**BACKGROUND**

Blast wave exposures, the leading cause of hearing loss in military personnel, damage not only the inner ear, but the central nervous system as well (Chandler, 2006). Current research reveals that blast wave exposure serves to suppress neurogenesis in the hippocampus (Kraus, 2010). Neurogenesis—the birth of new neurons—is known to occur in both the subventricular zone (SVZ) of the lateral ventricles and the subgranular zone (SGZ) of the hippocampal dentate gyrus (DG) in the brain. Hippocampal damage and subsequent deficits have previously been studied in the animal model utilizing radiation, noise exposure, and blast wave trauma (Kraus, 2010), (Newman, 2015), (Snyder, 2005). The aim of this study was twofold: (1) to assess the degree to which noise blast trauma suppresses neurogenesis in the adult male rat hippocampus visualized 45 days post-blast, and (2) to ascertain whether noise blast animals show sustained spatial retention memory deficit when tested on a spatial navigation task.

**METHODS**

**Animals:** adult male Sprague-Dawley rats (n=23)

**Groups:**
1. immunohistochemistry group (n=11): 6 sham controls, 5 noise-blast
2. behavior group (n=12): 6 sham controls, 6 noise blast

**Noise Blast Procedures:**
All animals (excluding sham) underwent 6 blast waves each and were exposed on their left side while under ketamine/xylazine. Blast waves averaged 185 ±5dB peSPL.

**Immunohistochemistry:**
On day 45 post-blast, the immunohistochemistry animal group was deeply anesthetized, brains were removed, post-fixed, and sectioned. Free-floating tissue sections including dorsal hippocampus were incubated in primary antibody (goat anti-Doublecortin) overnight and visualized with DAB. Doublecortin (DCX), a microtubule-associated protein, is commonly targeted as a marker for neurogenesis. DCX-stained somas were counted visually and dentate gyrus lengths were measured using ImageJ software.

**Morris Water Maze:**
On day 45 post-blast, the behavior group was trained on the Morris Water Maze—a task aimed to quantify both spatial navigation ability and spatial retention memory—for 6 days. A probe trial was conducted to gauge spatial retention memory 15 days post training.

**RESULTS**

**HISTOLOGICAL RESULTS**

- **Figure 2:** cross section of the rat brain, highlighting the dentate gyrus (adapted from Scharfman & Hen, 2007)

**NEUROGENESIS REDUCED FOLLOWING BLAST**

- **Figure 4:** Noise blast rats showed a significant reduction in DCX staining when compared with control rats (P = 0.0276, n = 11), implicating a reduction in neurogenesis when visualized 45 days post-blast. Quantified as cell density using cells/mm SGZ length.

**CONCLUSIONS**

Noise blast trauma reliably induces a suppression of hippocampal neurogenesis 45 days post-blast. Additionally, when compared with their age-matched sham controls, blast animals fail to retain spatial memories regarding previously learned tasks. Based on the aforementioned results, it is implicated that ongoing neurogenesis is necessary for spatial retention memory.

**REFERENCES**

Snyder J.D. et al. (2001). A Role for Adult Neurogenesis in Spatial Long-Term Memory. Neuroscience, 130, 463-472