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The role of ARP2/3 and Scar/WAVE complexes in polar growth of the apical cell of the moss *Physcomitrella*

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The components required for moss filaments to undergo polar extension growth, and to perceive and respond to orienting vectors such as light and gravity, are localized in the single apical cell. To identify genes that function in these polar processes, the moss *Physcomitrella* patens has the unique ability among plants to undergo efficient homologous recombination. RNAi methodology is also available for this purpose. Actin microfilaments are required for these polar responses in *P. patens*. When the ARP2/3 complex member arpc4 is deleted, the null mutant (Δarpc4) is viable and clearly undergoes normal morphogenesis of filaments into leafy shoots. However, we observe a striking reduction of tip growth of the apical cell and a defect in its response to polarized white light. Insertion of YFP-ARPC4 into Δarpc4 rescues the mutant phenotypes and localizes ARPC4 exclusively to the tip of the apical cell, the site of actin dynamics and polarized extension. Using RNAi, we show that when another member of the ARP2/3 complex (i.e. ARPC1) is lacking, a similar but more severe phenotype is seen. We are able to rescue this RNAi line by ARPC1 overexpression. When BRK1(Scar/WAVE) is deleted, the resulting null mutant (Δbrk1) is viable and responds normally to polarized light. Δbrk1 completes the morphogenetic transition from filamentous growth to leafy shoots but displays a striking reduction of apical cell growth. Insertion of BRK-YFP into Δbrk1 rescues the mutant phenotypes, and localizes BRK1 exclusively to the tip of the apical cell. However, Δbrk1 is unable to localize both ARPC4 and the cell wall proteoglycan AGP to the tip of the apical cell. Our results are consistent with a model that the Wave/SCAR complex is required to localize Arp2/3, which is an essential component for orienting polar tip growth. Supported by the NSF (IBN-00112461).

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