

Analytical study on signal transduction pathways and mechanism of movement in chloroplast photorelocation movement

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【 Outline of survey 】

Chloroplasts move towards light to maximize photosynthetic activity by absorbing light efficiently (accumulation movement). On the other hand, they move away from strong light to minimize photodamage of chloroplasts (avoidance movement). We have clarified the photoreceptors of these responses as phototropin2 (phot2) for blue-light-induced avoidance response, phot1 and phot2 for chloroplast photo-accumulation responses. We also found that the red light-induced chloroplast photorelocation movement in fern is mediated by phytochrome3 which is a chimera photoreceptor made of phytochrome chromophore-binding region in N terminus and a full length phototropin in C-terminus. However, signal transduction pathways and the mechanism of chloroplast movements are not well understood. We will investigate the signal transduction pathways using Arabidopsis mutants that are deficient chloroplast photorelocation movement probably by defect of elements in signal transduction pathways. We also analyze chloroplast movement itself using another mutants in Arabidopsis. We will also use fern gametophytes as a good model system for analyzing signal transduction of phototropins and chloroplast movement photobiologically and cell biologically.

【 Expected results 】

We have already cloned and sequenced several genes involved in chloroplast photorelocation movement from Arabidopsis mutants that we have selected by ourselves. We will be able to clarify the function of these proteins in chloroplast movement, and moreover we will be able to find binding partners of phototropins and others factors that are necessary for the signal transduction pathways. We also may find the mechanism how chloroplasts move and how chloroplasts decide the direction to move. Overall, we may give an answer on almost all mechanisms of chloroplast photorelocation movement from photoperception to the movement of chloroplasts.

【 References by the principal researcher 】

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Responses of ferns to red light are mediated by an unconventional photoreceptor.

Nature 421:287-290, 2003

【 Term of project 】 FY 2004 - 2008

【 Budget allocation 】 80,200,000 yen

【 Homepage address 】

<http://chloroplast.biol.metro-u.ac.jp/> webpage/