**Theme 1: How plants make cellulose:**
- Structure and function of cellulose synthesis complex (CSC)
- Regulation of CSC activity and cellulose fibril formation

Chemical structures of D-glucose, glucon chain, and cross section of cellulose microfibril (Kim 2013)

OM/NMR analysis provides the first theoretical model of the mechanism by which cellulose synthase elongates a cellulose polymer (one glucose moiety at a time (Yang et al. 2015))

A trimer arrangement of CESAs in a rosette CSC is predicted using computational and modern image analysis. (Nixon et al. 2016)

Matrix polymer delivery: Allyllyl fucose clickable probes for metabolic labeling and fluorescence imaging of polysaccharides (pectin) in cell walls (McClusky et al. 2016)

**Theme 2: How plants assemble multi-functional cell walls:**
- Mesoscale architecture of the cell wall
- Polymer interactions and conformations
- NMR of primary and secondary walls, including grasses
- Matrix polymer delivery
- Mobility of water, polysaccharides and proteins in the wall
- Spectral analysis of cell wall structure

NMR of primary and secondary walls, including grasses: sNMR and density functional theory (DFT) calculations indicate cellulose structural polymorphisms in plant primary cell walls (Wang et al. 2016)

**Collaborative, integrated transdisciplinary research**

The CLSF brings together unique expertise to reveal how plants construct their cell walls. Our goals are to discover how cellulose microfibrils are synthesized in diverse forms and how plant cell wall properties, including recalcitrance, emerge from interactions and assembly of cell wall polymers.

**Center for Lignocellulose Structure and Formation**

An Energy Frontiers Research Center supported by the US Department of Energy, Office of Basic Energy Sciences

**CLSF Mission**

To develop a nano-scale understanding of the structure and formation of lignocellulose, the main structural material in plants, forming a foundation for significant advances in sustainable energy and materials.

**CLSF Lead Institution**

Penn State

**Partner Institutions**

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