Protein Acetylation – an Overlooked Regulatory Mechanism of Photosynthesis?

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Cells regulate protein function at many levels spanning from the regulation of gene expression to the degradation of protein molecules. One way to rapidly and reversibly alter a protein's function is through post-translational modifications (PTMs). In the context of photosynthetic organisms, protein phosphorylation is a well-known PTM regulating both light harvesting and carbon assimilation. During recent years, however, it has become increasingly apparent that also acetylation is a widespread modification among photosynthetic proteins. Its functional significance is however only starting to unravel. In plants and green algae, tens of chloroplast proteins undergo N-terminal and Lys acetylation after their import to the chloroplast, which implies that chloroplasts must contain a functional acetylation machinery. Indeed, plants contain several proteins with a predicted transit peptide and an acetyltransferase domain that have not been functionally characterized. By screening the photosynthetic parameters of Arabidopsis T-DNA knock-out lines of the putative acetyltransferases, we discovered that one of the mutant lines (lacking a protein named NSI) had problems in the photochemical quenching of photosystem II under low light intensities. By studying the protein in more detail, we were able to show that NSI is a chloroplast localized Lys acetyltransferase that targets several photosynthetic proteins. Moreover, the presence of NSI seemed to be a prerequisite for the light dependent movement of light harvesting complex II trimers between photosystems I and II, i.e. state transitions.

Links to papers:

https://www.ncbi.nlm.nih.gov/pubmed/29967049

https://doi.org/10.3389/fpls.2018.00461

https://doi.org/10.3389/fpls.2017.00240

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