Plant scientists link phospholipid sensing with control of gene expression

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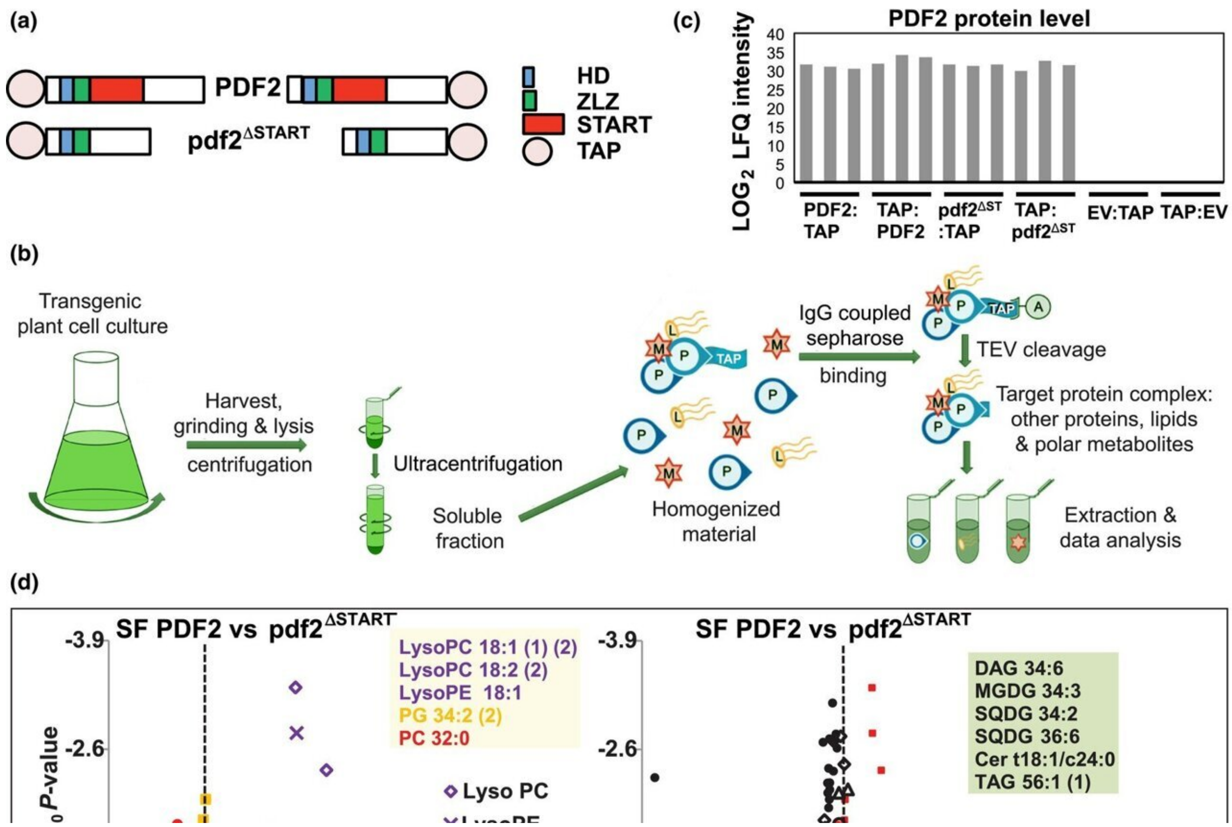

PDF2 START binds lysophosphatidylcholine (LysoPC) in *Arabidopsis* cell cultures. (a) PDF2 and pdf2$^{\Delta START}$ proteins used for tandem affinity purification (TAP) experiments. Credit: *New Phytologist* (2024). DOI: 10.1111/nph.19917

Plant scientists have long known that phosphorus is a crucial component in plant growth. A major discovery by a Kansas State University (K-

State) biologist and her lab is leading to a better understanding of how plants detect and use that resource—potentially leading to more efficient production of crops for food, fiber and fuel.

A team of researchers led by Kathrin Schrick, associate professor of biology, recently published this research in *New Phytologist*.

Schrick's lab focused on a specific transcription factor that regulates gene expression during development. They discovered a new kind of molecular interaction between the protein and a fat-soluble molecule that contains phosphorus, a type of phospholipid. The phospholipid binds to the transcription factor, which then regulates gene expression levels.

"We've got a connection between the binding of a phospholipid to the regulatory protein and the gene expression that is actually happening as a consequence of that," Schrick said. "And we have a model for how it all works. In this case, the sensing occurs through the outer layer, in the epidermis of the plant, and somehow, the plant has to figure out how much phosphorus it has available to it in order to regulate its growth."

Schrick said it's important to try to develop plants that can efficiently use phosphorus because it is an essential element for all of life. The team's findings can help scientists develop crop varieties that could better use their available phosphorus to withstand drought and climate change.

"This major discovery links phospholipid sensing directly with the control of gene expression," Schrick said. "The significance of this work is that it reveals how plants use information about phosphate levels, from the environment and within their cells, to change which genes are turned on or off."

K-State undergraduate students were co-authors on the publication, including Sophia Peery and Ashley Panagakis, biology; Kyle Thompson, nutritional sciences; and Graham Mathews, computer science. Co-authors also include Bilal Ahmad, a current doctoral student in biology; Aashima Khosla and Bibek Subedi, former doctoral students; and Thiya Mukherjee and Xueyun Hu, former postdoctoral researchers in the Schrick lab.

The work in the publication is from an ongoing collaboration with the group of Aleksandra Skirycz, associate professor of biochemistry and molecular biology at Michigan State University and former research group leader at the Max Planck Institute of Molecular Plant Physiology in Germany. Skirycz's lab performed the binding studies and mass spectrometry work to establish the protein-lipid interaction, while the Schrick group performed the genetic and molecular studies linking the interaction to a biological function relevant to plant growth.

More information: Izabela Wojciechowska et al, Arabidopsis PROTODERMAL FACTOR2 binds lysophosphatidylcholines and transcriptionally regulates phospholipid metabolism, *New Phytologist* (2024). DOI: 10.1111/nph.19917

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