Laboratory of Plant Development
Graduate School of Science

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Formation of multicellular plant body is a self-organization processes that depends on genetic information. We are investigating the mechanisms of plant morphogenesis and development.

Lateral root formation

The first step of lateral root formation is spontaneous formation of auxin peaks in the pericycle and asymmetric cell division in response to auxin. We have identified dimers of bHLH transcription factors (PFA/PFB) that govern these unique features of pericycle (Figure 1). We are examining how these bHLHs confer stem-cell like features of the pericycle. We are also working on how primordial pattern formation is initiated by intercellular communication.

Vascular formation

The vascular system consists of a regular arrangement of xylem, phloem, and intervening procambium cells. We investigate transcription factors and intercellular signaling molecules that create the vascular cell pattern.

Growth regulation in response to environmental stresses

Plants live in changing environments with a variety of stresses, including drought, temperature, nutrient environments, and pathogens. Plants cope with stresses by regulating their growth. We investigate how plants manage the trade-off between stress responses and their growth. We are also interested in evolution of ecotypes with altered environmental responses.

Positional signals that direct cell fate decision in plants— How do plant cells recognize their position?

In the development of multicellular organisms, different types of cells are generated and arranged in a regular pattern. However, many of the mechanisms by which each cell recognizes its own position and differentiates into an appropriate cell type remain a mystery. In our laboratory, Assistant Professor Shinobu Takada and his colleagues are focusing on the epidermis, which is formed only in the outermost layer of plants, to identify and analyze the sensor proteins that recognize the outermost location and the signal transduction pathways that lead to epidermal differentiation.

Mechanisms regulating the morphology and dynamics of organelles

When we see the inside of the plant cells, various organelles are dynamically moving around. We are trying to elucidate the molecular mechanisms that regulate the morphology and dynamics of organelles by using fluorescence and luminescence imaging and proteomic analysis.

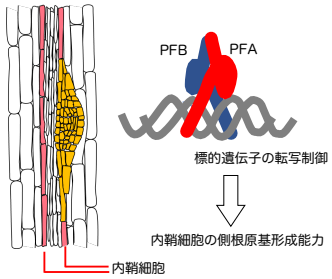

Figure 1. The PFA/PFB transcription factor dimers control the competence of the pericycle to undergo formation of the lateral root primordium.
Left, Pericycle spontaneously creates auxin peaks, and undergo asymmetric cell division culminating in the formation of a lateral root primordium. The PFA/PFB dimers govern these unique features of pericycle.

The laboratory is a place to discover new things. An important thing is to have your own idea. I hope you will enjoy research life.

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