Plenary Lectures

June 6 (Wed) 9:30-12:10 Room A
Chairperson: Yasuhiro Sawada (NRCD)

PL-01 09:30-10:10 From matrix rigidity to nuclear mechanics in development and disease

○Dennis E. Discher (University of Pennsylvania)

Chromatin in animal cells is surrounded by a nuclear envelope that has long been known to differ between cell types in terms of composition and sometimes shape. Differentiation of soft and featureless embryos to organs with form and function requires expression of extracellular matrix proteins that become the most abundant proteins in animals and dictate whether a tissue has low matrix and is soft (like brain) or has abundant matrix and becomes stiff (like heart, or rigid bone). Cell adhesion to matrix leads to cells exerting contractile tensions on matrix in relation to stiffness but also on the nucleus within. Based on mechanisms of tension-stabilization against degradation, levels of matrix collagen and nuclear lamins scale together across many normal cell and developmental systems, feeding back into transcription and differentiation, and sculpting basic architectures and properties of tissues and nuclei. However, if a nucleus is highly stressed, its rupture causes mislocalization of DNA repair factors and increases DNA damage. Such processes might explain the high genomic heterogeneity of solid tumors relative to liquid tumors. A coordinated interplay of adhesion and the contractile cytoskeleton with the stiffness of matrix thus regulates the nuclear lamina and chromatin in key cell fate decisions.

Chairperson: Kaoru Sugimura (Kyoto Univ.)

PL-02 10:10-10:50 Control and self-organization of cell mechanics during tissue morphogenesis

○Thomas Lecuit (Tissue architecture and plasticity IBDM, CNRS & Aix-Marseille University)

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.

Chairperson: Fubito Nakatsu (Niigata Univ.)

PL-03 10:50-11:30 Intracellular Membrane Contact Sites and Lipid Dynamics

○Pietro De Camilli (Departments of Neuroscience and Cell Biology, Howard Hughes Medical Institute, Kavli Institute for Neuroscience, Yale University School of Medicine)

A defining characteristic of eukaryotic cells is the presence of intracellular membranes. The most abundant endomembrane system is the endoplasmic reticulum (ER), which participates in a multiplicity of functions, including protein and lipid synthesis, a variety of metabolic reactions and intracellular signaling. While membranes of the ER are functionally connected to all membranes of the secretory and endocytic pathways via vesicular transport, they only physically fuse with each other and with vesicles involved in retrograde transport from the Golgi complex. However, close appositions between the ER and other membranes mediated by tethering proteins play important roles in cell physiology, and their dysfunctions may result in disease, including neurodegeneration. In my talk I will discuss the properties, regulation and functions of tethering proteins that contain lipid transfer modules and that mediate exchange between bilayers independently of vesicular transport.

Chairperson: Yoshiko Takahashi (Kyoto Univ.)

PL-04 11:30-12:10 Organizing the radial axis of the vertebrate gut

○Clifford J. Tabin (Department of Genetics Harvard Medical School)

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