



US DEPARTMENT OF DEFENSE

# BLAST INJURY RESEARCH PROGRAM COORDINATING OFFICE

## Injury Models

### Understanding Realistic Blast Impact on Neurons and Tissue Slices: Experimental and Modeling/Simulation Approaches

TBI is a major health issue that is hard to diagnose because it often occurs without signs of external injuries. Although it is known that shock wave exposure causes cell membrane damage, the mechanisms of injury and the role of certain physical parameters (e.g., shock wave velocity, shock pulse duration, or shock pulse shape) are unknown. Also, there is no well-characterized correlation between different physical shock loading mechanisms of injury and pathoanatomic injury, especially blast-induced mechanisms of brain injury. Researchers at USARL developed a novel in vitro indoor experimental system to study the effects of primary explosive blasts on dissociated neurons, using real military explosive charges to more accurately represent battlefield blast exposure. The study examined the effects of a series of pressure waves (30–500 psi) on neuroblastoma and glioma cell co-cultures. A computational model was used to help guide blast experiments. Pressure traces were generated from the simulation to provide historical data that were otherwise inaccessible from the experiments. Preliminary analysis suggests increased membrane damage and the formation of reactive oxygen species in cells exposed to higher pressures. Furthermore, physical shock loading mechanisms may play a role in the complex biochemical and molecular mechanisms of primary blast-induced brain injury. Information from these ongoing experiments may inform the development of improved, novel in vitro models of mild primary blast-induced TBI, which could lead to better blast protective equipment, diagnosis, and therapy.