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THE TEMPERATURE DEPENDENCY OF GROWTH OF A MESOPHILIC CYANOBACTERIUM, *Synechocystis* sp. PCC6803.

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At the last meeting, we reported that photosynthetic activities of a mesophilic cyanobacterium, *Synechocystis* sp. PCC6803, grown at 35°C were more tolerant to high-temperature treatments than those grown at 25°C. However, the rates of photosynthesis measured at high temperatures were quite similar in the both cells.

Here, we will report the temperature dependency of growth of this cyanobacterium and show what is the limiting factor of the growth at high temperatures. A quite unique feature of this cyanobacterium is that the rates of photosynthesis at its growing temperatures are quite similar when it was grown at 25~40°C.

The cell growth under photoautotrophic and photoheterotrophic conditions will also be compared and discussed.

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CELLULAR DISTRIBUTION OF LIPID BIOMARKER FOR THE GROWTH TEMPERATURE OF COCCOLITHOPHORIDS

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Long-chain alkenones (nC_{37}-C_{39}) and alkyl alkenoates (nC_{37}-C_{38}) are known as specific lipid biomarkers of Gephyrocapscean coccolithophorids (Haptophyceae). Recently, these molecules are frequently used as a tool for the determination of paleotemperature in geological sciences, since the number of the unsaturated bond in the molecules are dependent on temperature given during their growth and the molecule can be conserved even in the marine sediments.. Very few studies, however, have been performed to examine their physiological function. We isolated cellular organells by liquid-two-phase fractionation methods and analyzed the molecules in each fraction. Our results show that those lipid biomarkers are located in the membrane fraction and distributed widely in most membranes, such as plasma membranes, thylakoids, endoplasmic reticulums, Golgi body and coccolith-producing compartments. The number of unsaturated bonds in the molecules was well-conserved.

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COOPERATION OF NUCLEAR AND CHLOROPLASTIC GENOMES IN THE PHOTOSYNTHETIC ACCLIMATION OF *CHLAMYDOMONAS* TO HIGH TEMPERATURE

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When cells of *Chlamydomonas* were grown at moderately high temperatures, the thermal stability of the oxygen-evolving machinery of PSII increased. However, the enhancement of thermal stability was prevented by either cycloheximide or lincomycin. Thus, the synthesis *de novo* of proteins from both nuclear and chloroplastic genomes might be required for enhancement of the thermal stability of the oxygen-evolving machinery. No induction of the levels of homologs of Hsp60 and Hsp22 was observed at physiological temperatures below 35°C, at which the photosynthetic acclimation occurred, suggesting that the synthesis *de novo* of heat shock proteins might not be involved in this process.

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CHARACTERIZATION OF A CYANOBACTERIAL MUTANT SENSITIVE TO HIGH TEMPERATURE

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In order to identify genes essential for adaptation to high temperature in cyanobacteria, we isolated a mutant (SHT1) sensitive to high temperature stress from a library of insertional mutants of *Synechococcus* sp. PCC 7002. Under relatively high temperature (38°C), the growth of one mutant (SHT1) retarded significantly in compared with the wild type. In contrast, under normal temperature (30°C), SHT1 grew similarly to the wild type. This suggests that the mutated gene in SHT1 is one of the important factors involved in the tolerance of high temperature. By a plasmid rescue, we determined that SHT1 has the mutated site in the endogenous plasmid DNA (pAQ1) of this cyanobacterium. Presence of four open reading frames, ORF943, ORF64, ORF71, and ORF93 are predicted in pAQ1(1), and in the SHT1 mutant a nucleotide sequence including an additional ORF93 has been found. To examine the effect of insertion of ORF93, the mutant overexpressing ORF93 is constructed, and analyses of its thermal tolerance and protein composition are in progress.

(1) Akiyama, H. *et al.*, *DNA Res.* 5, 127-129 (1998)