Inhibition of Cancer Cell Proliferation via G-Rich Oligonucleotides as Aptamer Nanosphere Bioconjugates

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Aptamers are short single stranded pieces of DNA with the remarkable ability to bind to cell surface proteins via shape specific recognition. The proper orientation for this shape specific recognition can more often be obtained when the DNA aptamer is conjugated to the surface of a delivery vehicle. However, this vehicle must be biocompatible and must be small enough to enter cells. For this reason, the chosen delivery vehicle was a 15 nm spherical gold nanoparticle that was synthesized. This synthesized particle was coated with an aptamer known as AS1411 that has the ability to bind to a cell surface protein via shape specific recognition. The cell surface protein in this research was nucleolin, a protein vital to tumor development, but practically undetectable in healthy cells. AS1411's ability to bind to nucleolin, a protein expressed primarily on cancerous cells, can be one step towards creating a more targeted cancer therapy. The reason why AS1411 can bind with shape specific recognition is because it is a G-rich DNA sequence which allows it to form 4 stranded quadruplex shapes that bind to nucleolin. To determine the efficiency of this treatment, AS1411 and a control aptamer with a repeated T-sequence were used to treat HeLa cells and were compared to show only G-rich AS1411 could cause cell death and have higher cellular uptake because of its targeting capabilities. This was seen in hemocytometer counts with greater cell death and ICP data with higher gold content, meaning higher uptake of treatment, in AS1411 treated cells.

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