C-5-14

Construction of artificial sensor to regulate gene expression in the cyanobacterium *Synechocystis* sp. PCC 6803

Misaki Kawaguchi[1] s1330329@u.tsukuba.ac.jp
Yoshihiro Shiraiwa[2] shiraiwa.yoshihir.ft@u.tsukuba.ac.jp
Iwane Suzuki[2] iwanes6803@biol.tsukuba.ac.jp

[1] Graduate School of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki 305-8572, Japan
[2] Faculty of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Ibaraki 305-8572, Japan

Keywords: Chimeric sensor; Environmental response; Ethylene; Histidine kinase

The cyanobacterium *Synechocystis* sp. PCC6803 is a model photosynthetic prokaryote, and is increasingly being recognized as a promising resource in the production of useful substances such as bioactive compounds [1] and biofuels [2], by genetic manipulations. Thus, it is inevitable that researchers will develop artificial systems to regulate gene expression.

Two-component signal transduction system is a major gene expression system in *Synechocystis*. One of the components of this system, a histidine kinase (Hik), includes two portions, a signal-input domain and a kinase domain, and linker domain between them. Substitution of the signal-input domain of a Hik with that from another Hik may alter the stimulus perceived by the former Hik to the later Hik [3].

In this study, we substituted the signal-input domain and the linker domain of SphS, a phosphate-deficient sensor, with those from ethylene sensors from *Arabidopsis thaliana*, i.e. ETR1, ETR2, ERS1, ERS2, and EIN4, to construct ethylene-responsible sensor. The activity of resulting five chimeric sensors was evaluated by the activity of alkaline phosphatase (AP), originally regulated by SphS.

Results showed that the cells carrying ERS1-SphS or ERS2-SphS did not expressed AP activity, whilst cells carrying ETR1-SphS, ETR2-SphS, or EIN4-SphS expressed AP activity under standard conditions. However, none of the chimeric constructs responded to ethylene treatment.

Then, we deleted 1 to 7 amino acid residues in the linker domain of ETR1-SphS to construct functional sensor. These linker-deleted mutants showed no responses to ethylene, but periodic changes in AP activity were shown corresponded to the number of deleted amino acids.

Currently, our experiments are focused on determining the suitable conditions under which the chimeric sensors will respond to ethylene in the cyanobacterial cells.

[1] Guerrero, F., Carbonell, V., Cossu, M., Correddu, D., Jones, PR., Ethylene Synthesis and Regulated Expression of Recombinant Protein in *Synechocystis* sp. PCC 6803, *Plos ONE*, 2012
[2] Schirmer, A., Rude, MA., Li, X., Popova, E., del Cardayre, SB., Microbial Biosynthesis of Alkanes, *Science*, 2010
[3] Shimura, Y., Shiraiwa, Y., Suzuki, I., Characterization of the Subdomains in the N-Terminal Region of Histidine Kinase Hik33 in the Cyanobacterium *Synechocystis* sp. PCC 6803, *Plant Cell Physiol.*, 2012