M.Sc. Thesis Project:

Investigating cargo internalization through electroporation after inhibiting cytoskeletal components on mammalian cells

Background & Motivation

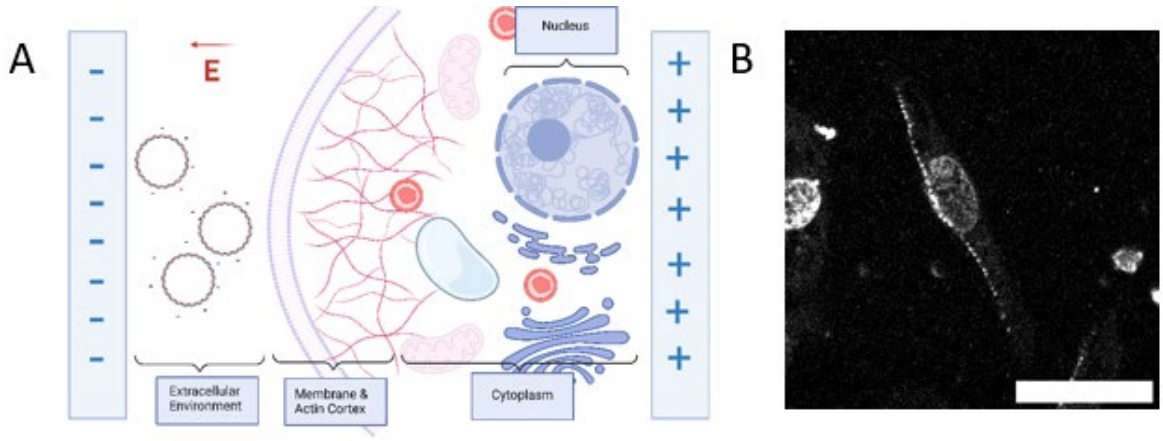

Figure 1A) Schematic representation of the experimental setup where nucleic acids are suspended in the extracellular environment and are transferred into the cell after the exposure of strong pulses. B) Image of Chinese Hamster Ovary cell after exposure to an electric field in a solution of suspended fluorescent plasmid DNA. Scale bar = 20 µm.

Genome editing methods can precisely alter mammalian cell genomes, driving cell biology advancement and promising treatments for congenital diseases. Efficient genome editing for therapy involves delivering cargo such as nucleic acids and editing enzymes to cell nuclei by breaching the cell membranes. Electroporation is a technique that can permeabilize and induce pores in the cell membrane using high-voltage pulses. Electrotransfer describes the translocation of cargo from outside the cell (Fig 1A), into the cell after electroporation (Fig 1B). However, clear understanding about the mechanism behind this transfer is lacking, which hinders efficacy in clinical applications. While prior research studied the active and passive intracellular transport of genetic cargoes, little is still known about how cytoskeletal components (septin, actin, microtubules, and intermediate filaments) and their structures (filament length, cross-linking density, etc.) influence cargo uptake and pore dynamics.

The project

Using electroporation as a transfection technique while inhibiting particular components of the cytoskeleton can help us better understand how to what extent cytoskeletal components play a role in intracellular transport and pore dynamics. In this M.Sc. thesis, the following tasks can be explored:

- Deepening your knowledge on the multidisciplinary field of electroporation and gain a better understanding of the underlying mechanisms involved in cargo transport and how the cytoskeleton plays a role in this.
- Developing your technical skills in cell culture, fluorescence microscopy, image analysis, and electroporation.

Interested?

Contact us at s.s.m.deboer@tudelft.nl for more information! The project will be supervised by Sophie de Boer, Dr. Bijoy Bera, and Dr. Pouyan Boukany (PPE/ChemE/TNW).