

【Grant-in-Aid for Specially Promoted Research】
Biological Sciences



Title of Project : Differentiation of endomembrane system for defense strategy in higher plants

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Research Area : Biology, Basic biology, Plant molecular biology/plant physiology

Keyword : Organelles, Response to environmental factors, Plant-microbe interaction, Plant molecular function

【Purpose and Background of the Research】

Our recent studies indicate a novel defense strategy, which is associated with the fusion of vacuolar membrane and plasma membrane, resulting in releasing anti-bacterial defense proteins to abolish propagation of bacteria on the outside of cells^[1] (Fig. 1). This novel defense system to attack bacterial pathogens outside the cells is contrasted with a VPE-mediated vacuolar-collapse system to kill viral pathogens inside the cells (*Science*, 2004). We also discovered a secretory signaling factor responsible for development of stomata, through which bacteria invade^[2]. The aim of this project is to understand the molecular mechanism underlying the differentiation of the ER and vacuolar membranes in response to pathogen and environmental stresses.

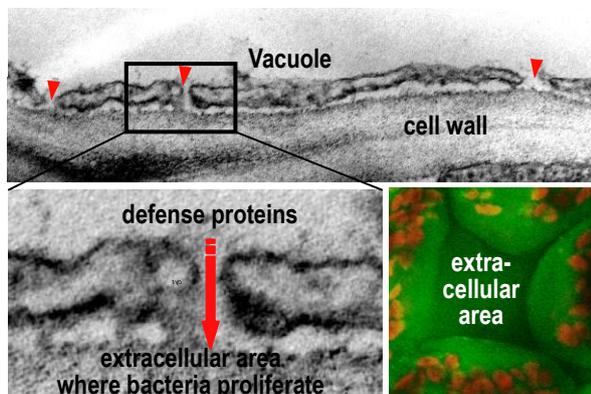


Figure 1. Membrane fusion-mediated plant immunity. Bacteria infection induces fusion of vacuolar membrane with plasma membrane (EM pictures). Membrane fusion triggers discharge of vacuolar content outside the cells (lower right).

【Research Methods】

This project focuses on four subjects (Fig. 2). Specific aims are to genetically and biochemically identify factors that participate in the inducible differentiation of the vacuolar membranes and endoplasmic reticulum and to address how the membrane dynamics support the defense strategy against various pathogen and environmental stresses.

【Expected Research Achievements and Scientific Significance】

Evidence from our studies provides an idea that plants have evolved the ER and vacuolar system as a defense strategy against pathogen and environmental stresses. This project is based on our findings on the diversity of plant endomembranes as described above. We believe that this research will give novel and valuable insights into the field of plant science.

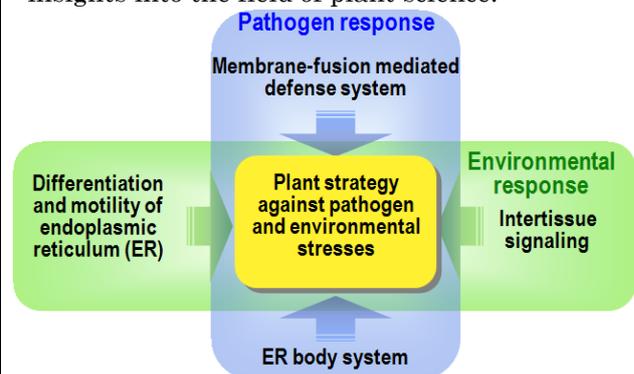


Figure 2. Conceptual diagram of this project.

【Publications Relevant to the Project】

- [1] Hatsugai, N., Iwasaki, S., Tamura, K., Kondo, M., Fuji, K., Ogasawara, K., Nishimura, M., and *Hara-Nishimura, I. (2009) A novel membrane-fusion-mediated plant immunity against bacterial pathogens. *Gene. Dev.*, 23: 2496-2506.
- [2] Sugano, S. S., Shimada, T., Imai, Y., Okawa, K., Tamai, A., Mori, M., and *Hara-Nishimura, I. (2010) Stomagen positively regulates stomatal density in Arabidopsis. *Nature*, 463: 241-244. (*These two authors contributed equally to this work)

【Term of Project】 FY2010-2014

【Budget Allocation】 419, 700 Thousand Yen

【Homepage Address and Other Contact Information】

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