



TOYOHASHI UNIVERSITY of TECHNOLOGY

Tempaku-cho, Toyohashi, Aichi, 441-8580 Japan
PHONE: +81-532-44-6577 FAX: +81-532-44-6557
E-mail: press@office.tut.ac.jp

PRESS RELEASE

Source: Toyohashi University of Technology, Japan, Committee for Public Relations

Title: New innovative method for delivering genes into cells

Subtitle: Modification of cell physiological function with novel parallelized electroporation of mammalian cells by using electrostatic manipulation in a water-in-oil droplet

Full text:

Living cells express genes involved in physiological functions like development and metabolism via complex mechanisms. The cell membrane protects the genome from various exogenous molecules. Cell transfection is a fundamental technique that is used to deliver molecules, such as nucleic acids, proteins, and drugs, into living cells. The technique has been implicated in the development of a broad spectrum of life science applications.

Electroporation is a popular technique for the delivery of cell-impermeable molecules into cells through transient pores in the cell membrane, which are formed by exposing cells to electric pulses. However, most commercial electroporation-based transfection methods require the use of specialized pulse generators to produce short electrical pulses at high voltage.

Now, researchers at the Department of Environmental and Life Sciences and Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) in the Toyohashi University of Technology have developed a novel gene-transfection method: water-in-oil (W/O) droplet electroporation with sufficient transfection efficiency and cell viability. In this method, when a liquid droplet suspended between a pair of electrodes in dielectric oil is exposed to a direct current (DC) electric field, the droplet moves between the pair of electrodes periodically and deforms under the intense DC electric field (Fig. 1).

The first authors, Assistant Professor Hirofumi Kurita and Professor Akio Mizuno, said, "W/O droplet electroporation is operated using a DC power supply, which obviates the need for an expensive pulse generator. In addition, the size of the droplet is quite small compared with that in conventional bulk electroporation, resulting in the use of fewer materials in high-throughput analysis."

Associate Professor Rika Numano explained, "The W/O droplet electroporation technique has several advantages over conventional transfection techniques: small cell number required, as low as 1000 cells; small amount of DNA required, which makes it applicable for various cell types including neural cells; and changeable genome DNA. There have been improvements in W/O-droplet electroporation electrodes for use in disposable 96-well plates for concurrent performance (Fig. 2). The W/O droplet electroporation technique can contribute to further biomedical innovation in high-throughput screening with a large number of samples for applications in regenerative medicine and gene therapy."



TOYOHASHI UNIVERSITY of TECHNOLOGY

Tempaku-cho, Toyohashi, Aichi, 441-8580 Japan
PHONE: +81-532-44-6577 FAX: +81-532-44-6557
E-mail: press@office.tut.ac.jp

Funding agency:

This work was supported by the Ministry of Education, Culture, Sports, Science, and Technology (MEXT)'s "Program to Foster Young Researchers Cutting-Edge Interdisciplinary Research to R.N.), the Japan Science and Technology Agency (JST) (to R.N.), a Grant-in-Aid for Scientific Research from the Japan Society for the Promotion of Science (JSPS) (24590350 to R.N.), by a Grant-in-Aid for Scientific Research in Innovative Areas "Plasma Medical Innovation" (24108005 to A.M.) from the Ministry of Education, Culture, Sports, Science, and Technology (MEXT), Japan, a Grant-in-Aid for Young Scientists (B) (24760648 to H.K.), and a Grant-in-Aid for Scientific Research (C) (26390096 to H.K) from the Japan Society for the Promotion of Science (JSPS). In addition, R.N. was supported in part by the Takeda Science Foundation and the Tatematsu Foundation. Supporting company is Nepa Gene Co., Ltd.

Reference:

Hirofumi Kurita, Shota Takahashi, Atsushi Asada, Minako Matsuo, Kenta Kishikawa, Akira Mizuno, and Rika Numano (2015). Novel Parallelized Electroporation by Electrostatic Manipulation of a Water-in-oil Droplet as a Microreactor: PLOS ONE: 10.1371/journal.pone.0144254

Further information

Toyohashi University of Technology

1-1 Hibarigaoka, Tempaku, Toyohashi, Aichi Prefecture, 441-8580, JAPAN

Inquiries: Committee for Public Relations

E-mail: press@office.tut.ac.jp

Toyohashi University of Technology founded in 1976 as a National University of Japan is a research institute in the fields of mechanical engineering, advanced electronics, information sciences, life sciences, and architecture.

Website: <http://www.tut.ac.jp/english/>

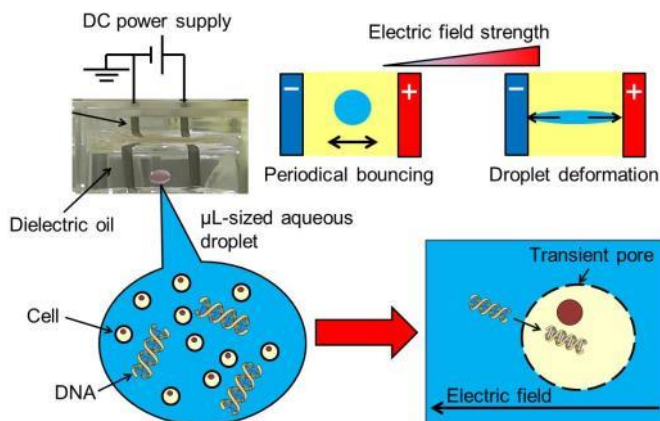


Figure 1:

Behavior of a water-in-oil (W/O) droplet in an electrostatic field, and scheme of W/O droplet electroporation.



TOYOHASHI UNIVERSITY of TECHNOLOGY

Tempaku-cho, Toyohashi, Aichi, 441-8580 Japan
PHONE: +81-532-44-6577 FAX: +81-532-44-6557
E-mail: press@office.tut.ac.jp

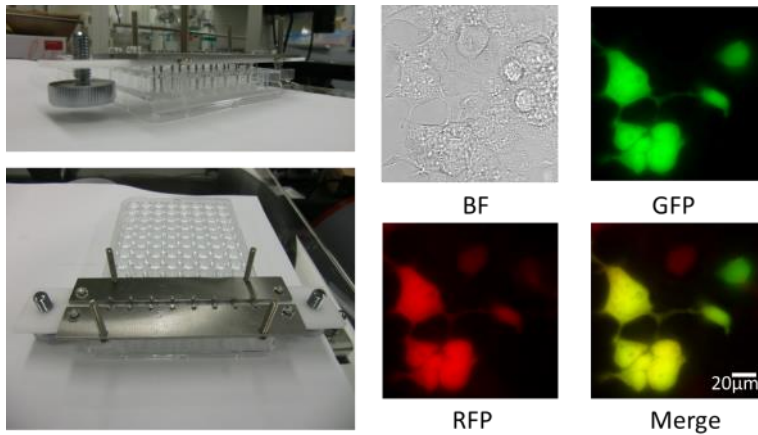


Figure 2:

Image of the parallel W/O droplet electroporation electrode for the 8-well string of disposable 96-well plates and HEK293 cells transfected with fluorescent protein plasmid by W/O droplet electroporation. BF: Bright field image; GFP: Green Fluorescent Protein image. RFP: Red Fluorescent Protein image; Merge: Merge image of GFP and RFP.

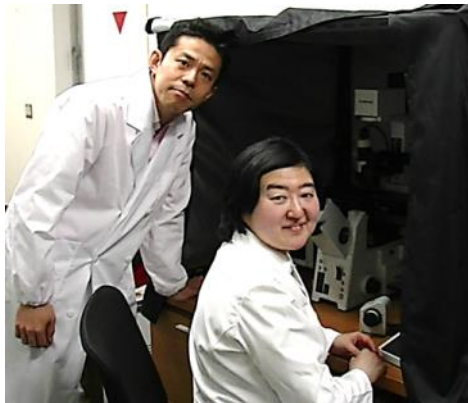


Figure 3:

Associate Professor Rika Numano and Assistant Professor Hirofumi Kurita

Keywords:

BIOLOGY, BIOMEDICAL/ENVIRONMENTAL/CHEMICAL ENGINEERING,
BIOMEDICAL/ENVIRONMENTAL/CHEMICAL ENGINEERING, BIOTECHNOLOGY, BIOTECHNOLOGY, CELL
BIOLOGY, MOLECULAR BIOLOGY, TECHNOLOGY/ENGINEERING/COMPUTER SCIENCE