



Bootcamp Special-- Electroacoustic Stimulation of the Human Auditory System

June 24, 2023

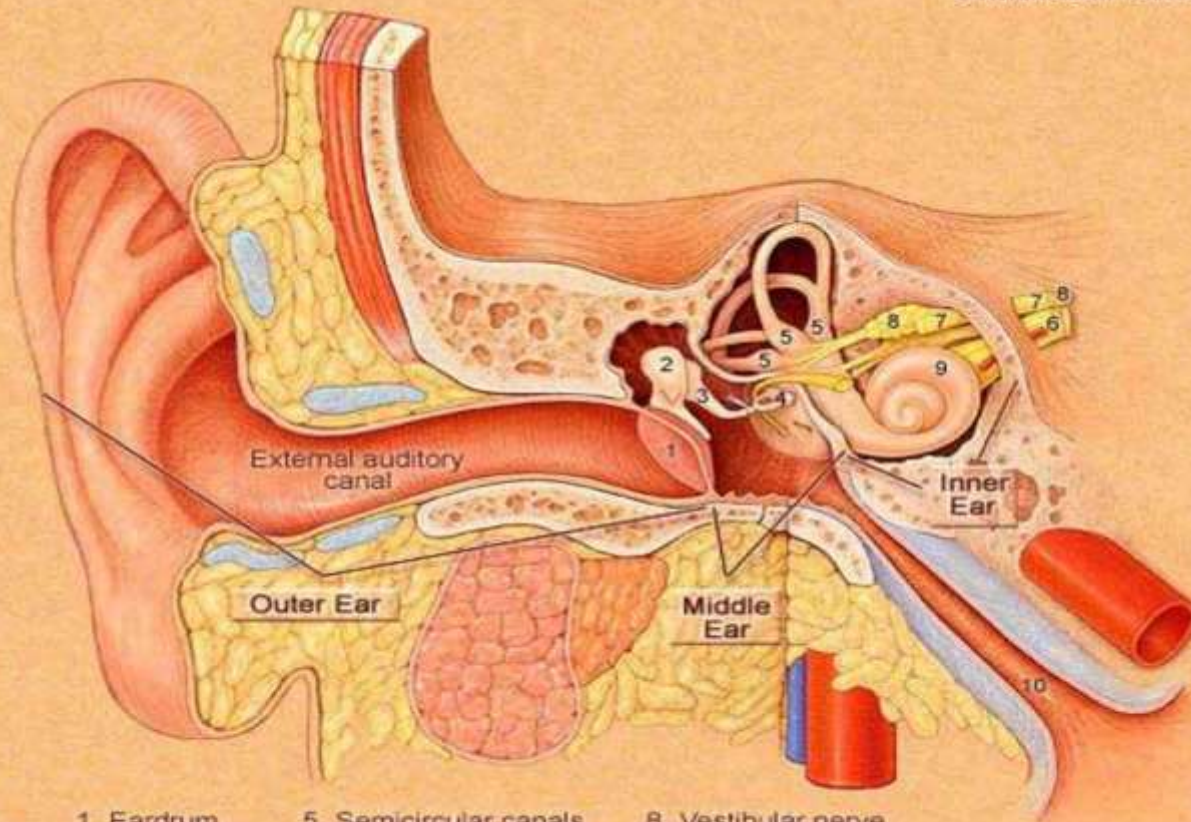


ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

WHAT ARE YOU DOING TO/FOR YOUR PATIENT?



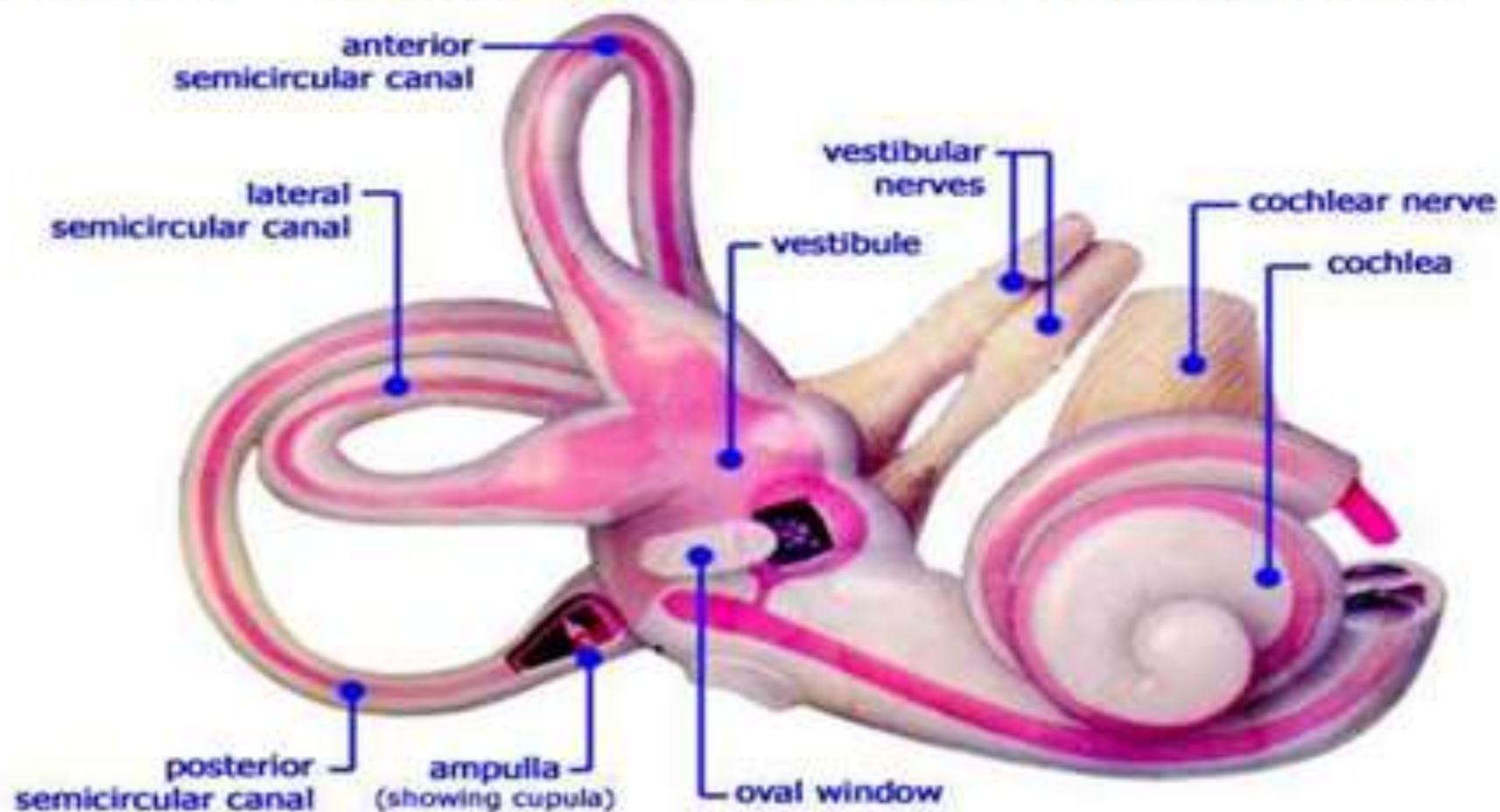
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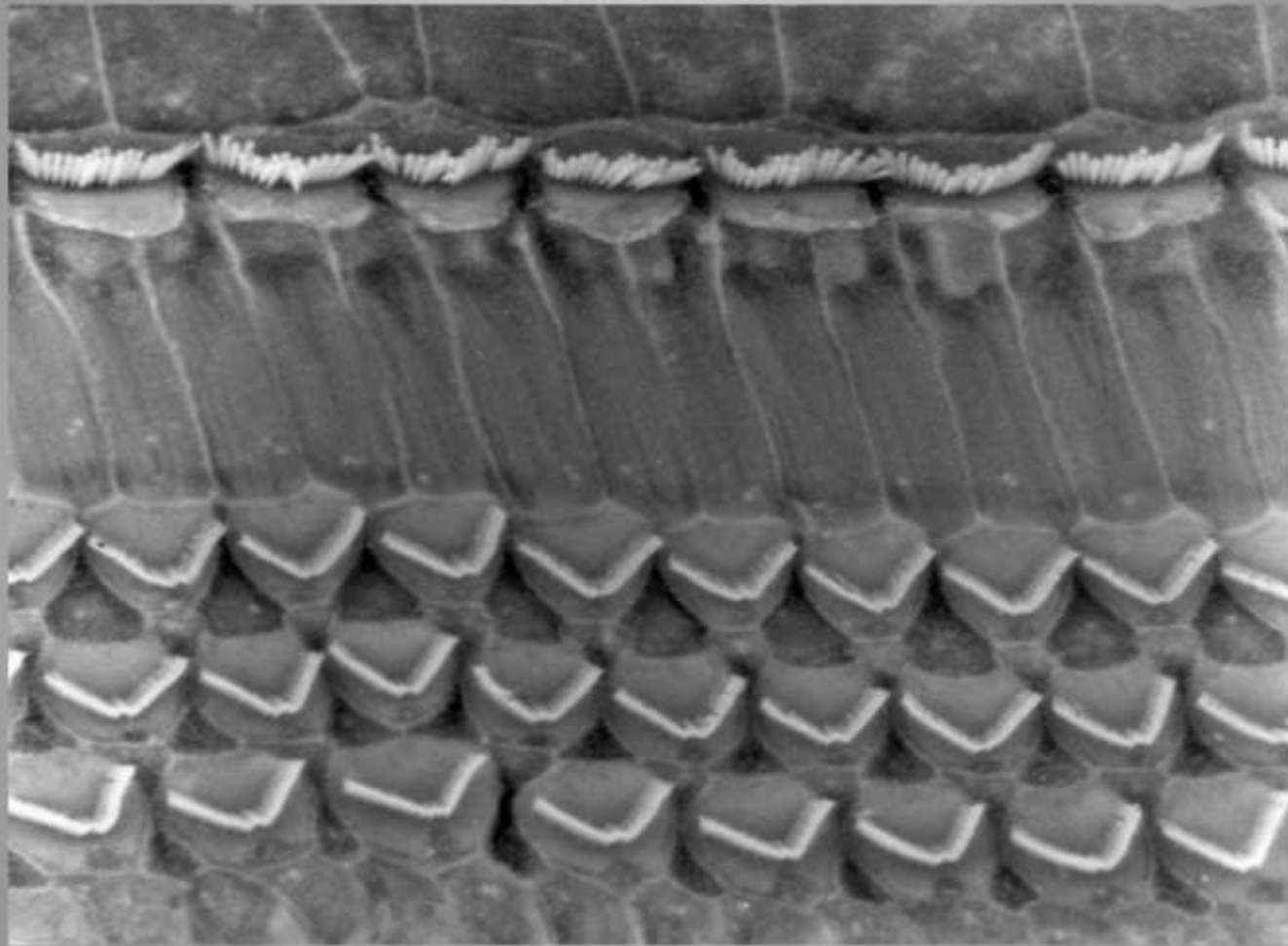


- | | | |
|------------|------------------------|---------------------|
| 1. Eardrum | 5. Semicircular canals | 8. Vestibular nerve |
| 2. Malleus | 6. Auditory nerve | 9. Cochlea |
| 3. Incus | 7. Facial Nerve | 10. Eustachian tube |
| 4. Stapes | | |

ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

Cochlea—dispensing professionals “playground”





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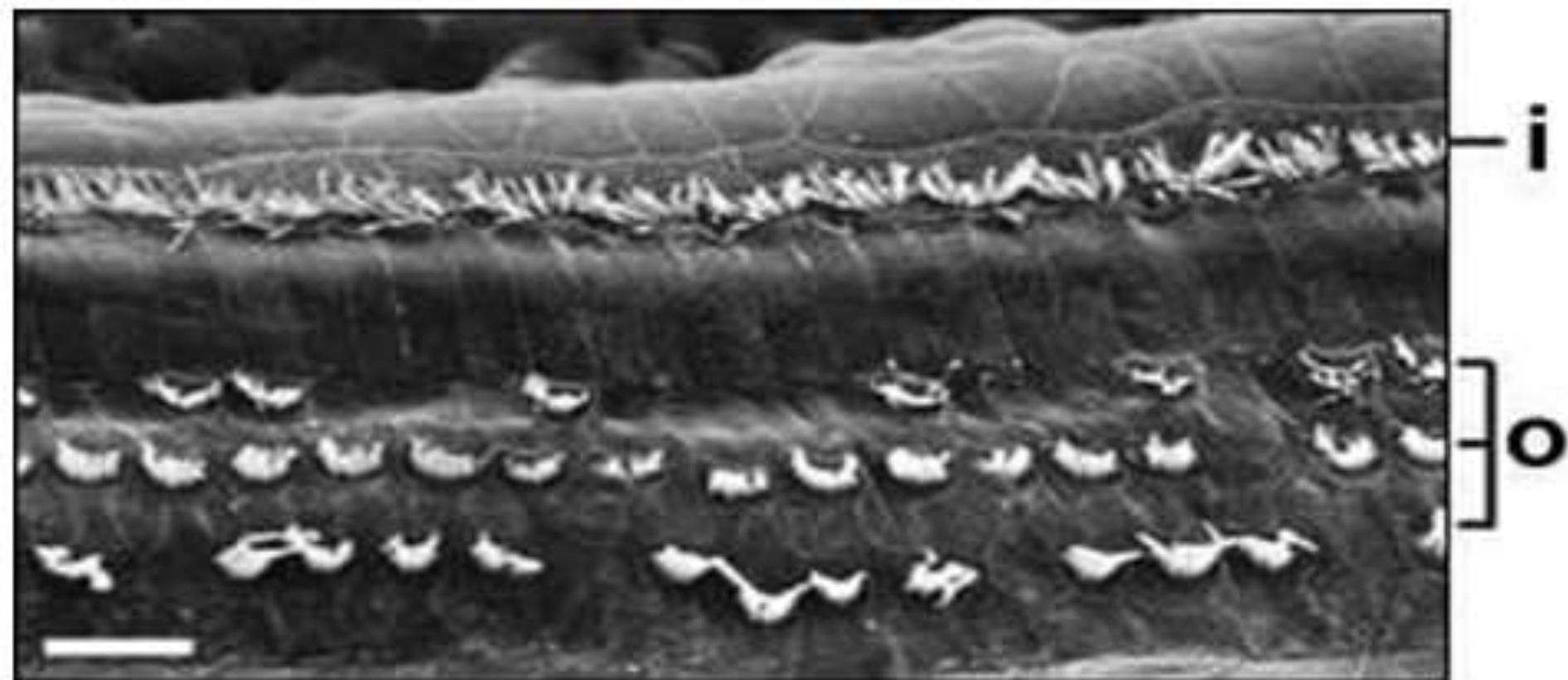
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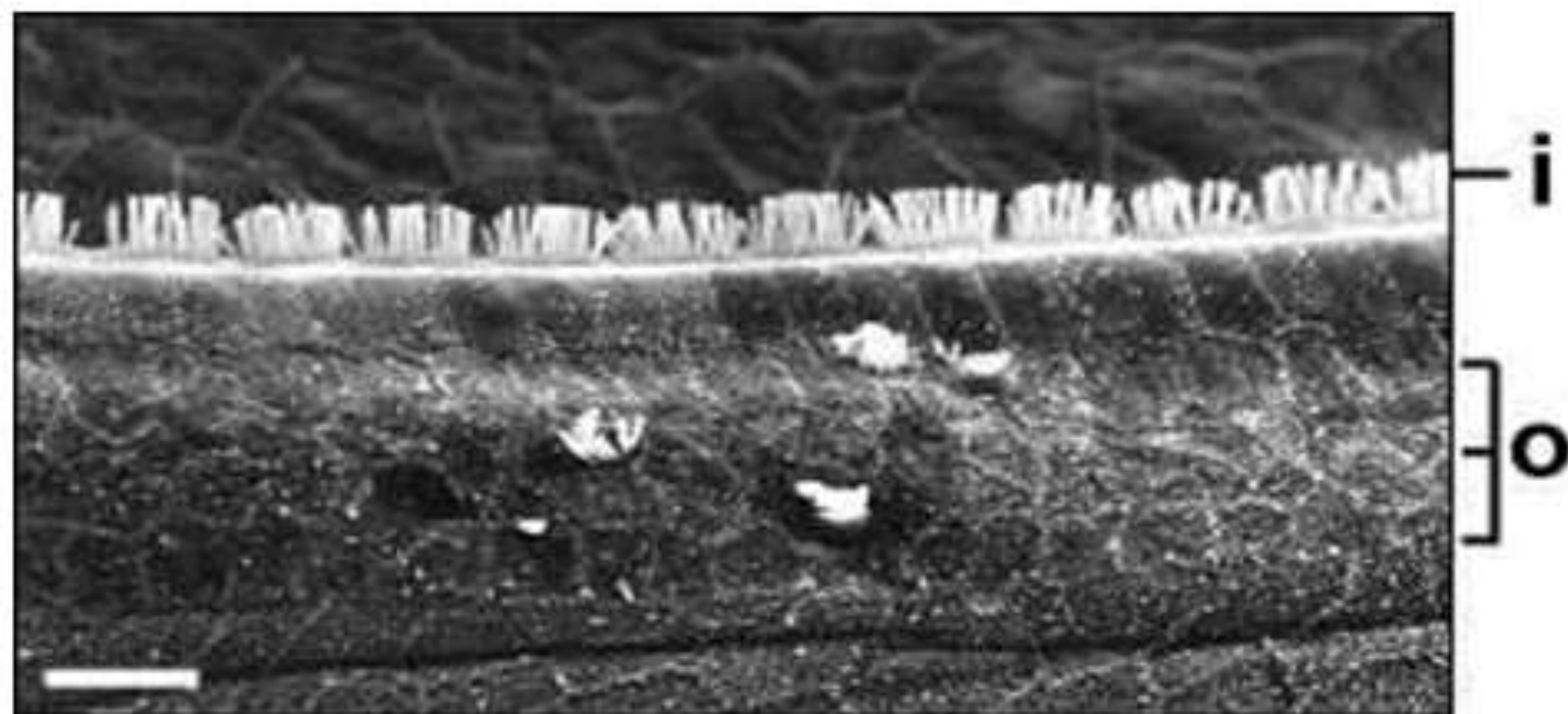
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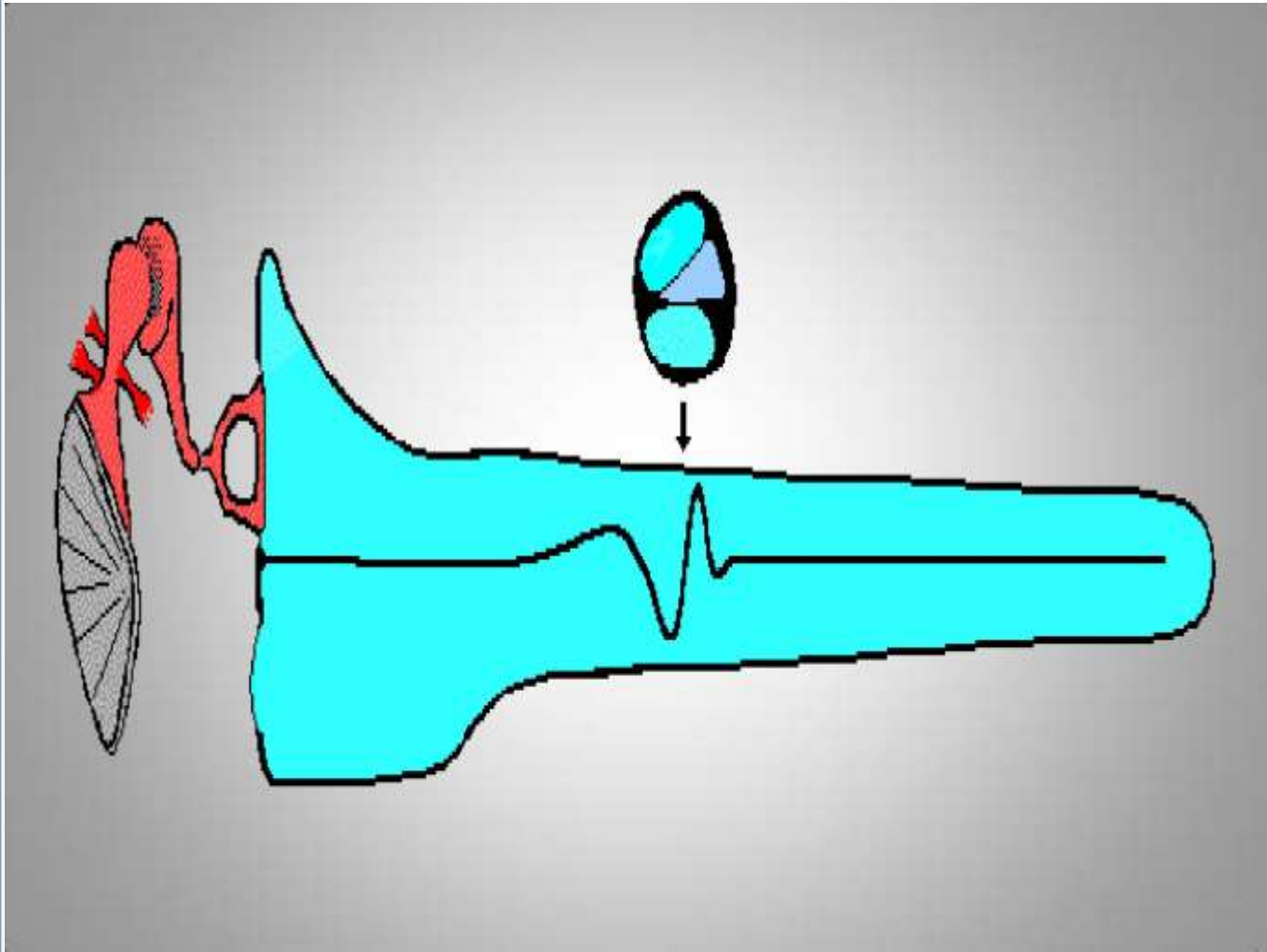
Three rows of outer hair cells create bio-amplification opportunity

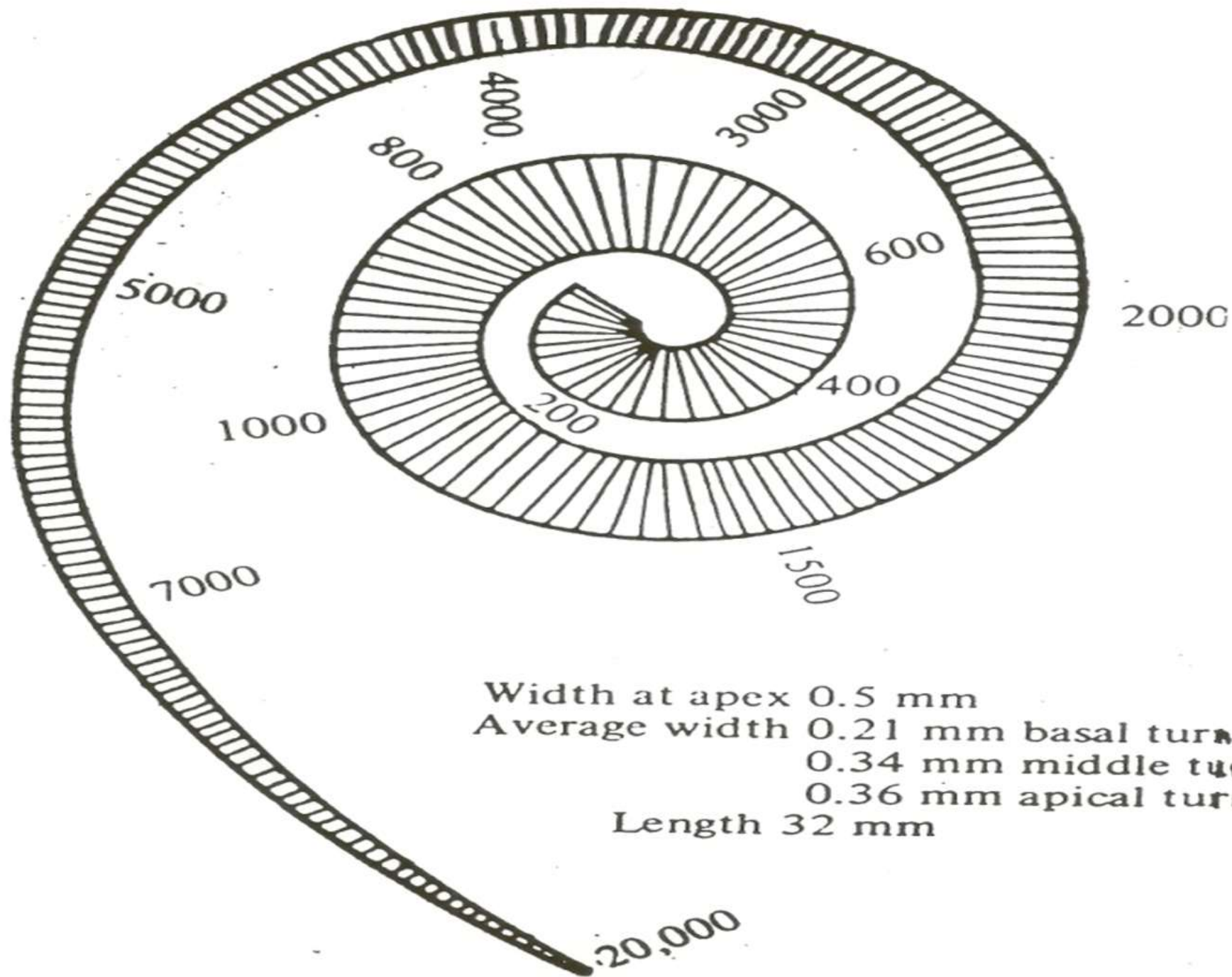


ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

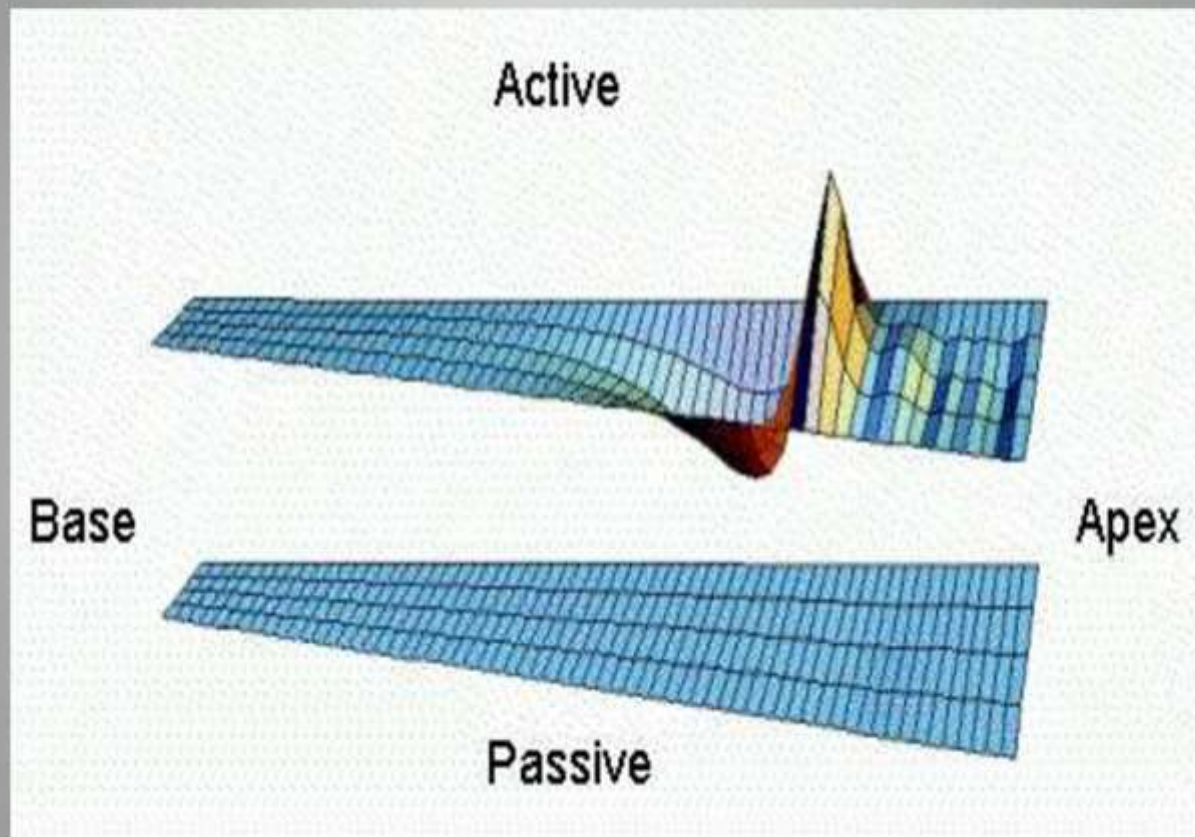
Reduced outer hair cell presence creates
reduced bio-amplification i.e. hearing loss.

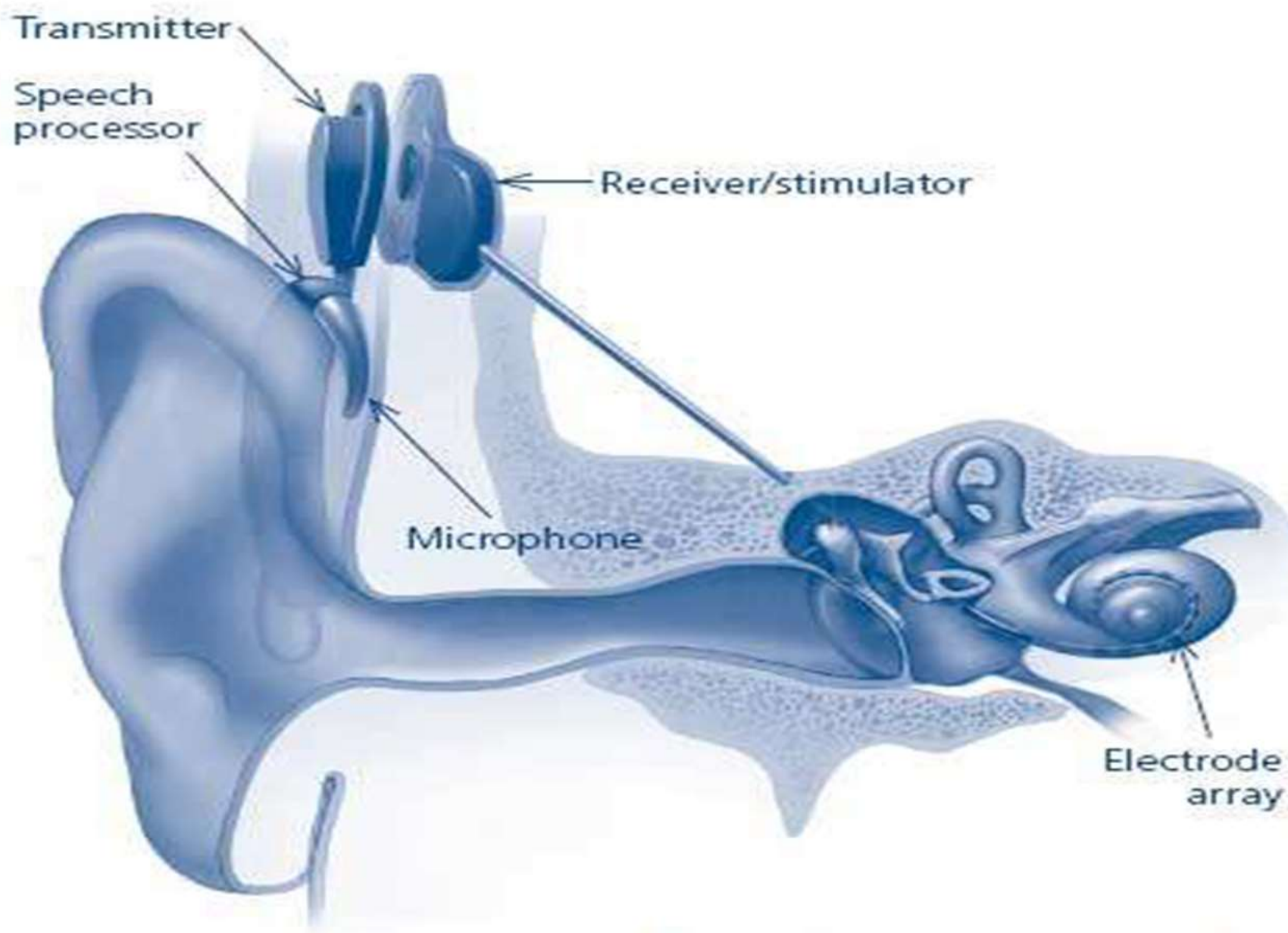






Width at apex 0.5 mm
Average width 0.21 mm basal turn
0.34 mm middle turn
0.36 mm apical turn
Length 32 mm



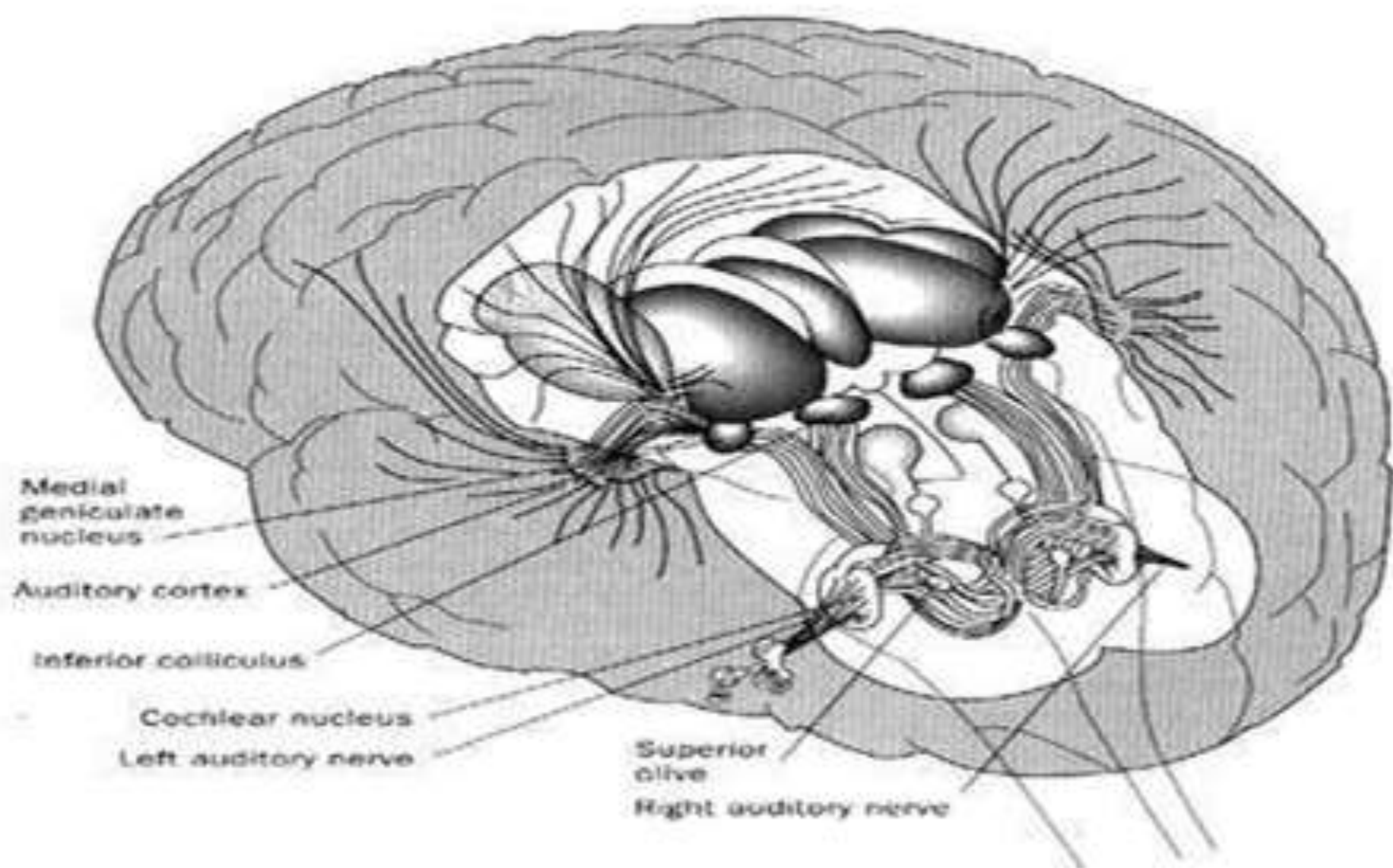


Ear with cochlear implant

Cochlear Implants



ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM



ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

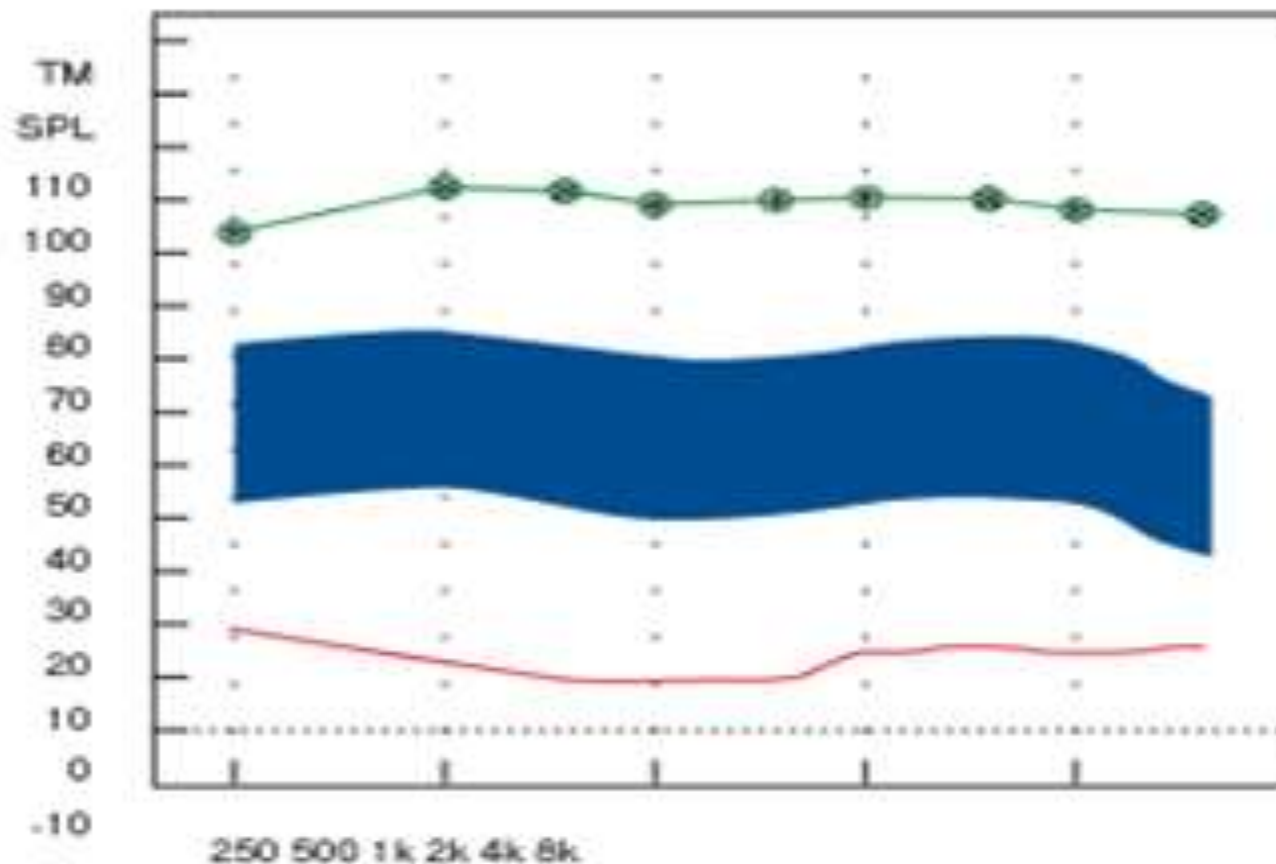


Figure #1

ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

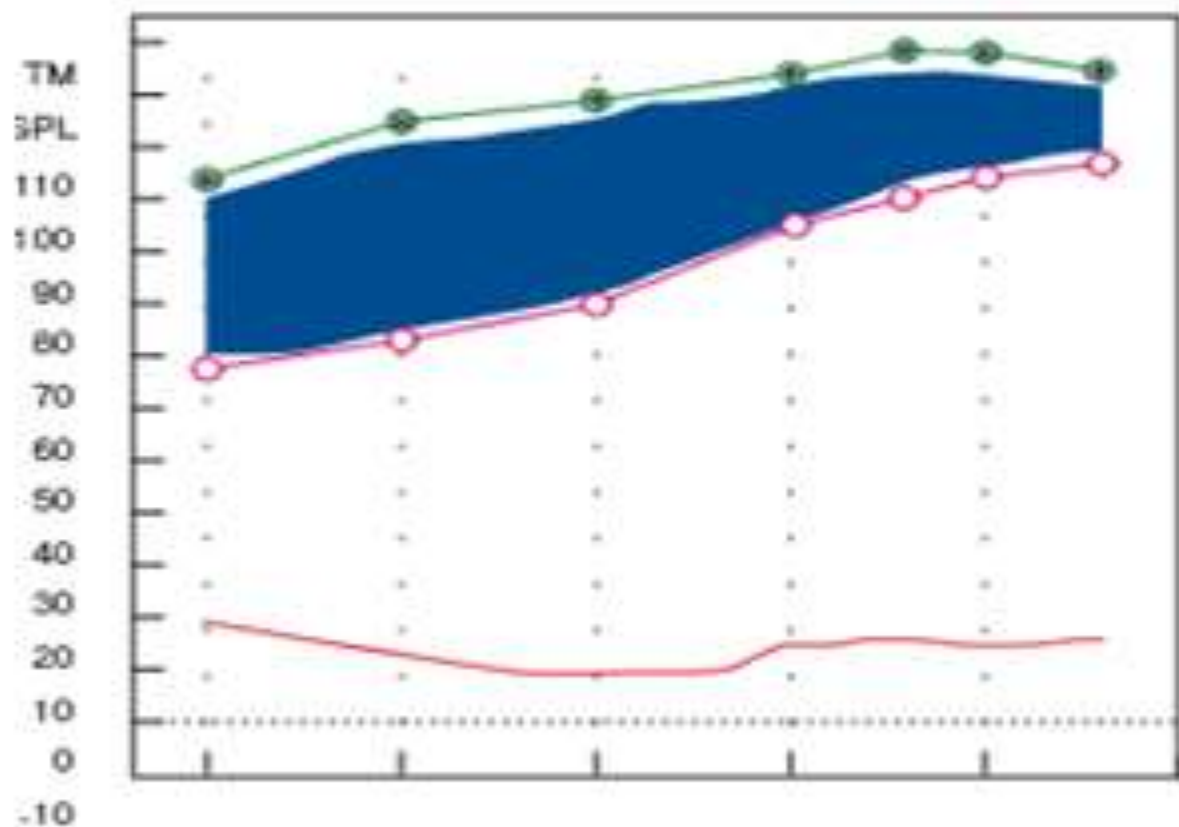


Figure #4

ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

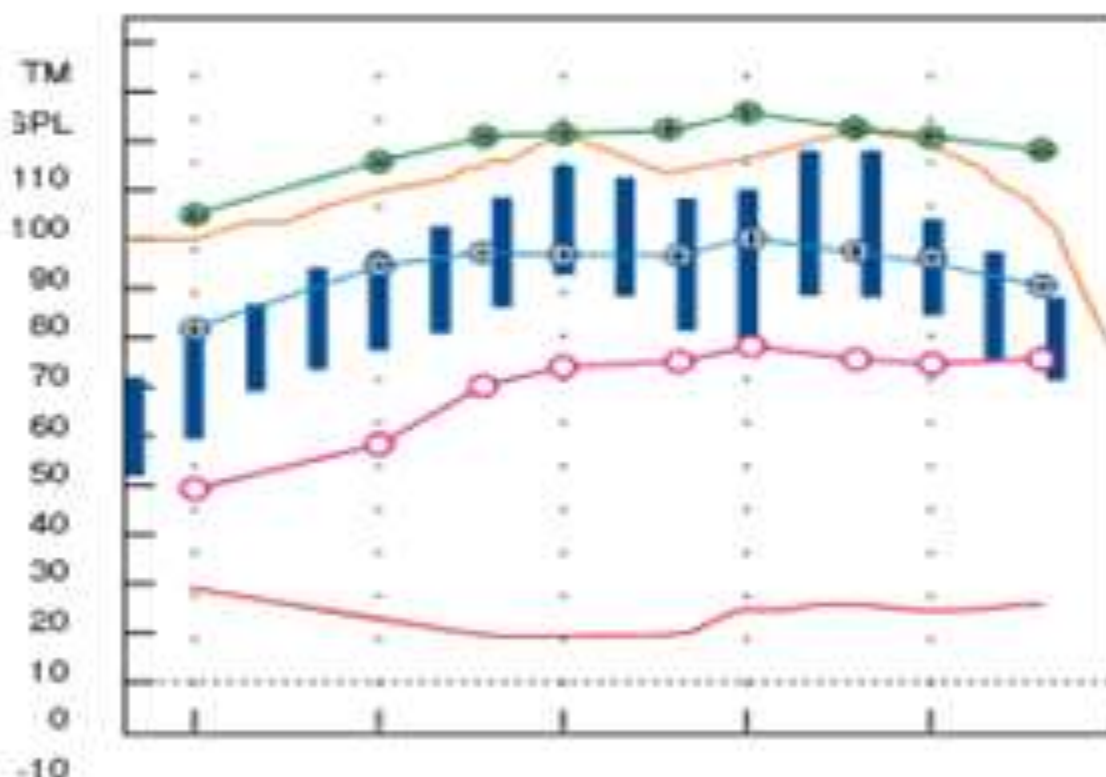


Figure #3

ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

QUIKSIN

QuikSin scores reveal SNR ability.

SNR Loss	Degree of SNR Loss	EXPECTED IMPROVEMENT W/ DIR. MICS
0 - 2 dB	Normal/near normal	May hear better than normal ears hear in noise.
2 - 7 dB	Mild SNR Loss	May hear almost as well as normal ears hear in noise.
7 - 15 dB	Moderate SNR Loss	Directional microphones help. Consider array mic. /8+ channels
> 15 dB	Severe SNR Loss	Maximum SNR improvement is needed. Consider FM system.

Note: Thresholds 40 dB HL and better, set volume at 70 dB HL

Thresholds worse than 40 dB HL, set at MCL + 5 dB HL

Etymotic Research QuickSIN

PATIENT: _____ EXAMINER: _____

First Presentation: _____ Second Presentation: _____

TRACK 9 RIGHT LEFT BOTH _____ dB HL

LIST 7:

Post-Score

Pre-Score

1. The <u>kite dipped</u> and <u>swayed</u> , but <u>stayed aloft</u> .	S/N 25	_____	_____
2. The <u>beetle droned</u> in the <u>hot June sun</u> .	S/N 20	_____	_____
3. The <u>theft</u> of the <u>pearl pin</u> was <u>kept secret</u> .	S/N 15	_____	_____
4. His <u>wide grin</u> <u>earned many friends</u> .	S/N 10	_____	_____
5. <u>Hurdle</u> the <u>pit</u> with the <u>aid</u> of a <u>long pole</u> .	S/N 5	_____	_____
6. <u>Peep under</u> the <u>tent</u> and <u>see</u> the <u>clown</u> .	S/N 0	_____	_____
25.5 – TOTAL = _____ SNR Loss	TOTAL	_____	_____

TRACK 10 RIGHT LEFT BOTH _____ dB HL

LIST 8:

Post-Score

Pre-Score

1. The <u>sun came</u> up to <u>light</u> the <u>eastern sky</u> .	S/N 25	_____	_____
2. The <u>stale smell</u> of <u>old beer</u> <u>lingers</u> .	S/N 20	_____	_____
3. The <u>desk</u> was <u>firm on</u> the <u>shaky floor</u> .	S/N 15	_____	_____
4. A <u>list</u> of <u>names</u> is <u>carved around</u> the <u>base</u> .	S/N 10	_____	_____
5. The <u>news struck</u> <u>doubt</u> into <u>restless minds</u> .	S/N 5	_____	_____
6. The <u>sand drifts</u> <u>over</u> the <u>sill</u> of the old <u>house</u> .	S/N 0	_____	_____
25.5 – TOTAL = _____ SNR Loss	TOTAL	_____	_____

TRACK 11 RIGHT LEFT BOTH _____ dB HL -L _____ dB HL -R

		Name: _____	Date: _____		
			presentation levels		
			HL	HL	HL
Signal To Noise Ratio (SNR)	Degree of Hearing In Noise Ability	Expected Communication In Noise with Directional Microphone Technology	Right Ear SNR	Left Ear SNR	Both Ears SNR
0-2 dB	Normal/near normal	May hear better than normal ears in noise.			
2-7 dB	Mild SNR Loss	May hear almost as well as normal ears hear in noise.			
7-15 dB	Moderate SNR Loss	Directional microphones help. Consider ear to ear mics /8+ channels			
>15	Severe SNR Loss	Maximum SNR improvement is needed. Consider Direct Audio Input system.			
Comments:					

ELECTROACOUSTIC STIMULATION OF THE HUMAN AUDITORY SYSTEM

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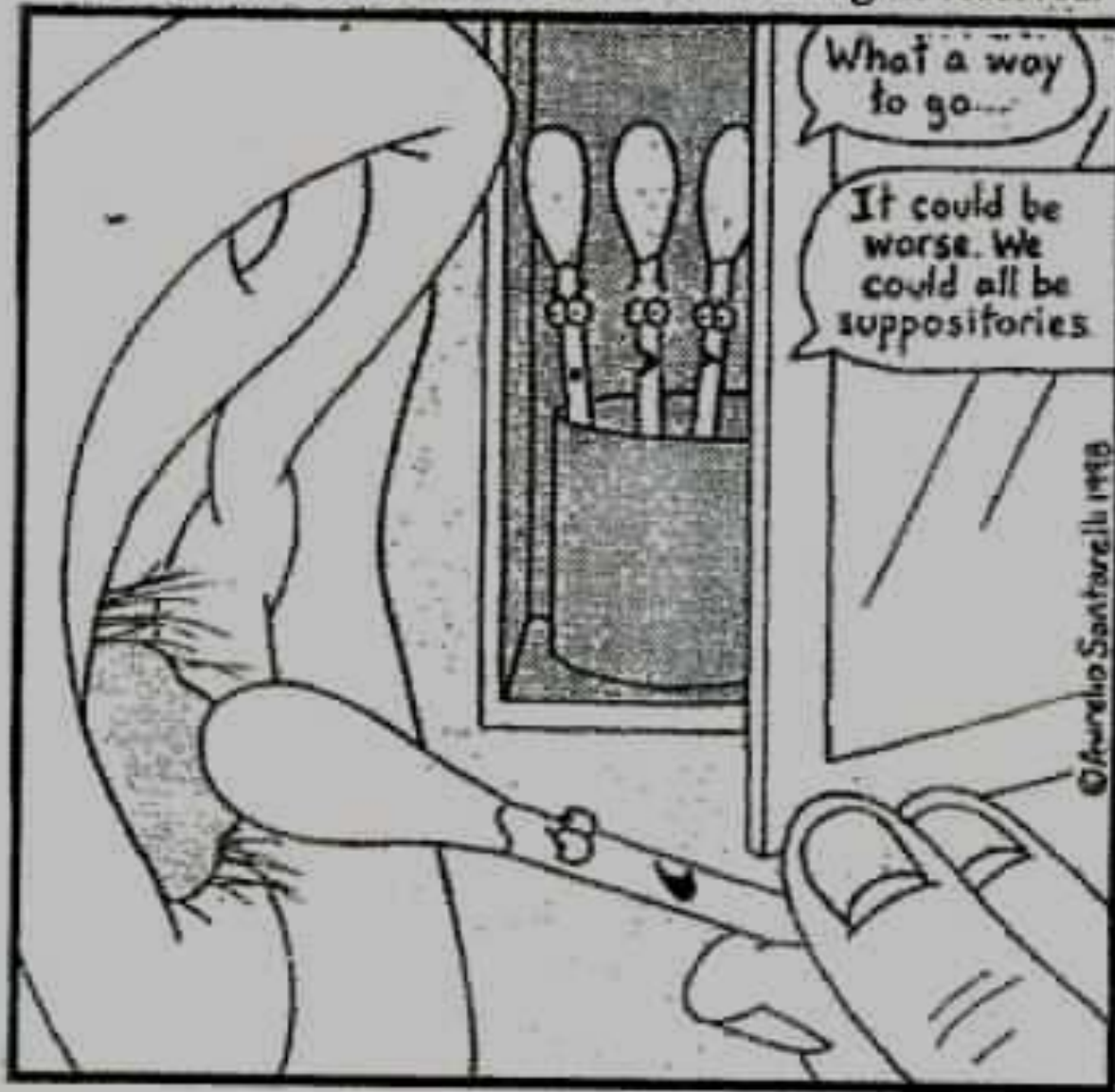
"It's a special hearing aid. It filters out criticism and amplifies compliments."

Normal Tympanic Membrane



3.16.98

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Q-tip horrifice

Unraveling the Mystery Surrounding Hearing Health Care and Hearing Aids



COGNITIVE DECLINE

Those with hearing loss experience a **30-40% GREATER DECLINE** in thinking abilities compared to those without hearing loss.

TINNITUS

90% OF PEOPLE WITH TINNITUS ALSO HAVE HEARING LOSS.

Tinnitus affects **1 in 5 people**. Tinnitus can be caused by hearing loss, an ear injury or a circulatory system disorder.



DEPRESSION

Uncorrected hearing loss gives rise to **poorer quality of life**, isolation and reduced social activity, leading to depression.

SAFETY/BALANCE

PEOPLE WITH MILD HEARING LOSS (25dB) ARE

3 TIMES

more likely to have a history of falling. Every additional 10 decibels of hearing loss increases the chance of falling by 1.4 times.

HYPERTENSION

THERE IS A SIGNIFICANT ASSOCIATION BETWEEN HIGH BLOOD PRESSURE AND HEARING LOSS.

Hypertension can be an accelerating factor of hearing loss in older adults.



OBESITY

HIGHER BODY MASS INDEX (BMI) AND LARGER WAIST CIRCUMFERENCE ARE ASSOCIATED WITH INCREASED RISK OF HEARING LOSS IN WOMEN.



OSTEOPOROSIS



A study linked osteoporosis and hearing loss, theorizing that demineralization of the three middle ear bones may contribute to a conductive hearing impairment.

ISOLATION

ADULTS 50 YEARS AND OLDER

with untreated hearing loss are more likely to report depression, anxiety, anger and frustration, emotional instability and paranoia than those who wear hearing aids.

TOTAL BODY HEALTH
BETTER HEARING HEALTH
BEGINS WITH

EYE HEALTH



VISION HELPS YOU IDENTIFY WHERE A SOUND IS COMING FROM.

If you have vision and hearing loss, your ability to target sound location is compromised. The amplification from hearing aids helps compensate for the vision loss.



HEART HEALTH

THE INNER EAR IS EXTREMELY SENSITIVE TO BLOOD FLOW.

Studies show that a healthy cardiovascular system – a person's heart, arteries and veins – has a positive effect on hearing. Inadequate blood flow and trauma to the blood vessels of the inner ear can contribute to hearing loss.



70% SMOKING

CURRENT SMOKERS HAVE A **70% HIGHER RISK** OF HAVING HEARING LOSS THAN NONSMOKERS.

DIABETES

HEARING LOSS IS **TWICE AS COMMON** IN PEOPLE WITH DIABETES COMPARED TO THOSE WITHOUT.

Adults whose blood glucose is higher than normal but not high enough for a diabetes diagnosis, have a **30% higher rate** of hearing loss compared to those with normal blood sugar.

OTOTOXICITY

THERE ARE MORE THAN **200 MEDICATIONS** ON THE MARKET TODAY THAT ARE KNOWN TO CAUSE HEARING LOSS (TOXIC TO THE EARS).

The list of known ototoxic drugs includes:

- Aspirin
- Quinine
- Water pills
- Certain antibiotics
- Some anticonvulsant drugs
- Some anesthetics
- Environmental chemicals like carbon monoxide, lead and mercury

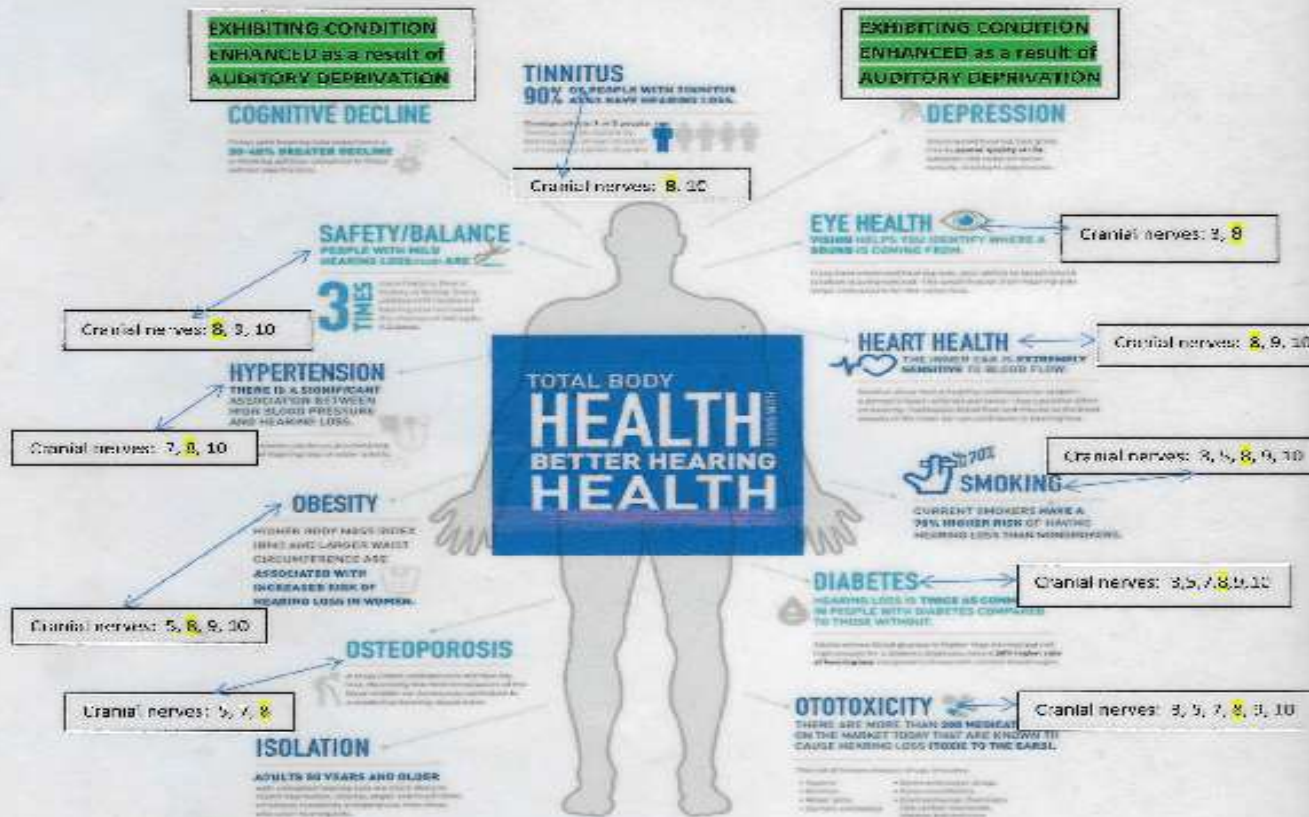


LIVE

INSTRUCTOR WORKSHOPS



AUDITORY STIMULATION & HEARING INSTRUMENT WEAR—CRANIAL INNERVATION



EXHIBITING CONDITION ENHANCED as a result of AUDITORY DEPRIVATION

THIRD CRANIAL NERVE = OCULAR MOTOR REFLEX

FIFTH CRANIAL NERVE = TENSOR TYMPANI MUSCLE

SEVENTH CRANIAL NERVE = STAPEDIAL MUSCLE

EIGHTH CRANIAL NERVE = VESTIBULAR/COCHLEAR NERVE

NINTH CRANIAL NERVE = EUSTACHIAN TUBE & MUCOUSAL LININGS

TENTH CRANIAL NERVE = VARIOUS BRANCHES OF THE VAGUS NERVE

Physician Partnership

Hearing Health Provider

- Suspected Hearing Loss
- Tinnitus
- Hearing Aid Requests
- Hearing protection Ed
- Measure Hearing Ability
- Sudden Behavior Change

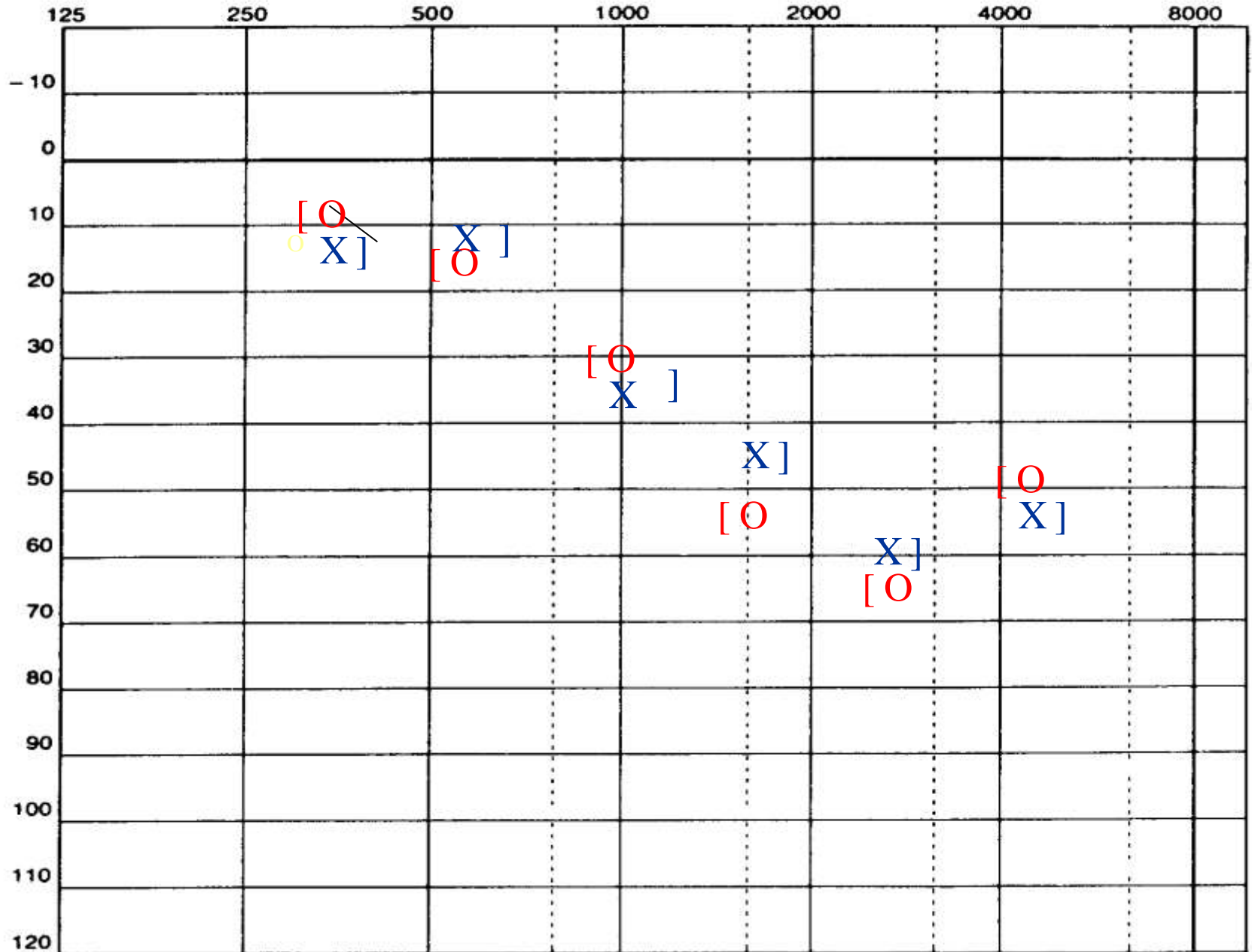
Physician

- Dizziness/Vertigo
- Sudden Hearing Loss
- Chronic Ear Infections
- Otalgia
- Ear Canal Discharge
- Suspected Tumor
- Ear “Fullness”
- Medications Review

PURE TONE AUDIOGRAM

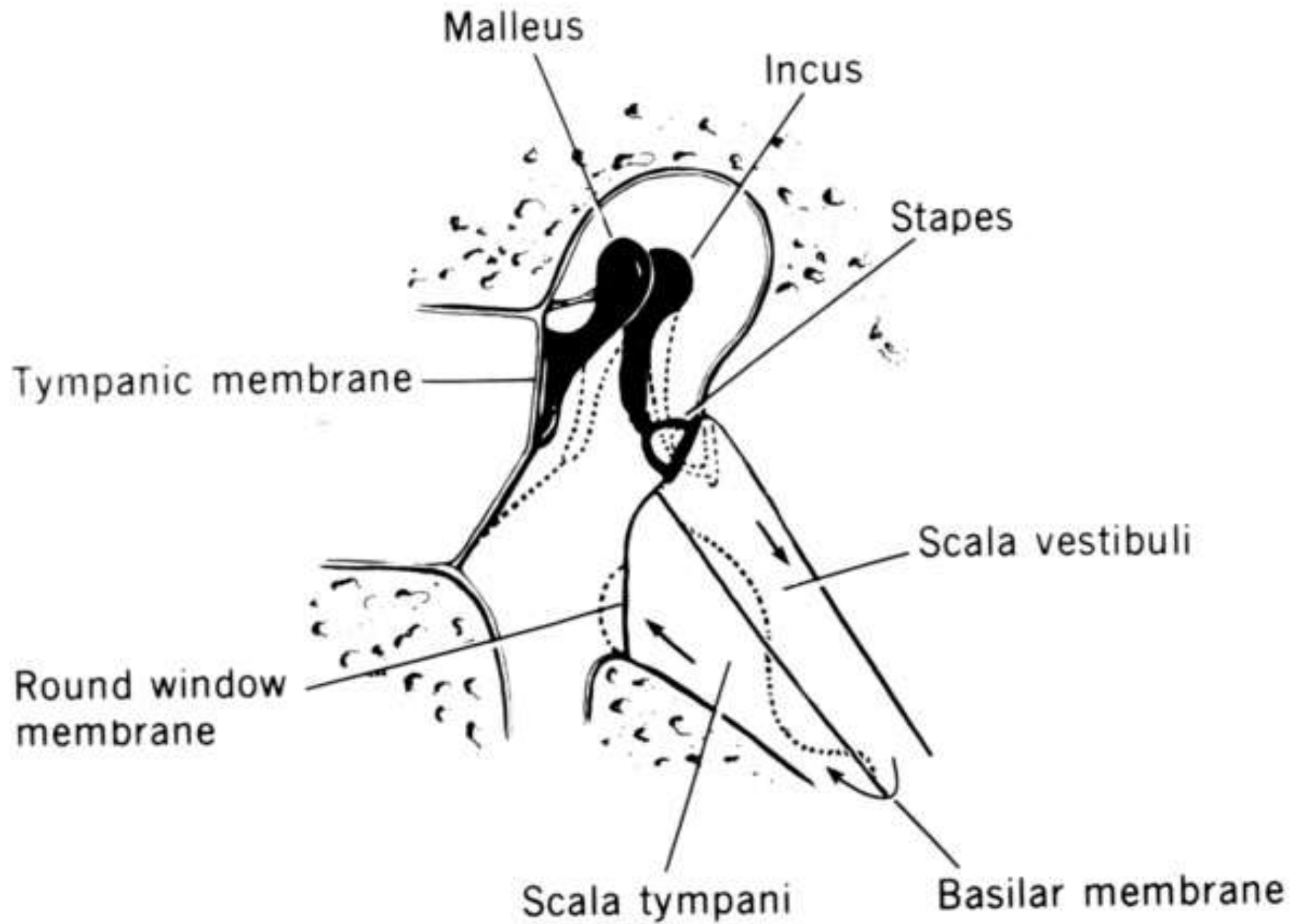
FREQUENCY IN HERTZ

HEARING LEVEL IN DECIBELS (dB)

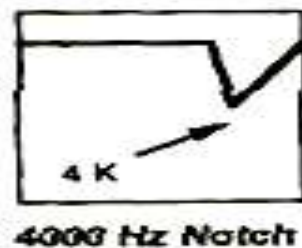
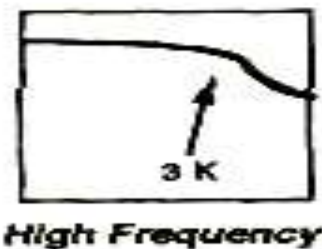
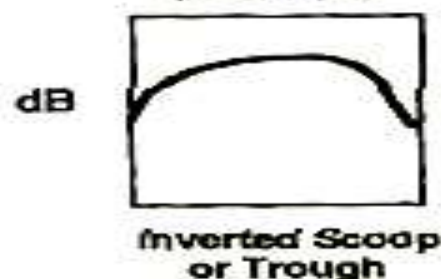
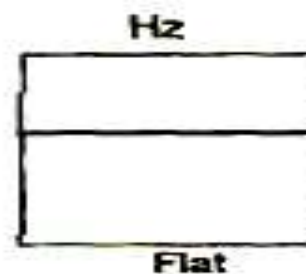
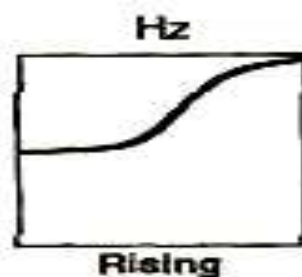
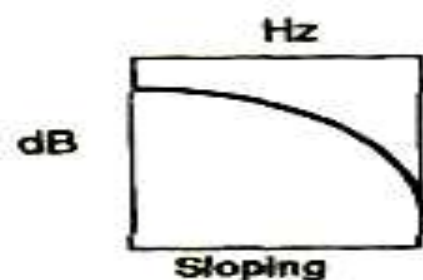


Degrees of Hearing Impairment

- **Suprathreshold Acuity:** -10 dB to -5 dB
- **Normal Acuity:** 0 dB to 20 dB
- **Slight Impairment:** 25 dB
- **Mild Impairment:** 30 dB to 45 dB
- **Moderate Impairment:** 50 dB to 60 dB
- **Moderately Severe Impairment:** 65 dB
- **Severe Impairment:** 70 dB to 90 dB
- **Profound Impairment:** 95 dB to 120 dB



Different configurations are often associated with different causes of hearing loss or etiologies.



A NEW PARADIGM

MEASURE THE PATIENT'S
HEARING ABILITY

*THIS APPROACH RESULTS IN MORE SUCCESSFUL
HEARING AID USE OUTCOMES AND GREATER
PATIENT SATISFACTION!*

AUDIOGRAM OF FAMILIAR SOUNDS

FREQUENCY IN CYCLES PER SECOND (HZ)

125

250

500

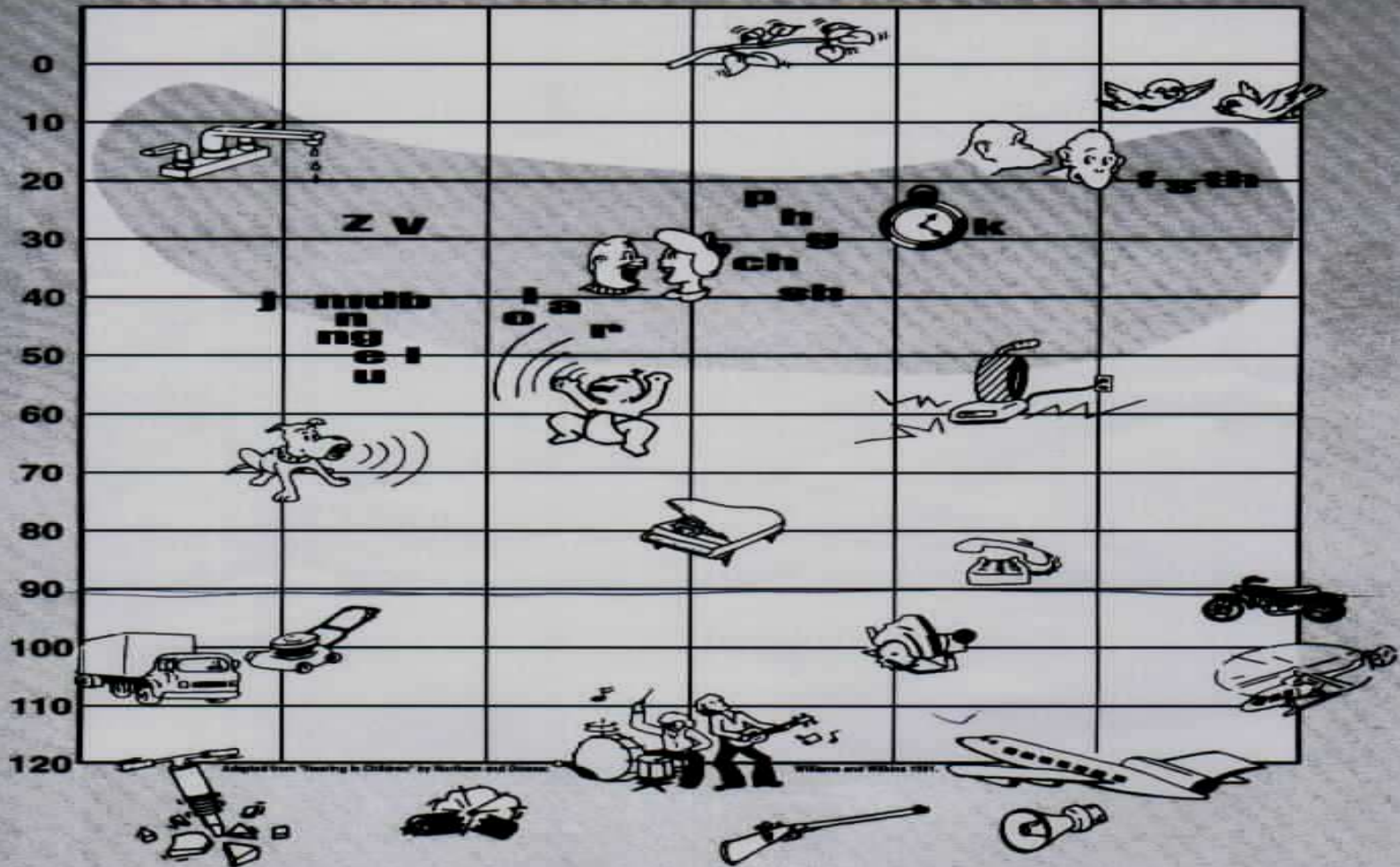
1000

2000

4000

8000

HEARING LEVEL IN DECIBELS (dB)



**AMERICAN
ACADEMY OF
AUDIOLOGY**

A NEW PARADIGM

- Measure LDL's by frequency
- 500Hz, 1000Hz, 2000Hz, 3000Hz, 4000Hz
- Place this information upon your recently created threshold audiogram.

You have now created a “window” for your patient's remaining hearing ability.

Their residual dynamic range of **hearing ability**

FREQUENCY IN HERTZ

FREQUENCY IN HERTZ

8000

120

HEARING LEVEL IN DECIBELS (dB)

Styles of Amplification

- Behind-the-ear
- Open-Fit over-the-ear
- Receiver-in-the-canal
- Full-Shell in-the-ear
- In-the-canal
- Completely-in-the-canal
- Invisible in-the-canal
- Wireless Cros/BiCros Aids
- Body Aid
- Bone Conduction Aid
- Cochlear Implants
- Bone Conduction Implants
- Middle Ear Implants
- Brainstem Implants



BTE



ITE



HS



ITC



MC*



CIC



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"It's a special hearing aid. It filters out criticism and amplifies compliments."

Implantable Hearing Aids



Other Handy Uses For Madonna's Old Bras No.13

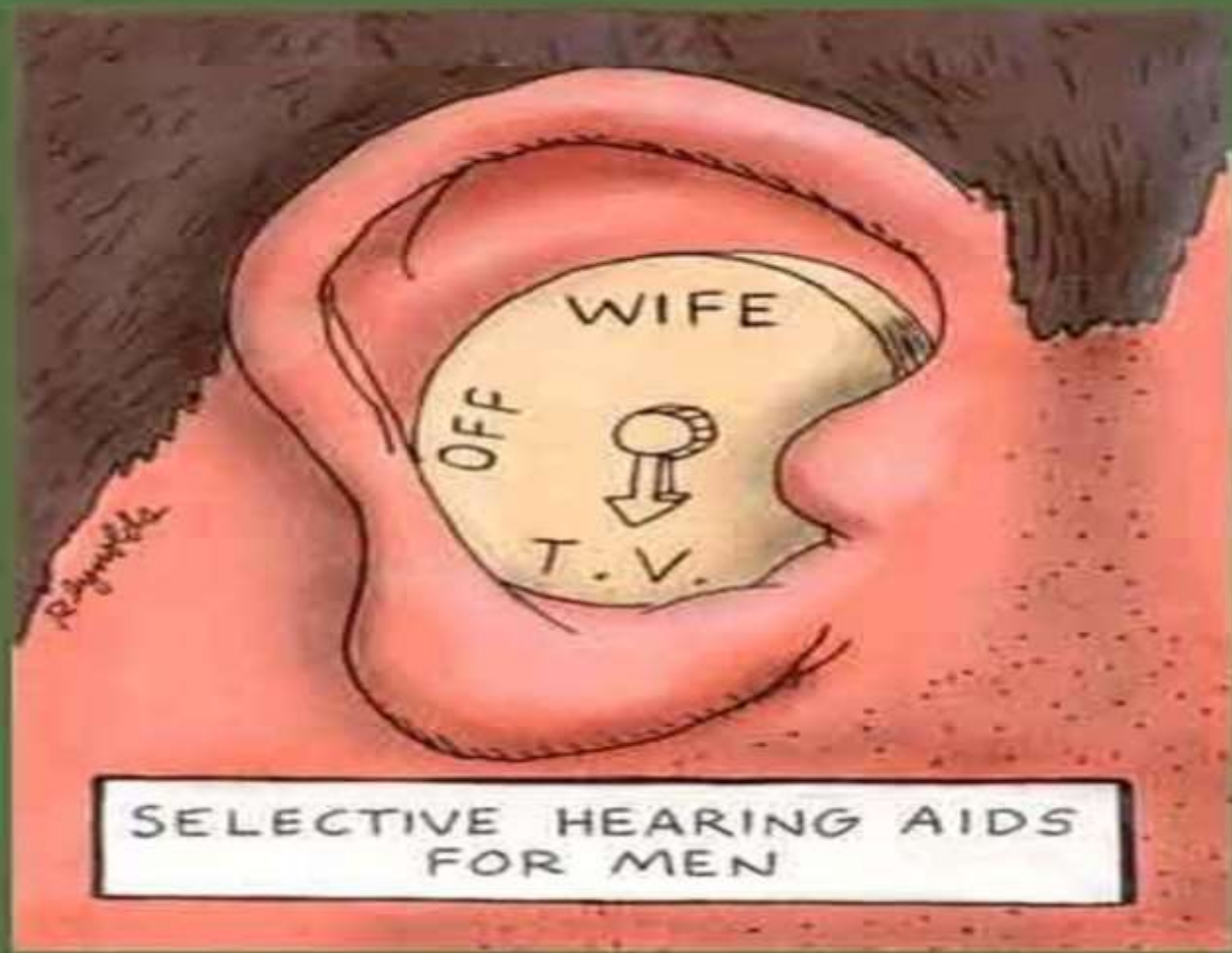
CARTOONS BY GIBBLEGUTS.COM



Low Budget Hearing Aid

Assistive Listening Devices

- Amplified Telephones and Caption Call
- Smoke Detectors/Carbon Monoxide Detectors
- Baby Monitors
- Alerting Devices (phone ringer & door knocker)
- Alarm Clocks and Watches
- Infrared Light Systems
- Sound field Amplifiers
- Sound field and Personal FM systems
- Amplified Stethoscopes
- Tele-coils
- Closed Captioning



Hearing Aid Accessories

- DriAid Kit/Dehumidifier
- Earmold Air Blower
- Battery Tester
- Disinfectant Spray/Wipes
- Battery Caddy
- Cleaning Tools
- Magnets
- Wax Guards
- SuperSeals/Hearing Aid Sweatbands
- Eargene
- Miracell
- Otoease
- Otoclips
- Wax Guards
- JodiVac/Waxman 2000

Hearing Aids

- Many levels of available features
- Multiple Channels, Multiple Bands, Multiple Memories
- Noise Suppression Algorithms
- Ear-to-Ear performance integration
- Feedback Management/Cancellation/Interception
- Automatic Directional Microphones
- Fully Automatic Volume Control and Tele-coil
- Often switch listening programs based upon environmental input
- Cost \$900 to \$3100 each

Ear Protection

- Earplugs
 - Pre-molded, formable, custom molded, and semi-insert
- Earmuffs
- Helmets
- Electronic Custom Made Earplugs

Noise Induced Hearing Impairment

- Most often occurs in industry and the military
- Also occurs from power tools, loud music, racing, hunting, explosions, motorcycles, etc.
- Begins as a selective loss at 4000 Hz (noise notch)
- As noise exposure continues the notch widens to other high frequencies
- Initially seen as threshold shift with tinnitus
- Permanent versus Temporary
- Occupational noise limits are designed and enforced by OSHA
- Best prevention is ear protection and limiting exposure

Table 1-1. Combinations of noise exposure levels and durations that no worker exposure shall equal or exceed

Exposure level, <i>L</i> (dBA)	Duration, <i>T</i>			Exposure level, <i>L</i> (dBA)	Duration, <i>T</i>		
	Hours	Minutes	Seconds		Hours	Minutes	Seconds
80	25	24	—	106	—	3	45
81	20	10	—	107	—	2	59
82	16	—	—	108	—	2	22
83	12	42	—	109	—	1	53
84	10	5	—	110	—	1	29
85	8	—	—	111	—	1	11
86	6	—	—	—	—	—	56
87	5	115	—	—	28	—	45
88	4	116	—	—	22	—	35
89	3	117	—	—	18	—	28
90	2	—	—	—	—	—	22
91	2	118	—	—	14	—	18
92	1	—	—	—	—	—	14
93	1	119	—	—	11	—	11
94	1	120	—	—	9	—	9
95	—	47	37	121	—	—	7
96	—	37	48	122	—	—	6
97	—	30	—	123	—	—	4
98	—	23	49	124	—	—	3
99	—	18	59	125	—	—	3
100	—	15	—	126	—	—	2
101	—	11	54	127	—	—	1
102	—	9	27	128	—	—	1
103	—	7	30	129	—	—	1
104	—	5	57	130-140	—	—	<1
105	—	4	43	—	—	—	—

THANK YOU
ANY QUESTIONS?

