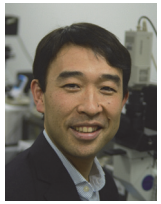
【International Leading Research】

Key-Molecule-Network in Plant Reproduction



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Project Information	Project Number : 22K21352 Project Period (FY) : 2022-2028 Keywords : molecular science, big-data science, young international PIs

Purpose and Significance of the Research

●Integrating functional molecular science in laboratories and big-data science in fields to elucidate key-molecule-network in plant reproduction

Plants foster diverse ecosystems by expanding into various environments on the earth. The evolution of reproductive systems has been essential for their expansion into different environments. However, as recent years' crop failure shows, plant reproduction cannot withstand recent drastic changes caused by global warming, such that understanding plant reproduction is an urgent need.

Plant reproduction consists of many steps involving various mechanisms: the shift from vegetative to reproductive growth, formation of sex organs and germlines, interaction between gametophytes, fertilization, and seed development. Key molecules with specific and essential functions exist at each step, and when they function one after another like opening multiple locks: they open the door for the birth of the next generation, in which the genomes of male and female parents are appropriately mixed to make new combinations. The network consisting of key molecules is referred here as the "key-molecule-network". The key-molecule-network changes during evolution, adaptation, and breeding, and it also changes flexibly in fluctuating environments in nature.

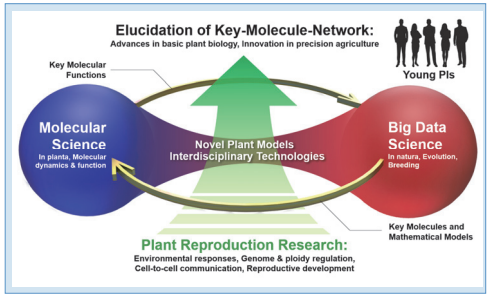

Fig.1 Project Overview

Plant reproduction research is among the top leading plant science areas. Particularly, it has shown significant progress in 1) functional molecular science and 2) big data science. Molecular action mechanisms and plant systems driven by the natural environment are becoming clearer. However, examples of the connection between them are still scarce. To elucidate the "key-molecule-network," we promote the identification of more key molecules and biological systems by large-scale research that integrate these two fields (Fig. 1). We will focus on four critical biological issues (Fig. 2) and set up seven technology units for tight networking and interdisciplinary research.

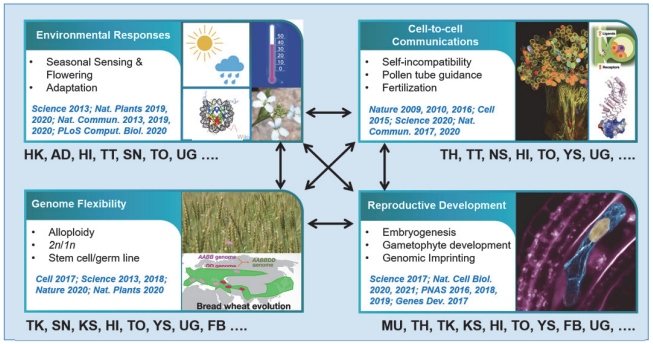

Fig.2 Four biological subjects and networking

Organization of the Project Team

●International interdisciplinary research through strong collaboration, bringing together top researchers from Japan and Europe

This project brings together top Japanese and European researchers in related fields who have been already collaborating partially (Fig. 3). Ten Japanese leading researchers having tight connections with the European researchers will participate as PIs and Co-PIs. From Europe, 21 leading researchers from eight research institutions in six countries will participate, with the University of Zurich in Switzerland as the main hub, under strong partnerships between the University of Zurich with Japanese universities including the University of Tokyo and Kyoto University. In addition, a Director and a Vice-Director with strong leadership will be assigned to Japan and Europe, respectively, in order to promote the project in tight cooperation with Japan.

Overseas core institutes of this project include the University of Zurich (rep, Dr. Grossniklaus (Vice-Director)), John Innes Centre in UK (rep, Dr. Dodd), and Gregor Mendel Institute in Austria (rep, Dr. Berger).

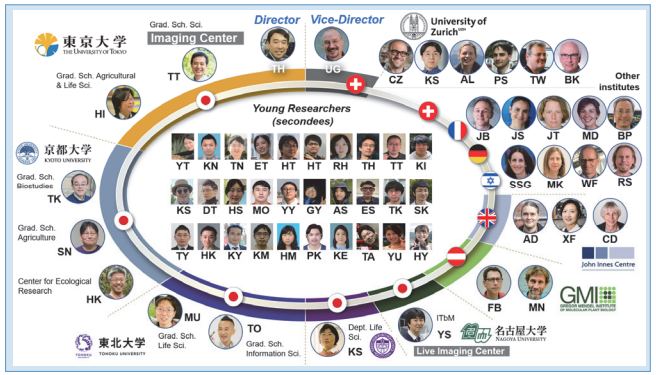

Fig.3 Project organization

Plan for Fostering Early-career Researchers

●Three key strategies to foster early career researchers

Every year, approximately 30 students and post-doctoral researchers will participate in this research organization network with independent research projects and will conduct research as independently as possible but within a strong mentoring structure fostering excellently trained future PIs. We emphasize three key strategies to foster early-career researchers: 1) networking, 2) interdisciplinarity, and 3) challenge (Fig. 4).

Networking is a major driving force to make students and post-doctoral fellows young independent-minded, active, and PI-oriented. Interdisciplinarity is best suited for students and post-doctoral fellows with high absorptive capacity, giving them the ability to overcome barriers and opportunities for career development. Challenge is the key to becoming a PI. An in-house grant system will be set up within the project, and the proposed projects will be reviewed for priority budget allocation with an emphasis on interdisciplinary fusion, on the condition that the research is conducted in collaboration with overseas researchers. Even if the proposed project is not selected, feedback will be provided on what was lacking, to encourage improvement and further the development of young scientists.

Fig. 4 Three key strategies

Homepage Address, etc.	Under construction (the homepage will be launched in the first half of this year 2023)