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MOLECULAR LINK BETWEEN COLD RESPONSES AND FLOWERING TIME

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Cold induces expression of a number of genes that encode proteins enhancing tolerance to freezing temperatures in plants. A *cis*-acting element responsive to cold and drought, the C-repeat/dehydration-responsive element (C/DRE), was identified in the *Arabidopsis* stress-inducible genes *RD29A* and *COR15a*, and found in other cold-inducible genes in various plants. Although C/DRE-binding factor/DRE-binding protein (CBF/DREB) has been established as a critical component during the cold-acclimation response, signaling pathways and networks are mostly unknown. To elucidate signaling pathways and networks, we generated transgenic *Arabidopsis* containing four copies of the synthetic C/DRE fused to a *GUS* reporter gene with a minimal promoter (*4C/DRE-GUS*) that responds to cold. Using genetic approach with *4C/DRE-GUS* line, we isolated *Arabidopsis* mutants exhibiting *a*ltered *c*old-responsive *g*ene *e*xpression (*acg*), and identifed ACG1 as a negative regulator of the CBF/DREB pathway. *acg1* showed the late-flowering phenotype with the elevated level of *FLOWERING LOCUS C* (*FLC*), a repressor of flowering encoding a MADS-box protein. We showed that *acg1*is a null allele of the autonomous pathway gene *FVE* encodinga homolog of the mammalian retinoblastoma-associated protein, a component of a histone deacetylase (HDAC) complex involved in transcriptional repression. We showed that plant senses intermittent cold-stress via *FVE* and delays the flowering with increasing *FLC* expression. These results suggest that dual roles of *FVE*in regulating the flowering-time as well as the stress-response to cold may have an evolutionary advantage for plants by increasing their survival rates.

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