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DISSERTATION SUMMARY

The structural and functional role of phosphatidylglycerol in *Synechococcus* PCC7942 and *Thermoshynecococcus elnogatus* BP-1

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Synechococcus PCC7942 and *Thermoshynecococcus elnogatus* BP-1, cyanobacterial strains are widely used as model organisms for studying the functional and structural aspects of oxygenic photosynthesis. These bacterial strains have a fine structured internal membrane system, the thylakoid membrane system. The thylakoid membrane is the place of oxygenic photosynthesis and has highly conserved lipid composition, which consists of mostly glycolipids and about 10% phosphatidylglycerol (PG) as the only phospholipid. PG has an improtant role in the assembly and maintenance of the photosynthethic apparatus (Hagio et al. 2000). Direct evidence for supression of the electron transfer between QA and QB was obtained by the thermoluminescence and flash-induced fluorescence measurements using a *pgsA* mutant cell line of *Synechocystis* PCC6803 (Gombos et al. 2002). Additionally, it was demonstrated that PG has a primary role in the PSI trimerization process (Domonkos et al. 2003).

In order to investigate the functional role of PG in *Synechococcus* PCC7942 and *Thermosynechococcus elongatus* BP-1 the CDP-dicylglycerol synthase (*CdsA*) gene was chosen for further mutagenesis. CdsA protein catalyzes the first step of the PG synthesis producing CDP-diacylglycerol from phosphatidyc-acid (PA) and CTP. In the PG synthetic pathway there are two other enzymes (*PgsA* and a putaive PGP-phosphatase), that are responsible for the PG, an anionic phospholipid production in a wide variety of bacterial strains (Cronan 2003). Two approaches were used to construct the *ΔcdsA* cell lines. One method was the disruption of the target gene with controlled insertional mutagenesis, and the other technique was used to control the *cdsA* gene expression. Using a controlled gene expression system, the generation of conditionally lethal mutants is much more accessible than that of the null mutants. In our experiments the TetR regulated expression system was used in combination with the $P_{LtetO-1}$ artificial promoter sequence of the pZ vector family, based on *E. coli* studies (Lutz and Bujard 1997). The transformation of cells was carried out by the commonly used transformation method for both strains. The homologous regions were constructed by using the DNA sequence available in public databases in order to guide the recombination-based insertion onto the proper region of the chromosomal DNA. The *ΔcdsA* mutant of *Synechococcus* PCC7942 was segregated and physiologically characterized. The mutant was not able to grow without exogenously added PG to the BG11 medium. In the absence of PG, the mutant lost its viability within 10-11 days of starvation and the cells shape became extremely elongated, suggesting a malfunction of the cell divison process. The oxygen evolving activity of the mutant is drastically decreased after 5-6 days in PG depleted condition simultaneously with a decrease in the cholorophyl/phycobiliprotein ratio. This auxotroph mutant line is suitable for further analysis including DNA chip experiments, and single dye tracking experiments with fluorescent PG.

Using two strains with distinct growth conditions – mesophile and thermophile–, and with specific mutations in them, we can investigate the possible environmental effects on the photosynthetic electron transport chain, the membrane biogenesis, lipid biosynthesis and cell division characteristics.

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