Complexing of Aminoglycoside Lipo-Polymeric Nanoparticles for mRNA Transfection in Melanoma Cancer Cells

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Melanoma cancer is a deadly disease that hundreds of thousands of people are diagnosed with each year and has little treatment success using current methods. One potential method is the transfection of nucleic acids using lipo-nanoparticles (LNP) as a vehicle to deliver the nucleic acids into the cell for them to be expressed as a protein, such as ones that trigger cell death. Aminoglycosides, specifically neomycin and paromomycin, are antibiotics that have biodegradable properties that have had great success with the transfection of plasmid DNA (pDNA) as monomers in aminoglycoside-derived LNPs, and therefore have transfection potential with mRNA, which has somewhat similar properties to pDNA, with key exceptions of larger negative zeta potentials and greater instability. In this project, different cross-linkers and aminoglycosides are used to form polymers and complexed with carbon chains. This Experiment used luciferase mRNA, which generates quantifiable luminescence when expressed properly. The polymers and the polymer:mRNA complexes were characterized for size and zeta potential, and the optimal ratio of polymer:mRNA was determined. Melanoma cancer cells (NRAS-A375) were transfected with different polymer:mRNA ratios, and each LNP was compared to its parental polymer, a positive control, Lipofectamine, and a negative control in order to determine if there is greater transfection/luminescence than the negative control. It was found that neither the parental polymers nor LNPs were effective for mRNA transfection.

Awards Won:
Arizona State University: Arizona State University ISEF Scholarship (valued at up to $52,000 each)
University of Arizona: Renewal Tuition Scholarship