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FLUORESCENCE ENHANCEMENT OF GOLD NANOCLUSTERS

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To detect early onset of carcinogenic tumors medical professionals perform a biopsy, an invasive surgical technique. A less invasive and more accurate method of cancer detection is using gold nanoclusters tagged with a fluorescent molecule. Once injected into the body, gold nanoclusters are thought to preferentially enter the gapped vasculature of tumor cells via the enhanced permeability retention effect, thus allowing for visualization.

The study of gold nanoclusters is on the forefront of scientific research. Monolayer protected Au_{25} nanoclusters have extreme versatility and unique optical and electrochemical properties that differ from the bulk gold material. They exhibit superatom behavior; a unique property that allows the central cluster of gold atoms to transfer electrons to the ligand attached. They are magic number clusters and thus have increased stability due to their closed shell electron configuration. Owing to their nanoscale size, (approximately 1.1 nm in diameter) their surface area-to-volume ratio increases exponentially. Gold nanoclusters are non-toxic to the human body and are cleared renally. They display optical absorption in the near-infrared region, and thus reduced toxicity when used in biological applications. Due to their biocompatibility, quantum-sized gold nanoclusters are highly applicable as biochemical markers.

A limitation of Au_{25} nanoclusters is their low NIR fluorescence and quantum yield. Tailoring gold nanoclusters to show an increased degree of excitation in the NIR region allows for these gold clusters to be used for enhanced biological imaging purposes and offers a more accurate, and less invasive way to detect cancerous tumor cells. This project focuses on modification of the surface of each gold nanocluster by exchanging the cluster's core-stabilizing ligand with a fluorescent fluorophore. The details of the synthesis and characterization of enhanced fluorescent gold nanoclusters will be presented.

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