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**Altering carbon allocation in hybrid poplar impacts cell wall growth and development**

Transgenic plants that overexpress galactinol synthase may be superior substrates for biomass conversion.

**The Science**

This study tested whether we can alter cell wall attributes and plant development by augmenting the available soluble sucrose pools. To this end, we overexpressed an exogenous galactinol synthase to alter carbon allocation in hybrid poplar and then examined the effects on plant growth, carbohydrate and lignin content and composition, xylem properties, wood physical characteristics, and transcript abundance of differentially expressed genes.

**The Impact**

This transgenic approach, which yields increased cellulose content, altered hemicellulose composition, and a slight reduction in lignin content, is an ideal strategy for poplar and other lignocellulosic-derived feedstocks for improved industrial processing, especially for bioenergy applications.

**Summary**

Galactinol synthase (GolS) is a pivotal enzyme in the synthesis of the raffinose family of oligosaccharides that function as transport carbohydrates in the phloem, as storage compounds in sink tissues, and as soluble metabolites that combat both abiotic and biotic stress in several plant species. To further understand the specific function of this gene *in planta*, we studied the changes in the development of sink tissues caused by the overexpression of GolS in hybrid poplar. Several lines were only marginally affected and, in many cases, had improved cell wall characteristics; however, two transgenic lines possessing the highest transcript abundance in the phloem clearly displayed significant developmental effects. Additionally, these transgenic lines possessed altered cell wall chemistries and fiber properties, traits characteristic of specialized tension wood (i.e., lower total lignin content, higher cellulose content, xylem that often contains small vessels and fibers with a unique inner cell wall layer made primarily of cellulose). Together, this implies that GolS and its product galactinol may have a dual role, acting both as a metabolite and as a signal that impacts cell wall development and the transition from normal wood to a specialized secondary cell wall. Expressing this gene with the appropriate spatial and temporal regulation may serve as an effective means to tailor biomass for improved degradation and digestability for bioenergy applications.

**Contacts (BER PM)**

N. Kent Peters
Program Manager, Office of Biological and Environmental Research
kent.peters@science.doe.gov, 301-903-5549

**(PI Contact)**

Shawn Mansfield
University of British Columbia, Vancouver, BC, Canada
shawn.mansfield@ubc.ca

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**Publications**

Unda, F. *et al.* “Altering carbon allocation in hybrid poplar (*Populus alba x grandidentata*) impacts cell wall growth and development**.”** *Plant Biotechnology Journal* (2017) [DOI: 10.1111/pbi.12682].

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<http://onlinelibrary.wiley.com/doi/10.1111/pbi.12682/abstract>

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