

【Grant-in-Aid for Specially Promoted Research】

Biological Sciences



Title of Project : Molecular Mechanism of Florigen Action and Application of Florigen in Crop Improvement

Ko Shimamoto

(Nara Institute of Science and Technology, Graduate School of Biological Sciences, Professor)

Research Area : Plant molecular genetics, Plant physiology, Plant breeding

Keyword : Florigen, Rice, Genes, Bioimaging, Structural biology, Gene targeting

【Purpose and Background of the Research】

Florigen is a molecular switch for flowering in plants, which is generated in leaves and moves up into the shoot apex to initiate flowering. The molecular nature of florigen has been unknown for over 75 years; however, our recent study showed that the protein encoded by *Hd3a/FT* gene is florigen (Tamaki et al, *Science*, 2007). Hd3a is expressed in leaf vasculature, then transported into shoot apex to induce flowering in rice.

Most recently we have demonstrated that Hd3a florige protein forms a protein complex with 14-3-3 protein and OsFD1, a transcription factor important for flowering in rice. The hexamer containing two proteins each of these three components is termed Florigen Activation Complex (FAC) and we determined its crystal structure (Figure 1, Taoka et al., *Nature*, 2011a)

We demonstrated that Hd3a can induce potato tuber formation as a mobile tuberization signal (collaboration with Dr. S. Prat, Spain, Navarro et al., *Nature*, 2011b). This finding will provide an unexpected function of florigen as the diverse developmental cue beyond flowering.

We plan to study two objectives; 1) identify molecular mechanisms of florigen function, and 2) study crop productivity by controlling florigen activity.

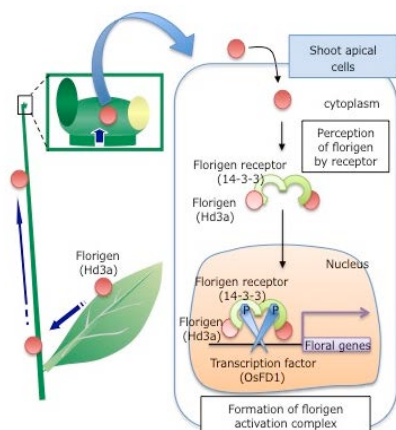


Figure 1 Model of florigen function

【Methods】

1. Analysis of molecular mechanisms for florigen activation complex function by biochemical and molecular genetic strategies.
2. Analysis of vegetative to reproductive phase transition in the shoot apical meristem by next generation sequencing technologies and live imaging.
3. Studies of crop productivity by manipulating florigen expression and activity by gene targeting.

【Expected Research Achievements and Scientific Significance】

A major challenge is to study molecular mechanisms by which florigen is transported into shoot apex and induces floral phase transition in shoot apical cells. This will open up the new research field of plant biology such as the regulation of plant development through mobile protein signal.

Our recent findings indicate that florigen controls diverse developmental events beyond flowering. Thus, we will study how florigen exerts this interesting multi-functional cellular activity and try to apply it for crop improvement in the future.

【Publications Relevant to the Project】

- Taoka, K.-I., et al. (2011a) 14-3-3 proteins act as intracellular receptors for rice Hd3a florigen. *Nature*, 476:332-335.
- Navarro, C. et al. (2011b) Control of flowering and storage organ formation in potato by FLOWERING LOCUS T. *Nature* 478:119-122.
- Tamaki S., et al (2007) Hd3a protein is a mobile flowering signal in rice. *Science* 316:1033-103.

【Term of Project】 FY2012-2016

【Budget Allocation】 438,000 Thousand Yen

【Homepage Address】

<http://bsw3.naist.jp/simamoto/simamoto.html>