Stochastic modeling of intracellular transport performed by kinesin-1 and mammalian dynein

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Intracellular transport is a bidirectional, biased stochastic motion carried out by teams of kinesin and dynein motor proteins. Dynein and kinesin walk actively in opposite directions along polar intracellular filaments, called microtubules. In general, a cargo is transported bidirectionally, meaning both kind of motors (kinesin and dynein) are involved. Kinesin and dynein motors are large proteins with complex dynamic behaviors which are not yet fully understood. In close collaboration with the biologists, we use all known biological properties to develop stochastic models for kinesin and dynein motors [1,2]. In our study we focus on conventional kinesin (kinesin-1) and cytoplasmic mammalian dynein. Mammalian dynein is known for needing an activation process to be able to walk pointedly along the microtubule. Our model [1] predicts a mechanical activation, where dynein motors activate by being stretched. In [1] we show that our kinesin and dynein models reproduce the experimental observations in the case of unidirectional transport, where either only kinesin or only dynein motors are involved. In our present work we demonstrate the agreement of simulation and experiment for the bidirectional transport, where both, kinesin and dynein motors are in involved and moreover investigate the influence of external control parameters like *i.e.* ATP concentration and hindering obstacles.

[1] G.A. Monzon, L. Scharrel, S. Diez, Journal of Cell Science, jcs220079 (2019)

[2] Sarah Klein, Cecile Appert-Rolland, and Ludger Santen, EPL 107, 18004 (2014)