Intracellular transport and filament organization in neurons

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Microtubules are protein polymers present in most cells; in neurons, microtubule filaments are believed to be stable and to have specific orientations. This is crucial, since other key proteins get transported along these polarized microtubules, which ensures long-term survival of neurons. But microtubules also need to be dynamic and reorganize in response to injury events. Using information from experimental measurements and a stochastic mathematical model, we seek to understand mechanisms that control microtubule length in dendrites of fruit fly neurons. We also develop a reduced deterministic model that validates and guides our choices of parameters for the more complex stochastic model. Insights from these models of microtubule dynamics can then be used to understand how the microtubule filaments collectively organize into polarized structures in neurons, and how this re-organization may impact cargo protein localization following axon injury events.