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Folate Receptor-Mediated Delivery of mRNA using Chitosan Functionalized Selenium Nanoparticles: Potential for Cancer Immunotherapy

Introduction
Systemic mRNA delivery, although still at its infancy, holds immense potential for application in cancer vaccination and immunotherapy. Its many advantages over DNA transfection makes it attractive in applications where transient expression in desired.Selenium nanoparticles have found a new role in biomedical science as drug delivery vehicles, owing to their biocompatibility, low toxicity, and biodegradability. Furthermore, selenium plays an important role in immune function and modulation.

Objective
Selenium nanoparticle use in the delivery of mRNA has proved challenging due to RNA's instability and susceptibility to degradation. Herein, we developed chitosan functionalized selenium nanoparticles for potential use in the delivery of therapeutic mRNA.

Methodology
In this study, we have synthesized chitosan-coated selenium nanoparticles with a folic acid targeting moiety for mRNA delivery to tumor cells.

Results and Discussion
Synthesised selenium nanoparticles were stable, well dispersed and ranged from 59-102 nm in size. Nanoparticles bound and protected mRNA from RNase degradation while exhibiting low cytotoxicity in HEK293, MCF-7 and KB cells in vitro. Moderate cytotoxicity in colon cancer cell lines Caco-2 and HT-29 were attributed to apoptosis induction by selenium, as confirmed by acridine orange/ethidium bromide staining. Cellular uptake of selenium was monitored by coupled plasma - atomic emission spectrometry (ICP- AES). The Fluc-mRNA expression investigated in folate receptor positive and negative cell lines indicated highest transfection in KB cells.

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