Soft Living Active and Adaptive Matter

CCBM NSF-CREST
CENTER FOR CELLULAR AND BIOMOLECULAR MACHINES

Do leader cells drive collective behavior in Dictyostelium Discoideum amoeba colonies?

Sulimon Sattari
Hokkaido University

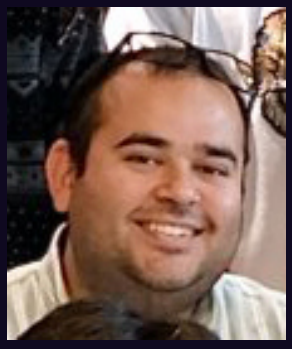
Abstract:

Dictyostelium Discoideum (DD) are a fascinating single-cellular organism. When nutrients are plentiful, the DD cells act as autonomous individuals foraging their local vicinity. At the onset of starvation, a few (<0.1%) cells begin communicating with others by emitting a spike in the chemoattractant protein cyclic-AMP. Nearby cells sense the chemical gradient and respond by moving toward it and emitting a cyclic-AMP spike of their own. Cyclic-AMP activity increases over time, and eventually a spiral wave emerges, attracting hundreds of thousands of cells to an aggregation center. How DD cells go from autonomous individuals to a collective entity remains an open question for more than 60 years--a question whose answer would shed light on the emergence of multi-cellular life. Recently, trans-scale imaging has allowed the ability to sense the cyclic-AMP activity at both cell and colony levels. Using both the images as well as toy simulation models, this research aims to clarify whether the activity at the colony level is in fact initiated by a few cells, which may be deemed "leader" or "pacemaker" cells. In this talk, I will demonstrate the use of information-theoretic techniques to classify leaders and followers based on trajectory data, as well as to infer the domain of interaction of leader cells. We validate the techniques on toy models where leaders and followers are known, and then try to answer the question in real data--do leader cells drive collective behavior in DD colonies?

Date:
8/2/2021

Time:
9:00 AM-10:15 AM (PT)

About the speaker:



Sulimon Sattari (@SulimonSattari) is a specially appointed assistant professor at Hokkaido University working under Prof. Tamiki Komatsuzaki. He specializes in understanding collective behavior in cells as well as in toy models, with a focus on data-driven techniques in information theory.

Dr. Sattari got his Ph.D in Physics from the University of California, Merced in 2017 with Prof. Kevin Mitchell. His Ph.D Dissertation was on understanding microfluidic mixing and atomic ionization rates using chaos theory.

For more information, contact: Kinjal Dasbiswas, Niranjan Sarpangala
kdasbiswas@ucmerced.edu, nsarpangala@ucmerced.edu

UNIVERSITY OF CALIFORNIA MERCED PHYSICS