SELF-ORGANIZATION OF DYNEIN MOTORS ON DYNAMIC MICROTUBULES GENERATES NUCLEAR OSCILLATIONS

Sven K. Vogel, Nenad Pavin, Nicola Maghelli, Frank Julicher, Iva Tolic-Nørrelykke
Max Planck Institute of Molecular Cell Biology and Genetics
Pfotenhauerstrasse 108, 01307 Dresden, Germany
E-mail: tolic@mpi-cbg.de

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Meiotic nuclear oscillations in the fission yeast *Schizosaccharomyces pombe* are crucial for proper chromosome pairing and recombination. We report a mechanism of these oscillations based on collective behavior of dynein motors linking the cell cortex and dynamic microtubules that extend from the spindle pole body in opposite directions. The dynamic behavior of microtubules and dynein motors was observed by two-photon and spinning disc confocal microscopy. Using two-photon laser ablation of single microtubules [1], we directly show that oscillations are driven by pulling forces, which are generated along the lateral microtubule-cortex interactions. By combining experiments with a theoretical description, we show that dynein dynamically redistributes in the cell in response to load forces, resulting in more dynein attached to the leading than to the trailing microtubules. The redistribution of motors introduces an asymmetry of motor forces pulling in opposite directions, leading to the generation of oscillations. Our work provides the first direct *in vivo* observation of self-organized dynamic dynein distributions, which, due to the intrinsic motor properties, generate regular large-scale movements in the cell.

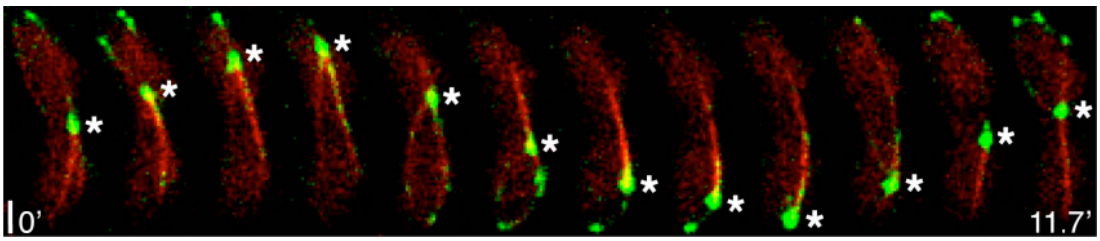

Figure 1: Oscillations of the spindle pole body (asterisk). Dynein is visualized in green and microtubules in red. Scale bar is 2 μm; figure is adapted from [2].

References:
[1] N. Maghelli and I.M. Tolic-Nørrelykke, "Versatile laser-based cell manipulator," *J. Biophoton,* **1**(4), 299-309 (2008).
[2] S. K. Vogel; N. Pavin; N. Maghelli; F. Julicher, and I.M. Tolic-Nørrelykke, "Self-organization of dynein motors generates meiotic nuclear oscillations," *in review* (2009).