



Seminar/Talk

Robustness in epithelial morphogenesis: from mechanical signalling to cell heterogeneity

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Embryonic development achieves remarkable consistency despite environmental fluctuations, variable initial conditions, or perturbations. It has been shown that beyond genetic programming, feedback mechanisms provide real-time control, coordinating cell behavior and collective dynamics. By analyzing live-imaging data from *Drosophila* gastrulation, we discovered that cells use mechanical signals to synchronize their activity. However, our results also show significant variability in cell dynamics despite genetic uniformity. It remains unclear whether this heterogeneity signifies robust self-organization or represents noise that must be regulated during key morphogenetic checkpoints. Quantifying heterogeneity in time series data is generally challenging due to intrinsic noise that obscures extrinsic variability. I will present a reverse-time stochastic framework that (i) infers effective dynamical equations from noisy trajectories and (ii) directly decomposes observed variability into intrinsic noise and extrinsic (parameter) heterogeneity among cells. Using this method on junction constriction during T1 transitions in the germband, we find that wild-type embryos show very heterogeneous constriction events, whereas a mutant with impaired T1 transitions is largely homogeneous. Revealing cell-cell variability in time series data paves the way towards a systematic understanding of heterogeneity in developmental processes.

Friday, October 31, 2025 03:00pm - 04:00pm

Mondi Seminar Room 2, Central Building



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