Review of: "Measurements and simulations of microtubule growth imply strong longitudinal interactions and reveal a role for GDP on the elongating end"

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The article by Cleary et al. “Measurements and simulations of microtubule growth imply strong longitudinal interactions and reveal a role for GDP on the elongation end” quantitatively addresses the role of GTP hydrolysis (GTPase activity of beta-tubulin) and the effect of GDP-tubulin on microtubule growth behavior. The in vitro growth rate and fluctuation were compared in two situations, with GTP (both GTP- and GDP-tubulin presence) or non-hydrolysable GTP analog GMPCPP (solely GTP-tubulin). The interference reflection microscopy allowed long time-lapse recording, sub-pixel tracking of microtubule ends, and improved time resolution and S/N ratio. The obtained dynamics was recapitulated by computer simulations. Without GTP hydrolysis (in the presence of GMPCPP), microtubule growth is slow and stable, whereas it is faster and fluctuated in the presence of GTP (GTP/GDP-tubulin). In combination with simulations, GDP-tubulin poisons plus-end growth of microtubule to enhance their dynamicity and catastrophy. The purpose and concept is clear, and results are well described and supporting authors’ conclusions. This article will provide novel insights on microtubule dynamics and promote our understanding and reconsideration of the regulation of GTPase activity, GTP/GDP exchange, and GDP-tubulin dissociation rate.

Minor comments

1. The slow growth rate in the presence of GMPCPP seems to be counterintuitive. The straight conformation of GTP-tubulin promotes microtubule polymerization. Some additional explanations may be helpful to convince.

2. The computational model seems to overestimate fluctuations in the presence of GTP. Is it in a permissive range in this simulation? (although I’m not familiar to this model)