S10-2 Importance of targeting bubbles in sonoporation using short-pulsed ultrasound

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Cavitation, dynamic behavior of bubbles in water, is a one of major subjects of fluid dynamics, and many researchers have shown interest in this phenomenon. In the field of diagnostic ultrasound, a new method of contrast imaging was developed using the characteristics of oscillating microbubbles, that is, that the reflected ultrasound contains higher harmonics of the insonified ultrasound. Microbubbles are also used in the field of therapeutic ultrasound for enhancement of thermal and mechanical effects of ultrasound on biological tissues.

Sonoporation is a technique for transducing a transduct gene or drug into cells by exposure of cells to continuous or long burst ultrasound, and efficiency of transduction is enhanced in the presence of microbubbles. We have studied the mechanisms of the transduction and found that membrane perforation was produced by the mechanical effect of oscillating bubbles beside the cells and also that, in the case of bubbles attached to a cell, a single shot of short-pulsed ultrasound is sufficient to cause membrane perforation. In this presentation, we discuss the mechanisms of sonoporation and propose a sonoporation technique using single-shot pulsed ultrasound. The importance of targeting bubbles in this technique is also discussed.