How Cryptochromes Affect Arabidopsis Leaf Development:
Response to Light Fluence Rates.

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Cryptochromes (CRY) are a blue light sensing class of proteins that contain a photolyase-like domain and two chromophores, flavin adenine dinucleotide (FAD) and a pterin. In Arabidopsis there are 3 cryptochromes; CRY1 and CRY2 have been extensively studied in their roles in regulating the circadian clock, flowering time, and seedling development. CRY3 is dually localized to the plastid and mitochondrion, but its role(s) has yet to be elucidated. CRY1 and CRY2 have been shown to alter Rubisco levels in the plastid and have effects on palisade structure in leaf tissue. When the CRY gene family was examined in transcript co-expression bio-informatics software ATTED[1], substantial differences were revealed in the co-expression of various genes and gene families with individual cryptochromes. CRY1 was strongly co-expressed with genes involved in anti-oxidant activities, especially those associated with protection from high light intensity such as Vitamin E pathway Gene 5 and Lycopene Cyclase. Differentially, CRY2 was co-expressed with developmental regulators and transcription factors. CRY3 was strongly co-expressed with genes involved with photo-protective pigments in the flavonoid pathway such as Flavonol Synthase and Chalcone Synthase. I hypothesize a critical role of all three CRYs in modulating plant responses to different light intensities. In order to elucidate specific and overlapping roles of the three CRYs in this phenomenon, I propose to quantify photo-protective pigments and antioxidants, as well as examine the plastid and cellular structure of Arabidopsis *cry* mutants and over-expressers in both the Columbia and Landsberg ecotypes in relation to light intensity. Applications of this project include increasing nutritional content and altering growing conditions of crops and decorative plants.

1. Arabidopsis thaliana trans-factor and cis-element prediction database