Formins determine the functional properties of actin filaments.

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Keywords: *Formin, Tropomyosin, actin, fission yeast.*

Abstract

The actin cytoskeleton executes a broad range of essential functions within a living cell. The dynamic nature of the actin polymer is modulated to facilitate specific cellular processes at discrete locations by actin binding proteins (ABPs) including the formins and tropomyosins (Tm). Formins nucleate actin polymers, while Tms are conserved dimeric proteins that form polymers along the length of actin filaments. Cells possess different Tm isoforms each capable of differentially regulating the dynamic and functional properties of the actin polymer. However the mechanism by which a particular Tm localises to a specific actin polymer is unknown. Here we show that specific formin family members dictate which Tm isoform will associate with a particular actin fialment to modulate their dynamic and functional properties at specific cellular locations. Exchanging the localisation of the fission yeast formins, For3 and Cdc12, resulted in an exchange in localisations of Tm forms on actin polymers. This nucleator driven switch in filament composition was reflected in a switch in actin dynamics, together with a corresponding change in the filament's ability to regulate ABPs and myosin motor activity. These data establish a role for formins in dictating which specific Tm variant will associate with a growing actin filament and therefore specify the functional capacity of the actin filaments which they create.