Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

How ion binding affects actin filament stability and flexural rigidity HYERAN KANG, MICHAEL BRADLEY, BRANNON MCCULLOUGH, Yale University, ANAËLLE PIERRE, ENS de Cachan, France, ELENA GRINTSEVICH, UCLA, ENRIQUE DE LA CRUZ, Yale University — Actin filaments are semi-flexible biopolymers essential for the mechanical support and cell motility. Ions strongly affect actin polymerization and the flexibility of actin filaments; however, the molecular basis for how ions are coupled to the mechanics of actin filaments remains elusive. Here, we demonstrate a linkage between cation binding and both actin filament polymerization and flexural rigidity. Our results show that the thermodynamic stability and flexural rigidity of actin filament increase with cation concentration in a manner that implicates specific cation binding as opposed to general electrostatic screening. Using structural bioinformatics, we identify two distinct cation-binding sites within the F-actin structure that help explain how specific cation binding is linked to actin polymerization and flexural rigidity. Site-specific substitution of a charged amino acid residue at one of the sites modulates the cation concentration-dependence of filament bending stiffness, consistent with a bound cation at this site increasing the flexural rigidity of actin filaments. Mutation of a charged amino acid at the other site causes "polymerization incompetent" G-actin.

Hyeran Kang
Yale University

Date submitted: 15 Nov 2011 Electronic form version 1.4