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Computational model of microtubule transport in axons HOWARD YEUNG, Central Washington Univ, ANAND RAO, Drexel University, NATHAN KUWADA, Central Washington Univ, PETER BAAS, Drexel University, ERIN CRAIG, Central Washington Univ — Neurodegenerative diseases, such as Alzheimer's, affect millions of people and cost the US economy over $100 billion annually. Microtubules (MTs) are cytoskeletal protein complexes that play a critical role in the structure of healthy nerve cells, and while the underlying mechanisms are not well understood, disruption of the MT bundle polarity pattern is associated with neurodegenerative diseases. MTs align in the axon to create a long bundle of polarized filaments that extend throughout the cell. The coordinated transport of short MTs along the axon by motor proteins is essential for the establishment and maintenance of an organized bundle. We present a computational model of MT transport along the axon, based on the hypothesis that this movement is driven primarily by cytoplasmic dynein through a sliding filament mechanism. Our model allows for the possibility that motor proteins of opposite polarity can attach to the same MT, creating a mechanical tug-of-war. Results show that as MT length increases, average velocity increases due to MTs spending less time stalled by the tug-of-war. We conclude that a motor protein "tug-of-war" is insufficient to explain the experimental observation that the average velocity of MT transport in the axon is inversely related to MT length.

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