



US DEPARTMENT OF DEFENSE
BLAST INJURY RESEARCH PROGRAM
COORDINATING OFFICE

Preclinical Models of Blast Injury

Preclinical Assessment of Blast-induced Auditory Injuries

Researchers at the Walter Reed Army Institute of Research (Silver Spring, Maryland) are identifying the underlying causes of blast overpressure (BOP)-induced hearing loss using an advanced blast simulator (ABS) which produces a high-fidelity recreation of BOP in the laboratory using a rodent model. They have found that:

- Blast shockwaves (17 pounds per square inch) produced auditory brainstem response threshold shifts that persisted through 28 days after exposure.
- Compared to persistent high frequency (40 kilohertz) hearing loss after blast exposure, low frequency (8 kilohertz) hearing recovered quickly.
- Appreciable damage to cochlear outer hair cells (OHC), inner hair cells (IHC), and other structures in the inner ear was observed.
- BOP generated by the ABS causes mild axonal degeneration and glial cell proliferation.

Collectively, these data show that peripheral and central auditory systems are vulnerable to blast injury and point to neuroinflammation as a pivotal contributor to the secondary neuronal damage. These findings serve the ongoing efforts by these researchers to develop strategies for mitigating or reversing debilitating blast-induced auditory and vestibular injuries. These results were presented in a poster at the Society for Neuroscience in November 2017 (Wang *et al.* 2017; Figures 1, 2 & 3).

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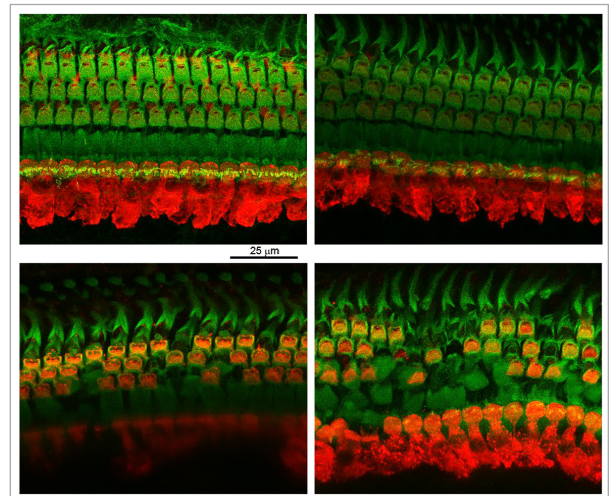


FIGURE 1: Blast shockwave damage to hair cells. Whole mount cochleae from sham (n=10), BOP (n=7) and BOP*3 (n=7) at 14 days post-injury were prepared for immunofluorescent examinations with phalloidin (green) and myosin7a (red) antibodies. Images were taken under confocal microscopy. (Figure used with permission from the authors)





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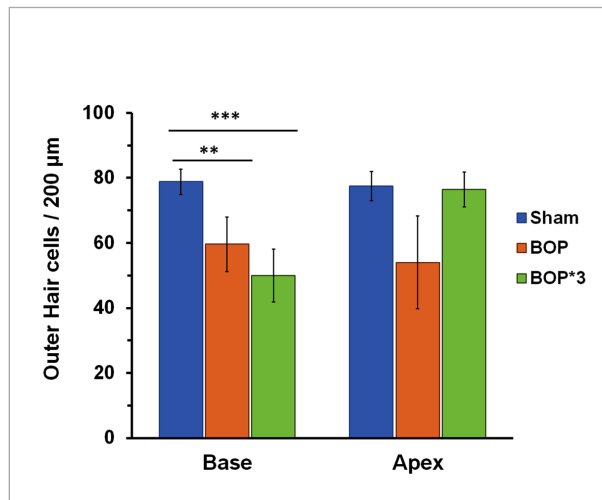


FIGURE 2: Hair cell counting revealed appreciable blast damages to OHC. There was no significant change in number of IHC. Compared to the sham controls, OHC loss showed significantly in the basal turn of the cochlea in the blast exposed animals. (Figure used with permission from the authors)

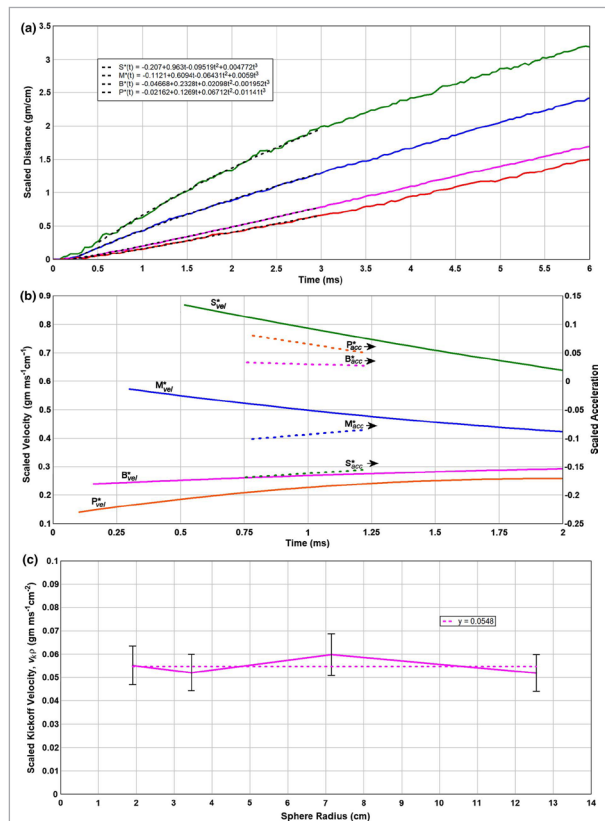


FIGURE 3: A Cubic polynomial curve-fits to the early post-diffraction motion to 3 milliseconds; b scaled velocity and acceleration for the early post-diffraction motion as determined from the curve-fits; and c kickoff velocity from the diffraction impulse loading as scaled by sphere density only. (Figure 8 from Wang et al. (2017) is reproduced with permission from the authors)

REFERENCES:

Wang, Y., Urioste, R., Wei, Y., Driwech, W., Wilder, D., Arun, P., Hollingsworth, K., Su, Y., Venkatasivasaisujith, S., Van Albert, S., Gist, I., Wise, M., Chang, W., Kelley, M., and Long, J. B. 2017. "Effects of Blast Shockwave Exposure on Ears and Auditory Signal Processing Centers in Rodents." 47th Annual Meeting of the Society for Neuroscience, Washington, DC, November 11-15, 2017.

