Technischer Fortschritt und Weiterentwicklung der medizinischen Versorgung von Kindern mit Schwerhörigkeit: Konsequenzen für die Rehabilitation

T. Lenarz

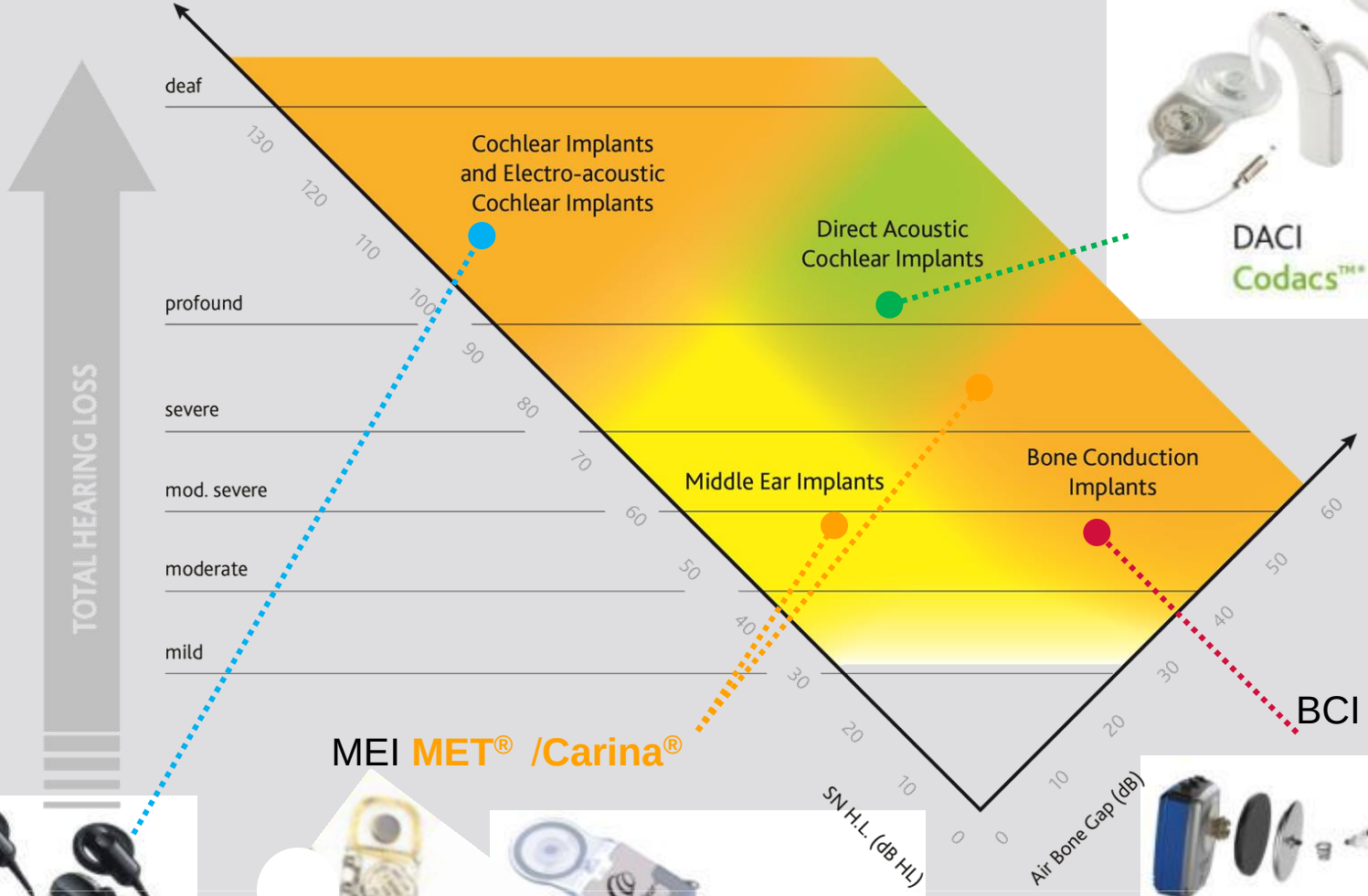
Symposium zur Weiterentwicklung von Hörfrühförderung im Rahmen früher Rehabilitation hörgeschädigter Kinder in Niedersachsen

30. März 2017

Hals-Nasen-Ohrenklinik der Medizinischen Hochschule Hannover

(Direktor: Prof. Prof. h. c. Dr. med. Th. Lenarz)

Auditory Implants



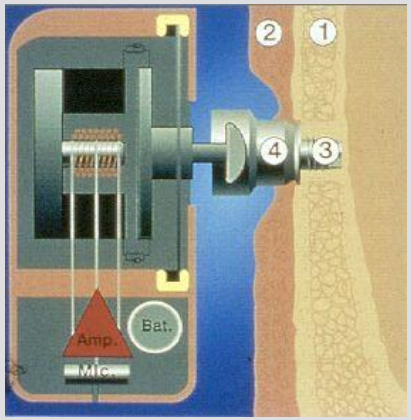
MEI **MET®** **/Carina®**

BCI **Baha®**

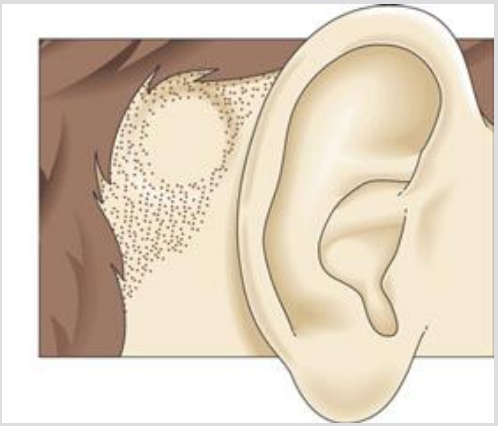
*Codacs is CE marked and for sale

Bone Conduction Devices BCDs

Bone Conduction



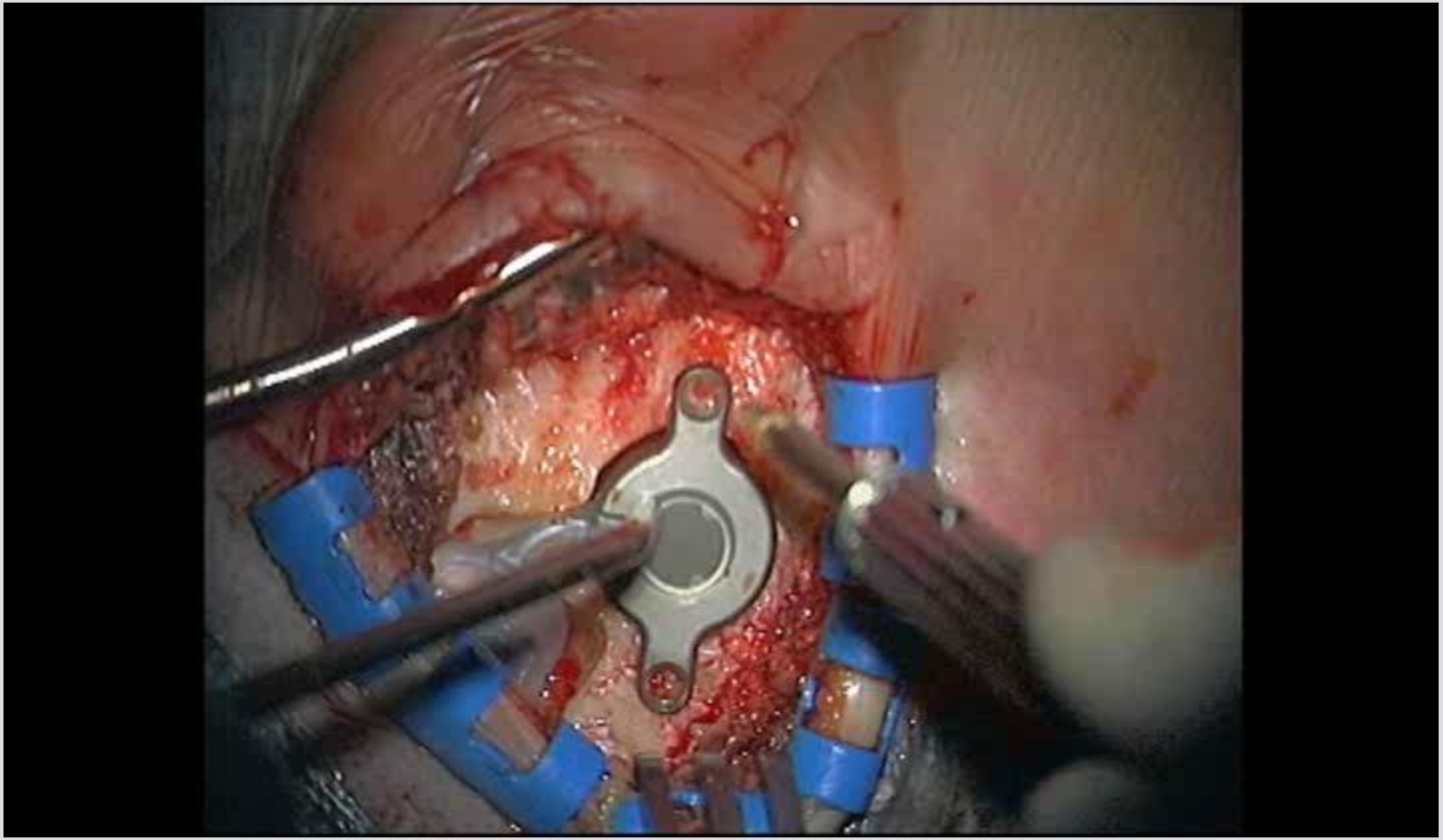
BAHA



BAHA Attract

Bonebridge

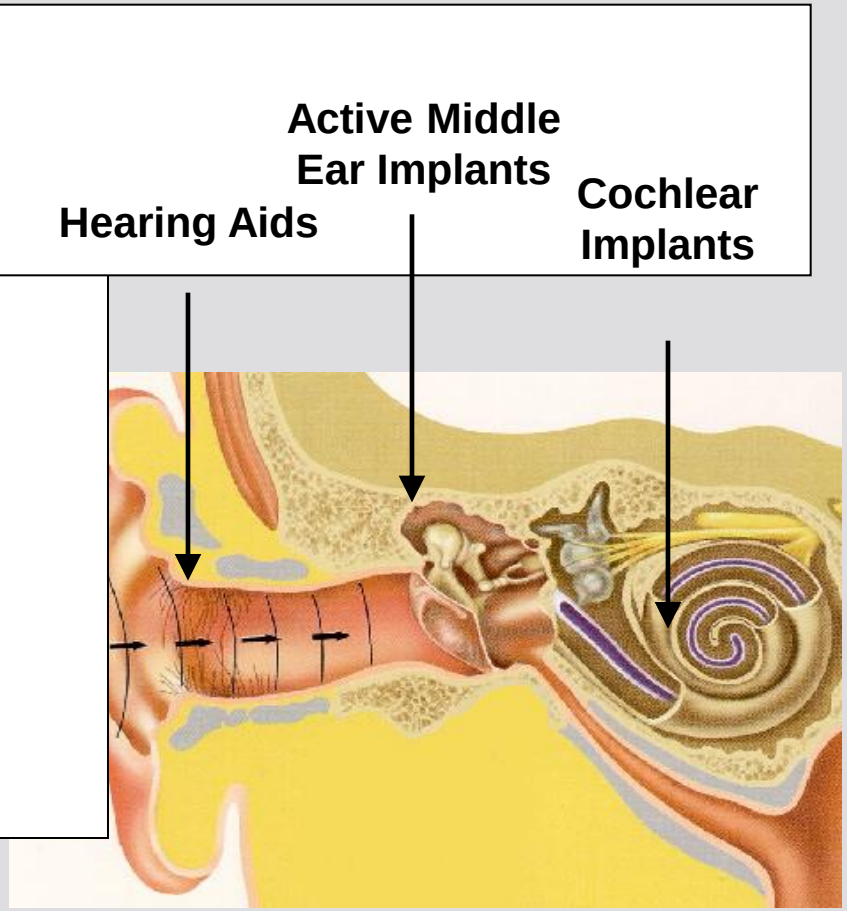
Bonebridge Implantation



Active Middle Ear Implants AMEI

Comparison Stimulation

- Acoustic: Hearing Aid
- Electric: Cochlear Implant
- Mechanical: Active Middle Ear Implant



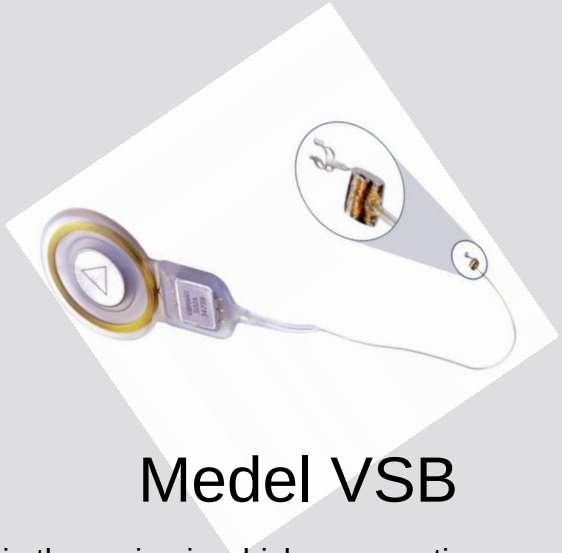
Acoustic Implants used at MHH

- Hannover Medical University
  - 500 CI / yr.
  - 50-90 AI / yr.
- Approx. 850 since 1996

Cochlear Codacs

Cochlear Carina

Cochlear MET

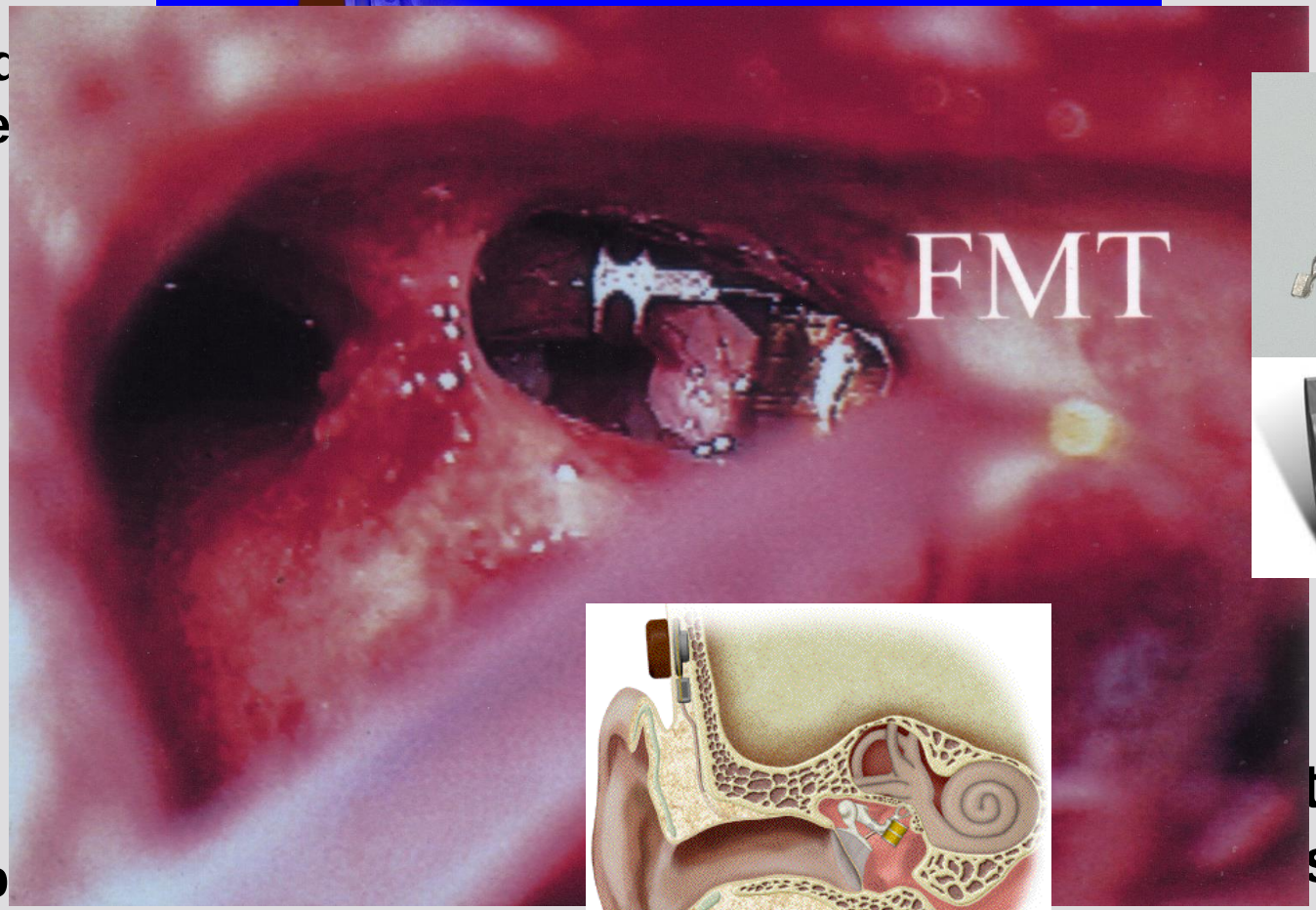


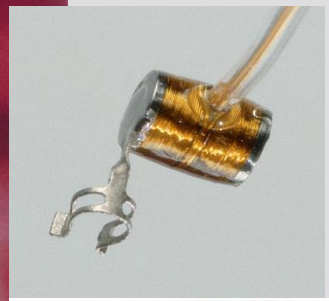
Medel VSB

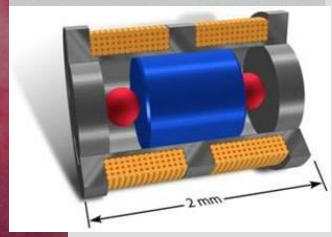
Codacs, MET and Carina are not approved in all markets and may be subject to restrictions in the region in which you practice.

Vibrant Soundbridge, Med-El

Aud
Proce



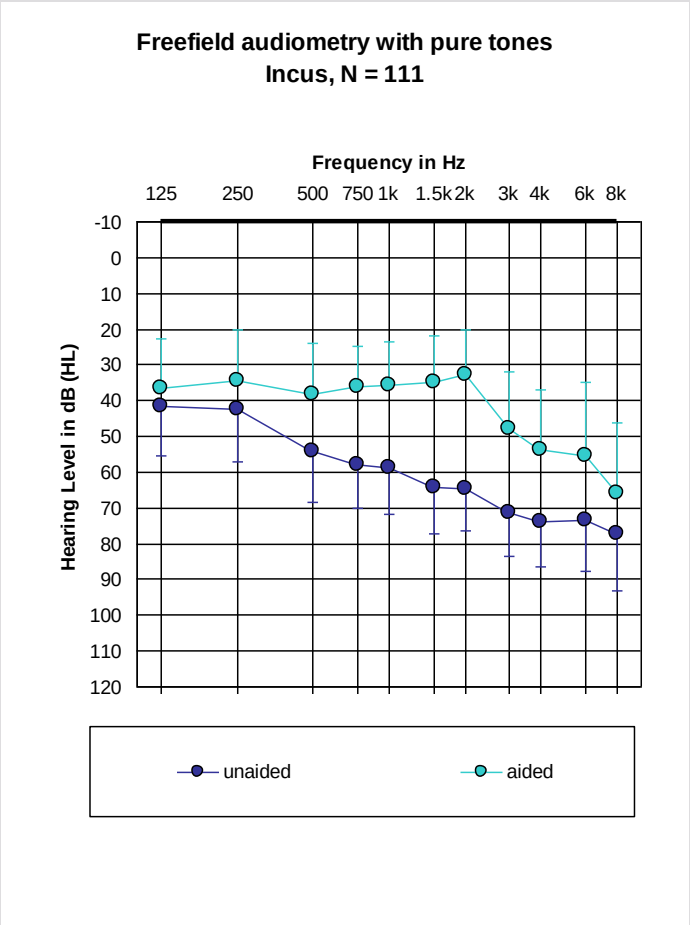


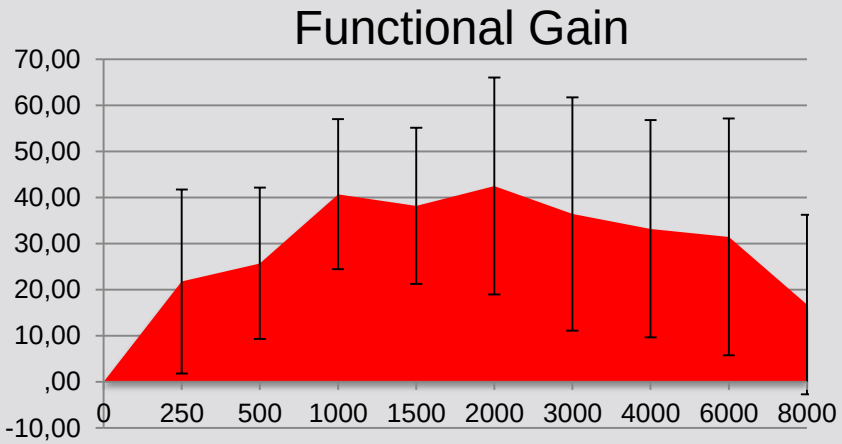


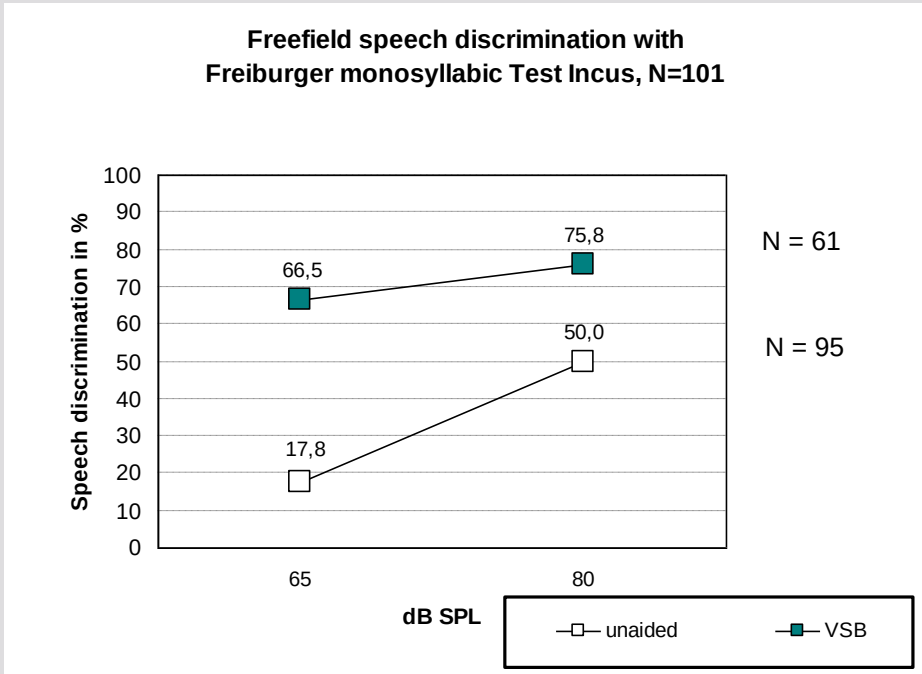
Imp
Demodulator

ting
ss
Transducer

FMT Incus – Coupling







VSB Coupling: “VIBROPLASTY”

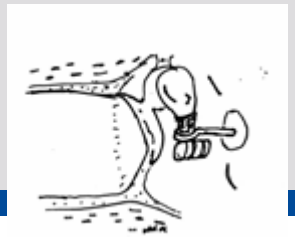
Vibrant classic

Vibrant round window

Vibrant TORP

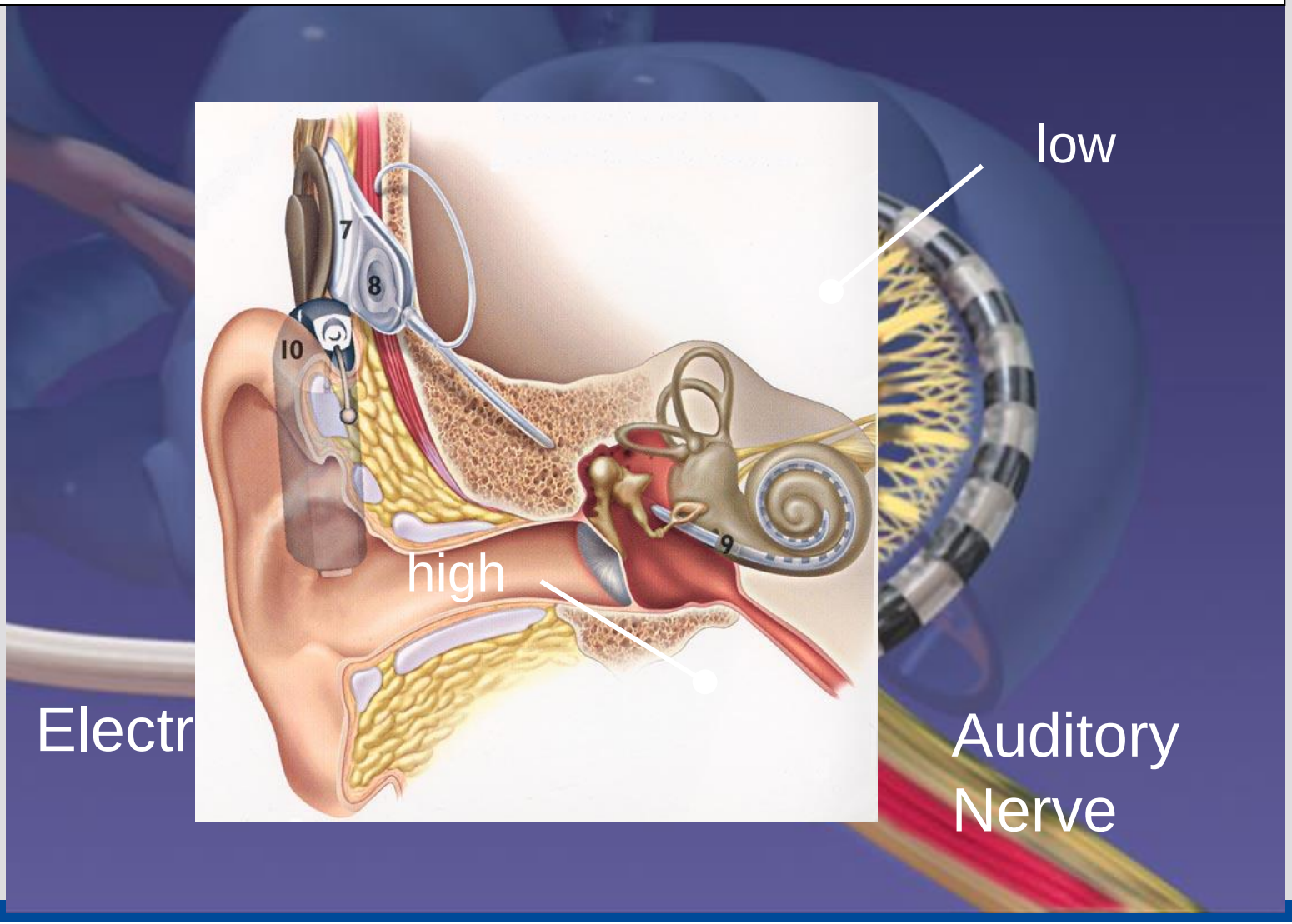
Vibrant PORP

Vibrant Piston



Vibrant ?

Cochlear Implant



Cochlear Implant:
Success Story of Neuroprotheses

- 450.000 recipients worldwide
- Germany. 1 Mio candidates

Awareness of sound	Speech Recognition In a few	Speech Recognition For most	Speech Recognition For all
Zeit			
1978	1990	2015	Future

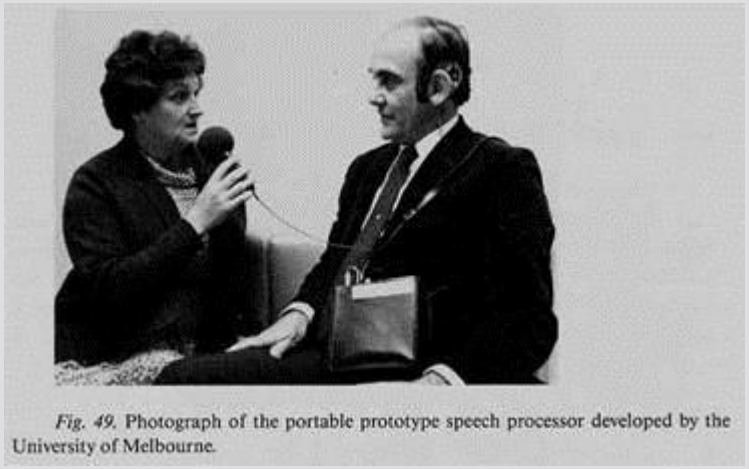
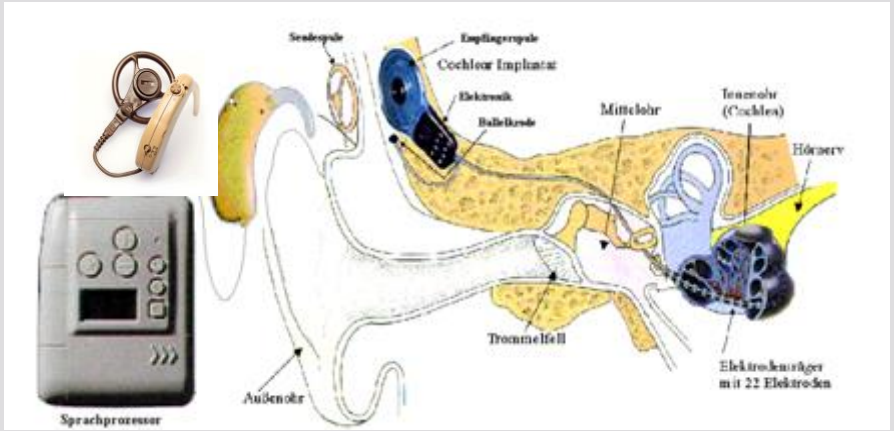
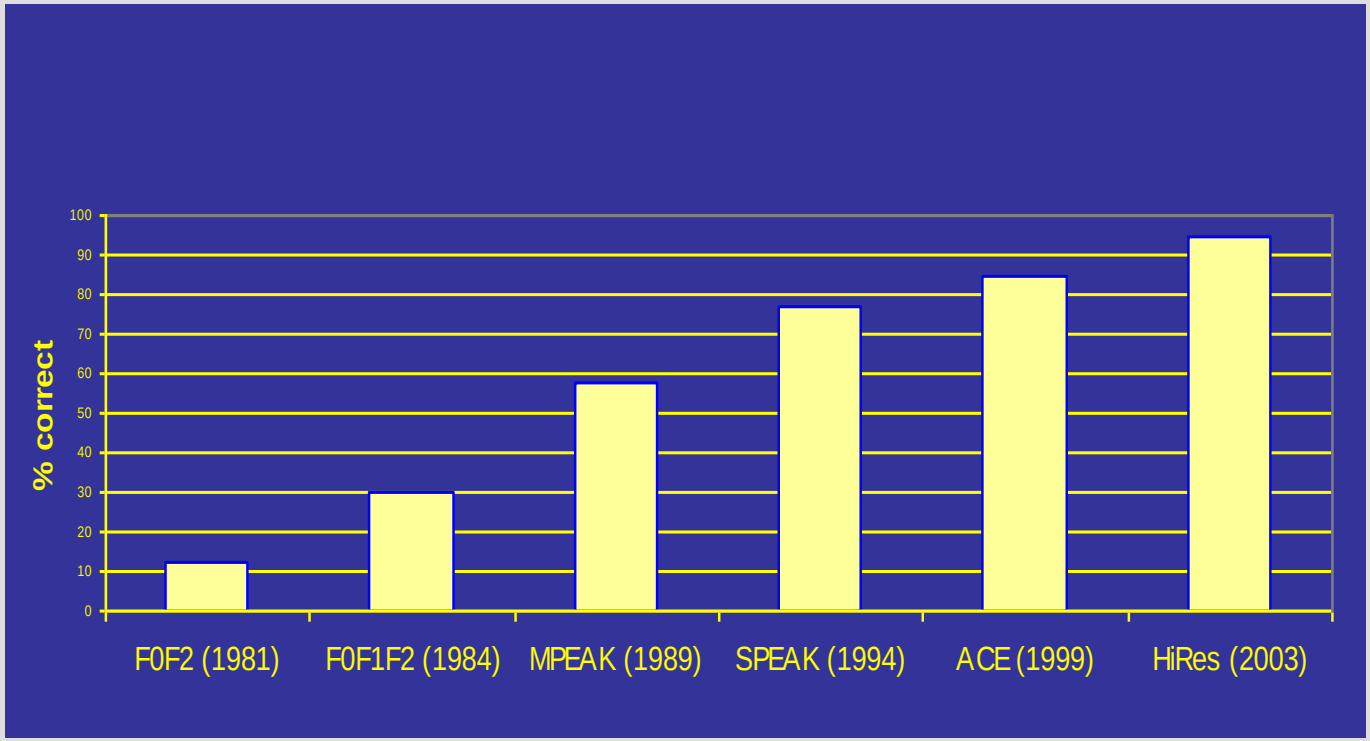


Fig. 49. Photograph of the portable prototype speech processor developed by the University of Melbourne.



Performance increase by simply turning up the stimumlation rate



total stimulation rate increased by:

7 x

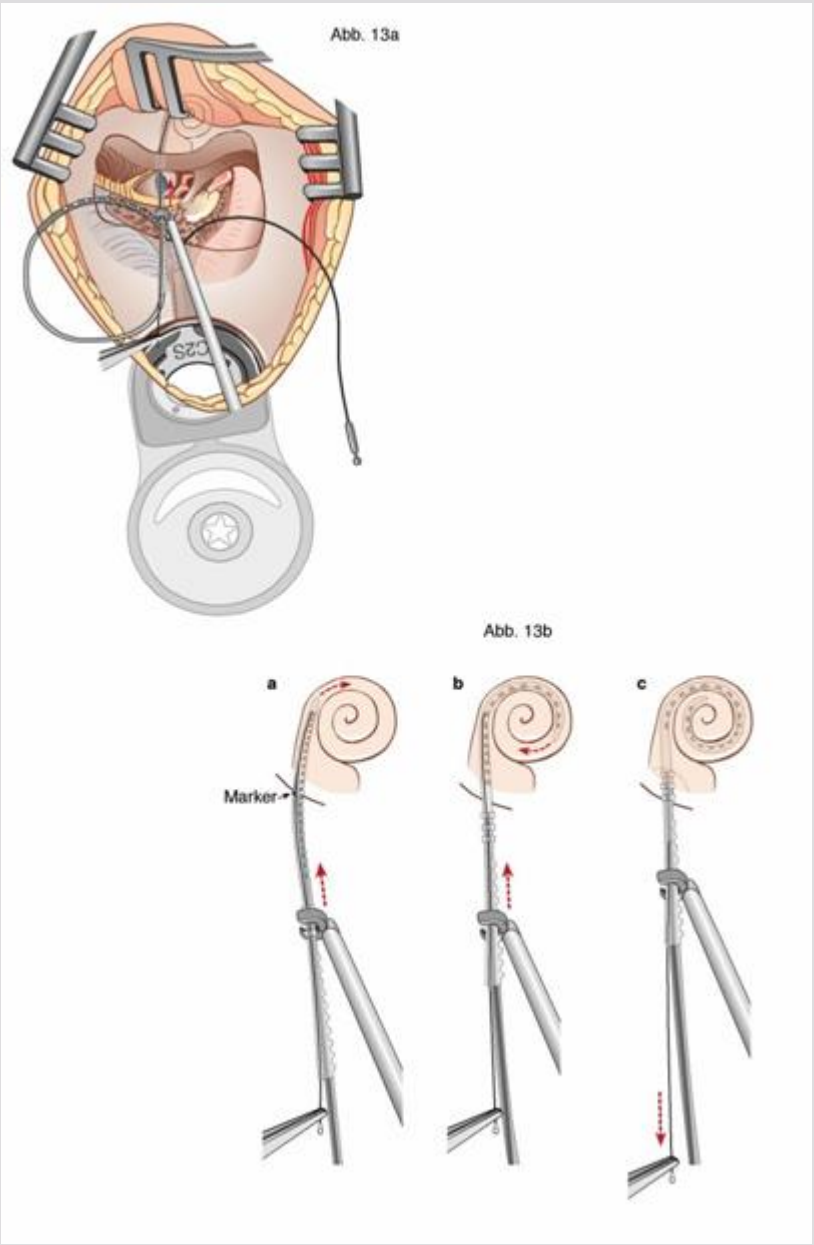
20 x

100 x

Indications for CI

- Bilateral profound to severe deafness
  - adults
  - Children
- High Frequency deafness
- Single sided deafness
- Borderline Cases

Electrode Insertion



Bilateral Implantation

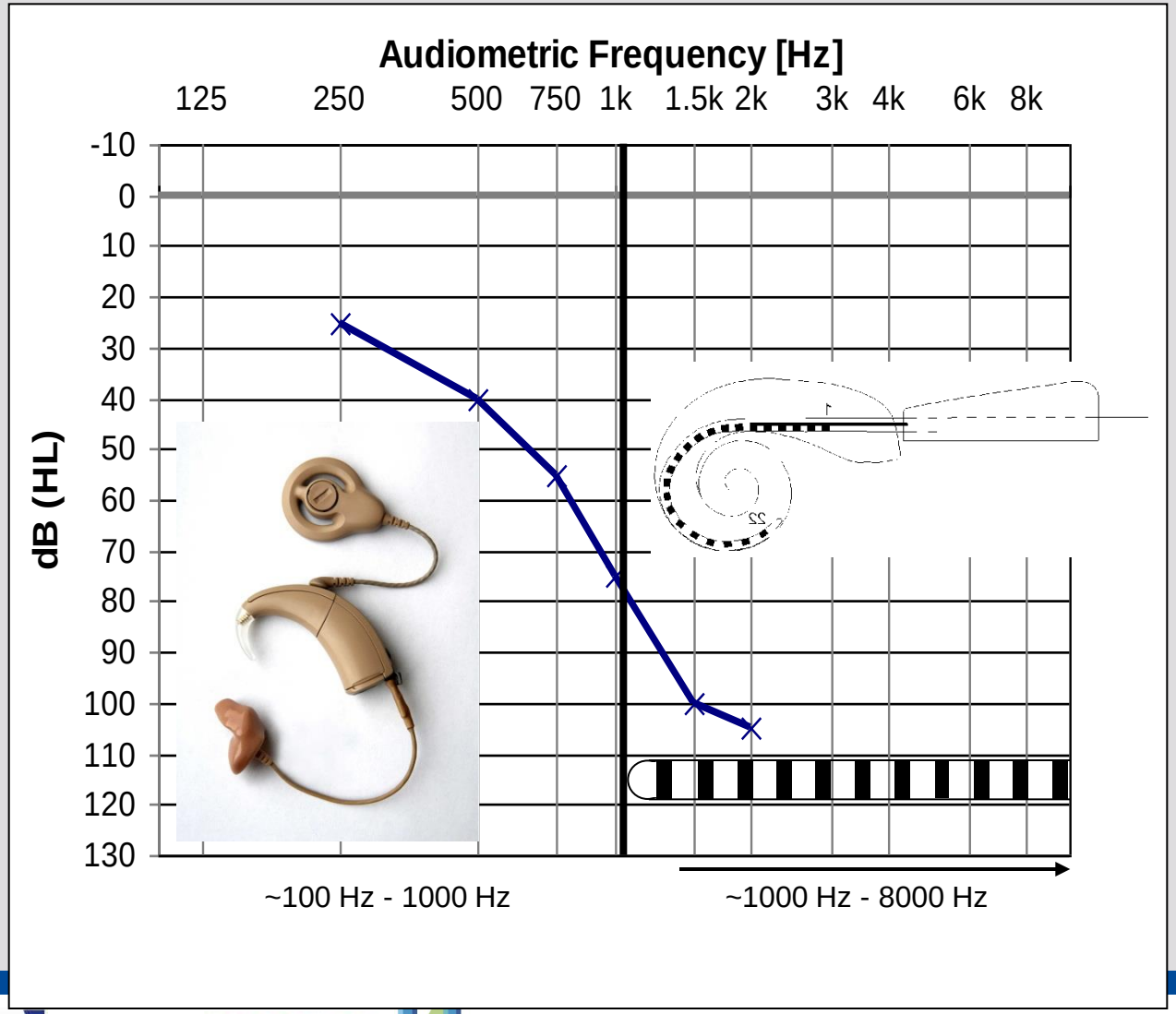
Sound Localization
Improved Hearing in Noise

Cochlear Implantation
Results / n = 8430

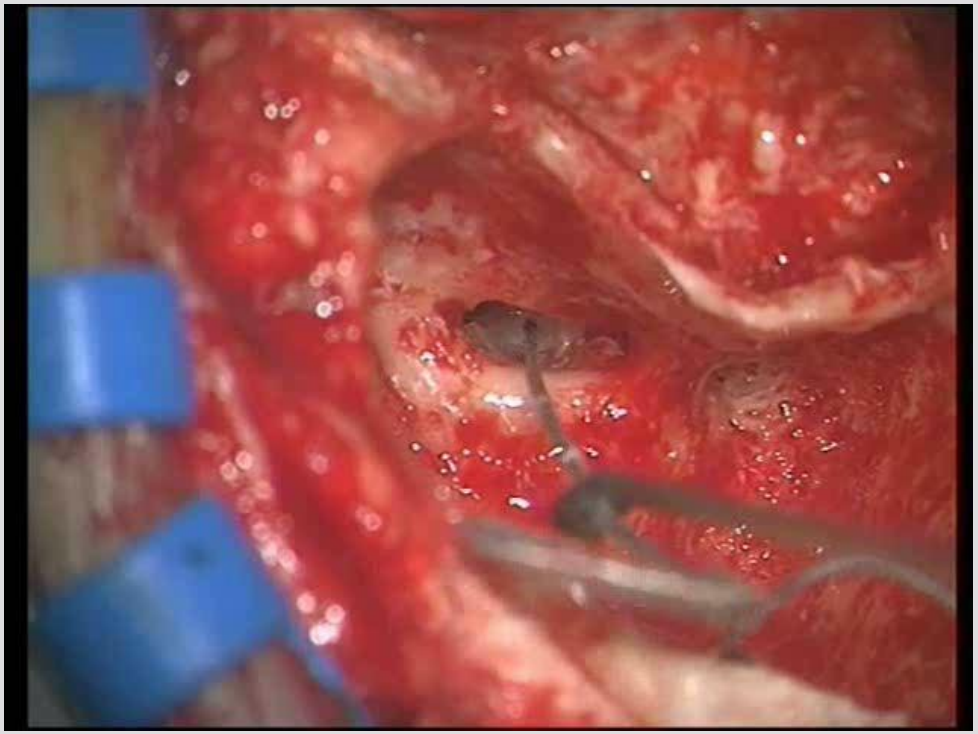
- 70 % of the adult population open set speech understanding
- When implanted early children achieve normal auditory and speech development
- Results are mainly influenced by duration and age of deafness and time of implantation
- Bilateral implantation gives additional benefit for sound localization in speech in noise recognition

HEARING PRESERVATION COCHLEAR IMPLANTATION

Hybrid System for Electro-Acoustic Hearing



Hybrid-L and CI422
Round Window Insertion

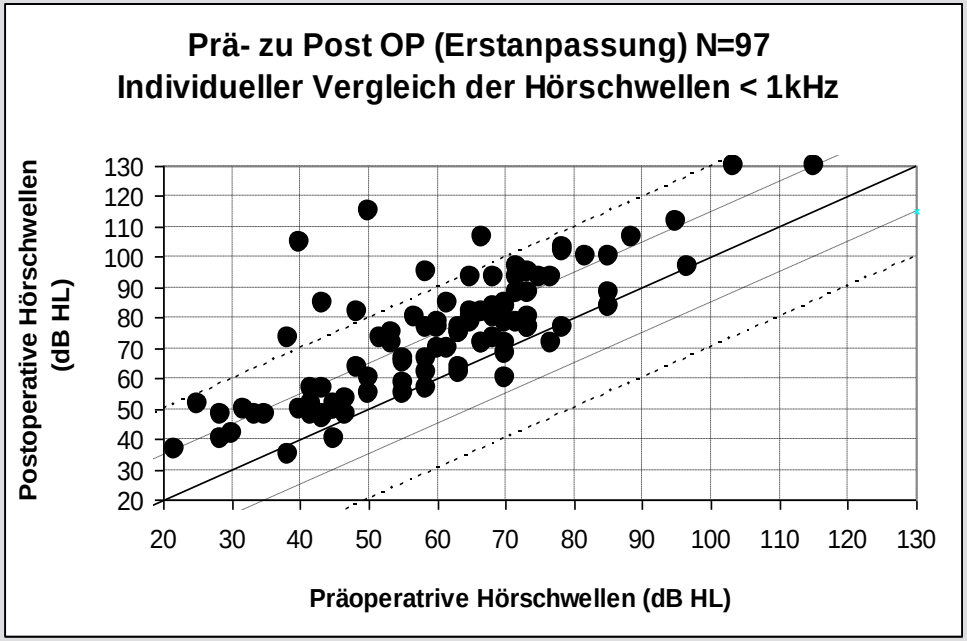


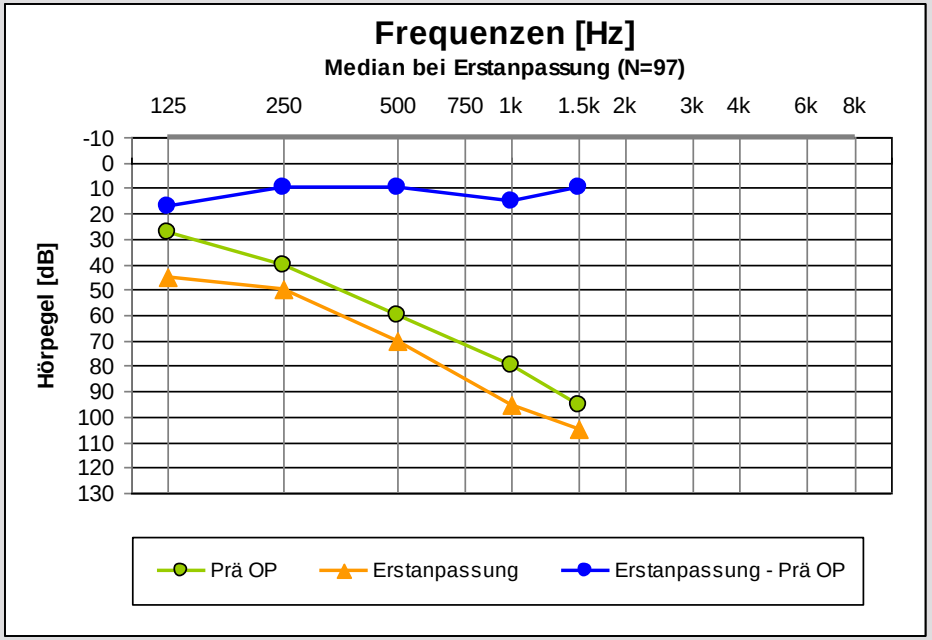
Hybrid-L

CI422

Hybrid-L
Pre- OP vs Initial Fitting

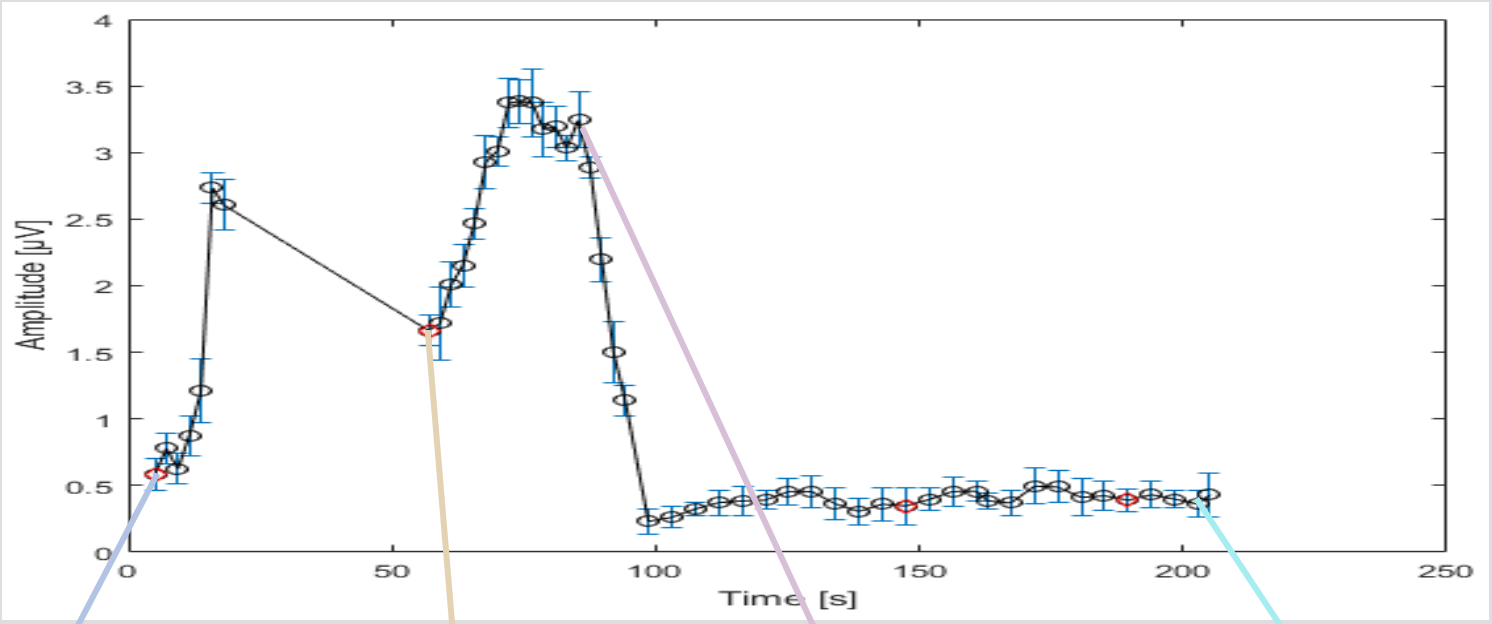
Hybrid-L

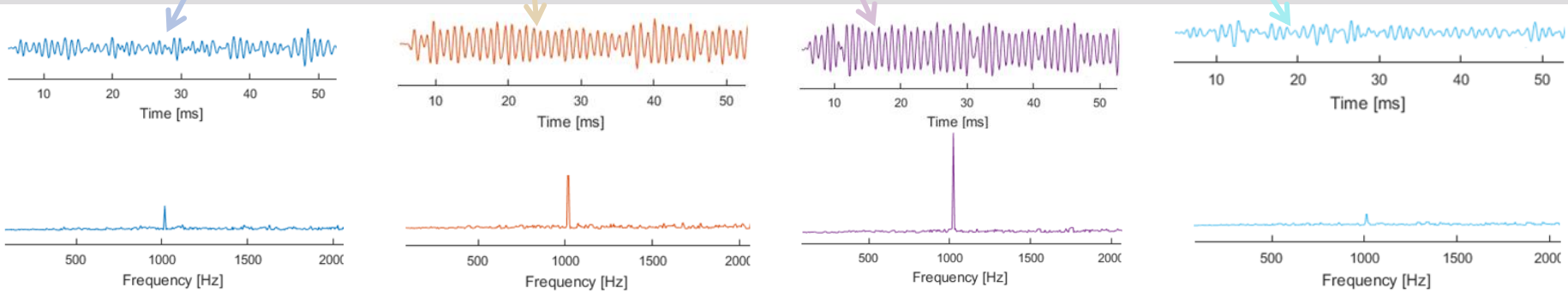




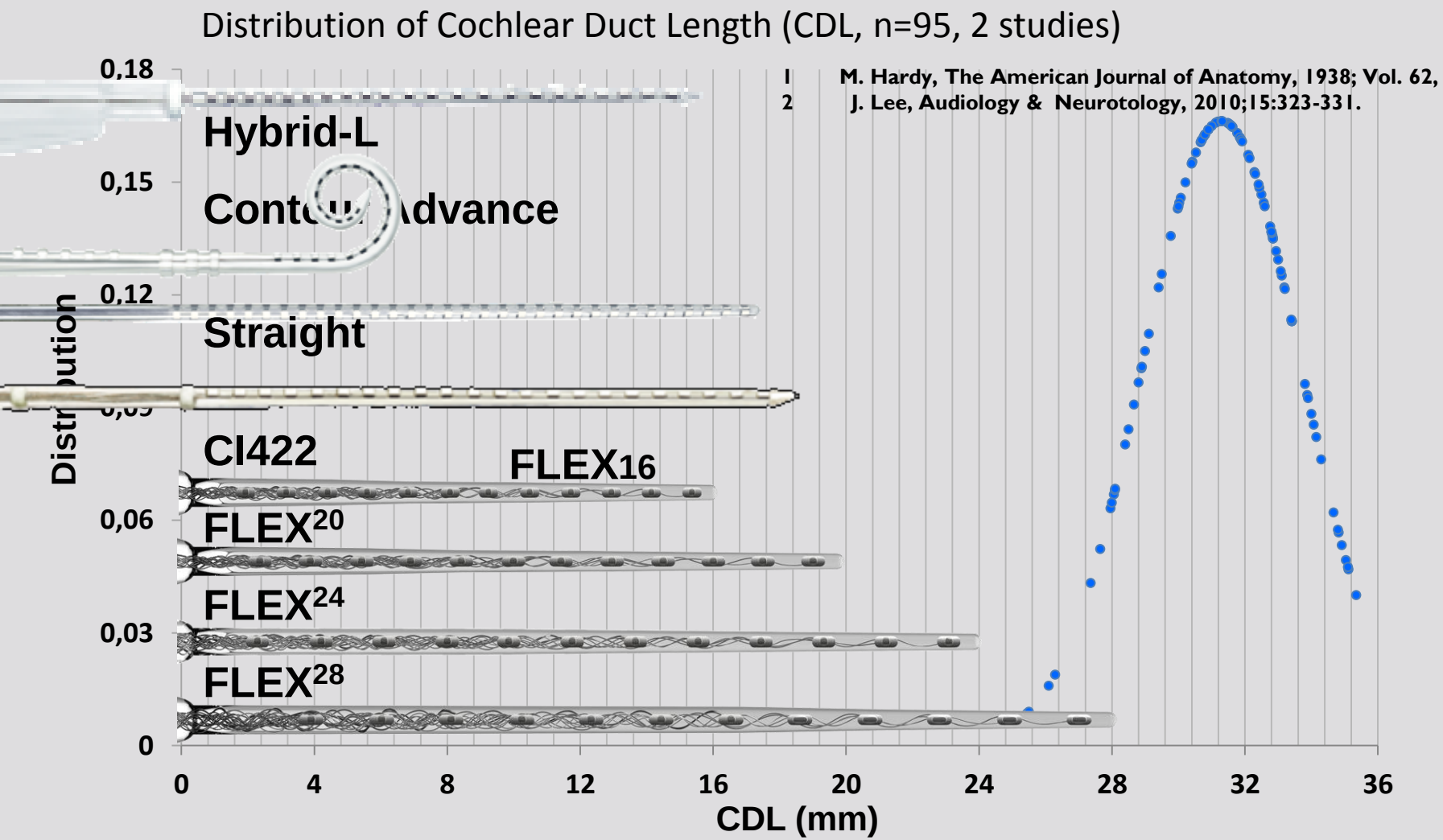
N	97	%
N <15 dB	53	54,6%
N <30 dB	90	92,8%
N >30 dB	7	7,2%

Intraoperative Cochlear Monitoring

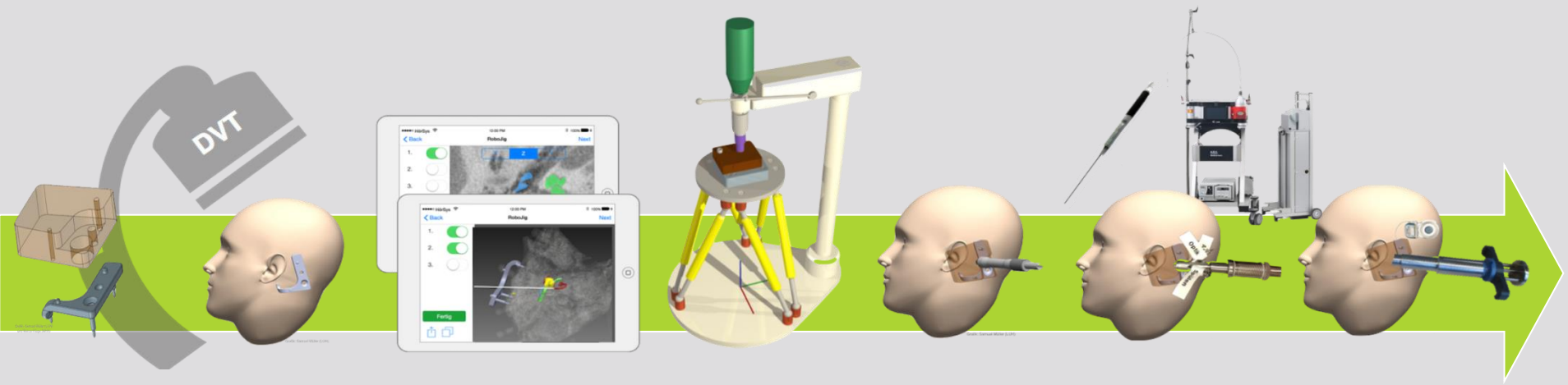




Current electrodes and CDL

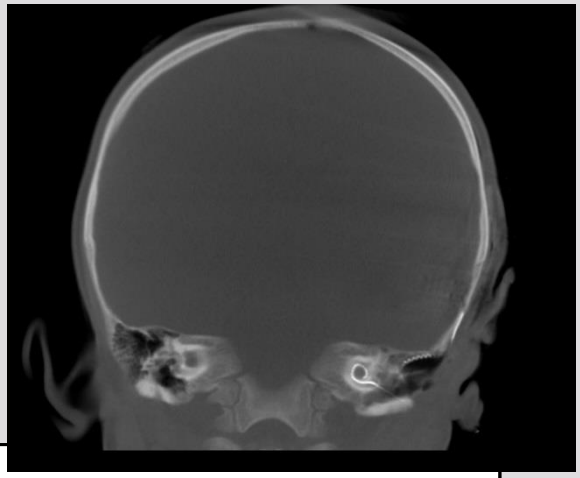


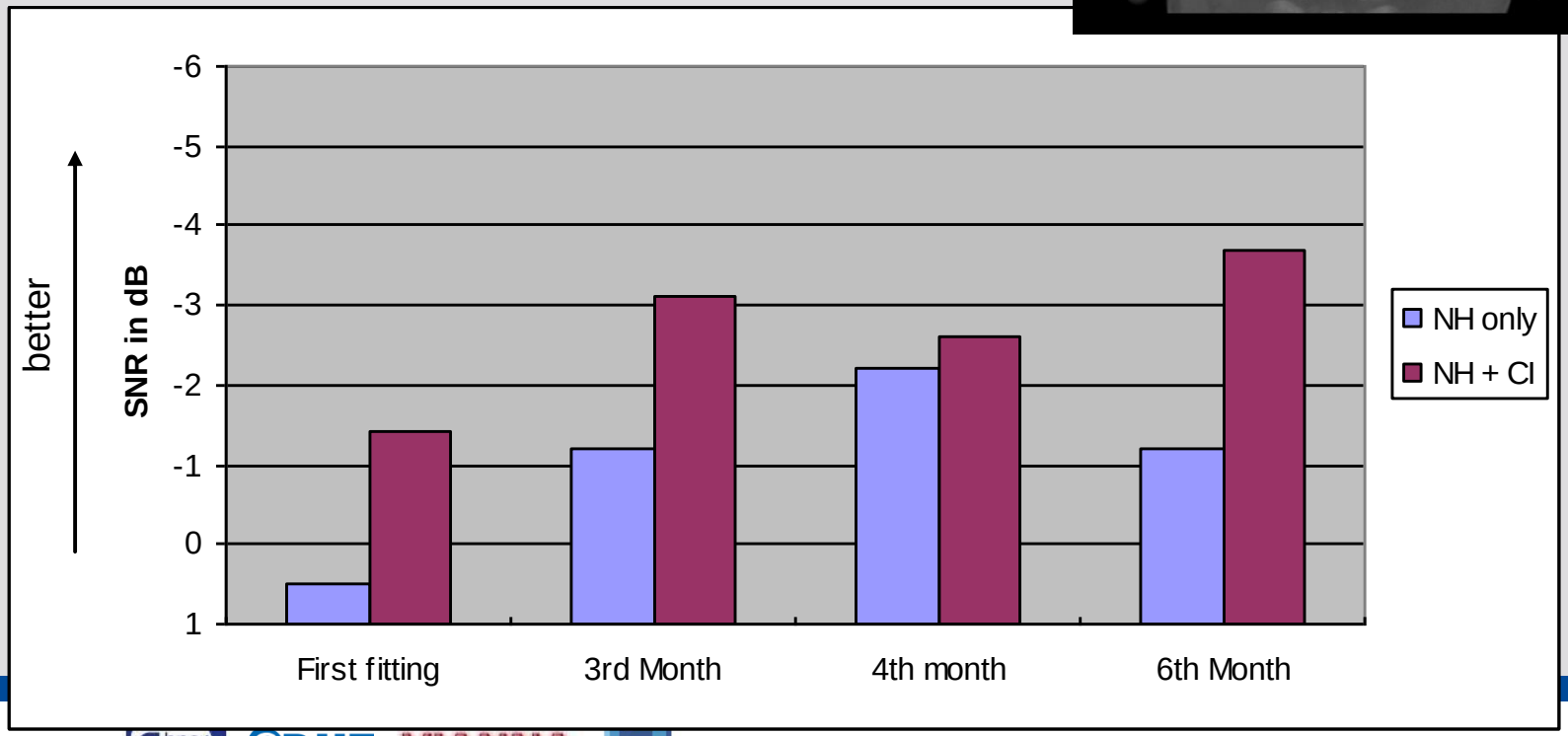
Minimally Invasive CI Surgery



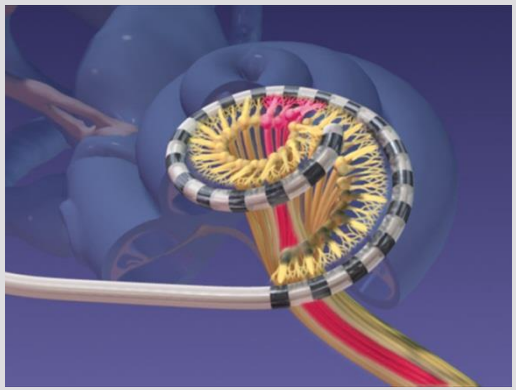
- Reusable bone anchored mini stereotaxic platform
- Intraoperative DVT scan
  - either registration with pre operative scan and it's segmentations
  - or semi- to full-automatic segmentation intra operative *(work-in-progress)*
- Hexapod based, sterile, patient specific preparation of the drilling jig (template)
- Minimally-invasive tools for extended round window approach → **hearing preservation!**

CI in Single Sided Deafness





Problem:
The electrode-nerve bottleneck



electrode-nerve interface

700 kBit

Audio-signal

??

Auditory System

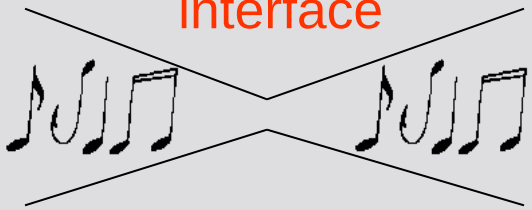
Cochlear Implant System : 10 - 60 kbit/s

Approach: Taking Load off the Electrode Nerve Interface

Audio-Signal

relevant
Signal compontents

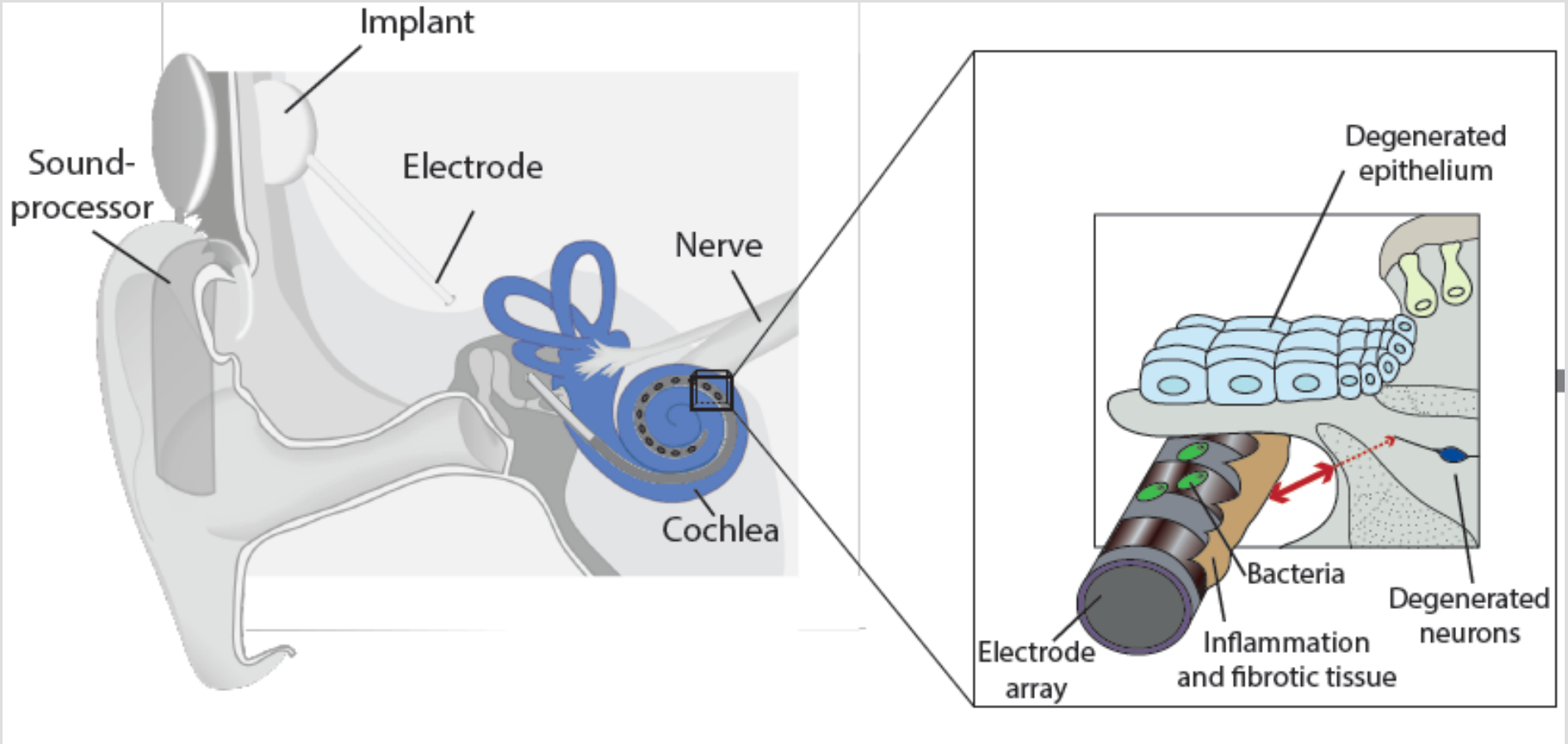
Electrode-nerve
interface



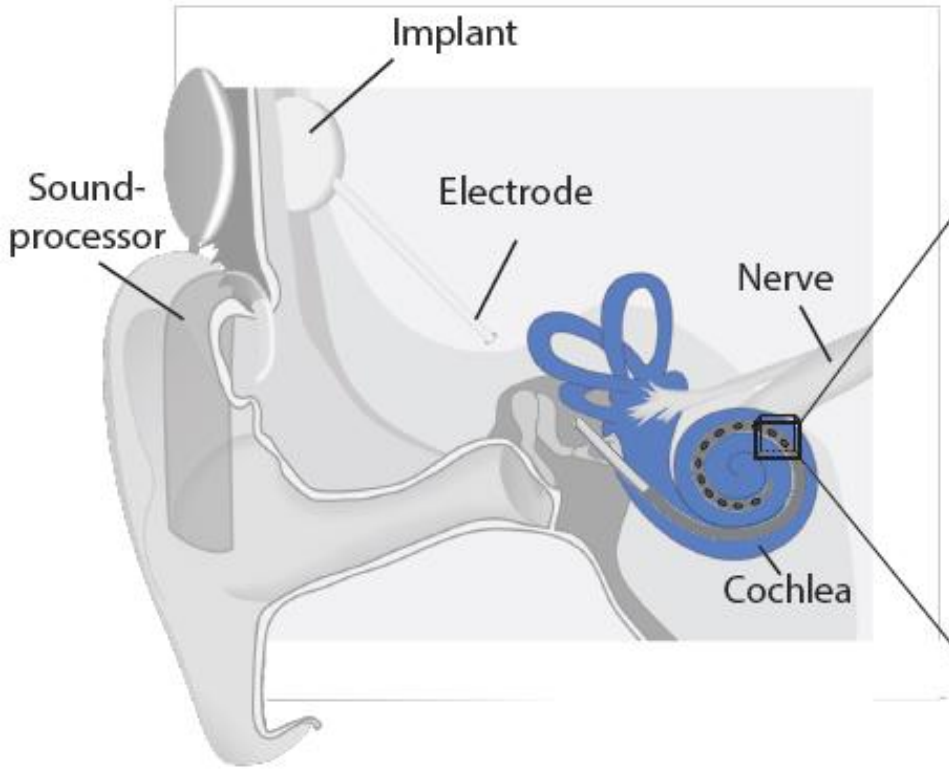
Auditory
System

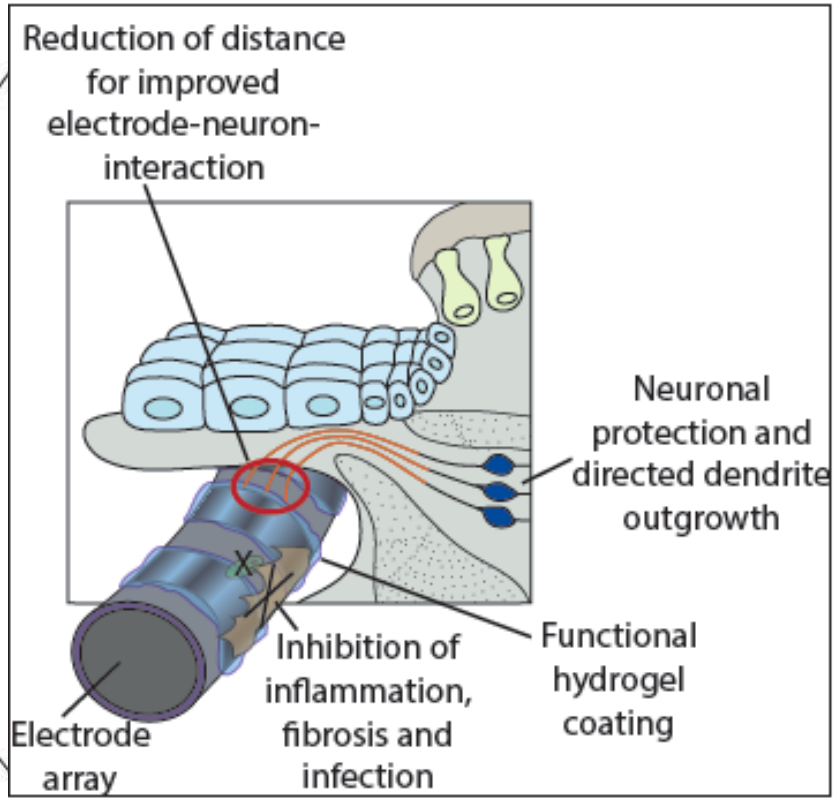
insignificant

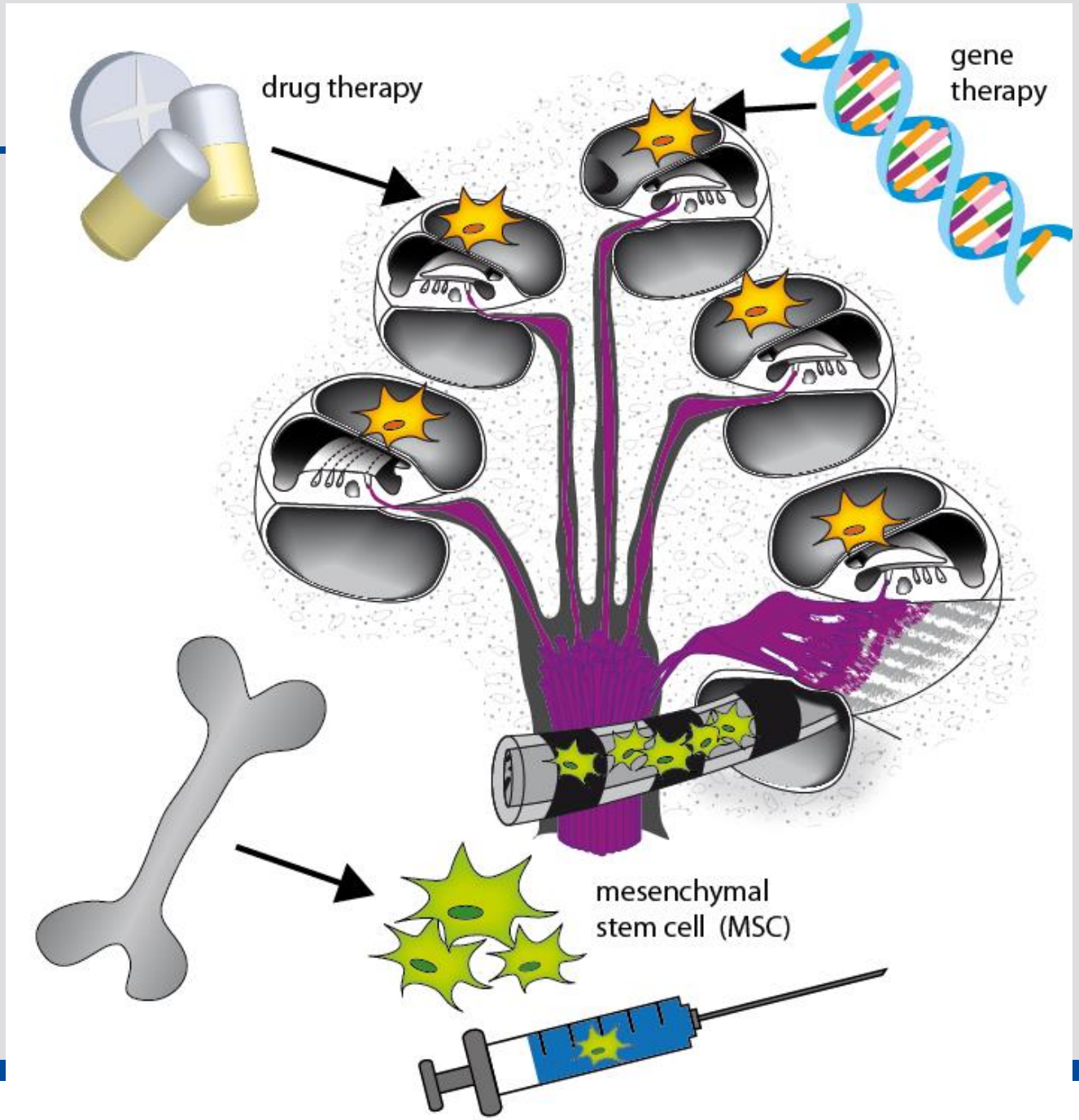
Current Limitations



Future Strategies






drug therapy
gene therapy
mesenchymal
stem cell (MSC)

Konsequenzen für die Rehabilitation

- Breite Palette an technischen Möglichkeiten
- Individualisierte Therapie
- Anspruchsvolle Diagnostik
- Prädiktive Modelle
  - Entwicklung der Schwerhörigkeit
  - Zu erwartender Hörgewinn
  - Zukunftssicherheit
- Erweiterte Indikationen
- Progrediente Schwerhörigkeit und Restgehör

Hearing Research in Hannover

Steps toward excellence:

1984	1st CI
1992	Children´s implant Center
2003	German Hearing Center
2003	Collaborative Research Grant Medical implants
2013	Center of Excellence Hearing4All
2016	VIANNA in NIFE
2016	Fraunhofer Center of Biomedical Excellence

Clinic – with 25,000 outpatients and 6,000 inpatients each year

German Hearing Center – patients go with hearing loss

LEO – laboratories of experimental otology basic research

VIANNA – transfer basic science into new products together with leading companies

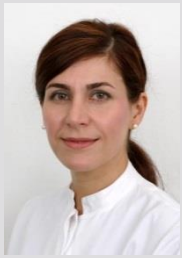
Fraunhofer ITEM – production, testing and certification

Hearing Research PIs Hannover

Prof.
Andreas
Büchner

Prof.
Theo
Doll

Prof.
Andrej
Kral



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Verena
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PD Dr.
Athanasia
Warnecke

And our
former
colleague

Prof.
Rolf
Battmer

Danke für Ihre Aufmerksamkeit