# Biophysical Principles of Microtubule Dynamics

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## Abstract

Microtubules are dynamic cytoskeletal polymers essential for cell division, motility, shape and intracellular transport. Remodeling of the microtubule cytoskeleton relies on precise regulation of switching between growth and shrinkage of individual polymers, behavior known as microtubule dynamic instability. We use bottom-up in vitro reconstitution approaches with purified proteins and total-internal-reflection-fluorescence microscopy to elucidate the molecular mechanisms underlying dynamic instability and its regulation. Our research showed that microtubules age: the switch between growth and shrinkage requires multiple steps, allowing for greater control of microtubule length distributions. Additionally, we identified a minimal system needed for reconstitution of physiological microtubule growth rates, never previously obtained using purified components. The acceleration of growth is achieved through collective effects of two microtubule-regulating proteins, leading to fast and dynamic microtubule behavior typically observed in cells.

## Biography

Dr. Marija Zanic is currently an assistant professor at Vanderbilt University (USA). She received her Ph.D. degree from the University of Texas at Austin in 2007. Following that, she completed two postdoctoral studies at Max Planck Institute of Molecular Cell Biology and Genetics (2008 — 2013) and Yale University (2013 — 2014), respectively. Zanic laboratory is interested in the dynamic behavior of the microtubule cytoskeleton. They use a multidisciplinary approach to investigate the microtubule dynamic instability by combining biochemical in vitro reconstitution, single molecule studies, quantitative image analysis and theoretical modeling. Dr. Marija Zanic has received a number of awards including: Searle Scholars Award (2016 — 2019) and Career Development Award (2014 — 2017, Human Frontier Science Program).