Tata Institute of Fundamental Research
Survey No. 36/P, Gopanpally Village, Serilingampally, Ranga Reddy Dist., Hyderabad – 500107

EMBO Global Exchange Lecture Series

February 1, 2018 (Thursday)
Venue: Auditorium, TIFR-Hyderabad

Time	Speaker	Topic
09:00 - 9:45	Sandra Schmid	A dual role for dynamin in clathrin-mediated endocytosis
9:45 - 10:30	Thomas Lecuit	Control and self-organization of cell mechanics during tissue morphogenesis
10:30 - 11:00	**BREAK FOR TEA**	
11:00 - 11:45	Anne Spang	Cellular Compartmentalization
11:45 - 12:30	William C Earnshaw	Chemical Biology and Hi-C Reveal a Helical Organization for Vertebrate Chromosomes
12:30	**LUNCH BREAK**	

A dual role for dynamin in clathrin-mediated endocytosis

Sandra Schmid

UT Southwestern Medical Center, Texas

Clathrin-mediated endocytosis (CME) is the major endocytic pathway in mammalian cells. It is responsible for the uptake of transmembrane receptors and transporters, for remodeling plasma membrane composition in response to environmental changes, and for regulating cell surface signaling. CME occurs via the assembly and maturation of clathrin-coated pits (CCPs) that concentrate cargo, invaginate and pinch-off forming clathrin-coated vesicles. The large GTPase dynamin is an essential component of the CME machinery. Dynamin is best known for its role as the prototypical fission GTPase that assembles into helical structures around the narrow necks of invaginated CCPs and catalyzes membrane fission. Recent studies have shown that dynamin is also a key regulator of early steps in CME, in an unexpectedly isoform-specific manner. We use quantitative live-cell total internal reflection microscopy to study dynamin's role in regulating early stages in CCP initiation and maturation. Together these studies show that dynamin plays a dual role in clathrin-mediated endocytosis: in early stages, where it's function is regulated downstream of signaling pathways and driving membrane fission at late stages.

Control and self-organization of cell mechanics during tissue morphogenesis

Thomas Lecuit

IDBM, Aix-Marseille Université & CNRS, France

Epithelial tissues exhibit a remarkable dual property of robustness and fluidity. This manifests on different time and length scales and relies on unique mechanical properties of the cell cortex and on adhesive interactions between cells. We seek to understand the fundamental molecular mechanisms responsible for this property.

To that end we develop a range of approaches, from the genetic and pharmacological perturbations of molecular components, the quantitative imaging of proteins using a variety of photonic methods, probing of the physical properties of cells within intact tissues, and computational modelling of morphogenesis at different scales (molecular to tissue scales).

I will present our recent progress in understanding how cortical tension controls the dynamic remodelling of cell contacts in the primary epithelium of Drosophila embryos and how dynamic patterns of subcellular actomyosin contractility (pulses, trigger waves and flows) drive a rich repertoire of tissue morphogenetic processes. I will delineate G protein regulatory modules that control cell mechanics and reveal the role of mechano-chemical feedbacks that underlie the self-organisation of cell contractility.

Cellular Compartmentalization

Anne Spang

University of Basel, Switzerland

Membrane organelles and the plasma membrane are compartmentalized in such that they maintain specific domains to fulfil distinct functions. For example, the ER has domains for protein translation, transport vesicle formation and individual contact areas as communication tools with all membrane organelles and the plasma membrane. The compartmentalization is not restricted to membrane-bound organelles but also extends to the cytoplasm, which harbours the centrosome and RNP granules such as P-bodies and stress granules. The compartmentalization in the cell is dynamic and can quickly adapt to changes in the environment such as stress or nutrient limitation. These changes may provide a survival strategy and extend lifespan. I will discuss examples of dynamic compartmentalization.

Chemical Biology and Hi-C Reveal a Helical Organization for Vertebrate Chromosomes

William C Earnshaw

University of Edinburgh, ICB, Scotland

The discovery of mitotic chromosomes by Flemming in 1878 established a major question in Cell Biology that remains unanswered all of these years later: How does the interphase nucleus transform itself into the thread-like mitotic chromosomes that segregate the genome in mitosis? I will discuss work from our lab and those of our collaborators suggesting that mitotic chromosome formation involves two processes; compaction of the chromatin, and a functionally distinct architectural remodeling that disassembles the structure of the interphase nucleus and causes a helical transformation that results in the formation of individual chromatids. The helical nature of chromosomes was proposed as early as 1880 by Baranetzsky, but remained difficult to reconcile with other observations proposing that mitotic chromosomes are built from chromatin loops or from a disorganized spaghetti-like polymer melt. I will describe an integrated approach combining chemical genetics, gene targeting by CRISPR/Cas9, advanced microscopy, genomic analysis by Hi-C and mathematical modeling and simulations that has led to the first comprehensive view of how loops and helices combine to yield the structure of mitotic chromosomes. I will also describe the separate contributions of condensin I and II to the process of mitotic chromosome formation.