Department of Agrobiological Resources

Laboratory of Plant Molecular Genetics

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TEACHING	Biological Chemistry I Plant Systematic and Morphology Advanced Molecular Genetics (MC)	Cell biology Breeding science Advanced Molecular genetics (MC)

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Exploration of genes involved in plant development and production

Plants contain tens of thousands of genetic blueprints called “genes” involved in the biological processes that contribute to the growth of plant cells. Coordinated application of blueprints allows plants to grow, mature, and produce seeds at the end of their life cycle. Fully developed plant organs, such as tuberous roots, stems, leaves, and seeds, are used as food sources. Individual plants have their unique set of blueprints, which partially differ among plants. Whether a blueprint is associated with good farm productivity depends on the information contained in the blueprint of each plant.

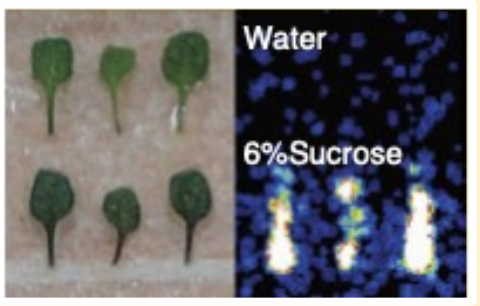
The recent progress in molecular biology and genetics has led to the introduction of techniques to decode the information contained in a gene. The techniques yield information about the product of a genetic blueprint, the part of the plant in which the product performs its functions, the chief function of the product, and the capacity of the product to carry out its functions. Depending on the information, a plant with superior traits and an ideal combination of genes could be selected to increase the agricultural output.

In the future, the population and demand for energy are thought to increase worldwide. We think that studies on plant production are needed to solve these problems. Therefore, we study the functions of individual genes in plants in an attempt to search for useful genes.

Research projects

1 Regulation of plant gene expression by sugar

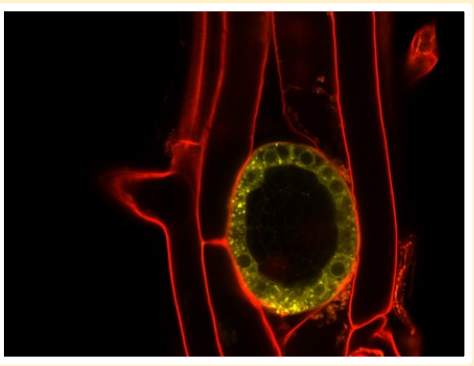
The main aim of agricultural production is to develop foods containing starch, lipids, and proteins. Thus, clarification of the mechanisms underlying the accumulation of these products in seeds or tuberous organs is very important. To address this problem, we focus on the analysis of plant genes whose expression was regulated by different concentrations of sugar.



Emission of light by leaves of a transgenic plant under conditions of high sugar concentrations.

2 Regulation of plant root development

Robust development of the root system architecture, which consists of primary root and lateral root system, is an important aspect in the growth of plants due to their sessile nature. Using imaging, transcriptome, and DNN analysis, we focus on the transcriptional network which regulates root growth. We also study signal transduction other than plant hormones, such as Reactive Oxygen species and lipids.



Expression of YFP fused protein that shows specific expression pattern in the epidermis of a lateral root primordia

Recent publications
- Inagaki S., Morikami A., et al. (2006). Arabidopsis TEBICHI with Helicase and DNA Polymerase Domain is Required for Regulated Cell Division and Differentiation in Meristem. *Plant Cell*, **48**, 879-892.
- Tsukagoshi H., et al. (2010). Transcriptional Regulation of ROS Controls Transition from Proliferation to Differentiation in the Root. *Cell* **143**, 606-616.
- Mabuchi K., et al. (2018). MYB30 links ROS signaling, root cell elongation, and plant immune responses. *Proc. Natl. Acad. Sci. USA.* **115**, E4710-E4719.
- Maki H., et al. (2019). ANAC032 regulates root growth through the MYB30 gene regulatory network. *Sci. Rep.* **9**, 11358.
- Mase K., & Tsukagoshi H. (2021). Reactive Oxygen Species Link Gene Regulatory Networks During Arabidopsis Root Development. *Front. Plant Sci.* **12**, 660274.