

【Grant-in-Aid for Scientific Research(S)】
Biological Sciences (Agricultural sciences)



Title of Project : Molecular elucidation of plant immune systems

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Research Area : Agricultural sciences

Keyword : Molecular interactions

【Purpose and Background of the Research】

In this project, we aim to understand how plants defend themselves and how pathogens overcome the defence system. Although a number of plant immunity components and pathogen effectors have been isolated, full elucidation of molecular mechanisms at protein level is not yet achieved. By using genomics, proteomics, and chemical genomics tools established in our laboratory, we will identify important proteins essential for plant immunity and pathogen virulence. Through structural and functional analyses of the proteins and their associated components, we aim to provide a unified view of plant immune systems. Especially, we will thoroughly characterize targets of newly identified plant immune inhibitors to set a new paradigm in the field.

【Research Methods】

We will identify and characterize targets of the plant immune inhibitors, immune sensor complexes, chaperone complexes (Fig 1), and ubiquitin ligase complexes by using a highly sensitive mass spectrometry and structural analysis tools. We also identify novel components in plant immunity by using genetics and chemical genomics. Furthermore, we will elucidate suppressor function of pathogen derived effectors by structural analysis (Fig.2).

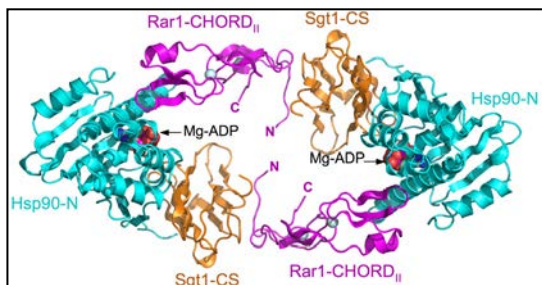


Fig 1. Immune Chaperone complex (Mol Cell 2010)

【Expected Research Achievements and Scientific Significance】

The study trend of plant immunity research is shifting from classic genetical analysis to genome-based systematic reverse genetics.

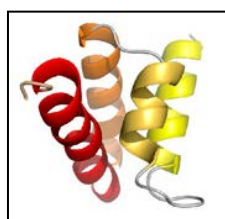


Fig.2 Structure of potato blight effector (PNAS)

However, there are only few good examples for protein structure-based characterization of mechanisms. Similarly, successful use of chemical genomics has been very limited. In this project we will utilize chemical genomics tools we established in our laboratory to identify targets of the novel plant immune inhibitors. Structural and functional analyses of the target proteins will be conducted. In addition, we will study important immune-related proteins whose functions are not clear. The novel insights we learn from our study on immune mechanisms including identification of new receptors and structural analyses will contribute to development of better breeding methods and agrochemicals with a distinct mode of action.

【Publications Relevant to the Project】

- Yaeno, T., Li, H., Chaparro-Garcia, A., Schornack, S., Koshiba, S., Watanabe, S., Kigawa, T., Kamoun, S., and Shirasu, K., Phosphatidylinositol monophosphate-binding interface in the oomycete RXLR effector AVR3a is required for its stability in host cells to modulate plant immunity. *Pro Natl Acad Sci USA*, (2011) 108: 14682-14687.
- Zhang, M., Kadota, Y., Prodromou, C., Shirasu, K*, and Pearl, L.H*, Structural basis for assembly of Hsp90-Sgt1-CHORD protein complexes: implications for chaperoning of NLR innate immunity receptors. *Mol Cell*, (2010) 39: 269-281. *co-corresponding authors

【Term of Project】 FY2012-2016

【Budget Allocation】 124,300 Thousand Yen

【Homepage Address and Other Contact Information】

<http://ksg.psc.riken.jp/index.en.html>