



Department of Biomedical Engineering

香港城市大學  
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# Exploring Structure, Mechanics, and Function in Soft Biological Systems Across Scales

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**Date:** 20 March 2025

**Time:** 10:00 am - 11:00 am

**Venue:** YEUNG-Y5204, 5/F

**Yeung Kin Man Academic Building**

### Abstract

Soft biological systems exhibit intricate hierarchical organization, with structures spanning multiple length scales, from tissues to cells and molecules. This structural complexity gives rise to rich mechanical behaviors that profoundly influence biological function. My research integrates soft matter physics and biology to establish a unified framework that connects structure, mechanics, and function in soft biological systems.

In this talk, I will demonstrate how this framework applies to diverse biological components, including biomaterials, cells, and molecular assemblies. At the bulk material level, I reveal how the hierarchical microstructure of biomaterials, such as fibrin, underpins their extraordinary resilience and complex mechanical behavior. At the cellular level, I uncover the distinct roles of cytoskeletal components in shaping the cell's internal mechanical environment. At the molecular level, I explore biomolecular condensates, which are dynamic, membrane-less compartments that are essential for cellular processes, highlighting how chromatin organization and mechanics influence their formation and behavior. Building on these insights, I will demonstrate how stem cells sense and respond to structural cues in their microenvironment, influencing key processes such as spreading, migration, and differentiation.

By integrating insights across these scales, my work advances our understanding of the physical principles that govern soft biological systems, and informs strategies for designing cell-instructive biomaterials and guiding cellular behavior for tissue engineering applications.

### Biography

Dr. Jing Xia is a postdoctoral researcher in the Department of Chemical and Biological Engineering at Princeton University. His research focuses on the physical principles underlying the organization and function of soft biological matter, including cells and biomaterials. At Princeton, Dr. Xia works with Professor Clifford P. Brangwynne, investigating chromatin mechanics and the liquid-liquid phase separation of nuclear condensates, contributing to a deeper understanding of nuclear organization and function. Dr. Xia earned his Ph.D. in Engineering Science from Harvard University, where he worked with Professor David A. Weitz. His doctoral research explored biomaterial mechanics, cellular mechanobiology, and the development of innovative tools for characterizing cell mechanics. His work has been published in many prominent journals, including Nature Communications, Proceedings of the National Academy of Sciences, Biomaterials, and Acta Biomaterialia.