

Targeted Multifunctional Nanoparticles for Cancer Imaging and Treatment

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Technology description

Technical Summary

Early detection and accurate diagnosis are important factors in prognosis and treatment of cancer. To this end, scientists continue to pursue increasingly sensitive imaging tools to aide clinicians in characterization of primary tumors as well as high resolution identification of metastases. Recently, quantum dot technology has been identified as an excellent probe for medical imaging by overcoming optical, electronic, and targeting limitations of non-specific fluorescent probes. Traditionally, however, direct conjugation of a targeting ligand to the surface of quantum dots is uncontrolled, resulting in an array of ligand orientations. Some of these orientations may mask important binding residues reducing the reducing specificity potential of these probes, and leaving significant room for improvement in this system.

To combat this shortcoming, a novel conjugation method has been developed. Recombinant peptides are engineered to include the same 6x-His tag popular in protein purification, and linked to quantum dots using a nickel-nitrilotriacetic chelating compound. This approach generates a highly reproducible ligand orientation. Furthermore, versatility in the placement of the His-tag ensures the antigen binding site of the ligand will always be bioavailable. This user-friendly system combines the superior optical characteristics and high systemic accessibility of quantum dot technology with the ease and high affinity of His-nickel chemistry to create a nanoparticle with multiple functions. Using ligands to well characterized tumor receptors, nanoparticles not only target the tumor specifically for enhanced imaging, their tight binding blocks the function of these receptors providing a de facto pre-diagnosis therapeutic treatment.

In 1999 cancer screening in the U.S. reached \$1.6 billion dollars in product sales, and by 2009 and the annual cost of breast cancer screening alone is estimated at \$450 million annually.

Application area

Quantum dots decorated with peptide ligands can enhance image acquisition during diagnosis and induce cytotoxicity by blocking important cancer cell receptors.

Advantages

Innovative His-tag conjugation system provides a versatile platform for indirect peptide binding to optically active quantum dots.

High antigen bioavailability enhances ligand specificity to the target receptor.

Multifunctional nanoparticles bind tightly to cancer cells receptors simultaneously serving as an imaging agent and a front line therapeutic.

Institution

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