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Remodeling of photosynthetic electron transport in *Synechocystis* sp. PCC 6803 for future hydrogen production from water

Prof. Matthias Rögner

Plant Biochemistry, Faculty of Biology & Biotechnology,
Ruhr-University Bochum, Germany

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Photosynthetic microorganisms such as the cyanobacterium *Synechocystis* sp. PCC 6803 (*Synechocystis*) can be exploited for the light-driven synthesis of valuable compounds. Energetically, this is much more rewarding if photosynthetic electrons are branched-off at Ferredoxin (Fd), which provides electrons for a variety of fundamental metabolic pathways in the cell, with the Ferredoxin-NADP-Oxido-Reductase (FNR, PetH) being the main target. In order to re-direct electrons from Fd to another consumer, the high electron transport rate between Fd and FNR has to be weakened[1]. Based on our previous *in vitro* experiments, corresponding FNR-mutants at position FNR_K190[2] have now been generated in *Synechocystis* cells to study their impact on the cellular metabolism and their potential for a future hydrogen producing design cell. Out of two promising candidates, mutation FNR_K190D proved to be lethal due to oxidative stress, while FNR_K190A was successfully generated and characterized: The light induced NADPH formation is clearly impaired in this mutant and it shows also major metabolic adaptations like a higher glucose metabolism as evidenced by quantitative mass spectrometric analysis. These results indicate a high potential for the future use of photosynthetic electrons in engineered design cells – for instance for hydrogen production. They also reveal substantial differences in the interaction of proteins if characterized in an *in vitro* environment[3] in comparison with the physiological conditions of whole cells which have to be considered in remodeling processes.

References:

1. Rögner M (2013) Biochem Soc Trans 41(5), 1254-9
2. Wiegand K et al. (2018) Biochim Biophys Acta 1859(4), 253-262
3. Kothe T et al. (2013) Angew Chem Int Ed 52, 14233-14236

問合せ先:
西山佳孝（分子生物学科）