

HEARING AND AUDITORY PROCESSING

Devon Barnes

Director

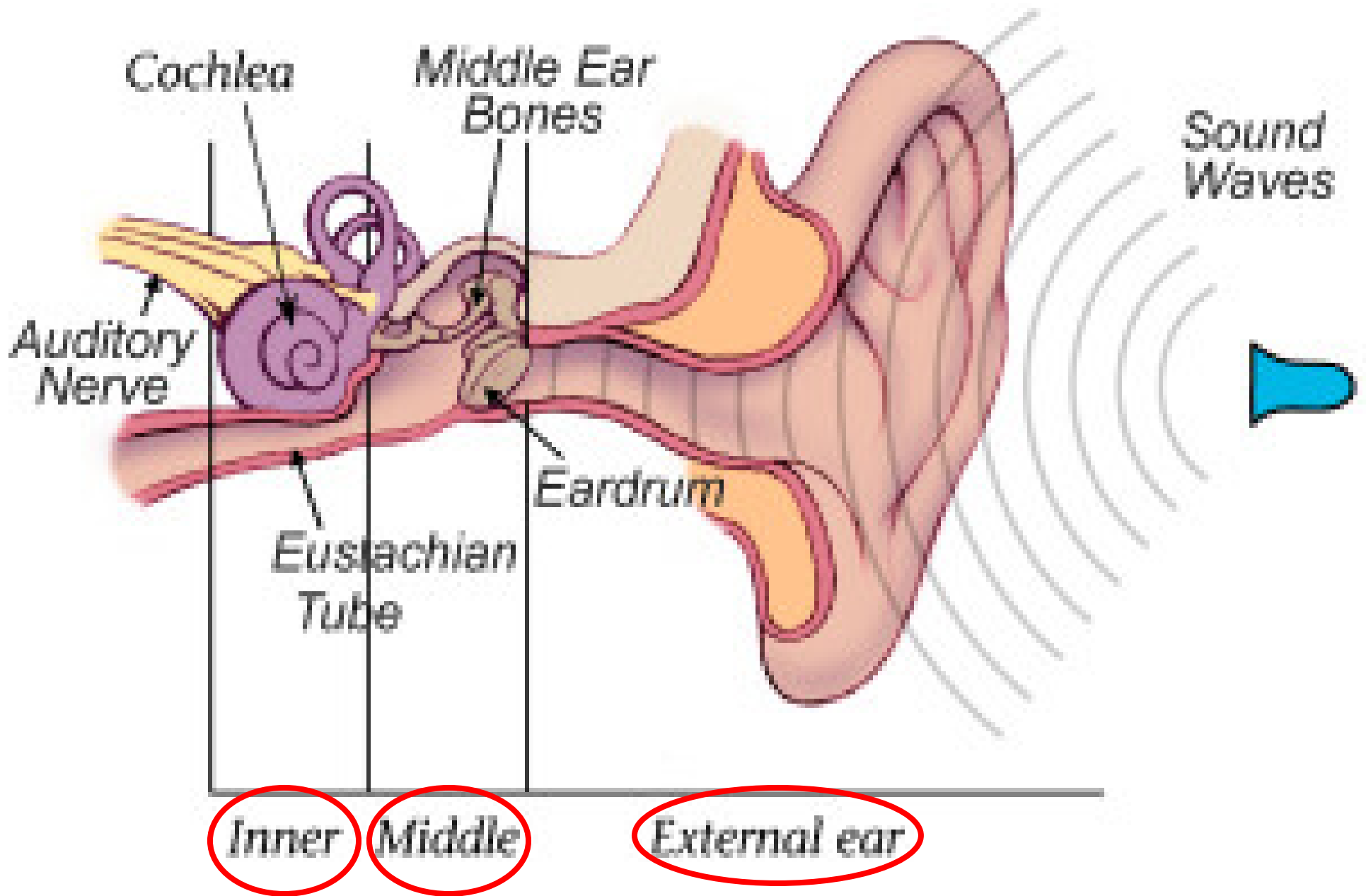
Lindfield Speech Pathology and Learning Centre

CONTENT

- × HEARING
- × AUDITORY PROCESSING
- × CAPD? ADHD? SLI?
- × ASSESSMENT
- × IMPLICATIONS FOR LEARNING
- × REMEDIATION

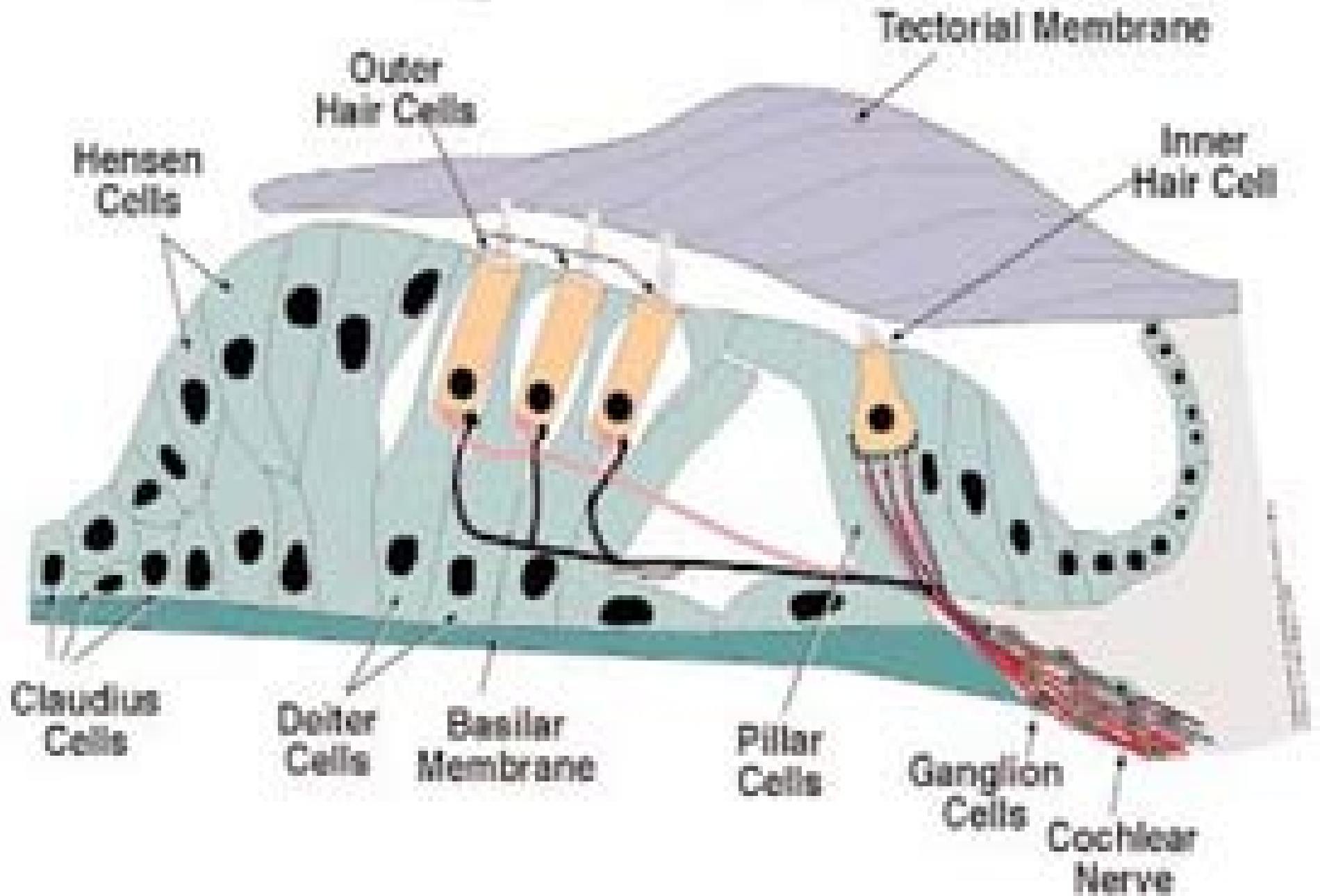
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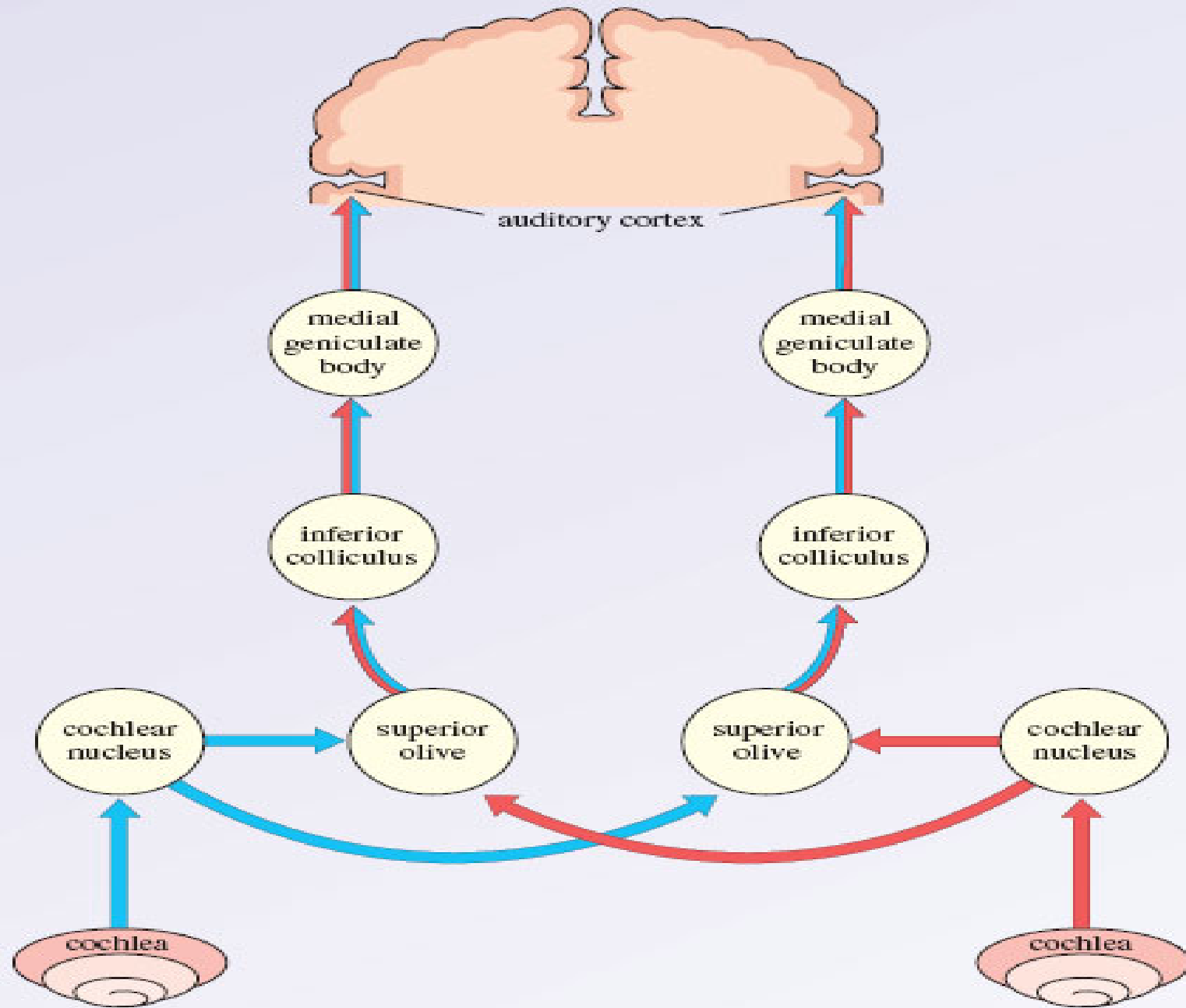
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Anatomy of the Ear

Organ of Corti





HEARING ACUITY

✘ INTENSITY- LOUDNESS (quiet – loud)

+ measured in Decibels (db)

✘ FREQUENCY-PITCH (low – high)

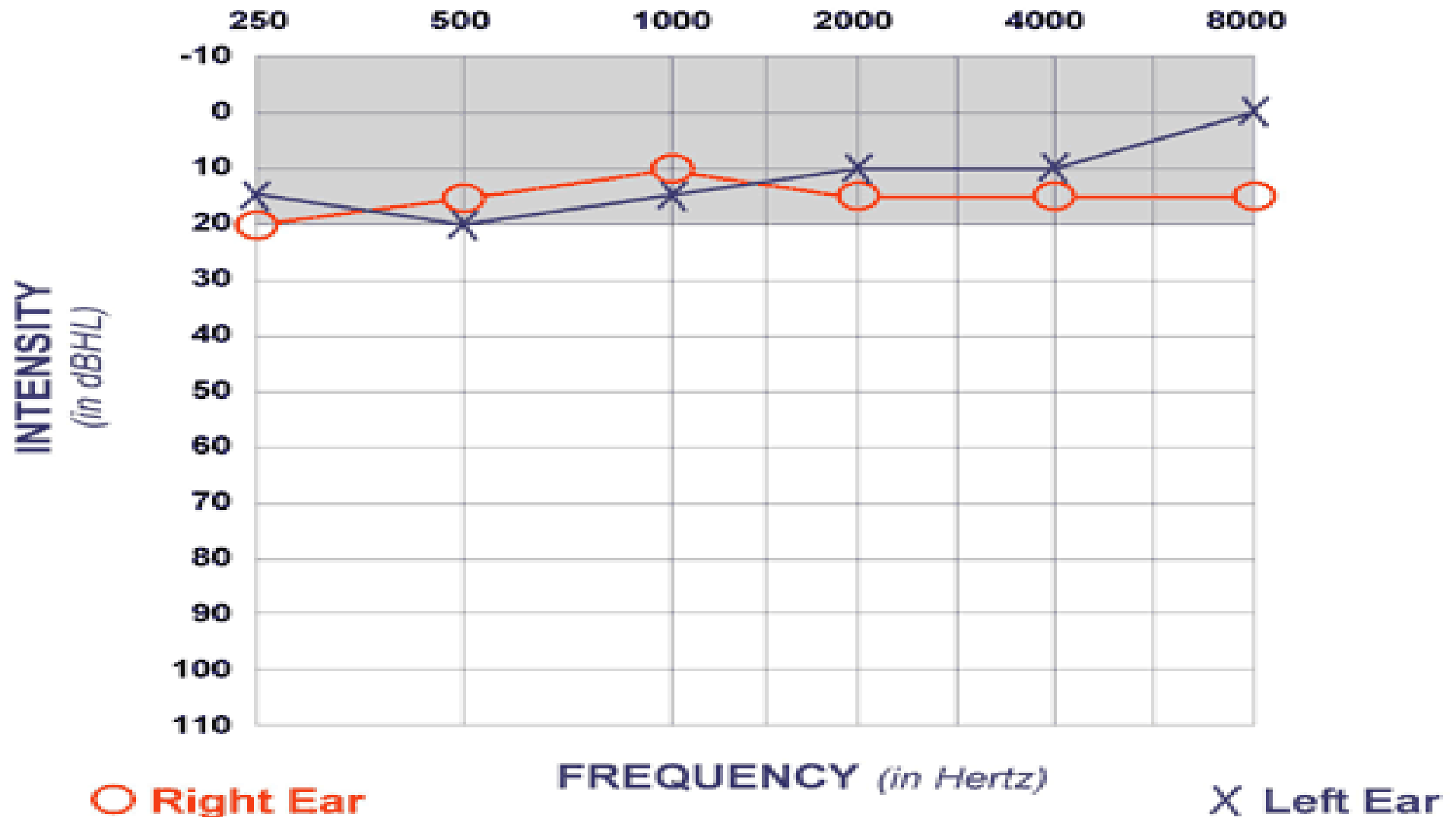
+ measured in Hertz (Hz)

TESTING HEARING

- × AUDIOGRAM
- × TYMPANOMETRY
- × ACOUSTIC REFLEX
- × ELECTROPHYSIOLOGICAL TESTS

HEARING ACUITY

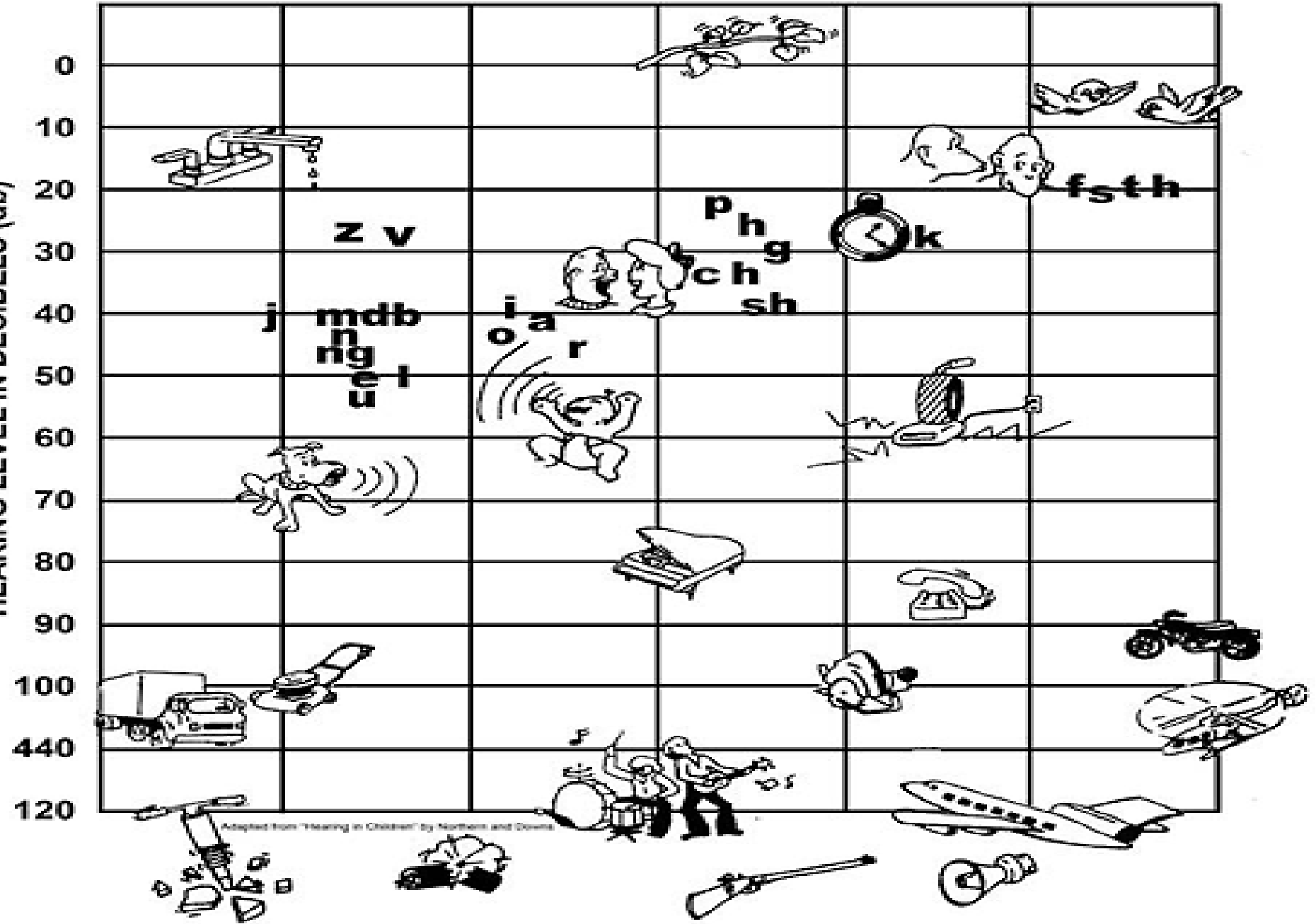
AUDIOGRAM INDICATING NORMAL HEARING



FREQUENCY IN CYCLES PER SECOND (HZ)

125 250 500 1000 2000 4000 8000

HEARING LEVEL IN DECIBELS (db)



Adapted from "Hearing in Children" by Norbert and Downs

MIDDLE EAR FUNCTION

- × TYMPANOMETRY

 - + measures middle ear pressure

- × ACOUSTIC REFLEXES

 - + measure stapedius muscle reaction

TESTING HEARING

- × ELECTROPHYSIOLOGICAL TESTS
- × OTOACOUTIC EMISSIONS
- × BRAIN STEM EVOKED RESPONSES

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AUDITORY PROCESSING

- ✗ WHAT THE BRAIN DOES WITH WHAT IT HEARS

AUDITORY PROCESSING DISORDER

- ✘ WHEN SOMETHING IS WRONG WITH
WHAT THE BRAIN DOES WITH WHAT IT
HEARS

AUDITORY PROCESSING

- ✘ Auditory discrimination (*same/different*)
- ✘ Auditory closure (*fill in missing bits*)
- ✘ Auditory pattern recognition
- ✘ Temporal aspects of audition (*timing*)
- ✘ Auditory localisation (*locate source of sound*)
- ✘ Auditory performance with degraded acoustic signal
- ✘ Auditory figure-ground (*perceiving sounds in background noise*)

APD BY WHAT WE SEE

- × Normal hearing acuity
- × Difficulty understanding verbal directions
- × Needs information to be repeated
- × Often says “what” or “huh”
- × Difficulty understanding speech in background noise
- × Suffers from auditory “overload” leading to
- × Distractibility / Inattentiveness
- × Very tired at end of school day
- × Academic underachievement and literacy difficulties

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DIFFERENTIAL DIAGNOSIS

- × APD/CAPD

- × ADHD

 - + ADHD-C(combined)

 - + ADHD-HI (predominantly hyperactive and impulsive)

 - + ADHD-PI (predominantly inattentive type)

- × SLI (Specific Language Impairment)

IS IT APD OR ADHD?

AUDITORY PROCESSING DISORDER?

OR

ATTENTION DEFICIT DISORDER?

APD/CAPD	ADHD-PI
Asks for things to be repeated	Inattention
Poor Listening skills	Academic Difficulties
Difficulty following oral instructions	Daydreams
Difficulty discriminating speech	Distracted
Difficulty hearing in background noise	Poor Listening Skills
Difficulty maintaining auditory attention in quiet	Disorganised
Academic difficulties	Asks for things to be repeated
Slow to process information	Auditory divided attention deficit

Chermak, Tucker, Seikel 2002

IS IT APD OR SLI?

AUDITORY PROCESSING DISORDER?

OR

SPECIFIC LANGUAGE IMPAIRMENT?

AUDITORY PROCESSING

- ✘ Behavioural manifestations of APD often appear as language comprehension disorders

IDENTIFICATION OF SLI

- ❖ Delayed or disordered language
- ❖ Poor comprehension
- ❖ Limited or use of unspecific vocabulary
- ❖ Poor grammar
- ❖ Difficulty with sentence formulation
- ❖ Poor pragmatic skills

AUDITORY PROCESSING DISORDER

- ✘ SPECIFIC TO PERCEPTION OF THE AUDITORY SIGNAL
- ✘ CAN CO-EXIST WITH ADHD, LANGUAGE IMPAIRMENT, ASPERGERS
- ✘ CAN UNDERLIE LANGUAGE AND LEARNING DIFFICULTIES

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DIAGNOSIS

- ✘ Only audiologists are qualified to diagnose APD
- ✘ However to diagnose accurately need to have background information:
 - + Cognition
 - + Behaviour
 - + Oral and Written Language

ASSESSMENT

- × Bottom-up
 - + Pathway mode
 - × Mechanisms and processes that occur in auditory system beyond the ear, along auditory pathway to auditory cortex

- × Top-down
 - + Functional assessment
 - × Receptive and expressive language
 - × Phonological awareness
 - × Literacy skills

ASSESSMENT TEAM

- ✘ Bottom-up

 - + Audiologist

- ✘ Top-down

 - + Speech Pathologist >>> oral and written language

 - + Psychologist >>> cognitive skills

 - + School Counsellor >>> academic skills

 - + Pediatrician >>> attention etc

AUDITORY PROCESSING ASSESSMENT

- ✘ General

- + Hearing Acuity
- + Middle ear function

- ✘ **APD assessment**

- + Screening
- + Questionnaires
- + Diagnostic

AUDIOLOGY ASSESSMENT FOR APD

Screening

SCAN-C

Questionnaires

Fishers, CHAPS

Diagnostic

dichotic tests

temporal patterning

auditory discrimination

integration tests



Hearing in background noise

Sound localisation

Separating competing signals

Auditory closure

(filling in gaps)

Detecting patterns

Temporal processing

SPEECH PATHOLOGY ASSESSMENT

- × Receptive and expressive language
- × Tests of vocabulary and word-finding
- × Phonological awareness and auditory processing skills
- × Literacy tests

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ASSESSMENT OF APD

Problems	Implications
Hearing in background noise	Coping in a noisy classroom
Sound localisation	Difficulty ignoring background noise
Separating competing signals	Following classroom discussions
Auditory closure- (filling in gaps)	

Problem	Implications
Detecting patterns	Understanding rhythm, stress and intonation
	Sentence types-questions v statements Don't touch that <i>book</i> . Don't touch <i>that</i> book.
	<i>Syllable stress</i> <i>Convict/convict, object/object</i>
	<i>Sarcasm: "That was smart!"</i>

ASSESSMENT OF APD

Problems	Implications
Temporal Processing Discrimination	<p>“Fuzzy phonological system”</p> <p>Problems with phonemic awareness</p> <p>Sequencing sounds & syllables for decoding and spelling</p> <p>Poor auditory discrimination</p> <ul style="list-style-type: none">❖ Sound and word discrimination❖ decoding, spelling, vocabulary❖ following instructions

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REMEDICATION

- × Environmental modifications
- × Compensatory Strategies
 - + Active Listening
 - + Linguistic Strategies
- × Direct Intervention
 - + Therapy specific to sub-profile
 - + Computer programs

REMEDICATION OF APD

- ✗ Environmental modifications
 - + Reduce ambient noise

 - + Preferential seating

 - + FM systems
 - ✗ Personal
 - ✗ Sound field

 - + Frequent checks for comprehension

REDUCE NOISE

- ❖ CARPET
- ❖ RUBBER TIPS ON CHAIRS
- ❖ CLOTH AND MAT POSTER BOARDS
- ❖ AWAY FROM SOURCES OF NOISE
 - ❖ FANS
 - ❖ CORRIDORS
 - ❖ OUTSIDE TRAFFIC

PREFERENTIAL SEATING

- ✘ FACE TEACHER
- ✘ AWAY FROM NOISE
- ✘ STRUCTURED SETTING RATHER THAN OPEN CLASSROOM

REMEDICATION OF APD

- × Environmental modifications
 - + Reduce ambient noise

 - + Preferential seating

 - + **FM systems**
 - × Sound field
 - × Personal





SOAPS

- S = Subject (general topic, ideas, content)
- O = Occasion (time, place, current situation)
- A = Audience (who is article directed to)
- P = Purpose (what is behind article) [Describe]
- S = Source (where did you find it)

Quality

TERM



COMPENSATORY STRATEGIES

- ✘ ACTIVE LISTENING
- ✘ CHECKS FOR COMPREHENSION
- ✘ MULTISENSORY INSTRUCTION
- ✘ MNEMONIC DEVICES TO ASSIST MEMORY

REMEDIATION

- ❖ Direct Intervention
 - ❖ Therapy specific to deficits
- ❖ Computer programs
 - ❖ Earobics
 - ❖ Fast ForWord

REMEDIATION

- ❖ Direct Intervention
 - ❖ Therapy specific to deficits
 - × Auditory training
 - × Speech in noise
 - × Phonological awareness
 - × Language therapy

REMEDIATION

- ❖ Computer programs
 - ❖ Earobics
 - ❖ Fast ForWord

MORE INFORMATION?

Audiological Society of Australia
03 9416 4606

National Acoustic Laboratory Research
Sharon.Cameron@nal.gov.au

Devon Barnes
devon@lindfieldspeech.com.au

REFERENCES

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“Like Sound Through Water” Karen J Foli

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in the Educational Setting” Teri James Bellis

“Central Auditory Processing Disorders” Jack Katz with Masters
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