New insight into how plants make cellulose

July 12 2016

Credit: University of Manchester

A Manchester and Dundee collaboration has found out more about one of the most abundant biological substances on the planet.

Professor Simon Turner from The University of Manchester and Dr Piers Hemsley from the University of Dundee and James Hutton

Institute, have been studying cellulose.

Cellulose is the major structural component in plants. It essentially provides the plant with its skeleton. It is also one of the most widely used natural resources, best known in the form of wood, cotton and paper, but is increasingly important as a renewable raw material for industrial applications.

Dr Hemsley and Professor Turner identified an important new process in cellulose synthesis called S-acylation. S-acylation involves adding fatty acids to proteins to change the proteins function. They found that when the proteins that create cellulose, known as the cellulose synthase complex, were not S-acylated, plants were no longer able to make cellulose. This makes S-acylation an extremely important part of the cellulose synthesis process.

Dr Hemsley said: "This work will help us to understand how the cellulose synthase complex works, how plants form cellulose and how they lay it down in the patterns that provide strength and structure to the plant.

"Plant cell walls have evolved to resist attack from microbes and insects, but this also means that the cellulose in plant cell walls is hard to break down and free up the sugars needed for fermentation into biofuels or use as industrial precursors.

"This work will help us to manipulate cellulose synthesis so that the cellulose structure is altered and therefore more open to processing. This will hopefully allow us to break down cellulose in cheaper, cleaner and more efficient ways."

Professor Turner said: "Manipulating and understanding cellulose biosynthesis to provide renewable energy sources and industrial starting

products while maintaining food yields is an important goal of plant science research. This will be of even greater importance in the future as more food and energy will have to be produced from the same land area to provide for an expanding global population while reducing CO2 emissions and environmental impacts.

"Our work highlights a critical aspect of cellulose synthesis that needs to be considered in fundamental research strategies that could help address some of these food and energy security issues."

The results of this work are published in *Science* (8th July 2016, Vol 353, Issue 6294, p 166-169)

More information: M. Kumar et al. S-Acylation of the cellulose synthase complex is essential for its plasma membrane localization, *Science* (2016). DOI: 10.1126/science.aaf4009

Provided by University of Manchester