Quenching of CP47 antenna by HLIPs during PSII assembly

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The one-helix high light -inducible proteins (HLIPs) are ubiquitous pigment-binding proteins among cyanobacteria. The model cyanobacterium *Synechocystis* sp. PCC 6803 contains four HLIP isoforms, HliA-D. HLIPs are found as homo- and heterodimers in chlorophyll biosynthesis complexes (HliC/D) and PSII assembly intermediates (HliA/B/C), where they are thought to protect the complexes against oxidative damage and to funnel pigments to other nascent pigment-proteins. The 87% identical HliA and HliB are found in the PSII assembly intermediates RC47 and RCC1 in the vicinity of the inner antenna CP47, while HliB can also bind free CP47 prior to its assembly to the reaction center core. However, the exact mode of binding and mechanism of photoprotection have not been experimentally resolved. We have employed a recombinant protein approach to pull down His-HliA and His-HliB associated protein complexes and studied the structure and energy transfer within these complexes as compared to HLIP-free CP47 preparations. We show that despite their high similarity, the binding of HliA and HliB to CP47-containing complexes is mutually exclusive. In fact, both seem to preferentially form heterodimers with HliC, while HliB has also the capacity to form homodimers. In contrast, the binding of HliA to PSII assembly intermediates is fully abolished in the absence of HliC. Additionally, we show that HLIPs are able to quench light energy arriving to the CP47 antenna.