Regulation of the actin cytoskeleton in the pollen tube

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Abstract

Pollen tube growth, the process that transports the sperm cell to the ovule, is fundamental for plant sexual reproduction. The actin cytoskeleton is essential to the process of pollen tube elongation. To further understand how actin is regulated in the pollen tube, I characterized two actin regulatory proteins: profilin and plant-villin (ABP-135) from *Lilium longiflorum* . Profilin, a small actin monomer binding protein, is abundant in pollen. By a combination of rapid fixation, immunological staining and live cell analysis, I show that profilin is a soluble protein evenly distributed in the cytosol. After estimating its intracellular concentration, I elevated its concentration by microinjection to study the effect on cytoplasmic streaming and cell growth. Increasing profilin concentration by 25% resulted in half-maximal growth inhibition, while a 60% increase was necessary to half-maximally inhibit cytoplasmic streaming. My results suggest that actin polymerization is essential for tube growth, that profilin is an actin-monomer sequestering protein, capable of regulating actin's polymerization state, and that the participation of actin on growth is separable from that on cytoplasmic streaming. ^ I characterized a second actin-binding protein, originally identified as an F-actin bundling factor, which co-localizes with actin cables in the pollen tubes. It is composed of several isoforms, and is widely distributed in different plant organs. By cloning its cDNA, I identified this protein as the plant homologue of villin; these are calcium dependent severing, capping, nucleating and bundling proteins. The actin cytoskeleton may be regulated via this plant villin, which could respond directly to the calcium gradient present at the tip of the pollen tube. ^

Subject Area

Molecular biology|Cellular biology|Plant biology

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