Department of Physics
Condensed Matter Physics
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UNIVERSITY OF OXFORD

CONDENSED MATTER SEMINAR

Friday 13 November at 10.00

'Dissecting the intercellular forces shaping tissues'

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During embryonic morphogenesis, tissue shape arises from the interplay between cellular contractility, intercellular adhesion and changes in boundary conditions applied by the movement of other embryonic tissues. Here, I will present recent work from my lab examining interactions between small aggregates of cells *in vivo* and the response of monolayered epithelial tissues to changes in their boundary conditions *in vitro*.

To investigate how complex shapes can emerge from differences in cortical mechanics and intercellular adhesion within small cell clusters, we examine the *C Elegans* embryo at the 2-4 cell stage. Using Atomic Force Microscopy, we characterise the temporal evolution of cortical tension in all of the cells of the embryo. With these cortical tensions, measurement of the angle of contact between cells allows to estimate the junctional tension between cells. In turn, knowledge of all surface tensions allows prediction of embryo shape. Furthermore, we show that cortical tension can be inferred from myosin motor enrichment at the cortex and junctional tension from the combination of myosin and the adhesion protein E-Cadherin at intercellular junctions. Using experimental perturbations to cortical and junctional tensions, we explore the use of surface tension models to predict aggregate morphologies in the 4-cell embryo.

During embryonic development and adult life, epithelia are constantly subjected to external forces on their boundaries. The resulting deformations can have a profound impact on tissue development and function. In particular, compressive deformations are central to tissue morphogenesis as they can trigger cell extrusion or differentiation via mechanosensory mechanisms. These processes are all controlled by the relationship between compression and the mechanical state of the tissue, however, the mechanics of monolayers remain poorly understood. Using suspended epithelia, we investigate the dynamic response of epithelial tissues to the application of large in-plane compressive strains.

While most epithelia must withstand mechanical stresses without rupture, some embryonic epithelia must rupture to allow emergence of mature organs. In Drosophila leg imaginal disks, the peripodial membrane breaks to release the leg. As it ruptures, the peripodial membrane curls basally, indicating the presence of spontaneous curvature within the epithelium. We investigate the biology and physics that give rise to curling.

Host: Achillefs Kapanidis

Zoom ID: https://zoom.us/j/95448874266?pwd=Tkh0ZythcGM3NnNkSVFVKzVGTXVRdz09