Special Issue on Quantitative Biology
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ARTICLES

Cytoskeleton

Local and global analysis of endocytic patch dynamics in fission yeast using a new “temporal superresolution” realignment method
J. Berro and T. D. Pollard 3501–3514

A temporal superresolution method is proposed to align data sets with a higher temporal resolution than the measurement resolution. Application to endocytic patches shows that the movement of endocytic vesicles is diffusive and impeded by the actin cytoskeleton. New tools are also proposed to count actin patches and study their polarization.

Synergies between Aip1p and capping protein subunits (Acp1p and Acp2p) in clathrin-mediated endocytosis and cell polarization in fission yeast
J. Berro and T. D. Pollard 3515–3527

It is shown that, in addition to capping actin filaments, Aip1p and the capping protein subunit Acp2p are also involved in actin patch polarization in interphase, but not in mitosis. In contrast, Acp1p is not involved in cell polarization.

TGF-β regulates LARG and GEF-H1 during EMT to affect stiffening response to force and cell invasion

Recent studies implicate a role for cell mechanics in cancer progression. Transforming growth factor β-induced epithelial-to-mesenchymal transition results in decreased stiffness and loss of the normal stiffening response to force applied on integrins.

Single-molecule tracking of tau reveals fast kiss-and-hop interaction with microtubules in living neurons

This is the first study in which the interaction of a microtubule-associated protein has been evaluated by direct single-molecule observations in living neurons. The data imply a novel kiss-and-hop mechanism of tau–microtubule interaction, rationalizing how tau can regulate microtubule dynamics without interfering with axonal transport.

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Membrane Trafficking

Quantitative analysis of APP axonal transport in neurons: role of JIP1 in enhanced APP anterograde transport

APP associates with kinesin-1 via JIP1. In JIP1-deficient neurons, the fast velocity and high frequency of anterograde transport of APP cargo are impaired to reduced velocity and lower frequency, respectively. Interaction of JIP1 with KLC via two novel elements in JIP1 plays an important role in efficient APP axonal transport.

Flat clathrin lattices: stable features of the plasma membrane

Endocytosis via clathrin-coated pits is a well-understood process; however, clathrin also assembles into large, flat clathrin lattices (FCLs), which remain poorly described. Quantitative electron, superresolution, and live-cell microscopy reveal that FCLs provide stable platforms for the recruitment of endocytic cargo.

A Highlights from MBoC Selection

Complete canthi removal reveals that forces from the amnioserosa alone are sufficient to drive dorsal closure in Drosophila

Laser microsurgery and computer tracking of embryo structures indicate that the morphogenetic process of Drosophila dorsal closure requires only forces generated by the amnioserosa tissue. Forces generated by both “zipping” of epidermal tissue at the canthi corners and the resulting actomyosin purse string curvature are not necessary for closure.
### Methods

**Comparative assessment of fluorescent transgene methods for quantitative imaging in human cells**  
3610–3618  
Despite widespread use the extent to which different mammalian transgene methods report on the properties of endogenous proteins has not been systematically compared. This study shows that the choice of fluorescence-tagging method fundamentally influences the ability to image the activity of the mitotic kinase Aurora B.

**Correlations of three-dimensional motion of chromosomal loci in yeast revealed by the double-helix point spread function microscope**  
M. P. Backlund, R. Joyner, K. Weis, and W. E. Moerner  
3619–3629  
The double-helix point spread function microscope is used to track single pairs of fluorescently labeled chromosomal loci in live yeast cells in three dimensions. Enhanced velocity cross-correlations are observed between pairs of GAL loci in diploid cells under repressive conditions, and ubiquitous subdiffusive exponents are found to be near 0.6–0.75.

### Nuclear Functions

**An agent-based model for mRNA export through the nuclear pore complex**  
M. Azimi, E. Bulat, K. Weis, and M. R. K. Mofrad  
3643–3653  
On the basis of previously published biophysical and biochemical parameters of mRNA export, a three-dimensional, coarse-grained, agent-based model is developed for the study and characterization of mRNA nucleocytoplasmic export.

### Signaling

**Structural basis for activation of trimeric Gi proteins by multiple growth factor receptors via GIV/Girdin**  
3654–3671  
GIV, a guanidine exchange factor for trimeric Gi, contains a unique domain that functions like a SH2 domain. GIV’s SH2-like domain binds autophosphorylated RTKs. Binding of GIV’s SH2 to RTKs enables the receptors to activate trimeric Gi. Inhibition of GIV:RTK interaction abolishes GIV-dependent Akt enhancement downstream of RTKs.
Quantitative analysis and modeling of katanin function in flagellar length control


3686–3698

A mutation in a microtubule-severing enzyme, katanin, causes flagella to become short due to a reduced cytoplasmic precursor pool. These results suggest that competition between flagella and cytoplasmic microtubules for a limited tubulin pool is facilitated by katanin, which is confirmed by stochastic models.

Measuring fast gene dynamics in single cells with time-lapse luminescence microscopy

A. Mazo-Vargas, H. Park, M. Aydin, and N. E. Buchler

3699–3708

Beetle luciferases and time-lapse luminescence microscopy were optimized to measure the dynamics of cell cycle genes in yeast with subminute time resolution. This method is faster and the cells are smaller than in previous work. It is shown that luciferase reporters are better than fluorescent proteins at tracking gene expression.

Mechanochemical regulation of oscillatory follicle cell dynamics in the developing Drosophila egg chamber

S. Koride, Li He, Li-Ping Xiong, Ganhui Lan, D. J. Montell, and Sean X. Sun

3709–3716

In the epithelium of Drosophila during tissue elongation, contractile forces in follicle cells can oscillate. These oscillations correlate with increasing tension in the epithelium from egg chamber growth. A mathematical model is proposed to explain the observed oscillations, together with a mechanism of active regulation of cellular contractile forces.