

Among different biological, chemical, or physical stimuli for cell manipulation, physical stresses are of particular interest, as they can transiently increase the permeability of the cell membrane with less side effects. Recent progress in nanosecond duration ultra-high voltage pulses provides exciting possibilities to produce direct intracellular effects.

Meanwhile, we have been using ultrashort pulses and miniature shock drivers to generate fine micro underwater shock waves, which can penetrate deep in soft tissue. These unique characteristics make them appropriate for delivering energy to manipulate cells/tumor for diagnostic and therapy. The micro-streaming of ultrasound and shock wave, as well as cavitation, are key parameters for this theranostic approach. This talk summarizes our group's experiences with shock and electromagnetic waves in this regard.