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IN BRIEF

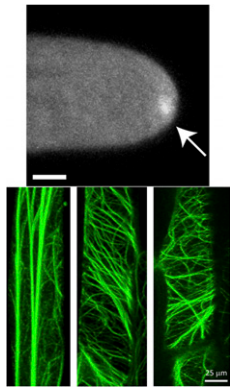
Dissecting the Functions of Class XI Myosins in Moss and *Arabidopsis*

Myosin XI strides along actin tracks at rates of up to 7 μm/s, making it the fastest known processive molecular motor (Tominaga et al., 2003). Class XI myosins are unique to plants and have been implicated in plant growth, intracellular transport, and root hair elongation (Prokhnevsky et al., 2008). *Arabidopsis thaliana* contains 13 class XI myosins, 6 of which are expressed predominantly in male reproductive tissue and the remainder of which occur in vegetative tissue. The moss *Physcomitrella patens* harbors only two myosin XI genes, myoXIa and myoXIb, and therefore is an ideal simplified system in which to study myosin XI function.

Vidali et al. (pages 1868–1882) made use of the moss system to analyze the function of myosin XI in tip growth. Using RNA interference, they silenced the expression of myoXIa and myoXIb genes in 1-week-old moss plants. Whereas silencing of either myosin XI gene had no effect on moss growth or morphology, the simultaneous silencing of both genes inhibited plant growth and disrupted protonemal tip growth and F-actin organization. Interestingly, altered cytoskeletal organization was not apparently due to a disruption of actin dynamics in the myosin XI knockdown lines. Nevertheless, these findings support the conclusion that the two myosin XI genes in moss are functionally redundant and are together essential for protonemal tip growth. Furthermore, the researchers generated a stable transgenic moss line expressing myoXIa fused with a fluorescent tag. Confocal microscopy revealed that fluorescently tagged, functional, full-length myoXIa accumulated in the tips of growing protonemal cells (Figure 1), in the same region occupied by tip-focused actin, providing additional support for a role of myosin XI in tip growth.

To determine the function of five *Arabidopsis* class XI myosins known to be expressed in vegetative tissue, **Peremyslov et al. (pages 1883–1897)** developed a series of triple and quadruple *Arabidopsis* knockouts. All of the knockouts exhibited stunted growth and delayed flowering time, and these effects were more severe in the quadruple knockouts. Quantitative measurements of pavement epidermal, spongy mesophyll, and midvein epidermal cells revealed that the reduced leaf area in the myosin knockouts was due to a decrease in both cell size and number.

Analysis of myosin XI knockouts transformed with an F-actin marker or with an endoplasmic reticulum–targeted fluorescent protein reporter pointed to a role for myosin XI-K, XI-1, and XI-2 in the proper organization of actin filaments (Figure 1) and endoplasmic reticulum networks in midvein epidermal cells. Similar to the study by **Vidali et al. (2010)** and a recent report from Ueda et al. (2010) that examined epidermal cells from the petioles of cotyledons, **Peremyslov et al. (2010)** observed that cellular architecture and the orientation of prominent actin filament cables are altered from predominantly longitudinal to random or transversely oriented in the leaf midvein epidermal cells of *Arabidopsis* myosin XI knockouts (Figure 1). Moreover, mutant cells appear to have fewer thick actin cables. Although the molecular mechanism for this change in cytoskeletal architecture was not explored, the authors speculate a function for class XI myosins in actin filament bundling or stiffening. This intriguing hypothesis begs for further experimentation using advanced imaging tools and quantitative analysis of actin dynamics parameters.



Myosin XI localizes to the tip of growing moss cells, and silencing of myosin XI genes disrupts actin organization in *Arabidopsis* midvein epidermal cells. Top, tagged myoXIa (arrow) localizes to the apex of tip-growing moss cells. Bar = 3 μm. Bottom, Knockout of three (middle) or four (right) *Arabidopsis* myosin genes disrupts the longitudinal organization of actin filaments (control; left) in midvein epidermal cells expressing an F-actin marker.

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