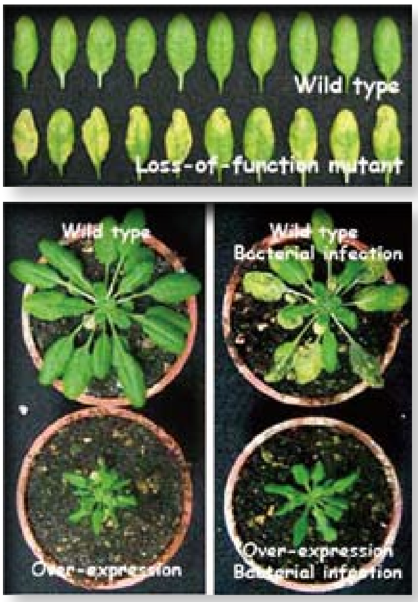
JOURNAL ARTICLES FURTHER UNDERSTANDING OF INNATE IMMUNITY IN PLANTS

Prof. Laurent Zimmerli's research team at the Institute of Plant Biology recently had two articles published that demonstrate the importance of a novel class of receptor kinases in plant resistance to microbial pathogens. Specifically, the team, working with the model plant Arabidopsis thaliana, discovered that the two lectin receptor kinases LecRK-VI.2 and LecRK-V.5 play a critical role for innate immunity in plants. Prof. Zimmerli's findings make a major contribution to the effort to produce crops that are more resistant to microbial pathogens.

First published in the journals *The Plant Cell* and *PLoS Pathogens*, these findings garnered high impact factors of 9.396 and 9.079, respectively. Prof. Zimmerli is the first NTU faculty member to publish research findings in these journals.

Prof. Zimmerli's research focuses on the response mechanisms of plants to microbial pathogen attacks, and his articles appear regularly in prestigious journals. While there is an abundance of research documenting the importance of lectin receptor kinase in mammal's innate immunity, the function of lectin receptor kinases in plant innate immunity remains unclear.

In *The Plant Cell* article, published in March, Zimmerli's team reports that LecRK-VI.2 is a positive regulator of Arabidopsis innate immunity. Notably, lecrk-VI.2-1 knock-out mutants were more sensitive to bacterial infection. Enhanced sensitivity was correlated with reduced innate immunity activation, such as defective up-regulation of innate immunity marker genes, impaired callose deposition, and stomatal closure upon bacterial infection. Overexpression studies combined with genome-wide microarray analyses indicated that LecRK-VI.2 positively regulates Arabidopsis innate immunity. In addition, the team pointed out that LecRK-VI.2 works independently of the microbe-associated molecular pattern flagellin receptor complex, suggesting a new signaling pathway in plant innate immunity.



The consequences of bacterial infection in the Arabidopsis thaliana

Stomata are small pores on the lower side of leaves that are critical for CO_2 uptake and photosynthesis. Pathogenic bacteria penetrate leaf tissue through stomatal openings. As an innate immunity response, plants close stomata that come in contact with bacteria.

The team's *PLoS Pathogens* article, published in February, demonstrates that LecRK-V.5 is vital to Arabidopsis stomatal immunity. Loss of LecRK-V.5 function increased resistance to surface inoculation with virulent bacteria, while lines overexpressing LecRK-V.5 were more susceptible to bacteria. The team also discovered that LecRK-V.5 is rapidly expressed in stomata after bacterial inoculation. They also showed that LecRK-V.5 interferes with abscisic acid signaling, a plant hormone involved in stomatal closure, upstream of reactive oxygen species production. These results provide genetic evidence that LecRK-V.5 negatively regulates stomatal immunity. The team's data reveal that plants have evolved mechanisms to reverse bacteria-mediated stomatal closure to prevent long-term effect on CO_2 uptake and photosynthesis.

An electron microscope photograph reveals stomata on the underside of a leave.

Up to 25 % of agricultural yield is lost every year to attack by microbial pathogens. The identification of central plant defense elements, such as LecRK-VI.2 and LecRK-V.5, may generate novel breeding strategies for establishing a sustainable agricultural system.