HOW DOES PLANT RESPOND TO LIGHT: SIGNAL TRANSDUCTION AND PHOTOBIOTECHNOLOGY

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As a survival strategy to seek light for photosynthesis, all higher plants display an avoidance response to shade and darkness, so-called *shade avoidance response*.. The shade avoidance is particularly prominent in plants growing under the densely self-shading conditions. In this lecture, the structure and function of phytochromes for the suppression of shade avoidance response of plants will be discussed. Phytochromes (phy) are plant's red/far-red light-responding photoreceptor for the suppression of shade avoidance and many other photomorphogenetic phenomena. The light-induced Pr?Pfr phototransformation of phytochromes triggers subtle conformation changes in the apoprotein. The "light signals" thus stored are subsequently transmitted to the regulatory motifs of the C-terminal domain through as yet ill-defined inter-domain cross-talks. The cross-talks elicit activation of the C-terminal domain to prepare its interactions with phy-interacting proteins such as NDPK2, PIF3, PKS1, etc. Phytochrome phosphorylation may serve as a molecular switch to modulate the inter-domain cross-talks. The shade avoidance response is a general photomorphogenic response of all higher plants to red/far-red wavelength lights. Recently, we have shown that a dark-induced small G-protein, pea Pra2, regulates a novel cytochrome P450 that catalyzes C-2 hydroxylation in brassinosteroid biosynthesis [Kang *et al.*, *Cell*, 105:625-636, 2001 and unpublished results]. I will discuss how the light sensing properties of plant phytochromes can be targeted for biotechnological applications by illustrating the genetic engineering of turf grass. The genes introduced led to the suppression of the shade avoidance, thus requiring less frequent mowing and irrigation for healthier grass plants.