香港大學 機械工程系
Department of Mechanical Engineering
THE UNIVERSITY OF HONG KONG

SEMINAR

Microenvironmental Control of Chromatin Mechanobiology

Date: 2 December, 2026 (Wednesday)
Time: 3:00 p.m.
Venue: Room 7-34 & 7-35
Haking Wong Building
HKU

Speaker: Professor Vivek Shenoy
Center for Engineering Mechanobiology and School of Engineering and Applied Sciences
University of Pennsylvania
USA

Abstract:

The spatial and biochemical organization of chromatin is a fundamental regulator of gene expression, yet its sensitivity to changes in the cellular microenvironment is only beginning to be understood. Mechanical forces, inflammatory signals, and metabolic cues can all reshape chromatin interactions, histone modifications, and nuclear architecture, leading to profound effects on cell identity and function. Using a combination of theoretical models, super-resolution imaging, and sequencing[1-6], we show how microenvironmental perturbations reorganize heterochromatin domains, alter nuclear lamina affinity, and disrupt transcriptional regulation. These findings highlight general principles by which the microenvironment directs epigenetic states, with implications for diverse pathologies including cancer, fibrosis, and neurodegeneration. Understanding these mechanisms may open new avenues for therapeutic strategies that target microenvironment-driven chromatin remodeling.

[1] V. Vinayak, M. Lakadamyali and V. B. Shenoy Architecture and Regulation of Nanoscale Chromatin Domains, NATURE COMMUNICATIONS s41467-026-71213-5, April 2026.
[2] A. Kant, Z. Guo, V. Vinayak, M. V. Neguembor, W. S. Li, V. Agrawal, E. Pujadas, L. M. Almassalha, V. Backman, M. Lakadamyali, M. P. Cosma, V. B. Shenoy Active Transcription and Epigenetic Reactions Synergistically Regulate Meso-Scale Genomic Organization NATURE COMMUNICATIONS, 2024, 15(1), 4338, 2024.
[3] V. Vinayak, R. Basir, R. Golloshi, J. Toth, L. Sant'Anna, M. Lakadamyali, R.P. McCord, V.B. Shenoy Polymer Model Integrates Super-Resolution Imaging and Epigenomic Sequencing to Elucidate the Role of Epigenetic Reactions in Shaping 4D Chromatin Organization, NATURE COMMUNICATIONS, s41467-025-59001-z, APRIL 2025.
[4] Monika Dhankhar, Zixian Guo, Aayush Kant, Ramin Basir, Rohit Joshi, Su Chin Heo, Robert L Mauck, Melike Lakadamyali, Vivek B Shenoy, Revealing the Biophysics of Lamina-Associated Domain Formation by Integrating Theoretical Modeling and High-Resolution Imaging, NATURE COMMUNICATIONS, Article number: 7909, August 2025.
[5] S. Heo et al., Aberrant Chromatin Reorganization in Cells from Diseased Fibrous Connective Tissue in Response to Altered Chemo-mechanical Cues NATURE BIOMEDICAL ENGINEERING, s41551-022-00910-5, 1-15, 2023.

[6] F. Alisafaei, D. S. Jokhun, G. V. Shivashankar, V. B. Shenoy Regulation of Nuclear Architecture, Mechanics and Nucleo-cytoplasmic Shuttling of Epigenetic Factors by Cell Geometric Constraints PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, 116(27): 13200-13209, 2020.

Biography:



Vivek Shenoy is the Eduardo D. Glandt President's Distinguished Professor in the School of Engineering and Applied Sciences at the University of Pennsylvania. Dr. Shenoy's research focuses on developing theoretical concepts and numerical methods to understand the basic principles that control the behavior of biological systems. He has used rigorous analytical methods and multiscale modeling techniques, ranging from molecular to continuum methods, to gain physical insight into a myriad of problems in mechanobiology and biomaterials. He is the principal investigator and director of the NSF-funded Science and Technology Center for Engineering Mechanobiology established in 2016 and an MPI of the National Cancer Institute-funded Metastasis Research Network (MetNet) center funded in 2021. Shenoy is an ISI Web of Science/Clarivate Analytics Highly Cited Researcher.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. Y. Lin at 3917 7955.