

ELUCIDATION OF THE POSSIBLE PHOTORECEPTORS AND LIGHT SIGNAL TRANSDUCTION COMPONENTS FOR THE CYANOBACTERIUM SYNECHOCYSTIS SP. PCC 6803

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Introduction

Cyanobacterium *Synechocystis* sp. PCC 6803 (Syn6803) is an excellent model system for the molecular genetic study on many cellular processes such as photosynthesis, stress responses, and photosensory transduction. Among the advantages are 1) higher plant-like photosynthesis as a prokaryote, 2) ability to grow on sugars so that photosynthesis minus mutants can be easily found, 3) easiness of manipulating large number of this organism, 4) high transformation efficiency, and 5) recent publication of its genomic DNA sequence.

Syn6803 cells display a phototactic gliding movement toward light stimuli on agar plates and in liquid media. Syn6803 displays a relatively slow gliding motion. We found that the phototactic and photokinetic speeds of this cyanobacterium on agar plates and in liquid media were 5 mm/min and 15.8 mm/min, respectively, at 3 mmol/m²/s of stimulant white light. When directional irradiation was applied, the cell population of Syn6803 began to deviate from random movement and reached maximum orientation at 3 min after the onset of stimulant white light. Syn6803 showed high sensitivity to the stimulant white light of fluence rates from as low as 0.002 mmol/m²/s to 150 mmol/m²/s (Choi et al, 1999).

We also performed preliminary action spectrum test on the liquid medium using the Okazaki Large Spectrograph. The results of preliminary action spectrum test showed that Syn6803 has positive phototaxis at 560, 660, and 730 nm and negative phototaxis near 360 nm. This results demonstrated the possibility of involvement of: ① red/far red, ② yellow/green, and ③ UV/blue light receptors in this organism.

Calcium is required for the phototactic movement in Syn6803

We examined the effects of Ca²⁺ on phototaxis of the cyanobacterium using computer-assisted videomicroscope motion analysis system. When calcium ion was chelated from the motility medium by adding 0.5 mM EGTA, the photoorientation was completely inhibited, whereas the gliding speed was not so much affected. The