Institute of Science and Technology Austria

SLAM Seminar

Biomimetic emulsions as a tool to investigate tissue mechanics *in vitro* and *in vivo*

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Host: Jérémie Palacci

We use biomimetic emulsions to understand the physical basis of collective remodeling in biological tissues. In particular, we focus on the interplay between adhesion and extrinsic mechanical forces to control the emergence of tissue architecture during morphogenesis. We design our emulsions to reproduce the passive mechanical and adhesive properties of cells in biological tissues and we study their elasto-plastic response to an applied mechanical perturbation. In simple microfluidic constrictions we find that adhesion alone can polarize the droplets in the direction of the flow. This result indicates that adhesion alone could in principle induce cell polarization in elongating tissues, which could in turn trigger signaling inside the cells. We are now exploring how adhesion hierarchies inside such systems can lead to self-organization of the biomimetic tissue through repeated mechanical stimulations.

Conversely, in static packings we uncover a threshold proportion of adhesive contacts above which adhesion percolation in the contact network sets the deformation of all droplets in the packing, independently of their local adhesive properties. In biological tissues, this indicates that tuning the adhesion properties in a limited number of cells at a given packing fraction should be sufficient to modify globally the mechanical properties of the tissue.

Finally, in parallel to these in vitro approaches, we use oil droplets as force sensors in vivo, in developing zebrafish embryos. In particular, the injection of biocompatible oil droplets in their olfactory placode allowed us to measure the presence of anteroposterior compressive forces that can contribute to axon elongation in olfactory neurons. We are currently developing biocompatible self-functionalizing droplets in order to obtain the full force map in the placode and in surrounding tissues during development.

Thursday, June 22, 2022 11:00 - 12:00

Heinzel Seminar Room / Office Building West / Ground Floor

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