HEARING RESTORATION RESEARCH PROGRAM

WHAT IS THE PROGRAM'S CONGRESSIONAL INTENT?

Established in 2017, the Hearing Restoration Research Program (HRRP) develops regenerative strategies and other options that may reduce the burden of hearing loss on Service Members.

FY22 Congressional Appropriations	
$10M	
FY22 Research Investment	
Focused Research Award - Funding Level 1	$1,625,881
Focused Research Award - Funding Level 2	$7,250,961
Total:	$8,876,842
FY22 Withholds and Management Costs	
USAMRDC	$158,197
SBIR/STTR	$334,000
Mgt Costs (6.64%)	$630,961
Total:	$1,123,158

WHY IS THERE A NEED FOR HEARING RESTORATION RESEARCH?

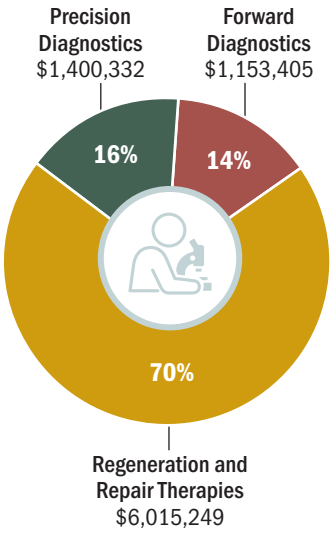
Combat experience increases the risk of hearing loss by 63%[1]

In 2022, the Veterans Benefit Administration reported 1.4 million Veterans are affected by service-connected disability due to hearing loss[2]

- **15%** of adults have some degree of hearing loss, however, those between 65-74 years old have a higher prevalence at 25%[3]
- **50%** of people 75 and older have hearing loss[3]

HOW IS THE PROGRAM ADVANCING HEARING RESTORATION RESEARCH?

The HRRP directed FY22 investments into three intervention types (left) for research that address at least one of four program priorities (right).



- **Translation of biological regeneration/repair mechanisms** into therapies that treat auditory system injury and restore auditory function
- **Diagnostic tests** that help differentiate sensory, neural, synaptic, and central processing disorders may inform applicability and outcomes for current or future hearing restoration therapeutics
- **Reliable in vitro human models** to facilitate the understanding, derivation, and characterization of human auditory cells, and/or to facilitate the evaluation of hearing restoration therapies
- **Techniques/methods beyond the audiogram** to diagnose acute auditory system injury in austere or remote environments. For example, but not limited to, simple and rapid assessments that are compatible with portable platforms

[1] Wells TS, Seelig AD, et al. 2015. Hearing Loss Associated with U.S. Military Combat Deployment. *Noise Health* 17(74):34-42. | [2] U.S. Department of Veterans Affairs. 2023. *Veterans Benefits Administration Annual Benefits Report, Fiscal Year 2022.* https://www.benefits.va.gov/REPORTS/abr/docs/2022-abr.pdf. | [3] Quick Statistics About Hearing, The National Institute on Deafness and Other Communications Disorders, https://www.nidcd.nih.gov/health/statistics/quick-statistics-hearing#6. | [4] Jiang S, Welch P, et al. 2022. Mitigation of Hearing Damage After Repeated Blast Exposures in Animal Model of Chinchilla. *Journal of the Association for Research in Otolaryngology.* Oct;23(5):603-616. | [5] Jiang S, Sanders S, et al. 2023. Hearing Protection and Damage Mitigation in Chinchillas Exposed to Repeated Low-Intensity Blasts. *Hearing Research.* Mar 1;429:108703.

PROGRAM MISSION: *Deliver groundbreaking research and solutions for hearing restoration by advancing the understanding, diagnosis, repair, and regeneration of the auditory system*

HOW IS THE PROGRAM MAKING AN IMPACT?

Building Collaboration

HRF-NET

The HRRP founded the **Hearing Research Funders Network**, or HRF-Net, in 2022 to bring together federal, private, and international organizations funding auditory and vestibular research. **Forty participants** from **26 organizations** attended an inaugural meeting in January 2023 to discuss critical gaps in the field. To foster continuous exchange and collaboration, the HRRP hosts quarterly HRF-Net meetings. HRF-Net helps organizations align initiatives and create greater efficiencies in hearing research and development.

Repairing Cochlear Damage with Neurotrophin Therapy

Andrew Wise, Ph.D., The Bionics Institute of Australia

Neurotrophins, proteins that regulate nervous system functions, are a promising therapeutic candidate to treat hearing loss because of their ability to stimulate the growth of sensory nerve cells and repair damaged synaptic connections. To work, however, they must be delivered into the inner ear over a sustained period of time in a manner that can be implemented clinically.

Through nanotechnology, Wise and his team developed a novel way to deliver neurotrophins by loading them in particles, called supraparticles. Experiments conducted in pre-clinical deafness models found neurotrophins delivered via supraparticles reached target cell populations and their presence sustained for at least one month after implantation and had a significant therapeutic effect. These results **advance the supraparticles-mediated neurotrophin delivery toward clinical translation**.

Therapeutic Function of Glucagonlike Peptide-1 for Hearing Restoration After Blast Exposure or Traumatic Brain Injury

Rong Gan, Ph.D., University of Oklahoma, Norman

Repeated exposure to blast overpressure not only can result in traumatic brain injury but can also cause hearing problems, even when hearing protection is used. Gan and her team investigated the effectiveness of liraglutide, a medication that activates a specific protein receptor in the brain, called the glucagon-like peptide-1 receptor, in mitigating hearing damage. The team explored damage that was caused in laboratory animals exposed to repeated low-intensity blasts, similar to those experienced in combat environments that often result in mild TBI.[4] The team then treated animals with blast-induced hearing loss with liraglutide and found the medication significantly lowered their auditory brainstem response thresholds, the minimal intensity of sound required to hear,[5] resulting in improved hearing at lower sound intensity. They also found liraglutide treatment protective against blast-induced increase of neural activity in the auditory system, which could be a source of tinnitus, for animals wearing hearing protection. These results help **advance liraglutide as a potential treatment** for hearing loss and mild TBI after blast exposure.

"Hearing loss is a global health concern, with the number of people with hearing loss expected to double by 2050 according to the World Health Organization. Any degree of hearing loss disrupts daily communication and affects people's ability to work, enjoy life, and stay active and not isolated. People use technology, strategies and medication, but there's a continued unmet need to treat hearing loss. While curative therapies are not yet available, the Hearing Restoration Research Program is working toward solutions that could restore or improve hearing, bringing a future of hope to those living with hearing loss."

Barbara Kelley, Executive Director, Hearing Loss Association of America, Programmatic Panel Member, FY23