The Chinese University of Hong Kong
Department of Biomedical Engineering

<u>Graduate Seminar – PhD Oral Defence</u>

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Date	:	25 August 2025 (Monday)
Time	:	3:00pm
Venue	:	Room 401, William M W Mong Engineering Building, CUHK

Title: Anti-inflammatory Drug-grafted Copper-doped Dynamic Hydrogel Promotes Osteogenesis

Hydrogels are hydrophilic biomaterials formed by crosslinking polymer networks. They offer high water absorbency that can swell substantially. Their biocompatibility allows cells to be encapsulated, giving them a large potential for research and clinical applications, including drug testing and tissue regeneration.

In this study, we developed a type of viscoelastic hydrogel with reversible crosslinks. The dynamic properties of such gel enable network reorganization that facilitates cell growth, spreading, and migration. In addition, we introduced a metal-organic framework (MOF) by conjugating anti-inflammatory drug Naproxen (Nap) to copper nanoparticles (Cu-NPs), so that this drug-loaded copper-doped hydrogel can induce osteogenesis in human mesenchymal stem cells (hMSCs) with optimized anti-inflammatory effect for bone regeneration.

The fabrication of our hydrogel involves two parts. First, by grafting Naproxen onto hyaluronic acid (HA) molecular chains via esterification and adding saline, a dynamic HA-Nap hydrogel is formed through π-π stacking. Second, Naproxen is carried in a copper-based metal-organic framework (Cu-MOF) synthesized by metal-ligand coordination between copper (Cu^{2+}) ions and carboxylate ($-COO^-$) groups in trimesic acid (TMA). Combining HA-Nap and Nap-Cu-MOF, both sustained and rapid drug release can be achieved by the hydrolysis of ester bonds in HA-Nap and disruption of π-π interactions between Naproxen and TMA in Nap-Cu-MOF respectively.

This thesis highlights the potential of drug-loaded dynamic hydrogels in bone tissue engineering, offering a promising approach for enhanced osteogenesis and anti-inflammatory treatment.

*** ALL ARE WELCOME ***

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