Mechanobiology in Epithelial 3D Tissue Constructs

ME3T

LECTURES

GRK 2415

Medhavi Vishwakarma
Department of Bioengineering, Indian Institute of Science
https://be.iisc.ac.in/medhavi-vishwakarma/

Spatio-temporal mechanics of epithelia dictate tissue function.

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at 9:00 am

Seminarraum B1.72
DWI – Leibniz-Institut für Interaktive Materialien
Forckenbeckstraße 50, 52074 Aachen

Host: Jacopo Di Russo

Contact: me3t@ukaachen.de

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Abstract: Epithelial tissues are first line of defence against pathogenic organisms and chemical agents and are present in our body in varying architectures. Studies on homeostatic epithelial monolayers revealed physical characteristics of epithelial cells and drew parallels with dynamic heterogeneity in non-equilibrium jammed matter. Our understanding of mechanics of epithelium however remains incomplete, firstly, because the characterization lack temporal analysis, and secondly, the crosstalk between physical manifestations of jamming, and biochemical signalling remain missing. Here, using epithelia of kidney and breast origin, we study spatio-temporal dynamics of epithelial mechanics, and relate tissue mechanics with tissue functions, such as remodelling during wound healing (1,2), and epithelial defence against cancer (3). As expected, clustering of cellular forces over multiple cell distances, in space correlated with clustering of biochemical force transducer actin. Interestingly, we found local temporal oscillations with a distinct period of 10 hours, in both cell-substrate forces, as well as in expression of actin, revealing a periodic heterogeneity in epithelia when looked at in temporal domain. We show that these local oscillations are driven by emergent collective behaviour and are dictated by the size of the tissue. Furthermore, using MDCK/HRasV12 competition model, we show that the local temporal oscillations within the tissue dictate the ability of epithelia to defend itself against cancer. Using 3D breast acini cultures, and pseudostratified lung air-liquid interface (ALI) cultures, I will also show our efforts towards studying epithelial mechanics in tissue like architectures, and how such systems can be used- not only for deciphering the fundamental mechanisms of cancer initiation and progression, but also to study impact of pharmaceutical agents, biological agents, and toxins on epithelia tissues.