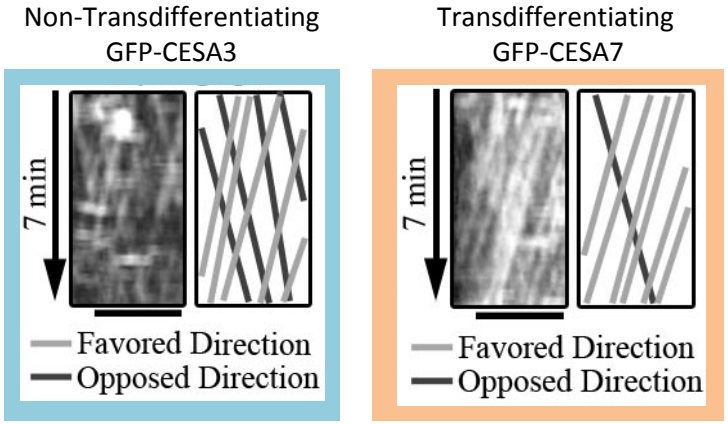
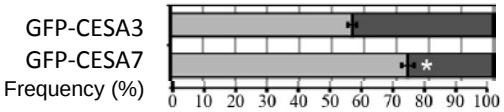
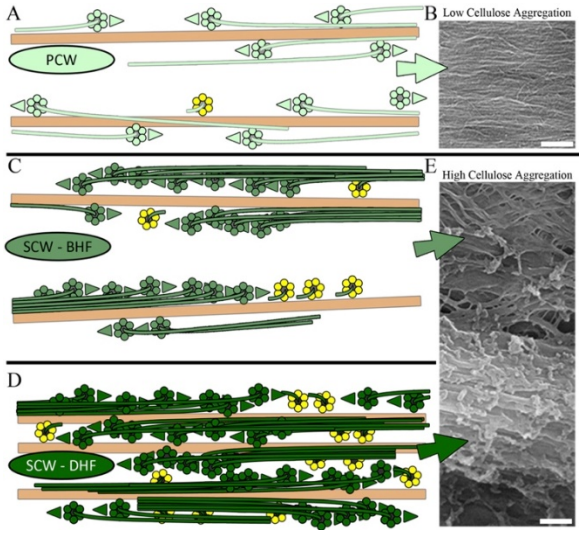
Cellulose Synthase Complexes Act in a Concerted Fashion to Synthesize Highly Aggregated Cellulose in Secondary Cell Walls of Plants







Uncoordinated activity of CSCs produces cellulose microfibrils with low aggregation in PCWs (A&B). During SCW synthesis in trans-differentiating xylem cells, high rates of CSC delivery result in swaths of active CSCs at the PM that move coherently in a common direction both before (C) and during hoop formation (D). The concerted activity of CSCs forms highly aggregated cellulose microfibrils of SCWs (E).

Significance

We show that cellulose synthase complexes (CSCs) exhibit different patterns of movement in the plasma membrane (PM) during synthesis of primary and secondary cell walls (PCWs, SCWs), contributing to distinctive organizations of these two types of cell walls.

Scientific Results

During PCW synthesis, CSCs move bidirectionally, whereas during SCWs synthesis, densely arranged groups of CSCs move coherently to synthesize highly aggregated microfibrils.

Research Details

- We introduced fluorescent cellulose synthases (GFP-CESA3, GFP-CESA7) into an Arabidopsis line containing an inducible transcription factor that causes epidermal cells to transdifferentiate into xylem cells that form SCWs.
- With spinning disk confocal microscopy we monitored CSC movements before and after induction of SCW formation.

Li S, Bashline L, Zheng Y, Xin X, Huang S, Kong Z, Kim SH, Cosgrove DJ, Gu Y (2016) *Proc. Natl. Acad. Sci. USA* 113(40): 11383-11353

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