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Leading at the Front: How EB Proteins Regulate Microtubule Dynamics

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Microtubules are the most rigid of the cytoskeletal filaments, they provide the cell's scaffolding, form the byways on which motor proteins transport intracellular cargo and reorganize to form the mitotic spindle when the cell needs to divide. These biopolymers are composed of alpha and beta tubulin monomers that create hollow cylindrical nanotubes with an outer diameter of 25 nm and an inner diameter of 17 nm. At steady state concentrations, microtubules undergo a process known as dynamic instability. During dynamic instability the length of individual microtubules is changing as the filament alternates between periods of growth to shrinkage (catastrophe) and shrinkage to growth (rescue). This process can be enhanced or diminished with the addition of microtubule associated proteins (MAPs). MAPs are microtubule binding proteins that stabilize, destabilize, or nucleate microtubules. We will discuss the effects of the stabilizing end-binding proteins (EB1, EB2 and EB3), on microtubule dynamics observed in vitro. The EBs are a unique family of MAPs known to tip track and enhance microtubule growth by stabilizing the ends. This is a different mechanism than those employed by structural MAPs such as tau or MAP4.