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Replacement of Ca^{2+} by other monovalent cations in photosynthetic oxygen evolving center

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Ca^{2+} ion is an indispensable inorganic cofactor for photosynthetic oxygen evolution. Extraction of this Ca^{2+} by various treatments inhibits the capability of evolving oxygen. The function of the Ca^{2+} is still largely unknown mainly due to the limited knowledge of the location and the properties of the ligation site for Ca^{2+} as well as the structure of the Mn cluster. In this report, we have studied binding of monovalent cations (Li^+, Na^+, K^+, Rb^+ and Cs^+) to the Ca^{2+} binding site and the effect of occupation of Ca^{2+} site by monovalent cations on the properties of the Mn cluster. The following results were obtained. 1) No monovalent cations could functionally replace Ca^{2+}. 2) Monovalent cations bind to the Ca^{2+} site in competition woth Ca^{2+}. 2) Li^+ and Na^+ showed very low affinity to the Ca^{2+} site, but K^+, Rb+, Cs^+ had much higher affinity to the Ca^{2+} site, indicating that monovalent cations with an ionic radius larger than Ca^{2+} can occupy the Ca^{2+} site. 3) Occupation of the Ca^{2+} site by $K^{+,}$ Rb^+ and Cs^+ modified the oxidation potential of the S_2 state Mn cluster that showed no multiline EPR signal.

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THE ANALYSIS OF PS II REACTION CENTER USING D1 MUTANT of *Chlamydomonas reinhardtii*

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Primary photochemical process performing chemistry in the photosynthetic reaction center generates a redox power. The redox potential of the primary donor, P680, in Photosystem II (PS II) is approximately 600-800 mV highest among other types of reaction centers and ensures the oxidation of water. Thus, some special micro environment must exist in the vicinity of P680. Site-deleted mutagenesis of PS II reaction center are useful technique for studying the reaction center. The predicted ligands of P680 are Histidine 198 of D1 and D2 protein, respectively. Therefore, we modified the Glu 189 and His 190 of D1 protein in a green alga *Chlamydomonas reinhardtii*, which are proposed to be in the vicinity of P680 of PS II. For this purpose, we isolated the PS II reaction center complex by use of His-tag conjugated at the carboxy terminus of D2 protein. One mutant of the Histidine 190 showed a decrease in the activity of P680 and a blue-shift of the Qy band of PS II reaction center. The properties of other variants are also reported.

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FUNCTION OF PHOSPHATIDYLGLYCEROL IN PHOTOSYNTHESIS STUDIED BY MOLECULAR BIOLOGICAL ANALYSIS

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Thylakoid membranes are the site of photochemical reactions of photosynthesis, and are composed of proteins and glycerolipids. Although they contain galactolipid, sulfolipid and phospholipid as major glycerolipids, the specific function of each lipid in photosynthetic processes has not been understood.

In this study to investigate the function of PG in photosynthesis, we have made a mutant of *Synechocystis* sp. PCC6803 defective in phosphatidylglycerol phosphate (PGP) synthase, and compared the phenotype of *pgsA* mutant to that of wild type. The obtained *pgsA* mutant required PG for growth and other phospholipids could not support the growth of the mutant. This result demonstrates that PG is essential for growth of *Synechocystis*. Moreover, photosynthetic activities of intact cells of the *pgsA* mutant dramatically decreased when the cells grown in the presence of PG were transferred to the medium that does not contain PG. This finding suggests that PG has an important role in photosynthesis.

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Chlorophyll *d*-TYPE OXYGENIC PROKARYOTE *Acaryochloris marina* : PS II REACTION CENTER

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Oxygenic prokaryote *Acaryochloris marina* has chlorophyll *d* (Chl *d*) as a major pigment with an absorption peak at 715 nm. PSII-enriched fraction was prepared from thylakoid membrane by treatment with dodecylmaltoside. Difference spectra and the kinetics of absorption changes (ΔA) after the ns-laser excitation were measured in the PSII preparation in the presence of dibtromothimoquinone. The decrease of ΔA at 720 nm and the increase at 830 nm detected, can be assigned to the chlorophyll cation radial. The results suggest that the primary donor is made of Chl *d* in the PSII of *A. marina*.