Physical Sciences Seminar

Seminar - Jean-Francois Joanny

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Host: Edouard Hannezo

Mechanics and geometry of growing tissuesThe mechanical properties of biological tissues are generally studied either at a macroscopic level by considering the tissue as a liquid (with a non-conserved number of cells) or at a microscopic cellular level by a vertex model that considers the tissue as an evolving graph. We derive a covariant coarse-grained continuum model of a generalized 2 dimensional vertex model of epithelial tissues. The formulation describes tissues with different underlying geometries, and allows for analytical description of the macroscopic behavior starting from the microscopic discrete vertex model. Using a geometrical approach and out-of-equilibrium statistical mechanics, we calculate various mechanical properties of a tissue, and their dependence on different variables, including activity, and disorder. Both plastic cellular rearrangements and the elastic response, depend on the existence of mechanical residual stresses at a cellular level. Our main result is an explicit calculation of the cell pressure in a homeosatic state. Additionally, we show that the homeostatic pressure can be negative and due to the existence of mechanical residual stresses. Using this geometric model we can readily distinct between elasticity and plasticity in a growing, flowing, tissue.

Tuesday, February 1, 2022 10:00am - 11:15am
Raiffeisen Lecture Hall, Central Building

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