CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

S1726

Project Title

Catalytic Delivery NanoSubstrates (CDNS) for Highly Efficient Delivery of Biomolecules

Abstract

Objectives/Goals

The delivery of biomolecules to rectify cells can potentially treat incurable diseases. Biomolecule delivery is performed with layer-by-layer deposition of biomolecules coated onto substrates. Targeted cells are then cultured on the substrates in order to induce biomolecule delivery. However, the pre-coating process prohibits continuous delivery of biomolecules. Furthermore, current approaches raise concerns pertaining to transfection performance, biocompatibility, and cell viability. In order to address these issues, Catalytic Delivery NanoSubstrates (CDNS) are engineered to efficiently deliver biomolecules to different types of cells. Additionally, to eliminate biomolecular pre-coating of substrates, CDNS use nanowires as substrates and improve delivery performance.

Methods/Materials

Transfection efficiency with CDNS was compared to that with two commercially available reagents, Lipofectamine 2000 and RGD-jet-PEI, at high and low DNA dosages. Enhanced green fluorescent protein (EGFP) was transfected into different cell lines. Additionally, cell viability after transfection was assessed for all transfection experiments.

Results

Transfection of EGFP using CDNS has the highest efficiency for all cell lines with both DNA dosages when compared to Lipofectamine 2000 and RGD-jet-PEI. In addition, cells transfected with CDNS exhibited high cell viability with both DNA dosages, whereas cells transfected with Lipofectamine 2000 and RGD-jet-PEI at high DNA dosage had lower cell viability.

Conclusions/Discussion

CDNS transfect biomolecules to different cells with high efficiency, compared to two commercially available reagents, Lipofectamine 2000 and RGD-jet-PEI. Cells transfected with CDNS had lower cytotoxicity as well. CDNS can potentially cure diseases by delivering biomolecules to cells for treatment and replacement. These substrates revolutionize in vivo and in vitro studies to treat cancer and deliver drugs.

Summary Statement

This project develops Catalytic Delivery NanoSubstrates (CDNS) for not only highly efficient delivery of biomolecules into targeted cells but also high cell viability after transfection.

Help Received

Used lab equipment at University of California, Los Angeles under the supervision and guidance of Dr. Tseng, Dr. Wang, and Dr. Liu.