



Title of Project : Principles of pluripotent stem cells underlying plant vitality

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【Purpose of the Research Project】

Plants can survive extended periods if the environmental conditions favor continuous growth. This suggests the presence of a persistent source generating new organs, namely plant stem cells. In plants, stem cells produce other stem cell populations, which then generate new organs at various positions of the plant. For example, stem cell populations produced at the shoot apex are positioned at the axillary bud and generate new stems, leaves, and flowers (Fig. 1). This implies that these stem cells possess pluripotency, which enables repeated production of organs.

In animals, pluripotent stem cells disappear soon after early embryogenesis, and in the adult body, tissue stem cells capable of differentiating into specific cell types are involved in the maintenance of tissue homeostasis (Fig. 1). In contrast, plant stem cells proliferate and are scattered throughout the plant body, and each stem cell population exhibits a continuing pluripotency. This feature enables continuous growth of plants, whereas the rapid disappearance of pluripotent stem cells in animals prevents post-embryonic organ formation. This project aims to answer these key questions: How do plants augment pluripotent stem cell populations *in vivo*, and how do plants maintain them over long periods of time?

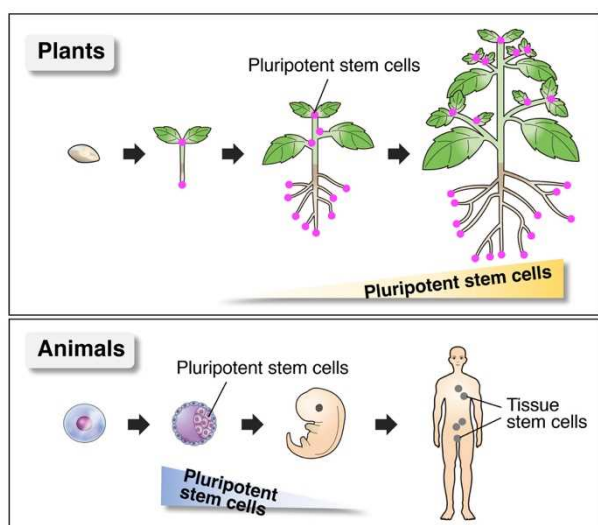


Figure 1. Pluripotent stem cells in plants and animals.

【Content of the Research Project】

To understand the mechanisms of proliferation and maintenance of pluripotent stem cells in plants, we intend to investigate the machinery of stem cell division and the regulatory system underlying maintenance of pluripotency and genome integrity. One of the major themes is to elucidate the role of plant hormones in modulating asymmetric division that produces stem cells and differentiated cells. Another focus is on the generation of stem cells through reprogramming, which occurs easily in plants. Regarding stem cell maintenance, we plan to investigate the key factor regulating the loss of pluripotency during the floral transition stage. Comparative analyses of transient and permanent stem cells will be performed to understand the chromatin-level regulation of pluripotency. Furthermore, research on regeneration of stem cells that is required for the maintenance of genome integrity under stressful conditions will be performed. Genome plasticity that allows for accrual of DNA mutations and contribution to genomic diversity in the progeny will be explored.

【Expected Research Achievements and Scientific Significance】

Reprogramming of somatic cells and long-term maintenance of pluripotent stem cells normally occur during plant development; thus, plants are assumed to have a higher ability to exhibit pluripotency than animals. Understanding plant stem cells will shed light on the principles of pluripotency, and our project will uncover the survival strategy of plants that enables high vigor under changing environmental conditions.

【Key Words】

Pluripotent stem cells: Cells capable of differentiating into many cell types.

【Term of Project】 FY2017-2021

【Budget Allocation】 1,166,500 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.plant-stem-cells.jp/>