Formins sense both force and torque during formin-dependent actin filament polymerization

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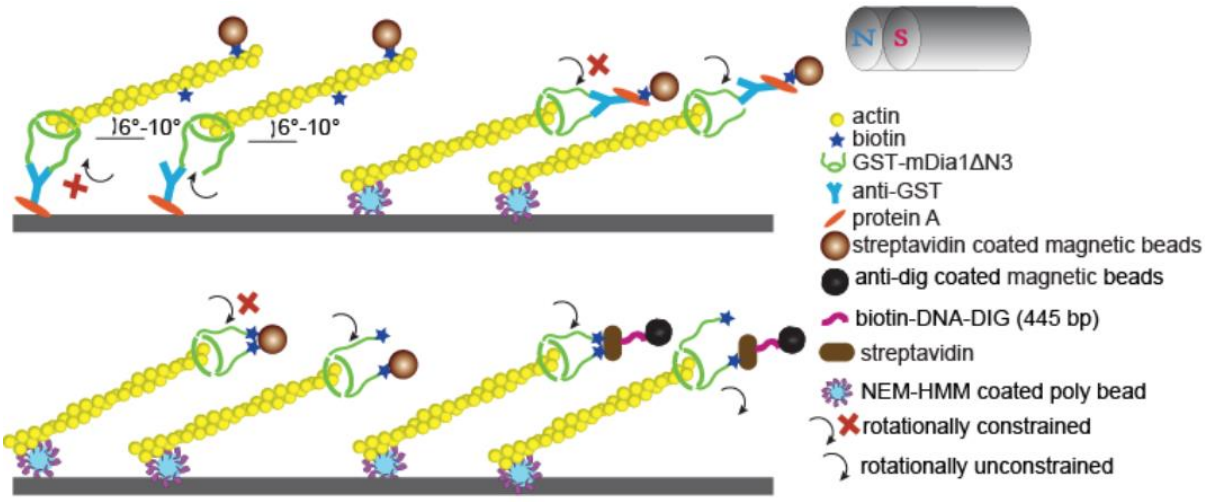
Formins, an important family of force-bearing actin-polymerizing factors, function as homodimers that bind the barbed end of actin filaments through a ring-like structure assembled from dimerized FH2 domains. In this work, we used transverse magnetic tweezers [1] to apply force to a single formin attached to a single actin filament. We found that physiological level of forces could drastically speed up the actin polymerization rate. Further, we found that this force-promoted actin polymerization required torsionally unconstrained actin filament, suggesting that formins also sense torque in the actin filament [2]. As actin filaments are subject to complex dynamic mechanical constraints in living cells, these results provide important insights into how formin/profilin-mediated actin polymerization is regulated by these mechanical constraints.



[1] Yan, J. et al. (2004). "Near-field-magnetic-tweezer manipulation of single DNA molecules." Physical Review E. 70: 011905

[2] Yu, M. et al. (2017). "mDia1 senses both force and torque during F-actin filament 2 polymerization." Under Review