

Neuer Termin!

Soft Matter Colloquium

Dienstag, den 10.04.2012, um 16:00 Uhr

Prof. Dr. M. Lisa Manning

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Emergent Mechanical Properties in Embryonic Tissues

Biological tissues often behave like elastic solids on short time scales and fluids on long time scales. Different tissue types exhibit different characteristic macroscopic mechanical properties such as surface tension and viscosity, and cell rearrangements in developing animal tissues closely resemble the behavior of immiscible liquids governed by their surface tensions. But individual cells are not equivalent to molecules in a fluid; cells resist shape changes, modulate adhesive contacts, and exert active tension on their neighbors in tightly packed, disordered structures. By exploiting analogies with foams and supercooled fluids, we develop two models for the emergent mechanical behavior in zebrafish tissues. The first “dynamic” model treats cells as individual units and introduces interactions between cells to capture intracellular degrees of freedom. We show that this minimal model, which contains only three parameters and is carefully calibrated using experimental data, makes predictions for bulk structural and dynamical properties of tissues which we have quantitatively verified. A second “thermodynamic” model studies ensembles of mechanically stable cell packings, and makes predictions for cell shapes that we have also verified experimentally. It also specifies how the collective property of surface tension emerges from properties of individual cells such as cell-cell adhesion and “cortical tension”. Taken together, these models provide a surprising answer to a long-standing paradox, which is the observation that the magnitude of tissue surface tension is orders of magnitude larger than one would expect if it was generated by adhesive molecules alone. Our results suggest that embryonic tissues are a strange viscoelastic “material”: the surface properties are very different than one might expect because individual cells at the surface polarize and change their shapes.

Ort: Theoretischer Hörsaal, Linnéstraße 5, 04103 Leipzig

**Alle Teilnehmer sind ab 15:00 Uhr zur Gesprächs-Kaffee-Runde
mit Prof. Manning in die Aula eingeladen.**