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Sound Approaches to Tinnitus Management

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Moderated by:
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Sound Approaches to Tinnitus Management

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Communicative Sciences

Learning Objectives

- **After this course learners will be able to:**
- **Contrast sound therapy based options.**
- **Describe methods for sound therapy applications.**
- **Describe counseling methods for effective sound therapy tinnitus management.**

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On the Agenda

- Overview of Popular Management Approaches
- Sound Therapy Options
- Amplification and Tinnitus
- Counseling & Considerations
- Q & A

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Disclaimer

- No conflict of interest to report
- Receive honorarium for this lecture

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First: Types of Tinnitus

- **Objective/Somatosound**
  - Pulsatile (often cardiovascular)
  - Clicking (often myoclonic)
- **Subjective/Neurophysiological/Sensorineural**
  - More common form associated with numerous sound experiences and unable to currently be measured objectively
    - We will focus on this type!

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Breakdown of Popular Approaches

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Question???????

- What approach for tinnitus management do you currently use?

A. Tinnitus retraining therapy
B. Tinnitus activities treatment
C. Modified version (my own thing)
D. Don't provide any formal counseling, just basic education and hearing aids when appropriate
E. Use Proprietary approach (neuromonics, soundcure, etc.)
F. Don't see tinnitus patients

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Approaches Overview

- Numerous approaches to tinnitus have been developed over the past few decades
  - Sound therapies (Many variations with and without counseling)
  - Cognitive Behavioral Therapy influenced Counseling (Many contributors)
    - Tinnitus Activities Treatment (Tyler and colleagues)
    - Integrated Approach to Tinnitus Patient Management (Sweetow and colleagues)
  - Tinnitus Retraining Therapy (Jastreboff and colleagues)
  - Progressive Tinnitus Management (Henry and colleagues)
  - Patient Centered Therapy (Acceptance of tinnitus as part of me (Mohr and colleagues)
  - Acceptance and Commitment Therapy (Hesser, Westin, and others)
  - Mindfulness based tinnitus stress reduction (Gans)
  - Combination of the above or modified approaches (Many others)

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Approaches Overview

- Though there are philosophical difference in these approaches, they also have a great deal in common.
  - Counseling of some type: Common
  - Sound therapy of some type: Common
  - None treat tinnitus, but rather the reaction to tinnitus
  - Some potential differences are the areas emphasized in counseling, perspectives of directive vs collaborative interaction with patient, idea of classical conditioning vs. operant conditioning, and level setting and type of sound for sound therapy

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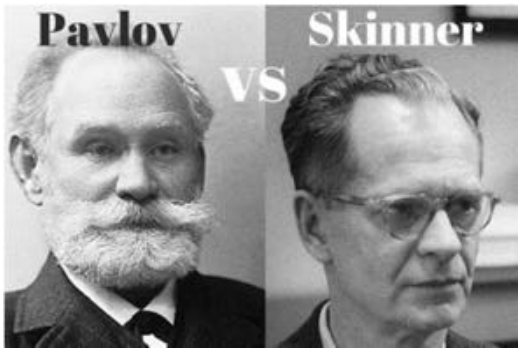
Approaches Overview

- Classical conditioning vs. Operant conditioning



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Approaches Overview

- CBT based approaches use more of a cognitive perspective and the restructuring of cognition via conscious strategy for voluntary change
- Classical conditioning based approaches emphasize the subconcious processing to alter the conditioned reflex

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Approaches Overview

- Cognitive-behavioral therapy
  - Combination of the principles of behavioral and cognitive principles; to alter one's thoughts about their problem and identify behaviors that contribute to problem and subsequent reaction
  - Patients can then address these distorted conceptions to overcome the problem once they recognize them (e.g. cognitive distortions like all or none thinking, generalization, disqualifying positive).
  - Numerous randomized control trials have shown success with affective elements of tinnitus (Cima et al. 2014).

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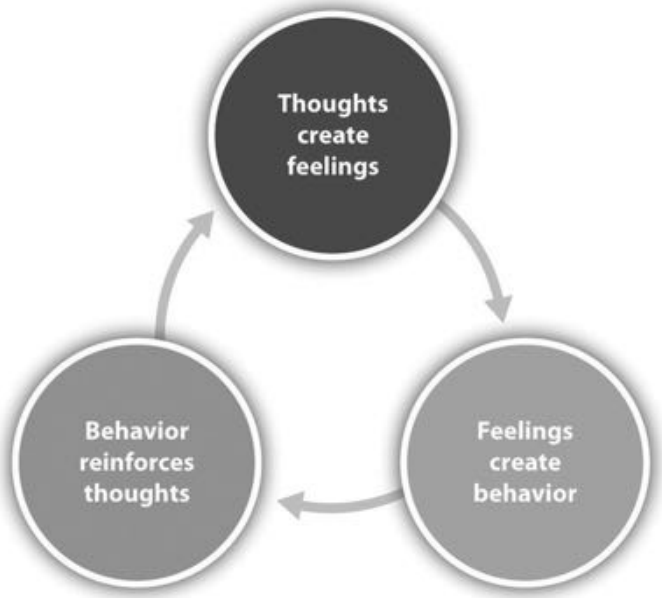
Study	Design	Positive findings	Negative findings
Sweetow[16]	Case series	Introduction to CBT	
Kröner-Herwig, et al.[23]	Case-control study	More satisfaction with training than with yoga	
Henry and Wilson[25]	Case-control study	Distress, handicaps associated with tinnitus; engagement in dysfunctional cognition	No effect on depression or subjective loudness
Andersson, et al.[26]	Controlled trial	Effectiveness in the elderly	
Rief, et al.[21]	Randomized clinical trial	Emotional distress	Reactivity of head muscles at the beginning predicted significant treatment effects
Kaldo, et al.[24]	Randomized clinical trial	Effectiveness of CBT-based self-help book	
Weise, et al.[22]	Randomized clinical trial	Tinnitus annoyance, diary ratings of loudness, feelings of controllability	
Andersson and Lyttkens[19]	Meta-analysis	Strong effect on tinnitus annoyance, some effect on tinnitus loudness	Lower effect on negative affect and sleep problems
Hesser, et al.[17]	Meta-analysis	Tinnitus distress Effective in the long term	
Martinez-Devesa, et al.[18]	Cochrane review	Depression score, quality of life	No effect on subjective loudness

Jun and Park, 2013



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Approaches Overview

- Cognitive-behavioral therapy and tinnitus
  - CBT (Psychotherapy)
    - Consists of face to face sessions, anywhere from 6-18, for around an hour each, over many weeks, occasional “booster” sessions are provided
    - Performed by a licensed therapist/psychologist in CBT
    - Good idea to find someone in your area as a referral source, if no one in your area there are telehealth alternatives

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Approaches Overview

- The Audiologist and Cognitive-behavioral therapy and tinnitus
  - CBT-based approaches (Adjustment Counseling)-Audiologist provided
    - CBT-based approaches (Adjustment Counseling)—consists of application of CBT principles often with sound-based therapy and other techniques like relaxation training, imagery, and etc.
      - Robert Sweetow, PhD: “patient may reject a purely psychological approach, instead patient should be counseled on physiological origin, but the reaction is ultimately a psychological interpretation”
      - Sweetow-Integrated Approach is the basis of the Widex Zen Therapy

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Perceived problem	Realistic assessment
My tinnitus keeps me awake all night	I fall asleep relatively easily but then I awaken twice each night and it takes about an hour to fall back asleep.
The tinnitus drives me crazy	I am finding it difficult to concentrate when I can't find any quiet time and I am frustrated, but I am not crazy!
Tinnitus is ruining my life	I am really stressed because I don't have enough time to juggle work, family and leisure, and I tend to blame the tinnitus for my problems

Maladaptive behavior	Alternative strategy
When I hear my tinnitus in the morning, I stay in bed all day, avoiding sound, and feeling depressed	Being active makes me think less about my tinnitus. I should go to a mall, put on other sounds in my house so that the tinnitus isn't so apparent, and do anything except nothing!
I have trouble falling asleep so I lay in bed worrying about how I will feel tomorrow	If I can't sleep in 30 minutes, I will get up and read on the sofa, or will watch some quiet TV show, or get some extra work done that I have been putting off

Negative thought	Thought error	Alternative thought
My life used to be perfect before I had tinnitus, now it is horrible	All or nothing thinking	Life is never perfect, I had some problems before, and I still have some good things about my life now (like my grandchildren)
My tinnitus makes me feel hopeless	Emotional reasoning	Other people have survived tinnitus, I can too

Sweetow, 2014

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Approaches Overview

- Tinnitus Retraining Therapy
  - Developed by Jastreboff and Hazell over 25 years ago
  - Based on the Neurophysiological Model of Tinnitus
    - Auditory system is secondary, primary are non-auditory regions (in particular limbic system)
  - Primarily uses directive/educational counseling
  - Primary goal is habituation of reaction and/or perception of tinnitus
  - Patients can be categorized based on perception of tinnitus, perceived hearing loss, and sound sensitivity
  - Sound therapy component suggest a "mixing point"

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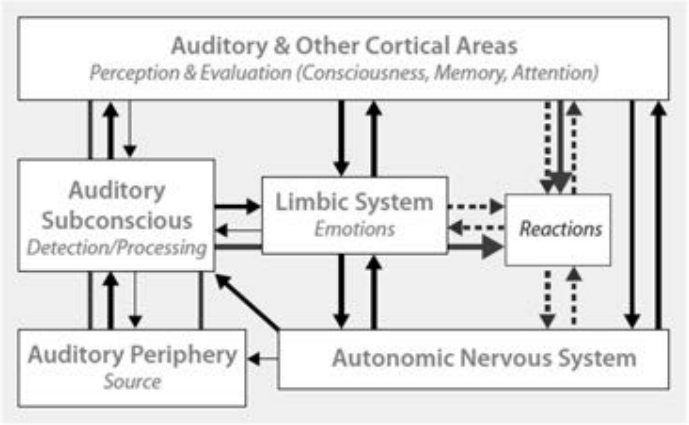

Fig. 1 ◀ Block diagram of the neurophysiological model of tinnitus

Jastreboff 2015

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Table 1 Categories of Tinnitus and Hyperacusis Patients

Category	Hyperacusis	Prolonged Sound-Induced Exacerbation	Subjective Hearing Loss	Impact on Life	Treatment
0	—	—	—	Low	Counseling only
1	—	—	—	High	Sound generators set at mixing point
2	—	—	Present	High	Hearing aid with stress on enrichment of the auditory background
3	Present	—	Not relevant	High	Sound generators set above threshold of hearing
4	Present	Present	Not relevant	High	Sound generators set at the threshold; very slow increase of sound level

Hyperacusis: significant sensitivity to environmental sounds typically associated with LDLs below 100 dB HL; prolonged sound-induced exacerbation of tinnitus/hyperacusis when the effects persist to the following day; subjective hearing loss: perceived subjectively by a patient as having a significant impact on patient's life; impact on life: the extent of impact of tinnitus and/or hyperacusis on patient's life; common treatment for each category involves counseling and the use of enriched auditory background

Jastreboff & Jastreboff 2000

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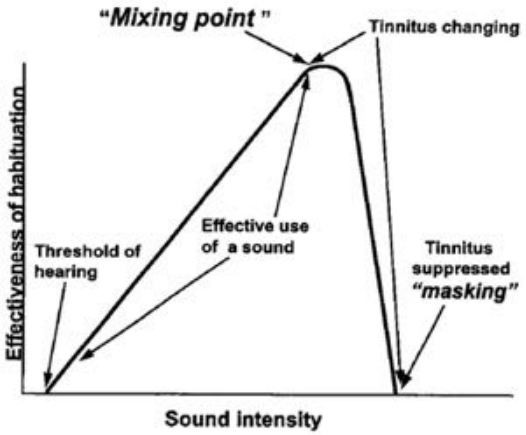

Figure 4 Theoretical dependence of the effectiveness of habituation on the intensity of the sound used for the sound therapy.

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Jastreboff & Jastreboff 2000

Approaches Overview

- Tinnitus Activities Treatment
  - Developed by Tyler and Colleagues and is based in principles of CBT
  - Interactive counseling with sessions covering topics
    - Thoughts and Emotions
    - Sleep
    - Hearing and Communication
    - Concentration
  - Picture-based materials are used to reinforce the concepts
  - Attention on issues patient is having, discussing strategies to specific issues, and involves use of diaries and homework (activities)
  - https://www.medicine.uiowa.edu/oto/research/tinnitus-and-hyperacusis

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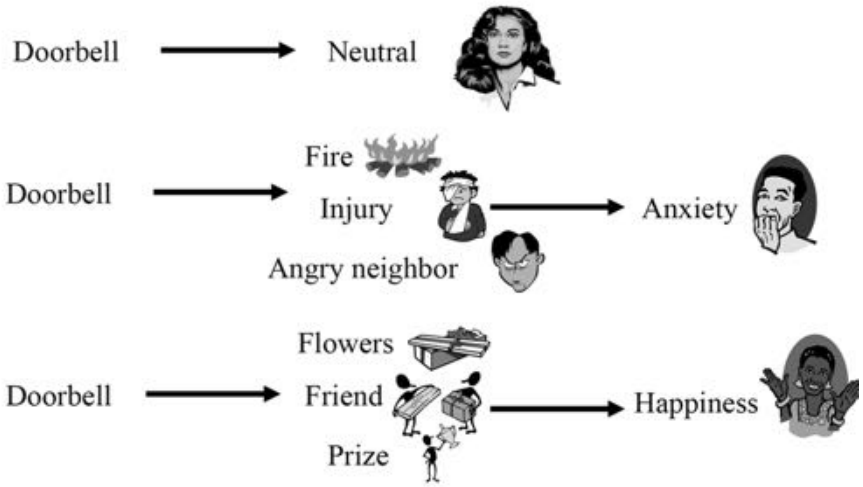
Our Thoughts and Emotions



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Question ???????????

Which Approach is Best?

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Question ??????????

When performed by a seasoned clinician significant differences were found (Henry et al. 2014). The difference is YOU!

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"patient may reject a purely psychological approach, instead patient should be counseled on physiological origin, but the reaction is ultimately a psychological interpretation" Sweetow

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Sound Therapy Options

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Tinnitus Treatment

- **SOUND THERAPY**
  - Masking (cover up)
  - Tinnitus Retraining Therapy (habituate by reduced reaction and perception)
    - Sound Generators or Noisers
  - Neuromonics (program uses music preconditioning stage and active stage)
  - Okamoto Notch Music
  - Sound Cure (Modulated tones)
  - CR Neuromodulation
  - Levo System
  - Phase Inversion
  - **Amplification**

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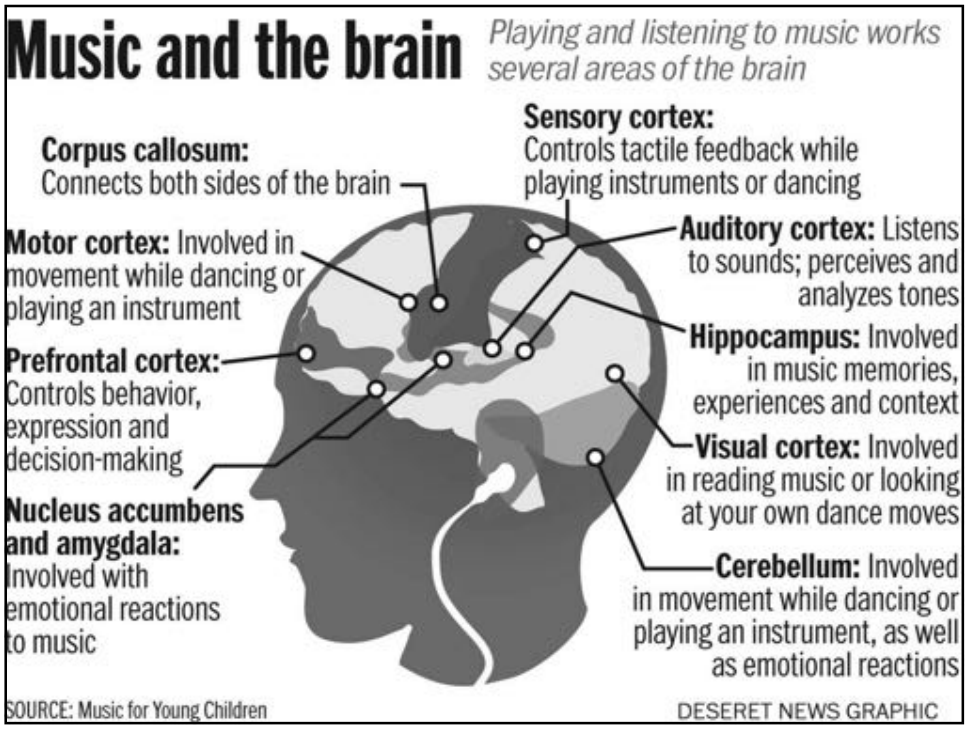

Proprietary Approaches

- **Neuromonics (music)**
- **Sound Cure**
- **Acoustic Coordinated Reset Neuromodulation**
- **Okomoto Notched Music (music)**
- **Phase-Out**
- **Widex Zen (music-like)**
- **Levo**

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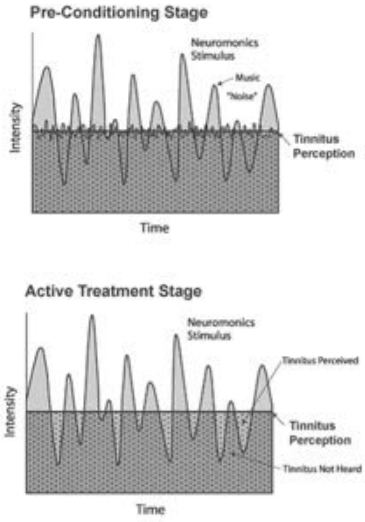
Proprietary Approaches

- Neuromonics
  - 6 month program that uses binaurally correlated music that intermittently covers patient's tinnitus percepton
    - Phase/Stage I ~8 weeks
    - Phase/Stage II ~16 weeks

  Evidence: Neuromonics has shown improvement compared to broad band noise and counseling only (Davis et al. 2008), but limited evidence and inadequate study design temper enthusiasm for any greater benefit than other sound therapy



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Proprietary Approaches

- Sound Cure (Serenade)
  - Based on low pulse rates with CI shown to suppress tinnitus perception (Zeng et al. 2011)
  - Amplitude modulate and Frequency modulated sounds to drive neural plasticity
  - Suppression of tinnitus more successful compared to white noise (Reavis et al., 2012)
  - Evidence: unaware of published randomized control trial

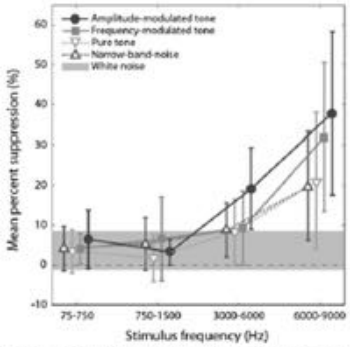

FIG. 2. Percent tinnitus suppression as a function of stimulus frequency (*X*-axis) and stimulus type (symbols): amplitude-modulated tones (*filled circles*), frequency-modulated tones (*filled squares*), pure tones (*open inverted-triangles*), and narrow-band noise (*open triangles*). *Solid lines* represent modulated stimuli whereas dashed lines represent unmodulated stimuli. Error *bars*=95% confidence interval. The *gray bar* plotted across the bottom represents the 95% range for the white noise control. See text for significant differences in tinnitus suppression.

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Proprietary Approaches

- Acoustic Coordinated Reset Stimulation
  - Tass et al. (2007, 2011)—Individualized auditory stimuli above and below the Tinnitus Frequency are presented as short tones to re-normalize pathological neural synchrony.
  - The purpose to correct or “reset” abnormal neural oscillatory activity through desynchronization.
  - Worn at a low level 4-6 hrs per day
  - Evidence: There has been 8 original reports in 3 different populations. Studies have in general showed benefit in reducing tinnitus complaints. However, small sample sizes, lack of appropriate controls, have limited enthusiasm (Wegger et al. 2017).

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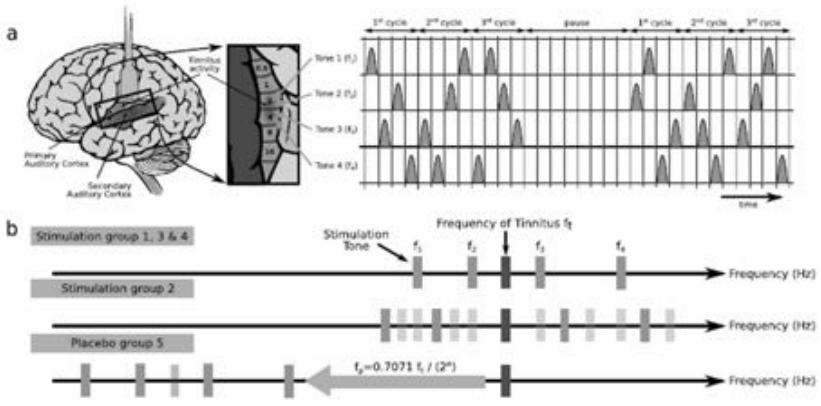

Fig. 1. Acoustic coordinated reset (CR) neuromodulation: (a) The concept of CR neuromodulation comprises a spatial and temporal coordination of the applied stimuli to induce desynchronization leading to anti-kindling (Tass, 2003): utilizing the tonotopic organization of the primary auditory cortex (left, brain adapted from Chittka and Brockmann PLoS Biology, 2005 with kind permission of the authors) short sinusoidal tones of different frequencies (f_1 to f_4) induce a soft reset in different target areas grouped around the tinnitus focus (Tass, 2002). Three CR cycles, each comprising a randomized sequence of four tones (right), are followed by two silent cycles. That pattern is repeated periodically. The random variation of the tone sequences (Tass and Majtanik, 2006) and the 3 : 2 ON-OFF pattern (Tass, 2003, Lysyansky et al., 2011) optimize the desynchronizing CR effect. (b) Four stimulation groups and one placebo group were investigated. For G1, G3 and G4 four tones (top, f_1 to f_4) are grouped around the tinnitus frequency (f_t). G3 differs only in repetition rate F being adapted to the individual EEG δ-band peak. For G2 each CR cycle is formed by a varying composition of four tones (dark green: active) chosen out of twelve tones (middle, f_1 to f_{12}) surrounding f_t. Placebo stimulation (bottom, G5) is formed similar to G1 using a down-shifted stimulation-frequency f_p ($f_p = 0.7071 \cdot f_t / (2^n)$, f_p within [300 Hz, 600 Hz]) outside the synchronized tinnitus focus.

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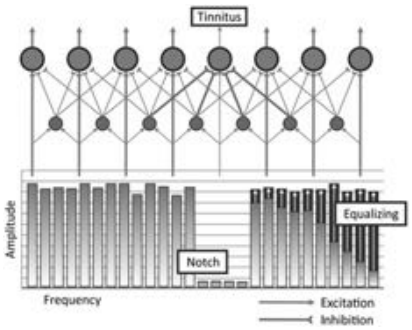
Proprietary Approaches

- Music Therapy
  - Okamato et al., 2010– Music with individualized frequency composition, where Tinnitus Frequency is notched out of music
  - Based on Pantev el al. (1999) that showed notched music can reduce cortical activity to the notch center frequency possibly through lateral inhibition
  - Evidence: Some small trials have shown subjective and MEG based benefit, but notch width did not influence as hypothesized (Wunderlich et al. 2015)



Wunderlich et al. 2015

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Proprietary Approaches

- Phase Inversion (Phase –out)
  - Match the tinnitus and then emit sound that is 180 degrees out of phase, i.e. phase cancellation, works for feedback
  - Vermeire et al. (2007) found reduction in tinnitus symptoms in 60% of subjects
  - Problem is a neural signal is not an acoustic signal (Meeus et al., 2010), found no sound cancelling, contributed effect in 2007 to inclusion
  - Evidence: None

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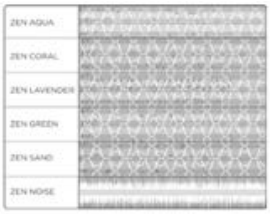
Proprietary Approaches

- Fractal tones (Widex Zen)
  - Melodic chain of random tones
    - Dynamically varying signals with semi-random temporal modulations
    - Musical like quality (sound like wind chimes)
    - Encourage passive listening rather than active
  - Sweetow et al., 2010
  - Some people like, others do not



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Proprietary Approaches

- Levo by Otoharmonics
  - Based on work out of Uruguay (Pedemonte et al. 2010)
  - Attempt to “reinstall the normal balance in the central processing”
    - Opposite of notch?
  - Match tinnitus
  - Play sound while sleeping
  - Evidence: No randomized placebo controlled trials to date to show effectiveness compared to any other sound therapy

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Neuromonics uses music filtered to stimulate hearing loss regions.	Okomoto notches music in regions where there is hearing loss to drive neural plasticity.
Zen fractal tones use unpredictable music and expound the virtues of unpredictability and relaxation via passive listening	Neuromonics uses a closed set of pre-recorded songs that may relax via active listening
Sound Cure uses signals designed to synchronize neural response	Coordinated reset (Tass) uses signals designed to desynchronize
TRT suggests avoiding silence and encourages sound enrichment 24-7.	Neuromonics suggests 2-4 hours per day
Cognitive-behavioral therapy employs distraction/avoidance techniques.	Mindfulness based stress reduction encourages the patient to embrace the sensation.

39 Sweetow, 2012

Changing tinnitus vs. Changing Perception

- Masking, TRT, TAT, etc seek to lead to habituation
- AC Reset, Levo, Notch-Therapy seek to augment tinnitus
- Enriched acoustic environment
  - Norena and Eggermont (2005) showed placing animal in enriched noise environment after noise exposure prevented map reorganization and changes in spontaneous firing
  - Vanneste et al., 2012 tried in humans with established tinnitus and found a worsening of tinnitus
    - Difference in preventing onset and already existing tinnitus

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Non-Proprietary Approaches

- Silence is not your friend, have sound around you, do not mask, but mix
  - Where to start: Environmental sounds, white noise player, MP3 player, CD player, Apps, etc.
  - Play sound as much as possible, but at least several hours per day, should mix with tinnitus
  - You can download online for free from ATA website, also purchase from amazon.com, iTunes, there are even apps for 99 cents.

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Non-Proprietary Approaches

- What kind of Sound??????
  - White noise, pink noise, modulated, music
  - Continuous (ocean, rain, white noise, pink noise, and etc)
  - Meaningless but relaxing (not actively listen)
  - Do not use a bothersome sound
  - There is no great evidence showing any specific sound is better than another for tinnitus management; though amplitude modulated sounds may be more effective in reducing perception (Tyler et al. 2014; Reavis et al. 2012)

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Non-Proprietary Approaches

- What kind of Sound??????
  - What is the benefit of shaping sound to tinnitus?
  - What level
    - Cover perception (masking/suppression)
    - Mixing level (TRT)
    - Softest level to achieve relief (TAT)
    - Other
    - Again there is well-demonstrated evidence of effectiveness of masking vs. mixing for habituation (Tyler et al. 2012).

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Tyler & Babin, 1986	"Both the noise and tinnitus are heard but the tinnitus is reduced in loudness." Patients should "use the lowest level masker that provides adequate relief."
Coles & Hallam, 1987	"Partial masking ... a low level background sound against which the loudness of the tinnitus is reduced."
Erlandsson et al., 1992	Reduced the noise from the complete masking condition until it was "comfortable enough to listen to."
Hazell, 1987	"The masking sound does not completely cover the tinnitus" and then it provides a "distracting background sound" (p. 107). The "tinnitus tends to 'break through' the masking noise" (p. 112).
Coles, 1987	"That is when the masker is used to provide only a low level of background sound against which the loudness of the tinnitus is reduced" (p. 398).
Tyler & Bentler, 1987	"Sometimes a masker can reduce the tinnitus loudness or annoyance, even though the tinnitus remains audible." "Partially mask the tinnitus yet produce the lowest SPLs and the least interference with speech."
Bentler & Tyler, 1987	"Urge the patient to use the lowest level of masker level that provides adequate relief" (p. 30).

From Tyler
Starkey Audiology Series

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Amplification and Tinnitus

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Amplification

- **AMPLIFICATION** (Searchfield et al., 2010; Parrazzini et al., 2011; McNeill et al., 2012)
  - Kochkin et al. (2011)-Hearing aids provided substantial tinnitus relief in 34% of patients
    - Enriched soundscape
    - Partial masking of Tinnitus
    - Reduced listening fatigue
    - Change focus of treatment
    - Linear octave frequency transposition (Peltier et al., 2012)
      - Reduced tinnitus perception, classical amplification and non-linear frequency compression did not.
    - **WHAT IS YOUR PATIENTS PRIMARY COMPLAINT?**
      - Very common, “I can’t hear because of the tinnitus”

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Amplification

- **AMPLIFICATION & Sound Generator**
  - Henry et al. (2015)-Compared hearing aid to hearing aid with sound generator
  - Both groups saw improvement
  - The hearing aid + sound generator group saw a mean reduction in TFI 6.4 points higher, which approached significance
  - Both groups received counseling

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Amplification

- **AMPLIFICATION & Counseling**
  - Henry et al. (2016)-RCT comparing masking and TRT to tinnitus education group with hearing aids and wait list controls in Veterans.
  - All saw decrease in tinnitus compared to wait-list
  - Masking, TRT, and Education with hearing aids were all effective; there was no significant difference between the approaches
  - Missing: group with hearing aid alone and no counseling
    - Bauer et al. (2017) showed that TRT + hearing aid compared to hearing aid and limited counseling both showed improvement but slightly greater in the TRT group; counseling component not well-controlled

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Advantage-Amplification

- **AMPLIFICATION**
  - If you have a hearing loss and tinnitus, hearing aids with a combo sound generator (noiser) are very effective, WHY?
    - Stimulate the pathways that are contributing to tinnitus
    - Turns the lights back on!
    - At same time be able to provide constant noise for retraining, should be set so mixes with tinnitus (can't habituate to what can't perceive)
    - Set it and forget it!
    - Move focus of treatment from tinnitus to auditory system and hearing loss

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Amplification and Tinnitus: Tips

- Keep it simple!
  - Fit to your preferred prescriptive methods using real-ear verification
  - Recommend: mic + sound therapy in most situations as much of the day possible
  - Patient control: Prefer to set at level in the office, mixing point and leave. Don't want them constantly adjusting and bringing attention back to tinnitus. But depends on patient!
  - Remind patient we don't want them to monitor the treatment (though they will at first) but set and forget!
  - Wear at least 8 hrs per day and use sound therapy at night in bedroom (e.g. soundpillow)
  - Provide sound therapy to both ears, even if tinnitus unilateral

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Amplification and Tinnitus: Tips

- There is an app for that!
  - Sound options are expanding with environmental sounds and/or use of smartphone
  - Manufacturer based Apps
  - SimplyNoise, SimplyRain
  - Fukuda et al. (2011) examined use of portable music players for TRT.
    - Found comparable reduction in tinnitus compared to hearing aids and ear level sound generators
  - Low-Cost
  - Customize sound (sound is subjective)
  - Downside: battery drain

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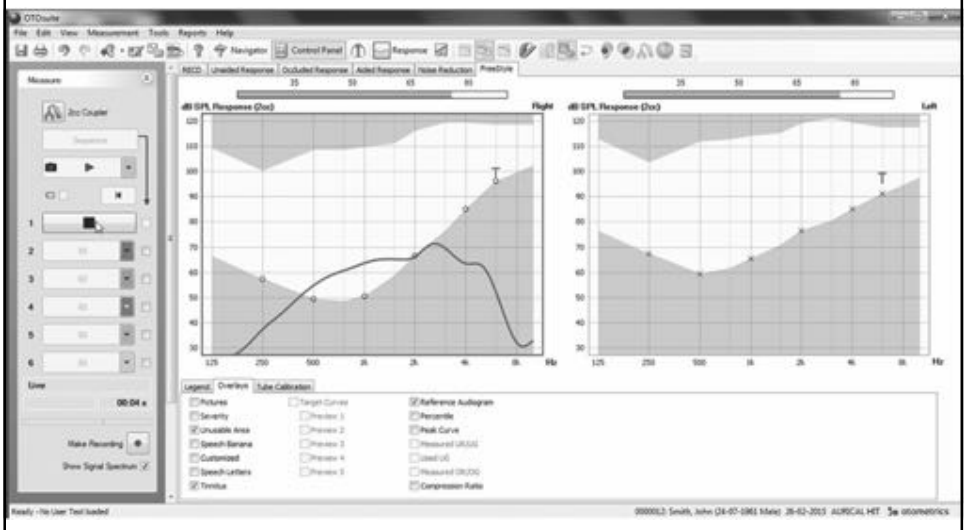

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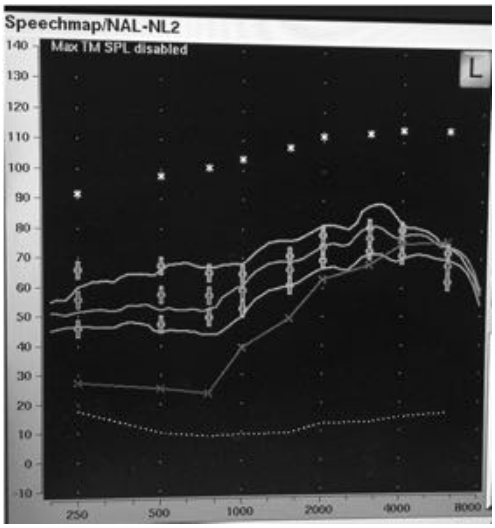

- Device fit to NAL-NL2 for a mild to moderate high frequency hearing loss.
- Speech-ISTS Stimuli
- Light Blue: Targets at 75
- Purple: Targets at 65
- Green: Targets at 55

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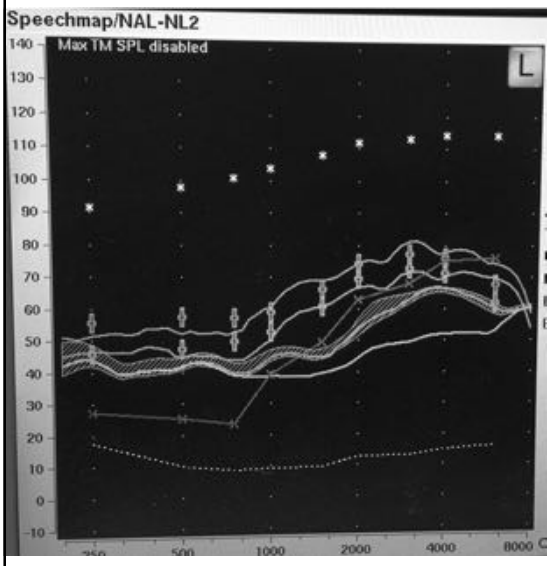

- Device fit to NAL-NL2 for a mild to moderate high frequency hearing loss on default settings for noise and directionality.
- Speech-ISTS Stimuli
- Purple: Targets at 65
- Green: Targets at 55
- Orange: Live setting-mic off, sound generator only
- Light Blue: Live-setting, Default sound generator on, mic-on, no speech (background noise only)

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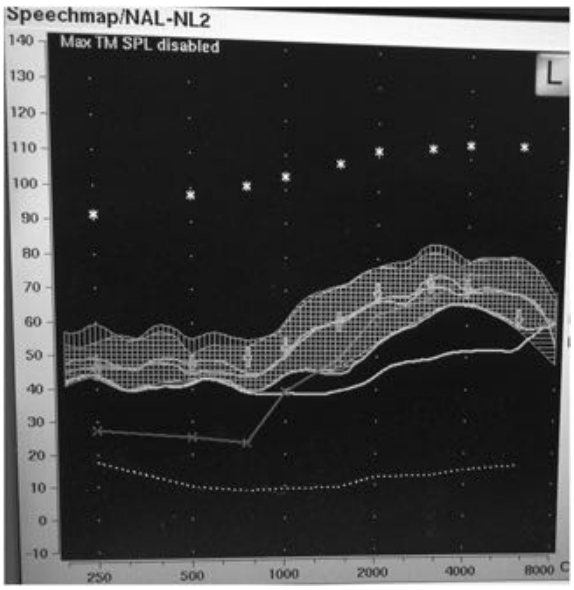
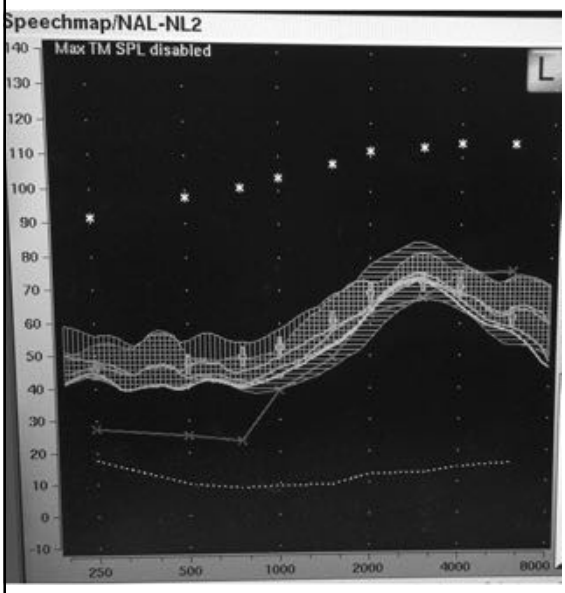


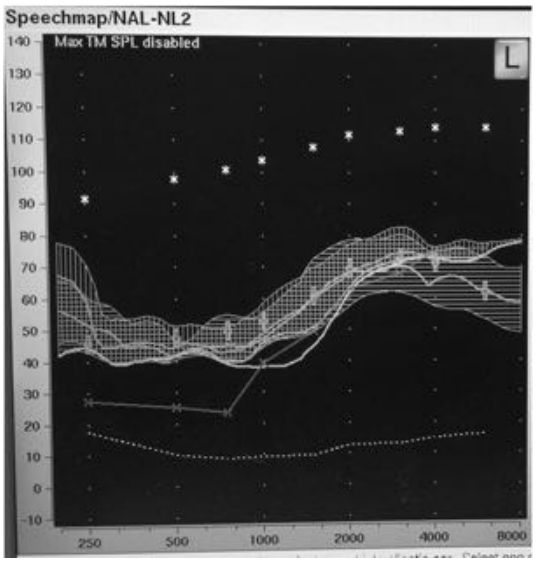
- Speech-ISTS Stimuli
- Green: Spectrum for 55 without sound generator on
- Purple: Spectrum for 55 with sound generator on
- Light Blue: Live setting with default sound generator on, mic on, but no speech
- Orange: Live setting-mic off, sound generator on, no speech (background noise)
- Sound generator was inaudible with mic on

55



- Speech-ISTS Stimuli
- Green: Spectrum for 55 without sound generator on
- Purple: Spectrum for 55 with sound generator on
- Light Blue: Live setting with sound generator on, mic on, but no speech
- Orange: Live setting-mic off, sound generator on, no speech (background noise)
- Sound generator raised until audible (mixing point)

56



- Speech-ISTS Stimuli
- Green: Spectrum for 55 without sound generator on
- Purple: Spectrum for 55 with sound generator on
- Light Blue: Live setting with sound generator on, mic on, but no speech
- Orange: Live setting-mic off, sound generator on, no speech (background noise)
- Sound generator changed to shaped noise and audible to subject

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	Tinnitus Feature Name/HA Models	Interesting Features	App Available?	App Features
Widex	Zen / Dream	Fractal "color" programs, reputation	No	n/a
GN ReSound	TSG & nature sounds/Linx2, Enzo, (Verso & Alero w/ phone clip)	6 nature sounds, "mixer" feature	Yes, Apple only	No steamer needed to track progress, bubbles calming experience
Starkey	Multiflex Tinnitus/ Z Series and Xino (RICs only)	16 bands of frequency adjustment	Yes, Apple & Android	No streamer needed. Soundpoint fitting, Target match
Phonak	Tinnitus Balance/ Bolero, Audeo	Can be used with com accessories, headphone or sound pillows	Yes, Apple & Android	No streamer needed calming exercises
Signia/Sivantos	Tinnitus Therapy Feature/ All current models	Ocean waves sound, up to 20 bands	Yes, Apple & Android	No streamer needed, adjust mic or therapy signal level
Oticon	Sound Support/ Alta2, Nera2, Ria2 Pro TI models	Ocean sounds	Yes, Apple	Uses streamer, can use sounds from own music library

Table 1. Comparison of hearing instruments with tinnitus features.

Young et al (2016)

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Amplification Summary

- Sound therapy summary
  - Keep it simple
  - Don't forget the therapy part
    - Once they reduce perception of time aware of tinnitus and annoyance significantly, reduce the level of the sound therapy one perceptual notch
    - Sound should not be bothersome, but relaxing, preferably passive listening

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Sound Sleep

- **SLEEP HYGIENE**
  - **Sleep is critical**,
    - No Naps, Bedroom = Sleep, Exercise (but not right before bed), Healthy Diet
    - Sound Pillow
    - Melatonin (run by physician)
    - Tinnitus wakes me up???
      - Early Flight Analogy
      - I have had 2 patients report tinnitus 24/7, and claimed they even had tinnitus in their dreams

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Counseling & Considerations: The Therapy Part

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5 Point (Holistic) Approach: Step by Step

1. Source: Counsel
2. Habituation & Cognitive Restructuring: Counsel
3. Sound Therapy: Treatment
4. Distraction: Treatment
5. Diet, Lifestyle, Sleep, Cure?: Treatment

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Holistic: Characterized by the treatment of the whole person, taking into account mental and social factors, rather than just the physical symptoms of a disease.

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Step by Step

- **Medical Evaluation**
- **History** and Structured Interview to direct assessment and counseling
- **Inventories to direct counseling (TFI, THI, TRQ, and etc.)**
  - **Tinnitus and Hearing Survey (Henry**
- **Go over Game Plan!**
- **Assessment (audio, tinnitus eval, and etc)**
- **5 Point Holistic Approach**
  - **Holistic meaning comprehensive whole person not pseudoscience**

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Tinnitus and Hearing Survey

	No, not a problem	Yes, a small problem	Yes, a moderate problem	Yes, a big problem	Yes, a very big problem	
A. Tinnitus						
Over the last week, tinnitus kept me from sleeping.	0	1	2	3	4	
Over the last week, tinnitus kept me from concentrating on reading.	0	1	2	3	4	
Over the last week, tinnitus kept me from relaxing.	0	1	2	3	4	
Over the last week, I couldn't get my mind off of my tinnitus.	0	1	2	3	4	Grand Total
	___	___	___	___	___	
	Total of each column					
B. Hearing						
Over the last week, I couldn't understand what others were saying in noisy or crowded places.	0	1	2	3	4	
Over the last week, I couldn't understand what people were saying on TV or in movies.	0	1	2	3	4	
Over the last week, I couldn't understand people with soft voices.	0	1	2	3	4	Grand Total
Over the last week, I couldn't understand what was being said in group conversations.	0	1	2	3	4	
	___	___	___	___	___	
	Total of each column					
C. Sound Tolerance						
Over the last week, sounds were too loud or uncomfortable for me when they seemed normal to others around me.*	0	1	2	3	4	

If you responded 1, 2, 3, or 4 to the statement above:

Please list two examples of sounds that are too loud or uncomfortable for you, but seem normal to others:

_____

_____

*If sounds are too loud for you while wearing hearing aids, please tell your audiologist.

For office use only (E): ☐M ☐H ☐N

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Slides and topics to incorporate into your counseling: See previous AO recordings

- Comprehensive Overview of Tinnitus Therapies
- Holistic Approach to Tinnitus Management

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5 Point Holistic Approach: Step by Step

1. Source: Counsel
2. Habituation: Counsel
3. Sound Therapy: Treatment
4. Distraction: Treatment
5. Diet, Lifestyle, Sleep, Cure: Treatment

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Tinnitus Theory

Peripheral

- Hair Cell
  - OHC & OAEs
- Auditory Nerve
  - Spontaneous Rate
  - Change in neural afferent potentiation
- Other neural
  - Imbalance of afferent and efferent input

Central

- Hyperactivity/increased spontaneous activity
- Bursting & synchronized activity
- Imbalance in inhibitory function (e.g. GABA)
- Reorganization of mapping
- Multisensory input
- Ephaptic transmission
- Limbic System
- Dysfunctional Gating
- Gamma and alpha waves

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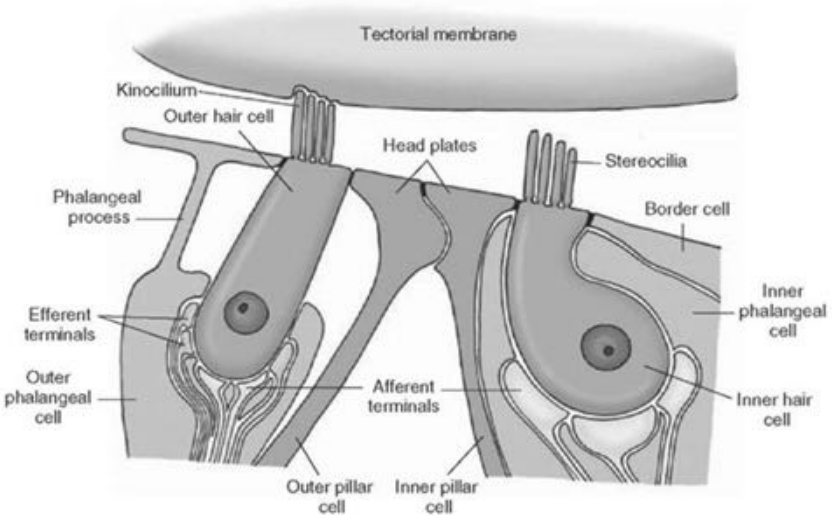

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Tinnitus Theory

- Limits of Peripheral Theory
  - Surgical sectioning of AN has limited effect (reviewed Baguley et al., 2002)
    - Approximately 40 to 85% see no improvement in tinnitus
  - Cochlear lesions result in numerous central changes

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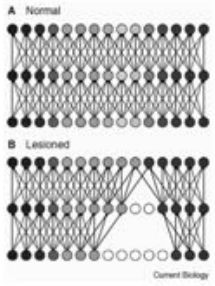
Tinnitus Theory

- Central (reviewed by Norena et al., 2012)
  - Central gain-compensatory price to pay
  - Abnormal amplification of spontaneous activity
  - Cross-modal plasticity
  - Reduced GABA (inhibition)
  - At all levels (CN---AC)



Schnupp (2011)

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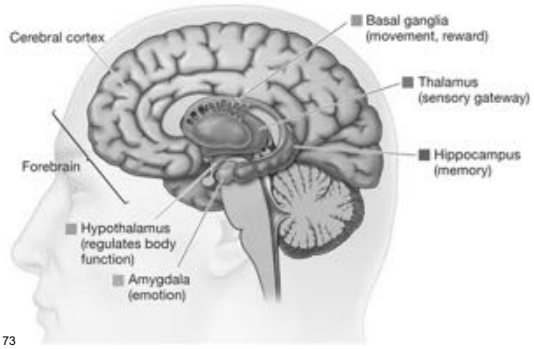
Tinnitus Theory

- Non-classical auditory
  - Somatosensory
  - Limbic System & Frontal Lobe
  - Cerebellum



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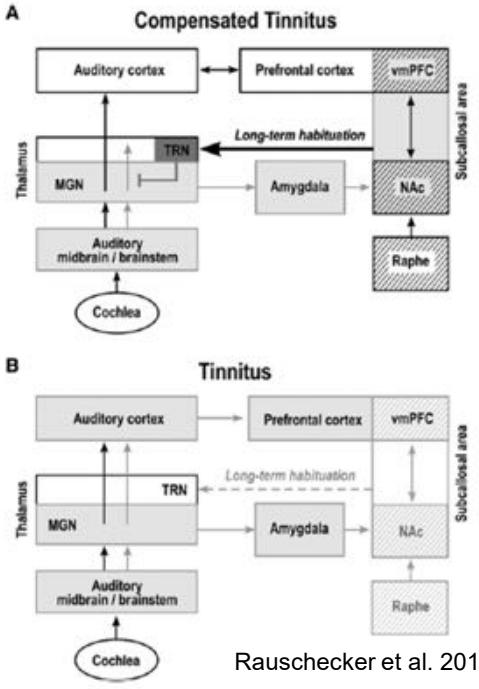

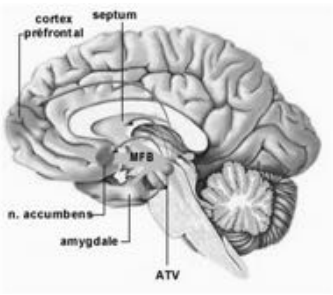

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Rauschecker et al. 2010

Source Homework

- Tinnitus is a spectrum based percept, most commonly a consequence of changes in auditory and non-auditory neural networks following damage to the cochlea. Homeostatic compensatory mechanisms occur after hearing loss and these mechanisms alter the balance of excitatory and inhibitory neurotransmitters. In many individuals with hearing loss, chronic tinnitus and related phenomena emerge. Some people with tinnitus are disturbed by this subjective sensation. When auditory network dysfunction is coupled with limbic-gating dysfunction, an otherwise meaningless auditory percept such as tinnitus may acquire negative emotional features.
- Ryan & Bauer (2016). Neuroscience of Tinnitus, Neuroimaging Clin N Am, 26 (2), 187-196.

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Counseling: How to Introduce Source Theory

- Do your homework: read!
- What to discuss with patient?
  - Normal Auditory System
  - Hearing Loss
  - Causes of Tinnitus
  - Transient Ear Noise
  - Tinnitus Neuroscience

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Summary on Hearing and Hearing Loss

- We hear with our brain not our ears
- The most common type of hearing loss is high frequency sensorineural hearing loss
- When hearing loss occurs are brain changes (neural plasticity) to try to compensate
  - This can result in ?

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Tinnitus Theory for Patient

- What causes tinnitus?
  - Early theories suggested everyone has tinnitus!
  - Heller and Bergman (1953)
  - Ear-lids?

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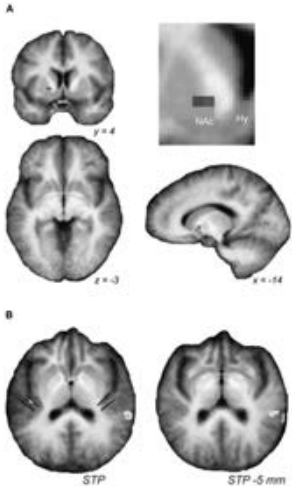
Tinnitus Theory for Patient

- What causes tinnitus?
  - More recent research using imaging
  - Tinnitus Modulation (gaze, cutaneous)
  - Auditory and Non-auditory regions implicated
    - Attention/Salience
    - Memory
    - Emotion/Stress



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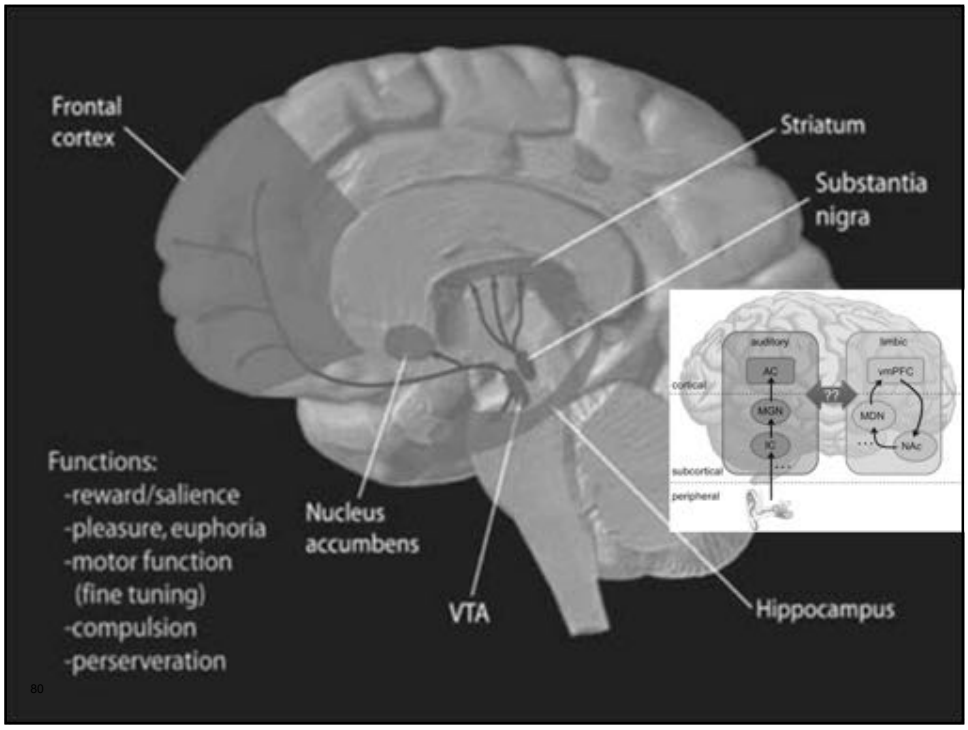

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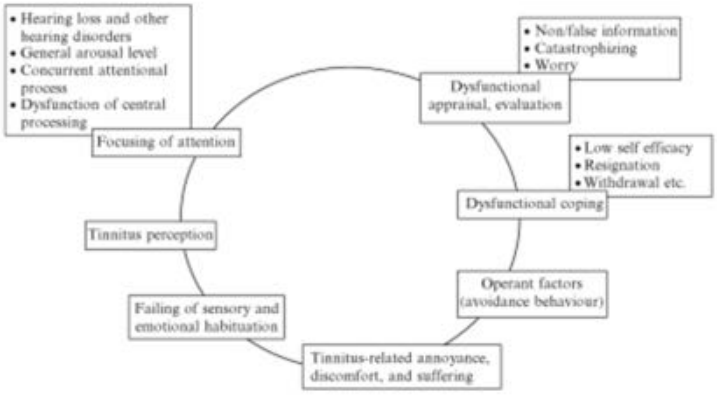

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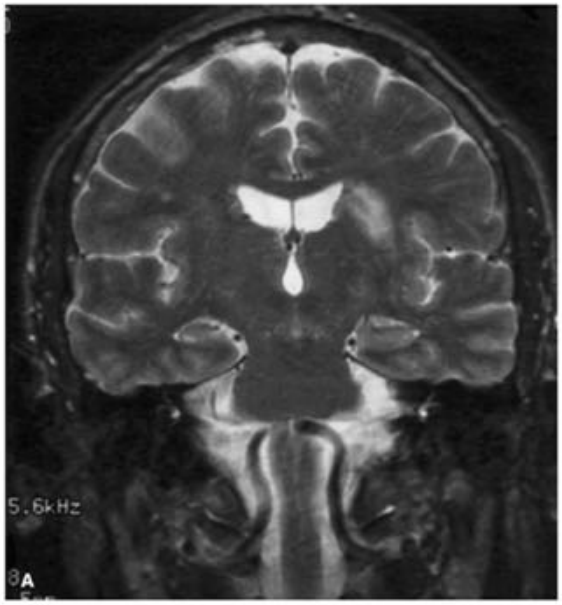

Lowry et al., 2004

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Non-Auditory Factors Analogies

- Tinnitus and Limbic Response
  - **Makes sense for brain to view as an alarm**
    - Normal reaction to not like
  - Car Engine Analogy (e.g., breathing)
  - Visiting Friend Analogy

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Source Summary

- Likely numerous contributions at various levels of system
- What to take away
  - Tinnitus is a side effect of neural change as a result of damage to hearing or other neural insult
  - This neural change results in a signal that is being interpreted in the brain as sound when no external sound is present
  - Tinnitus is not likely one single physiological disruption but involves both auditory and nonauditory regions of the brain
  - The brains interpretation of the tinnitus as a salient feature results in attention that can initiate a cascade of responses, which can result in the brain viewing tinnitus as negative or meaningless
  - Tinnitus is a psychophysiological phenomenon

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5 Point Approach

- Source: Counsel
- **Habituation and Cognitive Restructuring: Counsel**
- Sound Therapy: Treatment
- Distraction: Treatment
- Diet, Lifestyle, Sleep, Cure: Treatment

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Habituation

- When a new stimulus becomes “well known” and loses relevance, habituation can fail when associated with a negative evaluation.
- Brain does this all the time!
  - Shoes on feet
- It is the brains natural process to habituate to meaningless stimuli: this is why a doctor may tell you “you will learn to live with it”
- Sound is subjective
  - Learned positive and negative associations based on experiences

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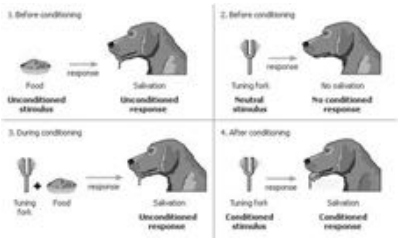
Habituation

- Definition of conditioning
- Can do the same with sound
  - Airport
  - Train
  - Clock
  - Air conditioning, fan, etc.



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Cognitive Restructuring

- Identify and correct maladaptive thoughts and behaviors
- What is the patient's perception of tinnitus
- Do they display cognitive distortions: e.g. all or none thinking, jumping to conclusions, disqualifying positive
- Help identify alternative thoughts and behaviors
- For example, patient stops going to concerts because of tinnitus

Negative thought	Thought error	Alternative thought
My life used to be perfect before I had tinnitus, now it is horrible	All or nothing thinking	Life is never perfect, I had some problems before, and I still have some good things about my life now (like my grandchildren)
My tinnitus makes me feel hopeless	Emotional reasoning	Other people have survived tinnitus, I can too

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Tinnitus: CBT/DBT

- **Can be very helpful even without sound therapy**
  - Relaxation techniques
    - Breathing and Imagery (see ATA website)
    - Yoga, Tai Chi
  - Other adjunctive therapy, e.g. Cognitive Behavioral Therapy
    - Tinnitus and Depression/Anxiety?
    - Hyperarousal
  - Do not make tinnitus a central part of your life, it shouldn't be
    - Internet searches, chat rooms, on search for the cure!
    - How can you habituate to something you are focused on.

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5 Point Approach

- Source: Counsel
- Habituation: Counsel
- **Sound Therapy: Treatment**
- Distraction: Treatment
- Diet, Lifestyle, Sleep, Cure: Treatment

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5 Point Approach

- Source: Counsel
- Habituation and Cognitive Restructuring: Counsel
- Sound Therapy: Treatment
- **Distraction: Treatment**
- Diet, Exercise, Sleep, Cure: Treatment

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Attention and Distraction

- **DISTRACTION**
  - When you notice or bothered do something positive!
  - Try not to actively engage the tinnitus
    - I can't just tell you not to think about it

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Whatever you do, do not think of a number right now!

7
3
4
?

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Attention and Distraction

- **Exercises**
  - **Switch attention from one stimulus to another**
  - **Start with something like the ring on your finger or shoes on feet**
    - **Forgot your shoes already???**
  - **Eventually move to tinnitus with caution**
    - **Focusing on tinnitus can change quality such as pitch and loudness and can demonstrate that altered attention can change these qualities as well as reaction**
    - **Incorporate sound therapy and relaxation techniques**
    - **Do so slowly**

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5 Point Approach

- Source: Counsel
- Habituation: Counsel
- Sound Therapy: Treatment
- Distraction: Treatment
- **Sleep, Lifestyle, Diet, Cure: Treatment**

95

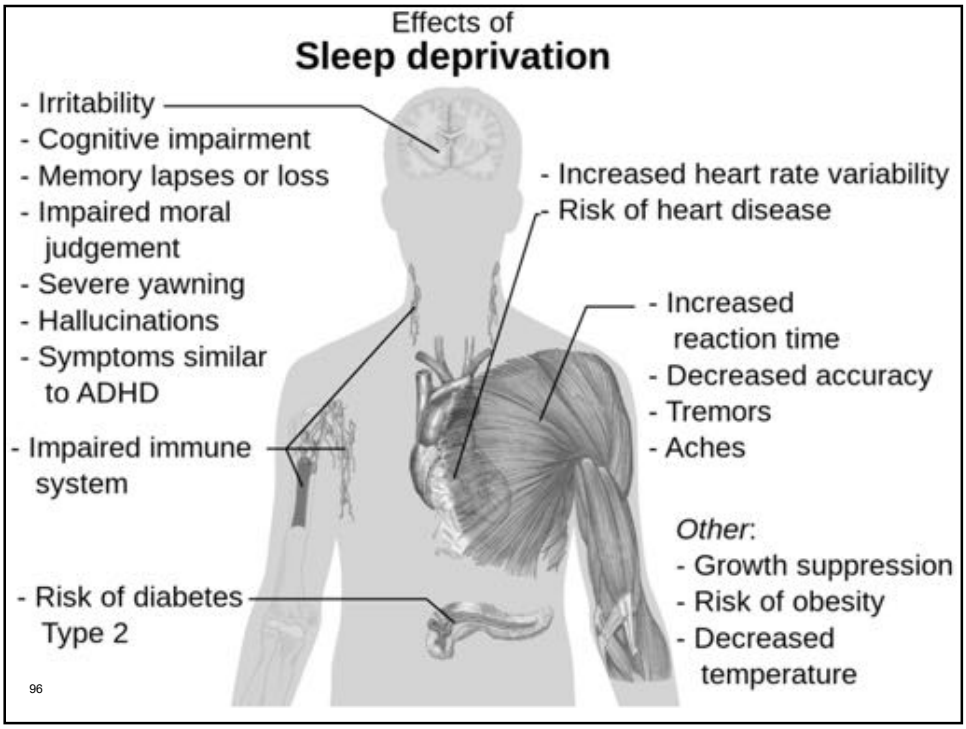

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Table 3

Sleep Hygiene

- Try to maintain a regular bedtime and waking time, even on weekends.
- Avoid napping.
- Use the bedroom only for sleep or sexual activity.
- Keep the bedroom environment cool, quiet, and dark. Avoid bright-light exposure during the night.
- Develop a relaxing bedtime routine. Avoid strenuous exercise or stressful activities before bedtime.
- Do not drink caffeine-containing beverages after noon; eliminate them if possible.
- Avoid heavy meals just before bedtime, a light bedtime snack may be helpful.
- Reduce fluid intake for several hours before bedtime to decrease the need to urinate during the night.
- Regular exercise, particularly during the late afternoon or early evening, may help to promote sleep. A hot bath or sauna at least several hours before bedtime may also be helpful.
- Avoid alcohol or nicotine use prior to bedtime.
- Turn the clock face away and do not check the time if you wake up at night.

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5 Point Approach: Lifestyle

- BE ACTIVE
  - Physical activity associated with lower levels of tinnitus severity (Carpenter-Thompson et al. 2015)
  - Adolescents and adults with higher physical activity were less likely to report tinnitus (Loprinzi et al. 2013)

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5 Point Approach: Lifestyle

- K-NHANES
- Tinnitus prevalence 20.7%
- Odds for reporting tinnitus was higher for females, smokers, less than 6 hrs sleep per night, those with stress, hyperlipidemia, depression, arthritis, thyroid disease, hearing loss, and noise exposure

Kim et al., 2015

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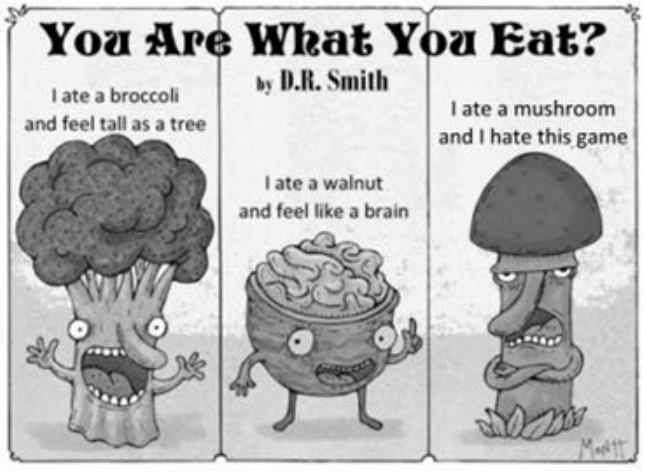

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5 Point Approach: Diet

- Zinc (DeBartolo et al. 1989)
  - Reduced tinnitus in people with zinc deficiency
- Low cholesterol diet and antilipid therapy (Sutbas et al. 2007)
  - Reduced tinnitus severity with diet and therapy
- Taurine (Brozoski et al. 2010, rats)
  - Reduce tinnitus in rats (glycine agonist)
- Caffeine abstinence (Claire et al. 2010)
  - No effect on reducing tinnitus

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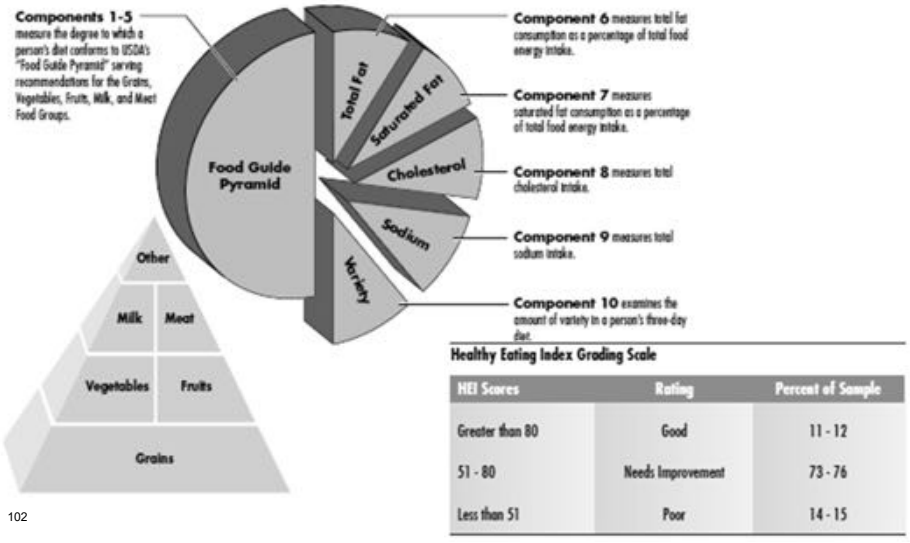
Health Eating Index



Healthy Eating Index Grading Scale

HEI Scores	Rating	Percent of Sample
Greater than 80	Good	11 - 12
51 - 80	Needs Improvement	73 - 76
Less than 51	Poor	14 - 15

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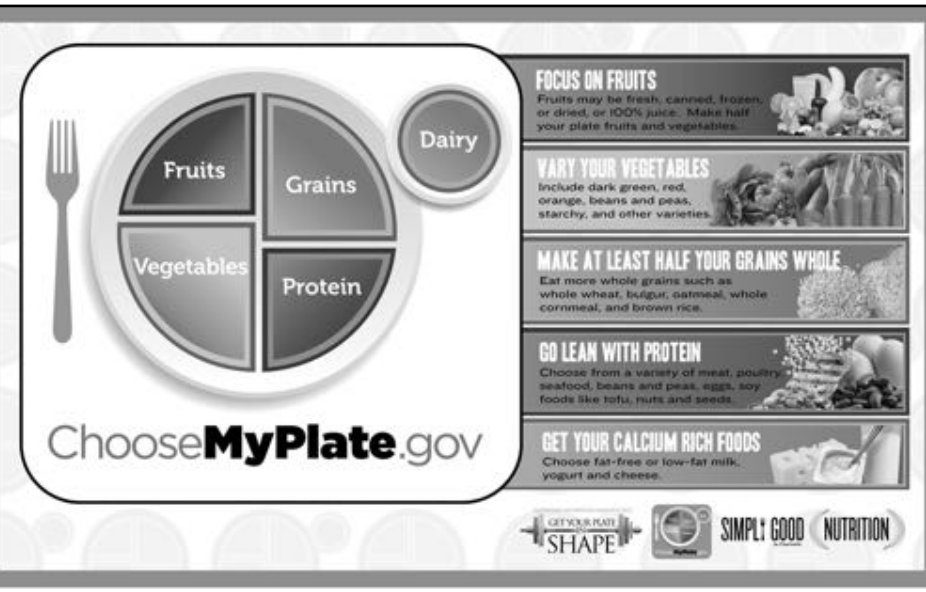

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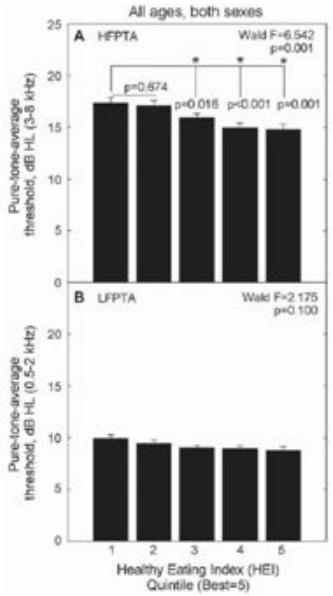
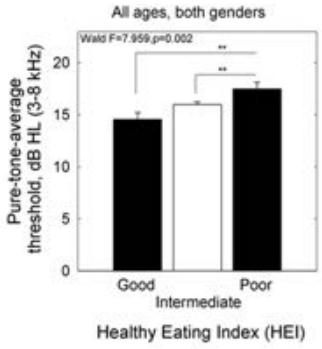


Figure 1. A. High frequency (HFPTA) and B. low frequency pure-tone average (LFPTA) and healthy eating index quintiles.



Spankovich & Le Prell (2013)

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5 Point Approach: Diet

- 2176 participants from 1999-2002
- HEI and reported tinnitus
- Weightings & Strata applied
- Adjusted for age, sex, race, education, smoking, noise exposure, diabetes, hypertension, and hearing loss
  - 3 Models
- Tinnitus
  - In the past 12 months have you ever had ringing, roaring or buzzing in your ears? (Yes or No)
  - How often did this happen (Always, At least once per day, at least once a week, at least once a month, less frequently than once per month)
  - Code: Tinnitus (in past year) coded as yes or no
  - Code: Persistent tinnitus coded as least once per month or greater, less than once per month or No were coded as not having persistent tinnitus

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Table 3. Covariate adjusted healthy eating index (bottom 40% vs. top 60%) and persistent tinnitus with sample weights applied.

	Healthy eating index (HEI)		
	Poorer HEI	*Better HEI*	P-*trend*
Model 1 odds ratio (95% confidence interval)	1.0 (referent)	0.64 (0.43, 0.94)	0.02
Model 2 odds ratio (95% confidence interval)	1.0 (referent)	0.73 (0.48, 1.09)	0.12
Model 3 odds ratio (95% confidence interval)	1.0 (referent)	0.67 (0.45, 0.98)	0.03

Model 1: Age and sex.
Model 2: Age, sex, smoking, race/ethnicity, diabetes, noise exposure and high frequency pure tone average.
Model 3: Age, sex, smoking, race/ethnicity, diabetes and noise exposure.

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Table 4. Covariate adjusted healthy eating index subscales and persistent tinnitus with sample weights applied.

Subscales of HEI	*Poorer intake*	*Better intake*	P-*trend*
Total fat*	1.0 (referent)	0.69 (0.49, 0.99)	0.04
Saturated fat	1.0 (referent)	0.88 (0.56, 1.37)	0.56
Sodium	1.0 (referent)	0.96 (0.67, 1.38)	0.84
Cholesterol	1.0 (referent)	0.79 (0.55, 1.15)	0.21
Grain	1.0 (referent)	0.74 (0.51, 1.08)	0.10
Fruit*	1.0 (referent)	0.61 (0.41, 0.91)	0.02
Vegetable	1.0 (referent)	1.25 (0.90, 1.79)	0.19
Meat and meat alt.	1.0 (referent)	1.01 (0.62, 1.65)	0.95
Dairy	1.0 (referent)	0.99 (0.66, 1.48)	0.95
Variety	1.0 (referent)	0.95 (0.61, 1.50)	0.83

*$p \leq 0.05$; Adjusted for age, sex, smoking, race/ethnicity, diabetes and noise exposure.

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5 Point Approach: Diet

- **HEALTHY DIET**
  - Health living-Diet and Exercise (get physician approval)
  - Eat healthy-Nutrient Dense: diet rich in green leafy vegetables, onions, mushroom, broccoli, berries, seed & nuts, tomatoes, colored veggies, Eat much as you want!
  - Make protein your side dish: grass fed beef and skinless chicken breast

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5 Point Approach: Diet

- **HEALTHY DIET**
  - Avoid: fried food, processed foods (including deli meats), reduce dairy intake, and reduce white foods (white flour, white rice, white pasta, white potatoes, white sugar)
  - Basically eat lots of whole fruits and veggies, reduce high glycemic index foods
  - Eat good amount of protein but not too much!
  - TALK WITH A NUTRIONIST/DIETITIAN

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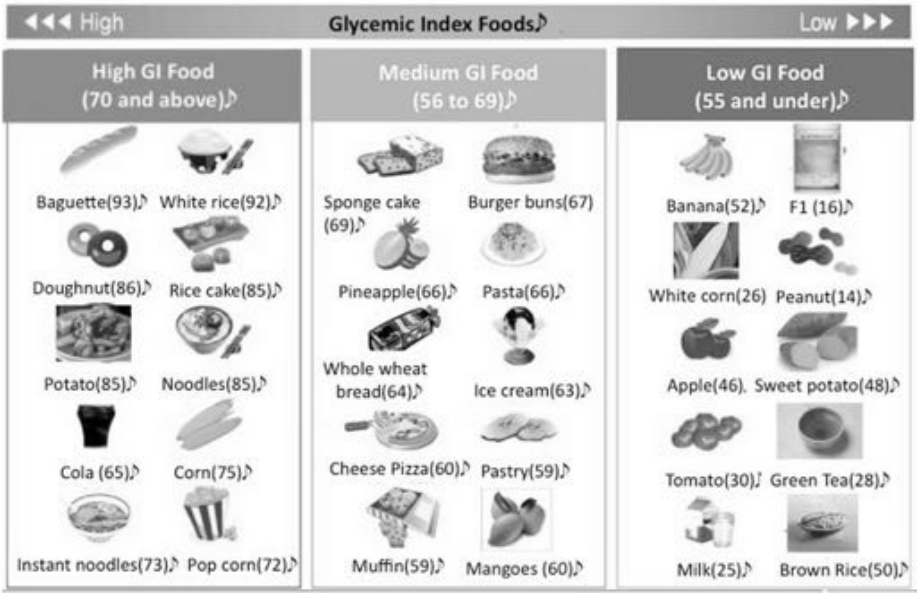

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Cure Train

- **Over the Counter**
  - No evidence any work greater than a placebo effect
  - Robert DiSogra, AuD has some good reviews an textbook available through Oak Tree Products
  - http://www.audiologyfreehold.com/ingredients-in-otc-tinnitus-relief-products

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Cure Train

- Iowa Women's Health Study (2011)
- Men's SELECT Study (2011)
- Chronic vs. Acute Prevention
- http://www.nytimes.com/2013/06/09/opinion/sunday/dont-take-your-vitamins.html?pagewanted=all&_r=0

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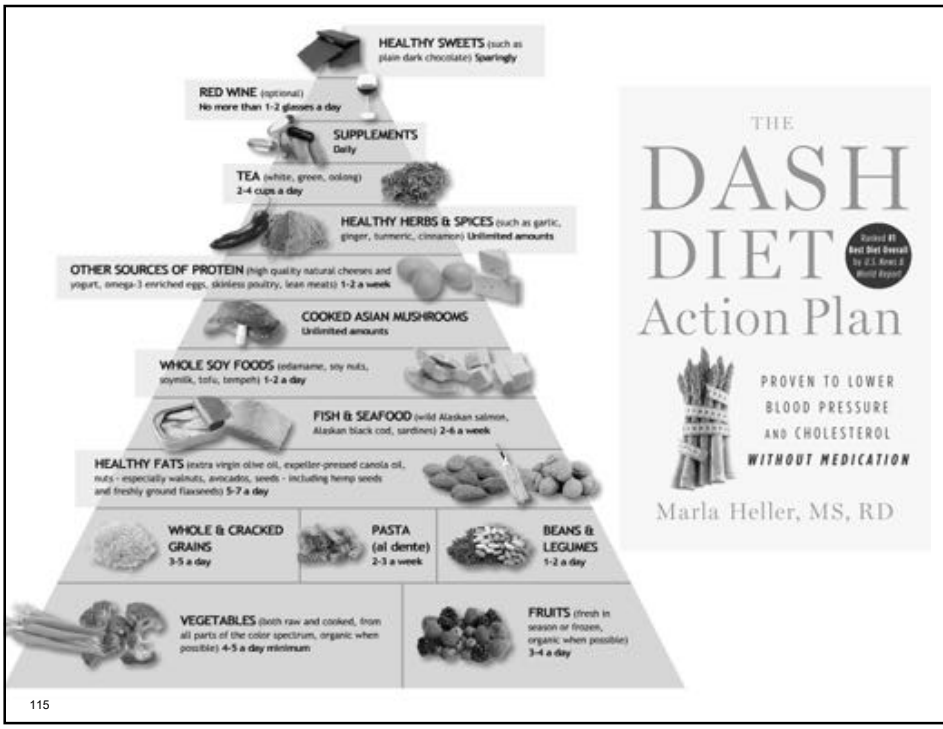

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5 Point Approach

- What I tell my patients?
  - My tinnitus story
  - Tinnitus is not a sign you are going crazy, the response you are having is normal to a sound your brain cannot resolve
  - Good news is the brain can habituate and this is its natural process (forgot those shoes again)
  - Good news is we can use sound, distraction, and other techniques to improve habituation
  - Avoid internet and “support” groups; I will keep you informed if a cure is developed (get off the cure train)
  - Don’t let the tinnitus control your life, you may not be able to turn off the sound, but you can change attention, thoughts, and behaviors (i.e. response)
  - Be healthy, eat healthy, exercise, improve sleep hygiene
    - Will not cure tinnitus but can help alleviate stress, increase physical activity, which can alter brains response
    - Tinnitus can be viewed as an alarm, but that does not have to be negative

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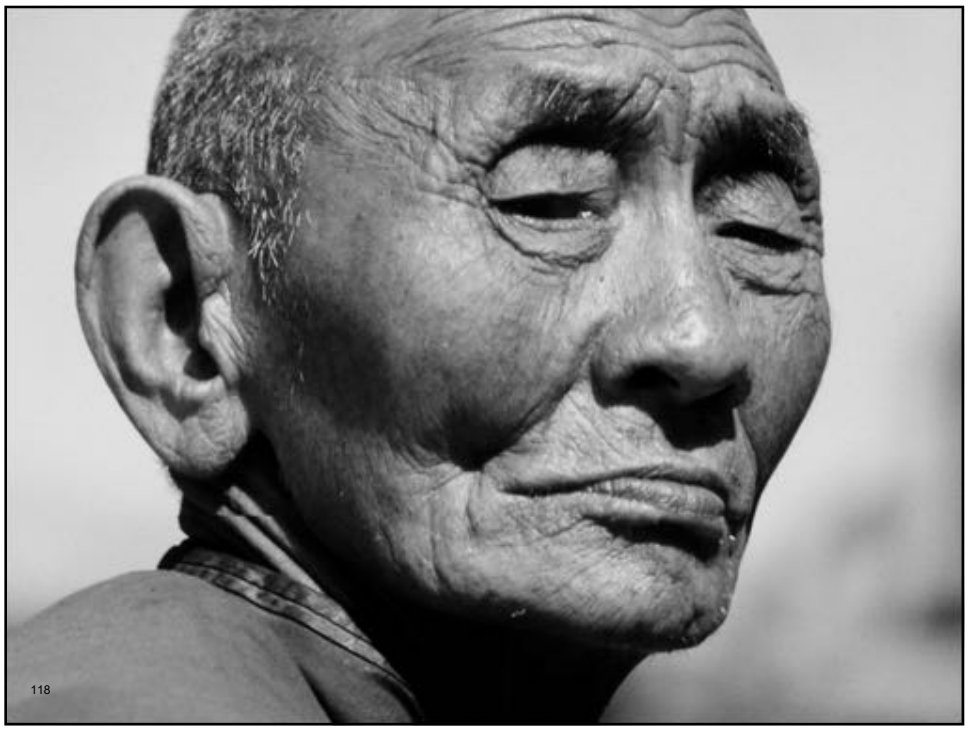

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Any Questions?
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