Injury Models

Physical, Biological & Physiological Mechanisms of Injury Modeling

The Institute for Soldier Nanotechnologies (ISN), housed at Massachusetts Institute of Technology and sponsored by USARL, focuses on basic research that can lead to the development of new, lighter-weight materials for improved protection from blast, ballistic, and blunt trauma. Researchers also study material failure and human injury due to blast and other forms of mechanical energy to guide the design and formulation of novel protective materials for Service Members. Recent accomplishments include progress in developing validated models of the response of human brain tissue to blast waves and the assessment of the effectiveness and optimization of head protection equipment in mitigating blast-induced TBI. In FY14, researchers at ISN published a paper in the *Proceedings of the National Academy of Sciences* on the development of scaling laws for the effect of blast on animals and humans, concluding that mass scaling fails to capture the brain's mechanical response to blast in mammals, and that human brain vulnerability to blast is higher than in any other mammalian species. Significant progress has also been made in understanding the gel mechanics for synthetic polymer gels that can mimic the mechanical deformation of biological soft tissues optimized for mechanical energy dissipation under impact loading, with implications for protective and wearable materials. The work done by ISN will lead to improved protection for the Service Member against blast and ballistic threats.