

MICRORNA-DIRECTED CLEAVAGE OF *ATHB15*  
MRNA REGULATES VASCULAR DEVELOPMENT IN  
ARABIDOPSIS INFLORESCENCE STEMS

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Class III homeodomain-leucine zipper proteins regulate critical aspects of plant development, including lateral organ polarity, apical and lateral meristem formation, and vascular development. *ATHB15*, a member of this transcription factor family, is exclusively expressed in vascular tissues. Recently, a microRNA (miRNA) binding sequence has been identified in *ATHB15* mRNA, suggesting that a molecular mechanism governed by miRNA binding may direct vascular development through *ATHB15*. Here, we show that miR166-mediated *ATHB15* mRNA cleavage is a principal mechanism for the regulation of vascular development. In a gain-of-function *MIR166a* mutant, the decreased transcript level of *ATHB15* was accompanied by an altered vascular system with expanded xylem tissue and interfascicular region, indicative of accelerated vascular cell differentiation from cambial/procambial cells. A similar phenotype was observed in Arabidopsis plants with reduced *ATHB15* expression but reversed in transgenic plants overexpressing an miR166-resistant *ATHB15*. *ATHB15* mRNA cleavage occurred in standard wheat germ extracts and in Arabidopsis and was mediated by miR166 in *Nicotiana benthamiana* cells. miR166-assisted *ATHB15* repression is likely to be a conserved mechanism that regulates vascular development in all vascular plants.