The Chinese University of Hong Kong

Department of Biomedical Engineering

Time: 2:30 pm, 23 Feb 2018 (Fri)

Venue: Room 215, William M.W. Mong Engineering Building, CUHK

Molecular Biomechanics and Cellular Mechanotransduction in Health and Disease

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Abstract

Living cells sense mechanical signals, and respond actively by changing their phenotype. This process, termed as cellular mechanotransduction, is mediated by a combination of biochemical and biophysical mechanisms via mechanically induced changes in the structure and function of specific molecules and molecular complexes. Our specific attention is on the role of three macromolecular systems in cellular mechanotransduction, namely the integrin-mediated focal adhesions bridging the cell with the extracellular matrix (ECM), and linkers of the nucleoskeleton and cytoskeleton (LINC complexes), and the nuclear pore complex (NPC) at the interface between the cytoplasm and nucleus. Focal adhesions are the immediate sites of cell interaction with the ECM, and as such they play a key role in mechanosensing and mechanotransduction at the edge of the cell. LINC complexes physically link the cytoskeleton and nucleoskeleton to regulate force transmission to the nucleus; their direct associations with focal adhesions through filamentous actin bundles results in ultrafast mechanotransduction. Nuclear pores could also play a role in the overall process of cellular mechanotransduction by exquisitely controlling the material transport in and out of the nucleus, thereby regulating gene expression and protein synthesis. In this seminar, I will present some of our recent efforts aimed at better understanding of these interconnected molecular systems in the context of cellular mechanotransduction.

Biography

Dr. Mohammad R. K. Mofrad is a Professor of Bioengineering and Mechanical Engineering at the University of California Berkeley. He completed his undergraduate in Mechanical Engineering at Sharif University of Technology in Tehran, Iran, before moving to Canada where he received his M.A.Sc. and Ph.D degrees from the Universities of Waterloo and Toronto, respectively. After post-doctoral work at MIT and Harvard Medical School, he joined the Berkeley faculty in 2005. Prof. Mofrad's research program (http://mechano.bio) encompasses the development of molecular and multiscale models of cellular mechanotransduction with the aim to shed light on the role of these biological signaling processes in human diseases. Dr. Mofrad’s multidisciplinary work has appeared in diverse journals ranging from Biophysical Journal, Physical Review and PLoS to Annals of Biomedical Engineering, ACS Nano, Biomaterials, PNAS and Lab on Chip. He has co-edited three books, including "Cytoskeletal Mechanics", "Cellular Mechanotransduction" published by Cambridge University Press. He has served on the editorial board of several bioengineering journals, including the Journal of Biomechanics, ASME Journal of Biomechanical Engineering, IEEE Transactions of Biomedical Engineering, PLoS One, Journal of Multiscale Modeling, and Nature’s Scientific Reports. Prof. Mofrad is a recipient of the National Science Foundation (NSF) CAREER award in 2010 and the American Heart Association (AHA) Innovative Research award in 2016. He is a Fellow of the American Institute for Medical and Biological Engineering (AIMBE).

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