

A photograph showing a woman in profile on the left, smiling and looking towards a baby on the right. The baby is looking towards the camera. The background is a soft, out-of-focus red.

# Cochlear Implants in Children

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# Hearing Impairment

- There are 28 million hearing impaired individuals in the United States
- Severe to Profound Hearing Impairment affects 500,000 to 750,000 Americans
- 33 babies are born with some form of hearing loss every day, one third of these are profoundly deaf



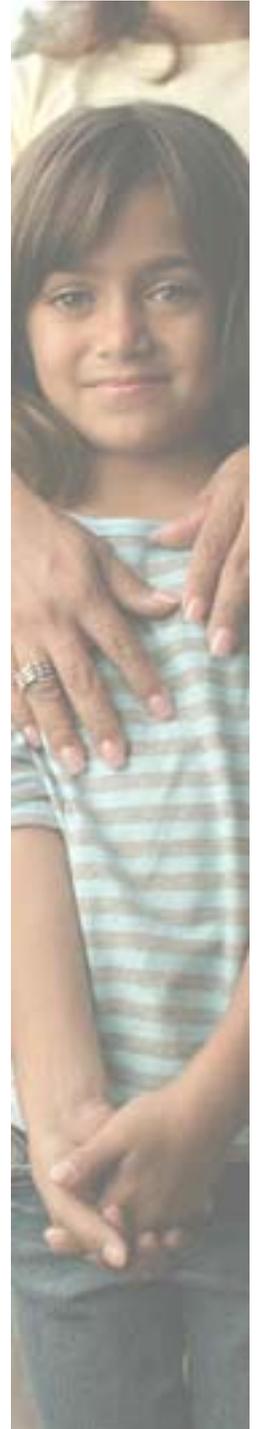
# Hearing Impairment

- 4500 infants are born each year profoundly deaf in the US (1/1000)
- 37,000 (6/1000) infants have significant hearing loss (>55dB)
- 90% of children with congenital hearing loss have parents with normal hearing
- 60% genetic, 25% environmental, 15% unknown causes

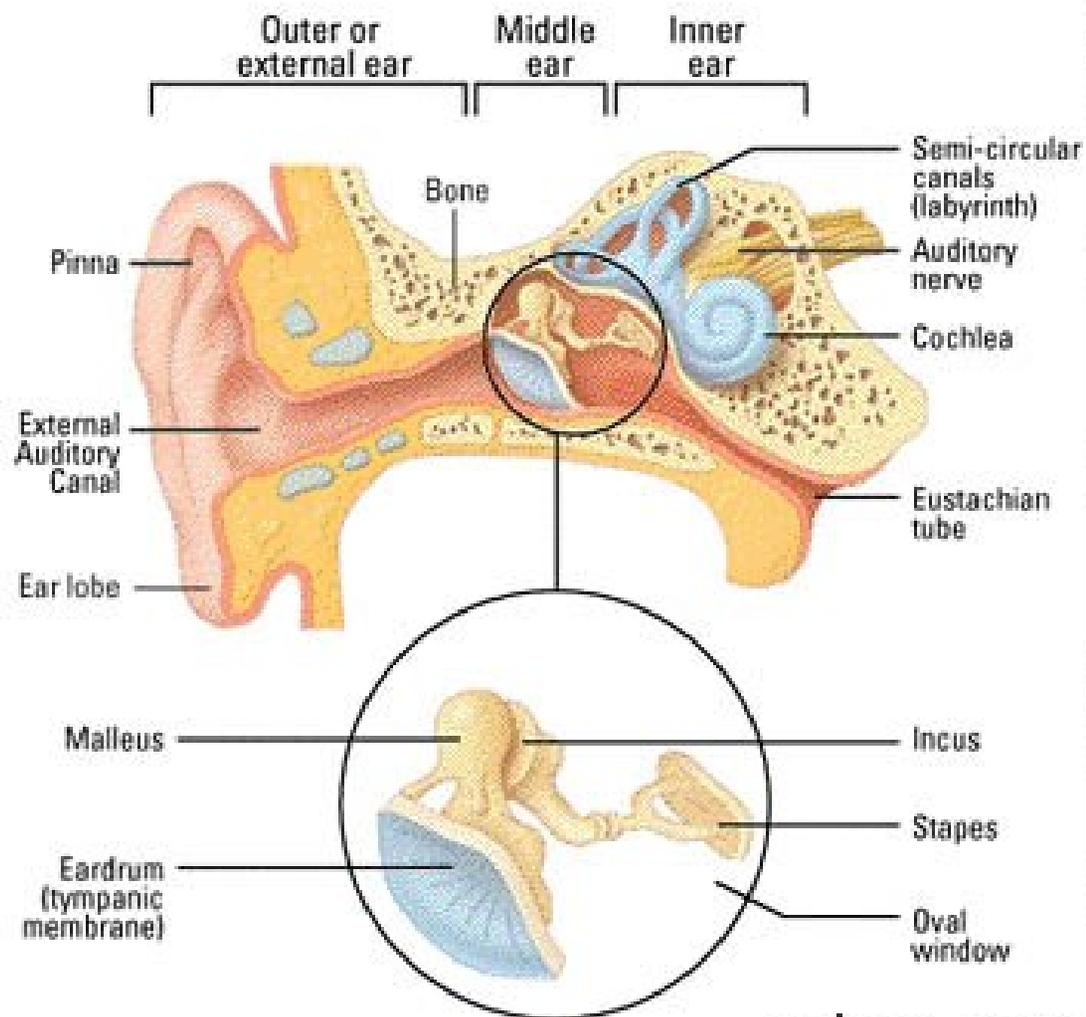


# Hearing Loss

- Types of Hearing Loss
  - Conductive
  - Sensorineural
  - Mixed
  - Neural



# The Ear

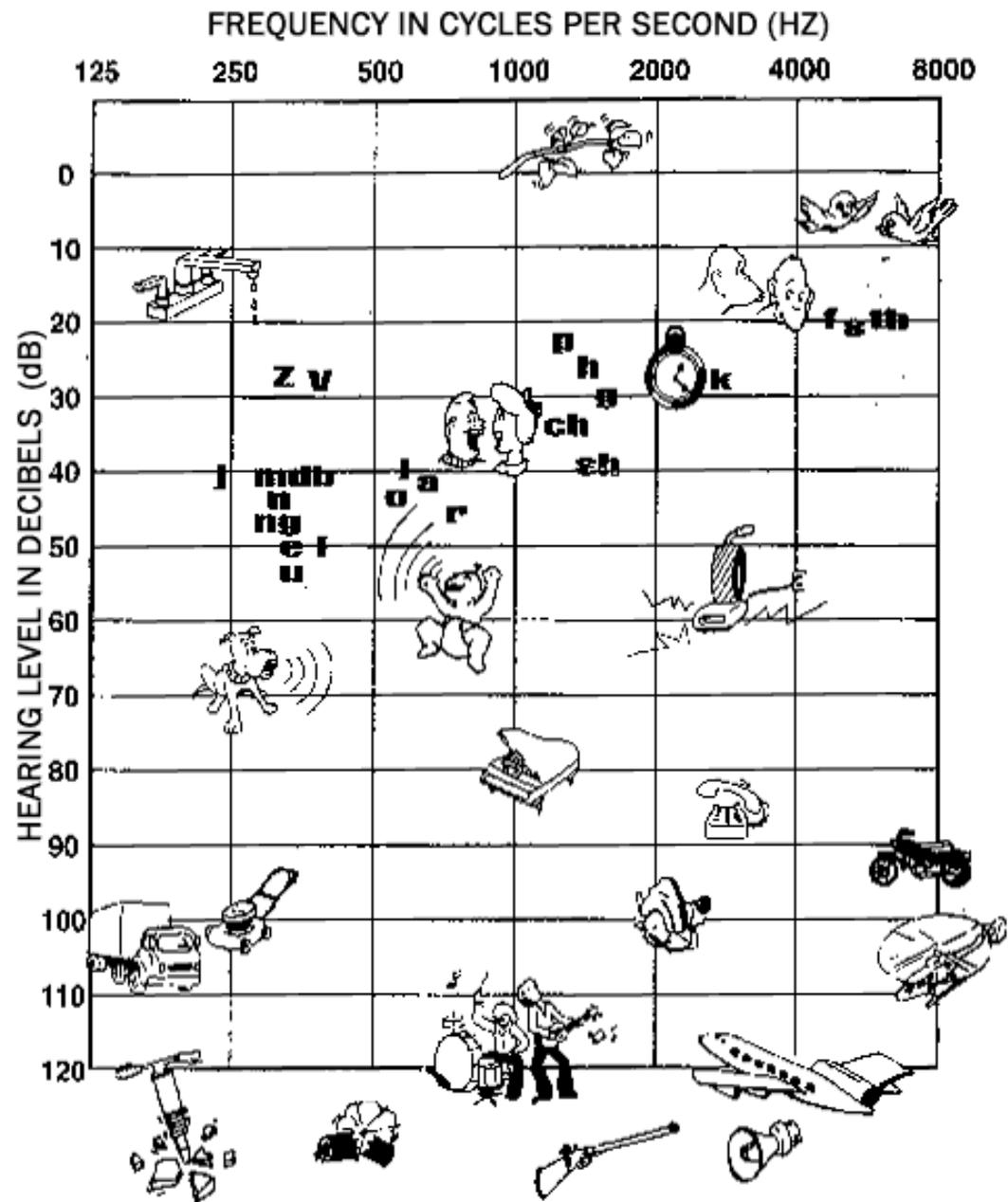


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# Hearing Loss

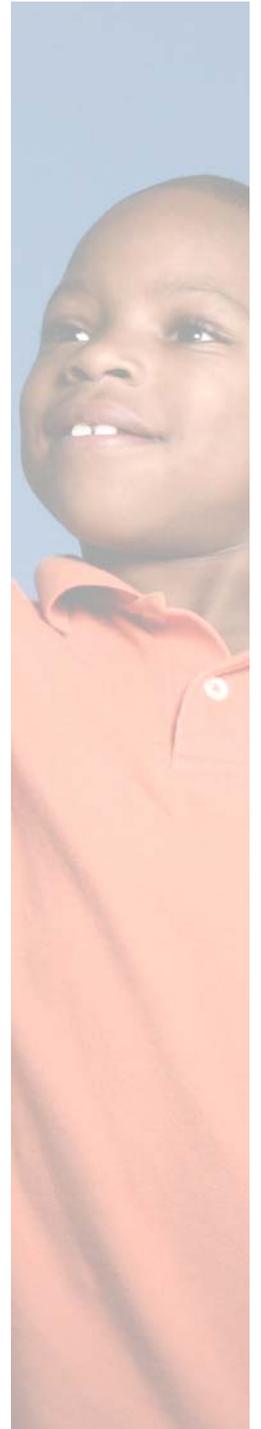
- Degrees of Hearing Loss
  - Mild
  - Moderate
  - Severe
  - Profound





# Hearing Loss

- National Institutes of Health, the American Academy of Otolaryngology/Head and Neck Surgery, and the American Academy of Pediatrics have recommended that hearing loss in infants be identified, and when possible treated, prior to 6 months of age.
- Based on studies that have shown that children identified with hearing loss prior to 6 months of age have a better chance of developing skills equivalent to their peers by the time they enter kindergarten.
- Children not identified until later (children identified at age 2 to 3 years) may ultimately suffer from irreversible and permanent impairments in speech, language, and cognitive abilities when compared to their peers.



# Hearing Loss



- Infant hearing screening programs – now law in 36 states
- Simple, quick, painless and reliable
- Referral rate = ~2%
- Once identified, quality treatment and devices can be available to babies to alleviate hearing loss
  - Medical and surgical interventions
  - Hearing aids and cochlear implants



# Cochlear Implants

# What is a cochlear implant?

- A cochlear implant is a “TOOL” for hearing
- For adults and children who receive little to no benefit from hearing aids
- For children, a cochlear implant on it’s own will not allow the child to develop normal speech and language
- Family support and therapeutic intervention are vital for allowing an implanted child to hear and talk



# What is a cochlear implant?

- **A prosthesis which is surgically implanted into the inner ear**
- **External equipment for sound processing**
- **Components**
  - Receiver/stimulator internal device
  - Speech processor
  - Microphone
  - Transmitting coil
  - Cables
  - Batteries



# Internal Device

- **Receiver/stimulator**
  - Computer chip = “The Brain”
  - Receiving coil
- **Electrode Array**
  - Number of electrodes is dependent on device/processing strategy
- **Magnet**

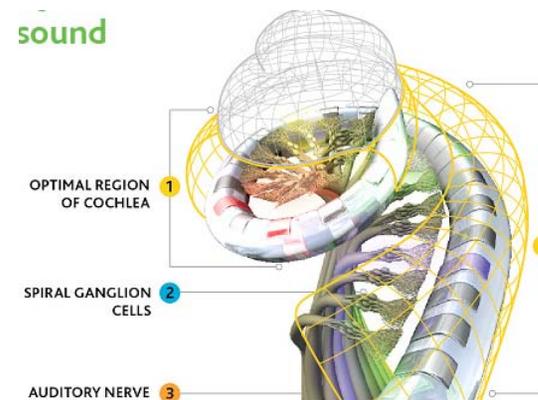


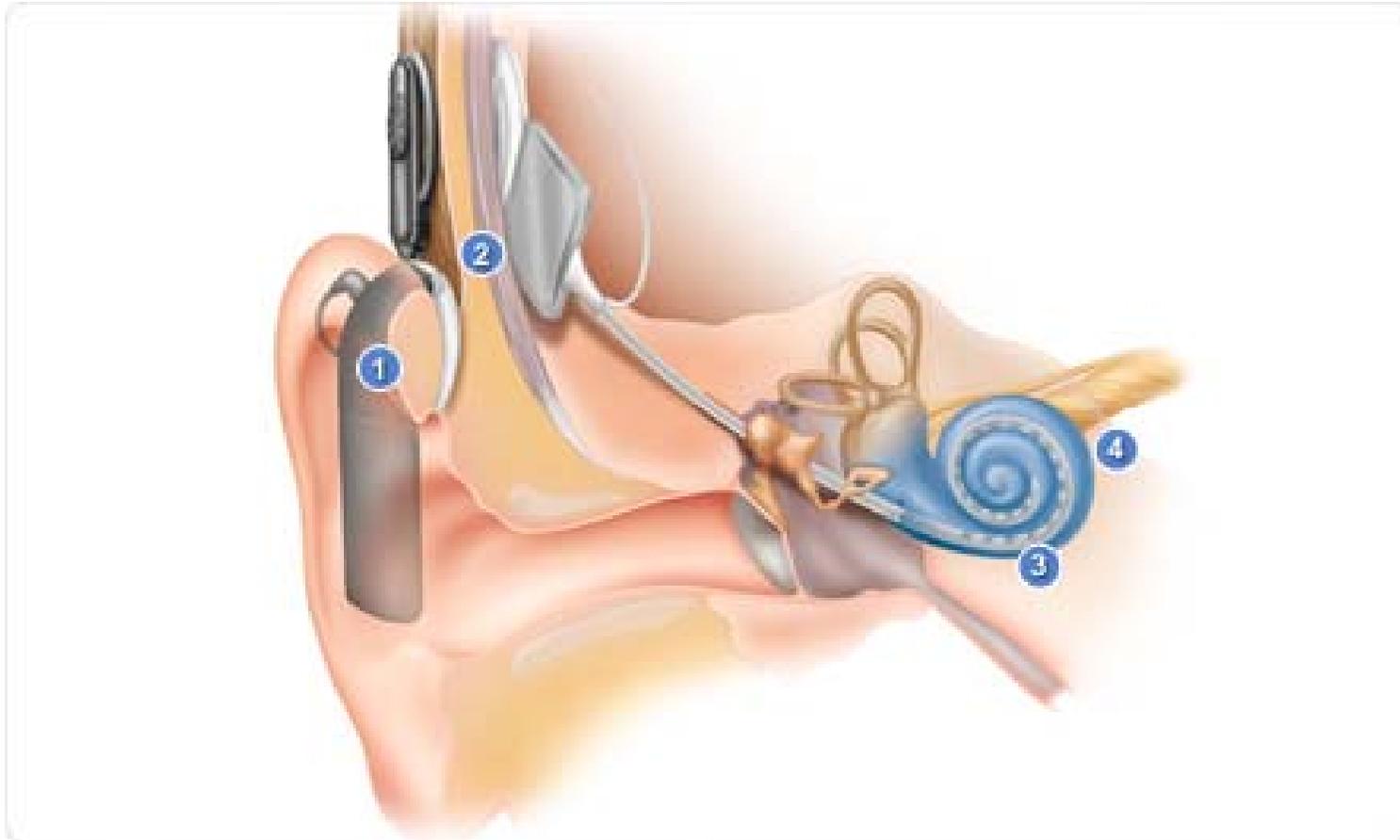
Illustration adapted from Gray's Anatomy Textbook

# External Devices

- **Microphone**
- **Transmitting Coil**
- **Speech Processors**
  - Converts acoustical signal into a “code”
  - “Code” is transmitted to internal device
  - Based on the code, the appropriate electrodes are stimulated to represent the acoustical signal



# How it works...



# Cochlear Implants

Med-EI



Advanced  
Bionics



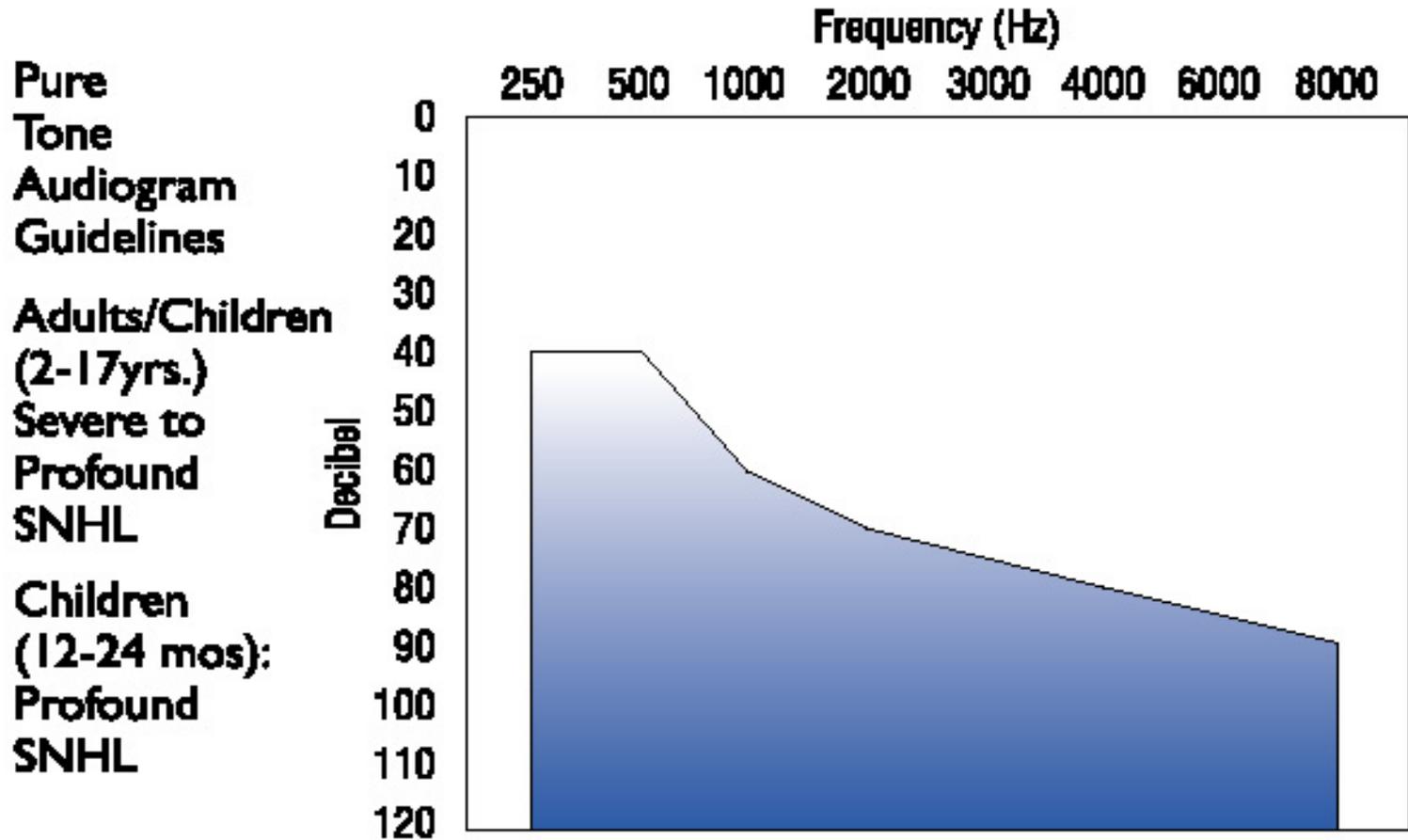
Cochlear



# “Which one is the “best” implant?”



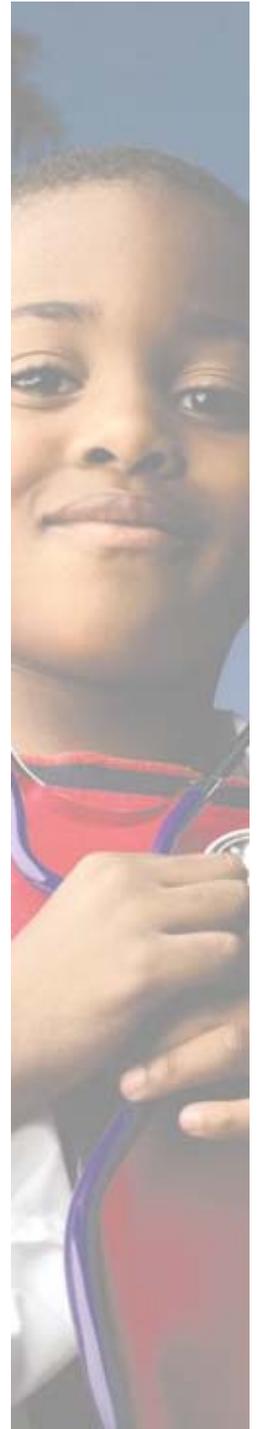
# Candidacy Criteria



# Candidacy Criteria

- **Pediatrics**

- Bilateral severe to profound sensorineural hearing loss
- Appropriate amplification
- No progress or plateau in therapy
  - Progress notes from therapist
  - No documented progress on questionnaires
- Strong oral/auditory based communication is stressed
- Highly motivated family with strong family support
- No medical contraindications
- Viable auditory nerve



# Surgery

# Surgery

- **Uses common surgical techniques**
  - “Seat” for receiver/stimulator
  - Mastoidectomy
  - Cochleostomy
  - Electrode Insertion
- **General anesthesia**
- **Smaller incisions used for some cases**
- **Surgery usually less than 2 hours**
- **Minimal trauma and risks**
- **Facial nerve monitoring**





# Programming & Follow-up

# Programming

- Routine follow-up is necessary to ensure proper functioning of cochlear implant
- Programming entails connecting speech processor to a computer and programming interface
- Current levels are adjusted based on each child's individual needs
- Children are taught to make a conditioned response to sound to let programmer know if they hear



# Therapy

- Auditory based intervention is the KEY to ensuring that an implanted child learns to hear and talk
- Use of sign language can inhibit the development of spoken language in implanted children
- Children should be enrolled in speech therapy/auditory training, auditory verbal therapy or oral education classroom



# Outcomes

- **Many factors affect outcomes of CI's in children**
  - Age at implantation
  - Family support
  - Therapeutic and educational intervention
  - Communication methodology
  - Length of deafness
  - Age at identification
  - Etiology of hearing loss





Questions????