

Gene Regulons and Regulatory Circuits Involved in Plant Cold Acclimation

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Plants vary greatly in their responses to cold temperatures. At one extreme are plants from tropical and subtropical regions such as soybean and rice, which suffer injury when exposed to chilling temperatures between 0 and 12°C. In sharp contrast, plants from temperate regions are not only chilling tolerant, but many, such as Arabidopsis and wheat, can survive freezing after exposure to low nonfreezing temperatures, a phenomenon known as “cold acclimation.” Our long range objective is to understand the genomic basis of this plant response. Much of our effort focuses on genes that are induced during cold acclimation. Recent studies with Arabidopsis have established that cold acclimation involves action of the CBF cold response pathway, a regulon of genes controlled by expression of the CBF transcriptional activators. Our current aim is to construct a low temperature “wiring diagram” of Arabidopsis that includes the identification of gene regulons and regulatory circuits that have important roles in cold tolerance. In addition, in a collaborative project funded by the NSF Plant Genome Research Program, we are determining whether the Arabidopsis CBF cold-response pathway is highly conserved in plants and whether differences in plant cold tolerance can be traced to differences in CBF cold-response pathways.