Bertrand Jauffred, Flora Llense, Bernhard Sommer, Zhimin Wang, Charlotte Martin, Yohanns Bellaïche (2013 May 31)

**Regulation of centrosome movements by numb and the collapsin response mediator protein during Drosophila sensory progenitor asymmetric division.**

*Development (Cambridge, England)*: 2657-68 : [DOI : 10.1242/dev.087338]

**Summary**

Asymmetric cell division generates cell fate diversity during development and adult life. Recent findings have demonstrated that during stem cell divisions, the movement of centrosomes is asymmetric in prophase and that such asymmetry participates in mitotic spindle orientation and cell polarization. Here, we have investigated the dynamics of centrosomes during Drosophila sensory organ precursor asymmetric divisions and find that centrosome movements are asymmetric during cytokinesis. We demonstrate that centrosome movements are controlled by the cell fate determinant Numb, which does not act via its classical effectors, Sanpodo and α-Adaptin, but via the Collapsin Response Mediator Protein (CRMP). Furthermore, we find that CRMP is necessary for efficient Notch signalling and that it regulates the duration of the pericentriolar accumulation of Rab11-positive endosomes, through which the Notch ligand, Delta is recycled. Our work characterizes an additional mode of asymmetric centrosome movement during asymmetric divisions and suggests a model whereby the asymmetry in centrosome movements participates in differential Notch activation to regulate cell fate specification.


**PTEN controls junction lengthening and stability during cell rearrangement in epithelial tissue.**


**Summary**

Planar cell rearrangements control epithelial tissue morphogenesis and cellular pattern formation. They lead to the formation of new junctions whose length and stability determine the cellular pattern of tissues. Here, we show that during Drosophila wing development the loss of the tumor suppressor PTEN disrupts cell rearrangements by preventing the lengthening of newly formed junctions that become unstable and keep on rearranging. We demonstrate that the failure to lengthen and to stabilize is caused by the lack of a decrease of Myosin II and Rho-kinase concentration at the newly formed junctions. This defect results in a heterogeneous cortical contractility at cell junctions that disrupts regular hexagonal pattern formation. By identifying PTEN as a specific regulator of junction lengthening and stability, our results uncover how a homogenous distribution of cortical contractility along the cell cortex is restored during cell rearrangement to control the formation of epithelial cellular pattern.
Carl-Philipp Heisenberg, Yohanns Bellaïche (2013 May 28)
**Forces in tissue morphogenesis and patterning.**
*Cell*: 948-62 : [DOI: 10.1016/j.cell.2013.05.008]

**Summary**

During development, mechanical forces cause changes in size, shape, number, position, and gene expression of cells. They are therefore integral to any morphogenetic processes. Force generation by actin-myosin networks and force transmission through adhesive complexes are two self-organizing phenomena driving tissue morphogenesis. Coordination and integration of forces by long-range force transmission and mechanosensing of cells within tissues produce large-scale tissue shape changes. Extrinsic mechanical forces also control tissue patterning by modulating cell fate specification and differentiation. Thus, the interplay between tissue mechanics and biochemical signaling orchestrates tissue morphogenesis and patterning in development.

Shuji Ishihara, Kaoru Sugimura, Simon J. Cox, Isabelle Bonnet, Yohanns Bellaïche, François Graner (2013 Apr 26)
**Comparative study of non-invasive force and stress inference methods in tissue.**

**Summary**

In the course of animal development, the shape of tissue emerges in part from mechanical and biochemical interactions between cells. Measuring stress in tissue is essential for studying morphogenesis and its physical constraints. For that purpose, a possible new approach is force inference (up to a single prefactor) from cell shapes and connectivity. It is non-invasive and can provide space-time maps of stress in a whole tissue, unlike existing methods. To validate this approach, three force-inference methods, which differ in their approach of treating indefiniteness in an inverse problem between cell shapes and forces, were compared. Tests using two artificial and two experimental data sets consistently indicate that our Bayesian force inference, by which cell-junction tensions and cell pressures are simultaneously estimated, performs best in terms of accuracy and robustness. Moreover, by measuring the stress anisotropy and relaxation, we cross-validated the force inference and the global annular ablation of tissue, each of which relies on different prefactors. A practical choice of force-inference methods in different systems of interest is discussed.