

Biosynthesis of fluorescent allophycocyanin alpha-subunits by autocatalytic bilin attachment.

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Abstract

Allophycocyanin (APC) is one of the phycobiliproteins expressed in cyanobacteria. Phycobiliproteins contain a covalently bound chromophore, and thus, they are valuable as fluorescent probes. Biosynthesis of a functional phycobiliprotein is achieved by a bilin attachment process between the chromophore and apoprotein. Chromophore lyases are necessary to catalyze the chromophorylation of cyanobacterial phycobiliproteins, such as C-phycocyanin, and phycoerythrocyanin. To identify the lyase that catalyzes the chromophorylation of the APC alpha-subunit (ApcA), we searched the entire genomes of two cyanobacteria, *Synechocystis* sp. PCC6803 and *Anabaena* sp. PCC 7120; however, these genomes do not appear to encode an APC-specific chromophore lyase. In this study, chromophorylated ApcA (chromo-ApcA) was obtained via a spontaneous bilin attachment reaction. The absorption and fluorescence characteristics of chromo-ApcA were similar to those of the native APC alpha-subunit. The extent of chromophore attachment to apo-ApcA was comparable to that of the lyase-catalyzed reactions for other phycobiliproteins. These results indicate that ApcA has autocatalytic bilin: biliprotein lyase activity.