New Frontiers Toward a Quieter and Better Future

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Editorial and advertising office:
American Tinnitus Association
P.O. Box 5, Portland, OR 97207
(503) 248-9985 • editor@ata.org • ATA.org

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Direction to a Better Future

Melanie West, Chair, ATA Board of Directors

The promise of a better future is key when a person is challenged with tinnitus or hyperacusis. But, how do ATA members learn about the options that might make their quality of life a little bit better? ATA has brought to light a new pathway of communication – webinars. As we walk down this road of discovery together we want to keep our sights on the final destination…a cure for tinnitus or cures for tinnitus. In the meantime, we need solutions for today.

When the early explorers Lewis and Clark were forging the rivers and climbing nearly impassable mountains on their expedition, they stopped temporarily to utilize their “spyglasses” – brass telescopes 10 to 20 power to anticipate what terrain lay ahead. Today, powerful binoculars strong enough to view craters on the moon appear to place you within reach of earth’s only natural satellite.

With exceptional vision toward the future, ATA has also made this close up perspective possible for our members. Webinars virtually allow ATA members in the comfort of their own homes to “sit” with the researchers who have published the abstracts. Members can listen to how the scientist conducted the trial and ask questions about the outcomes. In the future this new medium of communication will also allow attendees to observe clinicians present management tools and techniques that are working for patients and listen to the science behind why these methods are successful.

Just like the high-powered binoculars, webinars appear to send the viewer to the research lab or clinic in diverse parts of the world. From Arkansas to Missouri and Georgia to New Zealand, the attendee is able to participate with world-class researchers and clinicians from all over the globe. As an ATA member you are able to learn about treatment options for today and the possible therapies of the future.

In a similar way that Lewis and Clark used the “spyglass”, you can utilize your computer, iPad®, smart phone, Kindle™ or any other device that is compatible with the GoToWebinar® platform to check out what lies ahead in the form of research or management techniques. If you don’t have a device on which to watch the program or you are traveling, you can dial-in and listen on your phone. Be sure to tune in to these informative and exciting presentations. We hope you enjoyed the first ATA webinar on November 10th. If you missed it, go to ATA.org and log-in to the Members section where you can view the video as a brand-new ATA member benefit. But, don’t miss viewing or listening live – a reason for this is the Q & A at the end of each webinar allows you to ask your questions directly to the featured speakers. Another reason to view or listen live is to be part of a tinnitus community joining in simultaneously for a live event.

ATA will be producing these programs every two months. The topics will be both research-focused and clinically based. Each webinar will also feature an ATA member; someone who will tell his or her story that will inspire hope to those who are on a similar path to rehabilitation. We will send you an announcement via email when registration is open, but you need to accept the invitation and register right away. There are a limited number of virtual seats for each webinar. We are indebted to the researchers, clinicians, sponsors and highlighted members who volunteer their personal time to help each one of us.
Our Mission: Improving the lives of people with tinnitus and hyperacusis by providing hope of a quieter future through education, advocacy, and research toward a cure.

Lewis and Clark did not start out on their journey without a mission, nor has ATA. From the beginning ATA has funded research grants and educated people about tinnitus. While doing this, members have voiced a need for ATA to have a broader vision to provide services today that they can utilize to manage their tinnitus and/or hyperacusis. Therefore, the directors and staff have carefully designed a new mission statement that encompasses these expressed essential elements.

First, hyperacusis has been added to the mission statement. Some members with tinnitus also have a condition called hyperacusis. According to Bryan Pollard, President of Hyperacusis Research and an ATA Board member, “Hyperacusis is a condition that causes a person to be unable to tolerate everyday noise levels without discomfort or pain.” The estimates of how many individuals who have tinnitus also have hyperacusis vary, but according to Richard Tyler, Ph.D., “Hyperacusis and tinnitus are often related”¹

This newly future-focused vision encompasses management tools for today; research for tomorrow; support for patients on the local level; collaboration with like-minded organizations; and advocacy for effective public policies to continue to advance science towards cures for tinnitus and hyperacusis. As members of ATA we are all headed in a direction to a quieter and better future.


The opinions expressed here are strictly those of the letter writers and do not reflect an opinion or endorsement by the American Tinnitus Association. If you are interested in any treatment mentioned, please consult with your healthcare professional to determine whether that treatment is right for you.

Letters to the Editor

I was surprised at the answer given in your Letters to the Editor section of the Spring 2015 *Tinnitus Today* to the person inquiring about protection from the dental drill. As a person who has had tinnitus for 17 years, I am well aware that the dental drill can be the worst enemy of a tinnitus patient.

I had a two-hour dental procedure performed 10 years ago and experienced a permanent spike in my tinnitus. At that time, I contacted Dr. Jack Vernon, and he gave me excellent advice that has prevented any future problems. He told me to ask the dentist to drill on an alternate basis. Ten seconds of drilling, 10 seconds not drilling. However, you still must use hearing protection, preferably of the ear muff type. Dr. Vernon explained that it is the close proximity of the jaw bone to the ear canal that results in conductivity. Fortunately, I have a very understanding dentist who cooperates fully with my request. Any drilling procedure takes longer for me than other patients, so the dentist schedules additional time.

I look forward to receiving each issue of *Tinnitus Today*, and wish your organization continued success.

Douglas Crawford
ATA Member, Arizona

Dear Douglas, Thank you for your letter to the Editor. Dr. Vernon’s advice is still good today as it was when he first gave it some 20 years ago. As you said, it can be an effective way to address your dental needs without making your tinnitus worse. As quieter dental technology has evolved, Dr. Vernon later suggested asking your dentist whether or not he had access to a quieter drill (Tinnitus Today, Summer 2010, Page 6).

In that same issue of Tinnitus Today, a dentist wrote in, noting that he had tinnitus for many years and that it never occurred to him that the tinnitus could be related to his exposure to the high speed dental drill. Dr. Vernon referenced a former patient of his, who as a dentist himself, conducted a survey of dentists in northern California. The results of the survey found that every dentist who purchased and used the high-speed drill developed a hearing loss, and over half had moderate to severe tinnitus. So the issue of the dental drill is not just something that patients should be concerned with, it is also an occupational concern for dentists, dental assistants, hygienists and other employees of dental offices.

To share your own story or comment, write to editor@ata.org or *Tinnitus Today* Editor, ATA, P.O. Box 5, Portland, OR 97207.
For months afterwards I noticed mild noises in my ears. In April 2010, I had another accident. Smarty Boy, my beloved Quarter Horse, spooked while walking him. I hit the ground hard causing a whiplash injury to my neck.

One morning in May of 2010, I suddenly awoke to a very loud ringing sound. I realized it was coming from my own ears. I jumped out of bed and poured peroxide in my ears hoping it would stop, but it didn’t. Even though this sound made me very anxious, I still went to work that day and then babysat my grandchildren afterwards. On the way to babysit, I went to a pharmacy drive-thru asking what medicine she had for ringing in the ears. My heart sank when she told me that there was nothing for tinnitus.

I started talking to others about my tinnitus. Surely someone had to know about some kind of remedy to stop this ringing sound. I was told by one person that salt could make tinnitus worse and yeast could cause it; therefore, I began eliminating salt and yeast from my diet. My chiropractor innocently recommended I take Omega fish oils for inflammation, so inflammatory foods were eliminated. While both of these things had overall health benefits, they did not lessen my tinnitus.

Then my tinnitus got worse. The anxiousness I felt became almost unbearable. I remember pacing the house and nights of not being able to sleep. I hadn’t let on to my husband Pete just how bad the tinnitus was, and how it made me feel. But I had reached my breaking point. One night, I woke Pete up sobbing and finally told him how bad things were.

The tinnitus began to impact every part of my life. I was losing weight at an alarming rate and had become noticeably anxious, which was out of character for me. It got to a point where Pete would not let me get up from the table until I ate something. Like a child, I sat at the table crying because I was afraid the food was going to make the tinnitus worse. This thinking got me to a point where I became suspicious of all foods and was afraid to eat almost everything.

My family periodically gets together at my stepmother’s lake house. I was always the designated boat driver for outings on the lake. I remember texting my sister to tell her that I was not feeling well and didn’t think I could drive the boat. This then caused alarm to the rest of my family that something was really wrong with me – but none of them could quite understand what it was I was describing, as none of them had ever had tinnitus. My children especially didn’t understand – none of this made any sense to them. One of my daughters told my sister, “I want my mama back!”

Pete took me to various doctors. One asked why I was making a big deal out of the tinnitus because it wasn’t going to kill me. I never went back to that doctor. The otolaryngologist (ENT) I saw was kinder when he said there was no cure or treatment and that I would have to live with it.

By now, I was getting concerned too – I was thin, pale, and frail by most accounts. When my best friend saw me, she cried. I had two grandchildren and another on the way. I certainly didn’t want my legacy to them and my children to be that their grandmother and mother starved herself to death because she couldn’t handle tinnitus. I was depressed and the sound in my ears was very loud and constant.

I started talking to others about my tinnitus. Surely someone had to know about some kind of remedy to stop this ringing sound.
ears was NOT going to go away on its own – I knew
I needed to find help.

In August 2010 I went to my dentist and he could tell
I wasn't myself. I debated telling him and thankfully
I did! His colleague also had severe tinnitus accom-
panied by depression and he referred me to Emory
University Hospital, who then referred me to Norma
Mraz, Au.D.

When I walked into Dr. Mraz's office I became
hopeful for the first time since tinnitus entered my life.
She spent a long time with me and my sister, Laura
Ann (who had accompanied me to the appointment),
finding out what had been going on and why I was
pale and frail. I had a hearing test and learned a lot
about a tinnitus treatment called Tinnitus Retraining
Therapy (TRT), a sound therapy, and discussed
combination hearing aids with sound generators.

FINALLY someone educated me about something
that could be done! And Dr. Mraz told me that if we
worked on the tinnitus – that my eating and unintend-
ed weight loss situation would likely fix itself. I knew
right then that I was NOT leaving her office without
purchasing the hearing aids and signing up for TRT.
I finally had hope that I was on my way to getting
better! Laura Ann and I call ourselves Thelma and
Louise when we do anything adventurous; therefore,
I named my hearing aids Thelma and Louise.

After a few months of therapy, Pete was able to
attend my last TRT session. Dr. Mraz spent a lot of
time educating him about the therapy and hearing
aids. He listened attentively. I asked him many times
if he had any questions, but he was unusually quiet.
Finally, he looked at Dr. Mraz and said, “Thank you
for giving my wife back to me.”

It has been five years since I overcame my tinnitus
and I am back in the saddle. The sound generators
and hearing aids helped me turn my tinnitus down
to a volume that is manage-
able and it does not impact
my life as it did before. I never
thought in those first few
months of having tinnitus that
I would ever go back to doing
the things I loved doing, but
I now proudly say (as Laura
Ann once said) that I am a
Dr. Mraz success story!

Dedicated to the memory
of Pete, my husband and
devoted tinnitus caretaker
who died, October 27, 2011,
at 52 years old.

Connie with granddaughter Cori Lee.

The Board of Directors and staff of the
American Tinnitus Association wish you
a happy and hopeful New Year.
Historically, the inner ear has been like a “black box” – challenging for scientists and medical researchers to understand and treat. Perhaps this is why there are no FDA-approved drug treatments for tinnitus, hearing loss, and balance disorders such as Ménière’s disease where the hearing or balance organs located within the inner ear play a role. As a result, the best that physicians can offer their patients today is the use of medications to treat the symptoms of these conditions such as the anxiety or depression associated with tinnitus, or the nausea and vomiting that can occur with severe vertigo. Clinicians may also resort to the use of drugs approved and intended for treating other conditions that provide relief for patients with certain inner ear disorders. For example, diuretics and steroids are routinely used for patients with Ménière’s disease, and steroids are considered the standard of care for treating a type of hearing loss called sudden sensorineural hearing loss. The lack of approved treatments designed specifically for treating inner ear disorders is devastating for millions of patients, and frustrating for their physicians.

But thankfully, the otic drug development landscape is evolving quickly. Today a greater share of research dollars are being devoted to ear-related disorders including tinnitus: venture capitalists invested $76.2 million in these types of conditions in 2013—the highest annual total since 2008—followed by $114.4 million in just the first half of 2014, according to a report by The Wall Street Journal. These efforts have led to a number of drug product candidates in advanced stages of development. If clinical testing of new therapeutics proceeds as planned, then within the next several years patients could have access to inner-ear targeted medications that have gone through full review by the U.S. Food and Drug Administration (FDA). The FDA requires rigorous nonclinical and clinical testing to understand a therapy’s safety profile, ensure effectiveness for patients, and that the health claims made by the product’s marketer are scientifically sound (see sidebar on page 9).

This is welcome news for patients who are eager for relief, and for whom a treatment backed by evidence cannot come soon enough. One such patient is Jay Lichter, Ph.D., a San Diego-based venture capitalist and biotech entrepreneur, who was diagnosed with Ménière’s disease in 2008. In Jay’s own words, “the vertigo attacks were debilitating, lasting eight to 10 hours a day, three times a week. My doctor said there were no approved medicines for Ménière’s disease, and I decided that something needed to be done.” So working with his physician, Dr. Jeffrey Harris, Chairman of the Otolaryngology Department at the University of California San Diego.
Medical Center, Jay started a biotech company called Otonomy. This was the first company focused on optimizing drug delivery to the ear in order to create a pipeline of products for patients desperate for new treatments.

The challenge of delivering medications to the inner ear is due to its protected location. Entry from outside the ear is limited by the eardrum and delivery of drugs via oral or intravenous (IV) routes are restricted by the minimal blood flow to the inner ear and a blood-cochlear barrier similar to the blood-brain barrier that protects the brain. Fortunately, specialty ear physicians known as otologists realized more than a decade ago that local drug delivery via direct injection through the eardrum, called an intratympanic or IT injection, offered a viable approach to treating inner ear diseases. After numbing the eardrum, a drug is injected into the middle ear cavity where it passes to the inner ear through a thin membrane called the round window membrane. In clinical trials, favorable results have been reported with IT injection of drugs for various inner ear disorders including tinnitus, Ménière’s disease and sudden sensorineural hearing loss.

However, a limitation of IT injection of solution-based drug formulations is their rapid elimination from the middle ear cavity down the Eustachian tube when the patient talks, swallows or sits up. The short time that the solution remains in contact with the round window membrane in the middle ear cavity limits the amount of drug that can pass into the inner ear and also limits the duration over which the drug is retained in the inner ear. In an attempt to help mitigate this problem, ENTs require patients to remain immobilized for an extended period of time following each IT injection, and return for additional IT injections during the course of treatment.

To address this challenge, Otonomy has developed a proprietary formulation technology that is designed

What’s a Clinical Trial?

People with tinnitus and other untreated conditions often wonder why safe and effective medications are not already on the market, especially when they read about promising products in development. One main reason: The length of time required for companies to complete the rigorous clinical trials that are required for approval of a new drug product by the FDA.

A clinical trial is a research study that seeks to understand a treatment’s safety profile and whether it is effective for a particular condition. A trial is typically sponsored by a company and conducted at a number of clinical locations each of which has an investigator who is generally a physician and other clinical trial staff including a study coordinator. Drugs must progress through three phases of clinical trials carefully planned in collaboration with the FDA before they can be considered for approval, and may also undergo a fourth phase of testing after FDA approval. A description of the phases of drug clinical trials taken from the U.S. National Institutes of Health is as follows:

**Phase 1:** Researchers test a new drug or treatment in a small group of people for the first time to evaluate its safety, determine a safe dosage range, and identify side effects.

**Phase 2:** The drug or treatment is given to a larger group of people to see if it is effective and to further evaluate its safety.

**Phase 3:** The drug or treatment is given to large groups of people to confirm its effectiveness, monitor side effects, compare it to commonly used treatments, and collect information that will allow the drug or treatment to be used safely.

**Phase 4:** Studies are done after the drug or treatment has been marketed to gather information on the drug’s effect in various populations and any side effects associated with long-term use.

Drug Delivery Innovation Opens New Frontier: The Inner Ear

to provide sustained drug exposure in the ear from a single IT administration. This technology utilizes a thermosensitive polymer which transitions from a liquid to a gel when exposed to body temperature following administration. The polymer is combined with tiny drug particles that are retained in the ear for an extended period of time. Since the gel is retained in the ear, the patient does not need to remain immobilized and can get up right after the injection. Furthermore, the sustained release drug exposure profile has been designed to include only a single IT injection thereby eliminating the necessity for repeat injections.

Otonomy has applied this sustained-exposure technology to develop several potential therapies for inner ear disorders. This includes OTO-104, a potential treatment for Ménière’s disease that is entering the final phase of clinical testing called Phase 3, and OTO-311, a product candidate for treating tinnitus that is starting clinical safety testing called Phase 1 (See sidebar on page 9 for a description of the different phases of clinical testing. For more information on potential ear therapies in development by Otonomy, visit Otonomy.com/pipeline.) Although progress in the development of new drug treatments will never be fast enough for patients, especially those suffering from debilitating disorders such as tinnitus, vertigo, and hearing loss, the increased level of focus and activity by researchers and drug developers in this area should provide hope. And while the multiple phases of clinical testing required by the FDA before drug approval may seem excessive to patients, the rigorous testing is intended to protect future consumers and ensure that a new drug treatment is effective and its safety profile is well understood before widespread use. As in the tortoise and hare fairy tale classic, hopefully slow and steady wins this race to help those with inner ear disorders.

Dean Hakanson, M.D., is Otonomy’s Chief Medical Officer. He has previously held various roles in medical and regulatory affairs, and healthcare access at several international pharmaceutical companies, including Novartis AG, Bristol-Myers Squibb, Genentech, and GlaxoSmithKline. Dr. Hakanson received his medical degree from the University of Colorado School of Medicine.

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It’s a familiar scenario. A 76 year old woman notices that she is missing conversation with her bridge group, she has difficulty hearing the sermon at her church, and her son notices he frequently has to repeat himself.

She consults an audiologist for a hearing evaluation and she is informed that she has a significant loss and that hearing aids are strongly recommended. She recalls horror stories of her mother’s hearing aids from decades ago and elects not to address her hearing loss. As a result, she continues to miss jokes with friends, stops attending her weekly church services, and her son constantly has to speak up louder. So, what’s the risk? She will feel isolated from social activities or fatigued from straining to hear her family. But, could ignoring hearing loss negatively impact more than just her social life? The risk is greater than she might think.

**Hearing Loss and the Aging Population**

Approximately 48 million people in the United States have hearing loss and it is the third most prevalent chronic health condition in older adults. With the aging of our Baby Boomer population, these numbers are growing: 50% of those over age 70 and three in 10 people over age 60 have hearing loss. However, only approximately 15% of those with hearing loss use hearing aids. So why are people with hearing loss so willing to ignore it?

Hearing loss is typically very subtle in onset, such that symptoms are often ignored or attributed to another reason for miscommunication—too much background noise is present, the speaker mumbles or talks too fast, or the sound source is too far away. Additionally, the difficulties associated with hearing loss are often thought of as an “inconsequential part of aging,” and thus some people say that they “hear what they need to hear to get by” and choose not to treat their hearing loss. Perhaps surprisingly, this nonchalant approach to treating (or rather, not treating) hearing loss adopted by society is affecting more than just communication—it is negatively impacting the brain.

**Dementia Statistics**

The term “dementia” refers to a vast range of symptoms of memory decline that significantly compromise the patient’s independence. Symptoms vary from a decline in short term memory or difficulty with reasoning and judgment to visual hallucinations and changes in personality. Generally, dementia is caused by damage to brain cells; the symptoms are dependent on which area of the brain is damaged. As of 2010, there were 35.6 million people living with dementia globally—a number expected to reach 115.4 million (1 in 85 people) by 2050.

The overall impact of dementia goes far beyond the patient. It affects the children of the patient who may act as the sole caregiver to their parent or who often escort them to doctor’s appointments. The cost of unpaid caregiving by friends or family of those with dementia is estimated at $220 billion in the United States and there are 15.5 million dementia caregivers that provide over 17 billion hours of unpaid care for their patients. Treatment for dementia cost Medicare and Medicaid approximately $200 billion in 2012; a number that is expected to climb to $1.1 trillion by 2050. Consequently, the effect of dementia is much broader than that on the individual and their family.

**Can hearing loss really put someone at risk for dementia?**

It has long been documented that living with an untreated hearing loss puts someone at risk for social isolation and depression. Often, individuals will begin
Untreated Hearing Loss Linked to Dementia: Listen Up, Before You Forget

to avoid certain environments where they have difficulty hearing. Additionally, they may have difficulty with certain voices and they may stop answering their telephone because they cannot hear the person on the other end.

Over the past several years new research indicates that untreated hearing loss is independently associated with cognitive decline. In other words, having an untreated hearing loss is enough to put someone at risk for dementia. The risk is related to the severity of the hearing loss, such that for every 10 decibels of hearing loss, the chance of developing symptoms of dementia increases by 20%. For a 25 decibel hearing loss, considered only to be a “slight” hearing loss by audiologists, the associated cognitive decline is comparable to a seven-year decline in age (Lin).

So how does untreated hearing loss affect the brain? Someone with hearing loss has to use more cognitive effort to piece together the same speech information than someone without hearing loss, particularly in adverse listening environments. Over time, the strain associated with this cumbersome process of speech understanding may leave the brain vulnerable to dementia.

When a speech signal is not clearly understood, the brain uses different resources to hear at the expense of other brain functions. Hearing loss is shown to be associated with a loss of gray matter in the auditory cortex and in the right temporal lobe, two areas that play a very important role in speech processing ability. Brain atrophy in these regions not only adversely affects how individuals with hearing loss are able to process, understand, and respond to speech information, but also is comparable to brain atrophy observed in individuals developing mild cognitive impairment.

Use of Hearing Aids and Reducing Risk of Cognitive Decline

But what if the hearing loss is treated with hearing aids? It seems logical that by providing increased audibility, the person with hearing loss would no longer need to strain to hear in most listening environments. Consequently, this would reduce the associated social isolation and decrease the risk of developing dementia.

One study of 164,770 participants revealed that hearing aid use was associated with better cognition after accounting for age, sex, general health, and socio-economic status. This study also found that better cognition was independent of the reduction in social isolation and depression that is often associated with hearing loss. While this study demonstrated a correlation between hearing aid use and better cognition, it has limitations. The rate of cognitive decline was not measured longitudinally and the study did not show a direct causal relationship between hearing aid use and better cognition. Additionally, the study does not rule out the fact that more cognitively able people may tend to pursue hearing aids.

Further research on the use of hearing aids and their role in reducing the risk of cognitive decline is essential. Is untreated hearing loss a risk factor for dementia regardless of providing treatment? Or, could audiologists play a role in reducing cognitive decline by providing exceptional hearing loss management?

Proposed Solution: The Audiologist’s Role

While we don’t yet fully understand the impact that treating a hearing loss has on cognitive decline, it is possible that aggressively managing a hearing loss could reduce the risk of cognitive decline in people with hearing loss. Through excellent hearing loss treatment, audiologists keep their patients engaged in their social lives and have the potential to help preserve their cognitive abilities.

Hearing loss treatment should extend beyond fitting hearing aids alone, ensuring that people can hear as best as possible in the environments in which they previously had difficulty. For example, in poor acoustical environments, such as a place of worship or a theatre, hearing aids have limitations. The microphones cannot stretch from the 20th row of a place of worship and grasp the voice of the minister perfectly. Recommending hearing loop technology and hearing aids with telecoils from the speaker’s microphone directly into their hearing aids, thus bypassing the background noise in the room and overcoming the large distance from the alter, gives the person the ability to listen at their place of worship and engage with the congregation again. Accompanying adequately fit hearing aids with the use of hearing assistive technology (i.e., hearing loops, telephone amplifiers, television listening systems, etc.) gives the person the ability to hear in places they previously avoided because of their hearing loss. In doing so, audiologists may be treating more than just a hearing loss, but also reducing the risk of cognitive decline in our patients.

1 Bouton, 2013; Childers, 2012; Wingfield & Peelle, 2015
2 Lin et al, 2011
3 Peracino, 2014
4 Dawes et al 2015
Myths of Hearing Loss

In general, the medical model in the United States is to treat health problems as they arise, rather than to practice preventative care before the health issue occurs. Unfortunately, hearing is no exception to this model. Most people tend to avoid undergoing a hearing assessment until they notice they have difficulty hearing; and even then, only 15% of people with hearing loss treat the issue.

Here are some common myths of hearing loss and hearing loss treatment:

MYTH #1: If I had a hearing loss, my physician would tell me.
FALSE. According to the Better Hearing Institute, only 13% of physicians are routinely screening for hearing loss during a physical. Hearing loss is often difficult to notice in quiet environments (i.e., a physician’s office) because a lot of people who have difficulty hearing can fill in the gaps and respond appropriately with the use of visual and context clues. Consequently, physicians may not notice you are having difficulty if you do not specifically mention it to them.

MYTH #2: I should wait until I am having difficulty hearing to have my hearing tested.
FALSE. It is important to regularly monitor your hearing so that hearing loss can be treated at its onset rather than years later when the brain has more difficulty with processing speech information. There are several risk factors for hearing loss, including history of noise exposure, smoking and exposure to secondhand smoke, diabetes, high blood pressure, high cholesterol, heart disease, kidney disease, and family history of hearing loss. Anyone with these risk factors should be assessed for hearing loss regularly.

MYTH #3: Even if hearing aids are recommended for me, I won’t be able to afford them anyway.
FALSE. It’s true that hearing aids are expensive, but most audiologists offer different levels of technology at different prices. While they should make a recommendation for which technology level is best for you, they are open to discussing the differences each level would make for your hearing and for your budget. Also, there are often payment plans available that allow you to stretch the total cost over several months, making it easier for you to obtain the hearing aids that are best for you.

MYTH #4: A hearing aid alone is enough to help me hear perfectly in all the areas I have difficulty.
FALSE. Hearing aids are certainly wonderful for providing amplification in areas you otherwise would not hear. However, there are some places that are too noisy, some places that are too large, some voices that are too soft, and some speech that is too mumbled—even with normal hearing! It is important that you are educated on communication strategies through aural rehabilitation classes and that assistive technology is appropriately recommended by the audiologist.

MYTH #5: There is no risk in waiting a few years to treat my hearing loss.
FALSE! There are several risks when living with an untreated hearing loss. Firstly, the sooner a hearing loss is treated, the easier it is to learn how to use hearing aids. The brain is sharper for improved hearing, dexterity is better for proper insertion, and it is easier to learn new tasks when we are younger. Secondly, the phrase “if you don’t use it, you lose it” applies to hearing loss. When the brain is not accustomed to hearing specific speech sounds, it can actually forget how to recognize them. It’s called auditory deprivation. The longer your brain goes without hearing, the less likely speech will be clear once hearing aids are used. And lastly, leaving a hearing loss untreated leaves the brain susceptible to cognitive decline. The strain on your brain associated with trying to process a poor acoustical signal and the risk of social isolation and depression leaves those with hearing loss at risk for developing symptoms of dementia.
Now 25 years after his seminal 33-page publication entitled Phantom Auditory Perception (tinnitus): Mechanisms of Generation and Perception was published in the August 1990 issue of Neuroscience Research, it has become the most quoted paper in tinnitus literature and Dr. Jastreboff remains dedicated to teaching clinicians and refining the care of patients worldwide. In 1993, he received the prestigious “Robert W. Hocks” award from ATA for his contribution to the field of tinnitus. In 2014, at the 11th International Tinnitus Seminar, he received the “Award for Clinical Excellence” for his 25 years of work in TRT. He generously surrenders his knowledge in hopes of elevating the level of understanding and treatment for those with tinnitus and decreased sound tolerance. In celebration of this silver jubilee, I invited Pawel to this very special interview in hopes that ATA readers could learn more about the kind man who wears his heart on his sleeve and who feels blessed to have saved, and continues to save, quality of life for thousands of patients.
Michael Robb (MR): Thank you, Pawel, for this unique honor to speak to you in celebration of the silver jubilee of your scientific work and TRT.

Pawel Jastreboff (PJ): Well it is I who should be thanking you for your efforts to share your knowledge of TRT and for all the nice things you have said about me.

MR: What kind of a student were you in school?

PJ: I liked difficult problems and I enjoyed tackling seemingly impossible challenges. I never studied one subject too intensely because I found that boring. I was never a straight A student but in high school, I took part in the country-wide Olympics in Physics, Chemistry and Astronomy; I made it to the final level of all of the Olympics, received Distinction in Chemistry and consequently earned free entrance to the University of Warsaw. There I studied electroaoustics and electronic engineering for my first master’s in science degree and majored in biophysics for my second M.S., degree. My post-graduate work was in neurophysiology and electrophysiology and I earned my Ph.D., from the Polish Academy of Sciences. My post-doctorate work was at the University of Tokyo, Japan and subsequently a habilitation degree (Sc.D.) from the Polish Academy of Sciences. Later on in my career, I obtained a master’s degree in business administration from Emory University.

MR: Are your children following in your footsteps?

PJ: No. My daughter shares an interest in studying brain function using functional magnetic resonance imaging (fMRI), but she focuses on obesity and diabetes. She is an assistant professor at Yale with M.D., and Ph.D., degrees. I have one son who works in finance and is an executive at JP Morgan in Hong Kong.

MR: What are the main interests, passions and contributions of your wife, Margaret M. Jastreboff, Ph.D.?

PJ: Margaret was always a very curious person with broad interests, passion, ideas and a lot of energy. Her background is in pharmacology, cellular and molecular biology with a Ph.D., in cell biology and anti-cancer research. She conducted cancer research for 15 years. In 1991, she joined my group, initially in the lab, and later worked with patients. Her main contribution is recognizing the phenomenon of misophonia – or those who have adverse reaction to specific everyday sounds. She is passionate about treating children, particularly with autistic spectrum disorders who have decreased sound tolerance. Together, we devised protocols for misophonia treatment. She encourages me to go easy on theory and work on implementation via language that is easy to understand. She argues with me all the time.

MR: When you drafted the neurophysiological model of tinnitus and explained the critical role of the cochlea (generation), the brainstem (detection), the limbic system (fear and emotion), the autonomic system (fight or flight response) and the cerebral cortex (perception and evaluation of tinnitus) in problematic tinnitus vs. the classical auditory system playing a secondary role, were you aware of the ongoing research by Joseph LeDoux, Ph.D., at New York University on the amygdala and the human fear response?

PJ: No. I was not aware of him or his research in 1990 and even for several years later. I ended up using the terms “upper loop and lower loop” to describe important feedback loops and later found out that he was calling these same neural circuits the “high road and low road.” Through the years, I have gotten to know him and we have discussed our mutual interests at scientific meetings.

MR: What distinct contribution did your British otolaryngology colleague Mr. Jonathan W. P. Hazell and audiologist Jacqueline Sheldrake make to TRT?

PJ: The contribution of Mr. Hazell and Ms. Sheldrake has been very important. I had been instructed in the method of tinnitus masking personally by Jack Vernon, Ph.D., which at the time was also in use by Jonathan and Jacqui. On October 12, 1988, as a part of my travel around Europe, I stopped in London and met with Jonathan and Jacqui. Jonathan described their program to me, which was totally based on masking, while Jacqui shared an everyday clinical observation with me. She noticed that tinnitus patients were improving using a

It is important to realize that TRT offers not only effective treatment for tinnitus but also treats related symptoms like anxiety and depression associated with tinnitus. Post-treatment tinnitus no longer interferes with the patient’s life as it did before.
lower level of sound therapy that was not completely masking the tinnitus. This was exactly as predicted by my neurophysiological model. Then I described to them my model including the concept of habituation and the clinical method based on my model which later was named Tinnitus Retraining Therapy. They liked it so much that they switched from masking to what is now known as TRT and very quickly saw positive results which were much better than masking.

The meeting led to years of friendship with Jonathan complete with long constructive discussions that helped in shaping the TRT protocol. Initially, I did not have clinical experience and Jonathan shared with me his experience as a clinician. While he did not contribute to the neurophysiological model, to the scientific basis of TRT or misophonia, he was very helpful in shaping the clinical implementation of TRT as well as the propagation of TRT in England and Europe in the 1990s. Jonathan helped me translate the model from theory into the clinic so the patient could understand everything. He helped to squeeze the idea out of me and put the rather difficult concepts into words which could be used during counseling. Jonathan’s significant input made the tinnitus clinic in Baltimore, Maryland better.

**MR:** Who was the linguist who contributed to the generation of the term misophonia?

**PJ:** Guy Lee, a Latinist at St. John’s College in Cambridge who died in 2005. He was the father-in-law of Jacqueline Sheldrake, collaborator of Mr. Hazell. He was a scholar in Greek to Latin translations. At my request, he sent us a number of pre and post fixes indicating a negative reaction to sound. “Miso” means hate in Greek and “phonia” means sound thus “hatred of sound;” but the term misophonia should not be translated literally. It describes a patient’s negative reactions to specific patterns of sounds. Anecdotally, the additional factor in selecting this word was because I love miso soup.

**MR:** What would Professor Lee teach us about the proper pronunciation of tinnitus?

**PJ:** “Tee-nee-toos” is the correction pronunciation, neither “tin-eye-tus” nor “tin-uh-tus” are correct despite their common usage.

**MR:** What have you found to be helpful for patients with misophonia?

**PJ:** Since 2000, TRT has enjoyed an 85% success rate for misophonia based on our study of 200 consecutive patients seen at Emory in Atlanta. So far, we have seen about 1,000 misophonic patients. Many tinnitus patients have simultaneous decreased sound tolerance which consists of misophonia and/or hyperacusis (abnormal loudness tolerance levels). The TRT method has to be properly modified for these patients. Our publications on decreased sound tolerance can help educate those who are interested in the use of TRT in misophonic patients.

**MR:** What do you think will be the mechanism of the drug that cures non-pulsatile subjective tinnitus for most people with sensorineural hearing loss?

**PJ:** I believe it will be impossible to find a medication to cure tinnitus (meaning removing the tinnitus perception) because the neurophysiological mechanisms involved in tinnitus perception are too intertwined with the normal function of the auditory system (e.g., it is possible to evoke tinnitus just by spending a few minutes in a very quiet environment). I remain skeptical about medications for the cure of tinnitus. I have an ongoing bet with one
prominent tinnitus researcher and clinician about when a cure will
emerge, and I keep winning free beer each time we meet and there
is still no cure. It is important to realize that TRT offers not only
effective treatment for tinnitus but also treats related symptoms like
anxiety and depression associated with tinnitus. Post-treatment
tinnitus no longer interferes with the patient’s life as it did before.

**MR:** What are the common misperceptions, misunderstandings and
errors in the implementation of TRT?

**PJ:** Common misconceptions include: focusing on the conscious,
cognitive part of the brain and ignoring the crucial role of subcon-
scious centers; ignoring the fundamental role of conditioned reflexes;
treating only tinnitus without concurrently treating hyperacusis
and misophonia and without alleviating the effects of hearing
loss; belief that use of ear-level instruments (i.e., sound generators,
combination devices, hearing aids) are sufficient to achieve improve-
ment; and ignoring the importance of specific counseling based on
the neurophysiological model. Common errors are: counseling
that is too general or too abbreviated and not tailored to the patient’s
educational level, specific needs and background; inconsistent
counseling from a team treating the patient; false promises about
the perception of tinnitus going away forever; use of shortcuts in
the treatment without sufficient experience and understanding
of TRT; inappropriate diagnosis (categorization) of patients;
improper use of sound generators; too much medication that inhibits
neural plasticity; running loud audiological tests when patients
have decreased sound tolerance; and lack of follow-up visits.

**MR:** How has TRT changed over the past 25 years?

**PJ:** The model did not change over that time; however, its clinical
implementation changed quite a lot. For example, we introduced
the concept and treatment of misophonia, put more stress on
retraining the subconscious part of the brain, and substantially
changed the sound portion of the therapy. As a result of all of these
changes, the time required for seeing improvement shortened
substantially. In the early days, it
took on average one year of TRT
before patients saw some improve-
ment. Nowadays, they may begin
to see improvement in one month.

**MR:** Is it true that some patients can
habituat reaction and perception to
tinnitus even if they are taking benzo-
diazepines like Xanax® (alprazolam),
Ativan® (lorazepam), Klonopin®
(clonazepam), Valium® (diazepam),
and others?

**PJ:** The neural plasticity of the
brain is essential in the habituation
process. In my experience, doses of Xanax (alprazolam) greater
than 1.5 mg per day basically block the habituation process, thus
preventing successful outcome
of the treatment. Moreover, with-
drawal from benzodiazepines may
increase or even create the tinnitus
perception. Therefore, while it is
possible to achieve habituation
over a longer period of time
when patients are on relatively
small doses of benzodiazepines,
larger doses of benzodiazepines
prevent habituation from occur-
ing. Approximately one third of
my patients were on benzodiaz-
epines when I first saw them.

**MR:** What percentage of patients
experience tinnitus relief from the
use of hearing aids only?

**PJ:** In my experience, if hearing
aids are used alone, the success
rate is about 15%; when hearing
aids are used as part of TRT, the
effectiveness is over 80%.

**MR:** Which sound therapy devices do
you favor and why?

**PJ:** Sound is more important
than any particular device.
Consequently, the optimal device
depends on the specific patient.
Since the majority of tinnitus
patients have hearing loss, the
combination devices (hearing
aid plus sound generator in one
shell) are optimal. For misophonic
patients, who typically have
normal hearing, sound generators
are recommended. The stress
should be placed on sound and
not on the particular instrument.

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when hearing aids are
used as part of TRT, the
effectiveness is over 80%.

Fixation on a device will cause
patients to be constantly reminded
of tinnitus. Background sound
enrichment is important as well.
I am not dogmatic about one
particular brand of instrument but
reliability is paramount; using two
devices, one in each ear, is crucial.
The use of sound at night (but
not ear-level devices) is recom-
mended given the subconscious
role of the brain in habituation of
tinnitus reaction. There are several
companies making good sound
therapy products that can be worn
in the ear to facilitate habituation.
The most important criteria is that
the product should be robust and
not breakdown easily. Patients
Since habituation of tinnitus-evoked reactions can take place during sleep as well, it is important to take advantage of sound therapy all night long.
diazepines - Xanax® (alprazolam) use greater than 1.5 mg per day; 2) financial interest, e.g., litigants involved in car accidents or dental/medical procedures with adverse outcomes, disability applicants; 3) using tinnitus/hyperacusis to attract social attention.

**MR:** How do you determine the end of treatment?

**PJ:** When tinnitus is no longer a factor in the person’s life. Rating scales are very helpful. A Tinnitus Handicap Inventory (THI) score less than 20 out of 100 is a goal. The average initial THI score of my typical patient is 64/100. A subjective score of 0-2/10 on the impact of tinnitus on life is another good goal. I impose TRT treatment for a minimum of nine months (to prevent relapse) but certain patients need one to two years of treatment. There will be no change in tinnitus pitch match but the subjective loudness of the tinnitus on average decreases by about 50%.

**MR:** Have you had any success incorporating tinnitus education and TRT in the medical, neurology and otolaryngology residency programs?

**PJ:** No. Zero success. Our chapters have been written on tinnitus and TRT and included in major Otolaryngology textbooks but no clinical teaching rotation has ever been established. However, the goods news is that the audiology programs have been very receptive to my work. While Adjunct Professor at Salus University, we described the basis of TRT to over 25% of the doctors of audiology (Au.D.) in the USA. Many more audiologists have attended our Tinnitus and Hyperacusis course in Atlanta as part of their training. About 2,000 audiologists are familiar with the basis of TRT now.

**MR:** What are your plans nowadays since you have obtained your MBA? Do you foresee a master plan where the delivery of tinnitus care can be commercialized efficiently in order to reach more people faster yet safely and ethically?

**PJ:** Formal certification in TRT is long overdue. The current TRT Association is reasonably good but not good enough. Back in 1990, I was a naïve scientist and academician. I did not patent TRT because I was concerned that this move would erect barriers to clinical care and implementation of TRT. If TRT was patented, maybe I would be rich by now. I do not wish to franchise TRT. The diagram of the neurophysiological model of tinnitus is copyrighted. Audiologists, more than any other specialists, are taking the TRT course and learning how to implement TRT in clinical practice.

**MR:** What advice do you have for future tinnitus and sound tolerance clinicians?

**PJ:** Use common sense. Do not reject anything which is not harmful. Do no harm. TRT is a philosophical model and a guide. I did not patent TRT, hence, there are no barriers to its implementation. There are many treatments available now, but no method is as effective as TRT. For example, cognitive behavioral therapy (CBT) does nothing for decreased sound tolerance and hearing loss and published results show that it is not as effective as TRT. TRT can help save the quality of life of patients with tinnitus, decreased sound tolerance and misophonia. I have been working in the field since 1983, and I plan to continue my work with patients. By my work, I do hope I am not just saving a life but I am saving the quality of the life. This makes me happy.

1 P. J. Jastreboff and M. M. Jastreboff, 2014

Pawel J. Jastreboff, Ph.D., Sc.D., MBA is Professor of Otolaryngology-Head & Neck Surgery at Emory University School of Medicine in Atlanta, GA. He is a co-author of over 130 papers, 170 abstracts, and three books. He founded the first Tinnitus & Hyperacusis clinic in the U.S. at the University of Maryland in 1991.

Michael J. A. Robb, M.D., is an Oto-Neurologist in solo private practice at the Robb Oto-Neurology Clinic in Phoenix, Arizona. He was a student of Mr. Jonathan W. P. Hazell in London, 1994-95.
I am 70 years old and have had tinnitus for over 30 years in both ears. The flu vaccine and pneumonia vaccine have not bothered my tinnitus. However, I am interested to know if the shingles vaccine is safe for people with tinnitus. Any info you can provide would be greatly appreciated.

Shingles, also known as the varicella zoster virus (VZV), infects approximately 98% of the population in the United States. Although shingles can occur at any age, it is usually seen in adults over 50 years of age. The shingles vaccine was licensed by the Food and Drug Administration (FDA) in 2006 after years of research and safety testing for people. It is further monitored by the Centers for Disease Control and Prevention (CDC). It is recommended that adults over age 60 get the one-time shingles vaccine to help reduce the risk of getting shingles and the excruciating pain it can cause. In general, there has been no clinical evidence to show that the shingles vaccine has an effect on tinnitus.

There are related viruses you should also be aware of. The Ramsay Hunt Syndrome (also known as herpes zoster oticus) is a VZV infection of the head and neck involving the facial nerve, which usually results in facial paralysis on the same side of the infection. Classic symptoms that may be present are blisters and a painful rash in or around the ear, eardrum and it may even appear on the roof of the mouth or tongue. Other symptoms that may be observed are hearing loss, ear pain, dizziness and dry eye.

To reiterate, the shingles vaccine itself is considered to be safe but you should always consult with your healthcare provider to discuss any possible medical contraindications.

I recently viewed an ATA webinar on repetitive Transcranial Magnetic Stimulation (rTMS) for tinnitus. I am interested in knowing if there are any particular frequency ranges of tinnitus that get more benefit from rTMS? Does this prospective treatment work better for certain types of tinnitus?

There has been at least one study that attempted to categorize patients by their type of tinnitus and their response to rTMS. At this time, like much of the literature on rTMS, there is not enough information to say whether certain types of tinnitus are better treated by this therapy than others. There is also no evidence that those whose tinnitus falls within certain frequency ranges find more therapeutic relief from rTMS than others.

While rTMS remains a promising area of tinnitus treatment, additional research needs to be done to better understand how this therapy may work best for tinnitus patients.
I have both tinnitus and hyperacusis. Is there a connection between the two? If so, are there certain therapies that are better for those with both conditions?

The actual cause of hyperacusis and tinnitus is usually reported as unknown, the exact genesis remains elusive and there’s limited information of its prevalence. There also appears to be some discord in the percentage of tinnitus patients who also experience hyperacusis, and vice versa, however it has consistently been reported that tinnitus and hyperacusis co-exist.

Although there are no “magic pills” or surgery to eradicate tinnitus and hyperacusis, there certainly are viable options available today to help improve sound tolerance for those with hyperacusis while minimizing exacerbation of tinnitus. Wearing proper ear protection can help reduce damage to the auditory system from excessive noise exposure. This may allow a person with hyperacusis and tinnitus to participate in daily or special activities comfortably and confidently. Over protecting the ears may result in further sound tolerance problems along with more tinnitus awareness so ear protection should be worn prudently.

There are programs available that have proven to be effective for many individuals in need of tinnitus and/or hyperacusis management – Tinnitus Retraining Therapy (TRT), Cognitive Behavioral Therapy (CBT) and sound enrichment. It is highly recommended that a person afflicted with tinnitus and/or hyperacusis seek medical assistance from a healthcare professional (namely an Audiologist, Otolaryngologist or other tinnitus specialist) for a thorough evaluation, consultation and treatment. Most important, by communicating your tinnitus/hyperacusis needs with your healthcare provider, they should be able to develop an individualized and customized program tailored for you with the mutual goal of improving your quality of life.

Fortunately, due to an overwhelming interest and continued research in the areas of tinnitus and hyperacusis, questions will get answered, puzzles will be solved and determination will find a cure.
Scientists around the world are studying tinnitus, to better understand the condition, and to find new treatments and cures. Below is a summary of just some of the research that has been published over the last few months.

Full abstracts for all research papers are available at PubMed.gov, an online service of the U.S. National Library of Medicine, National Institutes of Health.

Research Review

Understanding Tinnitus

Cells Transplanted onto the Surface of the Glial Scar Reveal Hidden Potential for Functional Neural Regeneration

Proceedings of the National Academies of Sciences of the United States of America (June 2015)

Chronic tinnitus impacts many aspects of patients’ lives, including emotional stress, sleep disturbance, and concentration difficulties. These reactions are attributed to the body’s central nervous system involvement. Neuroimaging has revealed the implication of brain structures in the auditory system relative to tinnitus. This study reviewed literature that identifies the brain structures involved in the generation and persistence of various forms of tinnitus. Functional imaging research has revealed that tinnitus perception involves both auditory and nonauditory brain areas, including the front parietal area which processes our senses; and the limbic system, hippocampal and parahippocampal areas, which handle cognition and emotions. The review confirmed that the involvement of these parts of the brain are related to the persistence of perception, anxiety, distress, and suffering associated with tinnitus.

Researchers at Kyoto University in Japan recently discovered a way to solve a problem facing the scientific community in transplanting stem cells. Stem cells are thought to hold the potential to restore damaged hair cells in the cochlea that contribute to both hearing loss and tinnitus in many patients. However, in past experiments, transplantation of stem cells into the damaged areas has produced only varying results, and a challenging problem that prevents successful stem cell transplantation is to avoid stem cell deaths. Stem cells often die due to failure to bypass the glial scar, a hallmark of neural damage that is thought to act as a barrier for cell transplantation. The scientists at Kyoto University discovered that applying new stem cells to the surface of the glial scar rather than underneath it helps their survival. They reported that the survived stem cells were able to grow from the damaged segment of the auditory nerve, which then travel from the cochlea to the brainstem, the part of the brain which controls flow of messages between the brain and the rest of the body – in this case, the ear – and eventually restored remarkable auditory function. They discovered that auditory function was better restored with the new, surface transplantation method in comparison to previous direct transplantation.

This study suggests that surface stem cell transplant may become a powerful way to repair damage and restore lost function of auditory pathways. Furthermore, the current scientific models of tinnitus and possibly hyperacusis indicate that impairments in the connection between external sound and the central nervous system are necessary for the onset of phantom sounds (tinnitus) or intolerance to sounds (hyperacusis). As is commonly the case with tinnitus, these impairments may be consequent to noise-induced damage to hair cells in the cochlea, or possibly damage directly to the auditory nerve that carries information about sound from the ear to the central nervous system. Thus,
perhaps restoring normal functioning of these connections, as this new stem cell transplantation method in part seems to do, could mitigate or even in some cases eliminate tinnitus. The improved connections between the ear and the brain could also readjust the abnormally enhanced gain in the brain, thus lessening the symptoms of hyperacusis.

**Tinnitus Treatments: Present and Future**

The effect of Transcranial Direct Current Stimulation (tDCS) in Addition to Tinnitus Retraining Therapy (TRT) for Treatment of Chronic Tinnitus Patients: A Study Protocol for a Double-Blind Controlled Randomized Trial

*Trials* (November 2015)

S. Rabau, V. Van Rompaey, P. Van de Heyning

Because there is still no treatment that eliminates tinnitus for all patients, researchers utilized two known tinnitus therapies that have had positive results in the laboratory and clinic to see if they could improve treatment outcomes. Studies have shown that Tinnitus Retraining Therapy (TRT) significantly improves quality of life for tinnitus patients and several studies have reported that transcranial Direct Current Stimulation (tDCS) has a positive effect on attention, working memory, long-term memory and other cognitive processes. This study will evaluate the added effect of tDCS to TRT in chronic tinnitus patients. This is the first time that a study has used these two therapies together. The objective is to evaluate whether tDCS can provide faster and/or more relief from the annoyance experienced in chronic tinnitus patients’ daily lives. The advantage of the study is that it is double-blind and placebo-controlled.

Acoustic Coordinated Reset (CR) Neuromodulation in a Real Life Patient Population with Chronic Tonal Tinnitus

*Biomed Research International* (October 2015)


Acoustic Coordinated Reset (CR) Neuromodulation is designed to induce a long-lasting reduction of tinnitus symptoms. This study tested Acoustic CR Neuromodulation for chronic, tonal tinnitus under real life conditions in a multicenter clinical outpatient study called “RESET Real Life”. The study enrolled 200 patients of which 189 completed the study. The results found that Acoustic CR Neuromodulation produced a statistically and clinically significant decrease in tinnitus symptoms and perceived severity after 12 months of treatment in chronic tinnitus patients. There were also no persistent adverse effects reported related to the therapy. This indicates that Acoustic CR Neuromodulation is a viable tinnitus treatment that is safe and effective for patients in a real-life setting.

Sustained Benefit of Mindfulness-Based Tinnitus Stress Reduction (MBTSR) in Adults with Chronic Tinnitus: A Pilot Study

*Springer Science & Business Media* (2015)*

J. Gans, M. Cole, B. Greenberg

Because tinnitus is a multimodal disorder with many potential causes, it can be a challenge to treat, and current interventions often result in limited levels of success. Bothersome tinnitus is most commonly associated with symptoms of anxiety, sleep disturbance, and depression. Poor attention and concentration, interference with work, and negative impact on personal relationships are also commonly reported.

Cognitive behavioral therapy (CBT) a treatment that focuses on the psychological components that may be influencing tinnitus-related distress, has been shown to be a helpful treatment for some. Another approach is through the applied use of mindfulness. Unlike CBT, mindfulness is not a structured psychotherapy but a discipline involving a willful, nonjudgmental shifting of one’s perceptual awareness. Thoughts, emotions, and body sensations including tinnitus symptoms are seen as mental events not to be analyzed or manipulated but rather simply noticed as the mind is repeatedly brought back to the present. As such, mindfulness practice may help those with tinnitus to reappraise their sensations as impermanent rather than unbearable or unending, thus alleviating some of the co-occurring distress.

Mindfulness-Based Tinnitus Stress Reduction (MBTSR) is specifically tailored to the management of bothersome tinnitus with an emphasis on exploring the sensation of hearing and sounds. A recent pilot study showed that MBTSR results in a clinically significant decrease in the perceived annoyance and perception of tinnitus. Pre- and posttreatment questionnaires (this study used the tinnitus handicap inventory) provided both quantitative and qualitative indications that MBTSR helped participants decrease tinnitus annoyance and its impact on their daily lives, improve social functioning, increase non-judgmental mindfulness, and decrease their levels of depression and anxiety. The study included a 12 month follow-up to determine if there were lasting improvements after the MBTSR program and results indicate that reductions in perceived tinnitus severity and annoyance were sustained for at least 12 months following treatment.

*Abstract not available on pubmed.gov.*
Each year, the ATA Board of Directors is given the tough task of deciding which grants, recommended to them by our Scientific Advisory Committee (SAC), will be funded. Our SAC reviews each grant application that ATA receives through a rigorous peer-review process and then, together as a group, discusses each grant’s merits and opportunity to advance science. The grants are each given a score and only the highest ranked proposals are forwarded to the ATA Board of Directors for funding consideration.

One of the most important criteria that each grant is considered against is ATA’s Roadmap to a Cure – a document created by SAC that outlines four paths of research that are designed to help lead to new treatments and ultimately, as its name suggests, a cure.

ATA’s Roadmap to a Cure

Scientific progress doesn’t work on a set timeline, but it generally does follow a certain cumulative progression. ATA’s Roadmap to a Cure is a framework for understanding the incremental research process that will lead us to a definitive cure for tinnitus. The Roadmap identifies general investigatory paths and highlights specific research questions and objectives within each pathway.

### Roadmap Paths

**Path A**

**IDENTIFICATION OF TINNITUS GENERATOR(S):**

Determine sites in the ear or brain where tinnitus-producing signals arise.

**Path B**

**ELUCIDATION OF MECHANISMS OF TINNITUS GENERATION:**

Determine the nature of abnormal signals and their underlying cellular and molecular causes.

**Path C**

**DEVELOPMENT OF THERAPY:**

Assess the potential of intervention, manipulation, or treatment as a means of suppressing tinnitus.

**Path D**

**OPTIMIZATION OF THERAPY:**

Define parameters of treatment that optimize suppression of tinnitus and minimize side effects.

### Roadmap Path Details

**A1.** Identify areas in the auditory system exhibiting tinnitus-related abnormality.

**A2a.** Measure the changes in activity identified in A1.

**A2b.** Use or develop scientific metrics to assess tinnitus percepts in human or animal subjects with abnormalities identified in A1.

**A3.** Demonstrate that measures of tinnitus established in A2b are causally related to the abnormalities measured in A2a.

**B1.** Identify neural or cellular populations giving rise to tinnitus-generating signals.

**B2.** Determine the altered cellular processes in the cell populations defined in B1.

**B3.** Define the cellular triggers that induce the alterations identified in B2.

**C1.** Test therapeutic approaches to suppress tinnitus (electric/magnetic stimulation, drugs, surgery, acoustic stimulation).

**C2.** Use these approaches to target tinnitus generation sites defined in Path A.

**C3A.** Determine magnitude of therapeutic benefit of tinnitus treatment.

**C3B.** Assess side effects or risks associated with treatment.

**D1.** Refine therapeutic approaches to target specific tinnitus generators identified in Path B.

**D2.** Improve mode(s) of treatment delivery to reduce any side effects identified in Path C.

**D3A.** Establish dose/response relationships to maximize benefit and minimize side effects of treatment.

**D4.** Customize treatment to individual.
Developing and Treating Tinnitus by Modulating Neuroplasticity in Hippocampus and Amygdala

Lucien Thompson, Ph.D., University of Texas at Dallas, U.S.

Roadmap Paths A, B & C, third year of funding

It is well demonstrated that tinnitus induces plastic changes in the brain. Since tinnitus is an auditory phenomenon, many of these studies are focused in the hearing and sound centers of the brain. However, tinnitus-related plasticity can also occur in limbic regions; the parts of the brain responsible for emotions like anger and fear as well as instincts like hunger and memory. The hippocampus is a structural part of the brain essential for limbic function.

In previous work, prior to receiving ATA grants, Dr. Thompson demonstrated a rapidly developing plasticity (or change) in hippocampal excitatory neurons after intense sound exposure to induce tinnitus in an animal model. He used the first two years of ATA funding to show that this excitatory neuron plasticity in the hippocampus persists weeks after noise exposure while inhibitory neurons remain unaffected. He also showed that this hippocampal plasticity is amygdala dependent. The amygdala is another part of the brain responsible for experiencing emotions.

As a result of this, he and his team then delivered a drug known to alter neuronal activity in both the hippocampus and amygdala but not in the primary auditory regions like the auditory cortex. As a result they found the expression of Arc, a gene product which is a biomarker of tinnitus-induced plasticity in the hippocampus and amygdala.

The goal in the third year of funding is to compare the efficacy of the previously tested drug and calcium-channel blockers to reduce or block both tinnitus-induced neural plasticity and perceptual signs of tinnitus. They will also compare treatments soon after noise-exposure during early onset of tinnitus as well as after tinnitus has been well established. The findings of this study could very well point to a novel pharmacological approach to treating noise-induced tinnitus.
Informational Masking and Tinnitus Adaptation
Grant D. Searchfield, Ph.D., The University of Auckland, New Zealand

Roadmap Paths A, C

This project aims to offer a new perspective on an old treatment – masking. Two kinds of sound masking have been identified: 1) “Energetic Masking” which involves the same frequency range between the masking sound and the tinnitus frequency, and is thought to occur in peripheral auditory regions of the brain, and 2) “Information Masking” where the masking sound is not at the same frequency as the tinnitus, and is proposed to occur in central auditory brain regions.

In his proposal, Dr. Searchfield hypothesizes that the tinnitus masking occurs through “Information Masking.” By rigorous testing of human subjects with electroencephalogram (EEG) and behavioral measures, the proposal seeks to determine if Information Masking is the actual mechanism for tinnitus masking, determine if Information Masking through spatial similarity (targeting the location of the tinnitus) can lead to tinnitus adaption, and see if specific patterns of brain activity can predict responses to Information Masking. The results of this study could produce better clinical outcomes for patients undergoing sound therapy treatments by means of tailoring the treatment to a patient's response and evolving therapeutic needs.
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For questions and more information, please contact Paul Morris, ATA’s Development Director, at paul@ata.org or at 503-248-9985 x219.
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Norma Mraz, Au.D., Grant Searchfield, Ph.D.
Why it works; what kind of sound therapies are currently available; and prospective therapies of the future.

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Michael Hoffer, M.D., Jim Kaltenbach, Ph.D.
Learn about drugs that have been tested as tinnitus treatments as well as those that are under development.

Hyperacusis – May 17, 2016
Bryan Pollard, Richard Salvi, Ph.D.
What is it? How does it relate to tinnitus?

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Fan-Gang Zeng, Ph.D., and David Baguley, Ph.D.
Learn about these burgeoning therapies and how they can suppress tinnitus.

Vagus Nerve Stimulation – September 13, 2016
Michael Kilgarg, Ph.D., and Dirk De Ridder, M.D., Ph.D.
How it works for tinnitus; Results of animal and human trials.

A Salute to Veterans – November 15, 2016
LaGuinn Sherlock, Au.D., Jim Henry, Ph.D.
Why are veterans disproportionately impacted by tinnitus? Programs developed by the Department of Veterans Affairs for tinnitus and related conditions.