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Title: Mechanical role of α-actinin in F-actin network organization studied using optical tweezers

Text: Actin binding proteins (ABPs) regulate the assembly of actin filaments (F-actin) into networks and bundles that provide mechanical support for the cell and play important roles in cellular processes such as migration and division. Using optical tweezers we probed, *passively* and *actively*, the mechanical properties of F-actin networks *in vitro* as a function of the concentration of the ABP α-actinin. For the *passive* approach we tracked the motion of a thermally fluctuating colloidal sphere to estimate the frequency-dependent complex shear modulus of the F-actin/α-actinin network. In the *active* approach, we used an optical trap to apply a driving force to an embedded microsphere and monitored the response to obtain the viscoelasticity of the network. These microrheology results were compared to the bulk rheological properties measured by a stress-controlled, parallel-plate rheometer. Shear moduli for the three methods at a fixed frequency (~1Hz) varied by over an order of magnitude. Also, the dynamic behavior of α-actinin was examined by measuring the mechanical properties of the F-actin/α-actinin matrix before and after induced mechanical and/or chemical disruption. The F-actin/α-actinin network micro-structure was characterized by confocal microscopy in terms of mesh size and degree of bundling and crosslinking. Finally, the mechanical role of α-actinin in actin networks was investigated by correlating the micro-structural configuration with the mechanical properties. Support from the NIGMS is gratefully acknowledged.

Keyword: F-actin; actin binding protein; α-actinin; optical tweezers