Seminar/Talk

A Geometric Tension Dynamics Model of Epithelial Convergent Extension

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Animal development requires large numbers of cells to choreograph their force generation in order to sculpt tissues and organs. On a coarse scale, cell motion resembles laminar fluid flow; yet in contrast to a fluid, epithelial cells adhere to each other and maintain actively generated internal tension. To resolve this apparent paradox, we leverage the fact that cellular forces equilibrate rapidly compared to the speed of development, and formulate a geometrical model for the network of balanced active tensions in an epithelial sheet. Within this framework, we can investigate how cells adiabatically remodel the tension network to change tissue shape. A simple winner-takes-all'' mechanical feedback loop can self-organize complex cell movement, matching experimental data on the cell and tissue scale. We find that the ability to self-organize depends on initial order in the cellular packing. Cell rearrangement degrades this order so that tissue flow is self-limiting. Our model explains how genetic patterning, embryo geometry, and cellular packing geometry combine to determine tissue shape change.[joint work with Fridtjof Brauns & Boris Shraiman]

Thursday, December 14, 2023 01:00pm - 02:00pm
Mondi 2 / Central Building

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