

2016 Hyperacusis Grant Funded

Along with our partner, the Hearing Health Foundation, we are excited to announce our Emerging Research Grant for 2016. It goes to Xiyang Guan, Ph.D., of the Massachusetts Eye & Ear Infirmary and Harvard Medical School. He will be studying hyperacusis caused by abnormalities in auditory mechanics, or “conductive hyperacusis.” We are extremely grateful for the donor support that made this grant possible.



*Dr. Xiyang Guan,
Massachusetts Eye
& Ear Infirmary
and Harvard
Medical School*

Some hyperacusis patients have what is called “conductive hyperacusis” due to mechanical abnormalities of the ear that result in a hypersensitivity to sounds and vibrations transmitted through their bodies. These include the sensation of one’s own voice (autophony), pulse and body movements such as eye motion and footsteps, along with vibrations from machines such as power tools and engines. These symptoms are common among patients who have an opening in the bone encapsulating the inner ear.

Compared with hyperacusis stemming from neurosensory issues, conductive hyperacusis has the potential to be more immediately treated. Recently,

surgical treatment for hyperacusis by changing the mechanics of surrounding structures of the inner ear has shown mixed results.

While these experimental surgical treatments are being performed with increasing frequency, the mechanisms of conductive hyperacusis are not well understood, and scientific research targeting this problem is lacking. This study aims to understand how mechanical changes in fresh cadaveric specimens with similar gross mechanics as the living can influence the cochlear input drive (an estimate of hearing), resulting in hyperacusis.

The long-term goal is to understand how hyperacusis can occur due to mechanical disturbances of the middle and inner ear, and to provide the necessary scientific understanding to enable treatment. With a deeper understanding of these mechanical mechanisms, better diagnostic approaches can be designed to enable screening of all hyperacusis patients for these underlying pathologies.

2016 Hyperacusis Benefit Dinner Raises Funds and Shares Research Updates

Our second Hyperacusis Research Boston-area fundraising dinner was a great success! We raised over \$17,000 for research and had a broad range of attendees.

Before dinner, Bryan Pollard, President of Hyperacusis Research, gave the attendees a Noise and Ear IQ Test. Most people found they had more to learn about noise and its impact on the auditory system. After dinner, the presentation began with a deeper dive into problems with noise.

Bryan highlighted the recent update to the CDC's website on Noise Exposure and Health, which states: "In 1974, a U.S. Environmental Protection Agency (EPA) report identified 70 dB over 24 hours (75 dB over 8 hours) as the average exposure limit to environmental noise."



Faces of Hyperacusis display at the benefit dinner showing photographs of hyperacusis sufferers wearing earplugs to manage sound for daily activities.

This is an important and mostly overlooked guideline that is rarely referenced anywhere when it comes to safe noise levels. Almost all safe noise level references refer to a different section, also described on the CDC website, which recommends that the highest permissible level of noise exposure in the workplace be an average of 85 dB over an 8-hour day. Occupational limits are set to protect workers from developing "material hearing impairment," meaning an inability to hear and understand speech, if exposed over a 40-year period. They are not set to protect all workers or sensitive populations such as children and people with certain diseases.

Bryan explained that this limit of 85dB(A) became the broad standard published virtually everywhere as the "safe" limit, yet almost always without clarification of the 8-hour duration of exposure. The 70 dB standard is for the average 24-hour period.

Jamie Banks, Executive Director of Quiet Communities, gave an overview of the effort to reduce the

noise levels in our environment. Quiet Communities is focused primarily on reducing the use of noisy outdoor maintenance equipment.

To give the patient perspective, Ronna shared her challenging story about the impact hyperacusis has had on her life. She developed hyperacusis after years as a dental hygienist exposed to whining and whirring dental machinery. Ronna had to give up her job and her livelihood. Many public places are now off limits to her, including many restaurants, movie theaters and shopping locations that blast loud music. She endures constant ear discomfort.

Bryan next gave a brief summary of the impact Hyperacusis Research has had in promoting research. With a small volunteer base, Hyperacusis Research has raised nearly \$120,000 in only five years. This has been used to fund four important hyperacusis projects (totaling \$97,000 in grants), including the comprehensive Hyperacusis Literature review and three Emerging Research Grants in conjunction with our partner, the Hearing Health Foundation. With this seed effort, there has been a doubling of the number of publications focused on hyperacusis.



Ronna, Hyperacusis Sufferer

Bryan highlighted one of the most exciting trends from our seed grants — the dramatic growth in NIH grants funding hyperacusis projects at United States universities, which have also more than doubled in the last five years to over \$1,800,000 in 2016!

Professor Rich Salvi, one of our scientific advisors and Director of the Center for Hearing and Deafness at the University at Buffalo, concluded the event with a discussion of the fundamentals of the auditory system and a research update.

His overview of the auditory system explained the basic function of the middle and inner ear. He noted that the standard audiogram tests hearing up to only 8,000 Hz, which is required to hear human speech. But many people have hearing loss in the 8,000 to 16,000 Hz range. In a study of young college men, most were found to have some hearing loss in the high range. This is important when it comes to possible mechanisms of tinnitus and hyperacusis. Without the right testing, people mistakenly believe they have no noise damage.



Bryan Pollard with Professor Rich Salvi, Director of the Center for Hearing and Deafness, University of Buffalo.

After reviewing the parts of the brain used to process sounds, Rich described the results of imaging tests that demonstrated hyperactivity in the auditory cortex and other brain centers for patients with hearing loss and tinnitus. In other experiments, he described how animals with induced hyperacusis had faster reaction times to moderate sound levels. While these animals had reduced auditory nerve output, they also demonstrated hyperactivity in the auditory cortex as well as the Inferior Colliculus, Medial Geniculate Body and Amygdala. Potential treatments could target reducing these areas of hyperactivity.

Finally, he referenced an important recent paper from Buffalo titled “Noise-induced hearing loss:

Neuropathic pain via Ntrk1 signaling” by Senthilvelan Manohar, et al. In this work, the researchers searched for pain/inflammatory genes in animals exposed to very loud sounds. They found that noise exposure upregulated mRNA expression levels of four pain/inflammatory genes, Tlr2, Oprd1, Kcnq3 and Ntrk1. Pain/inflammatory gene expression changes via Ntrk1 signaling may induce neuropathic pain and microglial activation that could contribute to tinnitus, hyperacusis and ear pain. We consider this research of pain pathways critical to finding a cure for noise-induced pain.

Other notable attendees included Xiying Guan, the recipient of our 2016 Emerging Research Grant; Heidi Nakajima, Assistant Professor of Otolaryngology at Harvard Medical School; several audiologists including Lisa Kaye (now retired), Brian Fligor, Chief Audiology Officer at Lantos Technologies, and Jonathon Whitton, Senior Audiologist at Decibel Therapeutics; Dan Gauger, Senior Engineer for Noise Canceling Technology at Bose Corporation; Jamie Banks and David Sykes of Quiet Communities; and Hyperacusis Research board members Eddie DeVecchio and Michael Maholchic.

Year-End Tax Planning and 2017

As the year draws to a close, please remember that contributions to Hyperacusis Research are fully tax-deductible as allowed by law. We are incorporated as a 501(c)(3) non-profit organization. As a small organization working toward a cure of a rare disorder, we value all the contributions, big and small, that make a significant impact and enable us to award additional grants to medical researchers.

We are grateful to you, our donors. Thanks to your generosity, we have made substantial progress toward a cure and with your continued help we will make additional progress. As always, donations may be made by check to our mailing address or with a credit card on our website. Thank you!

Looking forward to 2017, stay tuned for updates after Hyperacusis Research meets with researchers at the Association for Research in Otolaryngology this coming February in Baltimore, Maryland!

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