Extrinsic proteins of Photosystem II studied by NMR spectroscopy

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An assembly of extrinsic Psb proteins located on lumenal side of Photosystem II (PS II) serves to stabilize the Mn_4CaO_5 cluster and optimize oxygen evolution at physiological calcium and chloride concentrations. Depletion of these proteins from PSII leads to significant reduction of oxygen evolution, fast degradation of the oxygen evolving complex and ultimately to termination of photosynthetic process.[1]

Our research targets not only structures of the studied proteins, namely PsbO, PsbQ, PsbP, and CP43 (extrinsic domain), but also the dynamic interplay between these proteins, which control the gateway to the photochemical reaction center. For this purpose solution NMR is method of choice to study both geometries and dynamics of protein-protein interactions in near-native experimental conditions. Previously we determined three dimensional solution structures of PsbP[2] and PsbQ[3]. Currently we work on the assignment of the PsbO backbone. The coexistence of rigidly structured and highly mobile partially disordered regions makes this NMR assignment a challenging task as signal overlap and incomplete spectral information prevail. An optimized overexpression protocol in isotopically enriched medium of the extrinsic domain of CP43 was developed and good quality of initial NMR spectra allowed us to start with backbone. Additionally, biophysical binding assays, in particular microscale thermophoresis (MST) and bio-layer interferometry supplement classical NMR titration. NMR CEST experiments allow us to find interactions, which occur via lowly populated (“excited”) states of the Psb proteins.

[1] Roose JL et al., Planta 2016; 243(4):889.

[2] Rathner A et al., Biomol NMR Assign. 2015; 9(2):341.

[3] Rathner P et al., Proteins 2015;83(9):1677.