Localized Gene Transfection through Cell Membrane Stimulated by Micro Solution Plasma\textsuperscript{1} TOSHIRO KANEKO, YUTARO HOKARI, SHOTA SASAKI, Department of Electronic Engineering, Tohoku University, MAKOTO KANZAKI, Department of Biomedical Engineering, Tohoku University, TAKEHIKO SATO, Institute of Fluid Science, Tohoku University — The micro-scale plasmas generated in solution (micro solution plasmas) are strongly desired to realize in vivo gene transfection, because most of the human body consists of water and internal organs are filled with solution. We attempt to generate the micro solution plasma and apply it to the living cells for clarifying the transfection mechanism toward developing minimally-invasive localized gene transfection. In this experiment, the coaxial type electrode is used to make the micro-scale plasma, where the curvature radius of the high voltage electrode is less than 1 $\mu$m. By applying a pulse voltage to the electrode, we succeed in generating the micro-scale plasma in phosphate buffered saline (PBS), which could stimulate the adherent cells in PBS. After the micro solution plasma irradiation, the cell membrane permeability is evaluated using fluorescent probe YOYO-1 \textsuperscript{[1,2]}. The YOYO-1 fluorescence is strongly observed only in the localized plasma irradiation area which can be controlled by the pulse width. Based on this result, the cell membrane permeability is found to be locally enhanced by the stimulation of the irradiated micro solution plasma. \textsuperscript{[1]} S. Sasaki, et al., Appl. Phys. Exp., 7 (2014) 026202. \textsuperscript{[2]} T. Kaneko, et al., Biointerphases, 10 (2015) 029531.

\textsuperscript{1}This work was supported by JSPS KAKENHI Grant No. 24108004 and the Knowledge based Medical Device Cluster/Miyagi Area.

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Date submitted: 19 Jun 2015  
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