Eugene Wigner Colloquium

joint event of GRK 1558 and SFB 910

SFB 910

Dr. Guillaume Charras

University College London

“Biophysical mechanisms of oriented tissue growth in epithelial monolayers”

Cell division plays an important role in animal tissue morphogenesis, which depends, critically, on the orientation of divisions. In isolated adherent cells, the orientation of mitotic spindles is sensitive to interphase cell shape and the direction of extrinsic mechanical forces. In epithelia, the relative importance of these two factors is challenging to assess. To do this, we used suspended monolayers devoid of ECM, where divisions become oriented following a stretch, allowing the regulation and function of epithelial division orientation in stress relaxation to be characterized. Using this system, we found that divisions align better with the long, interphase cell axis than with the monolayer stress axis. Nevertheless, because the application of stretch induces a global realignment of interphase long axes along the direction of extension, this is sufficient to bias the orientation of divisions in the direction of stretch. Each division redistributes the mother cell mass along the axis of division. Thus, the global bias in division orientation enables cells to act collectively to redistribute mass along the axis of stretch, helping to return the monolayer to its resting state. Further, this behavior could be quantitatively reproduced using a model designed to assess the impact of autonomous changes in mitotic cell mechanics within a stretched monolayer. In summary, the propensity of cells to divide along their long axis preserves epithelial homeostasis by facilitating both stress relaxation and isotropic growth without the need for cells to read or transduce mechanical signals.

GRK1558 research training group

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