Active cell surface deformations

Hervé Turlier

European Molecular Biology Laboratory, Germany.

The shape of animal cells is controlled primarily by the actin-myosin cortex, which lies beneath the plasma membrane. The cortex is a viscoelastic thin layer of cross-linked polymers (actin), to which molecular motors (myosin) provide contractile properties by converting continuously chemical energy into active stresses within the layer. Cells control locally and temporally this contractile activity to perform fundamental functions, such as cell division, cell polarization or cell migration. Deformations of the cortical layer are well described by hydrodynamic active gel equations (Kruse 2005). We present here a Lagrangian formulation for the dynamics of an active-viscous surface in axisymmetric geometry. Based on scaling arguments, we neglect at first order interactions of the cell surface with the surrounding fluid. We show that, for cell division, this approximation is well justified, and that we can calculate numerically very convincing cell shapes and division dynamics (Turlier 2014). We present further applications of our model for biology (Bun 2014) and we suggest possible extensions of our modeling approach.

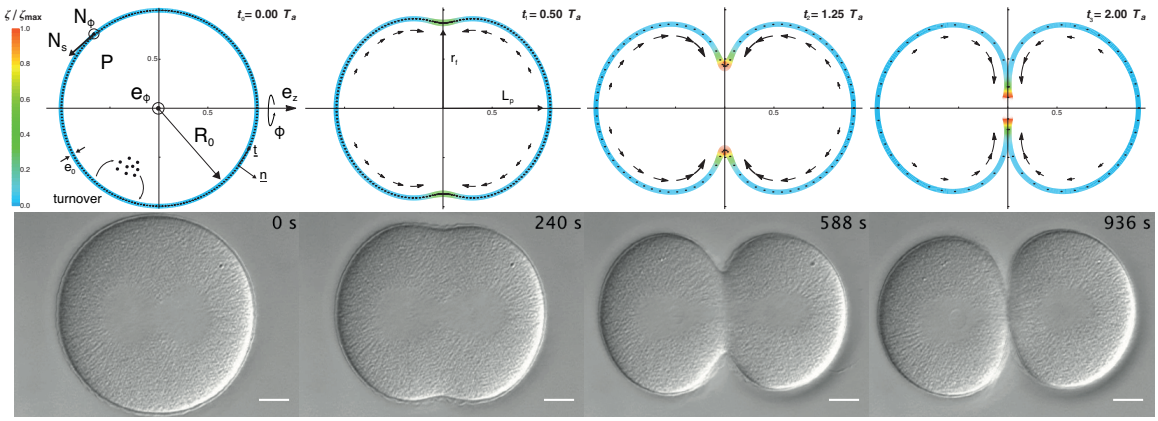

Figure: Comparison of numerical & experimental successive snapshots of cell division

(**Turlier 2014**) H. Turlier, B. Audoly, J. Prost & J-F. Joanny, *Biophys. J.* ***106****(1)* 2014

(**Kruse 2005**) K. Kruse, J.-F. Joanny, F. Jülicher, J. Prost & K. Sekimoto, *Eur. Phys. J. E* **16** 2005

(**Bun 2014**) P. Bun, J. Liu, H. Turlier, Z. Liu, K. Uriot, JF. Joanny & M. Coppey-Moisan, *Biophys, J.* ***107****(2)* 2014

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