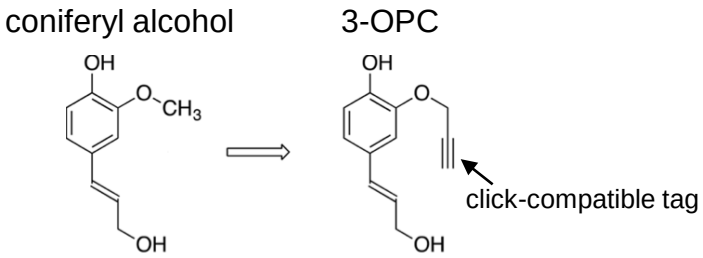
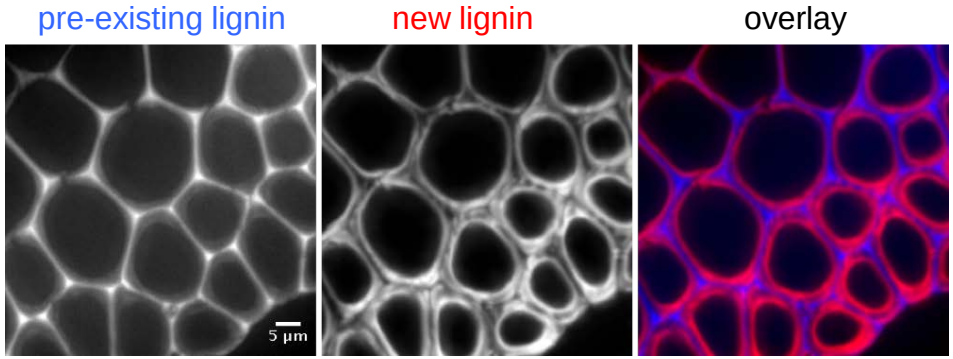
Click Chemistry-Based Labeling Reveals Spatial and Temporal Details of Lignification in Plant Cell Walls

Scientific Achievement

Synthesis and application of 3-OPC, a click-compatible analog of the lignin precursor coniferyl alcohol, allows for analysis of how lignin, a major contributor to biomass recalcitrance, polymerizes in plant cell walls





Autofluorescence from pre-existing lignin (blue) in middle lamellae and click labeling of new lignin (red) in inner wall layers in interfascicular fiber cells from 40-µm-thick sections of 8-week-old *Arabidopsis thaliana* stems treated with 20 µM 3-OPC + 20 µM coniferyl alcohol for 3 h.

Significance and Impact

The biosynthetic pathways for lignin precursors are well characterized, but how these precursors move through cell walls, are radicalized by peroxidases and laccases, and polymerize to form insoluble, water-resistant deposits in the wall is mysterious. This probe will enable us to gain new insights into how lignification works.

Research Details

- *3-OPC was synthesized and tested for bona fide incorporation into synthetic lignin by Raman and 2D-NMR spectroscopy*
- *Different plant tissues, including roots and stem sections, were incubated with 3-OPC + coniferyl alcohol or coniferyl alcohol alone as a control, click-labeled using a fluorescent azide probe, and imaged using confocal microscopy*

Bukowski N, Pandey JL, Doyle L, Richard TL, Anderson CT, Zhu Y. Development of a Clickable Designer Monolignol for Interrogation of Lignification in Plant Cell Walls. *Bioconjugate Chemistry* 2014 Dec 17;25(12):2189-96

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