UNIVERSITY OF DELAWARE

CENTER FOR BIOINFORMATICS & COMPUTATIONAL BIOLOGY

BIOINFORMATICS SEMINAR

BRIAN CAMLEY

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JOHNS HOPKINS UNIVERSITY

CBCB SEMINAR
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3:30 PM
DELAWARE BIOTECHNOLOGY INSTITUTE
Room 102

bioinformatics.udel.edu

COLLECTIVE CHEMOTAXIS: SIGNALING AND MECHANICS

Many eukaryotic cells chemotax, sensing and following chemical gradients. However, experiments have shown that even under conditions when single cells do not chemotax, small clusters may still follow a gradient. Similar collective motion is also known to occur in response to gradients in substrate stiffness or electric potential (collective durotaxis or galvanotaxis). How can cell clusters sense a gradient that individual cells ignore? I will discuss possible ``collective guidance" mechanisms underlying this motion, where individual cells measure the mean value of the attractant, but need not measure its gradient to give rise to directional motility for a cell cluster. One important aspect of collective chemotaxis is how cells process the gradient signal biochemically. I will show how the topology of these signaling networks can be constrained by simple experimental observations, reducing the space of possible minimal networks from millions to only a few possible candidates. Collective gradient sensing also has a new wrinkle in comparison to single-cell chemotaxis: to accurately determine a gradient direction, a cluster must integrate information from cells with highly variable properties. When is cell-to-cell variation a limiting factor in sensing accuracy? I provide some initial answers, and discuss how cell clusters can sense gradients in a way that is robust to cell-to-cell variation. Interestingly, these strategies may depend on the cluster's mechanics; I develop a bound that links the cluster's chemotactic accuracy and its rheology. This suggests that in some circumstances, mechanical transitions (e.g. unjamming) can control tactic accuracy.

BIOGRAPHY

Brian Camley studies the physics of cell biology with theory and computation, trying to understand how cells respond to signals, crawl through complex environments, and work together to move and measure signals. This has led him to analyze collective chemotaxis, build phase field models of collective cell migration that link mechanics and signaling, and study the hydrodynamics of proteins within lipid membranes. Brian is currently an Assistant Professor jointly between the departments of Physics & Astronomy and Biophysics at Johns Hopkins University. He joined JHU in January 2018 following a postdoc at the University of California, San Diego and PhD in Physics from the University of California, Santa Barbara.

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