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abiotic and biotic stress

Regulation of Freezing Tolerance and Salicylic Acid-Mediated Immunity by Arabidopsis CAMTA Transcription Factors

Arabidopsis thaliana calmodulin-binding transcription factors CAMTA1, CAMTA2 and CAMTA3 function in an additive manner to regulate the expression of genes involved in freezing tolerance and salicylic acid (SA)-mediated immunity. In the case of freezing tolerance, the CAMTA proteins act rapidly to induce genes in response to low temperature (4°C). In the case of SA-mediated immunity, the CAMTA transcription factors act to repress the expression of SA-pathway genes in healthy plants grown at moderate temperature (22°C). However, this CAMTA-mediated repression of SA-pathway genes is overcome in plants exposed to low temperature (4°C) for more than one week and in plants infected by biotrophic and hemibiotrophic pathogens. Our long-term goal is to understand the mechanisms by which the CAMTA transcription factors act as inducers and repressors of gene expression and how their activities are regulated by both rapid-acting and slow-acting cold-signaling pathways. We have found that CAMTA3-mediated repression of SA pathway genes involves action of an N-terminal repression module (NRM) that acts independently of calmodulin (CaM) binding to the CaM-binding (CaMB) domain, a finding that is contrary to current models. In addition, mutational analysis has provided evidence that the repression activity of the NRM is suppressed by action of the IQ and CaMB calmodulin binding domains responding to signals generated in response to low temperature and pathogen infection. Our results indicate that current CAMTA3 structure-function models require revision and that regulation of CAMTA3 repression activity by low temperature and pathogen infection involves related mechanisms with distinct differences.