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Improvement of Stability and Salt Tolerance of Photosynthesis by Lipid Modification of Extrinsic Proteins

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Summary

Post-translational modification of proteins with lipid is ubiquitously found in all organisms to facilitate the attachment of soluble proteins to biological membranes. Bacterial lipoproteins are modified with lipid at their N-terminal cysteine residues and play important roles at the membrane-aqueous interface. In cyanobacteria, which perform oxygenic photosynthesis, many genes for putative lipoproteins were found in genome databases by bioinformatic analysis. However, few studies have been performed on structure of lipid modification or physiological roles of lipid modification of lipoproteins.

In this study, we found that extrinsic proteins, PsbQ and Psb27, which are bound to photosystem II (PSII) complex of the cyanobacterium *Synechocystis* sp. PCC 6803, are modified with lipid, whereas other extrinsic proteins, PsbO, PsbU and PsbV, were not modified. In PsbQ, a sulfhydryl and an amino groups of the N-terminal cysteine residue were modified with a diacylglycerol and a palmitic acid moiety, respectively, whereas the corresponding sulfhydryl group of the N-terminal cysteine residue in Psb27 was modified with diacylglycerol but the amino group was only partially modified with a palmitic acid moiety. Since extrinsic proteins in PSII are required for stabilization of manganese cluster that is the most sensitive part of photosynthesis to stresses such as salt and heat stresses, these findings suggest that the lipid modification of PsbQ and Psb27 might play important roles in the stabilization of PSII complex. We also found that lipid modification of extrinsic proteins can be genetically changed by exchanging the coding region for signal sequences among extrinsic proteins. Such changes in lipid modification of extrinsic proteins may affect stability of PSII and lead us to make salt tolerant strains of cyanobacteria.