Multifunctional Porphyrin-Based Nanomedicine Platform

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ABSTRACT

Researchers at UC Davis have developed a novel targeting multifunctional drug vehicle that allows chemotherapeutics to better infiltrate tumors.

FULL DESCRIPTION

Several effective chemotherapeutic agents for treatment of various cancer types are very insoluble in water, requiring formulations that induce unwanted side effects. Recently nano-therapeutic formulations have been shown to improve the clinical toxicity profiles of the drugs, but their anti-tumor effects are only marginally better than the original drug formulations. This has been attributed in part to the relatively large size of the nano-therapeutic formulations, which limits the extent to which the drugs can penetrate into tumor mass. In some cases, the large size also causes noano-therapeutics to be trapped in the liver leading to a number of additional concerns. Accordingly, there is a need to develop smaller stealth and biocompatible nanocarriers for effective delivery of anti-cancer drugs *in vivo*.

Researchers at the University of California Davis have developed a novel targeting multifunctional porphyrin-based nanomedicine platform for cancer diagnosis and therapy. A novel telodendrimer was designed with linear polyethylene glycol, oligo-cholic acids, and porphyrin analogues.

This telodendrimer can self-assemble into nanomicelles that exhibit excellent biocompatibility, high absorption of near-infrared light, structure-dependent fluorescence quenching/emission, and ease of chelation of metal ions. The micelles can efficiently load many hydrophobic anticancer drugs (e.g. paclitaxel, doxorubicin, and vincristine). When cross linked via disulfide bonds or boronate ester bonds, the micelles are able to maintain integrity in physiological conditions and can be triggered to release the drug contents at the tumor sites.

This platform can be utilized in PET imaging, radiotherapy, photoacoustic detection and photodynamic therapy, sonodynamic therapy, and magnetic resonance imaging (MRI). Additionally, cancer targeting ligands can be conveniently ligated to the surface of the micelle for cancer-specific targeted delivery.

APPLICATIONS

- The nanoparticles can be used for cancer diagnosis and therapy.

FEATURES/BENEFITS

- All the building blocks for the telodendrimers are all nontoxic.
- The orthogonal functional groups at the distal end of PEG chain and the adjacent site of telodendrimers can be easily engineered for the conjugation of targeting ligands and imaging probes, respectively.
- These micelles exhibit excellent structure-dependent fluorescence quenching property that can be used for photodynamic diagnosis of tumors with low background and treatment.
- The porphyrin-based micelles can be efficiently loaded with radiometal such as Cu-64 and Cu-67, for PET imaging and radiotherapy, respectfully.
- The porphyrin-based micelles can chelate with gadolinium for magnetic resonance imaging (MRI)
- The porphyrin-based micelles can chelate with gallium for sonadynamic therapy
- The multifunctional porphyrin-based nanomedicine platform enable the integration of multiple imaging and therapeutic modalities for better cancer detection and therapy.

PATENT STATUS

INVENTORS

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- Lin, Tzu-yin
- Pan, Chong Xian

OTHER INFORMATION

CATEGORIZED AS

- **Biotechnology**
  - Health
- **Medical**
  - Delivery Systems
  - Disease: Cancer
  - Therapeutics

RELATED CASES

2013-338-0

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,219,692	01/11/2022	2013-338
United States Of America	Issued Patent	10,238,750	03/26/2019	2013-338
United States Of America	Issued Patent	9,642,916	05/09/2017	2013-338

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Novel Solid Tumor Chemodrug LLS2
- Affinity Peptides for Diagnosis and Treatment of Severe Acute Respiratory Syndrome Coronavirus 2 and Zika Virus Infections
- Nanoparticles for Drug Delivery, Tissue Targeting and Imaging Analysis
- Conjugates That Combine HDAC Inhibitors and Retinoids into Disease Preventatives/Treatments
- A Novel RGD-Containing Cyclic Peptide for use in Cancer Imaging and as a Targeted-Therapy Ligand
- Site-Specific Ligation and Compound Conjugation to Existing Antibodies
- Functional Illumination in Living Cells
- A Two-step Drug Delivery System Based on Click Chemistry
- Novel Leukemia Stem Cell-Targeting Peptides and Nanotherapeutics for Human Leukemia Treatment
- Transformable Smart Peptides as Cancer Therapeutics
- Engineered Biomaterial to Prevent Endothelial Inflammation
- Programmable Peptide Nucleic Acid-Based Nanoplatform for Customizable Drug Delivery
- Sequential Targeting and Crosslinking Nanoparticles for Tackling the Multiple Barriers to Treat Brain Tumors
- Systems and Methods of Single-Cell Segmentation and Spatial Multiomics Analyses
- Active Nanoplatform with High Drug Loading Capacity for the Diagnosis and Treatment of Cancer
- Mitochondria Targeting Photosensitizer for Photodynamic Therapy
- Proteoglycan Mimetics For Enhanced Wound Healing Angiogenesis And Vascular Repair
- Nanoplatform for Cancer Therapy
- Ligands for Improved Angiogenesis and Endothelialization of Blood Contacting Devices

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