Microtubule Lattice Dynamics

Microtubules are found in all eukaryotic cells. They are long and dynamic polymers supporting numerous cellular functions, e.g. cell division and intracellular transport. A complete understanding of the mechanisms regulating their dynamics and stabilization is a central issue in cell biology. Common textbook knowledge states that the microtubule dynamics is restricted to elongation and shortening of the microtubule tips and gives rise to a non-equilibrium phenomenon, called dynamic instability. Two years ago, we discovered unexpected exchanges of tubulin dimers occuring not at the microtubule tip but all along the microtubule shaft. These exchanges interfere with the classical dynamic instability thereby offering a novel regulation level of microtubule dynamics.

In this project we propose to explore microtubule lattice dynamics on a theoretical and/or experimental level. Our main hypothesis is that the lattice renewal at the shaft is due to structural defects in the microtubule lattice or can be facilitated by microtubule associated proteins.

The CytoMorphoLab offers a multidisciplinary research environment, including advanced in-vitro and imaging techniques combined with modeling approaches to study microtubule lattice dynamics. The successful applicant has a background in physics or life sciences with a strong interest in deciphering complex biological systems. We offer a basic training in

- experimental techniques, including protein handling, micro- or nano-fabrication methods combined to microscopy imaging techniques
- modeling of the microtubule lattice dynamics via, e.g. Monte-Carlo techniques.

Recent publications:

[1] Aumeier, C., Schaedel, L., Gaillard, J., John, K., Blanchoin, L., and Théry, M. (2016). Self-repair promotes microtubule rescue. Nat. Cell Biol., 18:13541364.
[2] Schaedel, L., John, K., Gaillard, J., Nachury, M. V., Blanchoin, L., and Théry, M. (2015). Microtubules self-repair in response to mechanical stress. Nat. Mater., 14(11):11561163.

Keywords:
microtubule dynamics, lattice defects, Monte-Carlo modeling, in-vitro techniques

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