Investigating the role of PsbR phosphorylation in photosystem II disassembly and repair

Lauren Dome, Matt Martin, and Sujith Puthiyaveetil

Department of Biochemistry and Center for Plant Biology, Purdue University, West Lafayette IN 47907, ldome@purdue.edu

Photosystem II (PSII) is vulnerable to photodamage from reactive oxygen species generated during photosynthesis, with damage intensified under abiotic stresses such as high light, drought, and elevated temperatures. To mitigate this damage, PSII undergoes a dynamic disassembly and repair cycle, in which the PSII supercomplex dissociates into a repair-competent submonomeric form, allowing for the selective replacement of damaged subunits. Our previous work showed that core protein phosphorylation facilitates this disassembly by promoting the dissociation of peripheral antenna complexes and the monomerization of the dimeric PSII core. However, the specific roles of individual phosphorylation sites remain poorly understood. Our recent phosphoproteomic analyses have identified several novel PSII phosphoproteins, including CP47 and PsbR. PsbR, a nuclear-encoded protein, contains up to four phosphorylation sites, with serine 58 (S58) being the most abundantly phosphorylated. We hypothesize that phosphorylation of PsbR promotes the disassembly of dimeric PSII supercomplexes spanning adjacent thylakoid membranes, with potential implications for thylakoid stacking and the mobilization of PSII for repair. To investigate this, we have employed Phos-tag gel electrophoresis to identify the physiological conditions under which PsbR is phosphorylated and to determine the protein kinase responsible. We are currently generating transgenic *Arabidopsis thaliana* lines expressing phosphorylation-deficient and phosphomimetic variants of PsbR to assess the functional consequences of its phosphorylation on PSII disassembly and repair.