Abstract Submitted
for the SHOCK15 Meeting of
The American Physical Society

Disruption of cell membranes via laser-activated, acoustically active, carbon nanoparticles[1] STEFANY HOLGUIN[2], MICHAEL GRAY[3], MARK PRAUSNITZ[4], Georgia Institute of Technology, NARESH THADHANI[5] — Physical drug delivery methods provide an avenue to overcome the selectivity of the cell membrane via physical forces that disrupt cell membranes and drive drug molecules into the cytosol. When carbon black nanoparticles in suspension with cells and drug molecules are exposed to nanosecond-pulsed laser light, high uptake and cell viability are observed. This laser-carbon nanoparticle interaction causes thermal expansion and local vaporization that results in the release of acoustic waves into the surrounding medium. These combined energy transduction mechanisms, phenomena called transient nanoparticle energy transduction (TNET), are responsible for disruption of the cell membrane and subsequent efficient intracellular drug uptake while maintaining high cell viability. The overall objective of this work is to investigate TNET and the bioeffects associated with physical disruption of cell membranes for drug delivery via laser-carbon nanoparticle interactions. For example, varying and quantifying energy input to carbon nanoparticles by way of laser beam manipulation, assists in the understanding and assessment of subsequent bioeffects. Results of work performed to date will be presented.

[1]National Science Foundation Graduate Research Fellowship under Grant No. 0946809, Georgia Tech University Center of Exemplary Mentoring (UCEM) & the Alfred P. Sloan Foundation.
[2]School of Materials Science and Engineering
[3]The Woodruff School of Mechanical Engineering
[4]School of Chemical and Biomolecular Engineering
[5]School of Materials Science and Engineering

Stefany Holguin
Georgia Institute of Technology

Date submitted: 30 Jan 2015 Electronic form version 1.4