Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Quantitative analysis of actin monomer funneling: how capping protein enhances actin filament growth and nucleation on biomimetic beads[1] RUIZHE WANG, ANDERS CARLSSON, Washington University — Capping protein (CP) caps the growing ends of actin filaments and thereby halts their polymerization. However, CP is required for actin-based motility, and experiments by Akin and Mullins [1] have shown that CP also enhances the rate of filament nucleation. Proposed explanations for these phenomena include the Actin Funneling Hypothesis (AFH) [2], in which the presence of CP increases the free-actin concentration, and structural changes of the actin networks induced by increasing CP [1]. In this article, we provide a quantitative analysis of the AFH based on rate equations including actin nucleation and branching, polymerization and capping, plus monomer depletion near the surface of the bead. With two adjustable parameters, our simulation results accurately match several aspects of the results of Akin and Mullins [1]. We find that CP increases the local monomer concentration at the bead surface, but has a much smaller effect on the global free-actin concentration. The increased local monomer concentration gives rise to an enhanced rate of branching events and thus a larger number of actin filaments. [1] O Akin and R. D. Mullins. Cell 133.5 (2008): 841-851. [2] M-F Carlier, and D. Pantaloni. Journal of molecular biology 269.4 (1997): 459-467.

[1]Supported by the National Institutes of Health under Grant GM107667.

Ruizhe Wang
Washington University

Date submitted: 13 Nov 2014 Electronic form version 1.4