Fluorescent Nanoparticle Quantum Dots for Targeted Drug Delivery and Bioassay

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Abstract
Advances in nanoscale materials and engineering technologies offer exciting potential for designing effective therapeutic agents and investigative tools for biomedicine. The capabilities afforded by precise molecular control of chemical composition and spatial resolution are suited for application to biological systems which, approaching fundamental limits, function as nanomolecular systems. Progress in drug delivery requires a comprehensive understanding of drug design in relation to the complexities of the biological system including tissue penetration, drug target interaction, and metabolic consequences. In this talk, I present work which applies the emerging technology of fluorescent semiconductor nanocrystals, called quantum dots, to design drug-delivery platforms specifically tailored to target and modulate the activity of neural receptor channels. Three aspects of this work will be discussed: 1) design and assembly of drug-bound QDs, 2) direct visualization of biomolecule-coupled quantum dot complexes, and 3) anatomical and physiological targeting in neural tissue. Applications of this work are directed toward development of selective drug delivery vehicles and optical monitoring of subcellular physiological processes to provide useful information about drug transport and bioeffectiveness.