

Protein root discovery seals future of climate-proof plants

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Researchers have discovered a protein that seals plant roots to regulate the uptake of nutrients and water from the soil, the discovery could help develop climate proof crops that require less water and chemical

fertilizers.

Researchers from the University of Nottingham identified new components of the [lignin](#) barrier in plant roots and the specific function of dirigent proteins (DPs), located in the root endodermis that control water and [nutrient uptake](#). Their findings have been published in [Science](#).

Plant roots function by absorbing mineral nutrients and water from the soil and also controlling their proper balance in the plant. This control is exerted by a specialized layer of root tissue called the endodermis.

The endodermis contains a barrier to the movement of solutes and water that is made of lignin, the same material present in wood. This impermeable barrier blocks the uncontrolled movement of material into the root, by forming a tight seal between cells. This seal ensures the only pathway for nutrients and water to be taken up by roots is through the cells of the endodermis. This allows full cellular control over what enters and leaves the plant via the roots.

This research has identified new components of the lignin deposition machinery that focus on the function of dirigent proteins (DPs), located in the root endodermis. These proteins act in coordination with other described root regulatory components to direct and organize the correct deposition of lignin in the endodermis allowing the plant to ensure it receives the optimum balance of nutrients from the soil.

"With record temperatures being reached in parts of the world this year and erratic rainfall it is ever more important to understand the mechanisms of plants so we can future proof them to secure future food supplies. This research shows how [plant roots](#) regulate their uptake of water and nutrients through the deposition of lignin, which is regulated by DPs," says Dr. Gabriel Castrillo, School of Biosciences.

"Without these proteins, proper root sealing is not completed and the [nutrient](#) balance in the plant is compromised. We can use this knowledge to engineer plants to be able to grow with less water and chemical fertilizers."

More information: Yi-Qun Gao et al, A dirigent protein complex directs lignin polymerization and assembly of the root diffusion barrier, *Science* (2023). [DOI: 10.1126/science.adi5032](https://doi.org/10.1126/science.adi5032)

Provided by University of Nottingham

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