New component of a plant steroid-activated pathway discovered

18 August 2011

Plant biologists have been working for years to nail down the series of chemical signals that one class of plant hormones, called brassinosteroids, send from a protein on the surface of a plant cell to the cell's nucleus. New research from Carnegie scientists Tae-Wuk Kim and Zhiyong Wang, with contributions from the University of California San Francisco, isolated another link in this chain. Fully understanding the brassinosteroid pathway could help scientists better understand plant growth and help improve food and energy crop production.

Brassinosteroids are found throughout the plant kingdom and regulate many aspects of growth and development, as well as resistance to external stresses. Mutant plants that are deficient in brassinosteroids show defects at many phases of the plant life cycle including reduced seed germination, irregular growth in the absence of light, dwarfism, and sterility.

The series of proteins involved in a plant cell detecting the presence of brassinosteroids and using this information to respond to the plant's environment is one of the best-studied aspects of plant cellular physiology and biochemistry. Previous research had identified a pathway of chemical signals that starts when a brassinosteroid binds to a receptor on the surface of a plant cell and activates a cascade of activity that consists of adding and removing phosphates from a series of proteins.

The research team was able to identify a new aspect of this pathway, a protein called Constitutive Differential Growth1, or CDG1. Their work will be published in *Molecular Cell* on August 19.

Using an extensive array of research techniques, they determined that when activated by the brassinosteroid receptor, CDG1 adds a phosphate to another protein called BSU1. It was already known that the BSU1 protein in turns deactivates a third protein called BIN2. When BIN2 is active it inhibits two other proteins called BZR1 and BZR2, which are part of a special class called transcription factors. When they are inactive, they are unable to enter the plant cell's nucleus. But once BIN2 is deactivated by BSU1, they are able to bind directly to DNA molecules inside the nucleus and promote a wide variety of gene activity.

"Together with our previous work, these results provide the detailed mechanisms of brassinosteroid signaling," Wang said. "Because this system of brassinosteroid-activated proteins is one of the best-understood chemical pathways in plant physiology, these results could help scientists understand many other plant cell systems."

Provided by Carnegie Institution