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Synthetic DNA nanopores for transmembrane delivery of biological material

DNA nanopores integrate into membranes to deliver proteins, nucleic acids, and molecules across cells.

DNA nanotechnology, especially DNA Origami-Engineered nanomaterials has been a novel area of exploration. It is incredibly versatile, allowing for creating specific two and three-dimensional structures with precise dimensions. Moreover, nanopore technology can have many applications in biotechnology and medicine, including use in gene sequencing of single-stranded DNA, RNA and the like. It allows scientists to synthesize DNA nanopores for transmembrane delivery of biological material, such as protein and foreign DNA. Researchers at Purdue University have designed nanostructures using DNA with pore sizes ranging from 0.8 to 5 nm. These nanostructures can be easily integrated into the membranes of various types of cells, both eukaryotic and prokaryotic. We believe that this innovation facilitates the cost-effective transport of these biological components, bypassing the cell's natural transport mechanisms to maximize the efficiency of targeted uptake, and provides a new path in cell transmembrane deliveries.

Technology Validation:

The results of flow cytometry analysis data show successful biomaterial transportation into U87 brain cancer cells. The analysis was conducted on cells with 1) No nanostructures. 2) with DNA nanopore (0.8nm pore size), 3) with a DNA nanocage of the present disclosure (7nm pore size), 4) with DNA nanocage of the present disclosure with central DNA strand.

Advantages:

-Versatility of the nanostructure

-Variety of biological materials that can be carried

Technology ID

2025-GREE-70808

Category

Materials Science & Nanotechnology/Nanomaterials & Nanostructures

Pharmaceuticals/Computational Drug Delivery & Nanomedicine

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Applications:

-Transfection of sons, proteins, molecules, chemical compounds, oligonucleotides, enzymes, or signal molecules

-DNA transfection (transformation of bacteria)

-Transformation of DNA into eukaryotic or prokaryotic cells at production scale

-Bacterial engineering

-Transportation of bioactive materials

TRL: Micro & Nanotechnologies

Intellectual Property:

Provisional-Gov. Funding, 2024-09-06, United States

PCT-Gov. Funding, 2025-09-08, WO

Keywords: Biological Materials, Biomedical Engineering, Cell, DNA Nanopores, Micro & Nanotechnologies, Transmembrane Delivery