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# Microarray analysis of the salt-inducible genes and signal transduction pathway of salt stress in cyanobacteria.

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Summary

Plants and microorganisms acclimate to salt stress by regulating the expression of large numbers of genes. In the cyanobacterium Synechocystis sp. PCC 6803, a DNA microarray analysis revealed that salt stress due to 0.5 M NaCl induced genes for heat-shock proteins and the enzymes for the synthesis of an osmolyte, glucosylglycerolm and genes for proteins of unknown functions. We screened a library of mutants of all 43 histidine kinases by the DNA microarray, suggesting that five histidine kinases, namely, Hik33, Hik34, Hik16, Hik41 and Hik10 perceived and transduced salt signals to regulate gene expression. However, Hik33, Hik34, Hik10 and Hik16 acting with Hik41 regulated the expression of different sets of genes. We further screened a mutant library of response regulators, which are phosphorylated by certain histidine kinases and regulate gene expression, and found that each pairs of mutants of histidine kinase and response regulator, ΔHik33-ΔRre31, ΔHik34-ΔRre1, ΔHik16-ΔHik41-ΔRre17, and ΔHik10-ΔRre3, were involved in the regulation of gene expression under the salt stress. The mechanisms of salt signal perception of the sensors should be studied in the future and the meaning of existence of the multiple salt sensors is also interesting questions to understand the acclimation process to the salt stress conditions.

Among the salt stress-inducible genes, we picked up 30 genes for unknown proteins, which were conserved in other photosynthetic organisms, such as cyanobacteria and higher plants, and inactivated each gene. These genes might encode important proteins which have roles for acclimation of photosynthetic activity under the salt stress. We examined phenotypes of the mutants with or without salt stress and found that growth rate of a mutant of slr1674, whose expression was induced 19-fold under the salt-stress condition, was drastically retarded under the salt stress. Precursors of a subunit of photosystem II, PsbV, in the mutant cells were more accumulated under the salt stress than those in wild-type cells, suggesting that the slr1674 encodes a protein which stimulates maturation of the subunit for photosystem II under the salt stress conditions. The in vivo function of the proteins will be demonstrated in near future.