

Rat Intestine Cells Absorption of Fluorescein Isothiocyanate–Dextran Induced by Microplasma Treatment

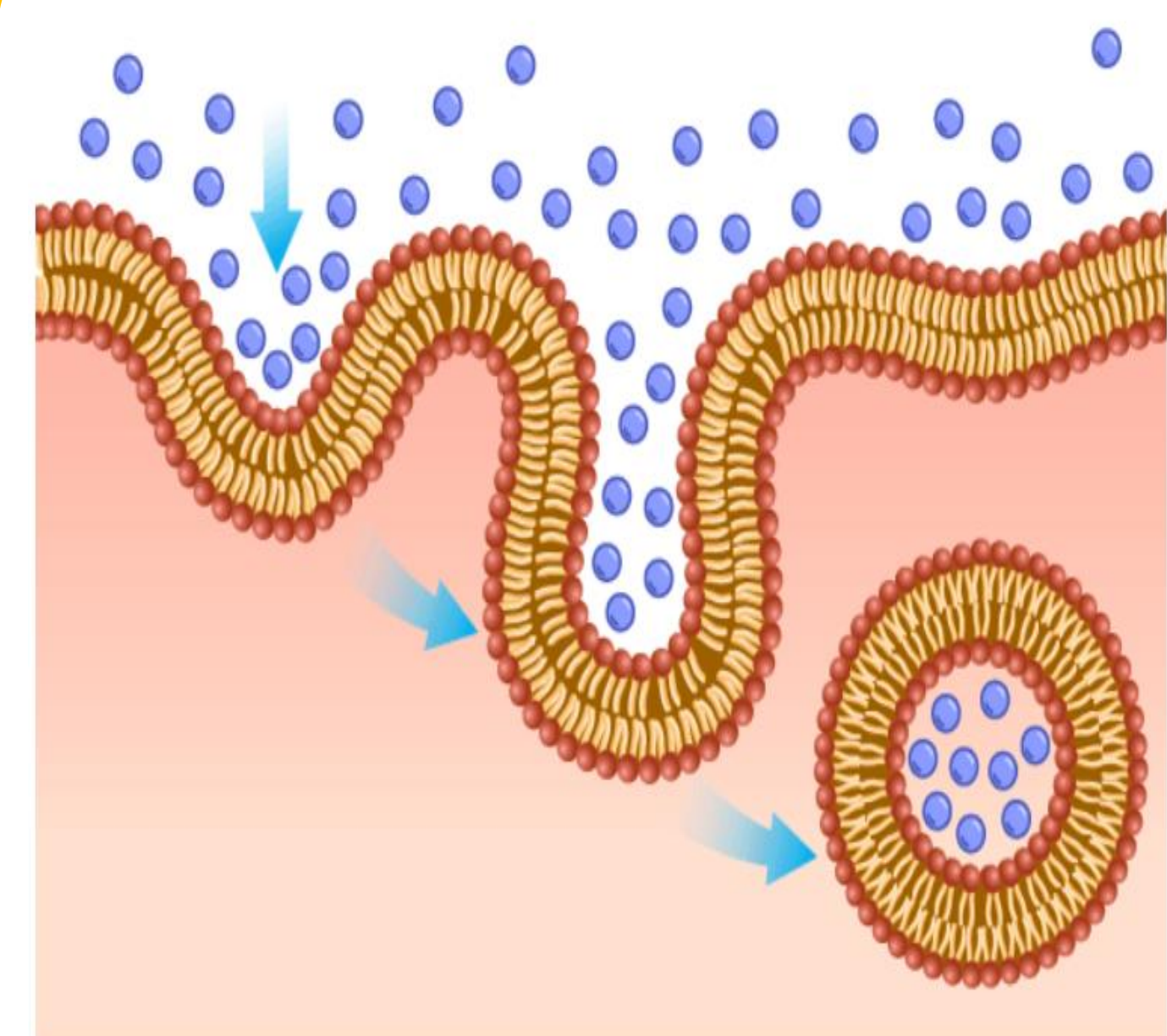
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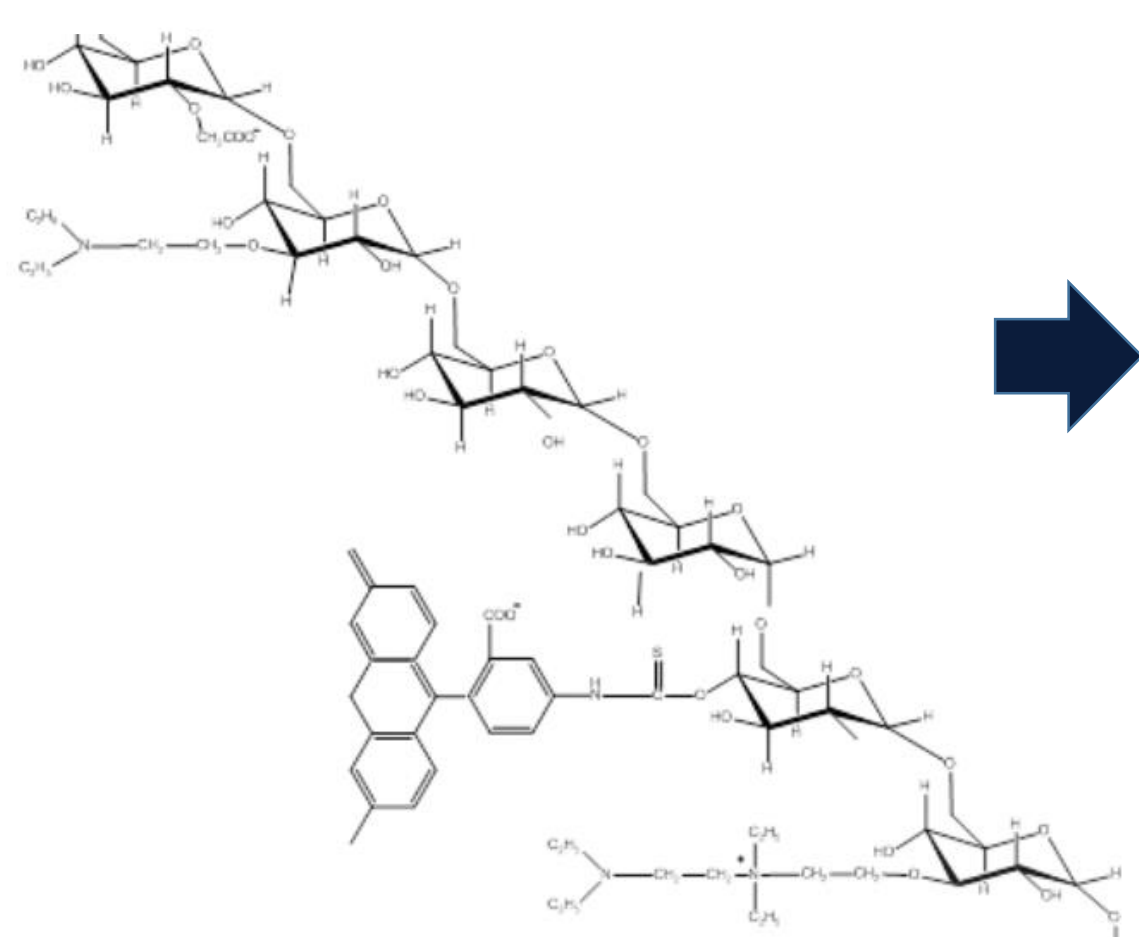
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Introduction. Living cells as drug delivery carriers has gained increasing interest in recent years. Cell-based targeting and delivery could be used to facilitate a more specific tools for the next-generation drug delivery systems. every cell is surrounded by lipid bilayer membrane. Drug has to pass this barrier of the white blood cells to be incorporated into the cell. This can occur through the distortion of lipid barrier, by activation of the TRP channels or endocytosis.

Experiment



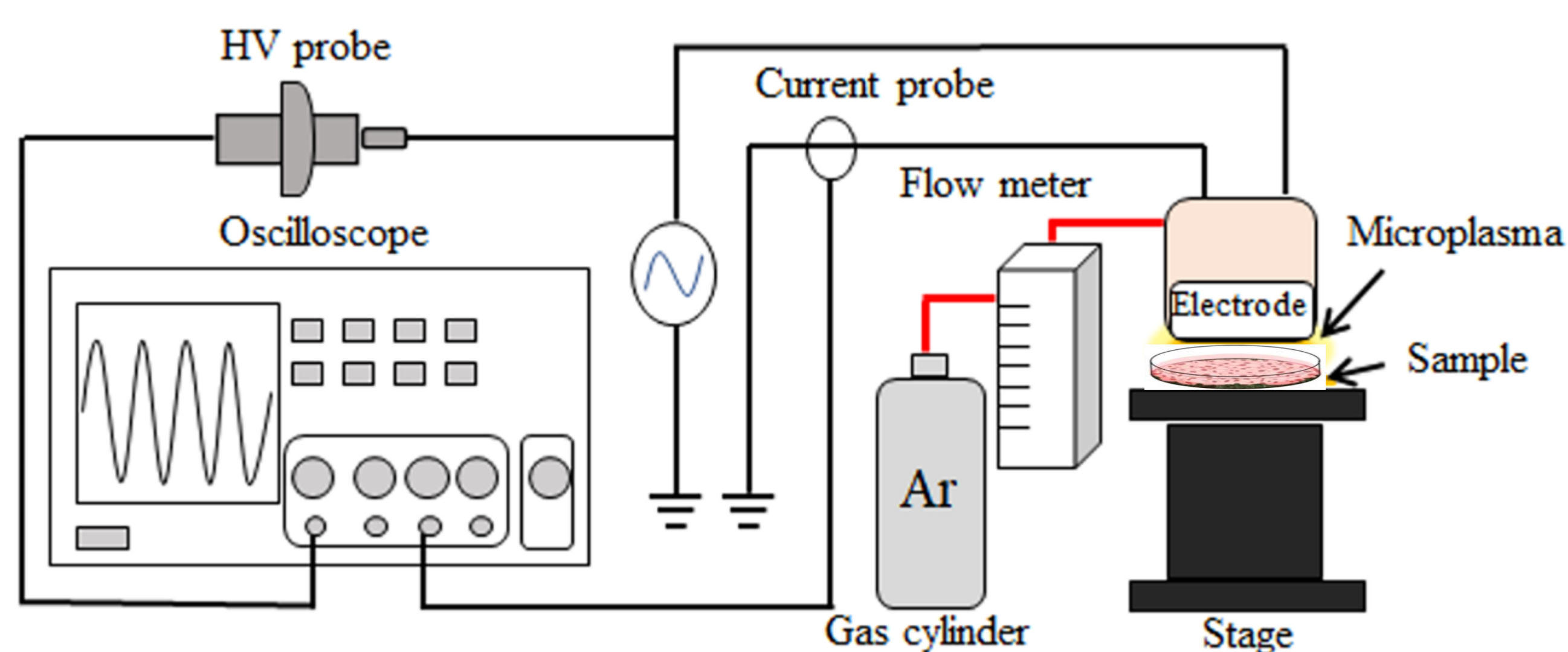
Endocytosis is process of bringing substances into the cell through surrounding area of the cell membrane which is pulled inside the cell to form a vesicle with the ingested material. 54% of the drug enters into the cell through this process after plasma treatment. The drug delivery efficiency and cell viability strongly depend on the plasma source. Drug delivery efficiency decreases with increase of molecular mass of drug.



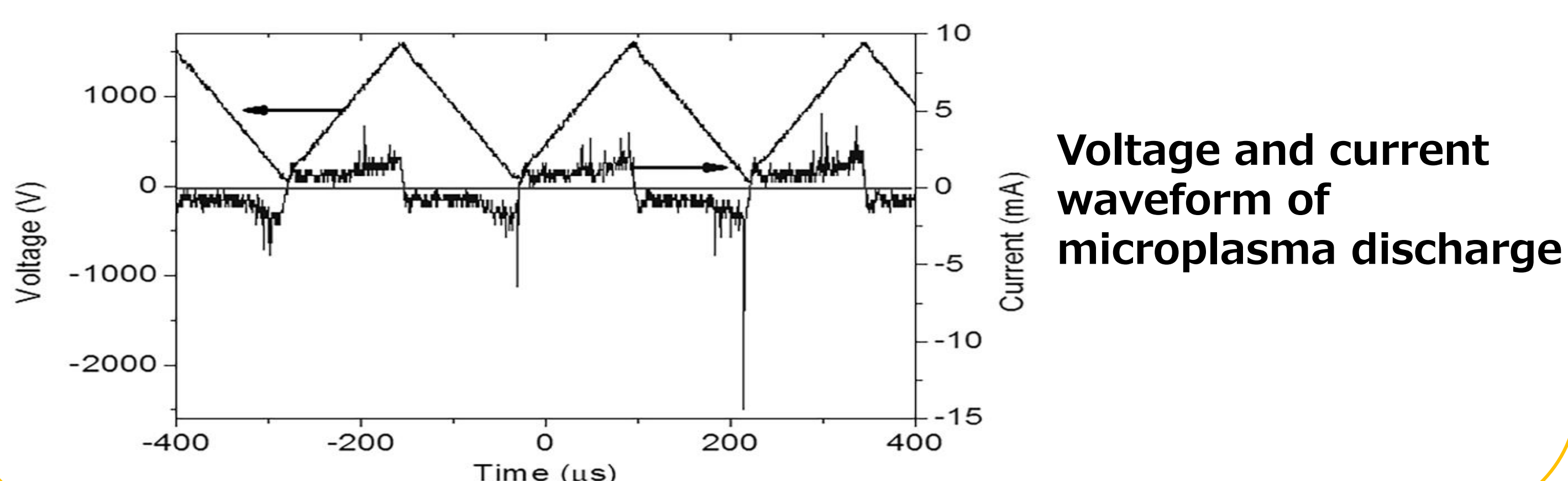
Fluorescein Isothiocyanate–Dextran (FD-150)

Molecular weight: 150 kDa

**Excitation: 493 nm
Fluorescence: 518 nm**

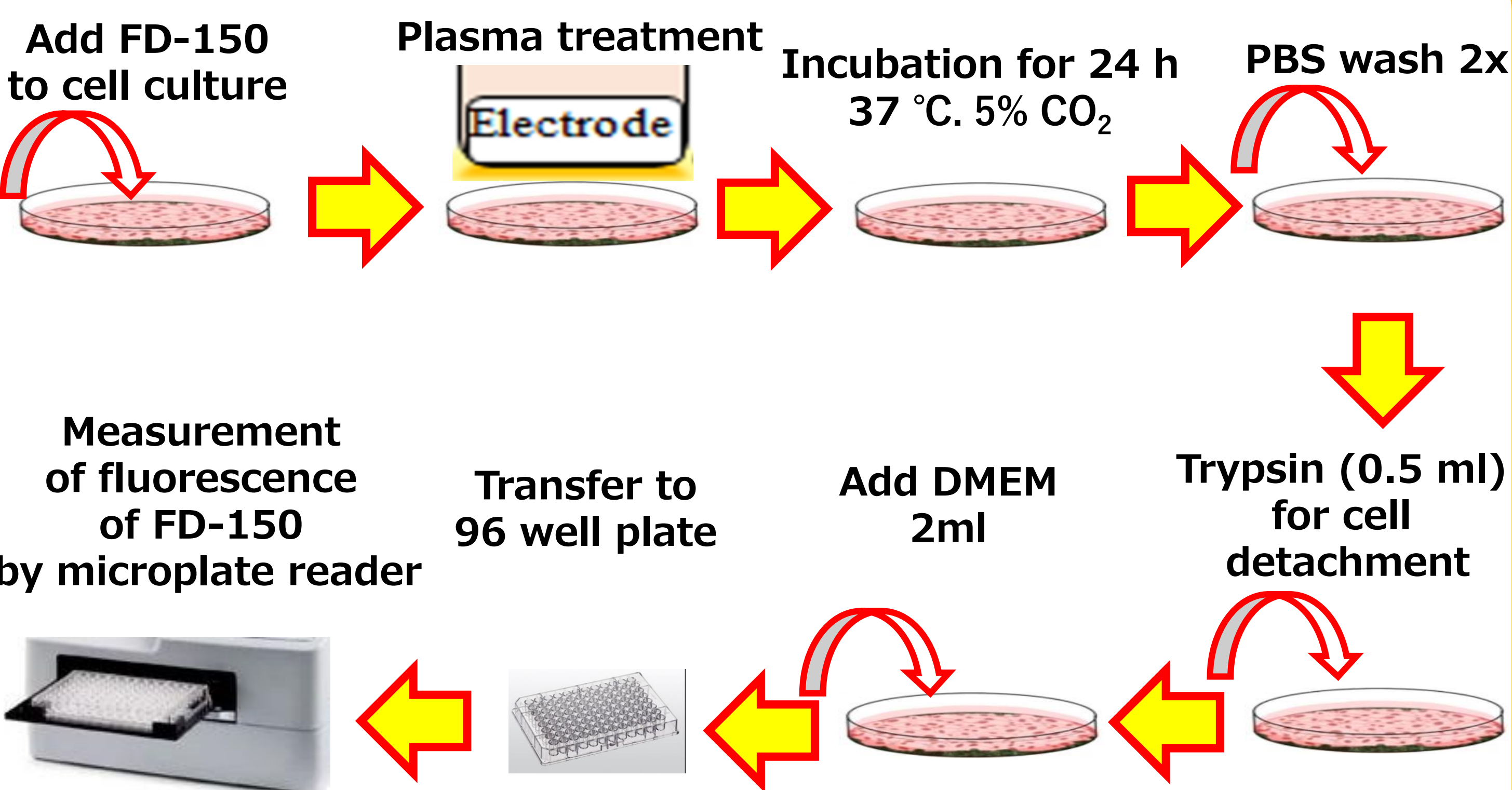


Microplasma treatment of the cells



Voltage and current waveform of microplasma discharge

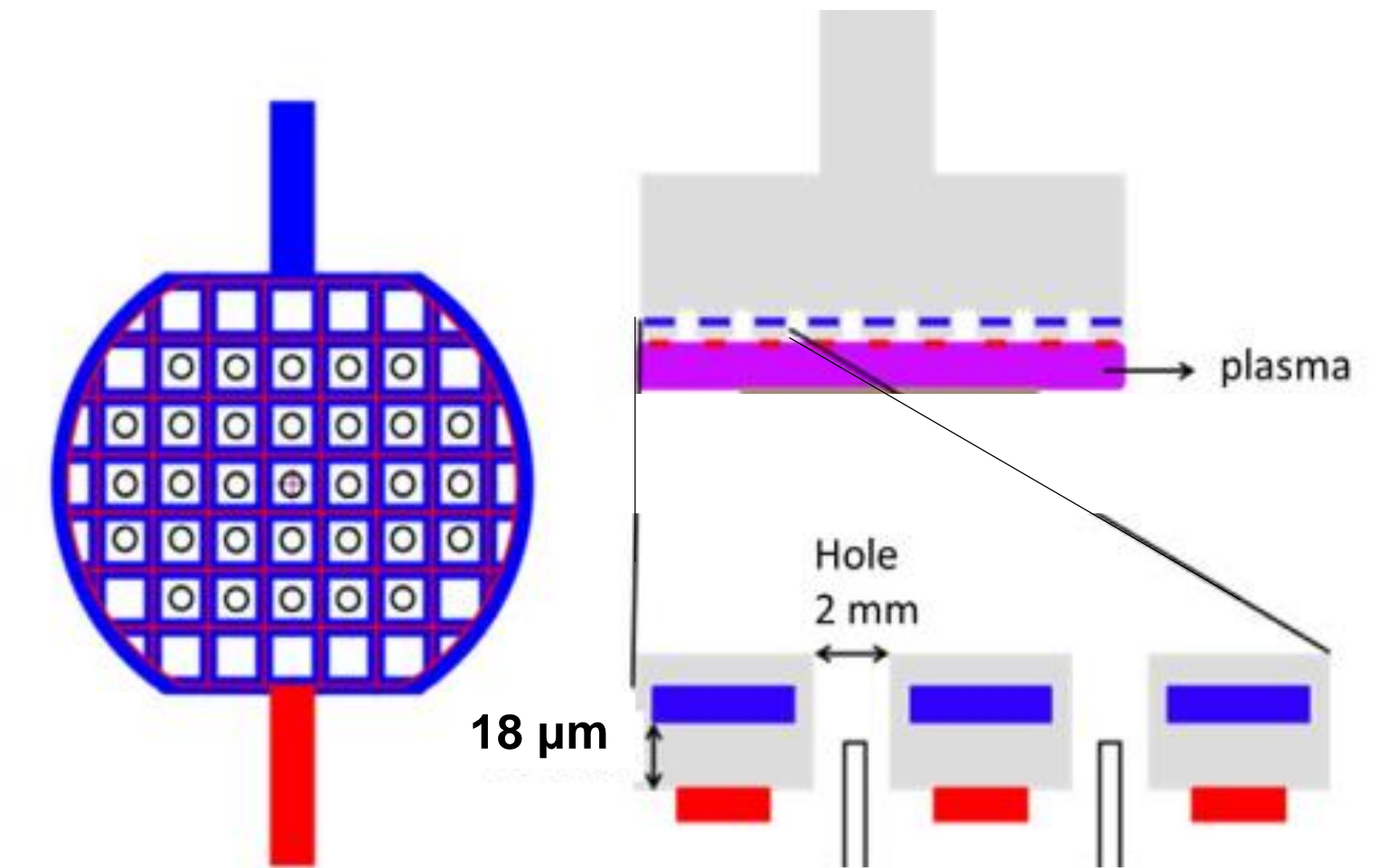
Cell treatment procedure



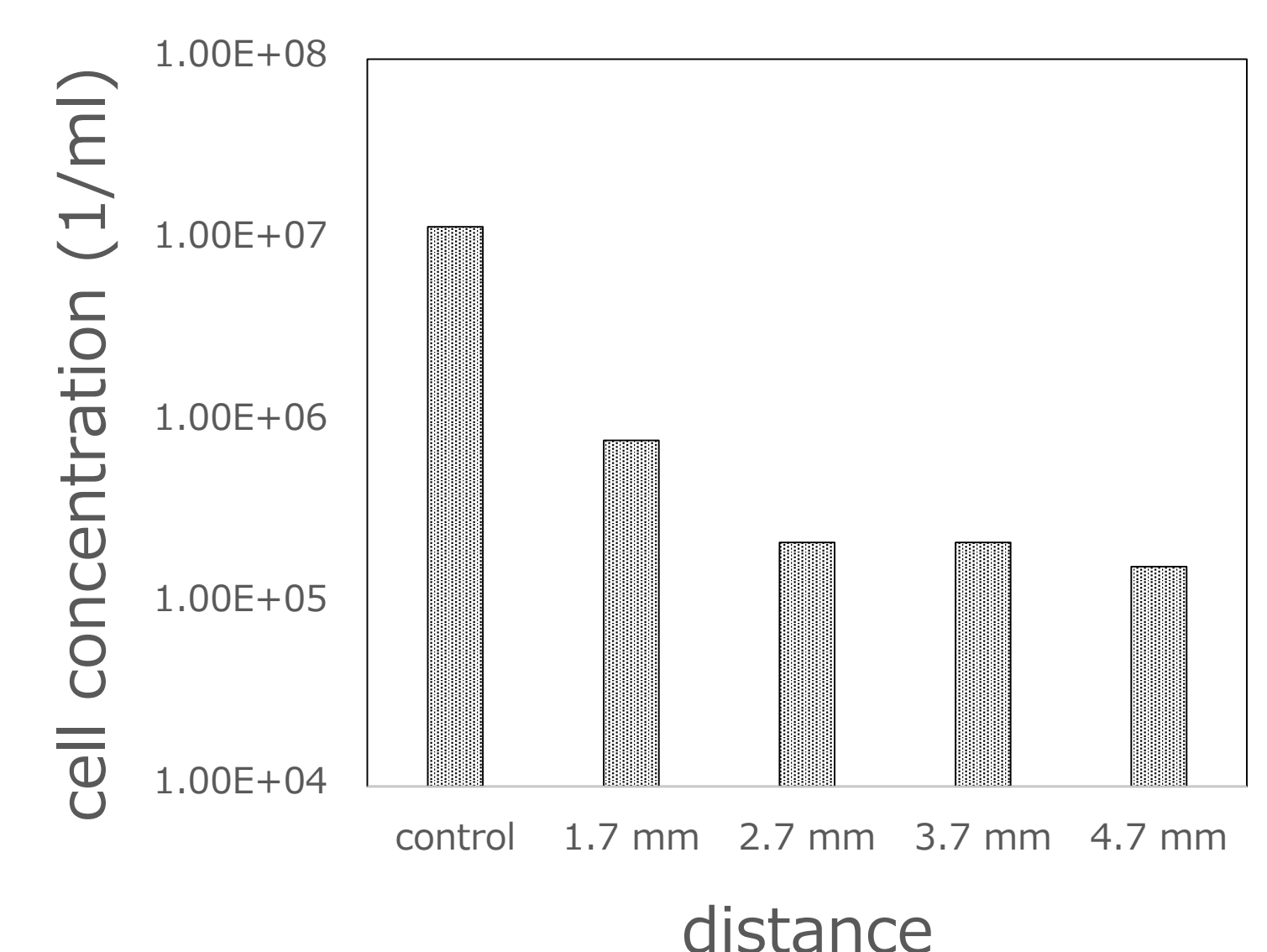
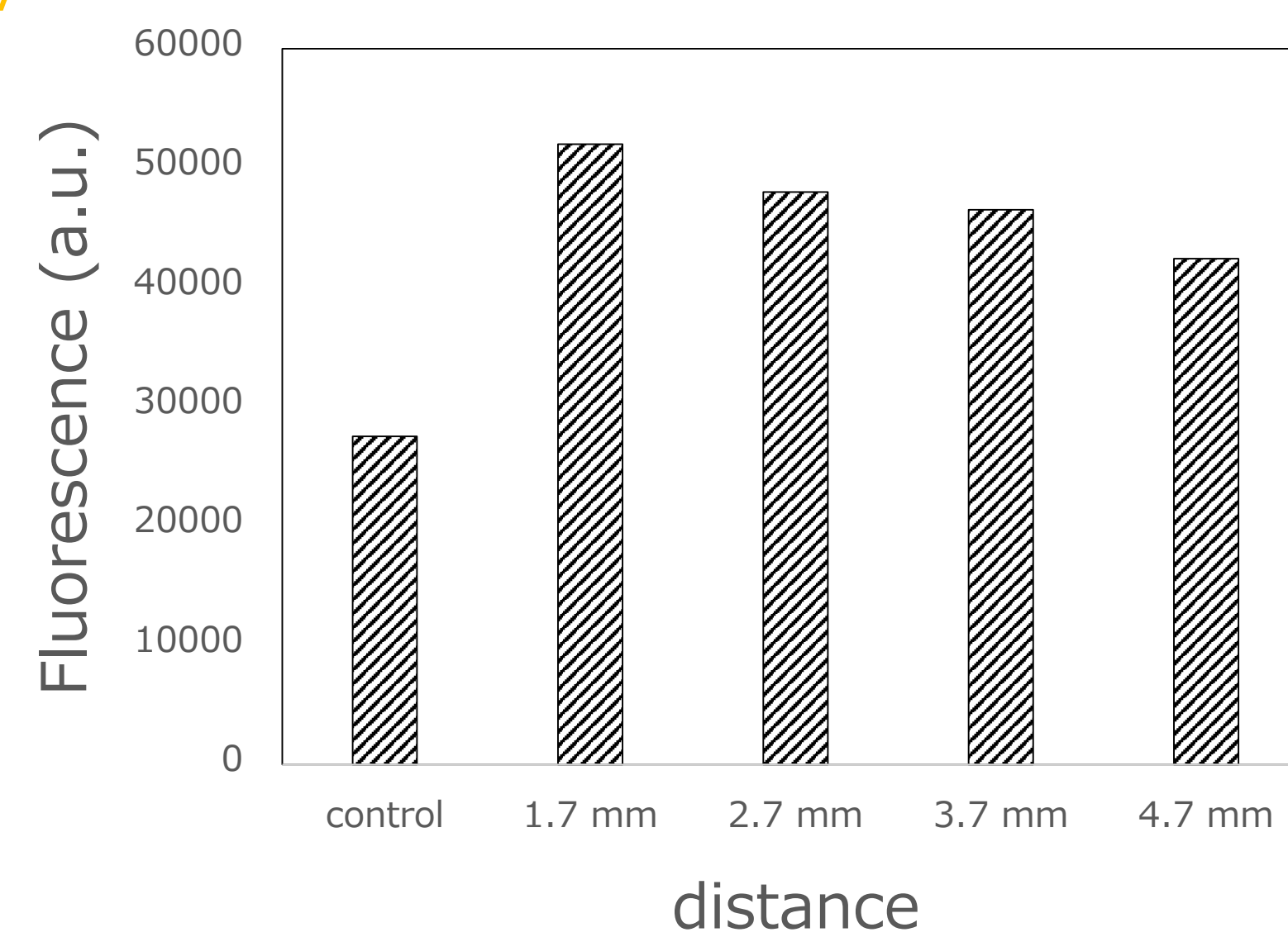
Microplasma electrode

Microplasma electrode

- Dielectric thickness = 18 μm
- Diameter = 3 cm
- Electrode temperature during discharge – under 45°C

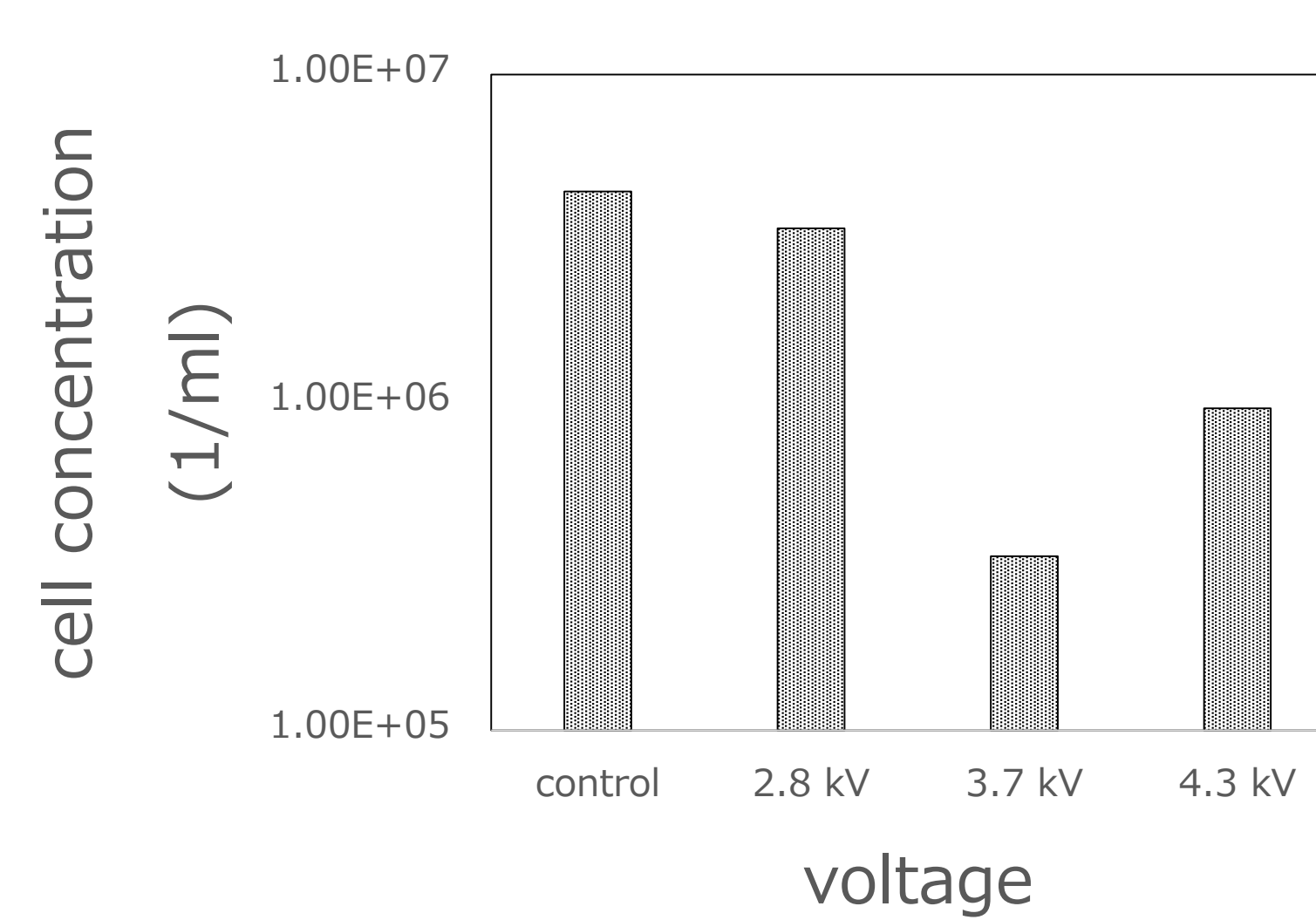
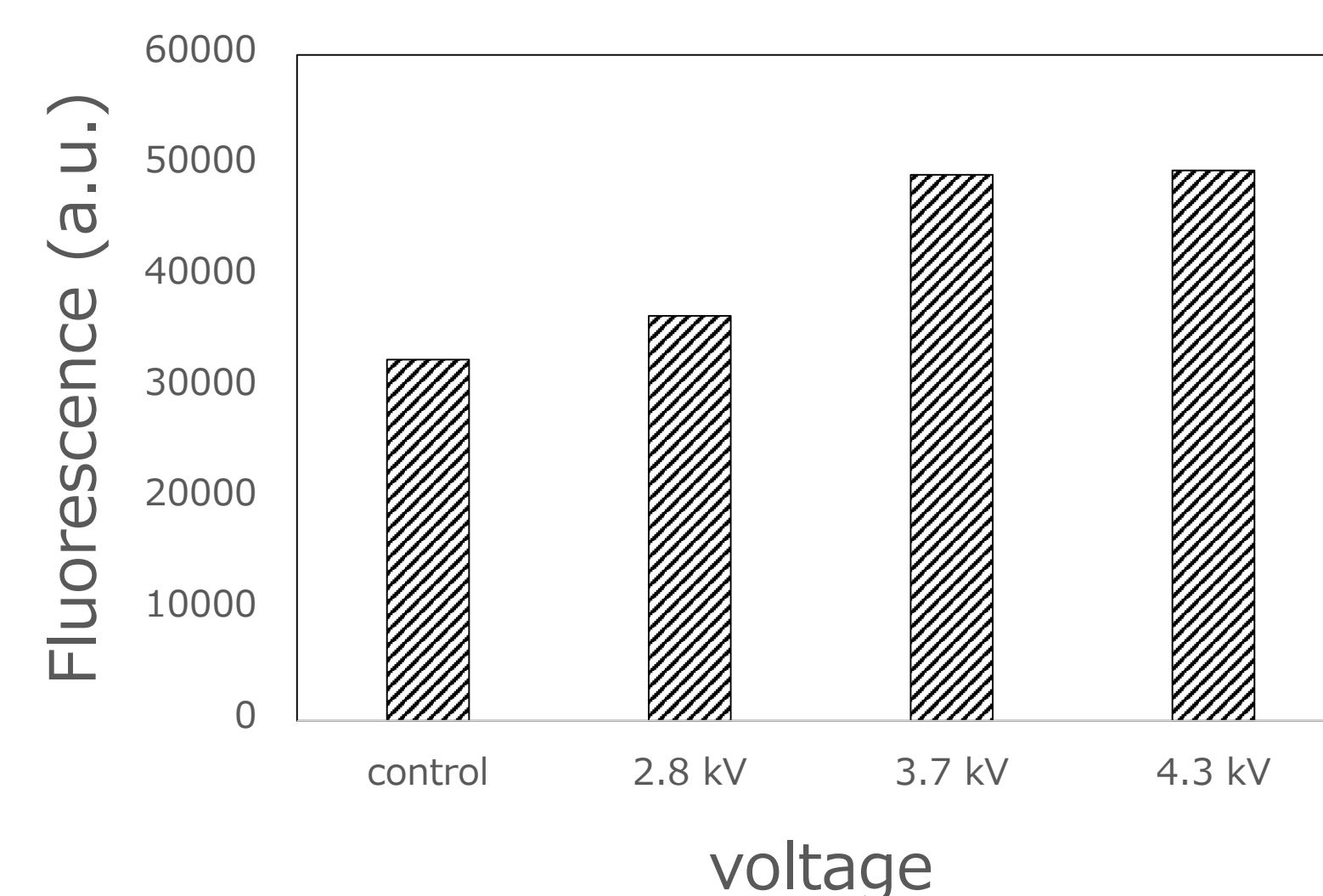


FD-150 cell absorption measurements



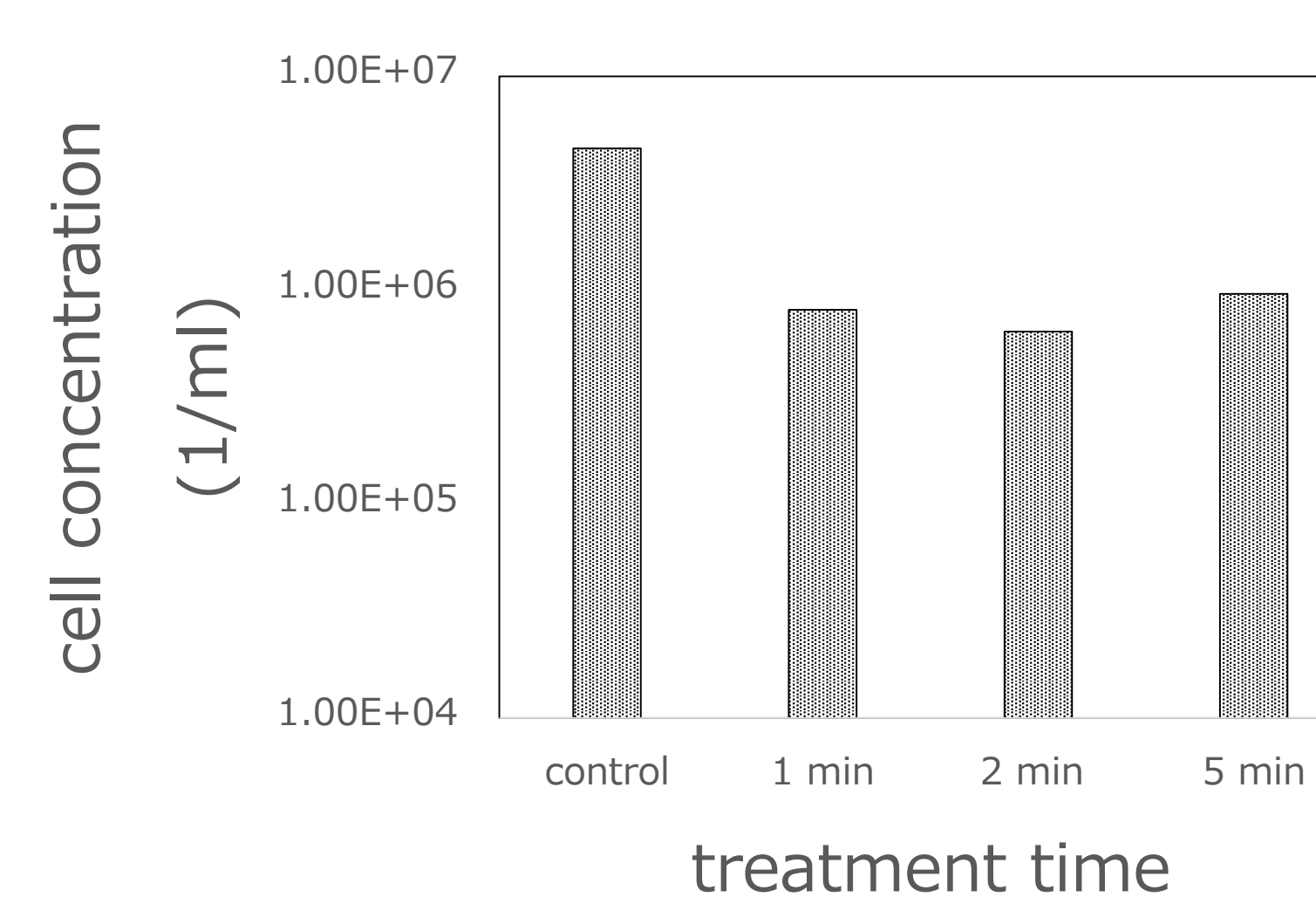
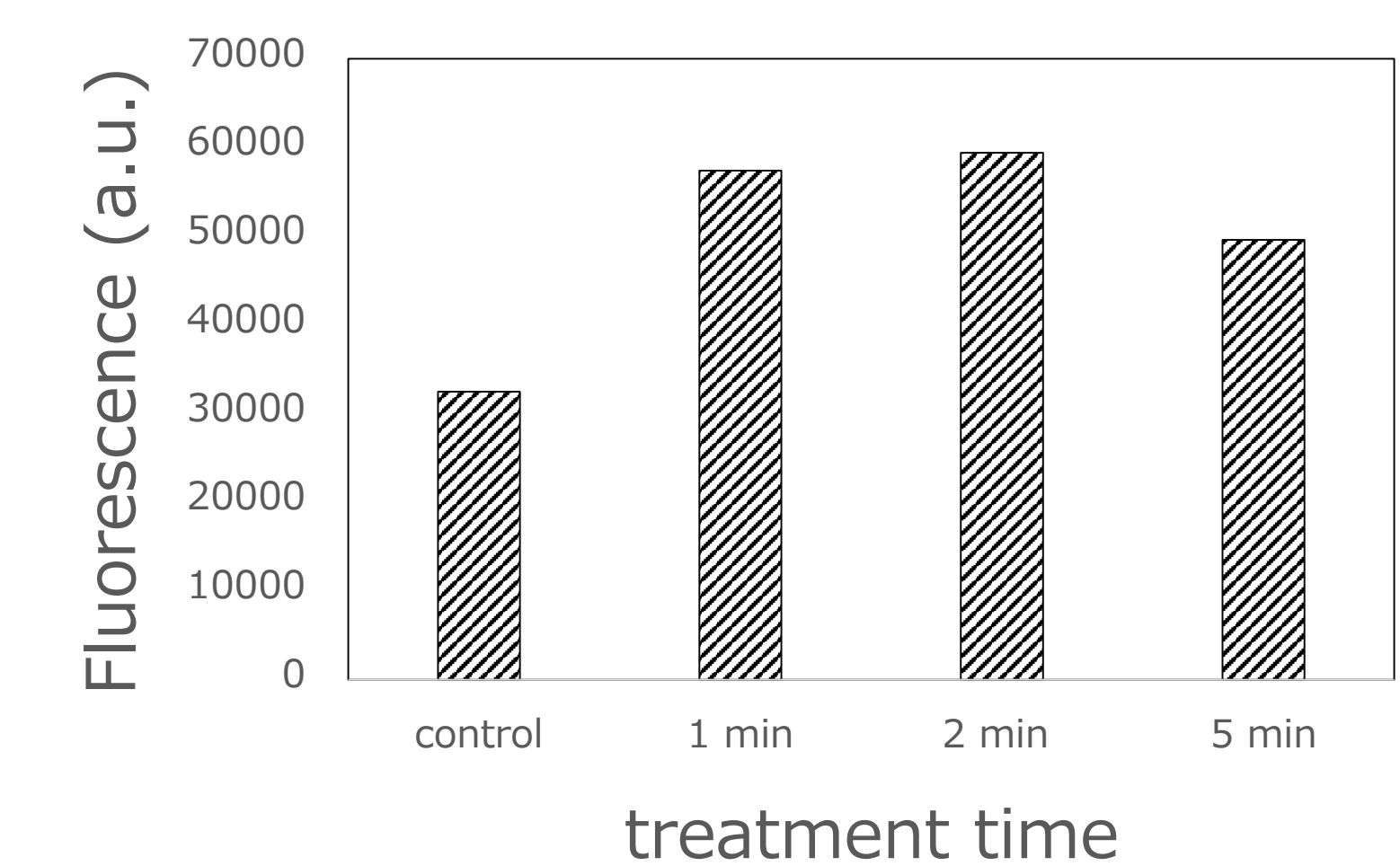
Fluorescence (absorbance of FD-150) Decreases with treatment distance

Number of cell decreases 1 order after plasma treatment and 24 h incubation – effect of distance is negligible



Higher voltage of discharge helps to increase fluorescence (absorbance of FD-150 into the cells)

Higher voltage of discharge can decrease viability of the cells



Treatment time (absorbance of FD-150 into the cells) is very similar for 1 and 2 minutes of plasma treatment and decreased after 5 minutes of plasma treatment

Length of treatment time does not affect cell viability significantly differently

Conclusions

- Applying of air microplasma can increase of drug absorption into intestinal cells
- Increasing of distance from plasma decreases probability of the cells to absorb drug but does not affect cell viability significantly differently
- The higher voltage can increase drug uptake but also decrease viability of intestinal cells
- Different treatment time did not affect cell viability differently. Drug uptake was similar for treatment time 1 min or 2 min and decreased in the case of 5 min of plasma treatment