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**Drug Delivery and Cell Transfection Using Shock Waves Produced by Nanothermites**[1]

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Shock waves have non-destructive life science applications in cell transfection and drug delivery. Based on molecular dynamics simulations, the shockwave causes transient compression of the cell membrane, which causes the hydrophobic interior of the lipid bilayer to become thinner. This allows diffusion of water molecules across the membrane. Recently, the nanothermite composition consisting of CuO nanorods and Al nanoparticles was shown to propagate at velocities in the same range as metallic azides and fulminates; however, the CuO/Al mixture produces lower pressure levels. An *in vitro* testing system was developed to deliver shock waves produced by nanothermites into cell suspensions and/or tissues. The plasmid encoded for production of green-fluorescent protein was delivered into cells including, among other types, chicken cardiomyocytes, cell lines (T47-D and Ins-1), and Arabidopsis plant cells. It was found that the nanothermite pressure impulses induced transfection resulting in production of green fluorescent protein in 99% of the cardiomyocytes. Additionally, transfected cell survival was evaluated, and the pressure impulses did not produce any elevated levels of cell death compared with control cell suspensions.

[1]In collaboration with Steve Apperson, Luis Polo-Parada, Rajagopalan Thiruvengadathan, and Keshab Gangopadhyay, The University of Missouri.