Radek Kana's group

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Title of the project: Detection of cyclic electron flow and its protein components during stress in cyanobacteria

For how many student/s: 1

Description of the project:

Cyclic electron flow (CEF) is an important alternative pathway of photosynthetic electron transport that contributes to additional ATP generation and helps maintain energy balance under adverse environmental conditions. In cyanobacteria, CEF is considered to play a key role in acclimation to stress by supporting photoprotection, regulating redox balance, and stabilizing photosynthetic performance. Environmental changes such as high light, high salinity, or limited CO_2 availability can strongly affect the activity of CEF and may also induce changes in the organization, abundance, and localization of its associated protein complexes. These stress conditions may further influence pigment composition, membrane organization, and overall photosynthetic physiology. Preliminary observations and current knowledge suggest that stress conditions may alter not only the photochemical activity of the cells, but also the expression, localization, and assembly of proteins involved in CEF and related photosynthetic pathways. NDH-1 protein supercomplex is one of the crucial gatekeeper for cyclic electron flow.

In the proposed project, the student will investigate the response of cyclic electron flow and its associated protein components (NDH-1) in cyanobacteria exposed to different stress conditions, such as high light, high salt, or CO_2 limitation. The project will combine physiological, spectroscopic, microscopic, and biochemical approaches to characterize stress-induced changes in photosynthetic activity, membrane dynamics, pigment composition, and protein complex organization. For instance, TFP-tagged NDH protein will be visualized under confocal and the data will be calibrated to SDS-gel electrophoresis signals of ndhk antinbody.

In the proposed project the student will:

1. Cultivate cyanobacterial WT strains and TFP-NDH strain cells under control and selected stress conditions (high light, high salinity, CO_2 limitation)
2. Evaluate the basic physiological parameters of cultures using methods such as P700+ kinetics and chlorophyll fluorescence.
3. Localization and quantification of NDH protein in native cells based on confocal microscopy.
4. Quantification of amount of NDH proteins based on proteomic analysis on SDS gel electrophoresis

Requirements:

The student should be comfortable speaking and writing in English and able to understand basic scientific literature. Previous laboratory experience is welcome, but not essential. The student should be comfortable with routine laboratory tasks and careful hands-on work. The project is suitable for senior bachelor's and all master's students.