



The Chinese University of Hong Kong  
Department of Biomedical Engineering

***Ion-Channel-Centered Biomolecular Engineering for  
Imaging, Neuromodulation, and Therapy***



**Dr. Yuxia LIU**

Postdoctoral Researcher  
Department of Chemistry  
National University of Singapore

Date: 21 January 2026 (Wed)

Time: 2:30 – 3:30 pm

Venue: ERB1122 (William M.W. Mong Engineering Building, CUHK)

**Abstract**

Advances in biomedical imaging and ion channel engineering are opening new opportunities to bridge fundamental biophysics with translational medical technologies. In this seminar, Dr. LIU will present an integrated research framework in which rationally engineered biomolecules, including ion channels and metal-binding proteins, are designed, visualized, and functionally modulated to achieve precise control and imaging of biological processes. Central to this framework is the concept that molecular transport and coordination processes within biomolecules can be both measured and engineered to regulate function. Using the pain-sensing ion channel TRPV1 as a model system, she shows that ion-channel activity can be modulated not only by ligands or voltage, but also through control of solvent transport. By integrating electrophysiology with advanced optical imaging, she demonstrates that regulating water flux through TRPV1 enables non-genetic and non-pharmacological control of channel activity, establishing a previously unexplored solvent-mediated route for neuromodulation and pain regulation. This molecular research approach is further extended to probe cellular responses to other diffusible physical cues, including temperature and mechanical force. Dr. LIU then expands this framework to diagnostic imaging by engineering a protein-based MRI contrast platform using lanmodulin as a programmable scaffold. Precise control of metal–protein coordination yields enhanced image contrast, organ-selective retention, and safe clearance, highlighting how molecular-level design can overcome long-standing trade-offs in biomedical imaging. Together, these studies illustrate a unifying strategy: leveraging molecular-scale engineering to precisely control ion-channel function and imaging agents. This approach establishes a foundation for developing next-generation tools for non-invasive diagnostics and biointerfacing, and it defines the future research direction at the interface of chemistry, biology, and biomedical imaging.

**Biography**

Dr. Yuxia LIU is a postdoctoral researcher at the National University of Singapore in the Department of Chemistry. She received her B.S. in Biomedical Engineering from Xi'an Jiaotong University and her Ph.D. in Biomedical Engineering from Tsinghua University, where her doctoral research focused on the structural and mechanistic basis of TRPP calcium channel function. Her research integrates molecular biophysics, ion channel engineering, and biomedical imaging, with an emphasis on understanding and controlling membrane protein function at the molecular scale. She has made contributions to the understanding of TRPV1 ion channel water permeability and solvent-mediated analgesia, as well as to the engineering of high-performance protein-based MRI contrast agents. Dr. LIU has published peer-reviewed work in *Nature Biomedical Engineering*, *Nature Communications*, *Accounts of Materials Research*, *Matter*, and *Cell Reports*. Her long-term research vision is to develop molecularly engineered biointerfaces for precise neuromodulation and non-invasive imaging, with a focus on translational biomedical applications.

**\*\* ALL ARE WELCOME \*\***

For enquiries, please contact Ms. Kitty CHUNG (BME) at 3943-8261.