Identification and Characterization of Salt Stress-sensors in Cyanobacterium *Synechocysts* sp. PCC6803.

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Summary

Activation of the expression of particular genes is necessary to cellular adaptation to high salinity. As details of the mechanisms by which salt stress-dependent gene expression is regulated are missing in cyanobacteria, we have investigated sensory components involved in salt signal transduction pathways in *Synechocystis* sp. PCC6803. In the present study, we focused in the non-ionic effects of salt stress. By screening of histidine kinase mutants of *Synechocystis* by monitoring the expression of genes for RNA helicase, RNA-binding proteins and protein chaperons under osmotic stress conditions, we identified two membrane-bound histidine kinases as putative osmo-sensors. Histidine kinase 16 (Hik16) has seven transmembrane regions and an unusual GAF (cGMP-specific and stimulated phosphodiesterase, *Anabaena* adenylate cyclase, *E. coli* FhlA) domain, whereas Histidine kinase 33 (Hik33) contains two transmembrane regions, type P linker, leucine zipper and PAS (Per, Arnt, Sim and phytochromes) domain. Due to the differences in target genes and effects on cell growth, it was speculated that Hik16 and Hik33 belong to different signaling pathways. In addition, together with our previous data, Hik33 is proposed to sense osmotic stress and low-temperature stress, although Hik16 seems to be specific to osmotic stress. Furthermore, expressions of some osmotic stress-inducible genes were not regulated by Hik16 and Hik33. These findings indicate that multiple and complex pathways regulate osmostress-dependent gene expression in *Synechocystis*.