EVOLUTION, REGULATION AND MANIPULATION OF *POPULUS TUBULINS*: THE USUAL SUSPECTS WITH UNUSUAL CONSEQUENCES

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Cortical microtubules are cytoskeletal components that have important roles in morphogenesis. Of particular relevance to the bioenergy and forest products industry is the postulated role of microtubules in orchestrating cellulose microfibril deposition during cell wall formation. The microtubule component proteins α- (TUA) and β-tubulins (TUB) are encoded by multi-gene families with very high overall sequence homology across species. We have previously characterized the spatiotemporal expression patterns of the *Populus TUA* and *TUB* families (Oakley et al. 2007). In addition to identifying several xylem-abundant and bending-responsive isoforms, we found unusual sequence heterogeneity at the C-termini, the post-translational modification (PTM) hot-spot in animal tubulins. To investigate tubulin function during wood formation, we developed a suite of transgenic *Populus* that exhibit perturbed *TUA* to *TUB* transcript ratios, or that express tubulin PTM mimics. Most of the construct combinations resulted in abnormal organogenesis and vascular development, and failed to produce viable plants. Only three of the combinations led to whole-plant regeneration, and interestingly, all three featured the C-terminal variants. The transgenic trees appeared morphologically normal, but exhibited a range of epinasty and twisting in mature leaves. Bark color was noticeably lighter in the transgenics. Lignin content and lignin structure were differentially altered in the transgenics. The results are consistent with a function of microtubules and microtubule PTMs for plant development and cell wall biogenesis in *Populus*, and offer novel strategies to manipulation of wood properties.

References Cited

Oakley RV, Wang Y-S, Ramakrishna W, Harding SA, Tsai C-J. 2007. Differential expansion and expression of alpha- and beta-tubulin gene families in *Populus*. Plant Physiology 145: 961-973.