The sweet growth of plant cells

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An international collaboration team unravels the fundamental role that carbohydrates play in the root hairs of Arabidopsis thaliana and shows how cell growth is modulated in this species.

Glycomics is the functional study of the entire set of sugars found in a given species. To some, the term may sound like a distant cousin of more familiar names such as genomics and proteomics. Indeed, while genomics and proteomics of several species have been extensively investigated in the last years, glycomics is still an emerging field. Now, a paper published in *Science* magazine by an international collaboration headed by Dr. Jose Estevez (University of Buenos Aires, Argentina) and co-authored by researchers from Argentina, Brazil, Denmark, the United States and Australia examines in depth the fundamental role that carbohydrates play in the growth of root hairs of Arabidopsis thaliana, a small flowering plant widely used as a model system in plant cell biology and development.

"The structural plasticity of carbohydrates is greater than that of amino acids but our understanding of the implications of such plasticity and how it relates to a potential biological function is still limited. This paper contributes with new insights into the fundamental role that these very dynamic compounds have in *Arabidopsis thaliana*" says Dr. Hugo Verli, a scientist at the Biotechnology Center of Federal University of Rio Grande do Sul (UFRGS), Brazil, and co-author of the study.

The cell wall of plants is a very rigid structure comprised largely of sugars and proteins. However, during plant growth these cells increase

200 times their original size by addition of more sugars and proteins. How does the cell wall withstand the driving forces for growth? It has been assumed that chemical changes of wall constituents and wall networks orchestrated by enzymes and cell-wall modifying genes are implicated in the process.

To investigate the issue, the collaboration group worked with the root hairs of *Arabidopsis thaliana*. Growing root hairs require intensive cell-wall changes to accommodate expansion at the apical end by a process known as tip growth. Apically growing cells, such as those of root hairs, are great models to study the dynamic regulation of growth. Additionally, root hairs play an important role in plant nutrition and water uptake. The authors found that *O-glycosylation*, a process by which carbohydrates are attached to proteins, lipids and other organic molecules, is crucial for root-hair growth in *Arabidopsis thaliana*.

The study shows that blockage of the *O-glycosylation* reaction inhibits the growth of root hairs by 50%. Additionally, when the genes expressing the enzymes responsible for the *O-glycosylation* reaction are missing in the cell, the plants display shorter than normal root-hair length and reduced root-hair density. On the other hand, over-expression of these same enzymes doubles the length and increases the density of root hairs.

The changes that O-glycosylated cell-wall proteins undergo during growth represent a starting point to unravel the entire biochemical pathway involved in plant growth and development. Most important, the acquired ability to modulate growth in *Arabidopsis thaliana* is a breakthrough that can be further applied to other species in order to increase plant biomass through the vital functions of nutrient and water uptake of plant root hairs.

More information: The study entitled "O-glycosylated cell wall

proteins are essential in root hair growth" by Silvia M. Velasquez, Martiniano M. Ricardi, Javier Gloazzo Dorosz, Paula V. Fernandez, Alejandro D. Nadra, Laercio Pol-Fachin, Jack Egelund, Sascha Gille, Jesper Harholt, Marina Ciancia, Hugo Verli, Markus Pauly, Antony Bacic, Carl Erik Olsen, Peter Ulvskov, Bent Larsen Petersen, Chris Somerville, Norberto D. Iusem and Jose M. Estevez appears in the June 17 issue of *Science* magazine.

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