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REGULATION OF POSITIVE PHOTOTAXIS BY CYANOBACTERIAL TWO-COMPONENT SYSTEM

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Unicellular cyanobacterium *Synechocystis* sp. PCC 6803 is an ideal model organism for the post-genomic study because the whole genomic sequence has been determined. Cyanobacteria have evolved to adapt the environment, in particular to sense light quantity and quality for the optimal photosynthesis, by the sophisticated signaling systems referred to as the "two-component regulatory system." The two-component signal transducers contain conserved and characteristic phosphor-transfer signaling domains, named the "transmitter" and "receiver" modules. *Synechocystis* sp. glides toward or away from a light source by type IV-pili dependent phototaxis machinery. During the *in vivo* screening of transposon *5* (Tn*5*)-tagging mutants involved in motility and phototaxis, a negative phototaxis mutant was isolated from *Synechocystis* Mutant Culture Collection and identified to insert Tn*5* at the hybrid sensory kinase, sll0043. Furthermore, all disruptants of chemotaxis-like gene locus 1 (*sll0038-sll0043*) showed negative phototaxis while separate gene locus 3 (*slr0322, slr0073*) lost gliding motility. To elucidate the signal transduction of positive phototaxis, we examined protein-protein interaction between histidine kinase (HK) domain and response regulator (RR) domain using a pairwise yeast two-hybrid (Y2H) analysis. The systematic Y2H work indicates that the phototaxis signals from Sll0043-HK flow predominantly through Sll0043-RR and Sll0038-RR via Hpt2 domain of Sll0043-HK to a putative signal switch molecule, PilT2 in *Synechocystis* sp. PCC 6803. From the proteomic profiling of *sll0043* null mutant, a twitching motility protein PilT1 was over-expressed to 30% compared to wild type. Semi-quantitative RT-PCR analysis revealed that the transcript level of motility motor protein *pilT1* was increased in *sll0043* mutant whereas that of motor switch *pilT2* was dramatically decreased in mutant. Thus, it suggests that Sll0043 down-regulateds *pilT1* and up-regulates *pilT2* in *Synechocystis* sp. PCC 6803. (This research is supported by grants from KOSEF.)