

Laboratory of Plant Cell Fate Determination

Graduate School of Science



Professor

Associate Professor

Associate Professor

Assistant Professor

Yuki KONDO

Tomoyuki FURUYA

Miho KITAZAWA

Tasuku ITO

kondo.yuki.sci@osaka-u.ac.jp

furuya.tomoyuki.sci@osaka-u.ac.jp

kitazawa.m.celas@osaka-u.ac.jp

ito.tasuku.sci@osaka-u.ac.jp

URL: http://www.bio.sci.osaka-u.ac.jp/bio_web/lab_page/kondo

The vascular system transports various substances throughout the plant body, thereby playing a major role in environmental adaptation. So far, our laboratory has developed a novel tissue culture system called "VISUAL" that allows us to reconstitute vascular development. We are investigating the mechanisms of cell fate determination in vascular stem cells from a synthetic biological approach. We are analyzing both the developmental mechanisms and physiological functions of vascular cells to unravel the importance of the vascular system for survival in plants.

Understanding the Regulation of Vascular Stem Cell Fate Determination

Vascular stem cells give rise to diverse vascular cells, including xylem cells (xylem vessels and xylem fibers), and phloem cells (phloem sieve elements and companion cells). However, the research is technically challenging, because vascular stem cells are located deep within the plant body. We have developed the VISUAL system capable of inducing ectopic vascular cells (Figure 1), which allows us to elucidate the mechanisms of stem cell fate determination through gene expression analysis. We are also developing new devices and microscopes that enable visualization and quantification of cell fate dynamics during VISUAL.

Manipulation of Vascular Stem Cell Fates

In the VISUAL induction system, vascular stem cells give rise to both xylem vessels and phloem sieve elements. Recently, we succeeded in the development of VISUAL-CC, which can induce phloem companion cells. Furthermore, we have been able to manipulate vascular cell fates by modifying VISUAL (Figure 2). We aim to understand the mechanisms underlying cell fate determination by developing novel culture systems.

Evolution of Regulatory Mechanisms Underlying Stem Cell Fate Determination

We have been analyzing the mechanisms of vascular stem cell fate control using the model plant *Arabidopsis thaliana*. We are also trying to establish a VISUAL system in the gymnosperm *Ginkgo biloba*, which possesses ancestral xylem vessels. Through comparative omics analysis, we aim to elucidate the evolution of vascular function and regulatory networks. Additionally, we are focusing on the regulatory mechanisms of stem cells in liverworts, which do not possess the vascular system.

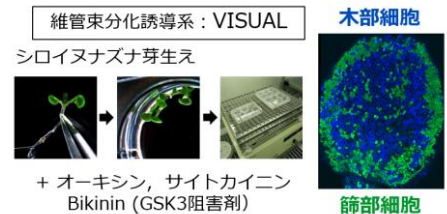


Figure 1: Vascular cell Induction culture System Using Arabidopsis Leaves (VISUAL)

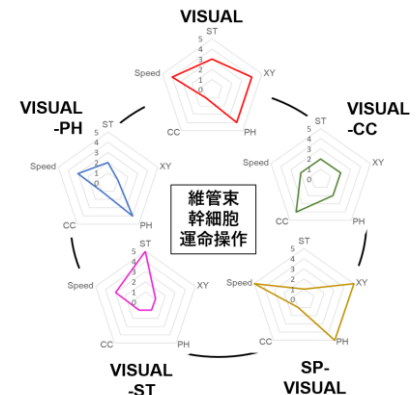


Figure 2: Development of various kinds of VISUAL systems

What does it mean to "understand" the mechanisms of living organisms? I believe it means "deepening our knowledge" × "using that knowledge to manipulate them."
Let's manipulate vascular cell fates to understand how plants survive.

Department of Biological Sciences
Graduate School of Science, Osaka University
1-1, Machikaneyama-cho, Toyonaka, Osaka
560-0043, Japan

TEL: +81-6-6850-5823



Scan here for the lab's website >>