

## 121. Laccases Direct Lignification in the Discrete Secondary Cell Wall Domains of Protoxylem

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**Project Goals:** To determine how the specificity of localized lignin deposition and cell wall cross---linking are dictated by the cell.

Plants precisely control lignin deposition in spiral or annular secondary cell wall domains during protoxylem tracheary element (TE) development. Because protoxylem TEs function to transport water within rapidly elongating tissues, it is important that lignin deposition is restricted to the secondary cell walls in order to preserve the plasticity of adjacent primary wall domains. The Arabidopsis (*Arabidopsis thaliana*) inducible VASCULAR NAC DOMAIN7 (VND7) protoxylem TE differentiation system permits the use of mutant backgrounds, fluorescent protein tagging, and high---resolution live---cell imaging of xylem cells during secondary cell wall development. Enzymes synthesizing monolignols, as well as putative monolignol transporters, showed a uniform distribution during protoxylem TE differentiation. In contrast, the oxidative enzymes LACCASE4 (LAC4) and LAC17 were spatially localized to secondary cell walls throughout protoxylem TE differentiation. These data support the hypothesis that precise delivery of oxidative enzymes determines the pattern of cell wall lignification. This view was supported by *lac4lac17* mutant analysis demonstrating that laccases are necessary for protoxylem TE lignification. Overexpression studies showed that laccases are sufficient to catalyze ectopic lignin polymerization in primary cell walls when exogenous monolignols are supplied. Our data support a model of protoxylem TE lignification in which monolignols are highly mobile once exported to the cell wall, and in which precise targeting of laccases to secondary cell wall domains directs lignin deposition.

### Publication

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