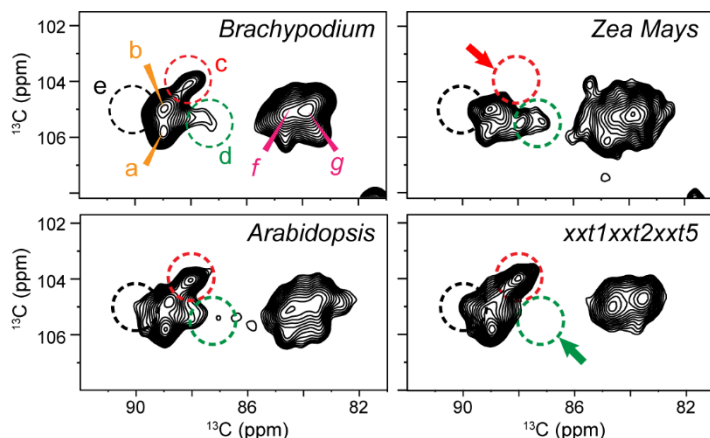
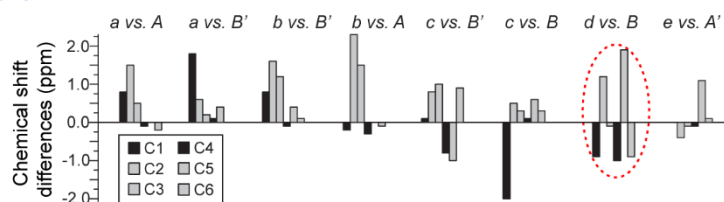


# High-Field 2D Solid-State NMR Reveals Cellulose Structural Polymorphism in Plant Primary Cell Walls

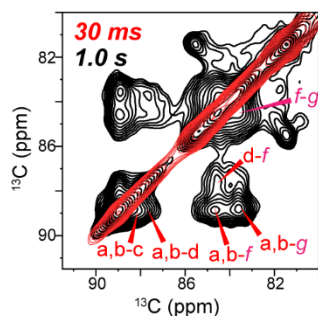
## (a) Cellulose polymorphism: seven forms



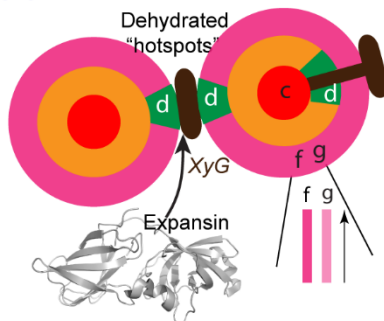
## (b) Plant cellulose vs. bacterial and animal cellulose



## (c) Spatial proximities



## (d) Cross-sectional model



## Significance and Impact

- Cellulose is the most abundant biopolymer on earth, with plant cell walls as its largest source. The structure of plant primary cell wall cellulose evades high-resolution characterization because of its extensive interactions with matrix polymers, which results in low crystallinity. With high-field 2D SSNMR and DFT calculation, the structural polymorphism and the spatial distribution of plant primary-wall cellulose were unveiled.

## Scientific Results

- Plant primary-wall cellulose is highly polymorphic.
- Five types (a-e) of interior cellulose and two types of surface cellulose (f and g) mix in the same microfibril.
- Plant primary-wall cellulose has different structure from celluloses of bacterial, algal, and animal origins
- Cellulose-d interacts with hemicellulose, and is targeted by expansin during wall loosening.

## Research Details

- Five primary cell wall samples from *Arabidopsis*, *Maize* and *Brachypodium* were measured using SSNMR.

Wang, T., Yang, H., Kubicki, J.D. & Hong, M. Cellulose Structural Polymorphism in Plant Primary Cell Walls Investigated by High-Field 2D Solid-State NMR spectroscopy and Density Functional Theory Calculations. *Biomacromolecules* 17, 2210-2222 (2016)