SPAU338
Hearing Aids II

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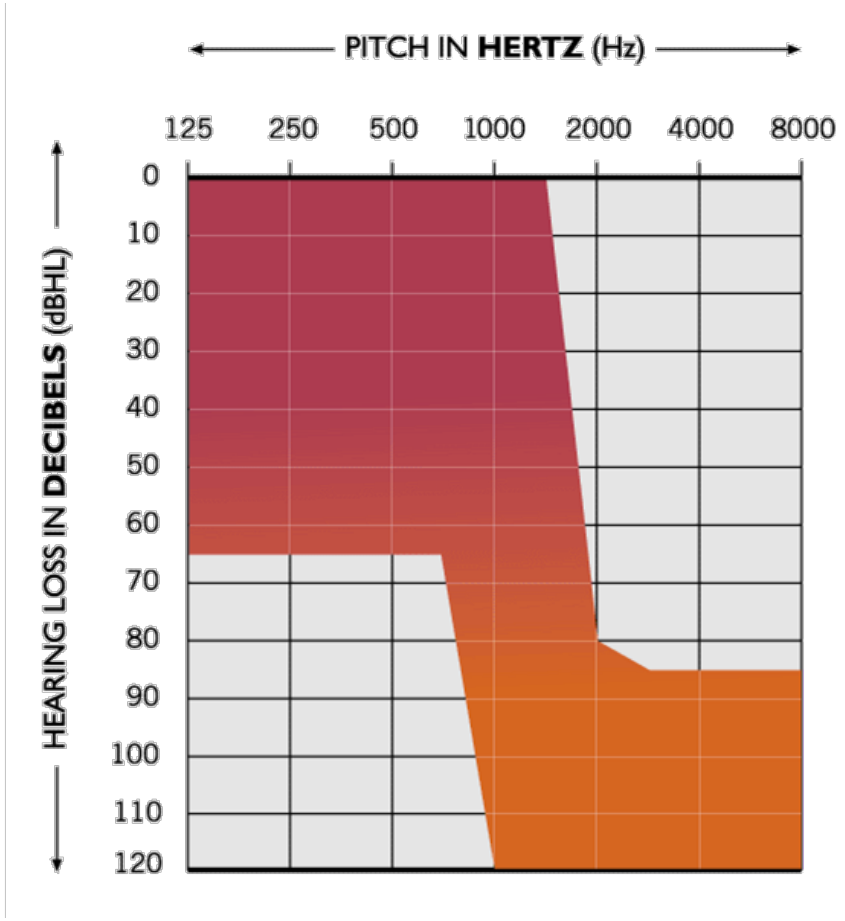
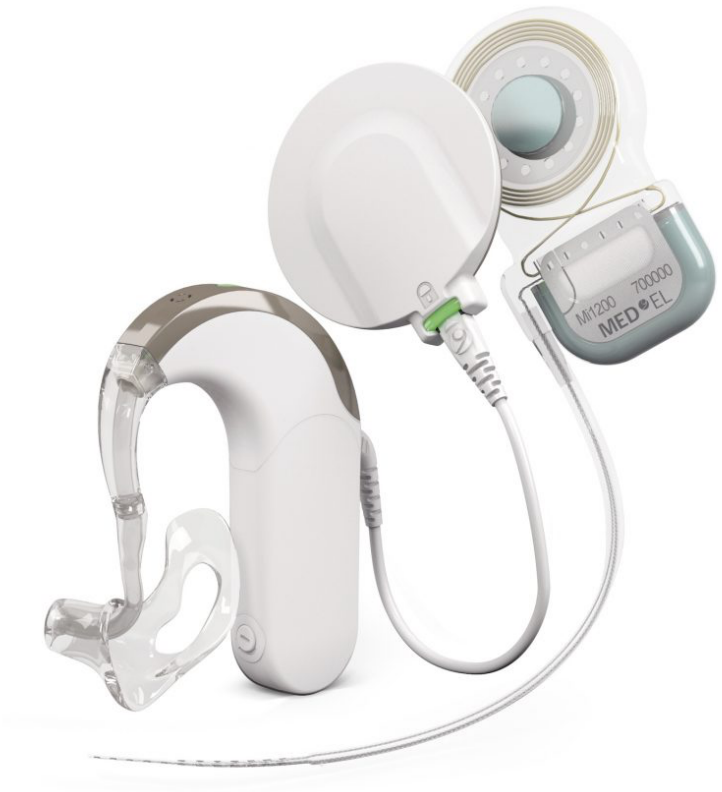
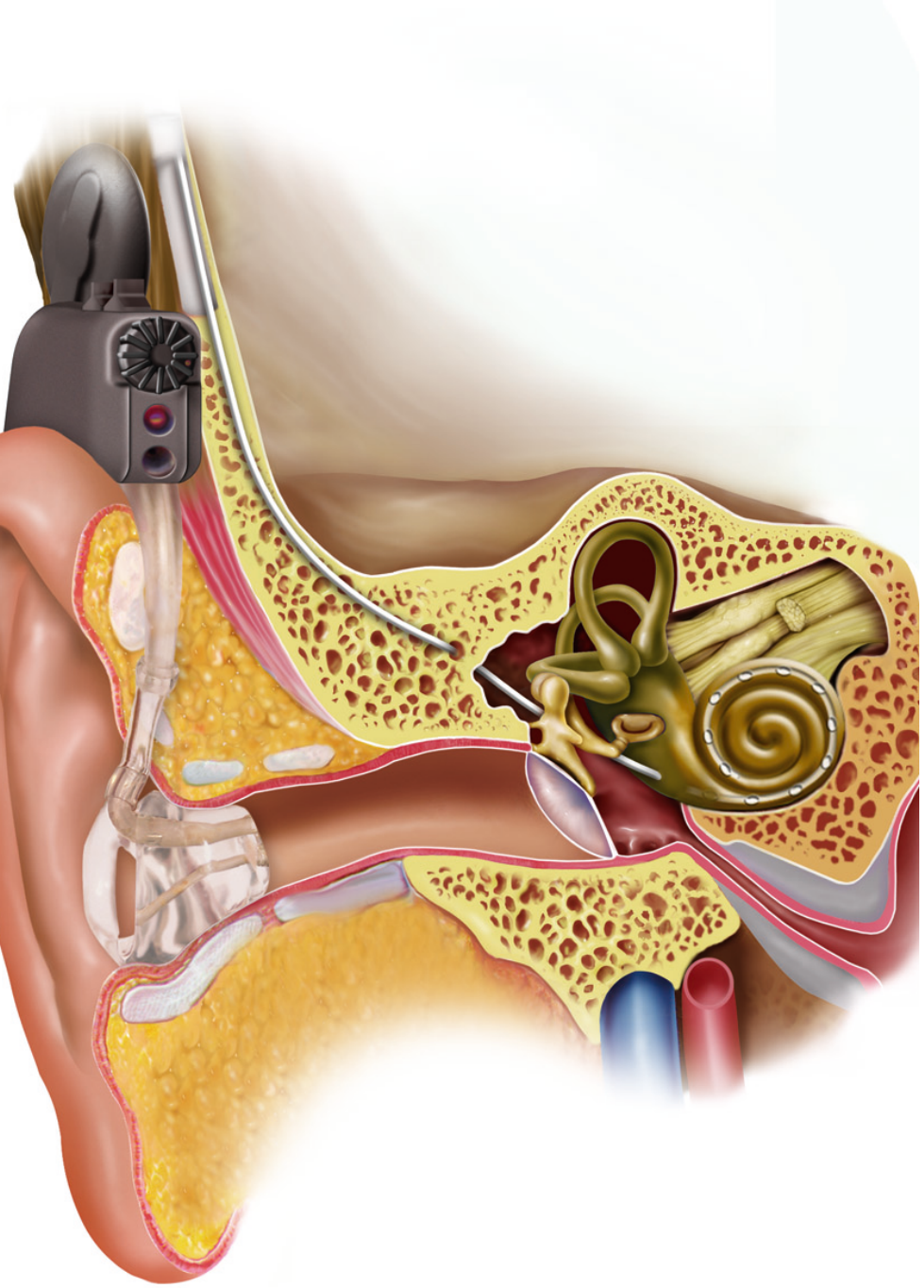
EAS Cochlear implant (electro-acoustic stimulation)







What's an EAS Cochlear Implant?

- EAS is the combination of two technologies: cochlear implant technology for high-frequency sounds, and hearing aid technology for low-frequency sounds
- The central auditory system is able to effectively combine the neural responses to electrical and acoustic stimulation
- Has one microphone for the input, but has two separate digital sound processors for differentiated processing

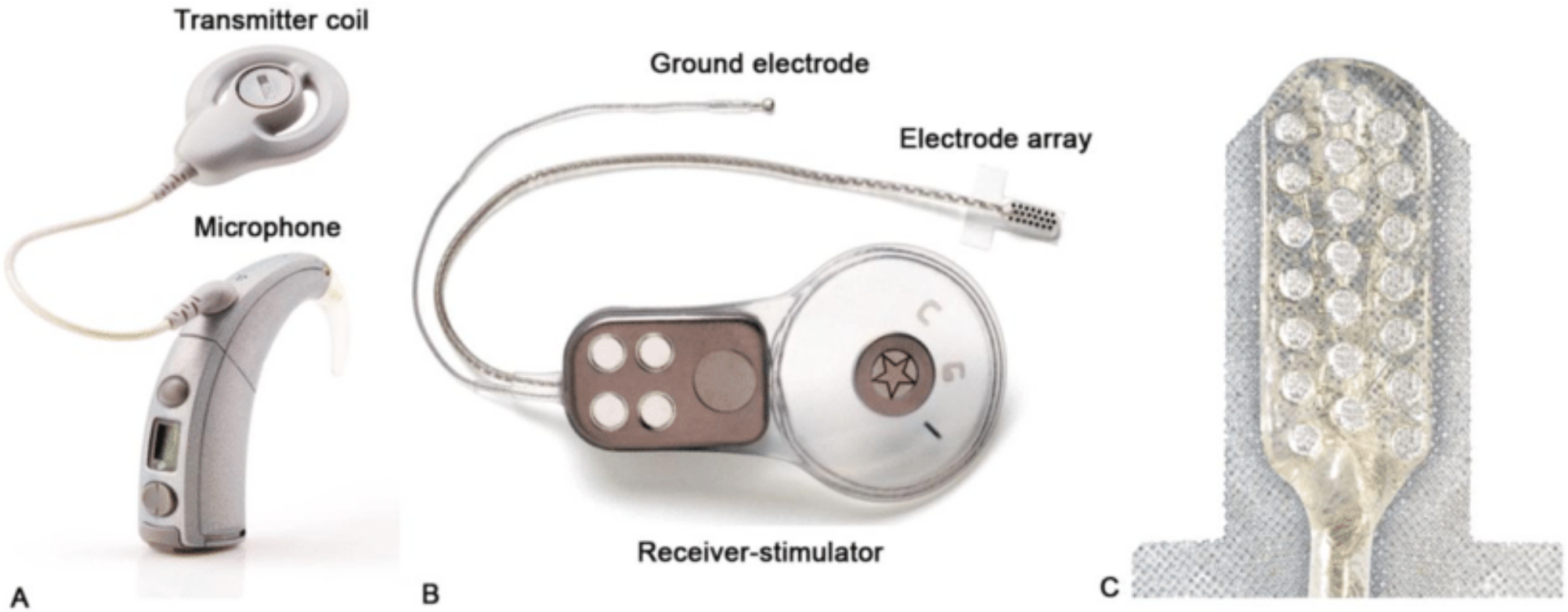
EAS Criteria

- SNHL of 65dB or worse at 1kHz
- Low freq hearing of 0-65dB at 125Hz, 250Hz, 500Hz and 750Hz
- Non progressive HL
- Score of ≤ 50/60% on monosyllable words in the best aided condition
- No external ear contra-indications to using amplification devices
- No malformations or obstruction of the cochlea
- Realistic expectations (risk vs benefit)

EAS Outcomes

- Hearing preservation is possible following cochlear implantation
- 80% have stable residual hearing over time
- 90% showed improved speech recognition using combined stimulation
- 80% indicated substantial subjective benefit

Auditory Brainstem Implants (ABI)



Auditory Brainstem Implants (ABI)

- The Auditory Brainstem Implant (ABI) system is designed to restore a **degree of hearing sensation** to patients who have **dysfunction or absence of the auditory nerve**
- This is achieved by direct electrical stimulation of the **cochlear nucleus** complex in the brainstem

ABI Indications

Traditional

- Neurofibromatosis Type II (NF2)

Non traditional (Congenital & Acquired)

- Paediatric congenital cochlear or cochlear-nerve aplasia
- Cochlear nerve avulsion (very rare)
- Complete Cochlear ossification

Neurofibromatosis Type II (NF2)

- Caused by single mutation on chromosome 22 (autosomal dominant)
- MISME: multiple inherited schwannomas meningiomas ependymomas
  - Bilateral acoustic neuromas
  - Multiple meningiomas
  - Spinal ependymomas
  - Posterior-subcapsular cataracts
- Incidence: 1:40,000
  - About 50% of people with NF2 do not have any family history of the condition
  - They have a de novo (new) mutation in the *NF2* gene.
- The most common morbidity associated with NF2: Hearing loss

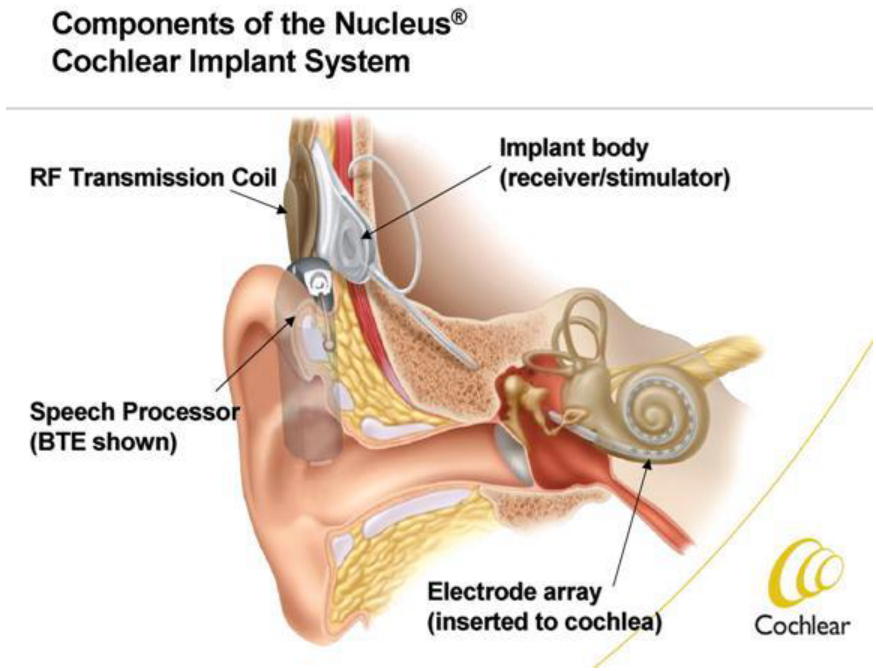
Cochlear/ Cochlear Nerve Aplasia

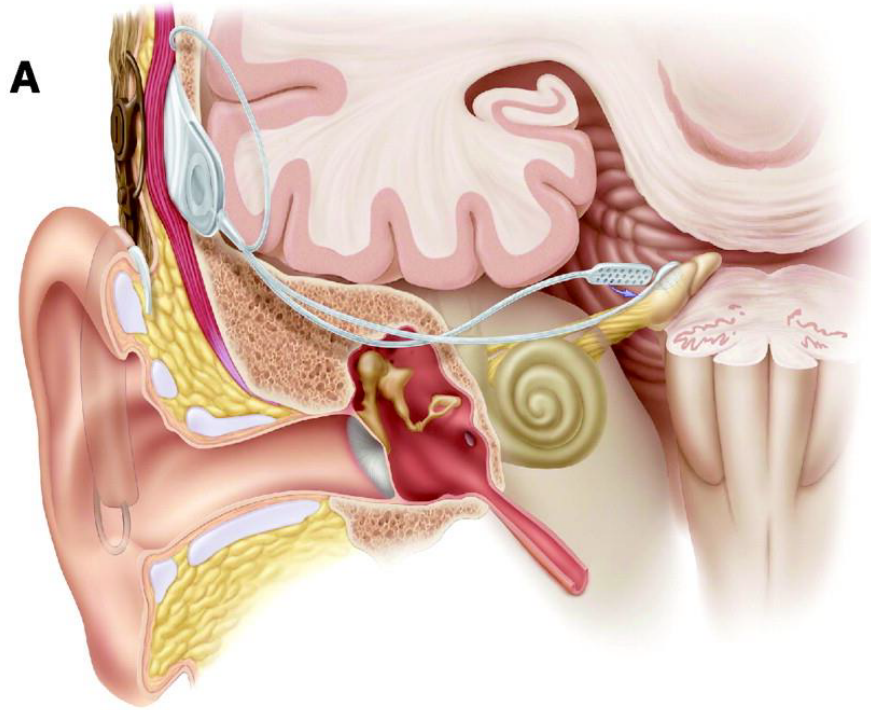
- Aplasia: Failure of an organ or tissue to develop or function normally
- Hypoplasia: Incomplete development of an organ or tissue
- (No development or incomplete development of the cochlear nerve)

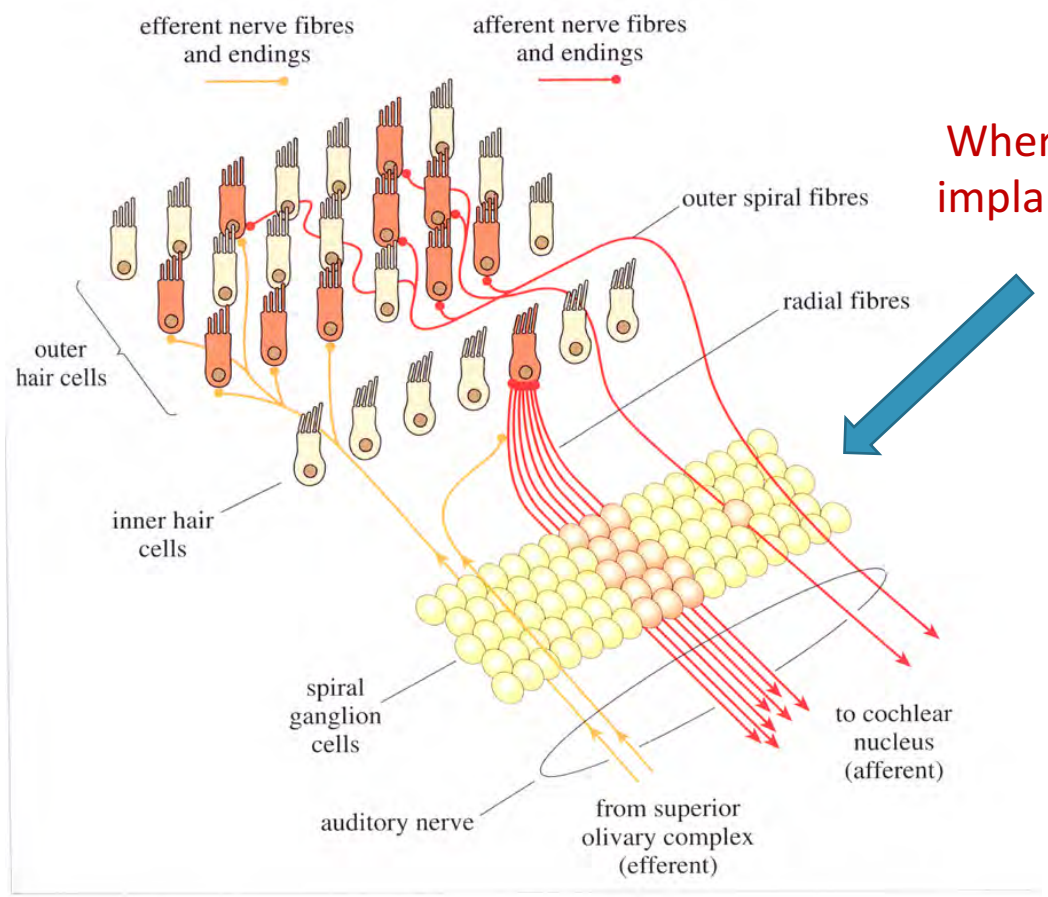
- Incidence less well defined
  - Bamiou et. al 2001 indicated 4.2% of cases referred for Cochlear Implantation present with radiologically defined aplasia or hypoplasia of the VIIIth nerve or unilateral aplasia and another contraindication to implant in the other ear

  - Wu et al 2015 indicated 4.3% of cases referred for Cochlear Implantation present with bilateral Cochlear Nerve deficiency either aplasia of hypoplasia

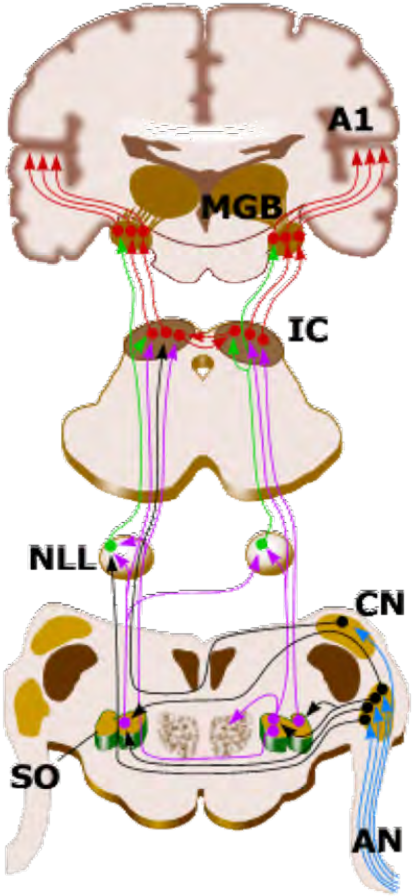
How Auditory Implants work







Where a cochlear implant stimulates



Where an auditory brainstem implant stimulates

CI Vs ABI

Cochlear Implant	Auditory Brainstem Implant
Electrode is sited within the cochlea (Otologic surgery)	Electrode is sited on the surface of the cochlear nucleus in the brianstem (neurosurgery)
Pitch is organized along the length of the cochlear enabling the electrode to match pitch to place	Pitch is organized both along the length and depth of the CN structure, the electrode is unable to match pitch to place
Requires an intact auditory nerve	An intact auditory nerve is required only above the CN

Main differences: ABI vs CI

Patient:	• Suffers a **debilitating** disease (if NF2) that is life-threatening • **Psychological** situation vastly different
Surgery	• **Surgery** is more complex and much longer • Precise **placement** of the array more difficult
Activation	• **Side effects** during activation are to be expected • Stimulation **levels** to reach audibility generally higher • Surface **tonotopicity** of CN is not predictable • More **active feedback** from recipient is required
Outcomes	• Generally **poorer** and much more difficult to predict

Performance expectations

- ABI recipients should experience:
  - Detection of medium to loud environmental sounds at comfortable listening levels
  - Detection of conversational speech at comfortable listening levels
- Most ABI recipients should also experience:
  - Improved perception of the rhythm and volume of speech resulting in some improvement in speech recognition and communication ability with lip-reading
  - Limited improvement in the recognition of environmental sounds
- A small number of ABI recipients will experience:
  - Improved speech recognition without lip-reading (whereas most CI recipients will have improved speech recognition without lip-reading)