

【Grant - in - Aid for Scientific Research on Innovative Areas(Research in a proposed research area)】

Biological Science



Title of Project : Multidimensional Exploration of Logics of Plant Development

Hirokazu Tsukaya

(The University of Tokyo, Graduate School of Science, Professor)

【Purpose of the Research Project】

The fundamental mechanisms of plant development are not yet fully understood. In this project, we will delineate the systems that coordinate intercellular and intracellular signals, the functions of key differentiation genes, and the control of metabolism.

We will combine the efforts of nine research groups and four supporting facilities/teams using multiple model species. The four supporting facilities/teams will provide assistance in metabolomics, the use of an *Arabidopsis thaliana* transcription factor library, the application of *Marchantia polymorpha* as a model system, and mathematical modeling. The multidisciplinary collaborative approach will enable us to explore new research directions in unprecedented ways.

To achieve our goals, intimate collaboration between all research teams will be given the highest priority with an emphasis on intergroup communication through periodic progress reports. Communication of our results to the general public and the training of young scientists will also be given substantial attention to ensure that Japan has a solid position in this challenging field of research.

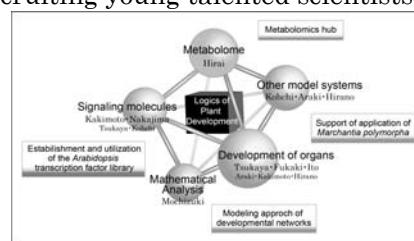
【Content of the Research Project】

This research project aims to revolutionize the field of developmental biology through new concepts and a research style that is expected to produce breakthroughs for the understanding of fundamental logics of plant development. The leaders of the nine research groups will work closely together as a team with emphasis on the following objectives:

- 1: Analysis of individual plant organs given the hierarchical nature of plant development.
- 2: Molecular genetics with a focus on signaling peptides, small RNAs, and transcription factors.
- 3: Transfer of our discoveries to other model systems such as rice and *M. polymorpha*.
- 4: A metabolomics-based approach to find links between metabolism and development.
- 5: Mathematical modeling of complex networks

to discover axial pathways.

Also, by recruiting young talented scientists and organizing workshops and an online forum, our challenges will create



a new era of discovering novel developmental concepts: logics.

【Expected Research Achievements and Scientific Significance】

The nine core research groups with diverse interests and backgrounds and the four supporting facilities/teams of this research project will provide unparalleled expertise to decipher the fundamental mechanisms of plant development. Our expectation is for pioneering achievements that will have a significant impact on the field of developmental biology.

In the mid and long term, our findings will go beyond basic science to provide new tools and a conceptual vision for achieving increased crop yields through improvements in agronomics, horticulture, and other applied biological and environmental fields. In this way, the contributions of our research will be deeply meaningful for both the basic understanding of plant biology and for applications with practical benefits.

【Keywords】

Marchantia polymorpha: A liverwort model species. Phylogenetically, a basal land plant species with very limited gene duplication, a simple body plan, and easy methods for gene targeting.

Metabolomics: A research technique to analyze and quantify metabolites of a given organism.

【Term of Project】 FY2013-2017

【Budget Allocation】 1,210,000 Thousand Yen

【Homepage Address and Other Contact Information】

<http://logics.plantdev.biol.s.u-tokyo.ac.jp/>
tsukaya@biol.s.u-tokyo.ac.jp