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Diffusive protofilament switching of kinesin-8 investigated with optical tweezers

Michael Bugiel[1*], **Elisa Böhl**[1], **Erik Schäffer**[2]

[1]Biotechnology Center, TU Dresden, Dresden, Germany
[2]Center for Plant Molecular Biology (ZMBP), Universität Tübingen, Tübingen, Germany
[*]michael.bugiel@biotec.tu-dresden.de

The budding yeast Kinesin-8 *Kip3* is a highly processive motor protein that walks to the end of microtubules and shortens them in a collective manner [1]. Microtubules usually consist of 12 to 15 circularly-arranged tubulin polymer chains, called protofilaments. Left-handed rotations of microtubules in Kip3 gliding assays indicate sideward motion of Kip3 perpendicular to the microtubule axis [2], i.e. a switching between single protofilaments. Here, we used a high-resolution optical tweezers setup in a force feedback mode to apply sideward loads on single motor proteins. Our studies show that Kip3 steps sideward in both directions under alternating sideward loads. In control experiments with immobilized Kip3 and not protofilament switching kinesin-1, we measured no effective sideward motion. Statistical analysis and comparison with simulations propose a diffusive motion of Kip3 on the microtubule lattice with a preference to the left with respect to the direction of forward motion. This is consistent with the gliding assays. Protofilament switching has implications for the suggested mechanical signaling role of Kinesin-8 in budding yeast with respect to its ability to bypass obstacles.

References

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