Linking virus sensing with gene expression, a plant immune system course-corrects

March 6 2018

Plant immune systems, like those of humans and animals, face a difficult balancing act: they must mount responses against ever-evolving pathogens, but they must not overdo it. Immune responses require energy and resources and often involve plants killing their own infected cells to prevent the pathogens from spreading.

Researchers at Durham University in the UK have identified a crucial link in the process of how plants regulate their antiviral responses. The research is published in the March 2 issue of the *Journal of Biological Chemistry*.

Martin Cann's lab at Durham, in collaboration with the laboratories of Aska Goverse at Wageningen University and Frank Takken at the University of Amsterdam, studied a receptor protein called Rx1, which is found in potato plants and detects infection by a virus called potato virus X.

Binding to a protein from the virus activates Rx1 and starts a chain of events that results in the plant mounting an immune response. But the exact sequence of cellular events—and how Rx1 activation was translated into action by the rest of the cell—was unknown.

"Our study revealed an exciting, and unexpected, link between pathogen attack and plant DNA," Cann said.

Specifically, the study showed that Rx1 joins forces with a protein called

Glk1. Glk1 is a transcription factor, meaning it binds to specific regions of DNA and activates genes involved in cell death and other plant immune responses. The team found that when Glk1 bound to virus-activated Rx1, it was able to turn on the appropriate defense genes.

Interestingly, when the viral protein was absent, Rx1 seemed to have the opposite effect—actually keeping Glk1 from binding to DNA. In this way, it prevented an inappropriate immune response.

"(T)he immune response involves reprogramming the entire cell and also often the entire plant," Cann said. "(A)n important part of this regulatory process is not only allowing activation but also making sure the entire system is switched off in the absence of infection."

As over a third of the annual potential global crop harvest is lost to pathogens and pests, breeding plants with better immune systems is an important challenge. Understanding how this immune system is regulated at the appropriate level of activity gives the researchers more ideas of points in the immune signaling pathway that could targeted to increase the plant's baseline ability to resist disease.

"To increase (crop) yield, there is an urgent need for new varieties that are resilient to these stresses," Cann said. "A mechanistic understanding of how plants resist or overcome pathogen attack is crucial to develop new strategies for crop protection."

More information: Philip D. Townsend et al, The intracellular immune receptor Rx1 regulates the DNA-binding activity of a Golden2-like transcription factor, *Journal of Biological Chemistry* (2017). DOI: 10.1074/jbc.RA117.000485