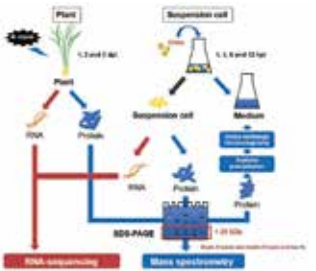
Prof.
KAWANO Yoji

Involvement of phytocytokines in rice immunity

Plants cleverly regulate their immunity by secreting endogenous peptides called plant cytokines (phytocytokines). We believe that understanding and optimizing phytocytokine signaling and their networks will improve plant immunity, and we are conducting this research. Recently, we have established a multi-omics pipeline to isolate potential phytocytokines in rice and identified 236 endogenous secreted peptides that were induced during the disease resistance response (Plant Biotech J 2020). These included cytokine-like peptides such as the cysteine-rich RALF7, the post-translationally modified PSK4, and a novel family of IRPs that do not contain any known domains. Further analysis revealed that IRPs do indeed have cytokine activity and act as positive regulators of resistance to blast fungus, the most important pathogen of rice (bioRxiv 2021).



Effector-triggered immunity through small GTPase OsRac1

Resistance (R) proteins are crucial intracellular receptors that detect attacks by insects and invasion by various pathogens, including fungi, bacteria and viruses. However, the signaling molecules which mediate R protein-induced immune responses are not yet fully understood. We have previously shown that an intracellular switch, the small GTPase OsRac1, is a master regulator controlling immunity in rice (Plant Cell 2016, Curr Genomic 2016, FPS 2014, COPB 2013, Rice 2010). However, the mechanism by which OsRac1 receives signals from the immune receptors and becomes activated has remained unclear. Thus, we explored OsRac1-binding proteins and identified the R protein Pit, which is an immune receptor for rice blast fungus, a prominent microbial disease of rice. Through various analyses, we demonstrated that OsRac1 functions as a molecular switch, controlling ROS production and hypersensitive cell death (CHM 2010) and a GDP/GTP exchanger OsSPK1 mediates the activation of OsRac1 by Pit1 (PNAS 2018). Besides, we have found that anchoring Pit to the plasma membrane through palmitoylation, a type of lipid modification, is required for Pit-induced activation of OsRac1 on the plasma membrane (JBC 2014). Our work has therefore revealed the signaling pathway of the R protein Pit through OsRac1.