

Ototoxicity Monitoring

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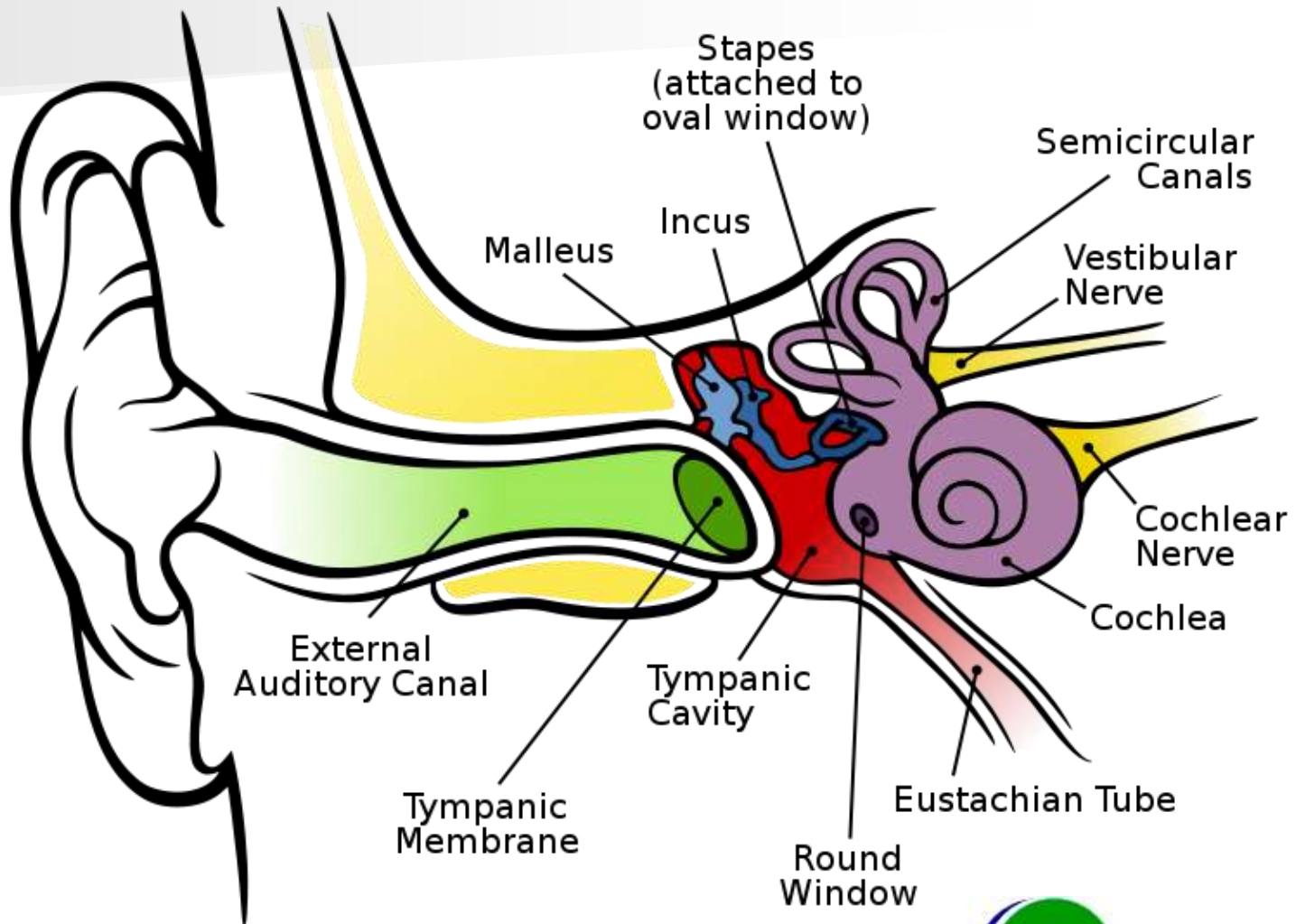
Doctor of Audiology

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Agenda

- Background
- Antineoplastic ototoxicity monitoring
- Case study
- Company overview

Gross Anatomy of the Ear



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The ear converts...

- Sound into neural impulses that can be recognized by the brain
- Movements of the head & orientation with respect to gravity into neural impulses that can be used by the brain to maintain balance

Ototoxicity

- Some chemicals have a harmful effect on...
 - Hearing (cochleotoxicity)
 - Balance (vestibulotoxicity)
- Risk factors include advanced age, renal impairment, genetic predisposition, pre-existing hearing loss & loud noise exposure

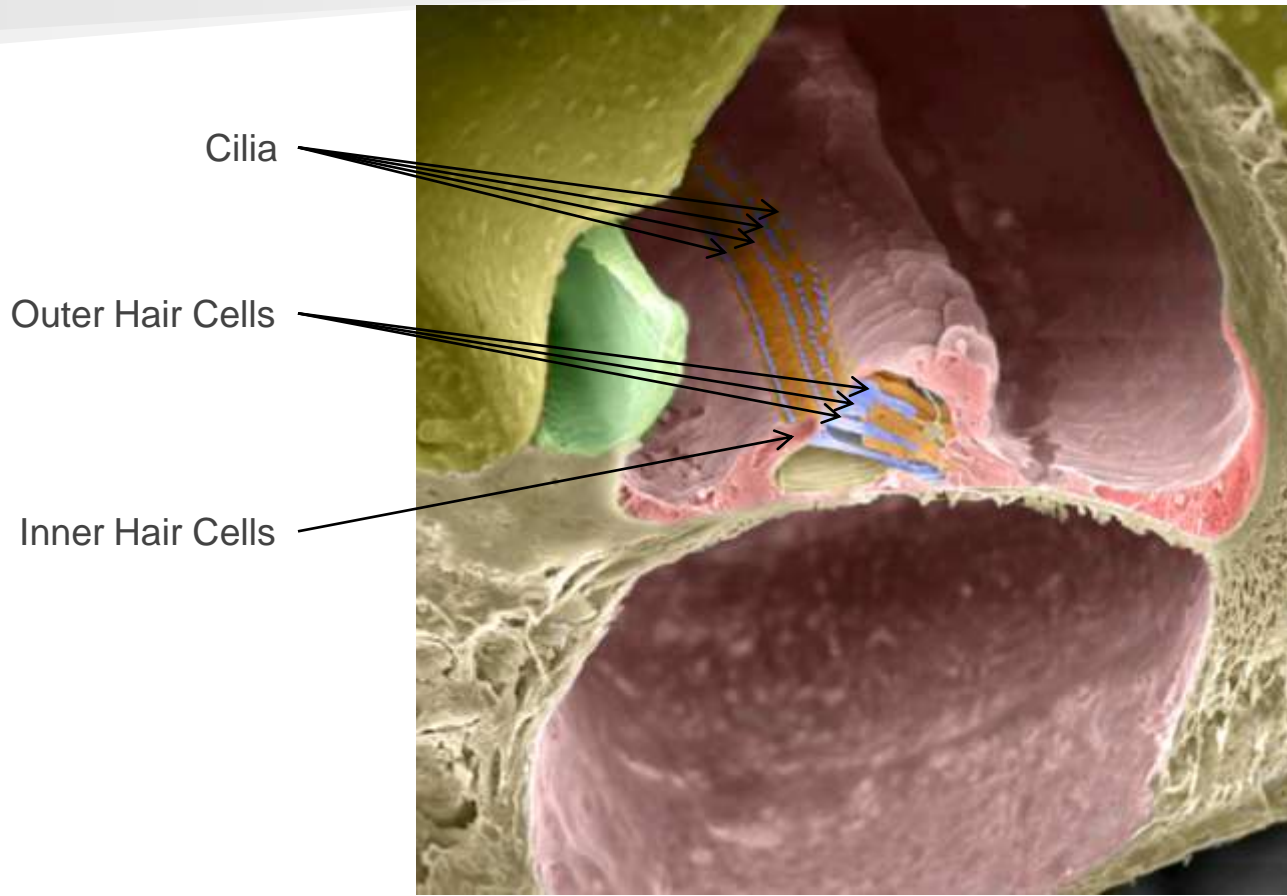
Common Ototoxic Agents

- More than 200
- Antineoplastics like cisplatin & carboplatin
- Aminoglycoside antibiotics like tobramycin
- Loop diuretics & analgesics
- Organic solvents & heavy metals

Ototoxicity Monitoring

- Ototoxicity related damage is usually permanent
- Ototoxicity monitoring...
 - Helps identify audiologic problems early
 - Ensures medical treatments are balanced with audiologic care whenever possible
 - Can improve quality of life

Inside the Cochlea



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Outer Hair Cell Motility

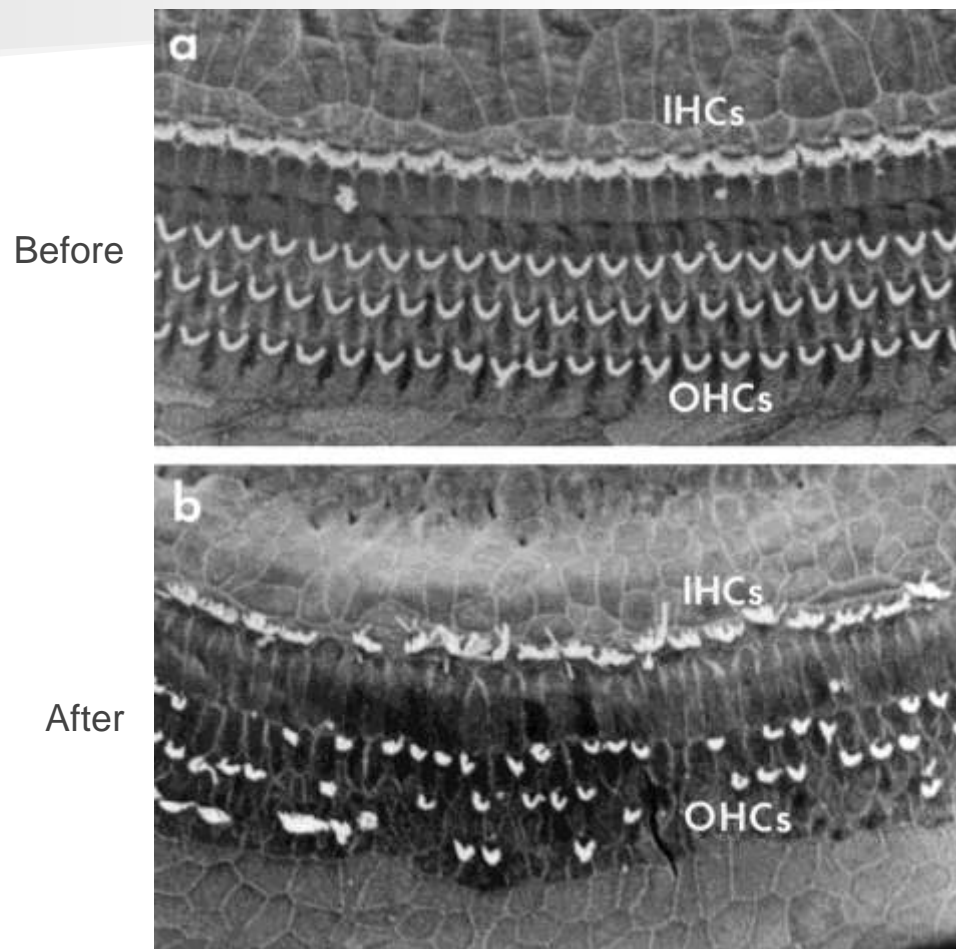
“Dancing Hair Cell”



Ototoxicity Mechanism

- Ototoxic agents kill hair cells & cilia
 - Induce reactive oxygen species
 - Damage DNA leading to apoptosis
- Adverse synergistic effects
 - Ototoxic agents with loud noise exposure
 - Antineoplastics with other ototoxic agents

Cochleotoxicity



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Image: <http://www.pnas.org/content/97/13/6939/F1.expansion.html>

Vestibulotoxicity

- To maintain balance the brain requires vestibular, visual & somatosensory inputs
- Ototoxicity can reduce vestibular function leaving eyes, muscles & skin to compensate
- What happens if also impaired vision, muscle weakness or peripheral neuropathy?

Symptoms of Ototoxicity

- Tinnitus
 - Typically high-pitched, constant 'ringing' in both ears or head 📢
- Hearing loss
 - Oftentimes difficulty discriminating speech, especially with background noise
- Imbalance/disequilibrium or oscillopsia

Antineoplastic Monitoring

- Important to obtain an audiologic baseline
- Recommended monitoring protocol:
 - Immediately before every infusion
 - Follow-up 3 months after last infusion; 6 months after if also treated with aminoglycoside antibiotic
 - Also 1 year after if treated with head/neck radiation

Monitoring Methods

- Questionnaire & Tinnitus Handicap Inventory
- Pure-tone audiometry at 0.125-16 kHz
- Distortion product otoacoustic emissions
- Word recognition testing
- Tympanometry
- Acoustic reflexes (at baseline)

Ototoxicity Research

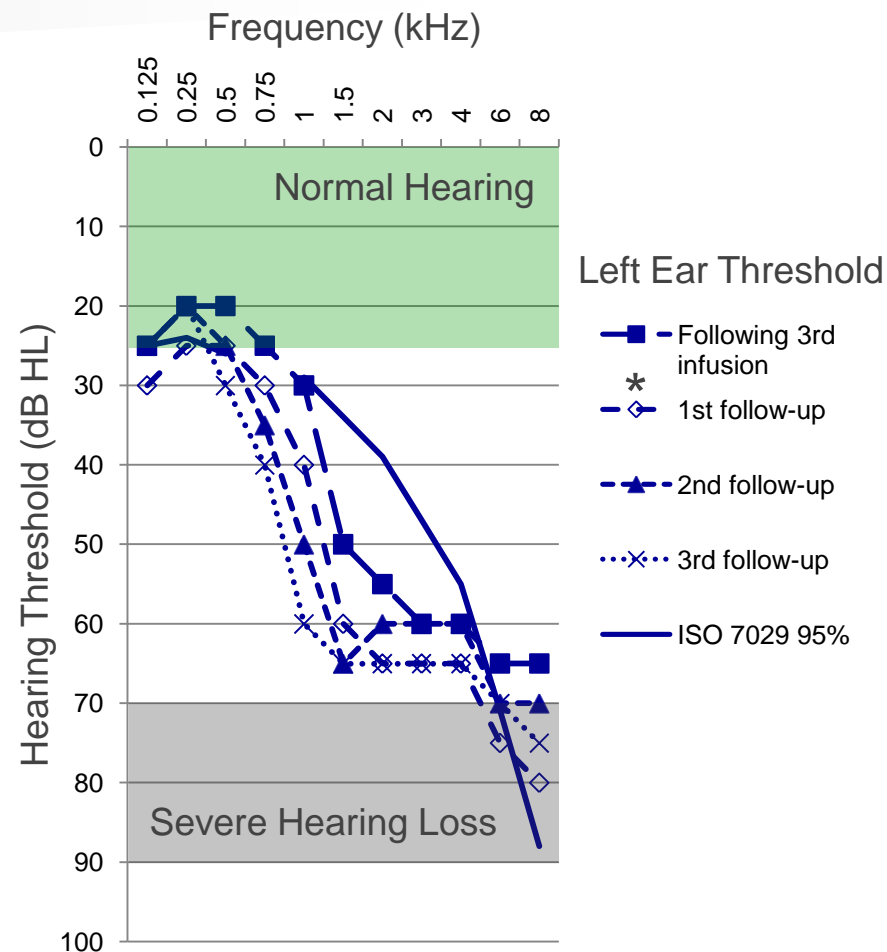
- Rademaker-Lakhai, J.M. et al. (2006)
 - 60 adults receiving gemcitabine-cisplatin
 - Ototoxicity had dose & schedule dependence
 - Worst when dosage was greater than 60 mg/m² & when delivered every 2 weeks vs. 1 week
- Reduce risk of ototoxicity by decreasing the dose & interval

More Research

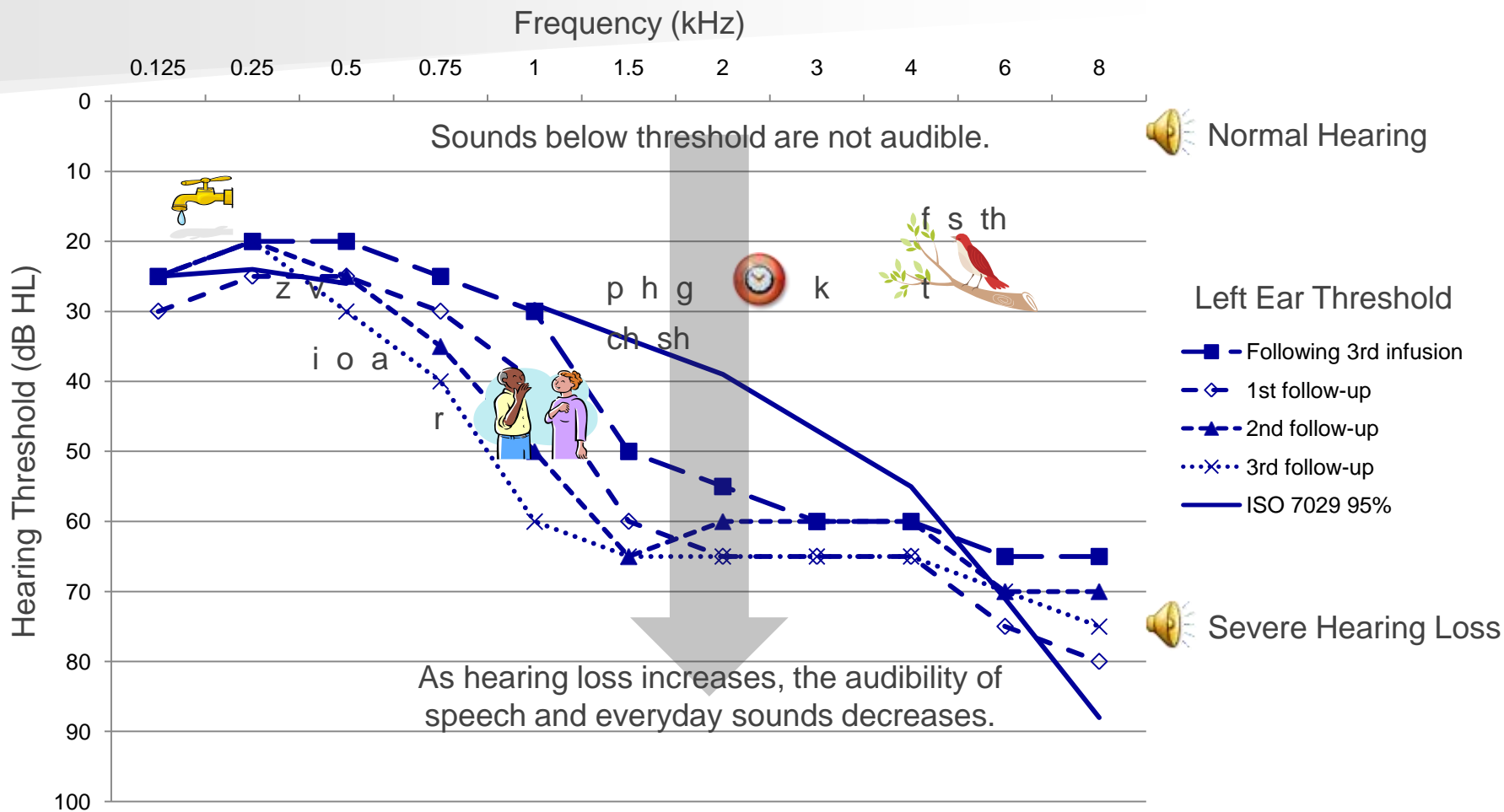
- Knight, K.R., et al. (2007)
 - 32 children receiving cisplatin &/or carboplatin
 - 62.5% had increased thresholds at 0.5-8 kHz
 - 81.3% had decreased DPOAE amplitudes
 - 94.1% had increased thresholds at 9-16 kHz
- Important to assess high-frequency hearing & outer hair cell health

Case Study

- 72-year old female
- Metastatic adenocarcinoma
- No audiologic baseline
- Cisplatin then carboplatin*
- Monitored over 4 months



Hearing Handicap



Balanced Care

- Modification of chemotherapy protocol
- Tinnitus therapy
- Hearing aids
- Vestibular rehabilitation
- Counseling

EAR Audiology, Inc.

- Private practice on campus of Scripps Encinitas
- Experienced ototoxicity monitoring
- Working closely with Stephen Dent, M.D. on cases requiring ENT referral



Insurance

- Medicare, Railroad Medicare & TRICARE
- Network for Blue Shield, CIGNA, United Healthcare/PacifiCare, HealthNet, First Health/Coventry, PFMC & MultiPlan
- Out-of-network for Anthem, Aetna & Humana

Medicare

- Audiologists do not have direct access to Medicare recipients
- All services provided must have associated medical referral
 - Fax or email a script requesting CPTs 92557, 92550 & 92587 for each appointment

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