BDR SEMINAR in Osaka

"CDB SEMINAR" and "QBiC SEMINAR" have been renamed "BDR SEMINAR".

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Wednesday, September 19, 2018 15:00-15:40

1F Lounge, Quantitative Biology Bldg. A, Osaka

Two physical mechanisms by which cells may regulate tissue architecture

Summary

In this talk I describe our work to understand how cells use mechanical forces to shape and remodel living tissues. In particular, I present experiments that explore two extremes of tissue architecture: sparse cells in an extracellular matrix (ECM), and tissues comprised almost entirely of living cells with little or no intervening ECM. In the first project, we sought to understand how cells adhere to, deform, and migrate through soft, three-dimensional (3D) ECMs. To do so, we used multicolor, time-lapse confocal imaging to quantify cytoskeletal motion and cell-generated matrix deformations for human fibroblasts embedded in 3D fibrin matrices, an environment that cells encounter during wound healing. Quantitative analysis of cytoskeletal and cell adhesion dynamics suggests that a modified version of the molecular clutch model of cytoskeletal force transduction, which was originally developed to describe cell migration on hard, flat surfaces, can be extended to understand cell migration in some 3D contexts. In a second project, we used colonies of human embryonic stem cells (hESCs) adhering to soft hydrogel substrates to examine the basic physical principles that determine the shape of simple 3D tissues. We found that a balance of surface tension, cell-ECM adhesion energy, and an active cell spreading term was sufficient to describe the shapes of hESC colonies adhering to substrates with a wide range of elastic moduli. Our results suggest the intriguing possibility that the addition of a cellular traction force to the equations used to model droplet spreading may be sufficient to describe the shapes adopted by tissues in a variety of contexts.

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