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Manipulating the plant genome to increase susceptibility to *Agrobacterium*-mediated transformation

Stanton B. Gelvin
Purdue University, USA

Numerous plant genes influence susceptibility to *Agrobacterium*-mediated transformation, but until recently no gene has been identified that globally regulates susceptibility. We identified *MTF*, an *Arabidopsis* myb transcription factor that negatively regulates transformation. *MTF* is down-regulated by cytokinins secreted by *Agrobacterium*, resulting in increased transformation susceptibility. In plants, cytokinins trigger a signaling cascade mediated by a two-component phosphorelay pathway consisting of the AHKs (*Arabidopsis* histidine kinases) and the ARRs (*Arabidopsis* response regulators). *ahk3* and *ahk4* mutants show attenuated transformation, indicating involvement of these primary cytokinin receptors in transformation. Of the several ARR mutants tested, only *arr3* shows decreased transformation-susceptibility. One of the earliest transformation events is the attachment of bacteria to plant cells. In the hyper-transforming mtf mutant, one of the transcriptionally up-regulated genes is AT14a, which encodes an integrin domain-containing protein. AT14a is plasma membrane-localized and may mediate connections between the cell wall and the cytoskeleton. mtf mutants show increased bacterial attachment and transformation, whereas at14a mutants show lower *Agrobacterium* attachment and transformation. AT14a transgenic plants also show increased transformation and bacterial attachment. Thus, modulation of MTF expression via the cytokinin signaling pathway plays an important role in *Agrobacterium*-mediated transformation via increased bacterial attachment.

We identified putative MTF orthologs in the crop species rice, *Brassica napus, B. rapa, B. oleracea*, soybean, and maize. cDNAs of these putative orthologs functionally complement the *Arabidopsis* mtf1-4 mutant, whereas an unrelated myb transcription factor cDNA does not. Preliminary data indicate that RNAi directed against the rice MTF ortholog results in increased rice transformation susceptibility.

Biography

Stanton B. Gelvin received his Ph.D. from U. C. San Diego and his postdoctoral training at the University of Washington. He joined the faculty of the Department of Biological Sciences, Purdue University in 1981 where he is currently the H. Edwin Umbarger Distinguished Professor of Biological Sciences. He has published more than 150 scientific papers, including the extensively used Plant Molecular Biology Manual, and holds 13 patents. Early in his career, he was selected as a NSF Presidential young investigator. He received the Purdue University Herbert Newby McCoy Award in 2004 and was elected a fellow of the American Academy of Microbiology in 2006 and a fellow of the AAAS in 2010.

gelvin@purdue.edu