

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

Biological Sciences (Biology)



Title of Project : **Molecular basis of pluripotency of vascular stem cells**

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Research Project Number : 16H06377 Researcher Number : 10165293

Research Area : Biology

Keyword : Plant, stem cell, pluripotency

【Purpose and Background of the Research】

Multicellular organisms have stem cells, which self-proliferate and give rise to various types of differentiated cells. In plants, stem cells in meristems play crucial roles in growth and development. We have studied regulation of stem cell fates in the vascular meristem and found various factors governing stem cell fates such as GSK3 kinases, which are inhibited by bikinin. By using bikinin, we established a new vascular cell differentiation system, Vascular cell Induction culture System Using Arabidopsis Leaves (VISUAL), which induces ectopic differentiation of vascular cells. In this study, therefore, using VISUAL we intend to reveal molecular basis of pluripotency of vascular stem cells.

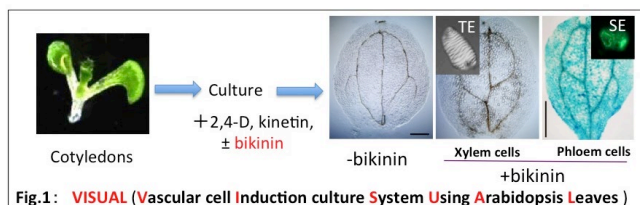


Fig.1: VISUAL (Vascular cell Induction culture System Using Arabidopsis Leaves)

【Research Methods】

Bikinin induces ectopic differentiation of vascular stem cells (procambial cells) from mesophyll cells and phloem and xylem cells from vascular stem cells in VISUAL (Fig.1). Therefore this system is efficient for studying vascular stem cell fates intensively. Using VISUAL, we aimed at revealing 1) how vascular stem cells are established, 2) how phloem differentiation is initiated, and 3) what determines switching between phloem and xylem differentiation (Fig.2).

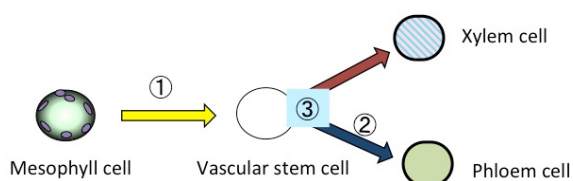


Fig.2: Targets of this study

【Expected Research Achievements and Scientific Significance】

It is expected that this study will reveal the real nature of vascular stem cells and intercellular and intracellular signaling pathways leading to establishment of vascular stem cells and determination of specific vascular cell types. In addition, this study will deepen our understanding of maintenance and development of plant meristems. Comparison with animal stem cells may provide a novel insight into universality and diversity of stem cells in multicellular organisms.

【Publications Relevant to the Project】

- Oda, Y. and Fukuda, H.: Initiation of cell wall pattern by a Rho- and microtubule-driven symmetry breaking. **Science** 337, 1333-1336, 2012
- Kondo, Y., Ito, T., Nakagami, H., Hirakawa, Y., Saito, M., Tamaki, T., Shirasu, K., and Fukuda, H.: Plant GSK3s regulate stem cell differentiation downstream of TDIF-TDR signalling. **Nature Commu.** 5, article number 4505, 2014.
- Kondo, Y., Nurani, A. M., Saito, C., Ichihashi, Y., Saito, M., Yamazaki, K., Mitsuda, N., Ohme-Takagi, M. and Fukuda, H.: Vascular cell Induction culture System Using Arabidopsis Leaves (VISUAL) visualizes the sequential differentiation of sieve element-like cells. **Plant Cell**, in press, 2016.

【Term of Project】 FY2016-2020

【Budget Allocation】 141,800 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.biol.s.u-tokyo.ac.jp/users/seigyolab.html>