NUS National University of Singapore | Department of Biological Sciences
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Hosted by Dr Chae Eunyoung

Evolution and Function of Receptor-like Kinases in Arbuscular Mycorrhizal Symbiosis

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About the Speaker

Chai Hao recently completed his PhD work in the laboratory of Uta Paszkowski in University of Cambridge, where he worked on the signalling mechanisms that underpin arbuscular mycorrhizal symbiosis in plants, using rice as the main model. The bioinformatic analysis of receptor evolution followed by careful genetic analysis of the receptor mutants allowed him to dissect their roles in regulating the establishment of this symbiosis. The mutants also revealed a conserved function of the receptors in promoting lateral root development during symbiosis. Prior to his PhD, he completed his undergraduate studies with a double-first class in Natural Sciences in Cambridge specialising in Plant and Microbial Sciences. His PhD was funded by the Gates Cambridge Trust Scholarship and the NUS-OGS. Moving to the laboratory of Giles Oldroyd, he will continue to work on receptor-kinase signalling in this hugely fascinating symbiosis as part of the research consortium for Engineering Nitrogen-fixing Symbiosis for Africa (ENSA) funded by the Bill and Melinda Gates Foundation.

Evolution of symbiosis with arbuscular mycorrhizal fungi (AMF) was one of the key innovations that enabled the successful conquest of land plants. In this mutually beneficial symbiosis, fungi-delivered mineral nutrients are exchanged for plant photosynthates in elaborate structures called arbuscules. Till today, it is not clear how early detection of the symbiotic fungus leads to appropriate signal transduction – as well as the signals and receptors involved. The main receptors are likely receptor-like kinases (RLKs) harbouring a lysin motif (LysM) domain capable of carbohydrate-binding. Intriguingly, the same receptors that activate pattern-triggered immunity are also involved in signalling for efficient association with AMF. It has thus been proposed that plant roots distinguish symbionts through different chitin-derived signals that activate different receptor/co-receptor complexes on the plasma membrane. I will introduce this symbiosis and the genetic pathways that lead to the establishment and maintenance of this symbiosis. To characterise the roles of LysM-RLKs in symbiosis, a comprehensive and systematic phylogenomic analysis of this receptor family provided a solid foundation for systematic genetic analyses of LysM-RLKs in rice. This work reveals a diverse set of signals employed by AMF for symbiosis establishment but at the same time, a conserved role for this signal-receptor system in activating lateral organs in response to chitin molecules.