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**Mechanisms of large length fluctuations during actin filament growth** MATTHEW B. SMITH, DIMITRIOS VAVYLONIS, Department of Physics, Lehigh University — Prior TIRF microscopy experiments monitoring the growth of single actin filaments have indicated that the magnitude of growth rate fluctuations, characterized by a "length diffusion coefficient" $D$, is much larger than the value expected from a simple monomer-by-monomer polymerization process. Several theoretical studies have explored mini-catastrophes or oligomeric annealing and fragmentation as sources of enhanced fluctuations. We used numerical simulations and analytical theory to examine additional mechanisms that contribute to length fluctuations. Fluctuations caused by cooperative kinetics, in which the rate of monomer addition and/or subtraction depends on the type of nucleotide bound to neighboring actin subunits exhibit qualitatively distinct dependence on actin monomer concentration and on concentration of phosphate than those caused by "short pauses." By comparing to analysis of experimental data, we show that the experimentally measured $D$ values can be distinguished from random noise. Further we propose experiments that will distinguish these sources of fluctuations. We relate our findings to other one-dimensional directed processes, such as in molecular motor walks.

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