

Emergent Functions of Plasma-induced Bubble

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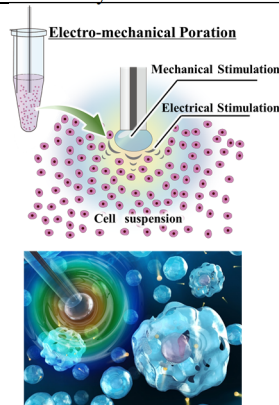
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Cell poration technologies offer opportunities not only to understand the activities of biological molecules but also to investigate genetic manipulation possibilities. Unfortunately, transferring large molecules that can carry huge genomic information is challenging. In this presentation, I will introduce electromechanical poration (Figure1, 2) using a core-shell-structured microbubble generator, consisting of a fine microelectrode covered with a dielectric material. By introducing a microcavity at its tip, we could concentrate the electrical field with the application of electric pulses and generate microbubbles for electromechanical stimulation of cells. Specifically, the technology enables transfection with molecules that are thousands of kDa even into osteoblasts and Chlamydomonas, which are generally considered to be difficult to inject. Notably, we found that the transfection efficiency can be enhanced by adjusting the viscosity of the cell suspension, which was presumably achieved by remodeling of the membrane cytoskeleton [1][2]. The applicability of the approach to a variety of cell types opens up numerous emerging gene engineering applications. In this presentation I will present the mechanism of plasma-induced bubbles and its wide range of application (Figure 3) including electro-mechanical poration.

References

- [1] W. Huang, S. Sakuma, N. Tottori, Y. S. S. Sugano and Y. Yamanishi, Lab. Chip. **22**, pp.4259-2248 (2022).
[2] W. Huang, Y. Ma, N. Tottori, Y. Yamanishi, et al., Bio. Tech. Letters. **45**, pp.1417-1430 (2023).

Electrically-induced bubble



Plasma-induced bubble

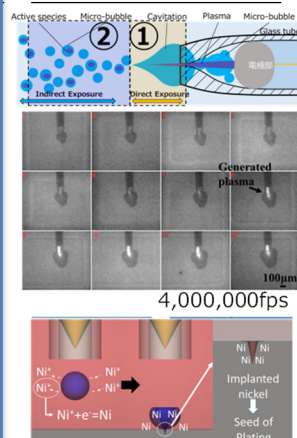


Figure 1 Overview of electrically-induced and plasma-induced bubbles

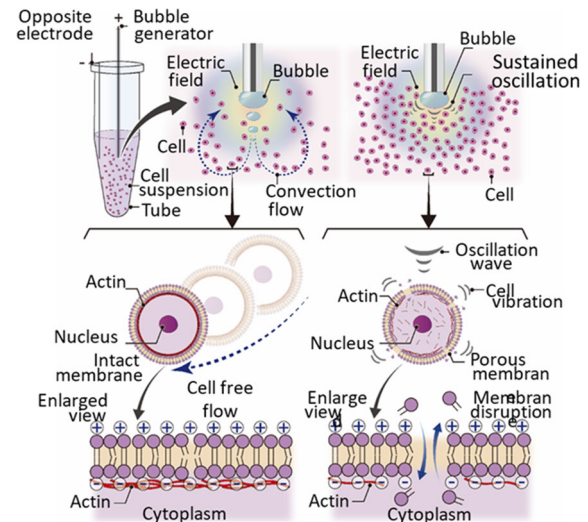


Figure 2 Mechanism of electro-mechanical poration

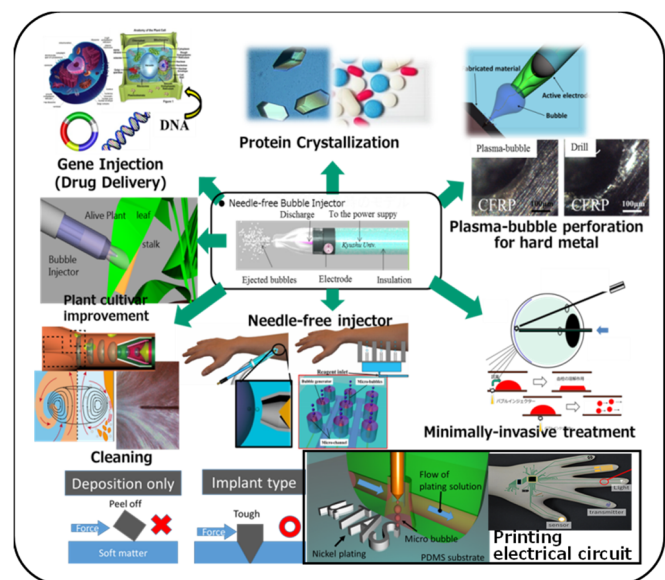


Figure 3 Emergent Function of Plasma-induced bubbles