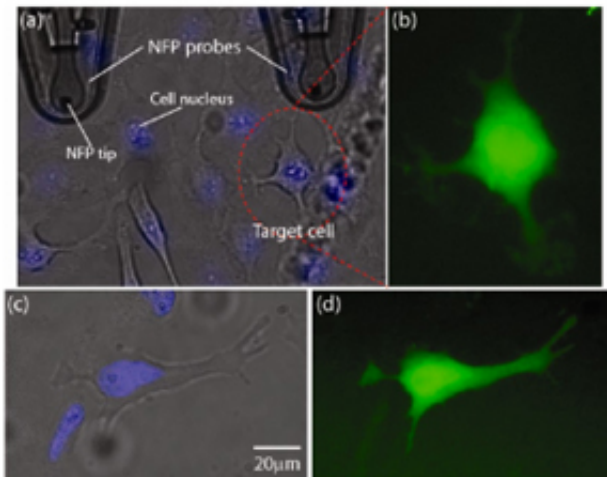


# Single-cell transfection tool enables added control for biological studies

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Transfection of the dextran Alexa Fluor 488 dye into a targeted HeLa cell using Nanofountain Probe Electroporation. Reprinted with permission from Nano Letters. Copyright 2013 American Chemical Society.

(Phys.org) —Northwestern University researchers have developed a new method for delivering molecules into single, targeted cells through temporary holes in the cell surface. The technique could find applications in drug delivery, cell therapy, and related biological fields.

Bulk electroporation—a technique used to deliver [molecules](#) into cells through reversible nanopores in the cell membrane that are caused by exposing them to electric pulses—is an increasingly popular method of cell transfection. (Cell transfection is the introduction of molecules, such

as [nucleic acids](#) or proteins, into a cell to change its properties.)

However, because bulk electroporation applies electric pulses to a bulk cell solution, it results in heterogeneous [cell populations](#) and often low [cell viability](#). To solve these problems, Northwestern University researchers have developed a novel tool for single-cell transfection.

The new method, called nanofountain probe electroporation (NFP-E), allows researchers to deliver molecules into targeted cells through temporary nanopores in the [cell membrane](#) created by a localized electric field applied to a small portion of the cell. The method enables researchers to control dosage by varying the duration of the electric pulses, which provides unprecedented control of cell transfection.

"This is really exciting," said Horacio Espinosa, James and Nancy Farley Professor of Manufacturing and Entrepreneurship at Northwestern's McCormick School of Engineering and one of the paper's authors. "The ability to precisely deliver molecules into single cells is needed for biotechnology researchers to advance the state-of-the-art in therapeutics, diagnostics, and [drug delivery](#) toward the promise of personalized medicine."

A paper describing the research, "Nanofountain Probe Electroporation (NFP-E) of Single Cells," was published May 7 in the journal *Nano Letters*.

NFP-E is based on nanofountain probe (NFP) technology developed in Espinosa's lab. The NFP-E chip consists of an array of microfabricated cantilever probes with integrated microfluidic channels. The probe has previously been used for high-speed nanopatterning of proteins and nanoparticles for drug delivery studies.

The new single-cell transfection application couples the probe with an

electrode and fluid control system that can be easily connected to a micromanipulator or atomic force microscope for position control. This integrated system allows the entire transfection process and post-transfection cell response to be monitored by an optical microscope.

The NFP-E system is being developed for commercialization by iNfinitesimal LLC, a Northwestern spin-off company founded by Espinosa, and is expected to be available in late 2013.

The technique is proving to be extremely robust and multi-functional. Researchers have used the NFP-E chip to transfect HeLa cells with polysaccharides, proteins, DNA hairpins, and plasmid DNA with single-cell selectivity, high transfection efficiency (up to 95%), qualitative dosage control, and very high viability (up to 92%).

**More information:** [pubs.acs.org/doi/abs/10.1021/nl400423c](https://pubs.acs.org/doi/abs/10.1021/nl400423c)

Provided by Northwestern University

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