
Guest seminar

Biological tissues as active amorphous solids

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Location: Ruder Bošković Institute, lecture hall Ivan Supek Wing

Host: Marko Popović

Abstract

Biological tissues can undergo large-scale shape changes during development and healing while remaining mechanically rigid. Understanding these flows requires coarse-graining cellular processes into tissue-level mechanics. In this view, tissues behave as active disordered solids, in which local rearrangements, or plastic events, are coupled through long-range elastic interactions to generate macroscopic flow.

In this talk, I first show that a quantitative analysis of experimental deformation fields supports describing the *Drosophila* wing epithelium as an elastic sheet. Within this continuum framework, cell divisions act as localized active force dipoles, generating anisotropic strain fields analogous to elementary plastic events in amorphous solids.

I then investigate the role of mechanically triggered cell extrusions in tissue rheology. Under increasing mechanical pressure, cells can become unstable and collapse. These collapse events, like divisions and rearrangements, generate force dipoles that redistribute stress across the tissue through elastic interactions. This yields an elastoplastic picture in which growth loads the tissue while extrusions relax it, driving the system toward a self-organized homeostatic pressure analogous to the yield stress of amorphous solids. In this framework, the distribution of near-threshold regions develops a pseudogap, which in turn predicts a characteristic scaling of small cell areas. These predictions agree well with measurements in the *Drosophila* wing disc and support an instability-driven mechanism of cell extrusion.

