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Title of Thesis

Genetic and molecular characterization of phycobiliprotein chromophorylation in marine Synechococcus

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Abstract

As marine *Synechococcus* is a very important microorganism, not only because it is a cyanobacterial strain that is capable of making their own food via photosynthesis, but also because it is the second most abundant phytoplanctonic in the marine environment. So they have a high contribution in primary productivity. This attracts scientists to understand how these organisms acclimate to different light condition to have this broad abundance. Among different types of chromatic acclimation, marine *Synechococcus* RS9916 is capable of type IV chromatic acclimation.

The light harvesting occurs via an antenna structure PBS. Chromophore attachment is mandatory for PBS assembly, the attachment of chromophores to PBP is accomplished by two groups of enzymes: lyases, which are responsible for chromophore attachment, and lyase isomerases, which both attach and/ isomerize the chromophore. The PBS assembly requires post-translational regulation of phycobiliproteins by specific enzymes and chaperones. In this investigation, we have characterized the role of many of these enzymes as well as a putative chaperone.

The emerging results from chapter two clarified the function of MpeU as a PEB lyase-isomerase responsible for PUB attachment on PEI or, more likely, PEII. MpeU is therefore a critical enzyme for adaptation of marine *Synechococcus* to environments where blue light predominates.

Data in chapter three indicate that the absence of CpeZ leads to unassembled PBS and a decreased level of PE, which clearly demonstrates the crucial role of CpeZ in proper PBS assembly. And because this role does not appear to be as direct as other lyases (lyase/ lyase isomerase activity) and the closely related *F. diplosiphon* CpeZ was previously shown to be helping another lyase, CpeY, with chromophore attachment, there is a strong possibility that CpeZ acting as a chaperone.

Our data in chapter four demonstrate that, in green light the enzyme CpeU is required for attaching PEB at Cys-140 of MpeA. During growth in blue light, CpeU is required to attach PUB to Cys-139 of CpeA. On the other hand, my data revealed that the putative phycobilin lyase CpeY is at least partially required for the attachment of PEB to Cys-82 of CpeA in blue light as well as involved in the attachment of PEB to CpeB, perhaps at Cys-159, during growth in both blue light and green light. These data make it likely that CpeY is not involved in chromatic acclimation, however CpeU does.

The summary not more than 500 words