Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Intracellular Transport of Cargo in a Sub-diffusive Environment over an Explicit Cytoskeletal Network BRYAN MAELFEYT, AJAY GOPINATHAN, UC Merced — Intracellular transport occurs in nearly all eukaryotic cells, where materials such as proteins, lipids, carbohydrates, and nucleic acids travel to target locations through phases of passive, diffusion-based transport and active, motor-driven transport along filaments that make up the cell's cytoskeleton.We develop a computational model of the process with explicit cytoskeletal filament networks. In the active transport phase, cargo moves in straight lines along these filaments that are spread throughout the cell. To model the passive transport phase of cargo in the cytoplasm, where anomalous sub-diffusion is thought to take place, we implement a continuous-time random walk. We use this approach to provide a stepping stone to a predictive model where we can determine transport properties over a cytoskeletal network provided by experimental images of real filaments. We illustrate our approach by modeling the transport of insulin out of the cell and determining the impact of network geometry, anomalous sub-diffusion and motor number on the first-passage time distributions for insulin granules reaching their target destinations on the membrane.

Bryan Maelfeyt
UC Merced

Date submitted: 10 Nov 2016 Electronic form version 1.4