Abstract (English version)

Oxygenic photosynthesis is crucial for most forms of the life on the Earth. The splitting of water and evolution of oxygen is conducted by photosystem II (PSII), a multi-subunit pigment-protein complex embedded in the thylakoid membrane. PsbO is an indispensable subunit of PSII, bound to its transmembrane subunits from the luminal side. The main function of PsbO is to stabilise and protect Mn_4CaO_5 cluster where the water splitting occurs. However, it has probably also some auxiliary functions. These additional functions might be different for isoforms of PsbO proteins, as suggested for *Arabidopsis thaliana*, which expresses two genes encoding protein isoforms PsbO1 and PsbO2. This thesis studies auxiliary functions of PsbO with a focus on functional differences between PsbO isoforms.

We found that besides *Arabidopsis thaliana*, also many other plant species express two *psbO* genes. Interestingly, the duplication of *psbO* gene occurred many times independently, generally at the roots of modern angiosperm families. In spite of this, the PsbO isoforms differ at similar sites in the protein structure, suggesting that similar subfunctionalisation of PsbO isoforms occurred parallelly in various lineages.

Biochemical characterisation of PsbO from green alga *Chlamydomonas reinhardtii* and PsbO1 and PsbO2 from potato (*Solanum tuberosum*) showed that the PsbO proteins from evolutionary distant photosynthetic organisms are very similar regarding the secondary structure and that conformation of the β-barrel part of PsbO is influenced by pH changes.

Investigation of *Arabidopsis thaliana* mutants with various amounts of PsbO1 and PsbO2 revealed that the total level of PsbO in a plant has a major effect on the function of PSII and phenotype of the plant. However, contrary to a general opinion, we show that the particular isoform present in a plant has rather marginal effect on the photosynthetic performance, both under normal conditions and under high light. Analysis of proteome changes in mutants with low level of PsbO1 or PsbO2 confirmed this result and unravelled some unexpected consequences of the low amount of PsbO in the plants.

Based on our results, we propose that PsbO isoforms does not have fundamentally different function, but rather differ in fine modulation of some process. We hypothesise that the frequent aspartate – glutamate substitutions between isoforms might tune the pH-dependent conformational changes of PsbO that might participate in regulation of PSII activity or repair.