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Tinnitus Treatment with Acoustic and Electric Stimulation, presented in partnership with American Auditory Society

Presenter: Fan-Gang Zeng, PhD
University of California Irvine

Moderator: Carolyn Smaka, AuD, Editor in Chief, AudiologyOnline

Allied Health Media AudiologyOnline

- Technical Assistance: 800-753-2160
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  - Must complete outcome measure with passing score (within 7 days for live webinar; within 30 days of registration for recorded/text/podcast formats)
- Questions? Call 800-753-2160 or use Contact link on AudiologyOnline.com

Tinnitus Treatment with Acoustic and Electric Stimulation

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- Using sounds to treat tinnitus ("no sound is no good")
- Differentiate between tinnitus suppression and masking
- Differentiate the three forms of electric stimulation: non-, mini-invasive and invasive

Learning Objectives

After this course learners will be able to:

- Explain the difference between acoustic and electric stimulation in tinnitus treatment.
- Explain the difference between tinnitus suppression and masking.
- Explain the difference between the three forms of electric stimulation: non-, mini-invasive and invasive.

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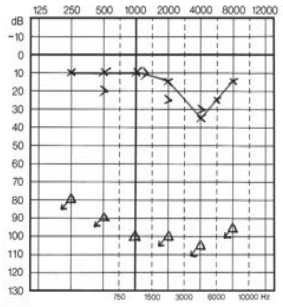
"Michael's story"

- Audiological info:
  - 46-years-old male;
  - unilateral sudden hearing loss (right ear) in 2004
  - normal hearing in the left ear



- Cochlear implant:
  - received Clarion HiRes 90k at Stanford
  - CIS strategy; HINT=75%
  - minimal effect on tinnitus

- Psychophysics of tinnitus:
  - most of the time: 5-7 out of 10 in loudness
  - attacks can occur and develop into migraine
  - matched to the following sounds:
    1. 4000 Hz at 73 dB
    2. 4000-8000 Hz 90 dB

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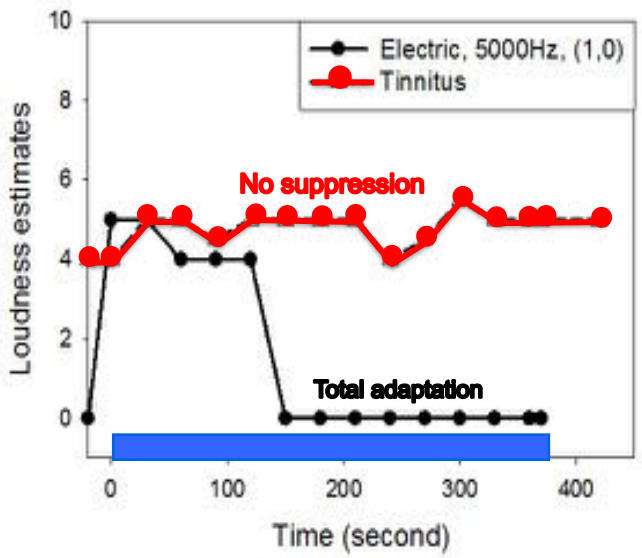
Zeng Tang Dimitrijevic Starr Larky Blevins (2011) Hear Res

High rate stimulation: Adaptation but no suppression



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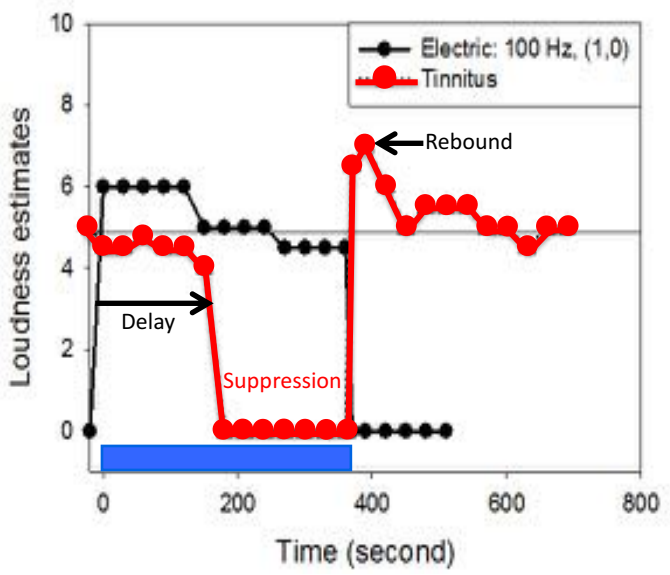
Zeng Tang Dimitrijevic Starr Larky Blevins (2011) *Hear Res*

Low rate stimulation: No adaptation but suppression



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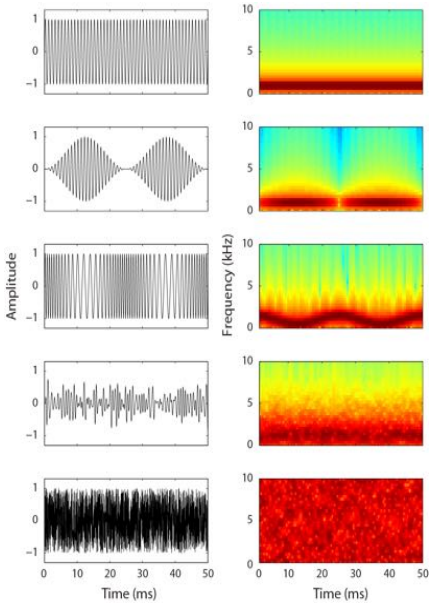
Zeng Tang Dimitrijevic Starr Larky Blevins (2011) *Hear Res*

Acoustic stimulation

Stimuli

- Five types:
  1. Pure tones
  2. AM tones
  3. FM tones
  4. NB noise
  5. White noise
- Four frequencies
- Total of 17 stimuli:
  4 types x 4 freqs
  + white noise control



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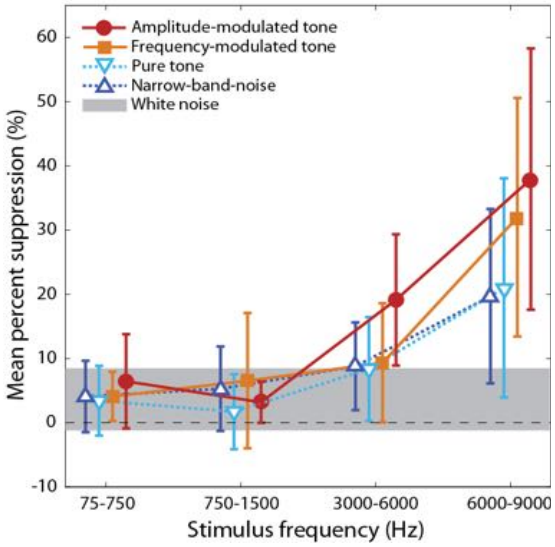
Modulated high-frequency tones are 4 times more likely than white noise to suppress tinnitus



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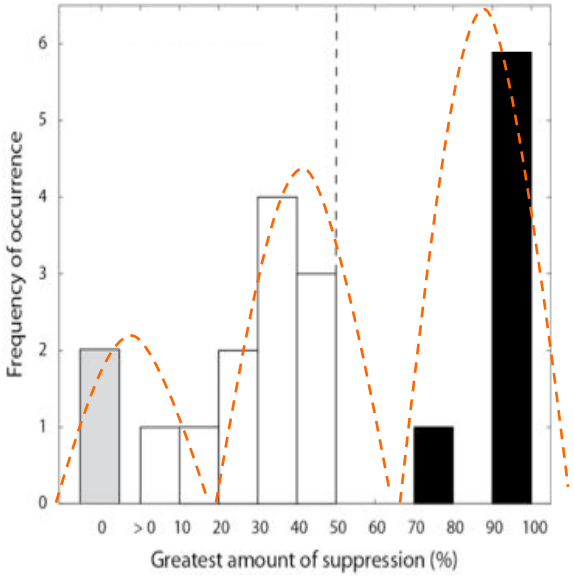
Reavis et al. (2012) JARO; Tyler et al. (Iowa, Buffalo and House, 2014) JAAA

Who benefited from the suppression?



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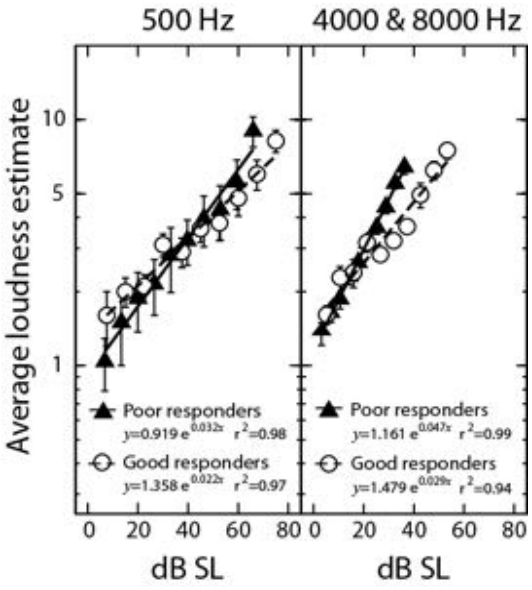
Reavis et al. (2012) JARO

Those without hyperacusis



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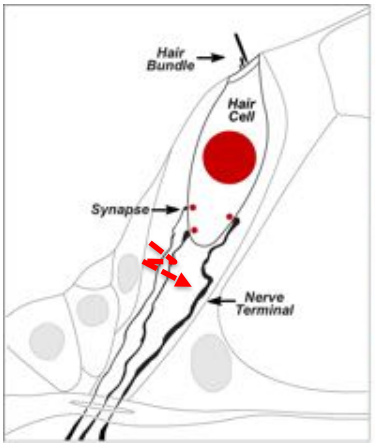
Reavis et al. (2012) JARO

Why does electric stimulation work?

- Reduced input or detached nerve fibers
- Cortical amplifier
- Hidden hearing loss

Sounds won't activate detached neurons but electric stimulation will



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Kujawa and Liberman (2009) *J Neurosci*. 11;29(45):14077-85.

How to make it work better and safer?

Most tinnitus sufferers have little or no hearing loss

Do you want an invasive and expensive cochlear implant that will likely destroy your hearing?

NO, So we develop treatments that will suppress tinnitus while preserving hearing?

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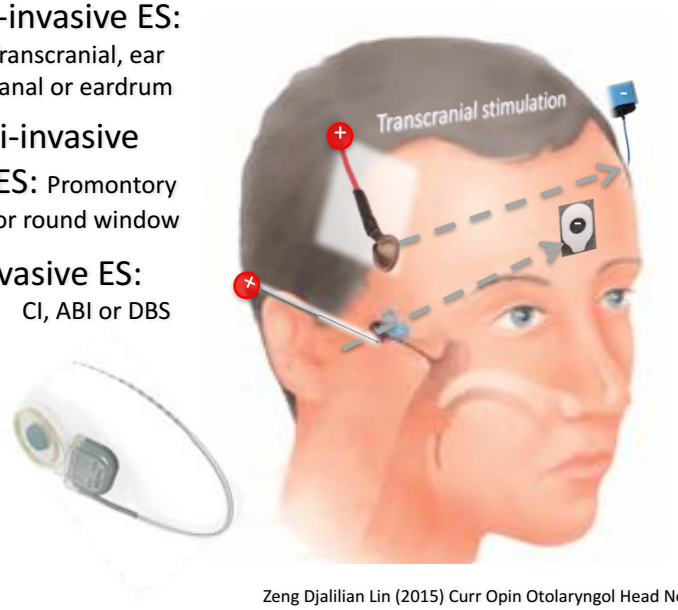
How to stimulate the detached auditory nerve fibers?

Non-invasive ES:
Transcranial, ear canal or eardrum

Mini-invasive ES: Promontory or round window

Invasive ES:
CI, ABI or DBS



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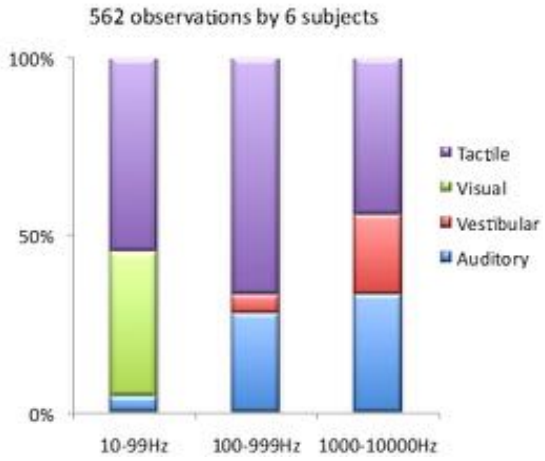
Zeng Djalilian Lin (2015) Curr Opin Otolaryngol Head Neck Surg

Noninvasive electric stimulation and side effects



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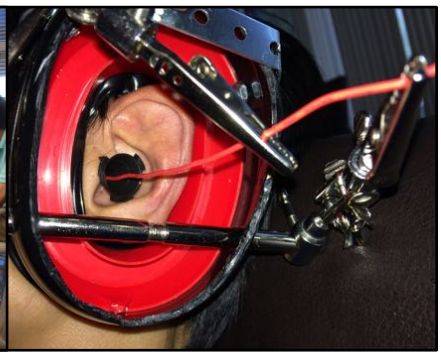
Minimally invasive electric stimulation

A. Custom-made electric stimulation setup.



B. Custom-made head-mounted electrode holder

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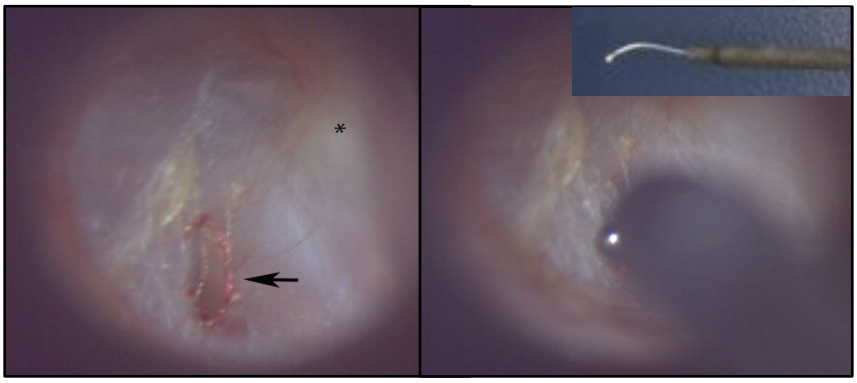
Minimally invasive electric stimulation



C. Umbo (asterisk) and myringotomy (arrow). D. Round window stimulation (bended electrode)

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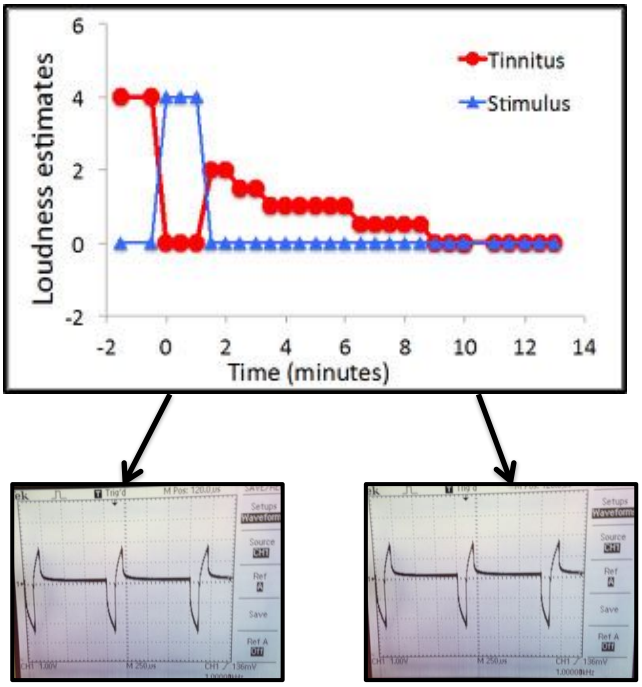

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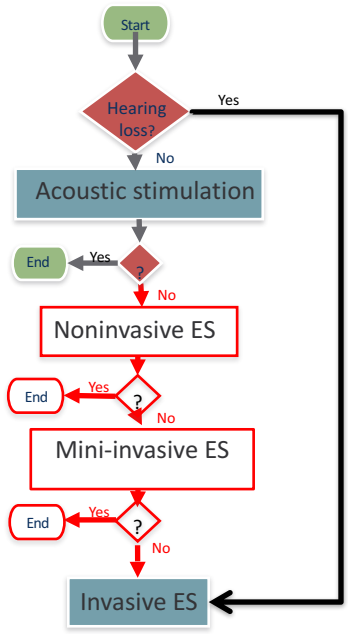
Clinical management strategies



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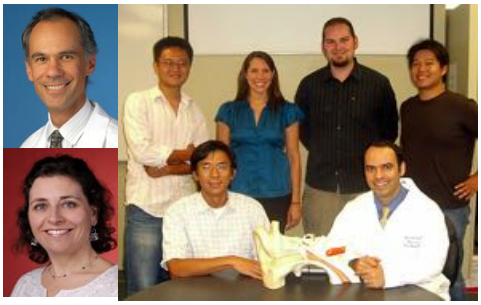
Conflicts of Interest:
- SoundCure: Founder and shareholder
- Nurotron: Founder and shareholder

Supported by



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