Functional Genetic Investigation of Dps proteins in the Cyanobacterium *Nostoc punctiforme* ATCC 29133

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In recent years, the energy crisis and climate change have become of globally great concern, along with an increased demand of energy. To reduce the greenhouse gas emissions caused by fossil fuels, alternative renewable fuels are recruited for the progressive replacement of fossil fuels. One of the most promising energy carrier is hydrogen, which is CO_2 neutral. Cyanobacteria are photosynthetic bacteria which have the ability to produce hydrogen by using light with water as the electron donor.

Nostoc punctiforme ATCC 29133 is a filamentous nitrogen-fixing cyanobacterium, during nitrogen deprivation, the vegetative cells differentiate to heterocysts, where nitrogenase reduces N_2 to NH_3 coupled by the production of hydrogen. The uptake hydrogenase then recycles the hydrogen produced in the nitrogen fixation. Both of the enzymes are oxygen intolerant and the formation of heterocyst is considered as a solution to the incompatibility of photosynthesis and nitrogen fixation (or hydrogen production). However, the cellular environment in heterocyst is still suboptimal due to the enzyme activity inhibited by reactive oxygen species (ROS) (e.g. hydroxyl radical (OH•), hydrogen peroxide (H_2O_2), etc.) generated during cellular metabolism such as respiration. The study of O_2 scavenging and protection against oxidative stress processes in heterocyst is of specific value.

A group of ferritin-like proteins named Dps (DNA-binding Protein from Starved cells) were discovered and have the ability of protecting cells against oxidative stress. By large scale quantitative proteomics, five putative Dps-like proteins - Npun_F3730, Npun_F6212, Npun_R3258, Npun_R5701 and Npun_5799 were found in *Nostoc punctiforme* ATCC 29133. Some of them are specifically expressed in heterocysts but the specific function of them are still unclear.

In this project, to study their genetic function, we made knock-outs as well as over expressed specific *dps* gene in *E. coli*, phenotypical changes of the *E. coli* cells could be observed and investigated while treated with H_2O_2. In a long-term perspective, we are aimed to produce a transgenic cyanobacteria which has optimal hydrogen productivity in the future.

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