Biology and Medicine Through Mathematics Conference 2024

May 16th, 2:00 PM - 2:30 PM

Modeling Mechanisms of Microtubule Dynamics and Polarity in Neurons

Anna Nelson
Duke University, anelson@math.duke.edu

Veronica Ciocanel
Duke University

Scott McKinley
Tulane University

See next page for additional authors

Follow this and additional works at: https://scholarscompass.vcu.edu/bamm

Part of the Life Sciences Commons, Medicine and Health Sciences Commons, and the Physical Sciences and Mathematics Commons

https://scholarscompass.vcu.edu/bamm/2024/thur/12

This Event is brought to you for free and open access by the Dept. of Mathematics and Applied Mathematics at VCU Scholars Compass. It has been accepted for inclusion in Biology and Medicine Through Mathematics Conference by an authorized administrator of VCU Scholars Compass. For more information, please contact libcompass@vcu.edu.
Presenter Information
Anna Nelson, Veronica Ciocanel, Scott McKinley, and Hannah Scanlon

This event is available at VCU Scholars Compass: https://scholarscompass.vcu.edu/bamm/2024/thur/12
Modeling Mechanisms of Microtubule Dynamics and Polarity in Neurons

Anna Nelson

February 29, 2024

In neurons, the stability and orientation of the microtubule cytoskeleton is required for long-range, sustained intracellular transport of cargo such as proteins and mRNA. The healthy microtubule cytoskeleton of fruit fly neurons has a specific orientation, or polarity, that depends on the region of the cell, where microtubules are either all minus-end out or all plus-end out. However, these microtubules are dynamic and rearrange their orientation in the event of an injury. It is unknown how these mechanisms can maintain both dynamic rearrangement and sustained function. To better understand these mechanisms, we introduce a spatially-explicit mathematical model of microtubule growth and polarity using parameters informed by experimental data. We implement several mechanisms that control microtubule length using both a stochastic model and a continuous model, and validate such mechanisms with experimental data. In turn, we will discuss how the microtubule growth mechanisms can impact the polarity mechanisms of the microtubule cytoskeleton, where we seek to understand how polarity can be maintained in healthy cells.