Abstract Submitted
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Coordination of individual and ensemble molecular motors studied using tools from DNA Nanotechnology NATHAN DERR, Smith College — Cytoplasmic dynein and kinesin-1 are cytoskeletal molecular motor proteins that move in opposing directions on intracellular microtubules. These motors are responsible for many functions in eukaryotic cells, including primary roles in cargo transport, cell division and the maintenance of sub-cellular spatial organization. These motors are homodimeric and move in discrete increments, averaging 8 nm perstep and outputting forces in the piconewton range. Moving processively on their microtubule tracks,they can take hundreds or thousands of consecutive steps. To better understand how individual dynein motors achieve this processive motion, we created orthogonally labeled dynein heterodimers joined by DNA base paring and observed their steps using two-color, single-molecule microscopy with high-precision, two-dimensional tracking. Additionally, to investigate the biophysical mechanisms that govern the collective behavior of motor ensembles, we built a programmable synthetic cargo using the techniques of three-dimensional DNA origami. This allowed us to precisely control the number, spacing and type of motors within the ensemble.

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