BIOMEDICAL ENGINEERING
Carnegie Mellon University

Tuesday, November 7, 2017
4:30 – 5:30 p.m.
Doherty Hall A302

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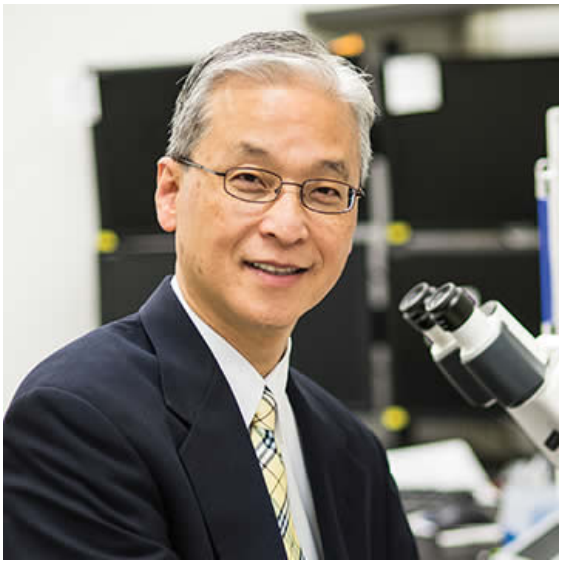

Elucidation of blast-induced Traumatic Brain Injury using in vitro Biosystems

Abstract: Blast-induced traumatic brain injury (bTBI) is a neurological dysfunction that can result from a sudden exposure to shockwave. bTBI is presumed to bear causative and adverse consequences particularly among combat veterans. For example, post-traumatic stress disorder attributed to explosive blasts may result from such brain injuries. However, the fundamental questions about the nature, diagnosis, and long-term consequences of bTBI remain still elusive. A better understanding of brain tissue injury requires elucidation of potential biophysical and molecular mechanisms. One such mechanism may be microcavitation in the brain following exposure to a shockwave. Formation of highly pressurized micron-size bubbles has been shown plausible and, upon collapsing of the microbubbles, secondary shockwaves are produced that further exacerbate the brain tissue injuries. Recent data obtained using novel in vitro models suggest that collapse of microbubbles induces multiple pathophysiological responses that can lead to necrosis and apoptosis. In this seminar, we will discuss strategic approaches to design and validate biosystems that are capable of producing microcavitation. Integration of the Biosystems with multi-modal imaging allows us to test several hypotheses to establish the mechanisms by which the brain cells are adversely impacted by the collapse of microbubbles. Successful integration of electrical engineering and tissue engineering led to the formulation of a paradigm shift in which bTBI is better understood with molecular details. Finally, the FDA-approved Poloxamer P188 was demonstrated to reconstitute the compromised cell membrane and restored the cellular function.