City University of Hong Kong
Department of Biomedical Sciences
presents a seminar

"PORPHYRIN NANOTECHNOLOGY: DISCOVERY, CLINCAL TRANSLATION AND BEYOND"

by

Professor Gang Zheng
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Date : 27 July 2016
Time: 3.30pm to 5.00pm
Venue: LT-10, 4/F (near Lift 3), Academic 1 Building, CityU

About the speaker

Dr. Gang Zheng is a Professor of Medical Biophysics, Biomedical Engineering and Pharmaceutical Sciences at the University of Toronto, a Senior Scientist and the Joey and Toby Tanenbaum/Brazilian Ball Chair in Prostate Cancer Research at the Princess Margaret Cancer Center. He received his PhD in 1999 from SUNY Buffalo in Medicinal Chemistry. Following postdoctoral training in photodynamic therapy at the Roswell Park Cancer Institute, he joined the University of Pennsylvania in 2001 as an Assistant Professor of Radiology. Since moving to Canada in 2006, His research has been focused on developing clinically translatable technologies to combat cancer. His lab discovered porphysome nanotechnology that opened new frontiers in cancer imaging and therapy, which was named one of the "Top 10 cancer breakthroughs of 2011" by the Canadian Cancer Society. Dr. Zheng is an Associate Editor for the Bioconjugate Chemistry and a Fellow of the American Institute of Medical and Biological Engineering.

Abstract

Porphyrins are aromatic, organic, light-absorbing molecules that occur abundantly in nature, especially in the form of molecular self-assemblies. In 2011, we first discovered 'porphysomes', the self-assembled porphyrin-lipid nanoparticles with intrinsic multimodal photonic properties (Nature Materials 2011). The high-density porphyrin packing in bilayers enables the absorption and conversion of light energy to heat with extremely high efficiency, making them ideal candidates for photothermal therapy and photoacoustic imaging. Upon nanostructure dissociation, fluorescence and photodynamic activity of porphyrin monomers are restored. In addition, metal ions can be directly incorporated into the porphyrin building blocks of the preformed porphysomes thus unlocking their potential for PET and MRI. By changing the way porphyrin-lipid assembles, we developed HDL-like porphyrin nanoparticles (<20nm), porphyrin microbubbles (~2um), giant porphyrin vesicle (~100um), hybrid porphyrin-gold nanoparticles and metal chelating nanotexaphyrins. By mimicking light harvest systems in photosynthetic bacteria, we introduced high-ordered porphyrin aggregates into supramolecular assemblies, resulting unprecedented photonic properties (e.g., reversible photoacoustic nanosensors). Such optical properties are also responsible for our discovery of the ultrasound-induced microbubbles-to-nanoparticle conversion phenomenon (Nature Nano 2015), which may open the door to bypass the enhanced permeability and retention effect when delivering drugs to tumors. We have now validated porphysome's multimodal theranostic utilities in different cancer types (head & neck, lung, pancreatic, prostate, brain and ovarian cancers, as well as lymph node and bone metastases), different tumor models (subcutaneous, orthotopic, chemically-induced and human primary xenografts) as well as different animal species (mice, rats, hamsters and rabbits). The effort of moving porphysomes towards first-in-human use is on the way. In summary, the simple yet intrinsic multimodal nature of porphysomes represents a new nanomedicine paradigm and also confers its high clinical translation potential.

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All are welcome