

PhD position (4 yr): Role of the cellular cytoskeleton in membrane electroporation and cargo translocation

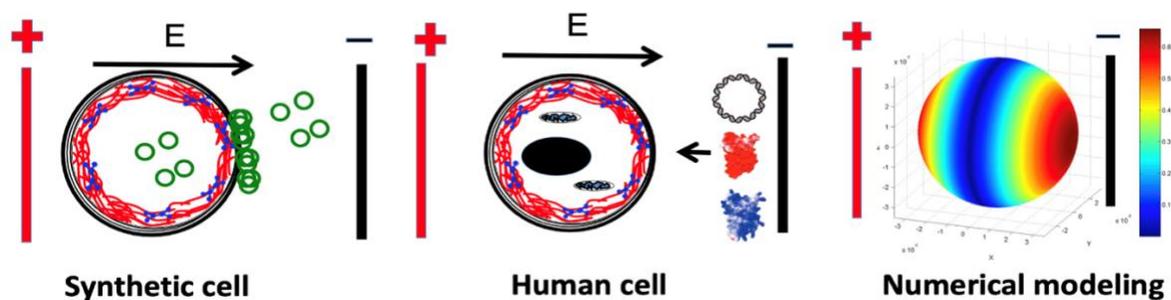
[Boukany lab @ Chemical Engineering department, TU Delft](#)

1. Are you inspired by the potential to use non-viral delivery of CRISPR-Cas complexes to reprogram mammalian cells for therapeutics?
2. Are you fascinated by using novel microfluidics to deliver a precise number of genetic cargoes into primary human cells with minimal side effects?
3. Are you eager to work in an exciting collaborative and interdisciplinary research environment at the interface of physics, engineering and biology?

Job description:

New genome editing tools (based on CRISPR-Cas components) promise to modify and correct cell functions at the source by fixing disease-causing mutations. However, they require the delivery of nucleic acids and/or gene editing enzymes directly into cells so they can effectively reach the cell nucleus. Electroporation is a safe non-viral delivery method that works by transient disruption of the membrane under electric pulses. This technology can in principle deliver genetic cargoes straight to the cytosol under ideal pulse conditions. However, electroporation can also yield substantial cell damage or poor transfection efficiency, due to a lack of understanding on the underlying mechanisms of membrane poration and cargo translocation. We recently discovered that the actin cytoskeleton, a crosslinked network of filamentous proteins that lines the cell membrane, plays an important role in the barrier function of the cell surface. **The aim of this experimental PhD project is to unravel the biophysical mechanisms by which the actin cortex and the membrane together govern electro-transfer of genes and proteins into living human cells.**

In this collaborative project, you will first use microscopy to unravel the role of actin cortex in the transport kinetics of genetic cargoes across the living cell membranes. Next, you will perform quantitative measurements of cellular uptake by primary human cells (e.g. T-cells and human induced pluripotent stem cells). To this end, you will develop novel microfluidics for measuring cell surface mechanics and cargo translocation with high spatiotemporal resolution under electric pulses. By teaming up with a PhD student in [the Koederink lab](#) who will study electroporation and electrodeformation in synthetic cells (with actin cortex) and with the team of Lea Rems for membrane simulations, we will be able to understand the mechanisms that govern electroporation efficiency as a prerequisite toward the future rational design of safe methods for non-viral delivery of gene-editing molecules.



The research environment: We offer an inspiring, supportive and collegial environment. Delft University of Technology is a top ranked research university, located in the Netherlands. The faculty of Applied Sciences has advanced clean-room and microscope facilities, offering very accessible and complete fabrication and analysis equipment. Its [Department of Chemical Engineering \(ChemE\)](#) is one of the leading schools in Europe. Within the Chemical Engineering Department, [the Boukany research group](#) focuses on fundamental and applied topics at the interface of engineering, soft matter, and biology, with a major emphasis on controlling and understanding the dynamics of biological systems. We will employ both experimental and theoretical approaches in our research to understand fundamental physics in soft-living systems. You will closely collaborate with several PhD/PD researchers (funded by the ERC-CoG, ZonMW and NWO-ENW) in the Boukany group work on the development of novel (bio)microfluidics and organ-on-a-chip devices for health-care applications (from diagnostics to therapeutics).

Qualifications: We hire outstanding experimental scientists with a strong affinity for research at the interface of physics, engineering and biology. Research experience in fields such as biophysics, soft matter science, single-molecule techniques, gene delivery, or nanoscience is welcomed. We are looking for a candidate with a high level of intellectual creativity and genuine interest in fundamental research, who is keen to work in an international and interdisciplinary team. Women are particularly encouraged to apply, as they typically make up a smaller fraction of the applicant pool. Applicants must

- hold a Master's degree, or approach its completion, in physics, chemistry, (bio)engineering, materials science, nanoscience, or a closely related discipline;
- have excellent written and spoken English skills;
- thrive in an international, multidisciplinary and highly collaborative environment.

Conditions of employment: PhD students are on a fixed-term (4 yr) contract. TU Delft offers a customisable compensation package, a discount for health insurance and sport memberships, and a monthly work costs contribution. Flexible work schedules can be arranged. [Coming to Delft Service](#) organizes diverse events for new international employees and their accompanying partners, like Partner Career Workshops and Dutch Culture Workshops. Located on campus are the International Children's Centre and an international primary school which are subject to availability as well as several bilingual schools in the nearby surrounding. Salary and benefits are in accordance with the Collective Labour Agreement for Dutch Universities. As a PhD candidate you will be enrolled in the TU Delft Graduate School. [TU Delft Graduate School](#) provides an inspiring research environment; an excellent team of supervisors, academic staff and a mentor; and a [Doctoral Education Programme](#) aimed at developing your transferable, discipline-related and research skills.

Employer: Delft University of Technology (TU Delft) is a multifaceted institution offering education and carrying out research in the technical sciences at an internationally recognized level. Education, research and design are strongly oriented towards applicability. TU Delft develops technologies for future generations, focusing on sustainability, safety and economic vitality. At TU Delft you will work in an environment where technical sciences and society converge. TU Delft comprises eight faculties, unique laboratories, research institutes and schools.

How to apply: Please submit your application to p.e.boukany@tudelft.nl with:

- A motivation letter describing why you apply for this position, your research interests, and why you would be a good fit for our team (no more than 1 A4).
- A detailed CV with publication list.
- Names and email addresses of 3 or more references who are willing to send a letter of recommendation on your behalf.

Your application will be reviewed as soon as it is received.