Long-Circulating PSMA-Targeted Phototheranostic Agent

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Technology description

Unmet Need

Prostate cancer is the leading cancer in the U.S. population and the second leading cause of cancer death in men. A promising precision cancer treatment known as photodynamic therapy (PDT) offers a way to selectively target prostate cancer cells for destruction. Prostate PDT uses a ligand to attach a light-sensitizing agent known as porphyrin to cells that exhibit prostate-specific membrane antigen (PSMA), a biomarker commonly overexpressed in prostate cancer. Laser irradiation of these cells causes highly unstable free radicals to form, which initiates cancer cell death while leaving nearby noncancerous cells unharmed. However, current attempts to target PSMA-expressing cells with PDT have limited efficacy because the ligands responsible for delivering porphyrin either 1) are rapidly excreted from the body, preventing sufficient accumulation in the tumor for treatment, 2) have high production costs and are not scalable, or 3) have poor tissue penetration and cannot distribute evenly throughout the entire tumor. Hence, there is a need for a PSMA-targeting compound that binds to the cancerous cells for a sufficient amount of time to perform PDT, is cost-effective and scalable to produce, and penetrates throughout the tumor.

Technology Description

A PSMA-targeting compound known as LC-Pyro was designed to carry porphyrin to prostate cancer cells and remain in tissue for extended periods of time. LC-Pyro comprises of a urea ligand that selectively binds to PSMAs on the surface of tumor cells, a peptide linker to increase the amount of time the compound can be bound to the tissue, and the photosensitizing porphyrin derivative known as Pyropheophorbide- a (Pyro acid). The peptide linker enhances water-solubility of the compound, allowing it to be circulated within the plasma and accumulate in the tumor for up to 8.5 times longer than current alternatives. LC-Pyro?s longer circulation times enable greater imaging flexibility and single-dosage PDT, while alternative small molecule-photosensitizing compounds may require multiple (up to 4) doses. Also, LC-Pyro uses a low molecular weight urea ligand to facilitate better penetration into tumors. Additionally, the Pyro acid molecule enables PET/fluorescence imaging to aid precision treatment planning. The compound is low cost and has a simple and scalable production process, making it a prime candidate for clinical translation.

Institution

Johns Hopkins University

Inventors

Juan Chen
Ying Chen
Research Associate
Radiology SOM
Marta Overchuk
Sangeeta Ray
Assistant Professor
Radiology SOM
Ronnie Mease
Associate Professor
Radiology SOM
Gang Zheng
Martin Pomper
Professor
Radiology SOM
Kara Harmatys

叶先生

电 话：021-65679356

手 机：13414935137

邮 箱：yeyingsheng@zf-ym.com