Modified Quantum Dots for Improved Biocompatibility in the Detection of Cancer

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The objective of this study was to improve upon the design of a useful class of nanoparticles known as quantum dots (QDs), in order to improve their capacity for biological applications, especially in the area of cancer detection. QDs are not presently used commercially in medicine but are being investigated due to their highly fluorescent properties. One impediment to their commercial use is that stable QDs are composed of heavy-metals such as Cadmium. Therefore, it was aimed to improve upon the design of the nanoparticle to reduce any toxic side effects. Last year experiments were conducted to create a QD with a gold shell to limit exposure of the cells to the harmful heavy metal ions, however it was found that the gold shell has an adverse effect on the primary useful trait of QDs - their fluorescence. This year the objective was to continue building on the nanoparticle design and synthesis process from last year to improve performance of the nanoparticle by reducing QD toxicity and reducing QD fluorescence lost due to the gold shell. The objective has been achieved in both regards. Fluorescence has been successfully preserved to the point that even with the thickest gold shell tested, fluorescence was still relatively five times brighter than the currently used organic dyes. Toxicity reduction has also been shown to be feasible as it has been thus far decreased toxicity to healthy cells by more than half.

Awards Won:

Fourth Award of $500