

Cell biology: new insights into the life of microtubules

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Every second, around 25 million cell divisions take place in our bodies. This process is driven by microtubule filaments which continually grow and shrink. A new study shows how so-called motor proteins in the cytosol can control their dynamics.

The cytoskeleton plays a central role in the process of [cell division](#). It is composed in large part of [protein filaments](#) known as microtubules, which also help determine the size, shape and mobility of a cell. In a new study, Ludwig Maximilian University biophysicist Erwin Frey and his colleagues Anna Melbinger and Louis Reese have used a theoretical model to show how cells control the construction and breakdown of microtubules. The dynamics of this process affect how cells divide, and how they maintain the cytoskeleton. In particular, it is responsible for regulating the size and shape of the [mitotic spindle](#).

Theoretical modeling has now revealed that the regulation of microtubule length relies on the length of the filament itself: The longer the filament the more [motor proteins](#) can attach to it. These all move towards the 'plus end' of the microtubule and tend to pile up as they do so. Upon arrival at the plus-end they shorten the filament. In parallel, new microtubule building blocks bind to precisely the same 'plus end' through spontaneous polymerization from the surrounding [cytosol](#), and the filament grows.

It has now been demonstrated that such interplay between growth and length-dependent shrinkage indeed results in the maintenance of a

precisely regulated microtubule length. This kind of length regulation might be essential for many intracellular tasks which depend on microtubules of a certain length.

More information: Microtubule Length Regulation by Molecular Motors, Anna Melbinger, Louis Reese, and Erwin Frey, *Phys. Rev. Lett.* 108, 258104 (2012). Published online June 22, 2012

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