

Lipoplex-Mediated Efficient Single-Cell Transfection Via Droplet Microfluidics

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BRIEF DESCRIPTION

The invention is an on-chip, droplet based single-cell transfection platform providing higher efficiency and consistency compared to conventional methods. Novel techniques following cell encapsulation yields uniform lipoplex formation, which increases the transfection accuracy. The invention solves the dilemma of the trade-off between efficiency and cell viability, and offers a safe, cell friendly and high transfection solution that is crucial for applications like gene therapy, cancer treatment and regenerative medicine.

FULL DESCRIPTION

Cell transfection, which is the delivery of genetic materials into living cells, is critical for many applications including gene therapy and cancer treatment. Various methods have been developed for the purpose of transfection, including viral vectors, where the virus is used as the carrier, non-viral vectors, and microinjection. Unfortunately, available solutions suffer from limitations. Viral vectors can cause side effects as undesired mutation and immunogenicity, whereas in electroporation, the use of high kilovolt level pulses endanger the cell's survival. For cationic lipids, they suffer from the large size distribution of the lipid-DNA complex (lipoplex) because of the preparation method itself, such as conventional vortexing or hand-shaking. Consequently, both the transfection efficiency and consistency are affected in an undesirable way. Inventors at UCI developed an on-chip droplet-based single-cell transfection platform. It adopts novel techniques for droplet advection, yielding uniform lipoplex formation. The technique overcomes the large lipoplex size distribution bottleneck in conventional methods. Gene delivery efficacy is improved, with no genomic disruption or cell damage. It provides a cell friendly transfection solution that for applications such as gene therapy and cancer treatment.

SUGGESTED USES

- Gene Therapy
- DNA vaccines
- In vitro fertilization
- Cancer Treatment
- Regenerative medicine
- Induced pluripotent stem cells

ADVANTAGES

- On chip, droplet based transfection platform
- Safe and cell friendly, with no genomic disruption nor viability damage

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OTHER INFORMATION

CATEGORIZED AS

- » **Biotechnology**
 - » Genomics
- » **Medical**
 - » Devices
 - » Disease: Cancer
 - » Gene Therapy
 - » Research Tools
 - » Vaccines
- » **Research Tools**
 - » Nucleic Acids/DNA/RNA
- » **Engineering**
 - » Other

RELATED CASES

2017-807-0

- Preparation method reduces the transfection variation between cells, improving the overall delivery efficiency
- Transfection consistency is improved
- Yields uniform lipid-DNA complex formation

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20200324288	10/15/2020	2017-807

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