2018-436 GUIDED MAGNETIC NANOSPEARS FOR TARGETED AND HIGH-THROUGHPUT INTRACELLULAR DELIVERY

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Technology description

Guided Magnetic Nanospears For Targeted And High-Throughput Intracellular Delivery

SUMMARY

UCLA researchers in the Department of Chemistry & Biochemistry and Department of Molecular & Medical Pharmacology have developed novel magnetic nanostructures that can be used to carry and/or deliver biomolecular cargo intracellularly to cells.

BACKGROUND

Current approaches for high-throughput and targeted intracellular delivery of biomolecules involve the use of viruses, external electric fields, or harsh chemical reagents, which are either costly, inefficient, or apply undesirable stresses or toxicities to the cells. Improving the safety, speed, cost effectiveness, and efficiency of intracellular delivery remains a challenge in the field of cell and molecular biology, and gene editing systems for clinical applications.

Membrane disruption-based approaches using sharp, needle-like nanostructures can physically penetrate flexible cell membranes to deliver biomolecules to cells efficiently, with minimal impact on cell viability and metabolism. Most nanoneedle platforms consist of arrays grown on planar substrates that support the growth of adherent cells, but they have problems releasing the modified cells after transfection and collecting them for further studies. Recently developed nano-/micromotor systems can be internally or externally powered to move in liquid environments, but these nanosystems have limited precision in terms of their guidance and biocompatibility due to byproducts from catalytic reactions that propel the nano-/micromotor structures to their targets.

INNOVATION

Researchers at UCLA have developed magnetic nanostructures that can be configured readily for single-cell modification, or they can be scaled progressively for direct and highly efficient high-throughput intracellular delivery. These biocompatible nanomaterials can be guided precisely to target cells without the need for chemical propellants via manipulation of locally applied magnetic fields. The guided nanospears can be manufactured and deployed in large scales while achieving exceptional transfection efficiencies, maintaining cell viability for applications in stem cell biology and the development of next-generation gene and cellular immunotherapies.

Application area

Carry and deliver biomolecular cargo (i.e. DNA plasmids, siRNA, proteins, targeted endonucleases) intracellularly to cells

Advantages

The position, orientation, and speed of the magnetic nanospears can be manipulated remotelyviaan external magnetic field, without needing chemical reagent
The surfaces of the nanospears can be easily configured to carry a variety of biomolecular cargos
The nanospears can be used to selectively transform neighboring cells with single-cell precision, or to transform a large population of cells

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