely on promoting the sense of listening to obtain information. The sequence of training and specific strategies utilized during Auditory-Verbal therapy may be similar to those detailed in other auditory training hierarchies; however, true Auditory-Verbal training is provided only by professionals trained in the specific strategies included in the Auditory-Verbal approach.

**For more information about the philosophy and strategies utilized in the Auditory-Verbal approach:**

[Learning to Listen Foundation](#)

[Auditory-Verbal Learning Institute](#)

## Resources

This list includes a selection of the resources that the Cochlear Implant Education Center has found useful when working with students and families in our demonstration schools. This does not represent a complete list of the many resources that may be available. The absence of a resource on this list does not indicate that we do not support it; it may never have come our way. We are always in the process of trying out new things and welcome your feedback on this list. Please [e-mail us](#).

This list includes the following sections:

- Manufacturer Information
- Agencies/organizations
- Web Resources
- Suggested Scales of Development and Assessment Tools
- Computer software for developing spoken language skills
- Curricula/Training programs
- Books
- Additional Resources

### **Manufacturer Information**

Cochlear implant manufacturers offer an abundance of free, promotional materials in various languages, as well as information on candidacy, services, research, and events. In addition, they offer the following videos and resources described below.

*Advanced Bionics/Clarion System*  
Mann Biomedical Park  
25129 Rye Canyon Loop  
Valencia, CA  
800-678-2575 (V)  
800-678-3575 (TTY)  
E-mail: [hear@advancedbionics.com](mailto:hear@advancedbionics.com)  
Web: <http://www.advancedbionics.com/>

***The Guide to Cochlear Implants for Parents and Educators (guide book and CD)***

The guide and accompanying CD offers a comprehensive look at the way the cochlear implant functions. It describes ways educators, parents, and other professionals can check the system to ensure it is functioning optimally and how to use its many features effectively in helping a child acquire and use spoken language.

***Cecilia's Story (video--open captioned, 47 minutes)***

This documentary follows Cecilia and her family from birth through age 8 as they make communication and technology decisions related to Cecilia's deafness. Using Cecilia's story as a vehicle, this video covers many of the issues families face in making decisions for their deaf child related to communication choices and whether or not to consider a cochlear implant, as well as going through the implantation process.

***Hearing Your Life (video--open captioned, 34:55 minutes)***

This documentary follows the lives of four adults before and after receiving the Clarion HiResolution cochlear implant. Each individual discusses the impact deafness has had on their lives and how much they benefited from getting a cochlear implant. This video describes the process of hearing and impact of hearing loss as well as how the cochlear implant works.

**“Loud and Clear” Rehabilitation Newsletter**

Issue devoted to the topic of sign language and cochlear implants can be downloaded at: [http://www.cochlearimplant.com/printables/L\\_CV4I2.pdf](http://www.cochlearimplant.com/printables/L_CV4I2.pdf)

**Infant-Toddler Meaningful Auditory Integration Scale (IT-MAIS)**

The IT-MAIS is a parent report checklist to document a young child's use of sound in the natural environment. Ten questions with an accompanying rating scale are provided addressing such areas as “Is the child's vocal behavior affected while wearing his/her sensory aid (hearing aid or cochlear implant?)” and “Does the child spontaneously respond to his/her name in quiet with auditory cues only when not expecting to hear it?”. The scale helps document the small steps in development of listening skills. This scale is widely utilized and available at no charge through Advanced Bionics.

**Tools for Schools: Helping Children with Cochlear Implants Succeed in School**

Advanced Bionics created a new division called the Educational Division of the Bionic Ear Association (BEA-E). Their first initiative is The Tools For Schools Launch Kit. The Kit includes:

- *Tools for Schools* literature series
- *The Bionic Buddy* movie on DVD or VHS
- A poster on how a cochlear implant works
- *The Educator's Guide* CD Presentations
- *The Guide for Cochlear Implants for Parents and Educators*
- Services handouts

(To order contact: [toolsforschools@advancebionics.com](mailto:toolsforschools@advancebionics.com))

### ***Online Training & Education Center***

Advanced Bionics offers online training courses as well as live courses. For upcoming and recorded online courses as well as a listing of live courses, go to:

<http://www.audiologyonline.com/aointeractive/courses/courses.asp?pid=5>

### ***Cochlear Americas /Nucleus System***

400 Inverness Parkway, Suite 400

Englewood, CO 80112

800-523-5798 (V/TTY)

303-792-9025 (FAX)

E-mail: [info@cochlear.com](mailto:info@cochlear.com)

Web: <http://www.cochlear.com/>

### ***Introduction to Cochlear Implants*** (video--closed captioned, 15 minutes)

This is a videotape developed in 2002 that provides an excellent overview of the anatomy and physiology of the ear, cochlear implants and how they work, the surgical procedure, and the post-surgical hook up. While specific to the Nucleus brand implant, this tape provides a general overview of implants regardless of the manufacturer.

### ***Nucleus 24 Contour: The Shape of Things to Come*** (video--also available in Spanish)

This promotional/educational videotape highlights three families with an implanted family member: a mother of two teens implanted as an adult, a 3-year-old twin implanted at 15 months, and a 9-year-old boy implanted after having worn hearing aids from age 18 months; it also details Nucleus implant technology, how the implant is fitted, and how it functions.

### ***Twins: A Cochlear Implant Study*** (video--open captioned, 30 minutes)

This videotape follows the language development of three sets of twins up to 4½ years of age (original tape followed the twins through age 3). Each set of twins has a deaf twin with an implant and a hearing twin.

### ***What to Expect at a Child's Hook-up*** (video--closed captioned, 60 minutes)

An in-depth explanation of issues integral to fitting the external components of a cochlear implant in the weeks following surgery are included in this videotape. Contents include the initial hookup, programming of the speech processor, including selecting the speech coding strategies and setting levels individual to each child, the child's first listening experiences, expectations for the implant, and troubleshooting of the implant system. This video covers many of the nitty-gritty questions families may have related to what goes into the fitting and the use of an implant.

### ***Start Listening: A Guide to Pediatric Rehabilitation*** (video--open captioned, 27 minutes)

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

© 2003 by Laurent Clerc National Deaf Education Center, Gallaudet University

This video includes a basic, easy-to-follow progression of auditory development narrated by an auditory-verbal therapist. This video provides information and ideas regarding how to facilitate the process of attaching meaning to sound, and provides a framework for developing listening skills, issues for consideration in developing listening skills, and strategies to promote listening regardless of whether a child is using an oral approach or a Total Communication approach. Strategies are provided related to promoting awareness of sound, providing an optimal listening environment, facilitating vocal play, integrating listening with language and cognition, as well as vocabulary and reading development.

***Nucleus Accessories and Assistive Listening Devices*** (closed captioned, 35 minutes)

Narrated by a cochlear implant user, this video discusses the various accessories to maximize listening through a cochlear implant. Devices covered include those used to assist with: a) listening in background noise, b) using a traditional phone and cell phone, c) listening to music, d) troubleshooting the implant device, and e) use of FM systems.

**Listen, Learn, and Talk** (Auditory Habilitation Program)

See below under Curricula/Training Programs for further information. There is a fee for this product.

**Hear We Go** (Auditory Habilitation CD)

See below under Curricula/Training Programs for further information. There is a fee for this product.

**Cochlear Implant Resource Guide: Meeting Children's Needs at School**

This Guide is for individuals who regularly work with children with cochlear implants regarding their needs in educational settings, including clinicians in cochlear implant centers and educational personnel in school settings. It consists of both new and existing materials that have been compiled and organized to correspond with typical issues relating to children's needs at school. The guide is organized in a loose-leaf notebook to allow easy removal and copying of specific materials. The contributing authors have given permission for their materials to be copied and used in this fashion, to encourage maximum dissemination to school personnel, parents, and others. Cochlear Americas will update the guide periodically with revised and new content.

(To order call Cochlear's Customer Service at 1-800-523-5798. Part number: FUN528 Price \$50.00)

**Hear We Go (Individualized rehabilitation workbook for teenagers)**

This CD contains an easy to install program that allows the therapist to access rehabilitation exercises and generate an individualized rehabilitation workbook for the Nucleus recipient. The workbook is built around 24 different topical interests for older children and teenagers and 3 different auditory skill levels within each topic. It also contains additional topics like Active Listening, Telephone Training, Communication Strategies, and more. It can either be printed or emailed to the recipient it has been designed for.

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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(To order call Cochlear's Customer Service at 1-800-523-5798. \$25.00)

**Sound and Beyond (interactive listening rehabilitation for adults)**

This CD is a self-paced, interactive computer listening tool that offers: Pure Tone Discrimination, Environmental Sounds, Male/Female Identification, Vowel Recognition, Word Discrimination, Everyday Sentences and Music Appreciation. There are 5 different skill levels within each topic and over 10,000 sounds, words, and sentences. It reports tracking progress to view and share. One license can be shared with up to 3 different users at a time.

(To order call Cochlear's Customer Service at 1-800-523-5798. \$290.00)

**HOPE (Habilitation Outreach for Professionals in Education)**

A comprehensive collection of products and services designed to assist educational personnel in addressing the unique needs of children with cochlear implants. HOPE includes online training for professionals, Cochlear products for professionals and parents, HOPE services, and workshops and seminars. For more information:

<http://www.cochlearamericas.com/americas/support/291.asp>.

*MED-EL Corporation*  
2222 East Highway 54  
Beta Building, Suite 180  
Durham, NC 27713  
888-633-3524  
919-572-2222 (V/TTY)  
919-484-9229 (FAX)  
E-mail: [implants@medelus.com](mailto:implants@medelus.com)  
Web: <http://www.medel.com/>

***How a Cochlear Implant Works*** (video--closed captioned, 15 minutes)

In addition to providing basic information about the MED-EL device and the testimonials of two adults and a parent of a deaf child discussing their choice to obtain a cochlear implant, this video provides a clear, animated segment on how a cochlear implant works.

***Listening Is Fun Video Kit*** (guidebook and video)

This is a guide for parents and families of cochlear implanted children. The theme of the guidebook is learning to listen through everyday activities. There is a suggested range of activities which are designed to encourage the child to listen and have fun at the same time. Activities are grouped and color-coded. Each color group activity covers different levels of listening skills. The price is \$25.00/set.

### **MED-EL hearLIFE Educator CD**

This CD contains the following: Handbook for Educators; Handling and Troubleshooting the TEMPO+; HearSay Newsletter; Communication Options; FM Guide; and How a Cochlear Implant Works video. There is a Glossary of Terms and a dynamic table of contents in both the Handbook for Educators and Troubleshooting the TEMPO+. The video clips in Handling and Troubleshooting the TEMPO+ demonstrate some of the information presented in the guide. To obtain the Educator CD, contact, MED-EL Corporation at (888) 633-3524 or <http://www.medel.com/>.

## **Agencies/Organizations**

### *Alexander Graham Bell Association*

3417 Volta Place, NW  
Washington, DC 20007  
202-337-5220 (V/TTY)  
E-mail: [agbell2@aol.com](mailto:agbell2@aol.com)  
Web: <http://www.agbell.org/>

A brochure on cochlear implants can be obtained from this organization in addition to a wealth of other resources on deafness and oral education.

### *American Speech-Language-Hearing Association (ASHA)*

10801 Rockville Pike  
Rockville, MD 20852  
800-638-8255 (V/TTY)  
E-mail: [actioncenter@asha.org](mailto:actioncenter@asha.org)  
Web: <http://www.asha.org>

This site includes information on cochlear implants that can be found directly at:

[http://www.asha.org/about/news/releases/2001/cochlear\\_facts.htm](http://www.asha.org/about/news/releases/2001/cochlear_facts.htm) and  
[http://www.asha.org/about/news/tipsheets/cochlear\\_quickfacts.htm](http://www.asha.org/about/news/tipsheets/cochlear_quickfacts.htm)  
[http://www.asha.org/NR/rdonlyres/215CC9B8-6831-494F-83ED-E02A6832A8A9/0/24402\\_1.pdf](http://www.asha.org/NR/rdonlyres/215CC9B8-6831-494F-83ED-E02A6832A8A9/0/24402_1.pdf)

and an article on cochlear implants and Deaf identity by Phil Aiello at:  
<http://www.asha.org/hearing/rehab/Aiellos.cfm>.

### *Cochlear Implant Association, Inc. (CIAI)*

5335 Wisconsin Avenue, NW, Suite 440  
Washington, DC 20015-2003  
202-895-2781  
Fax: 202-95-2782  
E-mail: [lasinger@mindspring.com](mailto:lasinger@mindspring.com)  
Web: <http://www.cici.org/>

CIAI is a nonprofit organization for cochlear implant recipients, their families, professionals, and other individuals interested in cochlear implants. The association provides support and information to anyone interested in information about cochlear implants.

*National Association of the Deaf*

814 Thayer Avenue  
Silver Spring, MD 20910  
301-587-1788  
E-mail: [nadinfo@nad.org](mailto:nadinfo@nad.org)  
Web: <http://www.nad.org/>

The NAD position paper on cochlear implants can be downloaded from this site. This paper subscribes to the NAD's philosophy of the wellness model upon which "the physical and psychosocial integrity of deaf children and adults is based." Also available from this site is a special issue of the NAD newsletter, *The NAD Broadcaster*, January 2001, Vol., No. 1, that is dedicated entirely to the topic of cochlear implants.

*National Institute on Deafness and Other Communication Disorders (NIDCD)*

1 Communication Avenue  
Bethesda, MD 20892  
800-241-1044 (V)  
800-241-1055 (TTY)  
E-mail: [nidcdinfor@nidcd.nih.gov](mailto:nidcdinfor@nidcd.nih.gov)  
Web: <http://www.nidcd.nih.gov/>

A cochlear implant information packet can be obtained through this organization's Web site. Information can be directly downloaded on the topic of cochlear implants and many other topics specific to hearing loss.

*Network of Educators of Children with Cochlear Implants (NECCI)*

Dr. Mary Ellen Nevins, Cochlear Implant Center  
Lenox Hill Hospital  
186 East 76th Street  
New York, New York 10021  
212-434-6650 (V)  
Web: <http://www.childrenshearing.org/custom/necci.html>

NECCI is an organization primarily composed of educators, audiologists, and speech-language pathologists. It publishes a newsletter several times a year. NECCI provides a curriculum workshop about cochlear implants for professionals that also includes a special parent component of the program.

*Educational Audiology Association (EAA)*

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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13153 N Dale Mabry Hwy, Suite 105  
Tampa, Florida 33618  
800-460-7322  
E-mail: [EAA@L-TGRAYE.COM](mailto:EAA@L-TGRAYE.COM)  
Web: <http://www.edaud.org>

The Educational Audiology Association is an international organization comprised of audiologists and related professionals who deliver a full spectrum of hearing services to all children, particularly those in educational settings.

#### *Hands & Voices*

<http://www.handsandvoices.org>

Hands & Voices is a nationwide, parent driven, non-profit organization that provides unbiased support to families with children who are deaf or hard of hearing. Support activities and information may include, outreach events, educational seminars, advocacy, lobbying efforts, parent to parent networking and a newsletter.

#### *National University Center for Human Advancement*

*Institute for Persons Who Are Hard of Hearing or Deaf (IHHD)*

<http://www.cha.nu.edu/IHHD.html>

Affiliated with the National University for Human Advancement, the IHHD serves the hard of hearing and deaf community, early childhood and regular educators, related professionals, vocational rehabilitation counselors, employers, advisors, and administrators who provide education, healthcare, and service delivery for persons who are hard of hearing and deaf and their families. The IHHD is funded by the U.S. Congress to provide personal preparation, education, career, and leadership training opportunities for the 28 million children and adults who are hard of hearing or deaf.

## **Web Resources**

#### *The Listen-Up Web*

<http://www.listen-up.org/>

The Listen-Up Web is an excellent Web site with extensive links to other sites about cochlear implants.

#### *Sound and Fury Web site*

<http://www.pbs.org/wnet/soundandfury/index.html>

This is a Web site surrounding a documentary on cochlear implants called *Sound and Fury*. This film addresses the decision and struggle of two branches of a family as they

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by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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decide whether or not to implant their children. This site includes discussion of the debate surrounding implantation of young children and the Deaf cultural perspective on cochlear implants. Lesson plans are provided to teach middle and high school students about hearing, cochlear implants, and communication. Links are provided to a variety of resources on cochlear implants, Deaf culture, and sign language.

*Navigating a Forest of Information: One Tree At a Time...*

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

This E- document is designed to assist parents and educators in navigating the extensive forest of information available on cochlear implants. The site is divided into modules on specific topics related to cochlear implants. It provides information within each topic and directs the reader to additional resources. This site is easy to navigate and provides information on topics often not covered via other websites (education and communication, role of sign language). The site is also available in Spanish.

*Children with Cochlear Implants Who Sign: Guidelines for Transitioning to Oral Education or a Mainstream Setting*

<http://web1.tch.harvard.edu/cfapps/oto/transition.pdf>

This E-document contains guidelines that were developed from round table discussions among audiologists, speech-language pathologists, psychologists, and teachers of the deaf who were convened by the Boston Center for Deaf and Hard of Hearing Children and the Cochlear Implant Center of Children's Hospital of Boston, MA. These guidelines are intended to facilitate discussion and decisions by families and professionals regarding appropriate educational settings for children with cochlear implants. It provides checklists for two age groups: young children under 5 years of age and students 5 years of age and older to evaluate competencies for transition from manual to oral instruction.

*A Website For Teenagers*

<http://www.ci-4teenz.com/>

This interactive and fun website is designed for teenagers. It offers teen testimonials as well as useful information on hearing loss and cochlear implants.

*Web sites that simulate listening through a cochlear implant:*

<http://www.bsos.umd.edu/hesp/zeng/simulations.html>

<http://www.utdallas.edu/~loizou/cimplants/>

<http://www.ucihs.uci.edu/hesp/Simulations/simulationsmain.htm>

<http://hei.org/research/depts/aip/audiodemos.htm>

*U.S. Food and Drug Administration (FDA) on Cochlear Implants*

<http://www.fda.gov/cdrh/cochlear/>

The FDA regulates manufactures of cochlear implants. The purpose of this website is to describe cochlear implants, link to FDA approved implants, tell the benefits and risks of cochlear implants, and provide news about cochlear implant recalls and safety issues. There is also information on what educators of implant users need to know, what happens before, during, and after surgery, and where to report problems.

#### *CI HEAR*

<http://www.cihear.com>

CI Hear began as an internet listserv created to support anyone interested in cochlear implants. The website still provides a listserv but also offers links to CI Stories, Bilateral CI information, Medical Information, Implant Manufacturers, Auditory Therapy, Resources, Support, and Surgery.

#### *ADA and Cochlear Implants*

<http://www.cochlear.org/sys-tmpl/adaandcochlearimplants1/>

This website provides individuals with a free resource for questions about third party health insurance reimbursement for cochlear implants and related services. It is a privately-owned site and the owners receive no compensations from manufacturers or providers.

#### *Cochlear Implant & Hearing Aid Interface Systems*

Company that manufactures cochlear implant accessories (custom cables, telephone adapters, microphone systems, stethoscopes, and FM interface). To order contact:

Robert Mendoza

4404 Hollingsworth Ct.

Rohnert, CA 94928

Phone: 707-585-0609

E-mail: [robm\\_94928@yahoo.com](mailto:robm_94928@yahoo.com)

Web: <http://www.cihais.com>

#### *Help Kids Hear.org*

<http://www.helpkidshear.org/resources/devices/cochlear.htm>

This website was founded by Tony & Alisa Hake, the parents of two hard of hearing children. It is designed to help parents of hard of hearing and deaf children by providing users with the latest news, commentary, and resources. There is also a discussion forum where parents can read and post questions about hearing loss across a wide variety of categories. The section on cochlear implants provides information on how a cochlear implant works, getting a cochlear implants, and links.

#### *Cochlear Implant Rehabilitation Resources*

<http://www.cochlearrehab.com/resources.htm>

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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Provides resource links to Manufacturers, Organizations, Informational Sites, Email Groups, Assistive Devices, Hearing Dogs, and Accessories/Miscellaneous.

*The Children's Hearing Institute (CHI)*

<http://www.childrenshearing.org/home.html>

The Children's Hearing Institute (CHI) is a private, non-profit foundation that was established in 1983 by Simon C. Parisier, MD, a pioneer in hearing loss and cochlear implant research and surgery. The CHI web site is available in English and Spanish. It features information on cochlear implants and hearing loss, an In The News section, and an extensive Patient and Family Resource Guide highlighting organizations, web sites, educational resources, emotional/social development, support groups, insurance information, online articles, advocacy resources, recommended books/videos/CD's, online tools, annotated research articles, and online forums related to cochlear implants and hearing loss.

*Cochlear Implant Awareness Foundation (CIAF)*

<http://www.ciafonline.org/index.html>

The Cochlear Implant Awareness Foundation provides information, resources, support, and financial assistance to individuals who may be eligible for a cochlear implant. The financial assistance program is not intended to cover the medical procedure itself, but rather to assist families with costs that are not traditionally covered by insurance (i.e., hotel or other travel expenses, childcare, etc.) or expenses which exceed the limits of health care coverage. For more information visit the CIAF website.

## **Suggested Scales of Development and Assessment Tools**

The following scales of development and assessment tools are provided as a reference. They have been categorized by Auditory Perception/Listening Skills, Speech/Intelligibility, Speechreading, Language, Basic Concepts, and Sign Language. A brief description of each scale/tool and information on availability is provided.

### **Auditory Perception/Listening Skills:**

*Auditory-Verbal Ages and Stages of Development (Levels I-VIII) in Cochlear Implants for Kids*

Available through: Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This checklist outlines the development of listening from sound awareness to auditory comprehension including; discrimination, identification, localization, auditory memory and sequencing, listening from a distance, and listening in noise.

*St. Gabriel's Curriculum for the Development of Audition, Language, Speech and Cognition*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This program contains a hierarchical order for the development of auditory awareness and auditory memory progressing from closed set to open set.

*Cottage Acquisition Scales For Listening, Language, and Speech*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This developmental checklist is for assessment and planning for diagnostic therapy. The listening section progresses from sound awareness to comprehension of paragraphs including phonetic listening skills.

*Early Speech Perception Test (ESP) for Profoundly Hearing-Impaired Children*

Available through Central Institute for Deaf (CID). Contact Dianne Gushleff at [dgushleff@cid.wustl.edu](mailto:dgushleff@cid.wustl.edu) or 314-977-0133 or 314-977-0016 (fax)

The ESP test battery is a test of speech perception for profoundly deaf children as young as 3 years of age. The ESP may be used to establish objectives and to measure the effects of a hearing aid or cochlear implant in terms of their impact on the child's speech perception ability. The kit includes a manual, response forms, box of toys, full-color picture cards and audiocassette.

*Functional Auditory Performance Indicators (FAPI): An Integrated Approach to Auditory Development*

Available on line at: [http://www.csdb.org/chip/resources/docs/fapi6\\_23.pdf](http://www.csdb.org/chip/resources/docs/fapi6_23.pdf)

The FAPI assesses the functional auditory skills of children with hearing loss. It examines seven categories of auditory development: sound awareness, sound is meaningful, auditory feedback, localizing sound source, auditory discrimination, short-term memory, and linguistic auditory processing. A profile of a child's functional auditory skills is generated after administering all items on the profile. The categories are hierarchical; however, it is appropriate for a child to be working on many skills at the same time. By working on multiple skills from different categories, the child will be learning an integrated approach to auditory skill development.

*Meaningful Auditory Integration Scale (MAIS)/Infant-Toddler: Meaningful Auditory Integration Scale (IT-MAIS)*

Available through: Advanced Bionics Corporation, 12740 San Fernando Road, Sylmar, CA 91342, 800-678-2575 (V) or 800-678-3575 (TTY)

E-mail: [info@advancedbionics.com](mailto:info@advancedbionics.com) Web: <http://www.cochlearimplant.com>

These scales were developed for children who have a profound hearing loss and designed to be administered to parents by an audiologist. The parent is asked questions regarding use of amplification/cochlear implant and auditory behaviors regarding environmental and speech sounds.

*Test of Auditory Comprehension (TAC)*

Available through: Foreworks Publications, Box 82289 Portland, OR 97282, 503-653-2614

The TAC is designed to test the speech reception skills of young children on a linguistic rather than phonetic level. It provides information about the following hierarchical auditory skills: ability to discriminate between linguistic and non-linguistic sounds, word identification, comprehension of speech phrases varying in complexity, comprehension of stories in quiet, and comprehension of stories against competition. Test stimuli are on an audiocassette. The child must fail two consecutive subtests to stop testing.

*Test of Auditory Comprehension of Language-Third Edition (TACL-3)*

Available through: AGS Publishing, 4201 Woodland Road, Circle Pines, MN 55014-1796 phone 800-328-2560

Order and inquiries: [customerservice@agsnet.com](mailto:customerservice@agsnet.com)

The TACL-3 measures a child's auditory comprehension skills including word classes and relations, grammatical morphemes, and elaborated sentences. The child is presented with a picture and points to the phrase or sentence that matches what he/she hears.

*The Screening Instrument for Targeting Educational Risk (S.I.F.T.E.R.) /The Preschool S.I.F.T.E.R.*

Available through: The Educational Audiology Association, 13153 N. Dale Mabry, #105, Tampa, Fla. 33624/ 800-460-7322

Web: <http://www.edaud.org>

The S.I.F.T.E.R. is used by the teacher to rate the child in comparison to other children in the classroom on 15 items. The responses are plotted on a chart which indicates pass, marginal or fail for each of the five areas of academics, attention, communication, classroom participation, and school behavior. If a child fails in a specific area, they should be referred for further evaluation. The Preschool S.I.F.T.E.R. was developed to be used with preschool children and is similar to the S.I.F.T.E.R.

*The Lexical Neighborhood Test (LNT) and the Multi-syllabic Lexical Neighborhood Test (MLNT)*

Available through: AUDIOTEC of St. Louis, 2515 South Big Bend Blvd, St. Louis, MO 63143/ 800-669-9065 or 314-781-8890/ 314-781-4946 (fax) Web:

<http://www.auditec.com>

The Lexical Neighborhood Test (LNT) and the Multi-syllabic Lexical Neighborhood Test (MLNT) were developed by Indiana University in 1995. The LNT and MLNT are two new open-set tests of word recognition. These tests include words that the child repeats, and have been used to assess recognition of individual words and phonemes in children who are cochlear implant candidates. The LNT and MLNT are based on the lexical characteristics of word frequency and neighborhood density, and include words found in the vocabularies of children age three to five. Results from these tests with pediatric cochlear implant users have shown that their lexicons appear to be organized into similarity neighborhoods, and these neighborhoods are accessed in open-set word recognition tests. Studies have shown that normal hearing three- and four-year old children are able to recognize all the words from these two open-set speech perception tests at very high levels of performance. Therefore, these results have been used as a benchmark for children with hearing impairments.

*The Listening Inventory for Education: an Efficacy Tool (L.I.F.E.)*

Available through: The Educational Audiology Association, 13153 N. Dale Mabry, #105, Tampa, Fla. 33624/ 800-460-7322

Web: <http://www.edaud.org>

The L.I.F.E. is designed to determine amplification benefit and considers input from both the student and the teacher. The protocol also provides suggestions for intervention accommodations designed for the specific situations that are identified as problems.

### **Speech/Intelligibility:**

*The Arizona Articulation Proficiency Scale-Third Edition*

Available through: Pro Ed, Inc. 8700 Shoal Creek Boulevard, Austin, Texas 78757-6897 (800) 897-3202 or (800) 37-7633 (fax)

Web: <http://www.proedinc.com>

The Arizona-3 is a tool designed to identify misarticulations and total articulatory proficiency. The stimulus pictures show children in more current clothing styles and activities. The test materials also include more ethnic diversity. The instrument has been restandardized on a sample of over 5,500 individuals, representative of the U.S. population according to geographic region, ethnicity, and parents' education level. Gender-specific norms are provided for the early childhood years. The kit includes an examiner's manual, picture cards, and 25 test booklets.

*The Goldman Fristoe: Test of Articulation 2*

Available through: AGS Publishing, 4201 Woodland Road, Circle Pines, MN 55014-1796 phone 800-328-2560

Order and inquiries: [customerservice@agsnet.com](mailto:customerservice@agsnet.com)

This test assesses a child's articulation ability by sampling both spontaneous and imitative speech production. Pictures and verbal cues are used to elicit single word

answers that demonstrate common speech sounds. It measures the articulation of speech sounds and identifies and describes the types of articulation errors produced by the child.

*The Phonetic-Phonologic Speech Evaluation Record: A Manual*

Available through: Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This tool is used to assess the segmental and nonsegmental aspects of speech at both the phonetic and phonologic levels. The phonetic level responses are obtained through imitation. Phonologic level responses are obtained from spontaneous language samples.

*Identifying Early Phonological Needs in Children with Hearing Impairment*

Available through: Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This is a standardized test used to assess how young children with hearing loss spontaneously use first-level phonological patterns. It numerically rates whether the child's patterns are missing, emerging, or mastered.

*St. Gabriel's Curriculum for the development of Audition, Language, Speech and Cognition*

Available through : Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This curriculum outlines the development of early speech, the development of early auditory feedback skills, and an order for the acquisition of vowels, diphthongs, and consonants. It also provides a developmental checklist of phonological processes.

*Cottage Acquisition Scales For Listening, Language, and Speech*

Available through : Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This curriculum provides a developmental checklist for assessment and diagnostic planning for therapy. The speech section tracks objectives from Phonetic-Phonologic Speech Evaluation Record and also links these objectives to phonetic listening development.

*Spoken Communication for Students Who are Deaf or Hard of Hearing: A Multidisciplinary Approach*

Available through: Butte Publications, Inc., P.O. Box 1328, Hillsboro, OR 97123-1328, 866-312-8883 (V/TTY), 866-412-8883 (FAX), 503-693-9526 (Direct)  
E-mail: [service@buttepublications.com](mailto:service@buttepublications.com) Web: <http://www.buttepublications.com>

This curriculum includes a Student Speech Record (SSR) which is used to evaluate the following: non-verbal communication (attention, turn taking, eye contact, and breath

support) and suprasegmentals, vowels and diphthongs, and consonants at the phonetic, phonologic, and pragmatic levels. The SSR also includes an oral peripheral examination form.

*The Central Institute for the Deaf (CID) Picture Speech Intelligibility Evaluation (SPINE)*

Available through: Central Institute for Deaf (CID). Contact Dianne Gushleff at [dgushleff@cid.wustl.edu](mailto:dgushleff@cid.wustl.edu) or 314-977-0133 or 314-977-0016 (fax)

The SPINE uses colorful pictures to evaluate speech intelligibility in children as young as 6 years of age. The assessment package includes 300 full-color picture cards, a test manual, and 25 response forms.

*Paden-Brown Phonological Kit*

Available through Med-El. Contact Linda C. Johnson at [ljohnson@medelus.com](mailto:ljohnson@medelus.com), 919-314-1272 or 888-633-3524

This tool is designed to assess spontaneous use of first level phonological patterns in children with hearing loss. It utilizes a list of 25 words that are typically within the speaking vocabulary of young children with hearing loss. The word list provides at least five opportunities for the child to demonstrate how well he/she spontaneously targets each basic consonant feature, such as manner, place, and voicing, as well as each of the primary vowel areas, diphthongs, and basic word patterns. Numerical scoring of the test reveals whether the child's patterns are missing, emerging, or mastered. Results can be used for developing auditory and speech goals for the child. The test kit includes an instructional manual, 10 score sheets, and 25 picture cards.

**Speechreading:**

*Kendall Demonstration Elementary School (KDES) Preschool Auditory and Speechreading Skills Inventory*

Available through: The Laurent Clerc National Deaf Education Center, Gallaudet University, Office of Support Services, KDES 800 Florida Avenue, N.E., Washington, D.C. 20002-3695 (202) 651-5045

Web: <http://clerccenter.gallaudet.edu>

This inventory is used to informally assess a child's listening (speech & environmental sounds) and speechreading readiness and ability to understand words and phrases (familiar/functional and phrases containing 2 and 3 critical elements).

**Language:**

*The Bzoch-League Receptive-Expressive-Language Test (REEL-2), 2<sup>nd</sup>. Ed.*

Available through: Pro Ed, Inc. 8700 Shoal Creek Boulevard, Austin, Texas 78757-6897  
(800) 897-3202 or (800) 37-7633 (fax)  
Web: <http://www.proedinc.com>

The REEL-2 is a scale designed for infants and toddlers up to 3 years of age. It measures and analyzes emergent language for intervention planning. Results are obtained from a parent interview and are given in terms of an Expressive Language Age, A Receptive Language Age, and a Combined Language Age.

*The Rynell Development Language Scales III (RDLS III), 3<sup>rd</sup> Ed.*

Available through: Super Duper Publications, P.O. Box 24997 Greenville, SC 29616-2497 (800) 277-8737 or (800) 978-7379 (fax)  
Web: <http://www.superduperinc.com>

The RDLS III assesses receptive and expressive language using real objects rather than pictures for the child to interact with. It is designed for children from 15 months to 7 years of age. The comprehension scale comprises sections such as agents and actions, attributes, locative relations, vocabulary and complex grammar, and inferencing, etc. The expressive scale comprises sections such as verb phrases, auxiliaries, clausal elements, inflections, etc.

*The Preschool Language Scale-4 (PLS-4)*

Available through: Harcourt Assessment, Inc. 19500 Bulverde Road, San Antonio, Texas 78259 (800) 211-8378  
Web: <http://marketplace.psychcorp.com>

The PLS-4 is a standardized test of auditory comprehension and expressive communication for infants and toddlers. The auditory comprehension subscale assesses basic vocabulary, concepts and grammatical markers in preschool and higher-level abilities such as complex sentences, making comparisons and inferences, etc. in older children. The expressive communication subscale asks preschoolers to name objects, use concepts that describe objects, express quantity, use grammatical markers, etc. For older children it includes word segmentation, completing analogies, telling a short story in sequence, etc. This test also includes an articulation screener and a language sample checklist.

*Preschool-Clinical Evaluation of Language Fundamentals (CELF-P)*

Available through: Harcourt Assessment, Inc. 19500 Bulverde Road, San Antonio, Texas 78259 (800) 211-8378  
Web: <http://marketplace.psychcorp.com>

The CELF-P evaluates expressive and receptive language ability. It focuses on word meanings, word and sentence structure, and recall of spoken language. This tool was standardized for children ages 3 years, 0 months to 6 years, 11 months and uses pictures as stimulus for all three areas of language development. The linguistic concepts subtest

evaluates the child's knowledge of modifiers and his/her ability to interpret one-level oral directions. The sentence structure subtest evaluates comprehension of early acquired sentence formation rules and the child's ability to comprehend and respond to spoken sentences. The recalling sentences in context subtest evaluates recall and repetition of spoken sentences. Formulating labels assesses the child's ability to name pictures. The word structure subtest assesses the child's knowledge and use of early acquired morphological rules and forms.

*The MacArthur Communication Development Inventory: Words, Gestures, and Sentences*

Available through: Singular/Thompson Learning 401 West "A" Street, Suite 325, San Diego, CA 92101-7904 (800) 730-2214

These questionnaire/checklists ask parents to identify various words that their child either says or signs. It includes vocabulary relating to: things in the home, people, action words, description words, pronouns, prepositions, question words, as well as sentences and grammar.

*The Rossetti Infant-Toddler Language Scale: A Measure of Communication and Interaction*

Available through: Linguisystems 3100 4<sup>th</sup> Avenue, East Moline, IL 61244 (800) PRO-IDEA

Web: <http://www.linguisystems.com>

This scale assesses preverbal and verbal areas of communication and interaction including: Interaction-Attachment, Pragmatics, Gesture, Play, Language Comprehension and Language Expression. The examiner can directly observe or elicit a behavior from the child or use the caregiver's report to equally credit the child's performance. Results reflect the child's mastery of skills in each of the areas assessed at 3 month intervals. A parent questionnaire with guidelines for parent interview is also included.

*Systematic Analysis of Language Transcripts (SALT)*

Available through: Language Analysis Lab, University of Wisconsin-Madison, Waisman Research Center, 1500 Highland Avenue, Madison, WI 53705-2280 (888) 440-SALT

<http://www.languageanalysislab.com/salt/ordering/index.htm>

A 30 minute play session is videotaped and every spoken and signed language utterance is transcribed. This analysis includes information regarding the number and types of spontaneous utterances that the child and caregiver produce. This analysis is intended to provide a portrait of the child's language, as well as the type of language the caregiver uses while communicating with the child. In order to measure the child's growth a videotape is made every six months.

*SKI-HI Language Development Scale*

Available through: Hope Publishing, Inc 1856 North 1200 East, North Logan, UT 84341; phone/fax: (435) 245-2888; e-mail: [hope@hopepubl.com](mailto:hope@hopepubl.com); Web Site: <http://www.hopepubl.com>.

This scale is developmentally ordered and contains a list of communication and language skills in varying intervals for different ages. Each age interval is represented by enough observable receptive and expressive language skills to obtain a good profile of a child's language ability.

*Test Of Semantic Skills-Primary (TOSS-P) (update of former test, Assessing Semantic Skills Through Everyday Themes (ASSET))*

Available through: Linguisystems 3100 4th Avenue, East Moline, IL 61244 (800) PRO-IDEA Web: <http://www.linguisystems.com>

The TOSS-P is a receptive and expressive diagnostic test designed to assess a child's semantic skills. Comprised of twenty realistic line-illustrations depicting natural, real-life scenes, the test is built around six common themes: Learning and Playing, Shopping, Around the House, Working at School, Eating and Health and Fitness. Test items emphasize vocabulary that is meaningful and relevant to the experiences of young children. The TOSS-P surveys ten semantic and vocabulary tasks through five receptive subtests and five expressive subtests.

*St. Gabriel's Curriculum for the development of Audition, Language, Speech and Cognition*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This curriculum provides a developmental sequence for the structure of English from birth to 6 years of age. It outlines the receptive and expressive skills in three month intervals from birth to 12 months and then in six monthly intervals to 6 years. Grammatical structures are included.

*Cottage Acquisition Scales For Listening, Language, and Speech*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This curriculum includes a developmental checklist for assessment and planning for diagnostic therapy. The language section includes steps from pre-verbal through to complex sentences including pragmatic development.

*Oral and Written Language Scales (OWLS)*

Available through: Super Duper Publications, P.O. Box 24997 Greenville, SC 29616-2497 (800) 277-8737 or (800) 978-7379 (fax)  
Web: <http://www.superduperinc.com>

The OWLS assesses higher order thinking, semantics, syntax, vocabulary, and pragmatics. It includes a Listening Comprehension Scale (picture pointing), an Oral Expression Scale (answering questions, and sentence completion) and a Written Expression Scale (use of conventions, syntactical forms, and ability to communicate meaningfully).

*Peabody Picture Vocabulary Test (PPVT)*

Available through: American Guidance Service, 4201 Woodland Road, Circle Pines, MN 55014-1796 (800) 328-2560 Ext, 7717

Web: <http://www.agsnet.com/>

The PPVT measures a child's understanding of individual words (receptive vocabulary). It is designed for children 2 years 6 months to 18 years of age. Raw test scores are converted into standard scores, percentile ranks and age equivalents.

*Expressive One-Word Picture Vocabulary Test (EOWPVT)*

Available through: Super Duper Publications, P.O. Box 24997 Greenville, SC 29616-2497 (800) 277-8737 or (800) 978-7379 (fax)

Web: <http://www.superduperinc.com>

The EOWPVT assesses a child's English speaking vocabulary by asking the child to name objects, actions and concepts pictured in illustrations. The test ends on 6 consecutive incorrect responses

*Receptive One-Word Picture Vocabulary Test (ROWPVT)*

Available through: Super Duper Publications, P.O. Box 24997 Greenville, SC 29616-2497, 800-277-8737 or 800-978-7379 (fax)

Web: <http://www.superduperinc.com>

The ROWPVT assesses a student's knowledge of vocabulary by asking the child to point to the object being named. The test ends when the child cannot correctly identify the pictured meaning of the word in 6 out of 8 consecutive items.

*Grammatical Analysis of Elicited Language, Pre-Sentence Level (GAEL-P)*

Available through: Central Institute for Deaf (CID). Contact Dianne Gushleff at [dgushleff@cid.wustl.edu](mailto:dgushleff@cid.wustl.edu) or 314-977-0133 or 314-977-0016 (fax)

This test contains three sections: readiness skills, single words, and word combinations. The examiner uses structured play and pictures to elicit language specific to these three areas. The test was developed for children with hearing loss and can be administered in spoken or signed English.

*Teacher Assessment of Grammatical Structures (TAGS)*

Available through: Central Institute for Deaf (CID). Contact Dianne Gushleff at

[dgushleff@cid.wustl.edu](mailto:dgushleff@cid.wustl.edu) or 314-977-0133 or 314-977-0016 (fax)

The TAGS consists of rating forms to be completed by the therapist regarding the child's understanding of grammatical structures in sentences of at least four words that contain a subject and a verb. The grammatical categories are noun modifiers, pronouns, prepositions, adverbs, verbs, and questions.

*Test of Early Reading Ability-3<sup>rd</sup> ed (TERA-3)*

Available through: Pro Ed, Inc. 8700 Shoal Creek Boulevard, Austin, Texas 78757-6897, 800-897-3202 or 800-37-7633 (fax)

Web: <http://www.proedinc.com>

The TERA-3 measures reading ability of young children ages 3-6 through 8-6. Rather than assessing a child's reading readiness it assesses their mastery of early developing reading skills. The three subtests include: Alphabet (knowledge of the alphabet and its uses), Conventions (knowledge of the conventions of print), and Meaning (measuring the construction of meaning from print). An overall Quotient is computed using all three subtest scores.

### **Basic Concepts:**

*Boehm Test of Basic Concepts-Revised (BTBC-R)*

Available through: Harcourt Assessment, Inc. 19500 Bulverde Road, San Antonio, Texas 78259, 800-211-8378

Web: <http://marketplace.psychcorp.com>

The BTBC-R is administered to children in Kindergarten, 1<sup>st</sup>, and 2<sup>nd</sup> grade (and older children who are deaf or hard of hearing) and tests basic concepts of comparison, direction, position, quantity, and time.

*Bracken Basic Concept Scale-Revised (BBCS-R)*

Available through: Harcourt Assessment, Inc. 19500 Bulverde Road, San Antonio, Texas 78259, 800-211-8378

Web: <http://marketplace.psychcorp.com>

The BBCS-R measures basic concept acquisition and receptive language skills of children from 2 years, 6 months to 8 years of age. It includes eleven conceptual categories-colors, letters, numbers, counting, sizes, comparisons, shapes, direction/position, self/social awareness, texture/materials, quantity, and time/sequence.

### **Sign Language:**

*Checklist of Emerging ASL Skills*

Available in: Easterbrooks, S & Baker, S. Language Learning In Children Who Are Deaf And Hard Of Hearing: Multiple Pathways. (2002) Allyn and Bacon, Boston, Mass.

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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This checklist provides a series of indicators to judge whether a deaf child has components of ASL in his or her communication system. The evaluator should not judge a child's skills based on English ability. The focus should be on ASL.

The checklist should be filled out by at least three different evaluators who are familiar with the child and who are proficient in ASL.

#### *ASL Development Observation Record*

Available through: ASL Resource Teacher, Early Childhood Education Program, California School for the Deaf, Fremont (CSDF), 39350 Gallaudet Drive, Fremont, CA 94538, 510-794-2536

This tool was developed by the Early Childhood Education program at the CSDF to document the ASL language development of deaf children from the time they entered the program to Kindergarten. The goal of the observation record is to identify the language strengths and needs of each child and to document the progress made over the time spent in the Early Childhood Education program. This record also serves as a guide for teachers in assessing their role as language models and how they use language with the children.

#### *The American Sign Language Proficiency Assessment (ASL-PA)*

Available by contacting: Dr. Sam Supalla, Department of Special Education, Rehabilitation, and School Psychology, College of Education, University of Arizona, Tucson, AZ 85721, 520-621-9466 (TTY)

E-mail: [ssupalla@u.arizona.edu](mailto:ssupalla@u.arizona.edu)

The ASL-PA globally assesses the expressive ASL skills of children ages 6-12 years of age. Items/target features are based on ASL acquisition studies. Language samples are elicited from varied discourse contexts. There are no sample norms presently available.

#### *Test of American Sign Language (TASL)*

Available by contacting: Dr. Philip Prinz, Department of Special Education and Communicative Disorders, San Francisco State University, 415-338-7655

E-mail: [pm@sfsu.edu](mailto:pm@sfsu.edu)

The TASL consists of two production measures (Classifier Production Test, and Sign Narrative) and four comprehension measures (Story Comprehension, Classifier Comprehension Test, Time Marker Test, and Map Marker Test). It is designed to be used with deaf students ages 8-15 years.

## **Computer Software for Developing Spoken Language Skills**

### *Earobics (Step 1, Step 2, Adolescent/Adult version)*

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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Available through: Technology for Education, 1870 East 50th Street , Suite 7, Inver Grove Heights, MN 55077, 651-457-1917, <http://www.tfeinc.com>, or Super Duper Publications, Dept. SD 2002, PO Box 24997, Greenville, SC 29616-2497, <http://www.superduperinc.com>

Earobics are colorful, interactive games to train listening skills. The games provide immediate feedback and are motivational. Step 1 provides six games focused on a range of fundamental listening and sound awareness skills. The games can be modified to work on beginning, intermediate, or advanced tasks. Step 2 provides more advanced listening activities to address phonics and language skill development. There are clinical and home versions of the software. The clinical versions provide greater flexibility in modifying activities.

### *Exploring First Words (I and II)*

Available through: Laureate Learning Systems, Special Needs Software, 110 East Spring Street, Winooski, VT 05404-1898, 800-562-6801, <http://www.laureatelearning.com/>

Exploring First Words provides activities to promote basic vocabulary development. The program is designed to give the instructor control over the content and presentation of the lesson. Levels I and II are similar in difficulty, varying only in the content of the vocabulary addressed. They each provide opportunities for students to listen for vocabulary associated with ten categories, including animals, body parts, clothing, common objects, food, household items, outside things, toys, utensils, and vehicles.

### *The Great Action Adventure*

Available through: Super Duper Publications, Dept. SD 2002, PO Box 24997, Greenville, SC 29616-2497, <http://www.superduperinc.com>

The Great Action Adventure is a software program designed to teach more than 100 verbs through listening and sign language. The program provides the opportunity to listen to a word and then see the associated sign via a brief video clip. Appropriate for ages 2 and up.

### *IBM SpeechViewer III*

Available through: Edmark, PO Box 97021, Redmond, WA 98073-9721, 800-362-2890, <http://www.riverdeep.net/>, or Psychological Corporation, 800-872-1726, <http://www.psychcorp.com/>

IBM SpeechViewer III is an interactive computer program that proceeds from simple to advanced exercises providing visual feedback to support development of voice and speech production skills. The system includes the games from Visual Voice Tools as well as more advanced activities that focus on phonological development as well as pitch and

loudness patterning. Purchase of the program includes a microphone and a clinical tracking system. It is intended for therapy/school use.

### *Intelli-Talk II*

Available through: Intellitools, Inc., 1720 Corporate Circle, Petaluma, CA 94954, <http://www.intellitools.com>, 800-899-6687

Intelli-Talk II is a word processing program that combines text, speech, and graphics. Students can listen to spoken production of letters, names, words, and sentences as they type. Text voicing is possible for letters, words, sentences, or a whole page at a time. Speech pronunciation can be modified for unusual spelling. The program comes with numerous pictures and pre-designed templates to develop individualized programs for each student. Activities can be modified for pre-readers utilizing an included picture library.

### *Listen-Hear*

Available through: Avaaz Innovations Inc., PO Box 8040, 1225 Wonderland Road North, London, Ontario N6G 2B0, 519-472-7944, <http://www.avaaz.com>

This software is divided into three sections: Sound Discrimination, Vocabulary Development, and Language Concepts. Each section can also be purchased individually. The Ling 6-sound test is included via a game that develops awareness and identification of these sounds. The progression through each level includes the option to “familiarize” the child with the specific targeted sounds for each unit prior to initiating the unit. The program also provides options for choosing which sounds/words to include in each activity. After participating in the familiarization portion of the software, the progression through the activity is pre-set and must be completed before moving to another activity.

### *Locu-Tour Literacy CD-Rom: Phonemic Awareness (pre-kindergarten to adult)*

Available through: Super Duper Publications, Dept. SD 2002, PO Box 24997, Greenville, SC 29616-2497, <http://www.superduperinc.com>, or Technology for Education, 1870 East 50th Street, Suite 7, Inver Grove Heights, MN 55077, 651-457-1917, <http://www.tfeinc.com>

Software includes seven activities to develop letter identification, word identification, lipreading, spelling, and memory for sounds. The lipreading component is especially useful for deaf and hard of hearing students. Each activity includes options to modify the difficulty level. The software is easy to use and can be modified for a variety of ages and listening/phonemic levels. (See other LocoTour software including Phonology, Articulation, and Look, Listen, and Learn.)

### *Nouns and Sounds*

Available through: Laureate Learning Systems, Special Needs Software, 110 East Spring Street, Winooski, VT 05404-1898, 800-562-6801, <http://www.laureatelearning.com>

Nouns and Sounds is an easy-to-use program that helps children discriminate and identify 100 environmental sounds. Users can select specific sounds and pictures to modify for individual listening levels. A variety of games is offered within the software. Photographs are used.

### *Otto's World of Sounds*

Available through Oticon, Inc. 1-800-526-3921 or [http:// www.otikids.com](http://www.otikids.com)

Games revolving around listening for sounds in ten varied environments (i.e. house, kitchen, farm, beach, etc...) Each environment contains 10 different sounds common to that environment ( i.e. doorbell, telephone, blender, farm animals, waves). A variety of activities are offered for each environment to help students identify and remember these sounds. The activities are easy for students to navigate, and the sound quality for the varied sounds is very good.

### *Seeing and Hearing Speech* (lessons in lipreading and listening)

Available through Sensimetrics at <http://www.sens.com>

Seeing and Hearing Speech: Lessons in Lipreading and Listening is a software program for established language users to train and practice lip-reading at their own pace and at home. This new interactive CD-ROM from Sensimetrics Corporation contains carefully planned lessons that help people combine what they see with what they hear to understand speech better.

### *Hear We Go* (Individualized rehabilitation workbook for teenagers)

Available through Cochlear Americas at <http://www.cochlearamericas.com/index.asp>

This CD contains an easy to install program that allows the therapist to access rehabilitation exercises and generate an individualized rehabilitation workbook for the Nucleus recipient. The workbook is built around 24 different topical interests for older children and teenagers and has 3 different auditory skill levels within each topic. It can either be printed or emailed to the recipient it has been designed for. It also contains additional topics like Active Listening, Telephone Training, Communication Strategies, and more. It can either be printed or emailed to the recipient it has been designed for.

### *Sound and Beyond* (interactive listening rehabilitation for adults)

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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Available through Cochlear Americas at <http://www.cochlearamericas.com/index.asp> (retail price is \$290.00)

This CD is a self-paced, interactive computer listening tool that offers: Pure Tone Discrimination, Environmental Sounds, Male/Female Identification, Vowel Recognition, Word Discrimination, Everyday Sentences and Music Appreciation. There are five different skill levels within each topic and over 10,000 sounds, words, and sentences. It reports tracking progress to view and share. One license can be shared with up to three different users at a time.

### *Talk Time with Tucker*

Available through: Laureate Learning Systems or Technology for Education, 1870 East 50th Street, Suite 7, Inver Grove Heights, MN 55077, 651-457-1917, <http://www.tfeinc.com>

Talk Time with Tucker is a set of voice-activated programs for young children; a variety of activities are included, all with the goal of facilitating use of voice.

### *Visual Voice Tools*

Available through: Edmark, PO Box 97021, Redmond, WA 98073-9721, 800-362-2890, <http://www.riverdeep.net/>, or Technology for Education, Inc., 1870 East 50th Street, Suite 7, Inver Grove Heights, MN 55077, 651-457-1917, <http://www.tfeinc.com/>

Visual Voice Tools is a software that includes seven child-centered games from IBM Speechviewer III to help students develop control of voicing and the suprasegmental aspects of speech production. Activities are provided to promote practice with: sound presence, loudness, voice onset, voice timing, pitch range, and pitch control. These games are appropriate for children of all ages. This software can also be used at home.

### *Words Around Me*

Available through: Laureate Learning Systems, Special Needs Software, 110 East Spring Street, Winooski, VT 05404-1898, 800-562-6801, <http://www.laureatelearning.com>, or Technology for Education, Inc., 1870 East 50th Street, Suite 7, Inver Grove Heights, MN 55077, 651-457-1917, <http://www.tfeinc.com>

The Words Around Me software program associates common vocabulary words with associated pictures. The students have the opportunity to listen to a word and see a variety of associated pictures. They can work independently and practice their listening for specified words while building a broader vocabulary.

### *Hear We Go* (individualized rehabilitation workbook for Nucleus recipient)

KidsWorld Deaf Net E-Document: *Cochlear Implants: Navigating a Forest of Information...One Tree at a Time*  
by Debra Nussbaum

<http://clerccenter2.gallaudet.edu/KidsWorldDeafNet/e-docs/CI/index.html>

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Available through: Cochlear Americas, <http://www.cochlear.com/>

This CD contains an easy to install program that allows the therapist to access rehabilitation exercises and generate an individualized rehabilitation workbook for the Nucleus recipient. The workbook is built around 24 different topical interests and 3 different auditory skill levels. It can either be printed or emailed to the recipient it has been designed for.

*Sound and Beyond* (interactive listening rehabilitation for adults)

Available through Cochlear Americas, <http://www.cochlear.com/> (retail price is \$290)

This CD is a self-paced, interactive computer listening tool that offers: Pure Tone Discrimination, Environmental Sounds, Male/Female Identification, Vowel Recognition, Word Discrimination, Everyday Sentences, and Music Appreciation. There are five different skill levels within each topic and over 10,000 sounds, words, and sentences. It reports tracking progress to view and share. One license can be shared with up to three different users at a time.

## **Curricula/Training Programs**

*Ausplan (Auditory Speech Language): A Manual For Professionals Working With Children Who Have Cochlear Implants Or Amplification (2003)*

Available through: <http://www.ausplan.com/>

Manual developed by Adeline McClatchie and Mary Kay Therres, members of the pediatric cochlear implant team at Children's Hospital and Research Center in Oakland California to guide professionals in developing a communication therapy plan for children with cochlear implants and/or hearing aids. The manual includes a useful framework for rating a child's potential to use a cochlear implant as well as performance outcomes. The manual is clearly organized and presents many tools to guide planning and training in the separate yet connected areas of auditory, speech, and language development.

*Bringing Sound to Life: Principles and Practices of Cochlear Implant Rehabilitation*

Available through Advanced Bionics:

<http://www.bionicear.com/professionals/rehabmaterials.asp>

This program provides a systematic approach to spoken language habilitation for children of all ages. It includes a video training series, a manual, and a program to develop phoneme perception and a production called Word Associations for Syllable Perception (WASP). The video training series includes four videotapes: 1) Building Blocks of Spoken Language; 2) Understanding Hearing and Hearing Loss; 3) Cochlear Implants and Children: An Opportunity, Not a Cure; and 4) Principles and Practices of Cochlear

Implant Rehabilitation. The videos are an excellent resource for family education and/or teacher training. The manual provides insights, strategies, and tools integral to the spoken language habilitation process. The WASP program includes a laminated set of picture cards. This program can be purchased as a package or as individual components.

*CHATS :The Miami Cochlear Implant, Auditory and Tactile Skills Curriculum*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

The guide provides a sequence of goals to facilitate auditory development for students of all ages using a variety of technologies including cochlear implants. There are receptive and expressive goal categories. The focus of the receptive goals is perception while the focus of the expressive goals is production. The objectives within each category follow a developmental sequence. Activities are provided to support the goals in each category.

*Classroom Goals: Guide For Optimizing Auditory Learning Skills*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This guide was designed to support development of auditory learning regardless of hearing level, type of amplification device used, grade level, or mode of communication. The guide describes practical ways for teachers to create situations to encourage development and use of residual hearing in the classroom. Lessons are suggested to demonstrate how to incorporate auditory experiences into learning. While the activities described are content specific, the strategies incorporated can be applied to any content area or book.

*Contrasts for Auditory and Speech Training (CAST)*

Available through: Linguisystems, 3100 4th Avenue, East Moline, IL 61244-9700, 800-776-4332 (voice), 800-577-4555 (FAX), <http://www.linguisystems.com/custom.php>

CAST is an analytic auditory training program for children with cochlear implants or hearing aids. CAST includes pre-test, step-by-step procedures for analytic auditory training and a progress log. It also provides 600 full-color stimulus pictures for listening practice.

*Cottage Acquisition Scales For Listening, Language, and Speech*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

A product to help assess, select objectives, and plan instruction to document and facilitate language acquisition in children with hearing loss. It is based on many of the language development beliefs of researcher Christie Yoshinaga-Itano (Language assessment of infants and toddlers with significant hearing loss, Seminars in Hearing, 1994) It includes a set of scales (pre-verbal, pre-sentence, simple sentence, complex sentence, sounds and speech) that follow the development of language, listening, cognition, and speech. The assessment component is based on language sampling. It also provides suggestions for using the tool to promote instruction in the addressed areas.

### *Learn To Talk Around The Clock*

Available through: Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This oral early intervention program is designed for professionals who work with families of children who are deaf or hard of hearing. It focuses on language learning in the child's home environment. It provides a toolbox for professionals to maximize the caregiver's language development techniques by encouraging interactions during everyday activities. The premise is that providing opportunities for interaction in everyday life provides the groundwork for auditory and language development. The curriculum includes a toolbox and VHS cassette.

### *Listen, Learn, and Talk*

Available through: Cochlear Corporation, 61 Inveness Drive East, Suite 200, Englewood, CO 80112, 800-523-5798 (V/TTY), 303-792-9025 (FAX), E-mail: [info@cochlear.com](mailto:info@cochlear.com) Web: <http://www.cochlear.com/>

An auditory habilitation program for young deaf and hard of hearing children who are learning to listen and talk. It consists of a manual and three videotapes (Babies Babble, Toddlers Talk, and Children Chatter). The videos provide practical ways that families can provide spoken language enhancement in their home. The manual provides information on the importance of parent participation in the habilitation process, theory behind auditory development, strategies for facilitating spoken language development, and integrated scales for monitoring/documenting development in listening, language, speech, cognition, and social communication.

### *Listen Little Star (A Listening Program)*

Available through Auditory Verbal International at: <http://www.auditory-verbal.org/llstar.asp>

Manual and activity guide available through Auditory Verbal International, Inc (AVLI) to facilitate spoken communication with deaf and hard of hearing infants. Developed by Dimitry Dornan a Speech Pathologist and Certified Auditory-Verbal therapist. The

techniques described are based on Auditory Verbal techniques. The program includes a manual with handouts about hearing loss and a step by step plan of sequential activities for the child, family and professional.

### *My Baby and Me*

Developed by: Betsy Moog Brooks. The Moog Center for Deaf Education, 12300 South Forty Drive, St. Louis, MO 63141. Available through:  
<http://www.hearingexchange.com/store/>

My Baby and Me is a notebook-style resource for parents (and professionals working with them) that provides strategies and tips for helping a child learn to listen and talk in an easy-to-use “baby book” format that is personalized for each child and family. This resource provides detailed information and resources about language learning and hearing loss and provides space for families to document their child’s individual development. While developed for families using an “oral only” approach to communicating with their deaf child, the information detailed is beneficial for any family interested in developing/documenting their child’s spoken language skills regardless of the communication methodology chosen.

### *Phono-Graphix*

Available through: Read America, 352-735-9292, <http://www.readamerica.net>

This program is intended to support phonemic development and reading and includes an instructional manual and materials. The program can be used as part of a reading and/or speech development program. It addresses skills to support children in “breaking the reading code.” It teaches children that letters are pictures of sounds, that sound pictures can be one or more letters, that there is variation in the code, and that there is overlap in the code.

### *St. Gabriel’s Curriculum for the Development of Audition, Language, Speech and Cognition*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

A guide for professionals working with children with hearing loss from birth to 6 years. The guide provides a developmental sequence for the areas of audition, language, speech and cognition. The audition component describes auditory awareness, the 7-sound test, and auditory memory, The language component describes expressive and receptive developmental sequence for the structures of English. The Speech section follows the developmental stages of early speech, the development of auditory feedback skills, and an order for the acquisition of vowels, diphthongs and consonants. It also provides a developmental checklist of phonological processes. The cognitive section details a

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hierarchical order for the development of critical thinking skills. While the guide was developed for a center utilizing the Auditory Verbal approach, its sequences can be applied to students using a range of communication methodologies and educational approaches.

### *See-the-Sound Visual Phonics*

Available through: International Communication Learning Institute, See the Sound Visual Phonics, 10712 308th Avenue, Princeton, MN 55371, 763-389-4875, [riggsll@msn.com](mailto:riggsll@msn.com)

This program uses a combination of visual, tactile, kinesthetic, and auditory feedback cues to assist in developing phonemic awareness, speech production, and reading skills. It provides a system to help deaf children “see” and internalize English phonemes. The system includes 45 hand movements for phonemes that relate to how a sound is produced. You must participate in a formal training session provided by a certified Visual Phonics trainer prior to purchase and use of this program.

### *SMILE*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY), <http://www.agbell.org/>

SMILE is a multi-sensory program that teaches speech, reading, and writing to children with severe language and communication delays, including those with hearing loss, dyslexia, or autism. Unique in its engaging yet simple focus, SMILE uses expressive and receptive modalities to improve the reading skills of target and general populations.

### *SPICE (Speech Perception Instructional Curriculum Evaluation)*

Available through: Central Institute for the Deaf, 4560 Clayton Avenue, St. Louis, MO 63110, 314-977-0000 (V), 314-977-0001 (TTY), <http://www.cid.wustl.edu/>

SPICE is a curriculum kit for developing speech/listening skills/processing skills in children who use either cochlear implants or hearing aids. The kit includes a manual, a set of accompanying toys and picture cards, and a demonstration video. The program provides a sequence of lesson objectives and suggests a variety of activities for each objective. The activities are designed for children ages 3 through 12 and can be adapted to a variety of language levels. Goals for the curriculum are listed in four categories: detection, supra-segmental perception, vowels and consonants, and connected speech.

### *Spoken Communication for Students Who are Deaf or Hard of Hearing: A Multidisciplinary Approach*

Available through: Butte Publications, Inc., P.O. Box 1328, Hillsboro, OR 97123-1328, 866-312-8883 (V/TTY), 866-412-8883 (FAX), 503-693-9526 (Direct)  
E-mail: [service@buttepublications.com](mailto:service@buttepublications.com) Web: <http://www.buttepublications.com>

A speech text that supports the instructional best practice of using a multidisciplinary team approach to develop spoken communication skills regardless of the type and degree of hearing loss or the educational philosophy. This habilitative program allows for teachers, speech therapists, parents and school personnel as well as the student to work together within the classroom setting to establish, develop and support spoken communication skills. The test is user-friendly and provides pictures, forms, springboard discussions, experiments, and practical ideas for use in school or at home.

*Top Ten Strategies for Parents* (Parent manual, professional manual, videotape)

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

Developed by Jill Bader, Founding Director of the *Hear At Home* program in Colorado (303-841-7987, [jbaderconsultant@aol.com](mailto:jbaderconsultant@aol.com)). The manuals (one for families and one for professionals working with families) include clearly written descriptions of ten strategies to facilitate a child's learning to listen and speak. With catchy names for strategies such as "Three Ring Circus", "Bore Me To Death" and "Make Your Point", this resource provides the important premises and foundations for promoting development of spoken language skills in terms that anyone will understand. The described strategies remove the professional jargon and help make sense of the information for families. The accompanying videotape demonstrates each of the 10 strategies.

## Books

Christiansen, J., & Leigh, I. (2002). *Cochlear implants in children: Ethics and choices*. Washington, DC: [Gallaudet University Press](http://www.gallaudet.edu/).

Written by two deaf professionals (one with a cochlear implant), this book provides a balanced look at many of the issues surrounding cochlear implants. Much of the information discussed was gathered from the findings of a 1999 Gallaudet University research survey of several hundred parents of children with implants, as well as information from interviews of Dr. Leigh and Dr. Christiansen with several dozen parents of implanted children. The book also includes an excellent chapter, "The Deaf Community: Perceptions of Parents, Young People, and Professionals," as well as an excellent chapter on language development of children with cochlear implants written by Patricia Spencer.

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Chute, P., & Nevins, M. E. (2002). *The parents' guide to cochlear implants*. Washington, DC: [Gallaudet University Press](#).

Written by respected professionals in the field of deaf education and the authors of *Children with Cochlear Implants in Educational Settings*, this book provides a guide for parents that reflects authors with many years of experience working with implanted children and their families. The book addresses many issues that families may or may not have thought about related to the process of obtaining an implant. The book is honest in highlighting the limitations as well as the benefits of implants, and the controversies related to communication, language, and Deaf cultural issues for children with implants. One chapter is dedicated to quotes from families and provides valuable insights into parent perspectives related to their decision to obtain a cochlear implant for their child.

Easterbrooks, S. & Baker, S. (2002). *Language learning in children who are deaf and hard of hearing: Multiple pathways*. Boston: Allyn and Bacon.

This book provides comprehensive insights and tools related to evaluating and planning for language learning with deaf and hard of hearing children. The book acknowledges that deaf/hard of hearing children are diverse and use multiple pathways for language learning based on their residual hearing and learning styles. Included in this book are many useful resources including a checklist of emerging ASL skills and a list of available language tests.

French, M.M. (1999). *Starting with assessment: A developmental approach to deaf children's literacy*. Washington, DC: [Pre-College National Missions Programs](#), Gallaudet University.

This book, including the separately bound appendices in The Toolkit, is about assessing the literacy development of children who are deaf. The book examines assessment philosophies and tools that can be used to guide educational planning during the preschool and elementary years. It describes a model of assessment for written language--reading and writing--that covers multiple areas of learning and stresses the importance of conversational language to literacy development. An important premise for this model is that assessment should guide instruction according to the developmental needs of individual children.

Mahshie, J., Moseley, M.J., Scott, S., & Lee, J. (2006). *Enhancing communication skills: Deaf and hard of hearing children in the mainstream*. Clifton Park, NY: [Thomson-Delmar Learning](#).

This book is designed to help clinicians who may have little or no experience working with deaf and hard of hearing students (including students with cochlear implants) to understand their unique communication needs and develop clinical skills for working with them. This book provides a useful framework for viewing and assessing children's communication abilities and goals at all stages of language development. It also includes

specific assessment and treatment techniques to help develop and improve communication skills and maximize learning.

Oliva, G.A. (2004). *Alone in the mainstream: A deaf woman remembers public school*. Washington, DC: [Gallaudet University Press](#).

Gina Oliva writes about her experiences being the only hard of hearing student in the entire school; she refers to it as a "solitary." She felt alone because she couldn't communicate easily with her classmates, but also because none of them had a hearing loss like hers. Years later at Gallaudet University, Gina discovered that she wasn't alone and that her experience was common among mainstreamed deaf students. This book recounts Gina's story, as well as those of many other solitaires.

Seal, B.C. (2003). *Best practices in educational interpreting*. Boston: Allyn and Bacon.

This book is a comprehensive overview of the process of interpreting in educational settings. It is a practical guide to the many issues and practices required to provide optimum access to the over 22, 000 deaf and hard of hearing students enrolled in local schools who are dependent upon an interpreter. It emphasizes the changing needs of deaf and hard of hearing students as they move from primary school through college. It is applicable for interpreters who use sign language, cued speech, and oral interpreting. This book is an excellent resource for anyone working with deaf and hard of hearing students including, interpreters, regular teachers, parents, speech-language pathologists, and deaf educators.

## **Additional Resources**

### *Dolch Bridge List*

Available through: [http://www.fairviewlearning.net/products/product\\_catalog.php](http://www.fairviewlearning.net/products/product_catalog.php)

The Dolch word list and Bridge List are designed specifically to support the language and reading development of deaf students. The lists provide commonly used English words and phrases and correlate them to American Sign Language. The lists assist students with the process of linking English and ASL. In addition to the lists, videotapes are also available to demonstrate the bridges between ASL and English.

### *Animusic*

Available at: <http://www.animusic.com/>

Animusic is a visual display of musical instruments playing a range of music. An engaging video/DVD, it provides an opportunity to visually experience music.

### *Listening Games for Littles*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

Developed by Dave Sindrey, Certified Auditory Verbal Therapist, the book is designed for parents and professionals working with children age 4 and under. Practical, fun ideas for integrating listening into the learning of a young child are provided. The book is divided into sections on listening, hearing, listening tips, and listening ideas.

### *It Takes Two to Talk: A Parent's Guide To Helping Children Communicate*

Available through :Alexander Graham Bell Association, 3417 Volta Place, NW, Washington, DC 20007 202-337-5220 (V/TTY) Web: <http://www.agbell.org/>

This book provides strategies for families to use in their daily life to facilitate early communication. It provides ideas to help families see their child as communicators and include their child in the communication process.

### *Sign with your Baby*

Available through <http://www.sign2me.com>

This video and manual train families on how to teach sign language to hearing babies. Based on research related to early language development, this program provides the materials for families to learn basic signs to use with their baby to facilitate signed language as an avenue to promote communication prior to the emergence of spoken language.

### *Summer's Story—Coming of Age with the Cochlear Implant*

(VHS 27 minutes, ASL and voice, open captioned)

Written by Summer Crider; Produced by Michael Munroe

Available through: Monroe Multimedia ([m2media@alltel.com](mailto:m2media@alltel.com))

This is the story of Summer Crider, who is profoundly deaf and uses a cochlear implant, from birth to the time she entered college. The story is primarily Summer's own, but includes interviews with her family, friends, and teachers. Summer became deaf at the age of three from spinal meningitis. The video describes her educational journey prior to receiving a cochlear implant and after, from a school for the deaf, to a regular mainstream school, and back to a school for the deaf where she finds peer support within the Deaf community. Summer describes her love/hate relationship with her cochlear implant and how she came to accept it as a "tool" instead of a stigma. She states that she hopes to become the bridge between the "Deaf" and the "Hearing" communities, as she grew up in both.

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*Sound or Silence: Discovery Health Channel Video*

(VHS 52 minutes, open captioned)

Available through: Discovery Health Channel at: <http://www.discovery.com/health>

This video is a compilation of a Discovery Health Channel series about cochlear implants. It provides information about the history of cochlear implant technology. It describes how the normal ear processes sound and the impact of deafness. Through a series of interviews, the video provides insight into varied perspectives about the implant. It discusses the deaf culture/community's perspective regarding implanting children as well as interviews with adults (culturally deaf and late deafened) who received implants. Parents (hearing and deaf) discuss their views and decisions to implant or not to implant. Overall, this video provides comprehensive information about cochlear implants, the complexity of the decision making process, and the perspective of the deaf community.

*ASL Songs For Kids*

Available through: Institute for Disabilities, Research and Training Inc at:

<http://www.idrt.com/>

A CD that provides six songs typically learned by young children. The songs presented in both spoken language and American Sign Language are: The Wheels on the Bus, Happy Birthday, The Ants Go Marching, The Green Grass Grows All Around, Old MacDonald Had a Farm, and Twinkle, Twinkle Little Star. As the songs are sung, Paws the dog signs, and graphics convey the lyrics, as well as information about the notes and volume.

*Keys to English print: Phonics, Signs, Cued Speech, Fingerspelling, and Other Learning Strategies; Programs & Insights. Odyssey. Vol. 5, Issue 1. Fall 2003*

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This issue of *Odyssey* reviews a number of tools that educators are using to facilitate the literacy skills of children who are deaf and hard of hearing. Several of the tools/strategies discussed are based on ways to develop phonemic awareness. The tools discussed include, Visual Phonics, Cued Speech, and Fingerspelling. Additionally, strategies to build pre-reading skills, such as memory and focusing are also described. This issue is also available as a KidsWorld e-document: [Keys to English Print...](#)

*Reference List: Sign and Spoken Language Changes in Pediatric Cochlear Implant Users*  
ASHA, November, 2004

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Compiled by: Brenda Seal, JMU; Kelly Clingempeel, JMU; Debra Nussbaum, Clerc Center; Susanne Scott, Clerc Center; Bettie Waddy-Smith, Clerc Center

This is a reference list of articles related to the following topics: Predictors of Success: Child, Family, & Implant Predictors; Habilitation & Education: Intervention Strategies & Placement Issues; Age At Implantation: Favors Young Children; and Diverse Outcomes: Users of Spoken Language, Sign Language, & Both.

Revised by:  
[Susanne Scott](#)  
1/13/06