Shinozaki Research Collaborative Group

Plant Molecular Biology Laboratory

Kazuo SHINOZAKI
Chief Scientist, Director of Plant Molecular Biology Laboratory

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Goal

Plants differ in various ways from animals and have inherent capabilities that animals do not have, such as plant-hormone-mediated regulation, responses to various environmental stresses, light regulation, and high-efficient totipotency.

Our research group is studying functions of plant genes using various mutants (T-DNA/transposon insertional mutants and enhancer-tagged mutants) of Arabidopsis thaliana. This group is interested in plant genes involved in environmental stress responses and tolerance, plant hormone responses, seed development and germination. This group aims to understand complex systems that are involved in the regulation of gene expression and cellular signal transduction in response to environmental stimuli in higher plants. It also contributes to collection of useful resources for basic biology and biotechnology through these research and development.

Activities

1. Analysis of plant genes by using insertional mutatant and enhance-tagged mutant
2. Development of reduction- of - function - type transgenetic plants by using RNAi and antisense technology
3. Analysis of plant genes involves in response to plant hommoros, sead development and germination

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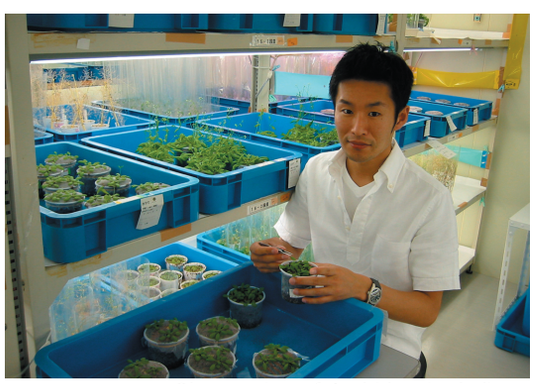
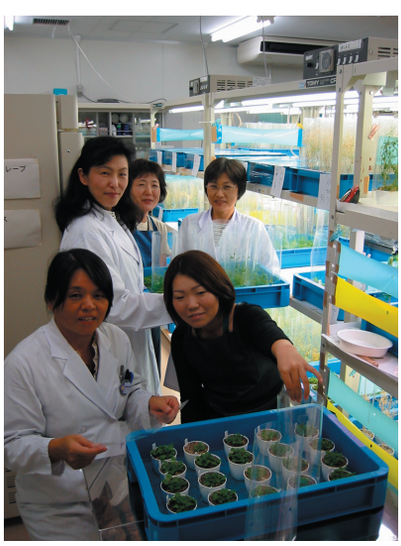
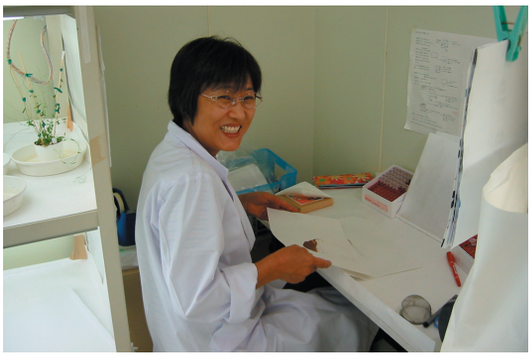


Observation of Arabidopsis thaliana



Supporting staff



Harvesting seeds of Arabidopsis thaliana.

Specific aim

I. Analysis of plant genes by using insertional mutants and enhancer-tagged mutants.

Using transposon-tagged or T-DNA-tagged Arabidopsis mutants with knock-out genes, we analyzed functions of various plant genes. We observed phonotypic changes of the mutants and analyzed the function of disrupted genes.

II. Development of reduction-of-function-type transgenic plants by using RNAi and antisense technology.

We tested various introns in the hairpin region of hairpin-loop RNAi constructs to improve the efficiency of gene silencing. Using RNAi (RNA interference) and sntisense transgenics technology, we analyzed functions of plant genes involved in gene expression and signal transduction in Arabidopsis plant.

III. Analysis of plant genes involved in responses to plant hormone, seed development and germination.

We are interested in plant genes involved in environmental stress responses and tolerance, plant hormone responses, seed development and germination. We used these mutants and transgenic plants to analyze complex systems involved in the regulation of gene expression and cellular signal transduction in response to environmental stimuli in higher plant, we used various mutants and transgenic Arabidopsis plants.

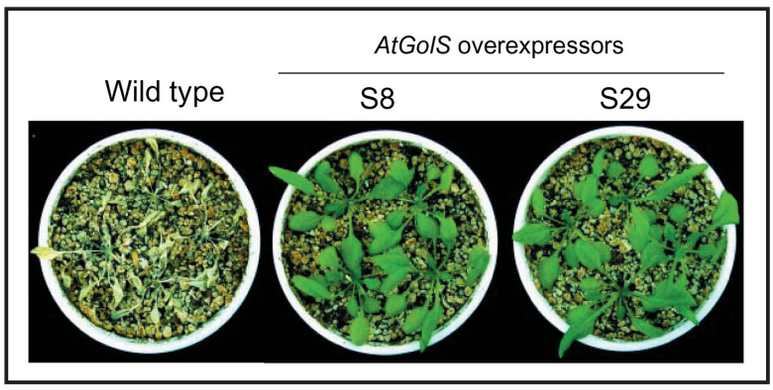


Figure 1.
Drought tolerance of transgenic Arabidopsis plants that overexpress galactinol synthase (AtGOlS).
(14 days dehydration) Raffinose and galactinol are involved in drought stress tolerance. (Taji et al., (2002) Plant J.)

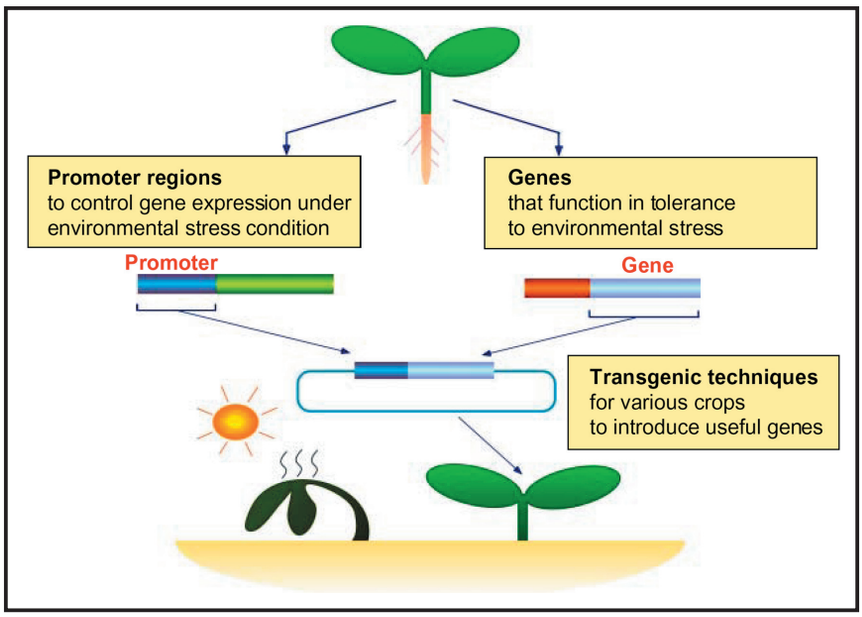


Figure 2.
Strategies to develop transgenic tolerance to environmental stress in plants. Combination of genes involved in stress tolerance and stress are important for molecular breeding of drought, salinity and cold stress tolerance.

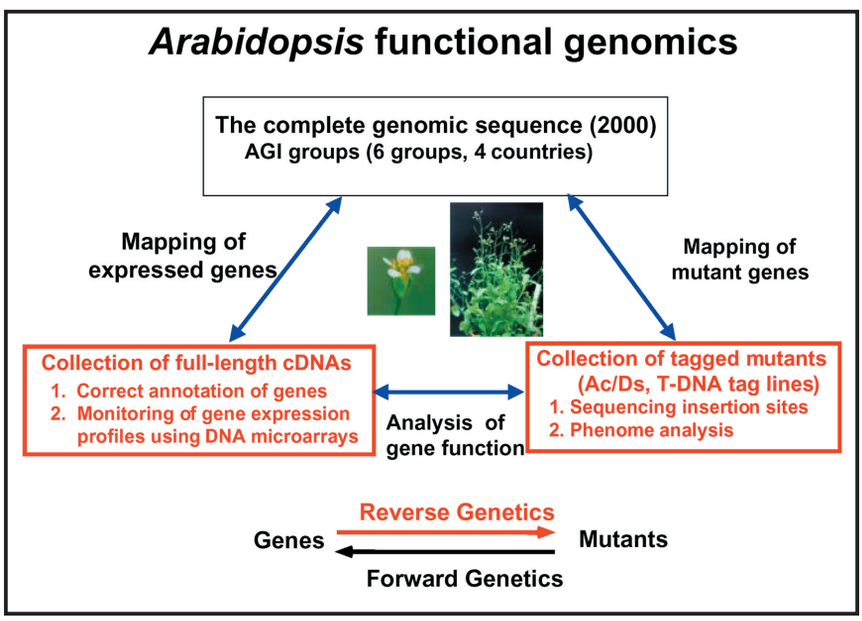


Figure 3.
In systematic analysis of Arabidopsis genome functions, it is important to collect both full-length cDNAs and tagged mutants. We have collected 18,000 full-length cDNAs from Arabidopsis, 70,000 T-DNA tagging mutant lines and Ds tagging lines and deposited to RIKEN Bioresource Center for the distribution of the resources for plant scientists.

Publications

Original Papers (*Peer reviewed Journal)

1. Takahashi S., Katagiri T., Hirayama T., Yamaguchi-Shinozaki K. and Shinozaki K.: Hyperosmotic stress induces a rapid and transient increase in inositol 1,4,5-trisphosphate independent of abscisic in Arabidopsis cell culture, Plant Cell Physiol., 42, 214-222 (2001). *

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Oral Presentations

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