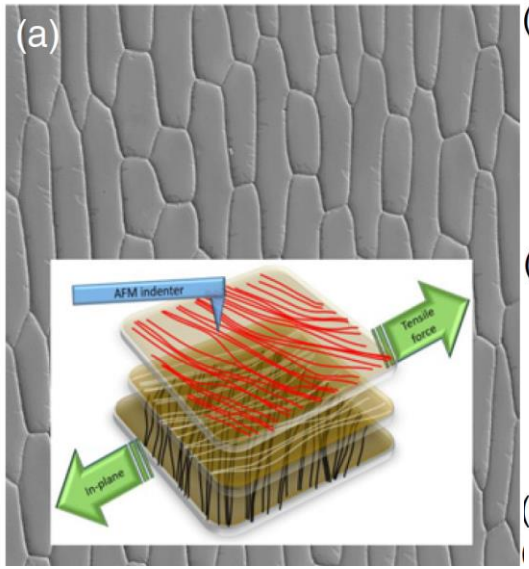
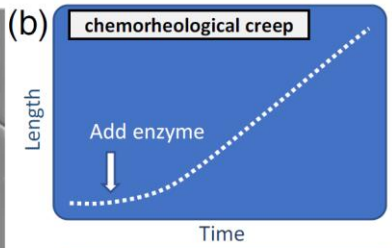
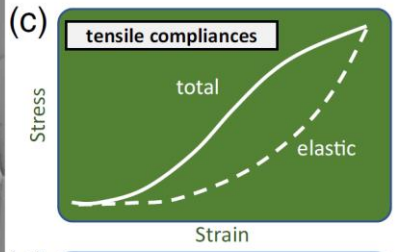
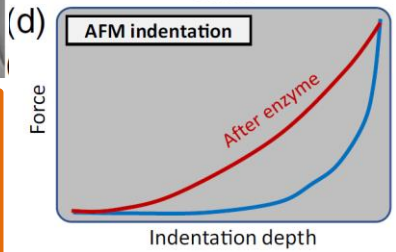
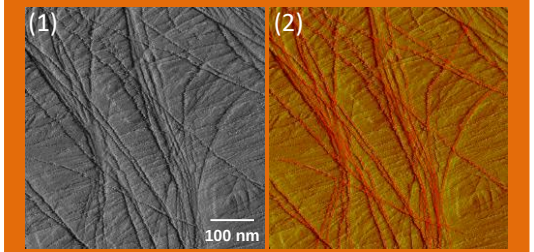
Biomechanical Results Constrain Models of Cell Wall Structure











ENZYMES: XYLOGLUCANASE, PECTATE LYASE, Cel12A CELLULASE, …

Zhang, T., Tang, H., Vavylonis, D. and Cosgrove, D.J. (2019) Disentangling loosening from softening: insights into primary cell wall structure. Plant Journal, 100, 1101-1117. [w/Cover image]

Significance and Impact

By measuring five biomechanical properties +/- enzyme digestions to identify load-bearing polymers, we find that tensile properties depend on cellulose networks in the plane of the wall, whereas indentation is sensitive to pectins. These results add new constraints to molecular models of cell wall structure.

Scientific Results

- **Pectin solubilization by pectate lyase and calcium chelation increased indentation compliance, but not tensile compliances.**
- **Increases in tensile plasticity were not closely coupled to cell wall creep.**
- **Lateral motions of cellulose microfibrils were increased by pectin treatments, yet cell wall creep was not increased.**

Research Details

Cell-free onion epidermal wall strips (a) were subjected to constant-force creep assay (b), stress-strain assay (c), surface indentation with a nm probe (d), and time-lapse imaging of the surface microfibril organization by atomic force microscopy (AFM, e), before & after enzyme treatments.