CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
S0514

Project Title
Aptameric Modulation of Gadolinium (III) Contrast Agents

Abstract

Objectives/Goals
This research investigates whether binding oligonucleotide-based receptors (aptamers) to gadolinium-based MRI contrast agents can increase the sensitivity of the contrast agents by increasing their relaxivity. It is a further objective of the investigation that the synthesized product interfere less with Ca2+ receptors in biological systems than existing gadolinium-based Magnetic Resonance Imaging (MRI).

Methods/Materials
These goals are achieved using a synthesized ligand and aptamers (synthetic, highly structured, single stranded DNA or RNA ligands). Increasing the molecular weight of contrast agents by binding them to a ligand and an aptamer should increase the relaxivity of the contrast agent and reduce the number of water molecules in the first coordination sphere. Binding the contrast agent to a DNA aptamer will also likely reduce the extent to which gadolinium competes with Ca2+ in biological systems.

Results
Currently, successful synthesis of all structures from the base of the ligands, all intermediary structures, and the fully-synthesized ligand has been confirmed using nuclear magnetic resonance and/or a mass spectrometer. Testing of both contrast agents shows no increase in clarity.

Conclusions/Discussion
The cause is still unknown; however, it creates new questions as to whether the library contained an aptamer with a high enough affinity, or if the protocol needed to be modified.

Summary Statement
The purpose of this project was to design a more effective gadolinium based contrast agent by increasing the molecular weight.

Help Received
Used lab at Columbia University under the supervision of Professor Milan Stojanovic and Marlin Halim.