History of Hearing Aids

DAVID BOLLINGER

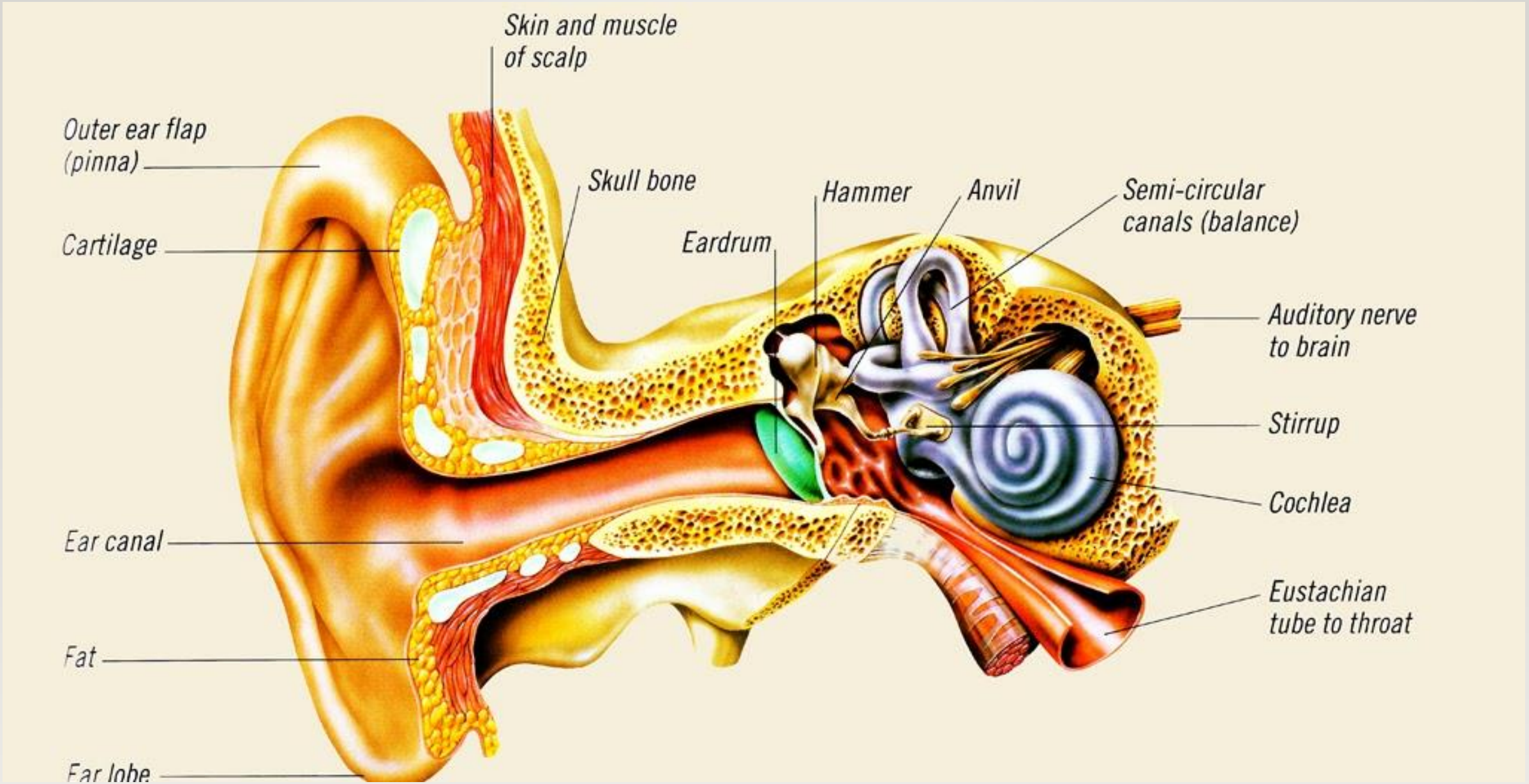
CLEARSOUND HEARING, LLC

JEFFERSON CITY, MISSOURI

Presenter

- David Bollinger was born and raised in St. Joseph, Missouri and graduated from William Jewell College in Liberty. After getting married in 1978 he and Mary lived in Kentucky, Iowa, Oregon, and California before returning to Missouri. They have two grown boys. David and Mary work for ClearSound Hearing from locations in Jefferson City, Fulton, Columbia and Boonville. They have been in the hearing healthcare field for over 20 years.


The UPS Store
at BELMONT UNIVERSITY
The UPS Store


Skin and muscle of scalp
Outer ear flap (pinna)
Skull bone
Hammer
Anvil
Semi-circular canals (balance)
Cartilage
Eardrum
Auditory nerve to brain
Stirrup
Cochlea
Ear canal
Eustachian tube to throat
Fat
Ear lobe

Today
Gives access to multiple speakers in all directions. Connects to the Internet

Multiple Speaker Access Technology

2014
Supports the way the brain works and makes sense of sound

BrainHearing™ technology

2007
Enables two hearing aids to interact to provide a richer sound picture

Wireless communication

1996
Advanced amplification of sound programmed to fit the individual hearing loss

Digital

1968
One of the first ear worn devices with simple amplification

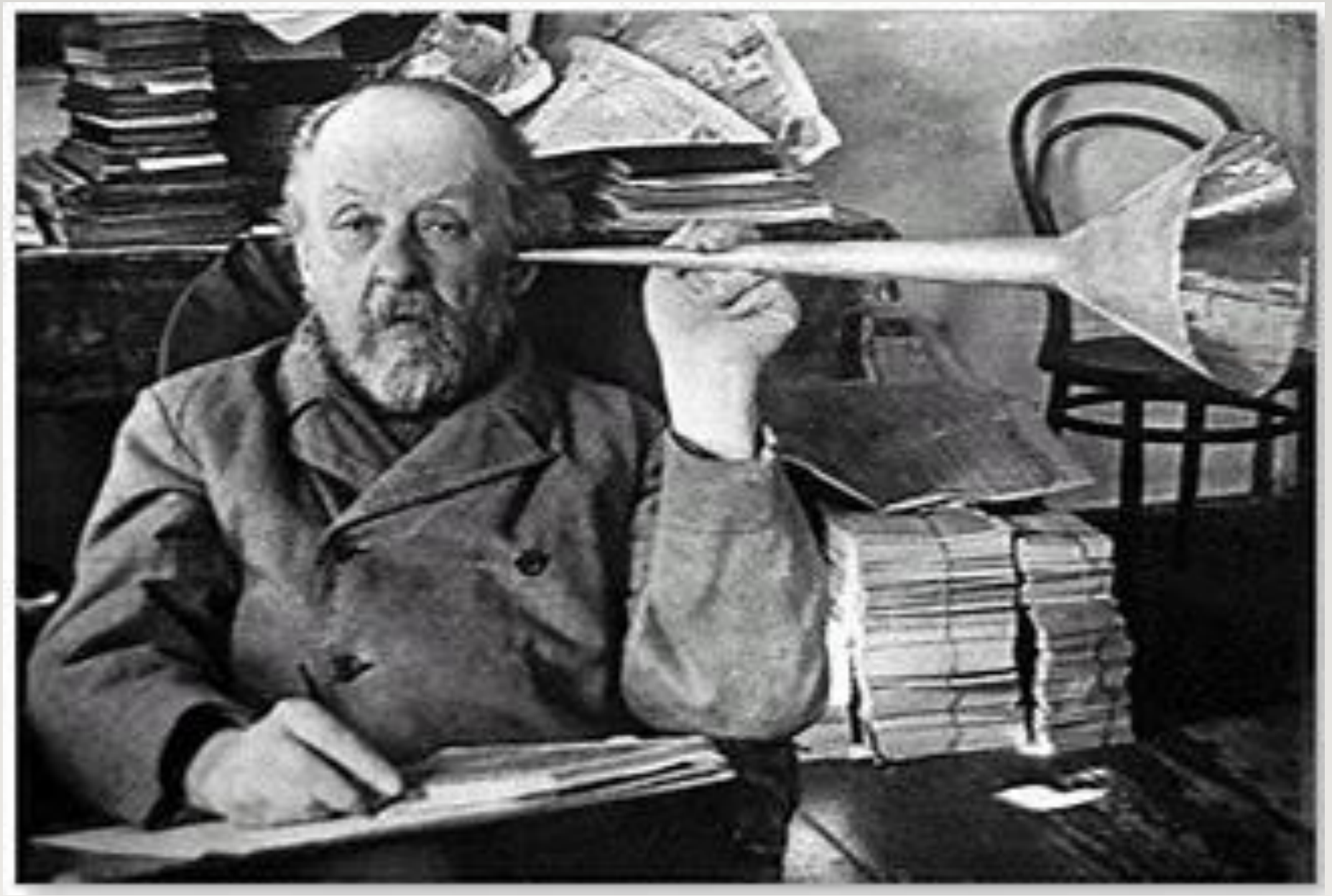
Analogue Ear worn

1950's
Pocket device with simple amplification that makes all sounds louder

Analogue Body worn

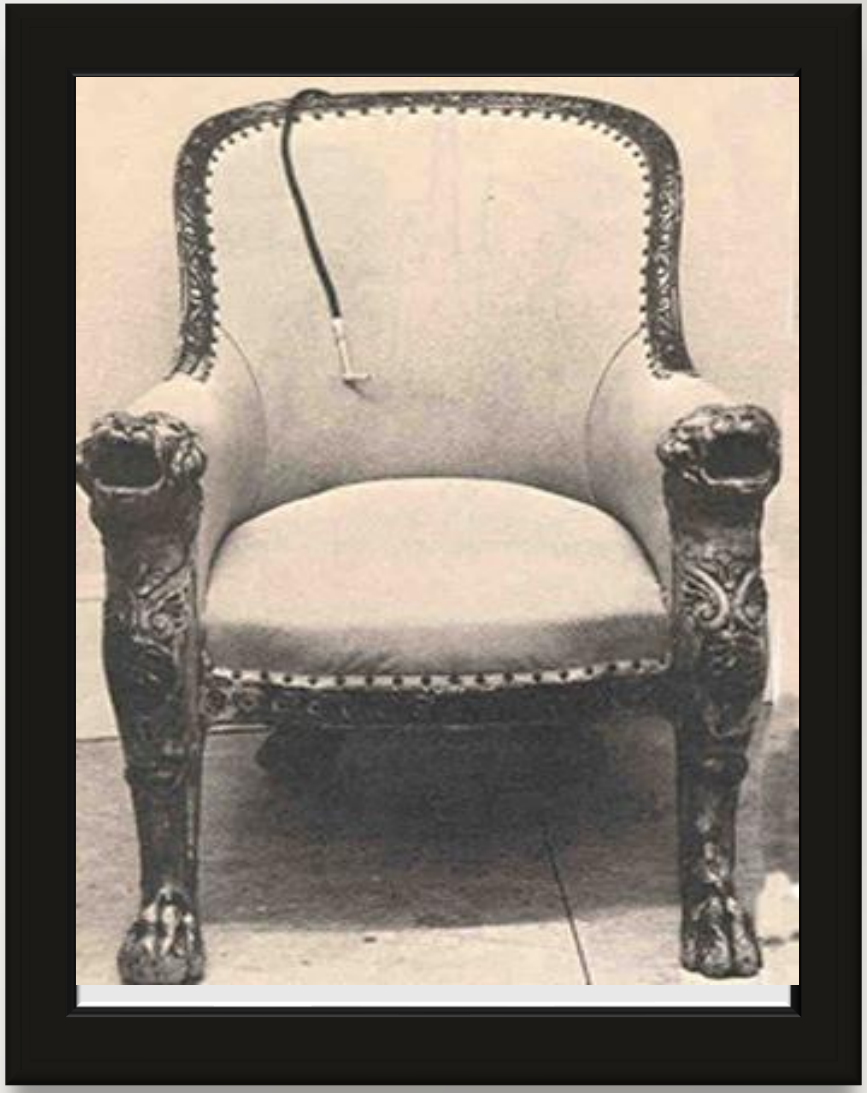
1900's
Horns, trumpets and tubes gather sound mechanically leading it into the ear

Acoustic



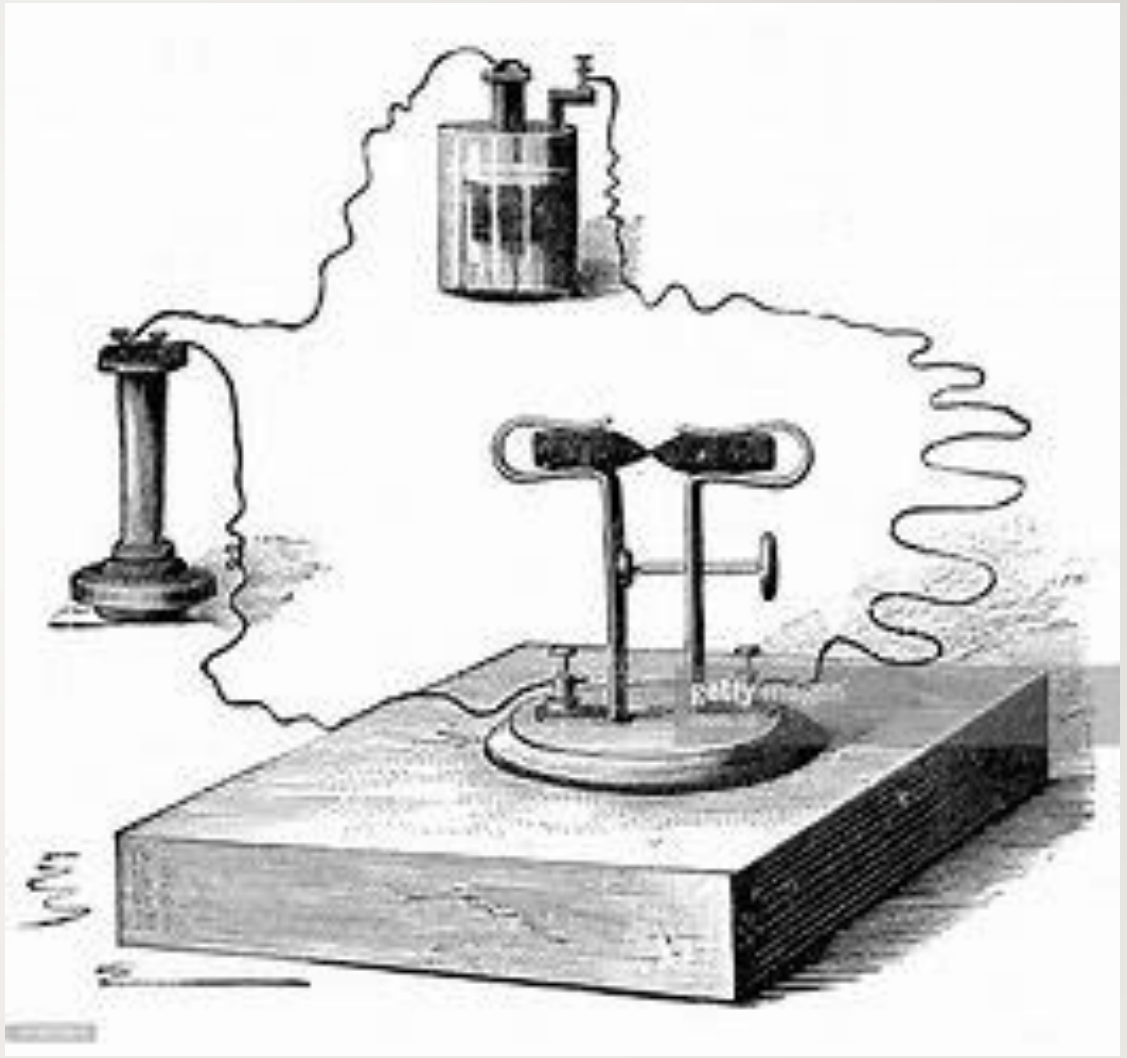
Hearing Throne

1820- Used by King Goa IV of Portugal



Invention of the Carbon Microphone

David Edwards Hughes - 1878




OTICON
BATTERI
TYPE A1

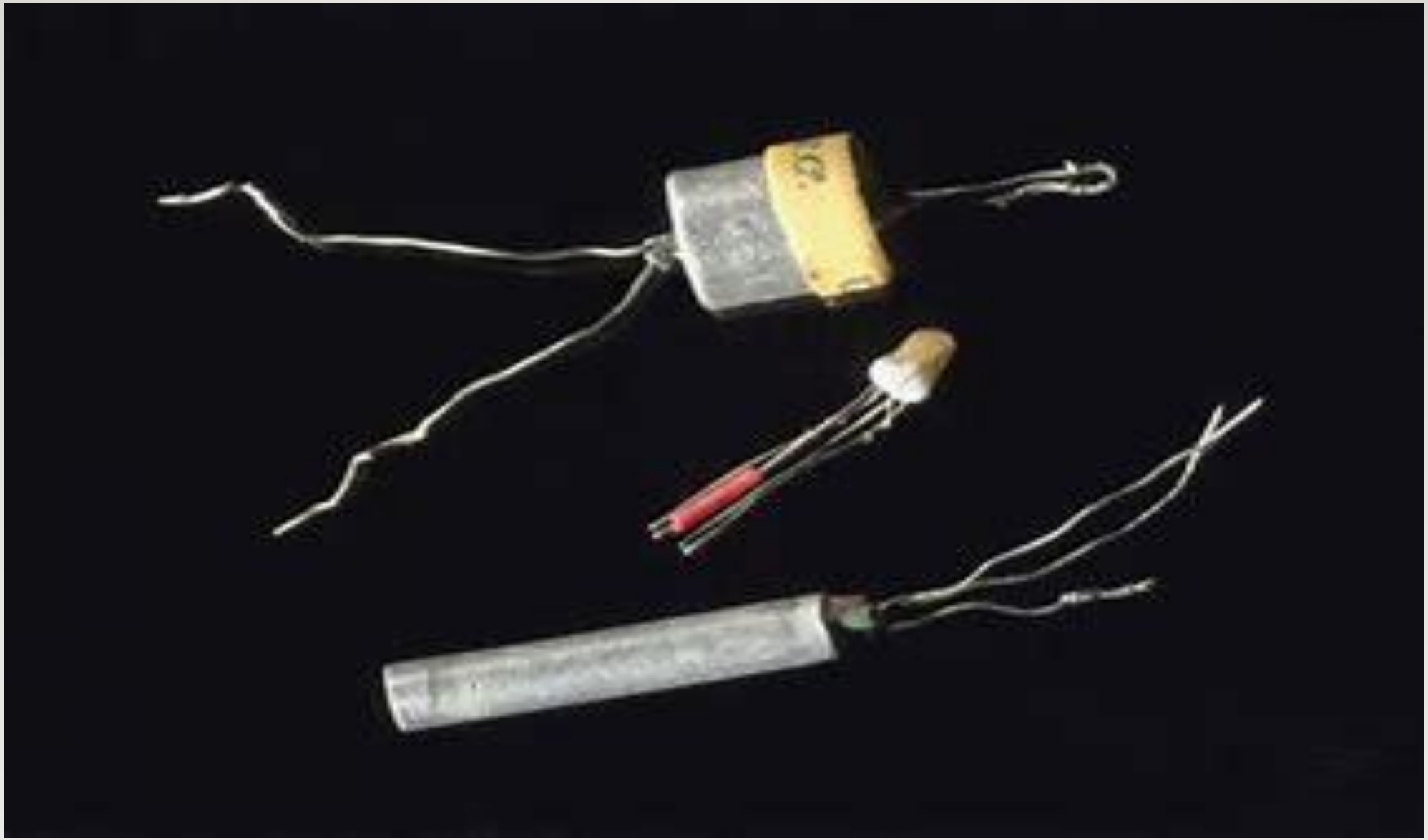
Development of the Vacuum Tube
First triode -1906

Development of the Transistor

First Patent 1925 Julius Edgar Lillenfeld

Ongoing development 1947- Bell Labs


2N83




ZENITH

DELUXE AMPLIFIER HOLDER

Adjusts for comfortable fit. Battery case fits right or left side. Washable. White.

Order No.	Size	Price
189-59	Small, 32-40 in.	$2.25
189-60	Medium, 40-47 in.	2.25
189-61	Large, 48-50 in.	2.25

STANDARD AMPLIFIER HOLDER

Without battery case. All straps fully adjustable for wide range of sizes and comfortable fit. Light weight, durable material. Washable. White.

Order No. 189-69.....Price $1.50

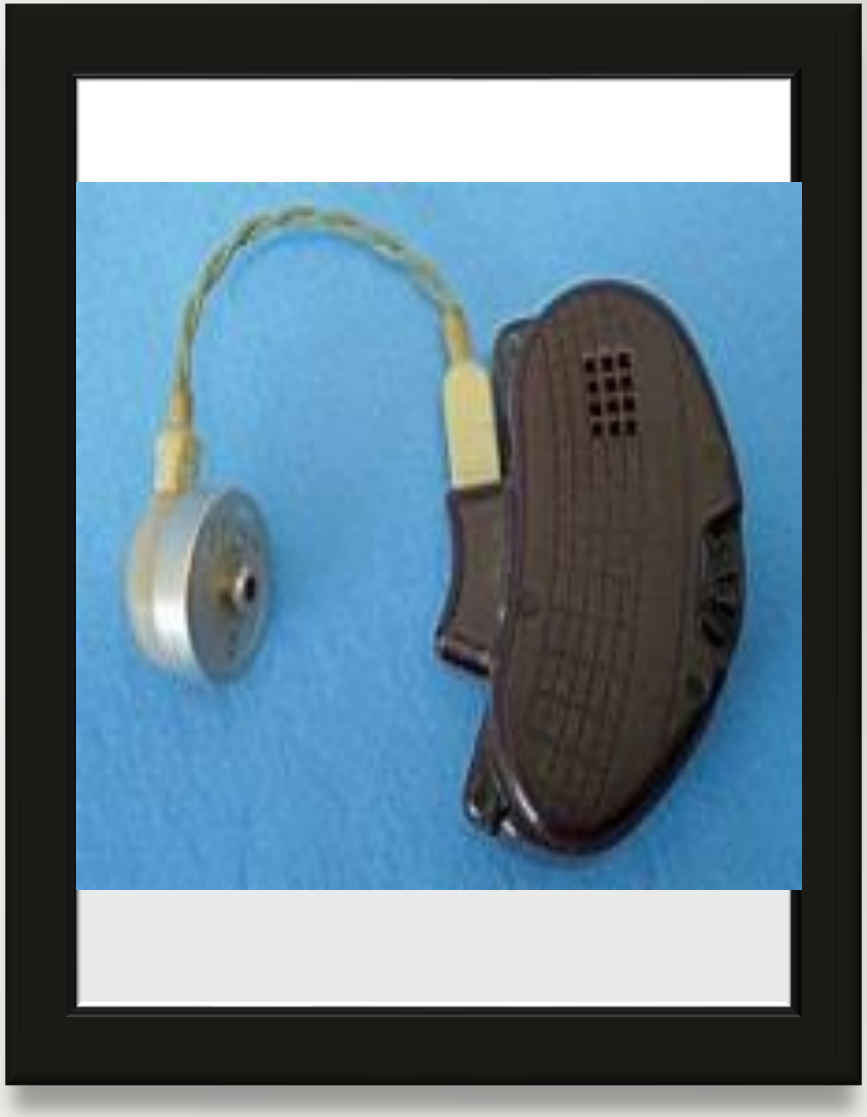
BATTERY CASE

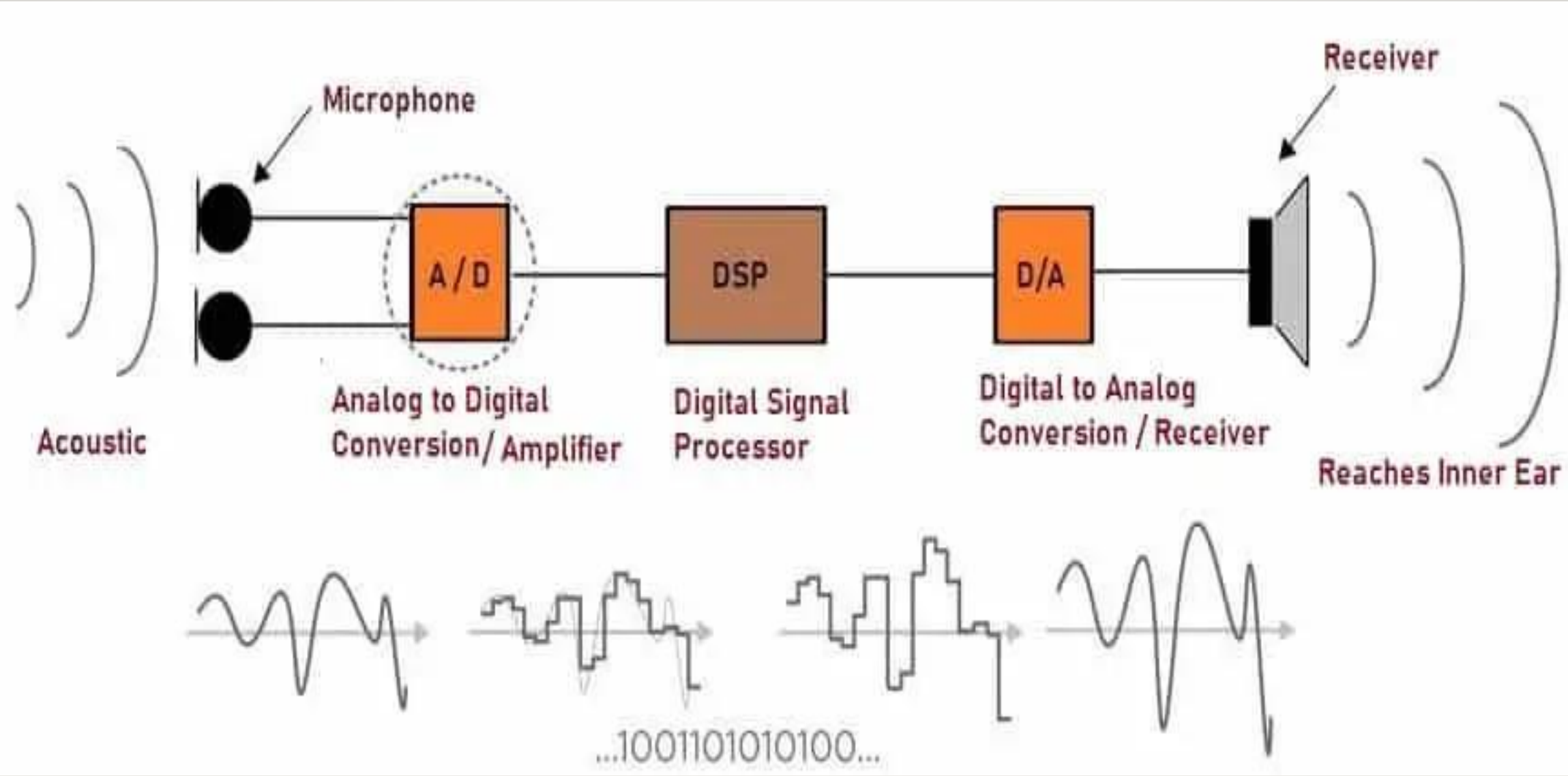
Attractive leather case. Fasten
or can be carried in pocket. Ho
A and B batteries. Same as c
supplied with your hearing aid.

Order No. 189-51.....Pri

Sonotone Model 79 BTE 1955

First 100% Transistor Behind the Ear Hearing Instrument




Receiver
Microphone
A / D
DSP
D/A
Acoustic
Analog to Digital
Conversion / Amplifier
Digital Signal
Processor
Digital to Analog
Conversion / Receiver
Reaches Inner Ear
...1001101010100...

PRISM®

Processing Real Time Intelligent Sound Management chip

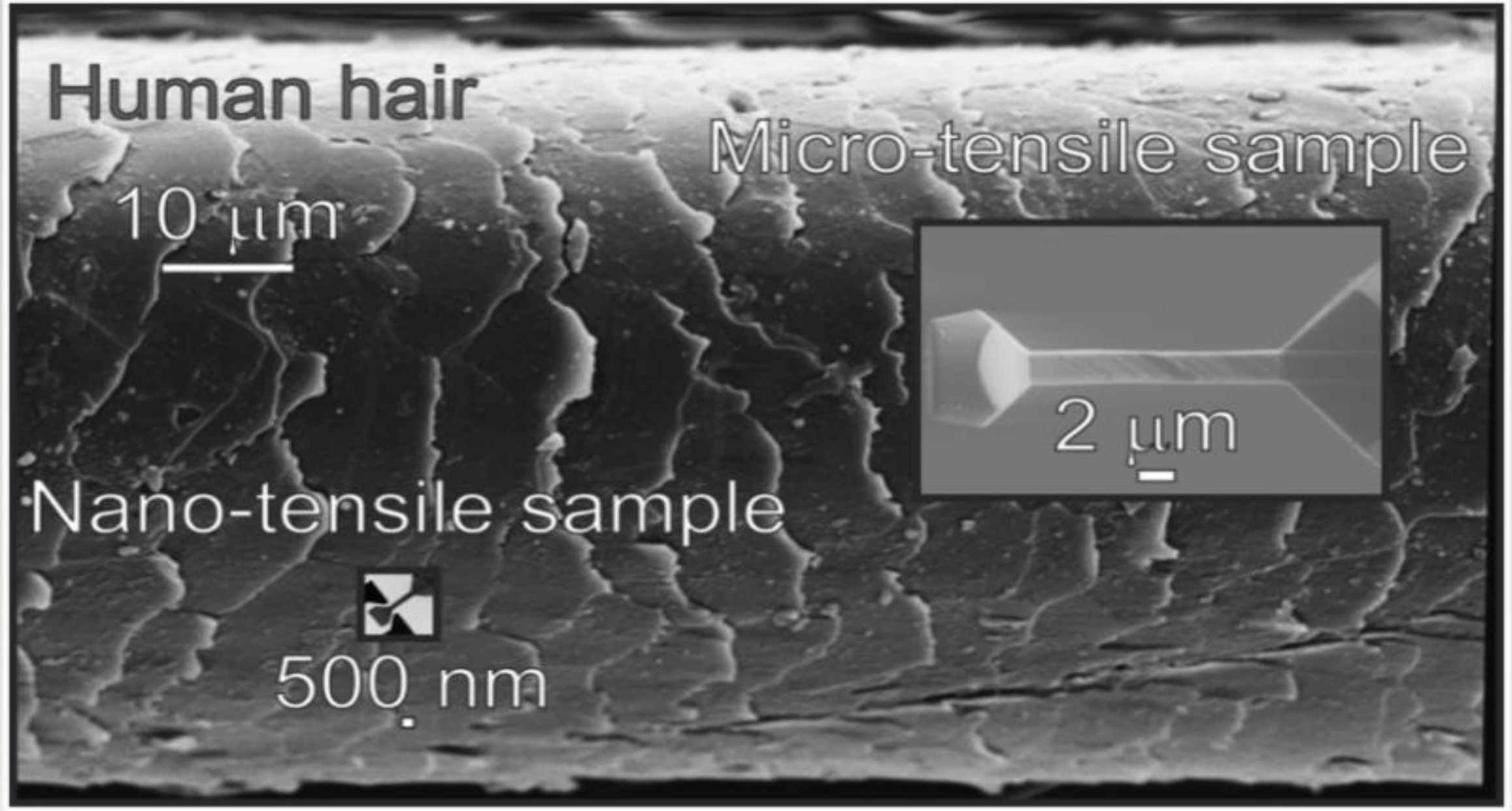
Operations per second
>552 Million

Size
5.51mm x 3.46mm

Total memory
8.42 Mbit RAM

Transistors
109 Mio

Processing Speed
DSP: 7.53 MHz / Radio: 26 MHz

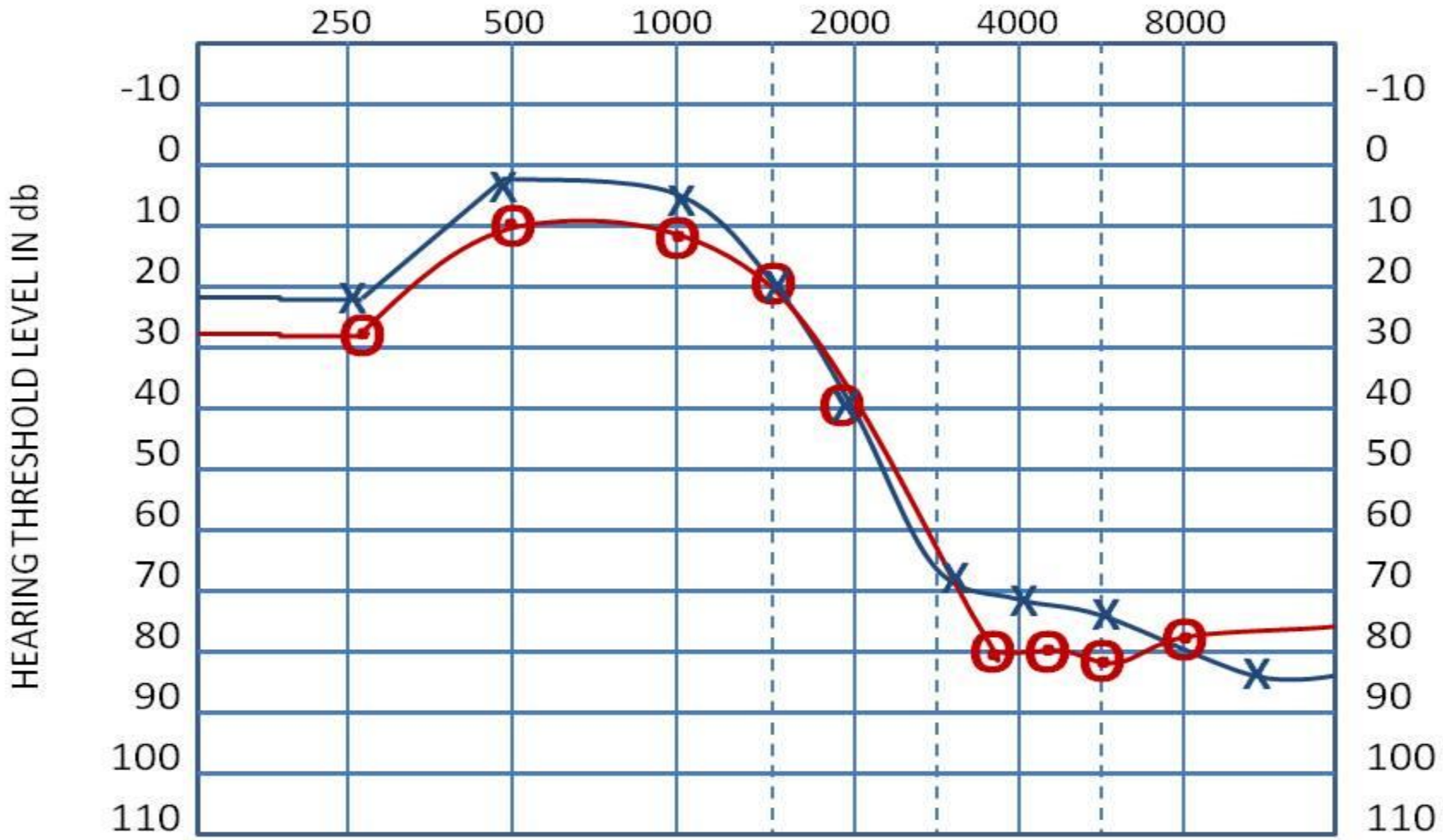

Human hair
10 μm
Micro-tensile sample
2 μm
Nano-tensile sample
500 nm

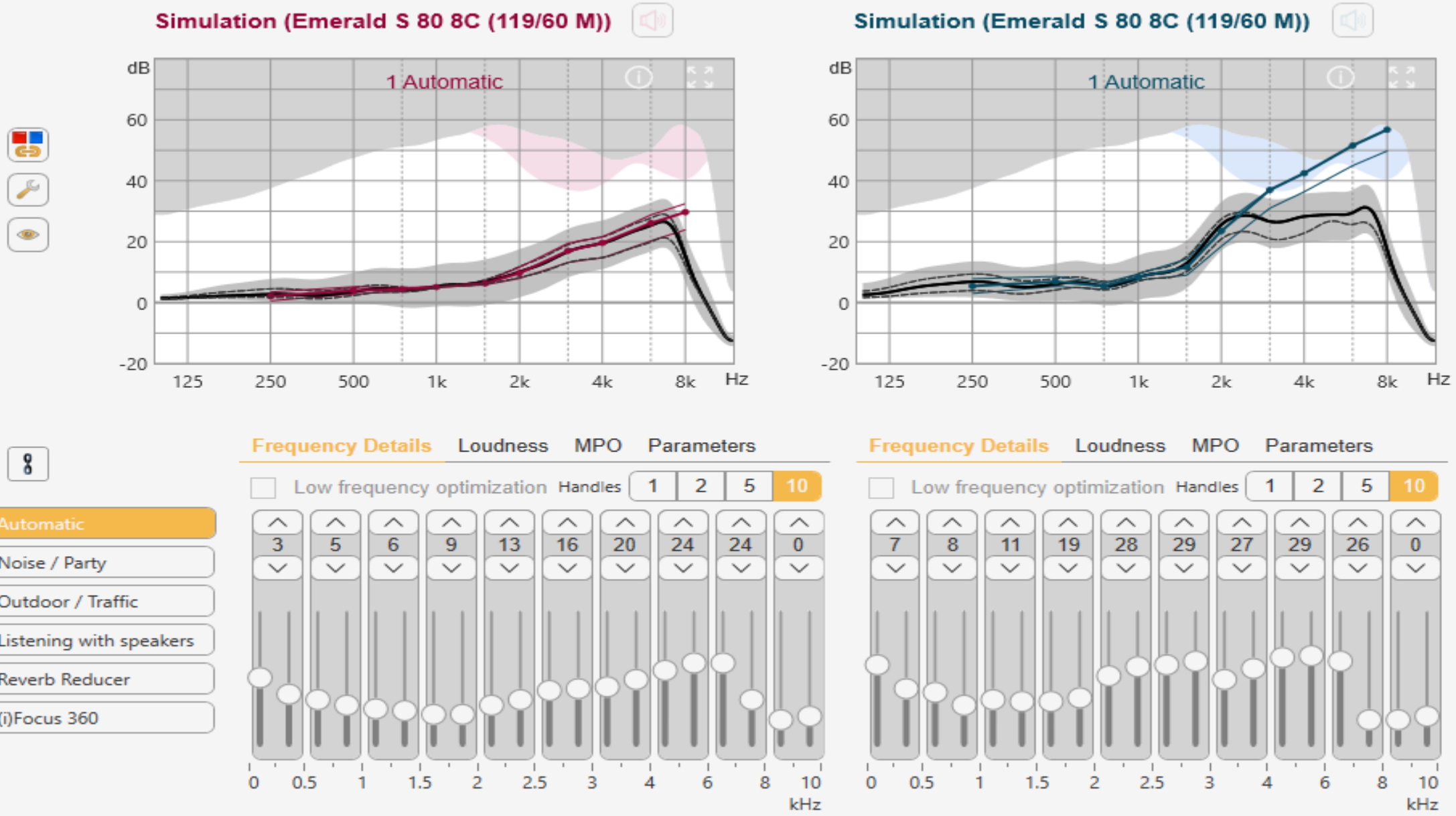
A New World of Hearing with Digitalization

- Frequency adjustability
- Input Compression
- Noise Management
- Frequency compression
- Feedback Management
- Wireless connectivity

AUDIOGRAM SAMPLE
FREQUENCY IN HERTZ

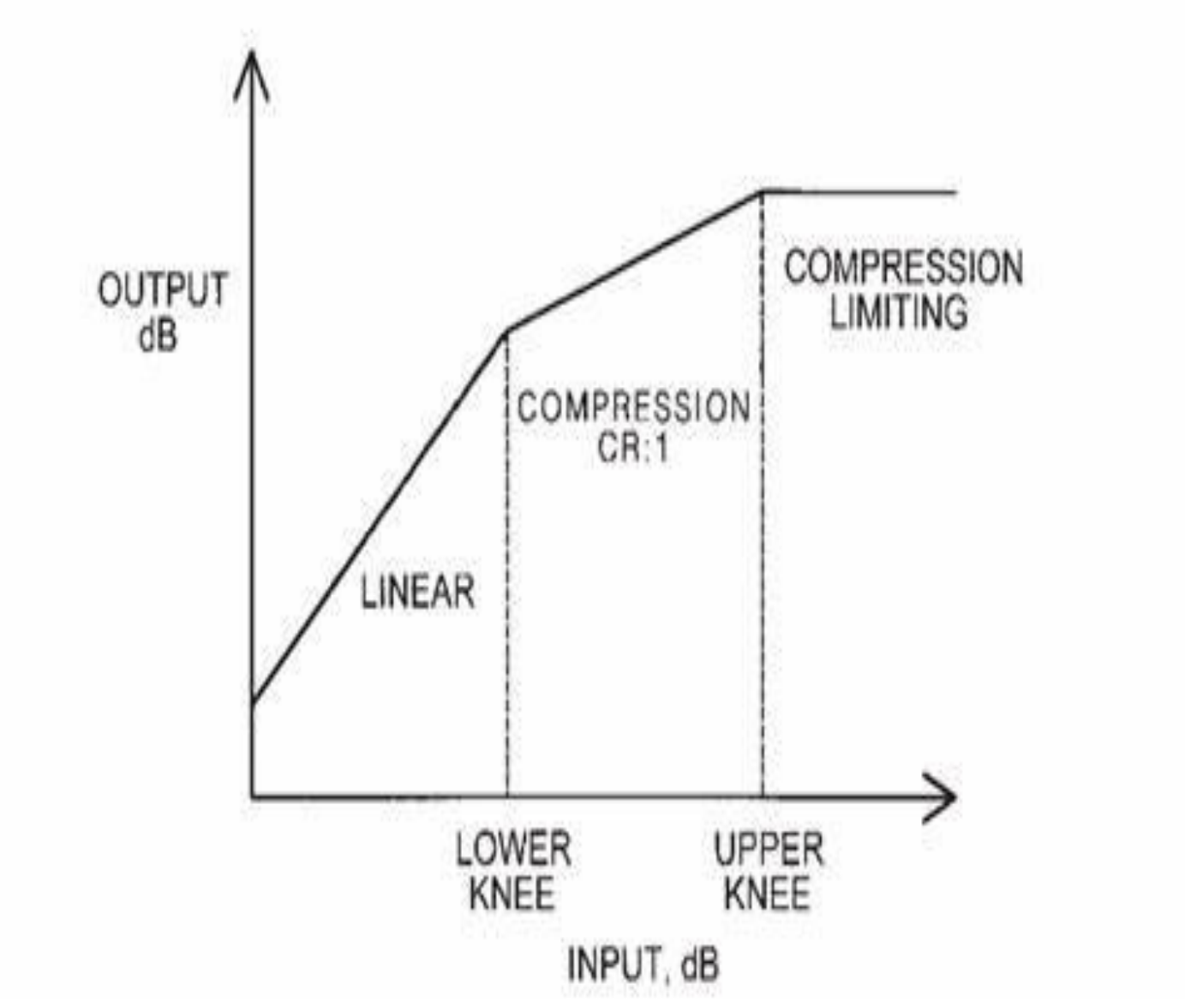
Helping Hearing Parents



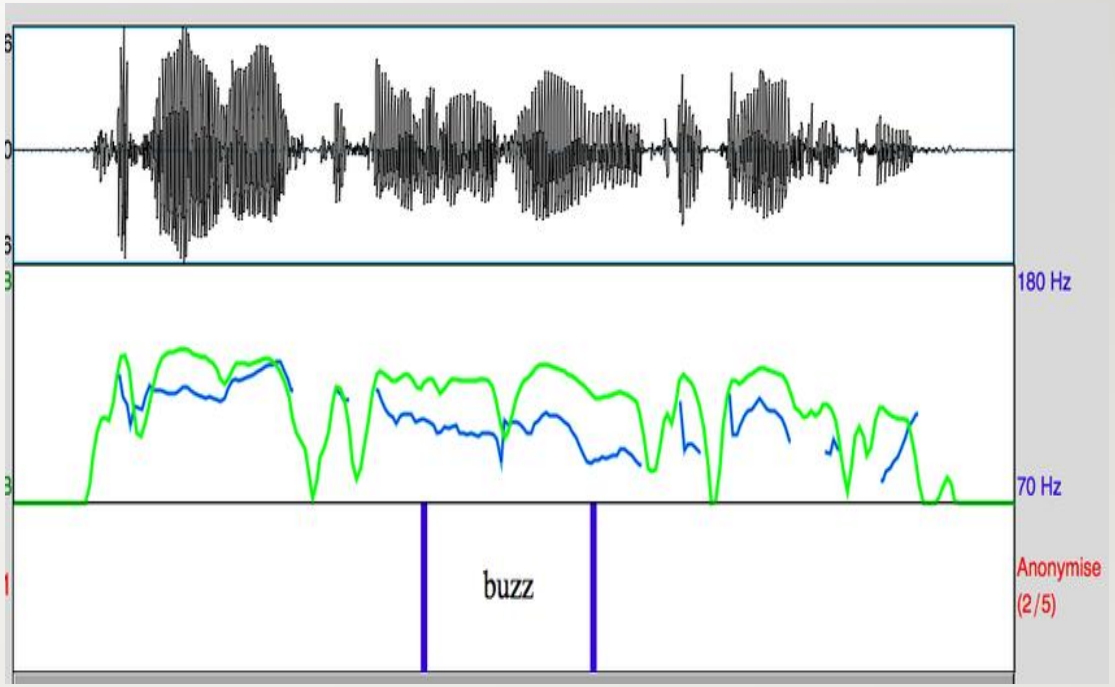

Simulation (Emerald S 80 8C (119/60 M))
dB
1 Automatic
60
40
20
0
-20
125
250
500
1k
2k
4k
8k
Hz
Simulation (Emerald S 80 8C (119/60 M))
dB
1 Automatic
60
40
20
0
-20
125
250
500
1k
2k
4k
8k
Hz
Frequency Details
Loudness
MPO
Parameters
Low frequency optimization
Handles
1
2
5
10
3
5
6
9
13
16
20
24
24
0
0
0.5
1
1.5
2
2.5
3
4
6
8
10
kHz
1 Automatic
2 Noise / Party
3 Outdoor / Traffic
4 Listening with speakers
5 Reverb Reducer
6 (i)Focus 360
Frequency Details
Loudness
MPO
Parameters
Low frequency optimization
Handles
1
2
5
10
7
8
11
19
28
29
27
29
26
0
0
0.5
1
1.5
2
2.5
3
4
6
8
10
kHz

Input Compression

Dealing with a limited Dynamic Range

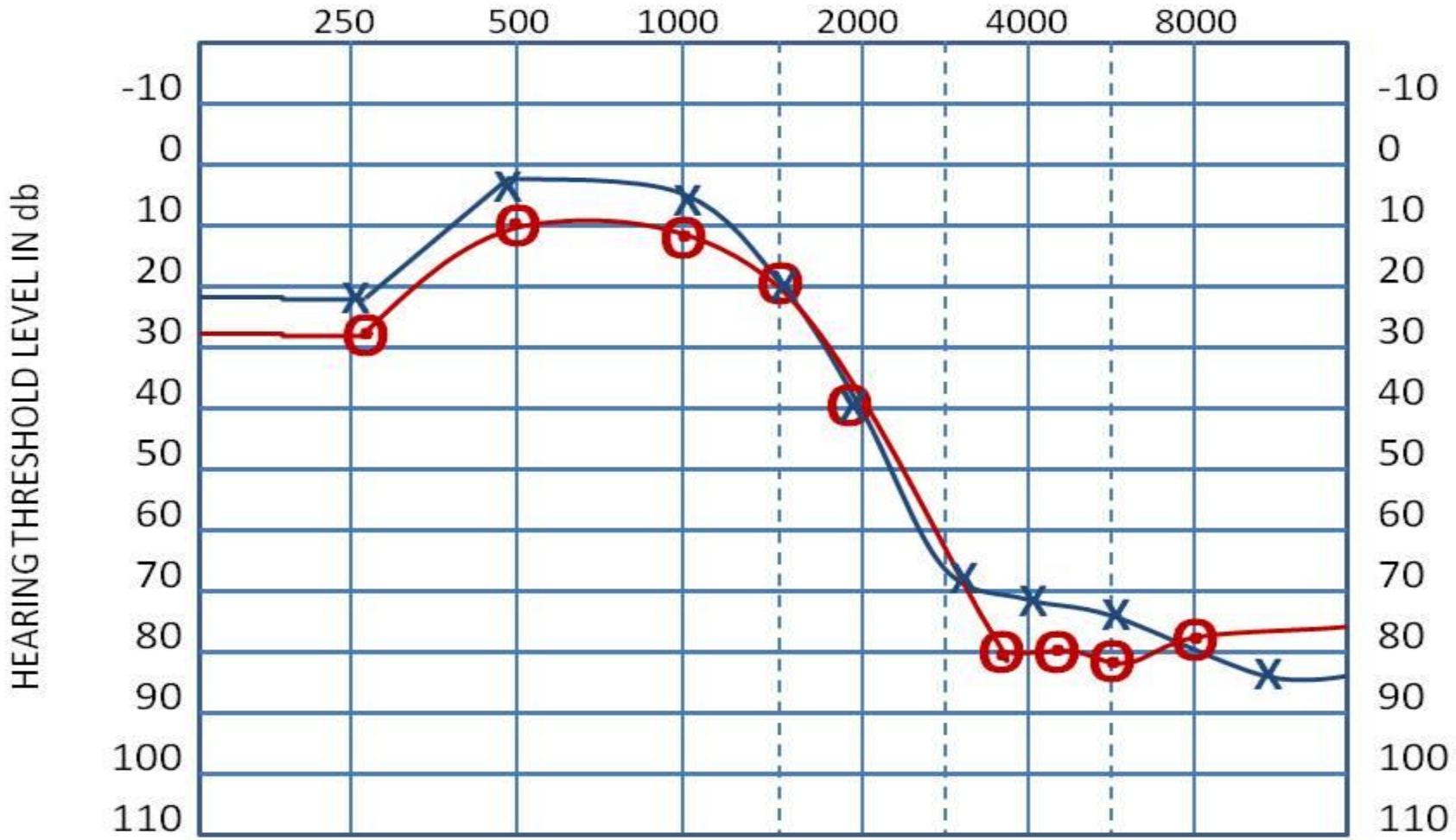


Dynamic Noise Reduction in Hearing Aids



AUDIOGRAM SAMPLE
FREQUENCY IN HERTZ

Helping Hearing Parents




SoundRecover
OFF
SoundRecover

Feedback Management

Digital marking

Dynamic Feedback

Cancelling

Active Gain adjustment

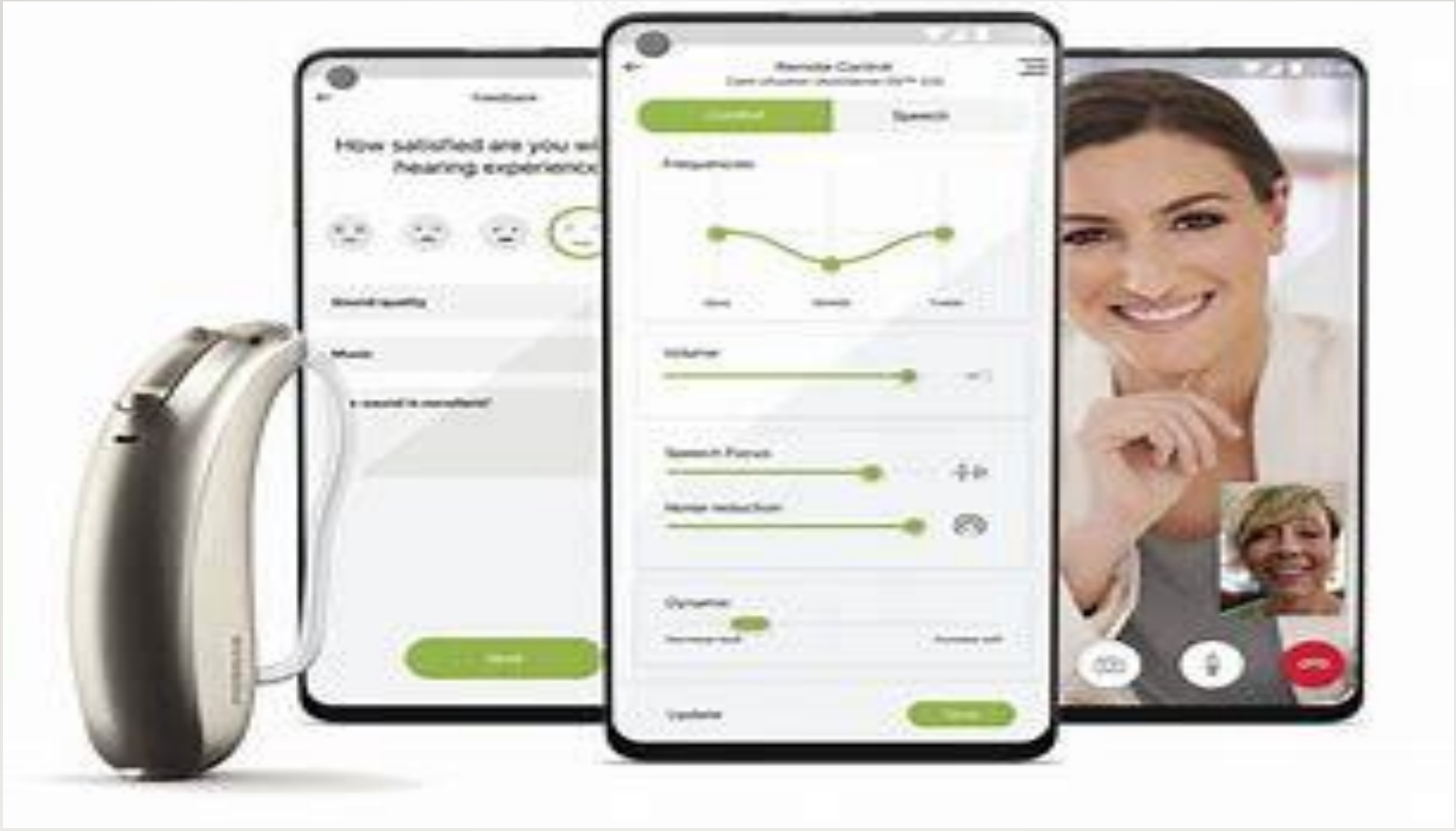
Bluetooth Connectivity

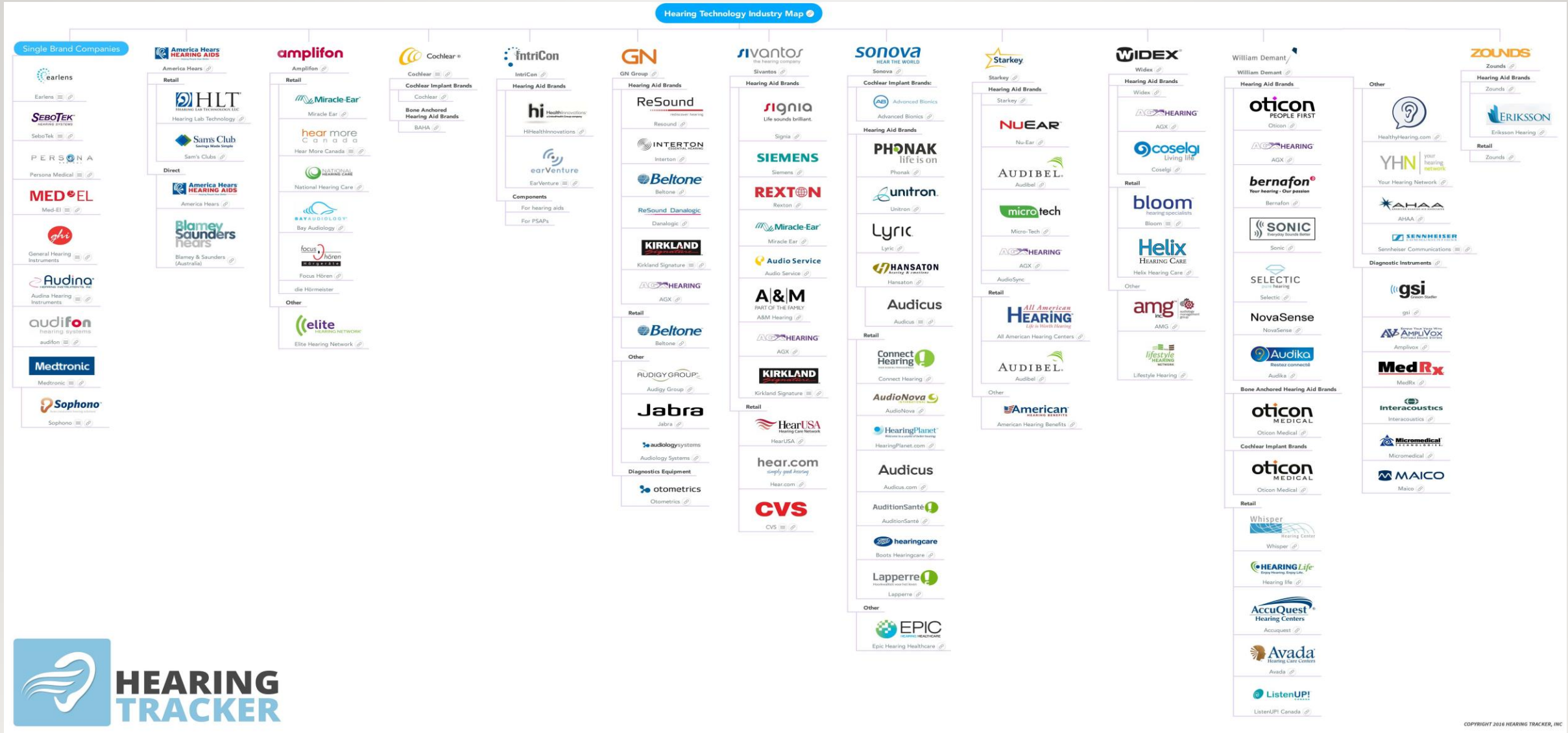
Audio Streaming

Phone Streaming

TV/ Remote Mic Streaming

App Usage




Hearing Technology Industry Map
Single Brand Companies
Earlens
SeboTek
Persona Medical
MED-EL
Med-El
General Hearing Instruments
Audina Hearing Instruments
audifon
Medtronic
Sophono
America Hears
Retail
HLT
Hearing Lab Technology
Sam's Club
Sam's Clubs
Direct
America Hears
Blamey Saunders hears
Blamey & Saunders (Australia)
amplifon
Amplifon
Retail
Miracle-Ear
Miracle Ear
hear more Canada
Hear More Canada
National Hearing Care
Bay Audiology
focus hören
Focus Hören
die Hörmeister
Other
elite
Elite Hearing Network
Cochlear
Cochlear
Cochlear Implant Brands
Cochlear
Bone Anchored Hearing Aid Brands
BAHA
IntriCon
IntriCon
Hearing Aid Brands
hi HealthInnovations
HiHealthInnovations
earVenture
EarVenture
Components
For hearing aids
For PSAPs
GN
GN Group
Hearing Aid Brands
ReSound
Resound
INTERTON
Interton
Beltone
Beltone
ReSound Danalogic
Danalogic
KIRKLAND Signature
Kirkland Signature
AGX HEARING
AGX
Retail
Beltone
Beltone
Other
AUDIGY GROUP
Audigy Group
Jabra
Jabra
audiologysystems
Audiology Systems
Diagnostics Equipment
otometrics
Otometrics
Sivantos
Sivantos
Hearing Aid Brands
signia
Life sounds brilliant.
Signia
SIEMENS
Siemens
REXTON
Rexton
Miracle-Ear
Miracle Ear
Audio Service
Audio Service
A&M
PART OF THE FAMILY
A&M Hearing
AGX HEARING
AGX
KIRKLAND Signature
Kirkland Signature
Retail
HearUSA
HearUSA
hear.com
Hear.com
CVS
CVS
Sonova
Sonova
Cochlear Implant Brands:
Advanced Bionics
Advanced Bionics
Hearing Aid Brands
PHONAK life is on
Phonak
unitron
Unitron
Lyric
Lyric
HANSATON
Hansaton
Audicus
Audicus
Retail
Connect Hearing
Connect Hearing
AudioNova
AudioNova
HearingPlanet
HearingPlanet.com
Audicus
Audicus.com
AuditionSanté
AuditionSanté
hearingcare
Boots Hearingcare
Lapperre
Lapperre
Other
EPIC HEARING HEALTHCARE
Epic Hearing Healthcare
Starkey
Starkey
Hearing Aid Brands
Starkey
NUEAR
Nu-Ear
AUDIBEL
Audibel
micro tech
Micro-Tech
AGX HEARING
AGX
AudioSync
Retail
All American HEARING
All American Hearing Centers
AUDIBEL
Audibel
Other
American
American Hearing Benefits
WIDEX
Widex
Hearing Aid Brands
Widex
AGX HEARING
AGX
coselgi Living life
Coselgi
Retail
bloom hearing specialists
Bloom
Helix Hearing Care
Helix Hearing Care
Other
amg inc
AMG
lifestyle HEARING NETWORK
Lifestyle Hearing
William Demant
William Demant
Hearing Aid Brands
oticon PEOPLE FIRST
Oticon
AGX HEARING
AGX
bernafon
Bernafon
SONIC
Sonic
SELECTIC
Selectic
NovaSense
NovaSense
Audika
Audika
Bone Anchored Hearing Aid Brands
oticon MEDICAL
Oticon Medical
Cochlear Implant Brands
oticon MEDICAL
Oticon Medical
Retail
Whisper
Whisper
HEARING Life
Hearing life
AccuQuest Hearing Centers
Accuquest
Avada
Avada
ListenUP!
ListenUP! Canada
Other
HealthyHearing.com
YHN your hearing network
Your Hearing Network
AHAA
AHAA
SENNHEISER
Sennheiser Communications
Diagnostic Instruments
gsi
gsi
AMPLIVOX
Amplivox
MedRx
MedRx
Interacoustics
Interacoustics
Micromedical
Micromedical
MAICO
Maico
ZOUNDS
Zounds
Hearing Aid Brands
Zounds
ERIKSSON
Eriksson Hearing
Retail
Zounds
HEARING TRACKER
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Invisible-in-canal (IIC)
In-the-ear (ITE) Half Shell
Behind-the-ear (BTE)
Completely-in-canal (CIC)
In-the-ear (ITE) Full Shell
Receiver-in-canal (RIC)

ReSound GN

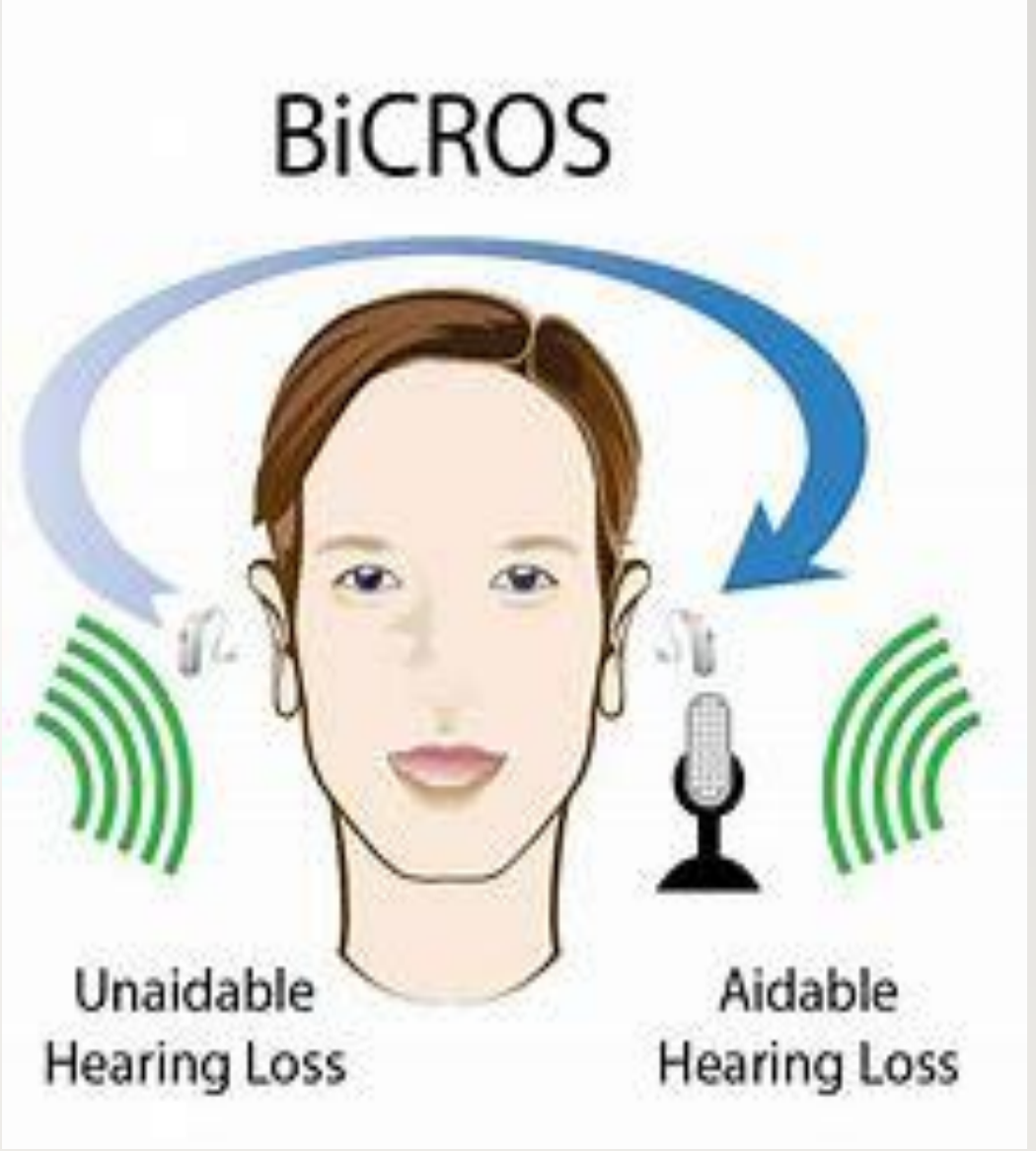
Rechargeable
Receiver in Canal

Phonak

Rechargeable
Receiver in Canal

Bi-Cros Hearing Device

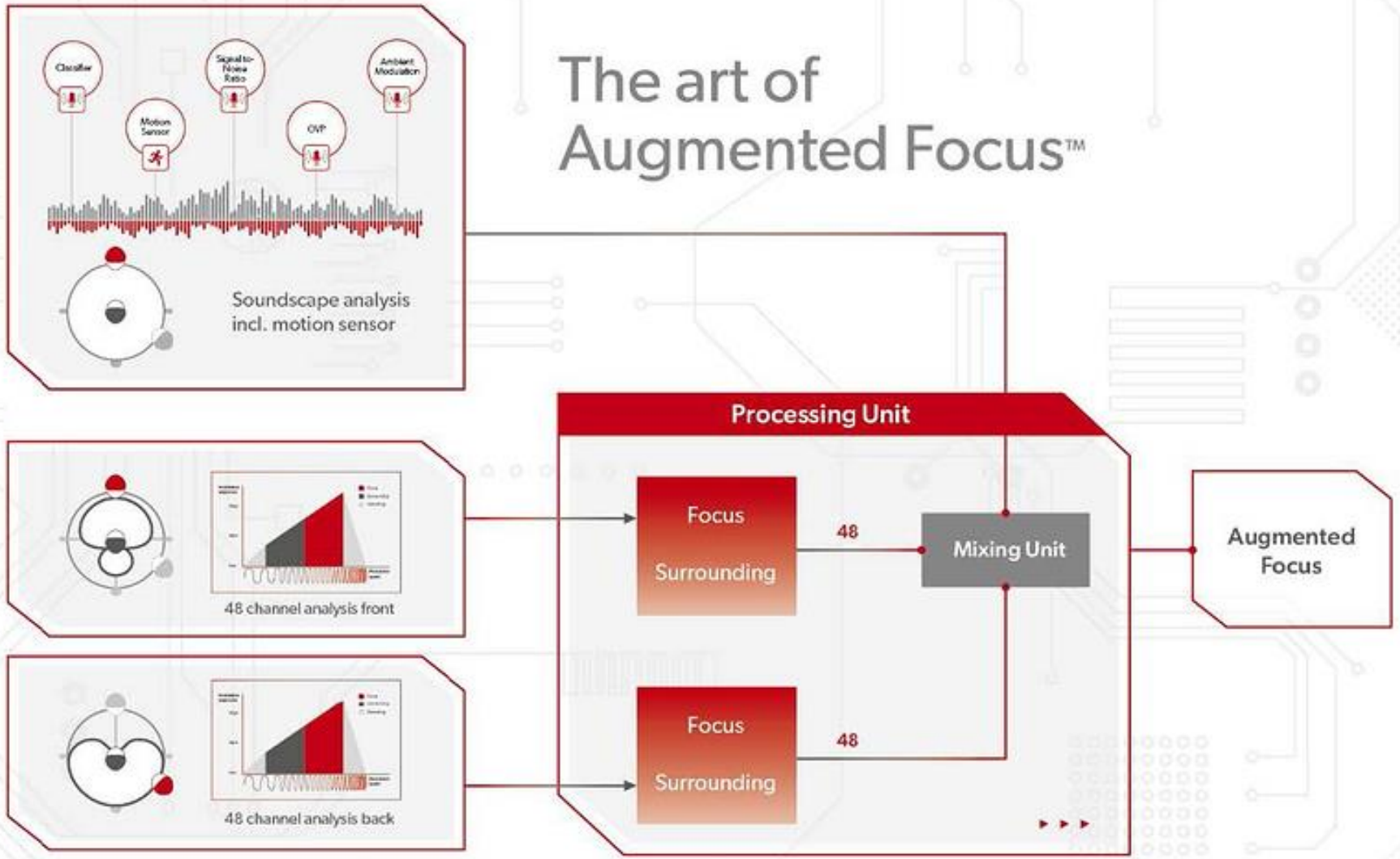
Designed to treat single sided / asymmetrical hearing loss



Signia

Rechargeable
Receiver in Canal

The art of Augmented Focus™

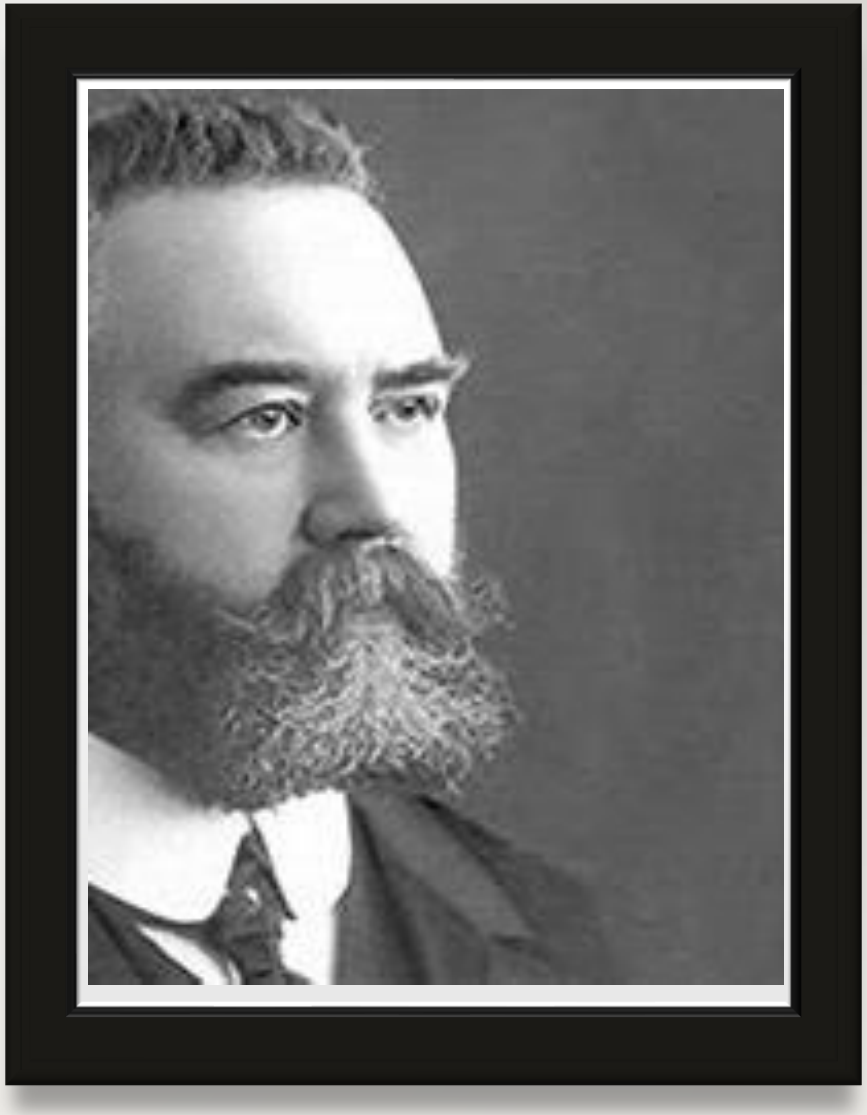


Oticon

Rechargeable
Receiver In Canal

Oticon Founder- Hans Demant

Founded 1904



Starkey Hearing Technologies

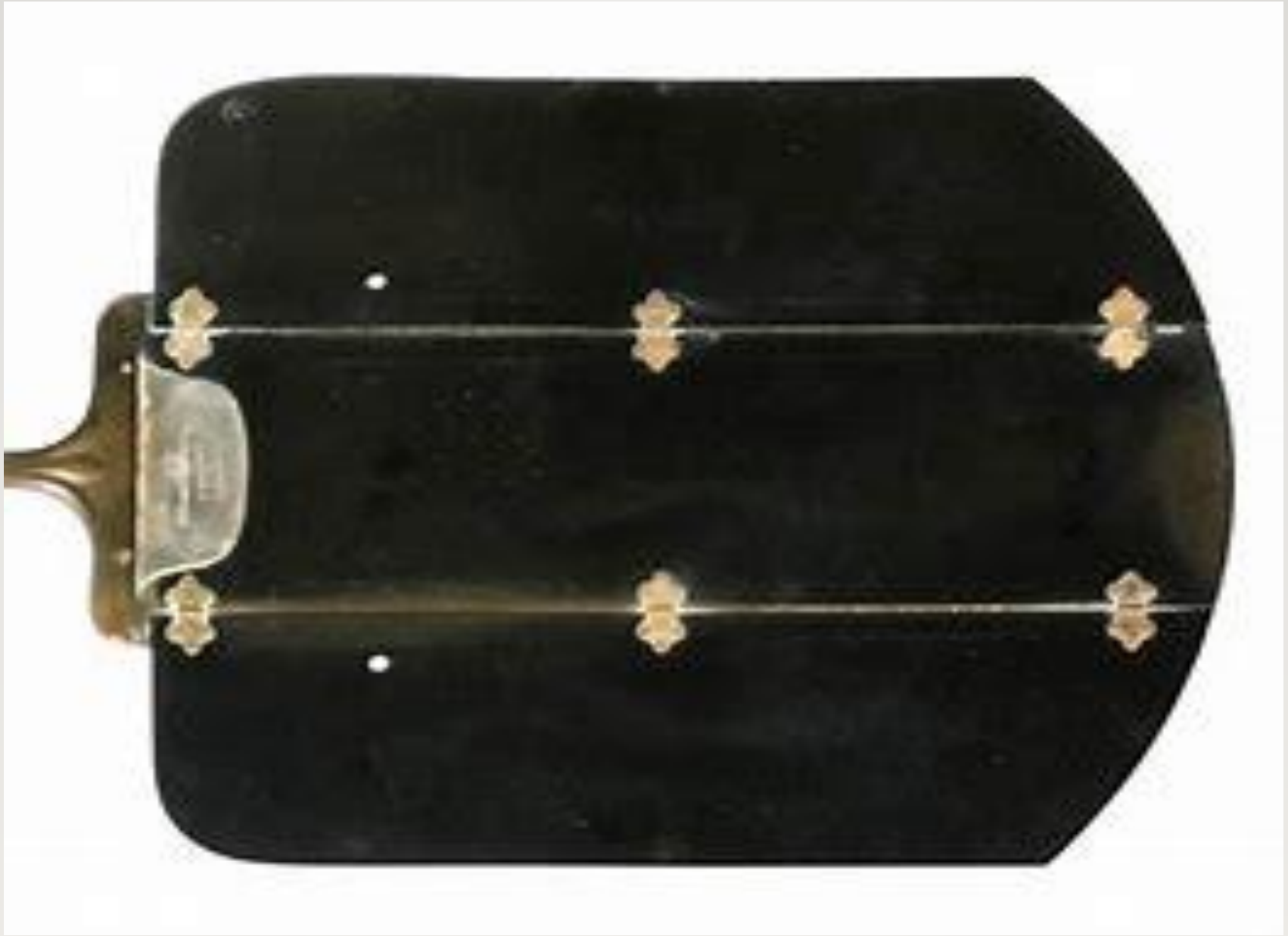
Rechargeable
Receiver in Canal

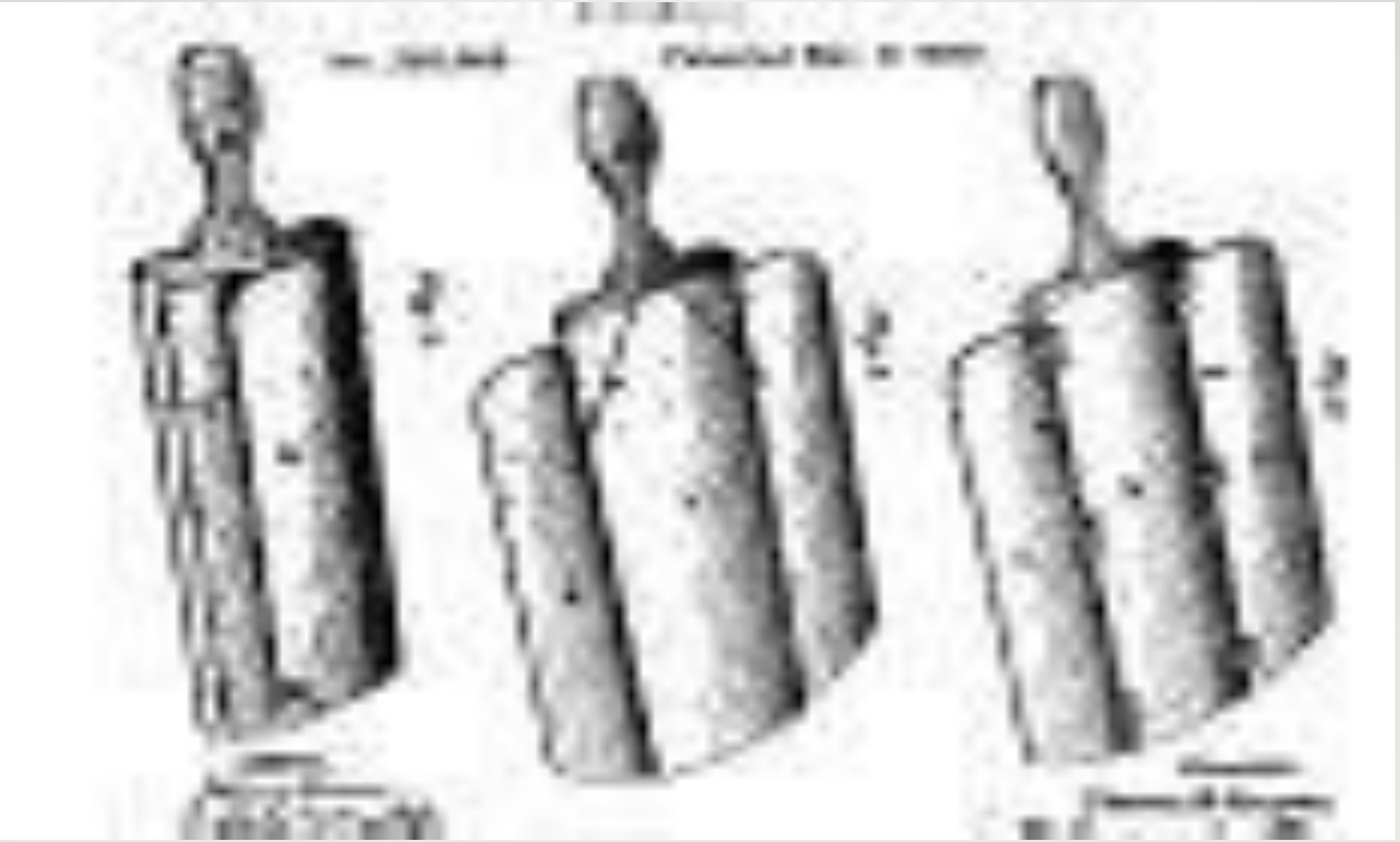
Starkey Hearing Technologies Founder- Bill Austin

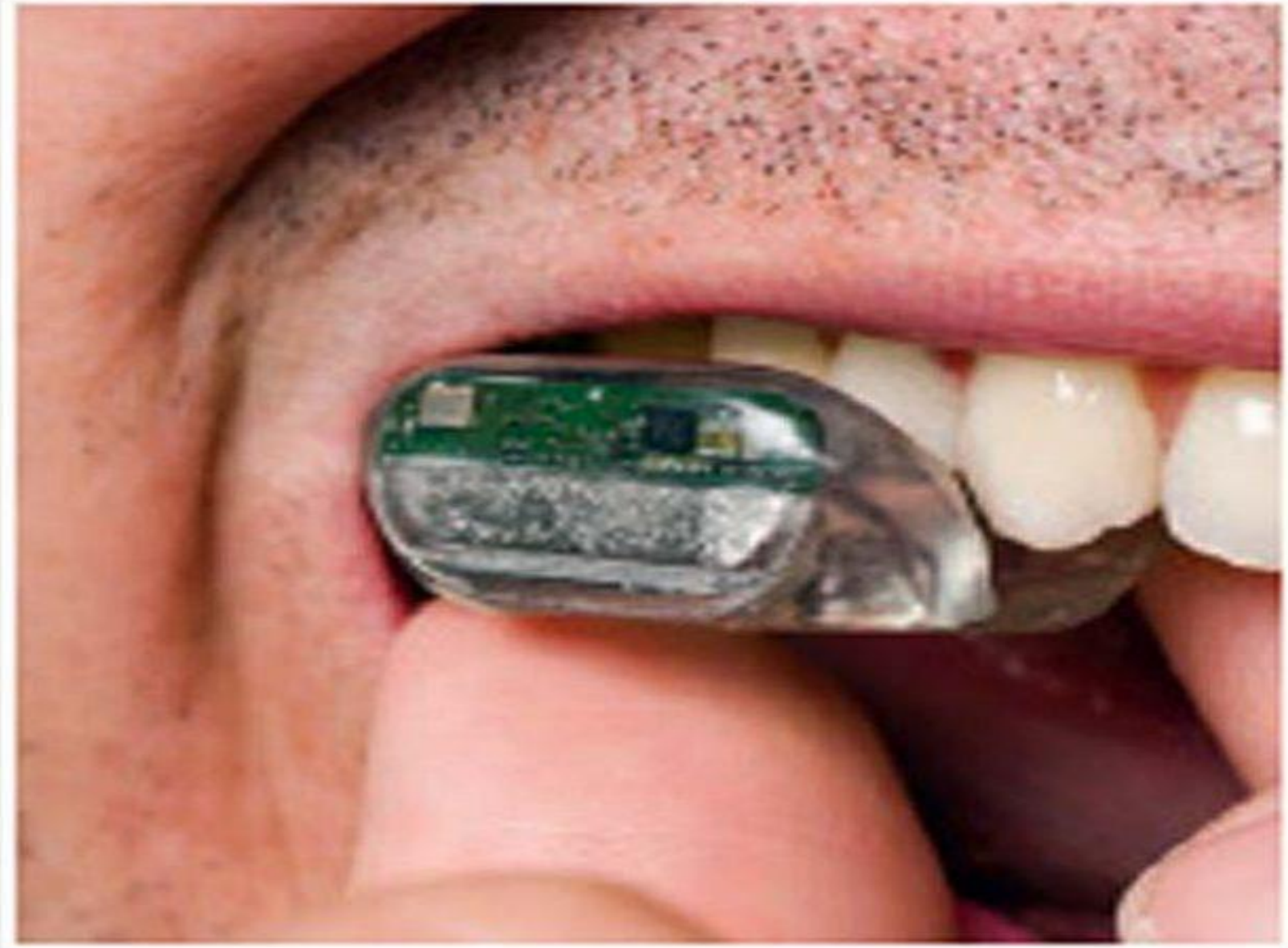
1942- Present

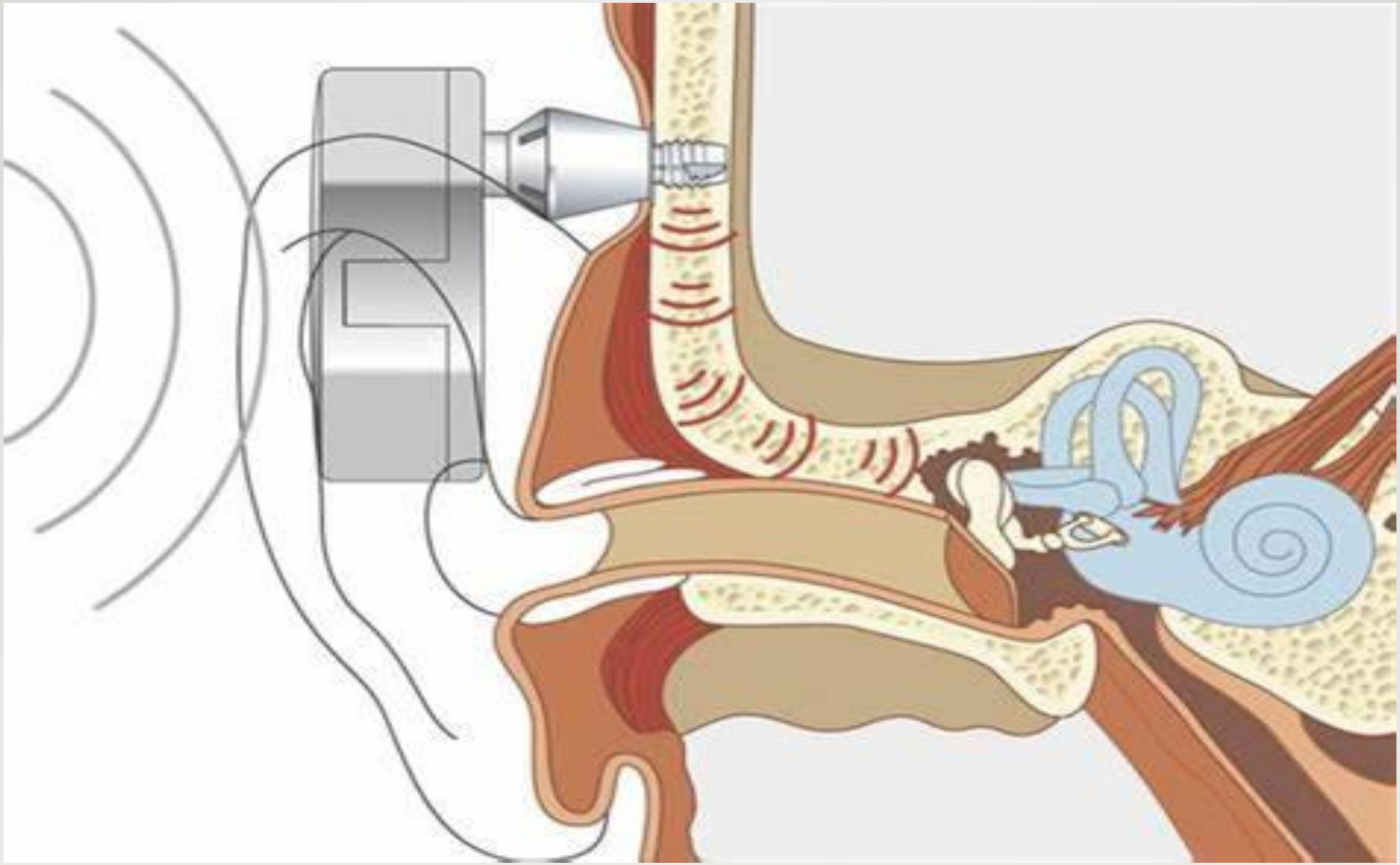
Bone Conduction Hearing Aids

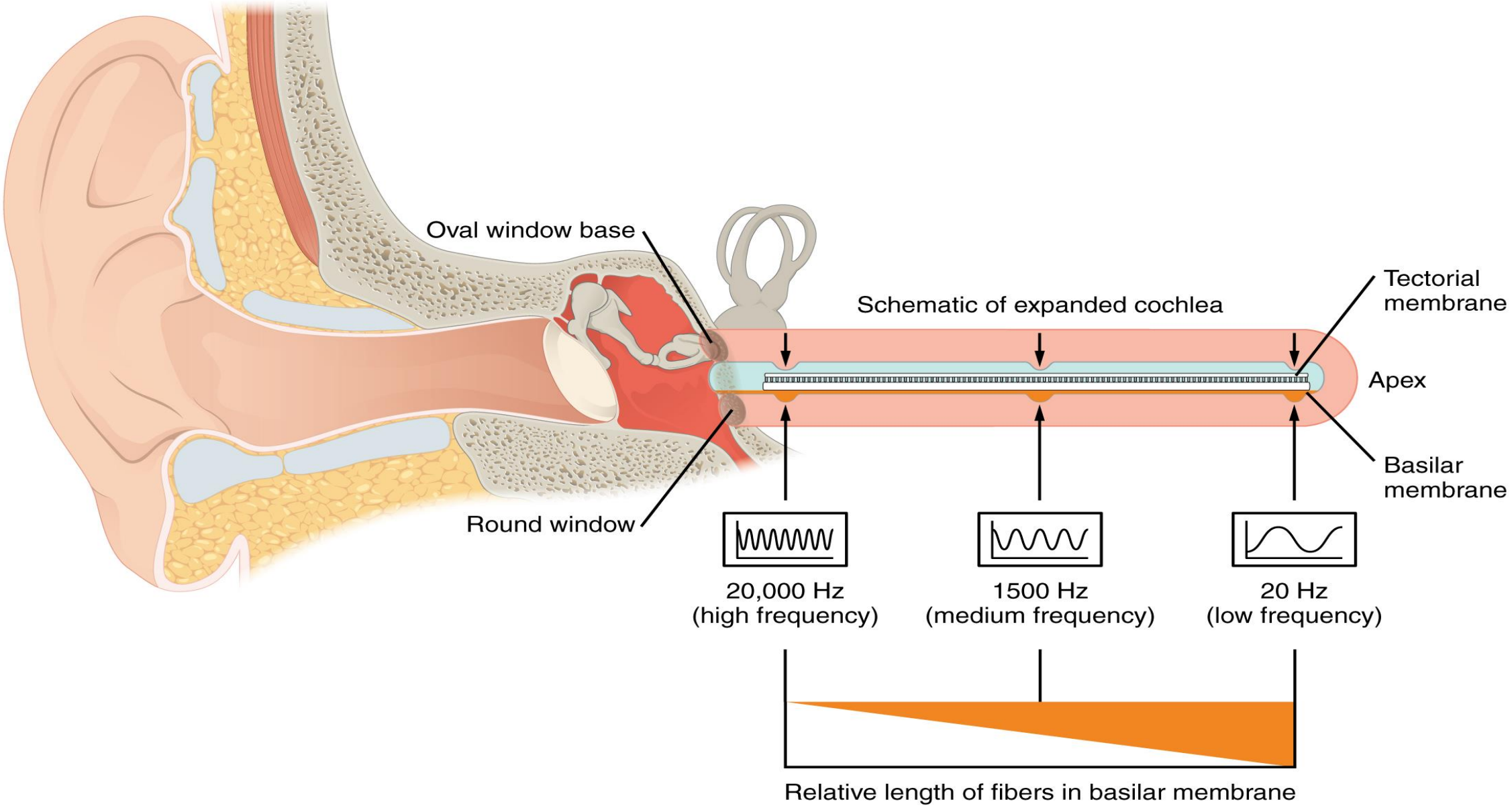
- Historical development
- 1960's Dr. Per Ingvar Branemark
- 1977- First successful use - Mona Anderson
- 1996- FDA approval as treatment for conductive hearing loss

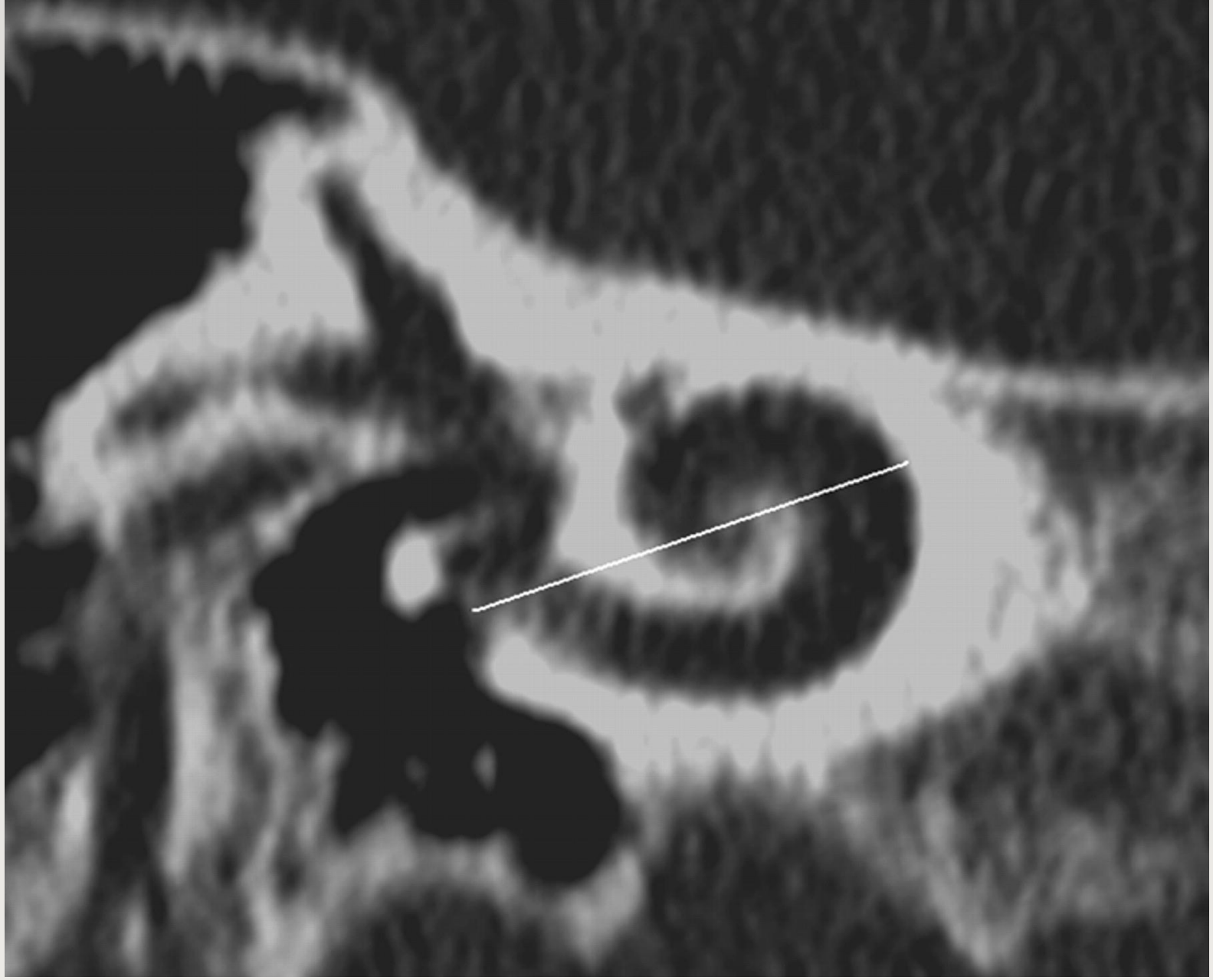









Oval window base
Round window
Schematic of expanded cochlea
Tectorial membrane
Apex
Basilar membrane
20,000 Hz
(high frequency)
1500 Hz
(medium frequency)
20 Hz
(low frequency)
Relative length of fibers in basilar membrane



Alesandro Volta

1790

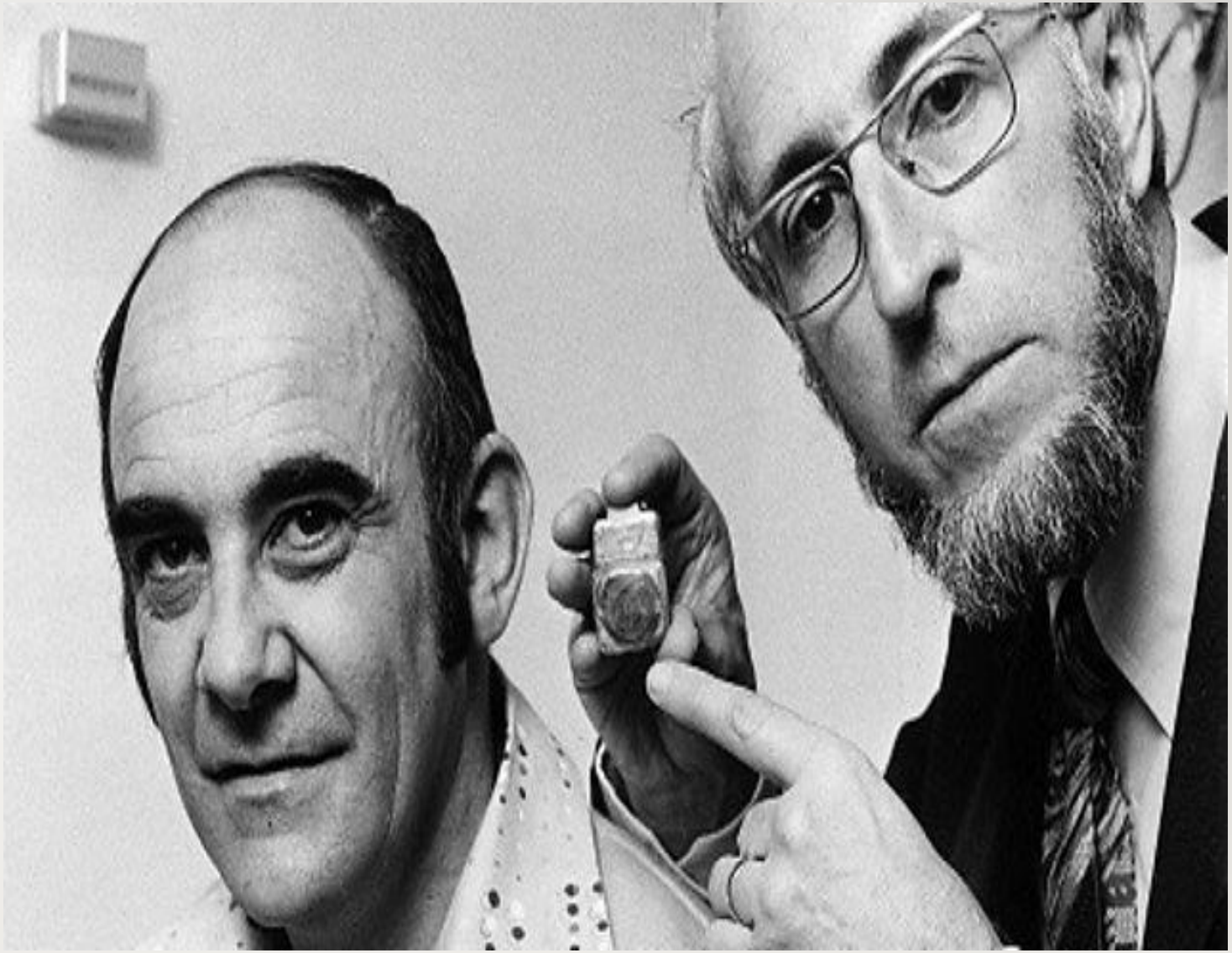
Andre Djuorno

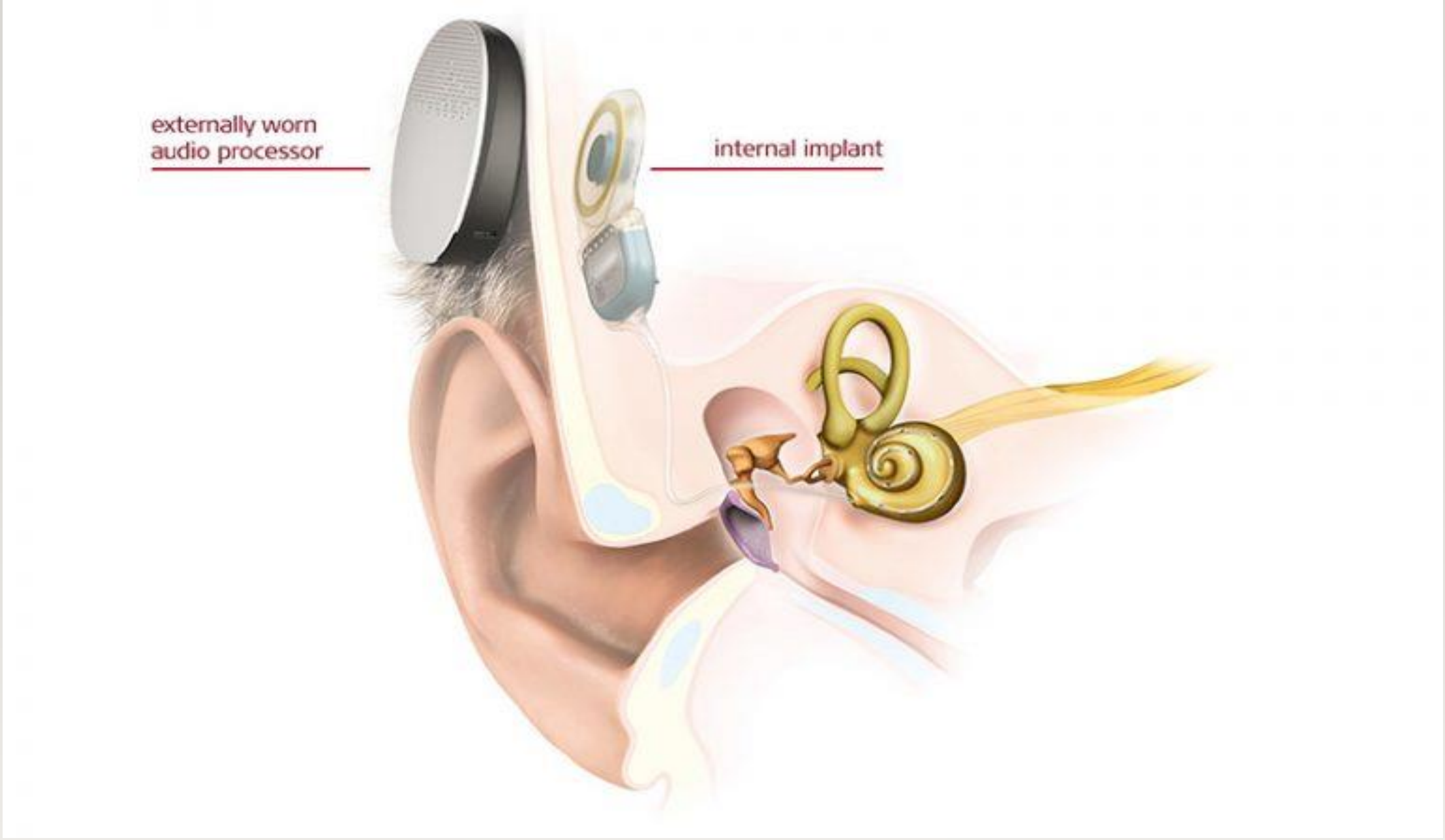
Charles Eyries

First single channel cochlear implant- 1957

Dr. Graeme Clark

First multi channel cochlear implant 1978




externally worn
audio processor
internal implant


SCIENCEphotoLIBRARY

Four Key Differences Between OTC and Prescription Hearing Instruments

- 1. Who is the intended patient?
- 2. Accessibility
- 3. Affordability
- 4. Level of consumer support.

Who is the intended patient?

- FDA- “individuals over the age of 18 with perceived mild to moderate hearing loss”
- Subject to several “Red Flag” conditions that disqualify their use
  - Including but not limited to:
    - Active pain or drainage from ears
    - Tinnitus
    - Asymmetrical hearing loss
    - A sudden change in hearing thresholds, tinnitus of vertigo.

Accessibility

Online-Retail

- Remove the involvement of hearing professional
  - Decisions regarding:
    - Design
      - Form factor
      - Acoustic coupling
    - Training and support
      - Usage
      - Care
      - Bluetooth connectivity

Affordability

- Price point
  - Several $100 to several $1000
  - Insurance considerations
- Sacrifices
  - Customized programming
  - Verification and validations
  - Ongoing support

Level of Customer Support

- Follow up scheduling
- Consistency
- Relationship

Thank You

DAVID BOLLINGER

CLEARSOUND HEARING. LLC

573-556-8700