

## 【Grant-in-Aid for Scientific Research (S)】

### Broad Section G



Title of Project : Molecular dissection of peptide signaling in plants

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Keyword : Peptide hormone, Receptor, *Arabidopsis*

#### 【Purpose and Background of the Research】

Identification of hormones and their receptors in multicellular organisms is one of the most exciting research areas leading to breakthroughs in understanding how their growth and development are regulated. In particular, peptide signals offer advantages as cell-to-cell signals in that they have the most diversity in structure and function. Our goal in this project is to uncover the mechanisms by which plant development is regulated through identification of novel peptide signals and their receptors by using genome information, biochemical analysis and phenotypic observation.

#### 【Research Methods】

Identification of novel peptide hormones by *in silico* screening:

By using *Arabidopsis* protein database, we will perform *in silico* screening of peptide hormone candidates based on the structural characteristics of the known peptide hormones. After structural elucidation by LC-MS/MS, we will identify receptors for peptides by exhaustive binding assay using receptor kinase expression library. Once we identified peptide ligand-receptor pairs, we will analyze their physiological roles in detail.

Ligand fishing using immobilized receptors:

We will use receptor-immobilized column to directly purify specific ligands in one step from the crude samples. We employ this approach to determine natural structures of peptide elicitors involved in disease resistance of plants.

Phloem-specific long distance mobile peptides:

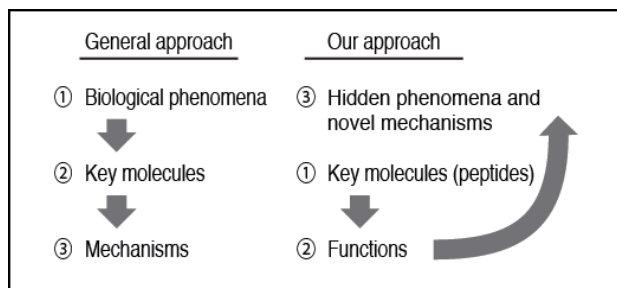


Figure 1 Outline of our experimental approach

Based on the tissue-specific microarray data, we have obtained several non-secreted peptides that show phloem-specific expression in leaves. They are strong candidates for shoot-to-root long distance mobile peptides. We will analyze their functions by combination of reverse genetics and biochemistry.

#### 【Expected Research Achievements and Scientific Significance】

Ligand-receptor pairs act as master switches of complex intracellular signaling that directly regulates plant growth and development. Molecular dissection of these signaling pathway greatly promote our understanding of plant growth mechanisms under fluctuating natural environment. Moreover, these signaling pathways are attractive targets for the development of novel plant growth regulators.

#### 【Publications Relevant to the Project】

- Tabata R., Sumida K., Yoshii T., Ohyama K., Shinohara H., Matsubayashi Y. Perception of root-derived peptides by shoot LRR-RKs mediates systemic N-demand signaling. *Science* 346, 343-346 (2014)
- Ohkubo Y., Tanaka M., Tabata R., Ogawa-Ohnishi M., Matsubayashi Y. Shoot-to-root mobile polypeptides involved in systemic regulation of nitrogen acquisition. *Nature Plants* 3, 17029 (2017)
- Nakayama T., Shinohara H., Tanaka M., Baba K., Ogawa-Ohnishi M., Matsubayashi Y. A peptide hormone required for Casparian strip diffusion-barrier formation in *Arabidopsis* roots. *Science* 355, 284-286 (2017)

【Term of Project】 FY2018-2022

【Budget Allocation】 148,100 Thousand Yen

#### 【Homepage Address and Other Contact Information】

<http://www.bio.nagoya-u.ac.jp/~b2/research4.html>