Mechanobiology in Epithelial 3D Tissue Constructs

me3t. LECTURES

GRK 2415

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Active Nematic Behaviors of Cellular Monolayers

Thursday, 22nd April 2021 at 9.15 a.m.

Zoom Details:
https://rwth.zoom.us/j/99418690091?pwd=S2E5emJVN1U1R0p6ZlNIcFhOc3NlZz09

Meeting-ID: 994 1869 0091
Password: 066958

ZOOM-Session

Host: Rudolf Leube

Contact: rleube@ukaachen.de

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LECTURES

Active Nematic Behaviors of Cellular Monolayers

I will present how active nematic activity of cellular monolayers can help to understand biological processes and tissue organization.

In the first part, I will show how these active behaviors and stresses govern cell extrusion. By modelling the epithelium as an active nematic liquid crystal and measuring mechanical parameters such as strain rates and stresses measurements within cellular monolayers, I will show that apoptotic cell extrusion is provoked by singularities in cell alignments in the form of comet-shaped topological defects. These results highlight the importance of active nematic nature of epithelia.

In the second part, I will focus on the intriguing extensile behavior of epithelial cells as a collective when single cells behave as contractile systems. Through a combination of experiments and in silico modelling, we uncover the mechanism behind this switch of behavior of cell monolayers from extensile to contractile as the weakening of intercellular contacts. We find that this switch in active behavior also promotes the buildup of tension at the cell-substrate interface through an increase in actin stress fibers and higher traction forces. Such differences in extensility and contractility act to sort cells, thus determining a general mechanism for mechanobiological pattern formation.