Improving substance intake efficiency using non-thermal atmospheric pressure plasma towards single cell gene transfection

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Non-thermal atmospheric pressure plasma (NTAPP) has been used in biomedical researches. One of the hot topics in the NTAPP applications is gene transfection to affect cell fate. However, improvement in the transfection efficiency is essential for the NTAPP method to be practically used in biomedical researches. In this study, we analyzed correlation between NTAPP dose and substance intake efficiency of the cells.

Murine fibroblast cells L929 were cultured in ϕ35 mm dishes and plasma irradiation was conducted using a standard NTAPP jet system. After irradiation, fluorescent dye (DiYO-1, AAT Bioquest) solution was added and incubated for 1 h. The cells were observed by fluorescence and phase microscopy (Fig. 1) and the dye administration efficiencies were calculated based on the images taken (Fig. 2). No native fluorescence was detected in dishes without plasma irradiation. Intake efficiency in the dishes was defined as 0. With plasma irradiation, fluorescence was detected in 60% of the cells. Efficiency was almost same by either 5 s or 30 s plasma irradiation. In this condition, 5 s NTAPP irradiation seemed enough to achieve maximum intake.

We have developed a microdevice referred to as Plasma-on-Chip, in which a single cell can be analyzed [1,2]. More detailed analysis will be possible using the device. By analyzing gene expression in irradiated cells, gene transfection efficiency can be also analyzed [3].

This study was supported by TOYOAKI SCHOLARSHIP FIOUNDATION, JSPS KAKENHI (26600130, 18K19942, 19H04457), and the Program for Forming Strategic Research Infrastructure, Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan (S1511021).

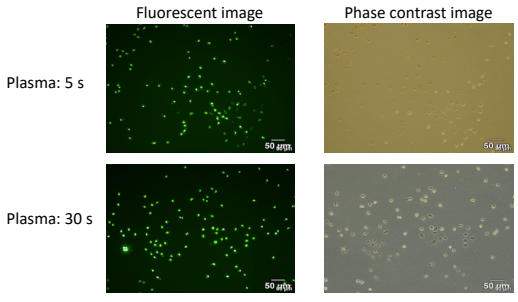

Fig. 1: Fluorescence and phase microscope images.

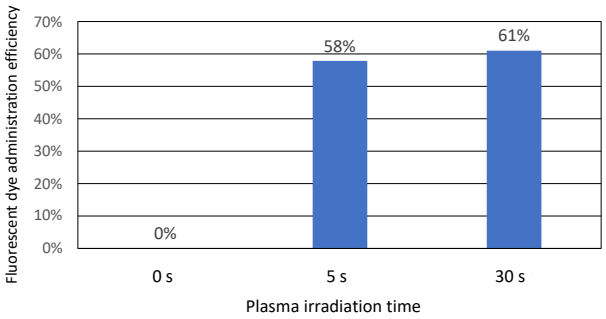

Fig. 2: Fluorescent dye administration efficiency.

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