Deciphering the transport of intermediate filaments by motor proteins

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Intermediate filaments are elastic fibres that are transported in cells by microtubule-associated motor proteins kinesin and dynein. How elastic filaments are efficiently transported by antagonistic motors is not well understood and difficult to measure with current experimental techniques. Adapting the tug-of-war paradigm for vesicle-like cargos, we develop a mathematical model to describe the motion of an elastic filament punctually bound to antagonistic motors. As observed in cells, up to 3 modes of transport are obtained; dynein-driven retrograde, kinesin-driven anterograde fast motions and a slow motion. Motor properties and initial conditions that depend on intracellular context, regulate the transport of filaments. Filaments elasticity is found to affect both the mode and the efficiency of transport. We further show that the coordination of motors along the filament emerges from the interplay between intracellular context and elastic properties of filaments.

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