Centre for Biosystems Science and Engineering

Seminar

Revealing molecular order across biological scales with computational microscopy

on

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10:30 AM, Meeting Room, BSSE.

by

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Living systems differ from inanimate ones by their ability to create and sustain ordered assemblies of molecules at the expense of chemical energy. While '-omics' approaches are generating the 'parts list' of bio molecular assemblies at a rapid pace, how these parts come together to form functional cellular mechanisms remains an outstanding question in many fields of biology. For example, the principal components of the cellular contractile machinery that shapes, divides, and moves cells have long been identified, viz., actomyosin network, plasma membrane, and adhesion complexes but the dynamic architecture of this machinery remains challenging to measure, especially in three-dimensional (3D) (patho)physiological environments.

The speaker will talk about recent work on fluorescence-based computational microscopy assays that reveal nanoscale architecture of molecules within the context of micro scale assemblies. As part of this work the intrinsic polarisation of fluorescence was used to measure sub-resolution orientation and alignment of molecules. This led to the development microscope, dubbed instantaneous fluorescence polarisation microscope (instantaneous fluorescence PolScope), to acquire four polarisation-resolved measurements with single molecule sensitivity.

Further, the speaker will describe how in a multi-institutional collaboration, synergistic use of fluorescence polarisation microscopy and computational analysis revealed that integrin transmembrane receptors are 'actively aligned' by their engagement with retrograde flow and extracellular ligand. The active alignment of integrin receptors may be a general mechanism used by cells to sense directional cues within extracellular matrix and is uniquely accessible with fluorescence polarisation microscopy.

About the speaker

Shalin Mehta studied electronics engineering and information theory in India. After a stint in industrial research (Defence R&D Organization, India), Shalin obtained his PhD in bioengineering from National University of Singapore. Shalin visited Marine Biological Laboratory (MBL), Woods Hole, in summer 2010 to explore biological applications of microscopy methods he was developing and he joined MBL as a Human Frontier Science Program (HFSP) Postdoctoral Fellow in 2011.

His work in Singapore led to elegant image models of phase microscopes widely used for biological imaging and a simple-yet-quantitative method of imaging morphology of biological specimens. At MBL, Shalin studies molecular order in biological systems at the scales ranging from single-molecules to tissues using polarisation of light, computational methods.