

Title: In-vivo Medical Imaging using Quantum Dot Technology

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This project investigates the use of In-vivo medical imaging techniques coupled with a new technology in that of the Quantum Dot technology as a method of early diagnosis of cancer and also as an alternative treatment method.

The present imaging methods although very effective are not able to accurately pinpoint the exact locations of certain tumors and as such treatment is difficult. However with the aid of quantum dots, detection, diagnosis and essentially treatment will be much easier. Quantum dots are fluorescent nanoparticles and are made up of inorganic semiconductor materials such as Cadmium Selenide (CdSe) or Cadmium Telluride (CdTe) and they possess the ability to be used as probes for cancer screening.

The structure of the quantum dot and its properties of fluorescence, photo bleaching, absorption and emission are carefully investigated to see what makes it such a good topic for use in cancer research as compared to conventional organic dyes. Fluorescence Resonance Energy Transfer (FRET) and blinking which are phenomena that the quantum dots exhibit that play important roles in their functionality and their abilities.

The ability of the dots to be tuned to emit light at various wavelengths from the UV (ultraviolet) range to the visible light range and even the IR (infrared) range via change in size is also another phenomenal property of the quantum dot that has it standing out from other possible options.

Quantum dots face a minor setback as biological probes due to toxicity issues and the various functions that occur within the dots during detection are uncovered. However, there have already been steps taken to work around such issues by encasing the quantum dot core in a Zinc sulphide (ZnS) shell which give results that are quite favourable.

In terms of treatment of cancer, the usefulness of the quantum dots is also quite noticeable, namely in the Photodynamic effect which is a key treatment method which is already in use for various ailments and serves to be a great alternative to chemotherapy.