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Dynamic molecular responses of plants to photon

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Plants exhibit, as sessile photosynthetic organisms, particularly plastic development and growth response to their ever-changing environmental conditions. This is in part achieved by formulating and integrating the dynamic properties of light signaling components including photoiomserization, nucleo-cytoplasmic partitioning, nuclear body formation, dynamic protein complex, and propagation of gene regulatory networks. We are interested in understanding the role of various dynamic properties in light signal processing.

The nucleocytoplasmic distribution and photoisomeration of phyB is a crucial mechanism for light signaling transduction. We discovered that Pr and Pfr photoisomers of phyB have opposite roles in light dependent BR responses and that phyB exerts clearly distinct effects in these responses depending on the cellular localization. To investigate the dynamic combinatorial complexes of phytochrome B under different light conditions, we are characterizing phyB interactomes and found that their composition may be dynamically changed dependent on the photophysiological status of phyB.

The circadian clock is one of biological apparatuses featured with dynamic molecular responses to environmental light. With the aim of understanding dynamic properties of circadian clock, we are characterizing function and dynamics of clock-related genes and are analyzing the response kinetics of clock components to arbitrarily induced expression of clock genes driven by a chemically inducible promoter. We discovered that a new clock gene. FIONA1, controls the circadian period mostly. We will also present our progresses on the induction kinetics of the clock genes.

While depicting the photon responses has been mostly static, we anticipate that this new views of systems and dynamics level of researches will provide important clues to understand new principles on how plants accurately and delicately process their environmental light information.