Hong Kong University of Science and Technology
Department of Chemical & Biological Engineering

Guest Seminar

Acoustic pH Sensors for Ultrasound Imaging of Tissue Inflammation

by

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Abstract

Ultrasound has limited use in molecular imaging due to the lack of tools for visualizing processes within specific cells. A new class of genetically engineered ultrasound contrast agents called gas vesicles (GVs) can function as acoustic biosensors, revealing processes like cellular acidification linked to tissue inflammation. We engineered pH-sensitive GVs that act as nonlinear scatterers at normal pH and linear scatterers at acidic pH. This design uses the pH-dependent properties of histidine amino acids to modulate GV shell stiffness and scattering.

To create these GVs, the GV shell protein GvpC was mutated to have outward-facing histidine residues, enabling pH-dependent changes in the protein's structure and charge interactions. These changes were measured using hydrostatic collapse pressure and imaged using ultrasound. The pH-sensitive GVs, termed "pHonons," exhibited an increase in hydrostatic collapse pressure and distinct imaging behavior at acidic pH, making them effective for monitoring intracellular acidification in immune cells. This development could enhance ultrasound imaging of cellular acidification and tissue inflammation.

Biography

Byung Min Park holds a BSc in Biology from HKUST and earned both his MPhil and PhD in Bioengineering from HKUST. He conducted research on protein hydrogels and protein photoacoustic contrast development under the guidance of Prof Fei Sun. Following his doctoral work, he pursued postdoctoral research at HKUST, under both Prof Fei Sun and Prof Terence Wong. In his second postdoc at TU Delft with Prof David Maresca, he focuses on the development of protein-based ultrasound contrast agents.

Date : 20 September 2024 (Friday)
Time : 10:00 – 12:00 noon
Venue : Rm 3598 (near lift 27/28), 3/F, Academic Building, HKUST