Hormone acting as 'molecular glue' could boost plant immune systems

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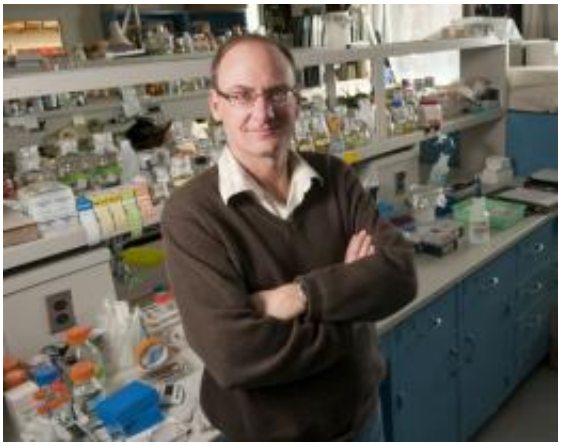

Gregg Howe, biochemistry and molecular biology professor, works in the MSU-Department of Energy Plant Research Laboratory studying the dynamic immunity influences of the hormone jasmonate. Photo by Kurt Stepnitz

(PhysOrg.com) -- The discovery of a hormone acting like molecular glue could hold a key to bolstering plant immune systems and understanding how plants cope with environmental stress.

The study, which is featured in the Oct. 6 issue of *Nature*, reveals how the plant hormone jasmonate binds two proteins together – an emerging new concept in hormone biology and protein chemistry. The study also identifies the receptor's crystal structure to provide the first molecular view of how plants ward off attacks by insects and pathogens.

In short, the work explains how a highly dynamic form of plant immunity is triggered, said Gregg Howe, biochemistry and molecular biology professor, who worked with fellow MSU professor Sheng Yang He on the study. The study is a collaboration between the MSU-Department of Energy Plant Research Laboratory and the University of Washington.

“In many respects, this receptor is novel in how it binds its target hormone to switch on gene expression,” Howe said. “Jasmonate appears to act as molecular glue that sticks two proteins together, which sets off a chain of events leading to the immune response. Determining the structure of the receptor solves a big missing piece of the puzzle.”

Earlier research conducted by Howe and He helped to unveil the mechanism of action of jasmonate, the last major plant hormone to have its signaling pathway decoded. When a plant is attacked, the jasmonate signal causes direct interaction between a family of JAZ repressor proteins and the F-box protein COI1, which works to eliminate JAZ proteins so the plant can mount a defense.

Reconstructing the molecular mechanism of jasmonate perception revealed a multicomponent signaling hub. Instead of working as a single protein, which is typical of most receptors, this new receptor is actually a co-receptor complex that consists of COI1, JAZ and a newly discovered third component, inositol pentakisphosphate, Howe said.

Now that researchers understand the structure, they can design new hormone derivatives or other small molecules that can trigger a desired response. Such compounds could help to increase agricultural productivity by aiding plants in resisting bugs and diseases, he added.

The Nature study shows that plants and animals use fundamentally different mechanisms to perceive this type of fatty acid-derived

hormone. Humans have prostaglandin hormones, which are structurally similar to jasmonates and also play a role in immune responses. So this study may hold potential benefits for humans as well.

“Plants offer a rich opportunity to understand basic biological processes that are relevant to human health,” Howe said. “The new structural insight into jasmonate perception could have practical applications in medicine, including the design of drugs that stick two proteins together.”

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