CELL WALL PATTERNING

Polymers out of sync

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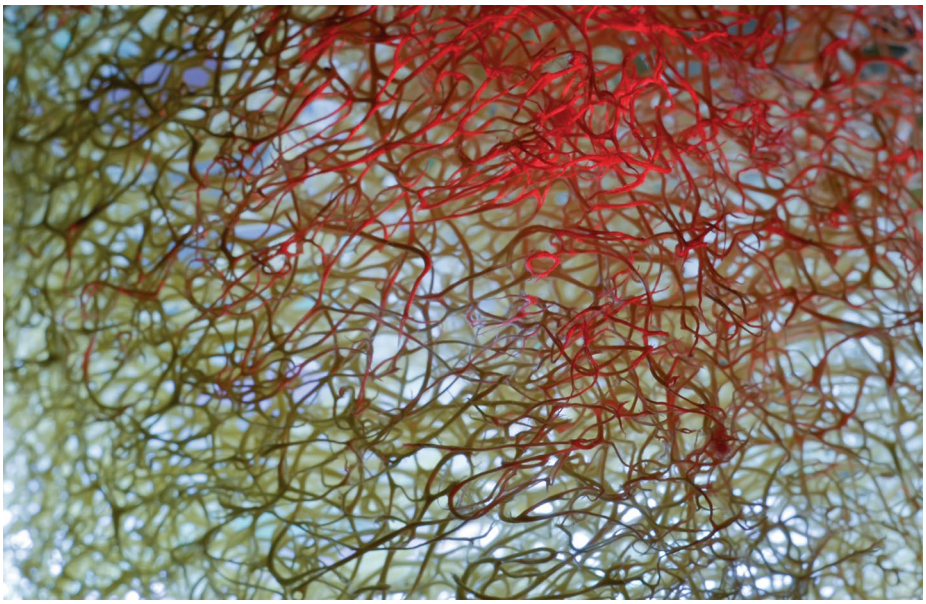

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In plants, water transduction from roots to shoots is carried out by xylem vessels. The development of a xylem cell follows a series of sequential events: precursor cell initiation, primary growth (cell elongation), secondary cell wall formation (deposition of cellulose, hemicellulose and lignin) and programmed cell death. In the secondary cell wall, xylan is the predominant component of hemicelluloses that contributes to crosslinking cellulose and lignin. Therefore, the initial patterning of these cell wall polymers is hypothesized to be well coordinated. However, in a novel *Arabidopsis* mutant identified by Takenaka et al. at Nara Institute of Science and Technology, Nara, Japan, the deposition of xylan and lignin was observed to be uncoupled from cellulose patterning, arguing against the strict coordination of polymer deposition in plant secondary cell wall.

The mutant was identified from a forward genetic screen based on the inducible *VND7–VP16–GR* cell line system. After dexamethasone induction, it shows abnormal cellulose deposition (with no spiral/annular patterning) in the secondary cell wall compared to that in the control cells (which display obvious spiral/annular patterning). Surprisingly, xylan and lignin are still deposited in spiral/annular patterns similar to what is observed in the control. It is believed that extensive cellulose synthesis in specific cell regions is one of the early steps of secondary cell wall formation. The observed uncoupled cellulose thickening and xylan/lignin deposition suggests that restricted cellulose synthesis is not a prerequisite for the patterning of xylan or lignin. The researchers further characterized the mutant as a novel missense allele of *cellulose synthase 7* (*cesa7*). They tested some other *cesa7* mutants in the inducible system, and found these mutants all displayed uncoupled polymers in the secondary cell wall. Treatment with oryzalin, a microtubule-depolymerizing reagent, altered the patterned deposition of xylan and lignin in the new *cesa7* mutant and all three polymer types in the control, supporting the determinant roles of the microtubule cytoskeleton in secondary cell wall formation.

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