New understanding of cellulose could lead to tailored biofuels

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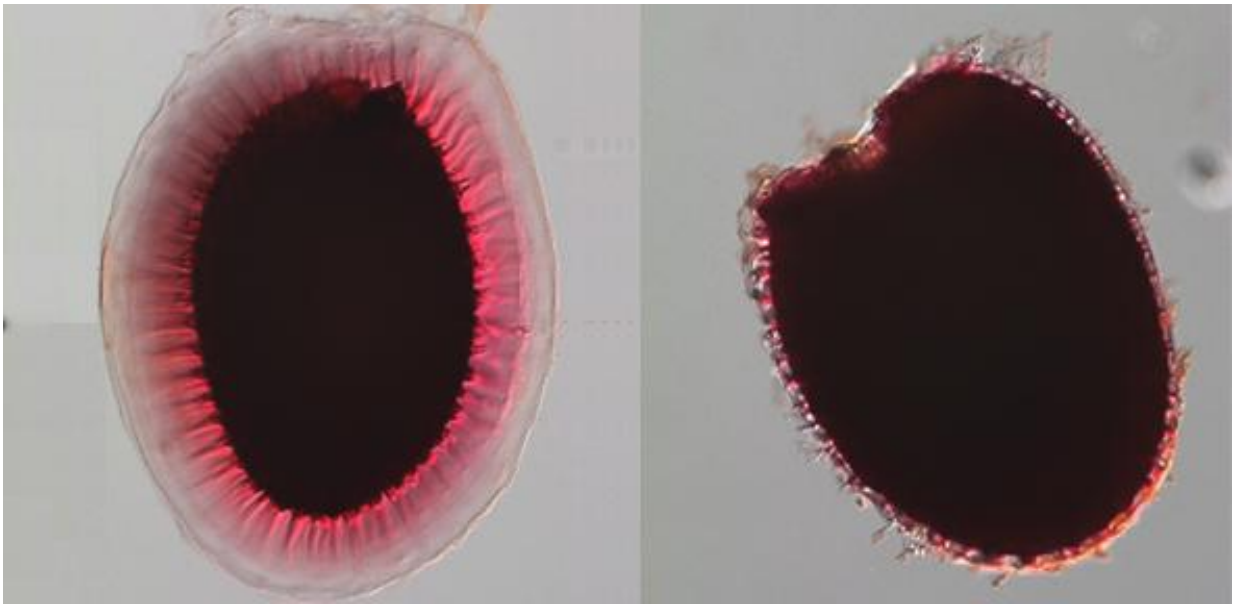

Arabidopsis seeds exude slime that is attached to the see by cellulose. On the left is a seed with normal slime stained pink, but on the right, in the stello mutant, the slime is lost because the cellulose is missing. Credit: Nino Nikolovski and Paul Dupree

In the search for low emission plant-based fuels, new research may help avoid having to choose between growing crops for food or fuel.

Scientists have identified new steps in the way plants produce cellulose, the component of plant cell walls that provides strength, and forms

insoluble fibre in the human diet.

The findings could lead to improved production of cellulose and guide plant breeding for specific uses such as wood products and ethanol fuel, which are sustainable alternatives to fossil fuel-based products.

Published in the journal *Nature Communications* today, the work was conducted by an international team of scientists, led by the University of Cambridge and the University of Melbourne.

"Our research identified several proteins that are essential in the assembly of the protein machinery that makes cellulose", said Melbourne's Prof Staffan Persson.

"We found that these assembly factors control how much cellulose is made, and so plants without them can not produce cellulose very well and the defect substantially impairs plant biomass production. The ultimate aim of this research would be breed plants that have altered activity of these proteins so that cellulose production can be improved for the range of applications that use cellulose including paper, timber and ethanol fuels."

The newly discovered proteins are located in an intracellular compartment called the Golgi where proteins are sorted and modified.

"If the function of this protein family is abolished the cellulose synthesizing complexes become stuck in the Golgi and have problems reaching the cell surface where they normally are active" said the lead authors of the study, Drs. Yi Zhang (Max-Planck Institute for Molecular Plant Physiology) and Nino Nikolovski (University of Cambridge).

"We therefore named the new proteins STELLO, which is Greek for to set in place, and deliver."

"The findings are important to understand how plants produce their biomass", said Professor Paul Dupree from the University of Cambridge's Department of Biochemistry.

"Greenhouse-gas emissions from cellulosic ethanol, which is derived from the biomass of plants, are estimated to be roughly 85 percent less than from fossil fuel sources. Research to understand cellulose production in plants is therefore an important part of climate change mitigation."

"In addition, by using cellulosic plant materials we get around the problem of food-versus-fuel scenario that is problematic when using corn as a basis for bioethanol."

"It is therefore of great importance to find genes and mechanisms that can improve cellulose production in plants so that we can tailor cellulose production for various needs."

Previous studies by Profs. Persson's and Dupree's research groups have, together with other scientists, identified many proteins that are important for cellulose synthesis and for other cell wall polymers.

With the newly presented research they substantially increase our understanding for how the bulk of a plant's biomass is produced and is therefore of vast importance to industrial applications.

Provided by University of Cambridge