Forces in Biomolecular Systems SFB 863

Understanding Intracellular Transport from the Millisecond-scale Dynamics of Kinesin Motor Proteins

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Abstract:

Kinesins are molecular motors that transport vesicles, organelles and chromosomes in cells. There are 45 different kinesin genes in humans that carry a range of cargo and possess diverse chemomechanical properties. To understand how different kinesins carry out their diverse tasks, we are investigating the nm-scale dynamics of kinesins as they walk along microtubules. By attaching a gold nanoparticle to one head in a dimeric kinesin and imaging by dark-field microscopy approaches, we can detect sub-steps in the chemomechanical cycle and measure how ATP hydrolysis triggers the forward step of the motor. This allows us to understand how different kinesins are biochemically tuned to their specific cellular tasks. By using DNA linkages to create multi-motor assemblies, we are able to gain insight into how multi-motor teams operate to carry cargo in cells. These experiments provide insight into the molecular mechanisms underlying bidirectional transport of cargo in cells, such as axonal transport of vesicles, and how these processes are altered in neurodegenerative disease.

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