HYPERACUSIS RESEARCH
Stop Noise-Induced Pain

Donor Newsletter Volume 8, Winter 2020-21

Benefit Webinar on Mechanisms of Hyperacusis with Pain

Hyperacusis Research was pleased to present a free webinar that focused on two key mechanisms of hyperacusis with pain. In light of the Covid-19 restrictions on gatherings, in place of our annual in-person benefit dinner in the Boston area we presented an online session using Google Meet. This approach enabled a much broader group of participants. Because it was held online, travel was not necessary, and anyone could join from home. In addition, the closed captioning feature allowed those unable to use audio to follow the presenters. We understand that technology is not always perfect, and apologize if some of the sounds were difficult.

The first presentation, by leading researcher Arnaud Noreña from Aix-Marseille Université, in Marseille, France, described his work that demonstrates how injury to middle-ear muscles may lead to peripheral inflammation, which increases sensitization of the trigeminal nerve and results in pain.

Arnaud Noreña, Ph.D., Aix-Marseille Université

The second presentation featured Megan Beers Wood, a postdoctoral research fellow in the laboratory of Dr. Paul Fuchs at Johns Hopkins University in Baltimore, Maryland. She discussed recent inner ear findings that demonstrate how pain signaling Type II nerve fibers are altered with loud noise. This novel research suggests a breakthrough in potential mechanisms of pain and provides a new pathway for research to a cure.

Megan Beers Wood, Ph.D., Johns Hopkins University

Both discussions are available to view on YouTube. Dr. Noreña's presentation may be viewed here:

https://youtu.be/hn_BSXf6oKs

Dr. Wood's presentation may be viewed here:

https://youtu.be/KRDU-kR4vTY

2020 ARO Research Conference

Hyperacusis Research was grateful to participate in the 2020 Association of Research for Otolaryngology (ARO) Midwinter meeting just before the Covid-19 pandemic struck the United States.

A doctor shared his insights into his wife's hyperacusis journey, which started over a decade ago. He

helped researchers understand the complexity of hyperacusis and emphasized two points:

- Clinicians must understand the importance of acknowledging the limits of their expertise when it comes to such a poorly-studied condition.
- All parties concerned must leverage the power and experience of patients in research priorities, design, interpretation and dissemination.

Brian R. Earl, Ph.D., Au.D., Associate Professor, University of Cincinnati, described his work to enhance the training of his audiology students on hyperacusis. Most Au.D. programs spend little or no time teaching about hyperacusis and how to approach management for patients. A number of years ago, Hyperacusis Research shared results of the Sanford CoRDS survey. Dr. Earl has taken the detailed results and integrated them directly into his hyperacusis training. This ensures that those training in the Au.D. program will have a true understanding of the dramatic, life-altering impacts of hyperacusis.

Richard Salvi, Ph.D, University at Buffalo, and Bryan Pollard, President of Hyperacusis Research

Richard Salvi, Ph.D., Distinguished Professor at the Center for Hearing & Deafness, University at Buffalo, described animal models of noise-induced hyperacusis. Since many aspects of hyperacusis are very difficult to explore in humans, it is critical to have methods to explore potential mechanisms in animals. Dr. Salvi's lab developed a novel reaction-time model where faster reaction times correlate to increasing levels of sound sensitivity after noise-induced hearing loss. Most importantly, this is also frequency dependent, which is an important factor in humans who often experience dramatic differences in impact depending on the frequency, or pitch, of sound exposure. It is hoped reaction time can also be explored in humans, as it would provide a nice cross-over diagnostic tool.

Megan Beers Wood, Ph.D., presented her work that suggests that Type II afferent neurons report damage and may be responsible for nociception in the ear. Her work aims to shed light on the role of Type II afferent neurons in the sensation of damage and pain. The research is focused specifically on the ribbon synapses after noise trauma. It appears that, unlike Inner Hair Cells, which show a loss of ribbon synapses, Outer Hair Cell ribbon synapses actually increase after noise exposure. This has significant ramifications for a possible mechanism of hyperacusis.

Ben Auerbach, Ph.D., Assistant Professor of Molecular and Integrative Physiology, University of Illinois at Urbana-Champaign, spoke about his work on Hypersensitivity in Autism, which is one of the most prevalent and problematic aspects of autism. Fragile X is a leading inherited cause of autism, and most present with sensory hypersensitivity. Since there are already proven animal models with Fragile X, it provides an opportunity to explore underlying mechanisms of hyperacusis in Fragile X. Knockout mice with Fragile X showed exaggerated sound avoidance behavior and faster reaction times in response to moderate and loud noise. These insights may help in modeling noise-induced hyperacusis.

Top 20 Priorities

A key output from ARO was the development of a set of research priorities for the next decade:

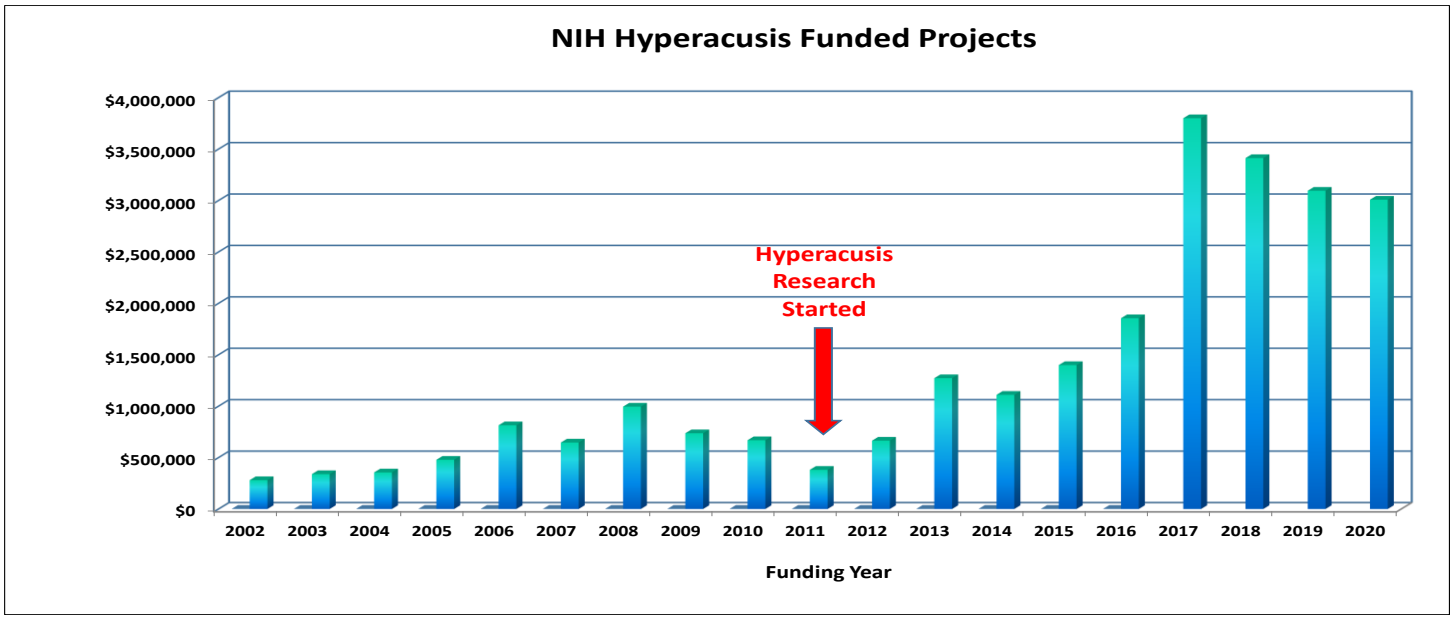
1. Investigate the cause of setbacks and determine ways to accelerate recovery time.
2. Partner with neurologists who focus on pain and participate in neurology conferences.
3. Collaborate to improve animal models to assess hyperacusis, and accelerate model findings with ENT and Au.D. engagement.
4. Obtain human clinical data such as the impact of current therapies on patients.
5. Investigate inflammatory cell contribution to hyperacusis and ear pain.

6. Investigate the interaction of the nociceptive system with the auditory system.
7. Investigate the role of the middle ear on hyperacusis, including the effect of mechanical perturbation on sound transmission and impacts from the tensor tympani.
8. Test drugs already on the market for other potentially related conditions (migraines, fibromyalgia).
9. Develop passive or active protective hearing devices that can instantly attenuate loud sounds.
10. Collaborate using strengths of each lab (e.g., combine one institution's animal behavioral model with another institution's anatomical studies).
11. Collaborate with inflammation specialists to investigate genomic inflammatory markers.
12. Utilize multi-institutional electrophysiology to study neuro-connectivity between auditory and non-auditory structures.
13. Initiate collaboration related to cochlear synaptopathy.
14. Develop a consensus definition of hyperacusis with clear subcategories.
15. Improve clinical knowledge of hyperacusis across the medical field and close the gap between research and clinical work.
16. Improve assessment and diagnostic tools for clinicians, researchers and epidemiologists.
17. Investigate cellular and molecular mechanisms of hyperacusis that may identify novel therapeutic targets.
18. Understand the role of central excitability and various areas of brain function in hyperacusis.
19. Drive cooperative studies by obtaining multi-institutional funding sources.
20. Determine if certain channels or receptors up-regulated in the cochlea by trauma could be treated pharmacologically to reduce further insults (sodium channels, NT receptors).

Looking Ahead to 2021

Our work is made possible thanks to your generous support. Hyperacusis grants have served as seed funding to promote the needed research focused on hyperacusis. As you can see in the chart, funding by the National Institutes of Health (NIH) has grown dramatically since the founding of Hyperacusis Research in 2011, increasing from under $1 million a year to around $3 million a year. This is a direct result of the grants your donations have funded. Many institutions started major hyperacusis efforts with seed grants from Hyperacusis Research. So each dollar of your contribution has a magnified effect.

As always, we continue to be grateful for contributions by check mailed to our address (printed on the last page of this newsletter) and for online contributions by credit card through our website, www.hyperacusisresearch.org and via our Facebook page at Facebook.com/HyperacusisResearch.



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Hyperacusis Research is a 501(c)(3) non-profit organization devoted to finding a cure for hyperacusis by accelerating research for novel treatment therapies and by connecting patients to researchers. Contributions are fully tax-deductible as allowed by law and are gratefully welcomed by credit card online at www.hyperacusisresearch.org or by check to our mailing address above.

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