Mathematical Biology Seminar

Monday, November 27, 2023

3 pm MST - 457 CAB (virtual)

Join Zoom Meeting

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Meeting ID: 984 9769 5684
Passcode: 32123

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Modeling and topological data analysis of zebrafish patterns

Many natural and social phenomena involve individual agents coming together to create group dynamics, whether the agents are drivers in a traffic jam, cells in a developing tissue, or locusts in a swarm. Here I will focus on the specific example of pattern formation in zebrafish, which are named for the dark and light stripes that appear on their bodies and fins. Mutant zebrafish, on the other hand, feature different skin patterns, including spots and labyrinth curves. All of these patterns form as the fish grow due to the interactions of tens of thousands of pigment cells. The longterm motivation for my work is to better link genes, cell behavior, and visible animal characteristics — I seek to identify the alterations to cell interactions that lead to mutant patterns. Toward this goal, I will overview our work using agent-based models to simulate pattern formation and make experimentally testable predictions. However, stochastic, microscopic models are not analytically tractable using traditional techniques, and comparing model output and in vivo patterns is often a qualitative process, both for zebrafish skin and other biological patterns. To help address this broader challenge, I will also discuss the topological methods that we have developed to quantify variability in cell-based patterns at large scale.

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