Plants can adapt their lignin using 'chemically encoding' enzymes to face climate change, study finds

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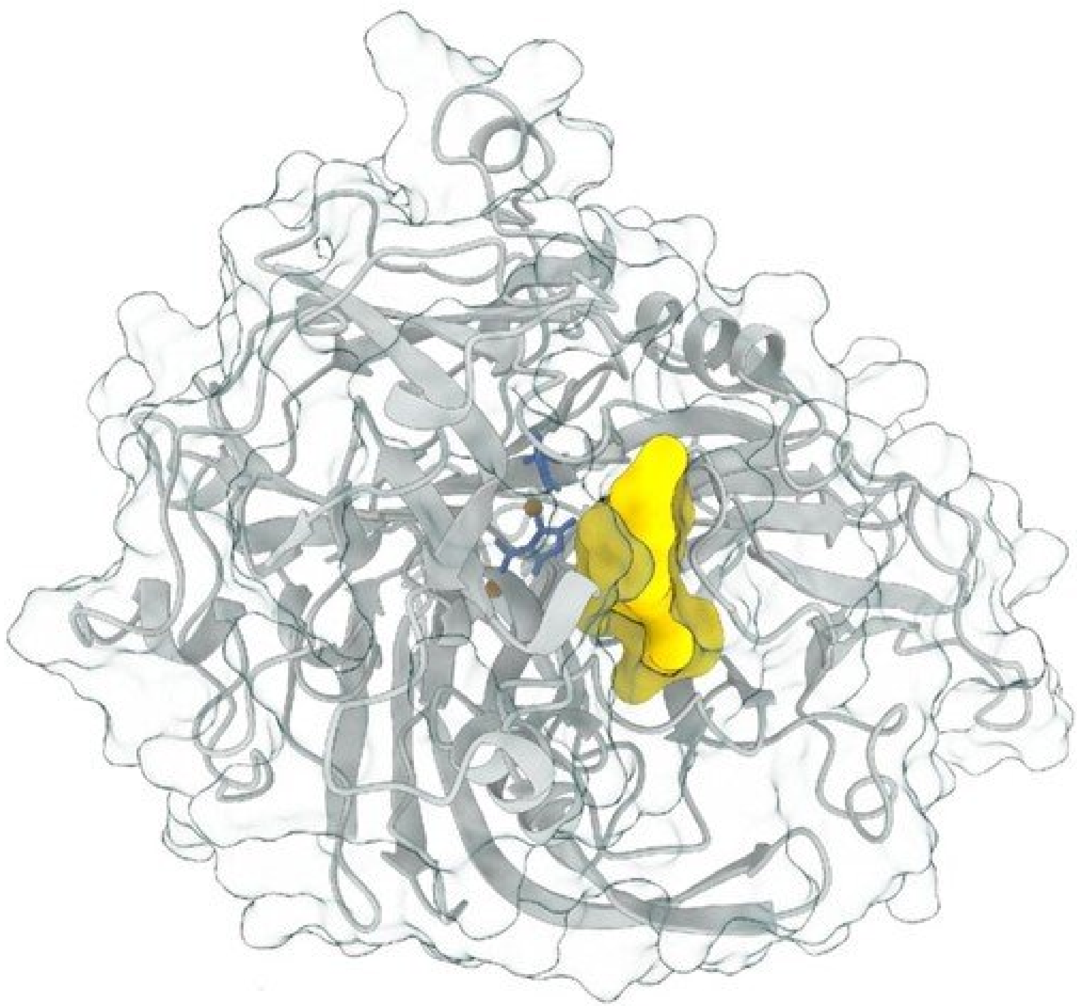

Three-dimension model of plant LACCASE responsible of "encoding" one aspect of lignin chemistry. Carbon skeleton is shown in grey, key amino-acids for lignin oxidation in blue with copper atoms in orange, the volume of the active site is shown in yellow. Model performed with alphafold2 and published in Blaschek and Pesquet, (2021 - 10.3389/fpls.2021.754601). Credit: Leonard Blaschek

A new study shows how plants "encode" specific chemistries of their lignin to grow tall amid climate changes: Each plant cell uses different combinations of the enzymes LACCASEs to create specific lignin chemistries. These results can be used both in agriculture and in forestry for selecting plants with the best chemistry to resist climate challenges.

Lignin is an important carbon sink for the environment as it stores about 30% of the total carbon on the planet. It allows plants to hydrate and reach tremendous heights up to 100 meters; without lignin, plants could not grow nor survive climate changes. At the cell level, specific lignin chemistries adjust the mechanical strength and waterproofing to support plant growth and survival.

Scientists at Stockholm University recently demonstrated that lignin has a chemical "code" that is adapted at the cell level to fulfill different roles in plants. How each cell "encodes" specific lignin chemistry however remained unknown.

Researchers at the Department of Ecology, Environment and Botany (DEEP) at Stockholm University led by Edouard Pesquet, Associate-Professor in molecular plant physiology and senior author of the study, just showed that different enzymes called LACCASEs are used by each cell to adjust their lignin "chemical code" in order to resist stresses such as drought or wind.

The study finally shows how lignin is spatially controlled at the nanometer level in each plant cell. The findings could be used in both agriculture and forestry to select plants with a lignin chemistry that better resist future climate challenges.

"The control of lignin chemistry at the cell level is ultimately the mechanism enabling plants to grow, hydrate and resist climate change stresses. These results finally demonstrate how lignin chemistry is controlled and open great possibilities to select plants upon their lignin code to improve crops and trees resistance to water availability problems," says Edouard Pesquet.

The research is published in *The Plant Cell* journal.

More information: Leonard Blaschek et al, Different combinations of laccase paralogs nonredundantly control the amount and composition of lignin in specific cell types and cell wall layers in Arabidopsis, *The Plant Cell* (2022). DOI: 10.1093/plcell/koac344

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