

Thursday, October 21, 2021, 12:00pm-1:00pm

Zoom meeting ID: 962 4475 4734

Passcode: 559273



Crowding tunes the organization and mechanics of actin bundles formed by crosslinking proteins

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ABSTRACT

Fascin and α -actinin form higher-ordered actin bundles that mediate numerous cellular processes including cell morphogenesis and movement. While it is understood crosslinked bundle formation occurs in crowded cytoplasm, how crowding affects the bundling activities of the two crosslinking proteins is not known. Here, we demonstrate how solution crowding modulates the organization and mechanical properties of fascin- and α -actinin-induced bundles, utilizing total internal reflection fluorescence and atomic force microscopy imaging. Molecular dynamics simulations support the inference that crowding reduces binding interaction between actin filaments and fascin or the calponin homology 1 domain of α -actinin evidenced by interaction energy and hydrogen bonding analysis. Based on our findings, we suggest a mechanism of crosslinked actin bundle assembly and mechanics in crowded intracellular environments.