Microtubule-based Neuronal Transport in C. elegans Sensory Neurons

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Abstract:

Members of the kinesin and dynein families are evolutionarily conserved molecular motors that power intracellular transport along microtubules. Cytoplasmic dynein-2 drives retrograde intraflagellar transport (IFT) that is essential for cilium formation and maintenance. Inactivation of dynein-2 causes skeletal dysplasias, and the composition and motility of dynein-2 are not well understood. Using the genome-editing, high-resolution live imaging and biochemical techniques, we identify the essential subunits of dynein-2 in Caenorhabditis elegans and show that the dynein-2 motor accelerates in the ciliary distal segment, and then moves at maximum velocity and decelerates adjacent to the base. We uncover the crucial roles of the dynein tail and IFT-A proteins in the regulation of dynein-2's triphasic movement. These results provide a molecular model for the regulation of dynein-2 motility and suggest that the disruption of its triphasic movement is implicated in ciliopathies. Our recent studies address how dynein-1 delivers centriole from soma to the dendritic endings where it forms a template for ciliogenesis and how kinesin-1 is involved in vesicle transport around the basal body.

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