

Real-time measurement of ultrasound-induced biochemical phenomena  
(超音波が誘起する生化学的現象のリアルタイム計測に関する研究)

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In recent years, medical research using ultrasound technology has been progressing. Practical applications are already underway in areas such as bone fracture treatment. It has also been shown to be effective in the treatment of heart failure and depression. However, there are challenges in optimizing ultrasound stimulation and clarifying its principles, particularly due to difficulties in cell evaluation and ultrasound output control. Therefore, we have developed a system to irradiate cells with ultrasound by varying amplitude and frequency and to measure biochemical responses in real time. This system enables real-time observation of cells and experiments under sterile conditions. To evaluate the system, we measured the driving frequency and vibration distribution and quantified the ultrasonic waves presented at the cell culture surface. Furthermore, we successfully observed the relationship between ultrasound irradiation, cell death, and calcium imaging, confirming that this system can be used to clarify the effects of ultrasound on cells. This research is expected to lead to further development of ultrasound-based therapies.