



## SEMINAR

### Mechanotransduction in Active Matter

**Date:** 16 June, 2026 (Tuesday)  
**Time:** 10:30 a.m. – 11:30 a.m.  
**Venue:** Room 7-34, Haking Wong Building  
HKU

**Speaker:** Professor Sulin Zhang  
Department of Engineering Science and Mechanics  
Penn State University  
USA



#### Abstract:

Life persists in dynamic disequilibrium, sustained by continuous flows of energy, matter, and entropy. Life harnesses these flows through mechanotransduction: the interconversion between mechanical forces and biochemical signals. At its core, metabolism powers biochemical cycles by generating mechanical forces that reshape free energy landscapes, alter chemical kinetics, and organize matter in space and time. Through mechanotransduction, these forces drive a profound duality: they disrupt orders near equilibrium, yet build ordered structures far from equilibrium that enable adaptation, complexity, and learning.

This talk will examine mechanotransduction across living and non-living active-matter systems. I will begin with electrochemical cells as prototypical active matter, where mechanical stresses, ion fluxes, and redox reactions form feedback loops that control degradation pathways and operational lifespans. In-situ transmission electron microscopy, combined with multiphysics modeling, reveals how mechanical forces and electrochemical signals interconvert in real time and at near-atomic resolution. We will then turn to biological cells, where forces are routed through dynamic cellular architectures as cells assemble, migrate, repair, and invade. Across these systems, examples will be given to illustrate how the mechanochemical crosstalk is regulated to support development and function, and how its dysregulation drives degradation and disease.

Through the lens of irreversible thermodynamics, I will close by asking how mechanical forces shape dissipative adaptation, encode memory, and guide emergent behaviors in living and nonliving active matter.

#### Biography:

Sulin Zhang received his Ph.D. in Theoretical and Applied Mechanics from the University of Illinois at Urbana-Champaign in 2002. He subsequently worked as a postdoctoral fellow at Northwestern University. He then served as an assistant professor at the University of Arkansas from 2005-2007 before he joined Penn State University. He is currently a Professor in the Department of Engineering Science and Mechanics at Penn State University, with courtesy appointments in the Departments of Biomedical Engineering and Materials Science and Engineering. Dr. Zhang's research focuses on the roles of mechanical forces and stresses in electrochemical and biological cells. He received the NSF CAREER Award in 2007 and the PSEAS Outstanding Research Award from Penn State in 2016. He is the founding editor of *Extreme Mechanics Letters* (2013-2025) and serves as an Associate Editor for *NPJ Computational Materials* (2026-).

**ALL INTERESTED ARE WELCOME**

**For further information, please contact Professor Yang Lu at 3910 2155.**