Cold-Stress Signal Transduction Pathways and Cross-Talk in *Arabidopsis thaliana*

Man-Ho Oh, Yun-Kyoung Kim, Hyun-Jung Kim, Jin-Young Park, Hyun-Jin Kim, Mi-Jin Park, Young-Min Ha, Mi-Young Yun, and Jungmook Kim

Kumho Life and Environmental Science Laboratory, Kwangju 500-712

Plants respond and adapt to environmental stresses including drought, high salinity, high and low temperature. Among these abiotic stresses, low temperature is one of the most important limiting factors in plant growth and crop yield. Low temperature induces a number of genes that encode the proteins promoting tolerance to freezing, mediated by ABA-dependent and ABAindependent pathways in plants. The *cis*-acting element called *C*-repeat/*DRE* has previously been identified responding to low temperature independently from ABA action. To investigate the signaling and network of ABA-independent pathways, the transgenic *Arabidopsis* plants were generated containing several copies of the *C/DRE* derived from *cor15a* gene with a minimal promoter fused to a GUS reporter gene. *4C/DRE-GUS* plants have been extensively characterized, showing that, while the *C/DRE* responds specifically to cold and drought stress, cross talk between the ABA-independent pathway and the ABA or salt stress signaling exits. Light was essential for cold- and drought-induced GUS expression. Induction of the *GUS* mRNA by red light and the cancellation of the *GUS* mRNA induction by far-red light with concomitant cold treatment suggest a role of phytochrome as a photoreceptor in mediating the light signaling to the cold-induced gene expression through the *C/DRE*. *4C/DRE-GUS* transgenic line was used for ethyl methane sulfonate mutagenesis to identify the signaling components by genetic approach. We have screened the mutants showing abnormal GUS expression at room temperature or under cold stress but in the absence of light, and found some putative primary mutants. In another approach, we used differential display of RT-PCR to isolate the genes induced at early time in response to low temperature and found three interesting genes encoding putative signaling components. We are currently employing a variety of reverse genetic methods to characterize the function of these components *in vivo* and *in vitro*. We have also isolated single lines of the T-DNA insertional mutants for these three components. These knock-out mutants will be useful for establishing the *in vivo* function of these components and the insights into cold signaling pathways.

(This research is supported by a grant (PF003105-03) from Plant Diversity Research Center of 21st Frontier Research Program funded by Ministry of Science and Technology of Korean government and Korea Kumho Petrochemical Co. Ltd.)