

STIFFNESS OF THE ISOLATED ARABIDOPSIS CELL WALL DURING SOAKING

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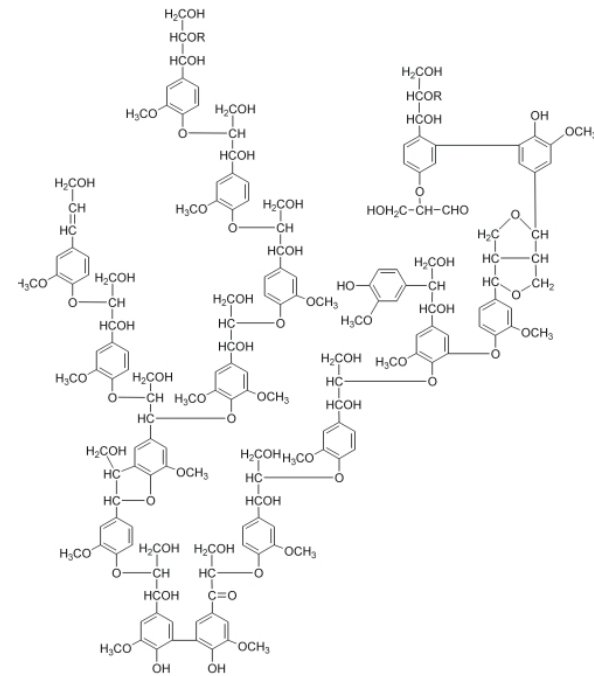
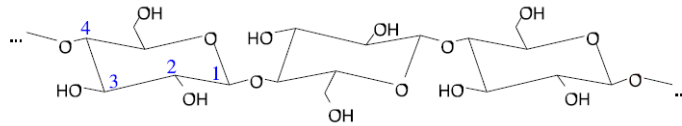
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Plant cell wall is able to store water

Hydration, absorption

cellulose



lignin

Understanding water absorption by wood

- vital for physiological processes in the apoplastic space, defense from microorganisms' attack, transport of water and nutrients
- practical importance: it affects the mechanical properties of the product.

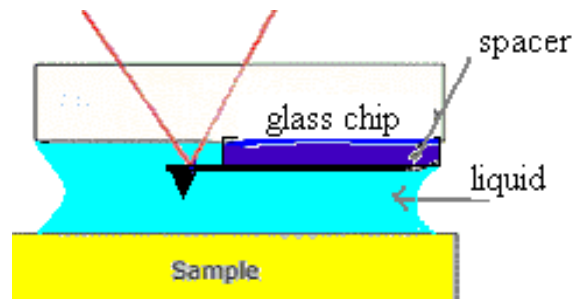
Cell wall (CW) isolated from arabidopsis stems as a model system to study changes in surface stiffness distribution during 3-hour soaking.

The CW was extracted using a series of solvents and the cellulase/pectinase treatment.



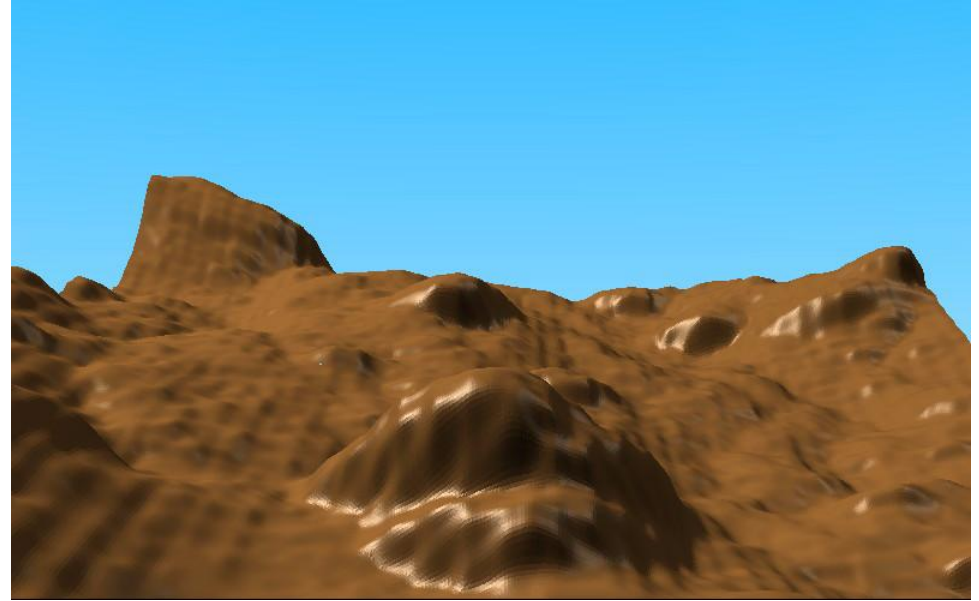
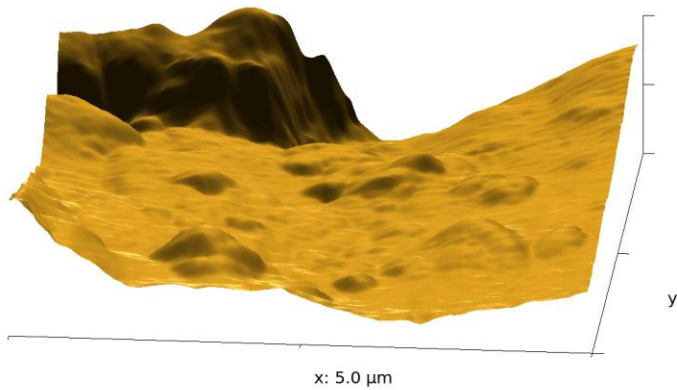
Imaging and measurements of CW elastic (Young's) modulus

- **Bioscope I AFM operating in the force volume imaging mode.**
- **The CW was fixed onto a glass surface during successive imaging in air and phosphate buffer pH 7.**

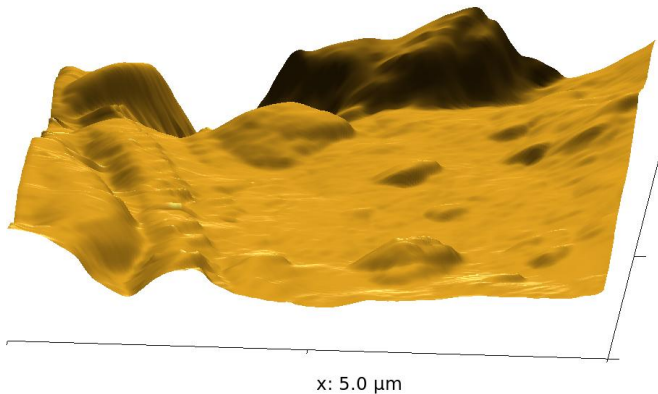


The topographic measurements (surface properties)

Before soaking



After 3h - soaking



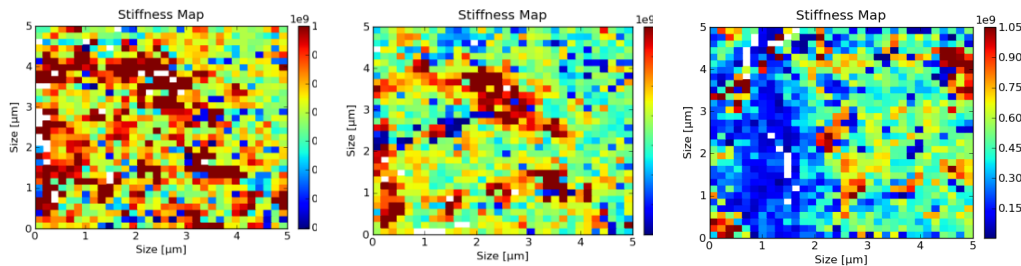
- flat surface was observed with globular structures
- swelling of the CW structure was obvious during soaking

The force volume measurements (mechanical properties)

Topography



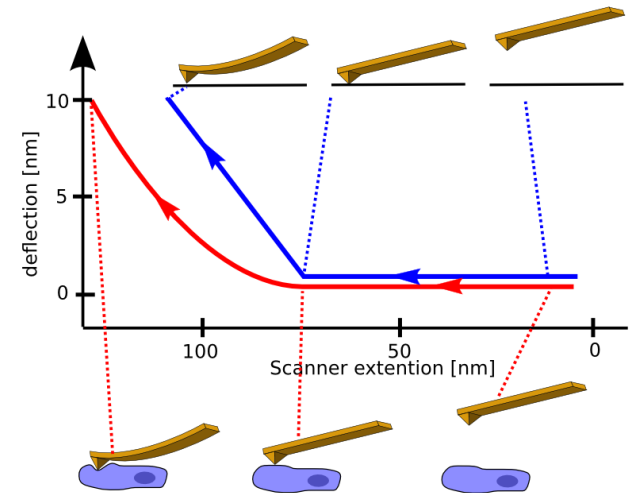
Piezo images



Dry CW

1h 45min in buffer

3 h in buffer



Young's modulus (stiffness):

from indentation curves

(IC = FD sample – FD glass)

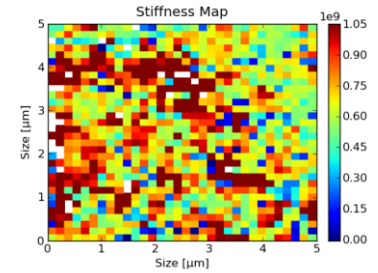
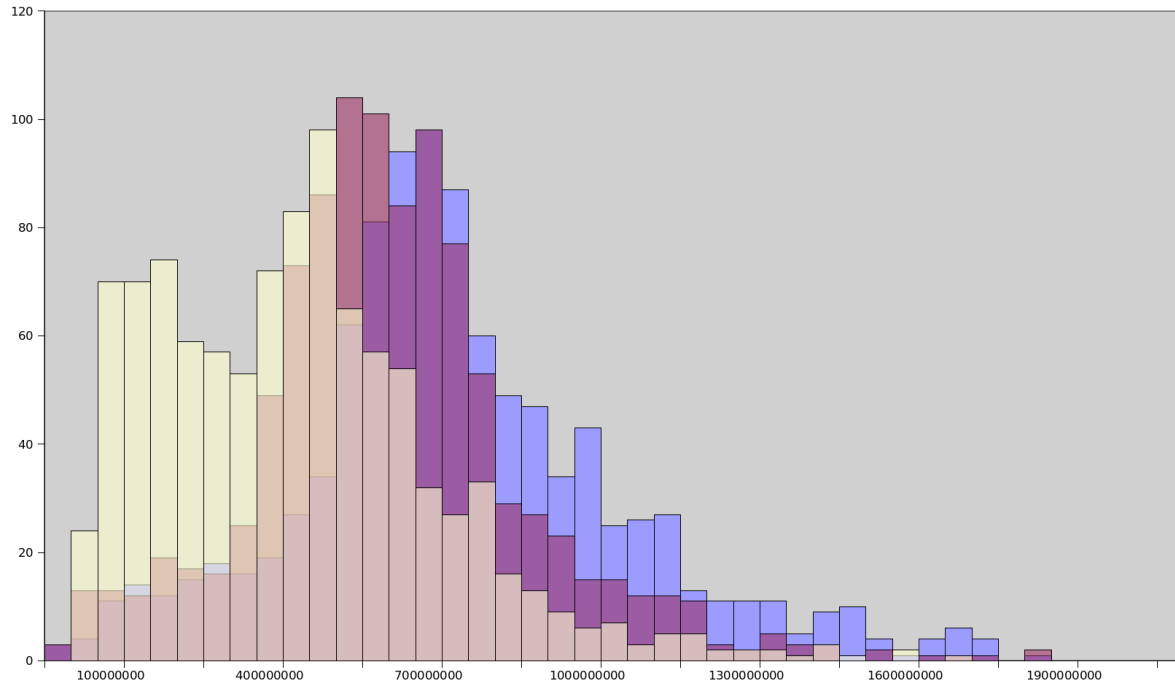
The analysis of the curves by homemade software OpenFovea permitted calculation of the sample topography and its Young's modulus.

blue = soft, red = stiff

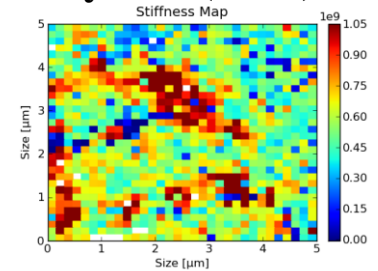
Stiffness surface distribution on the CW sample.

Five FV images averaged per site (2x2 μm with a 32x32 pixel resolution)

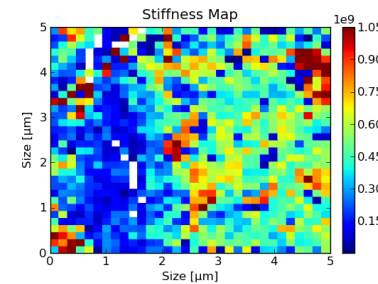
Arabidopsis CW stiffness evolution



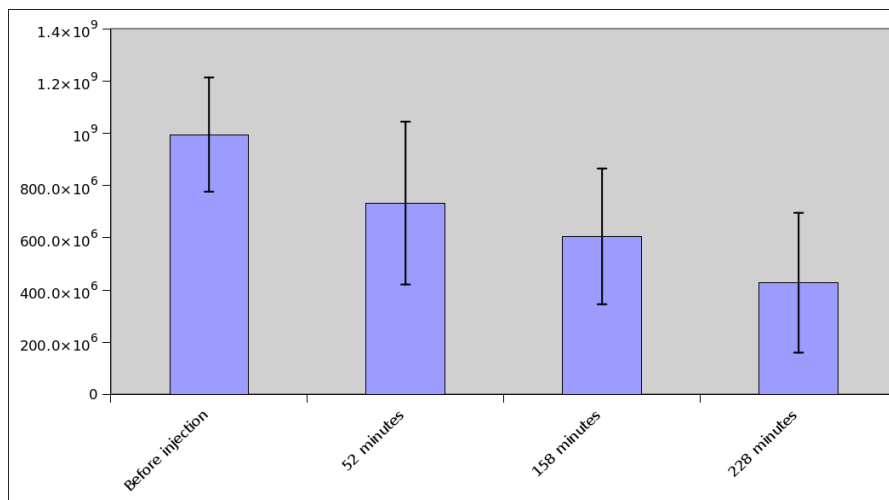
dry CW (blue)



1 h 45 min in buffer (red)



3 h in buffer (yellow)

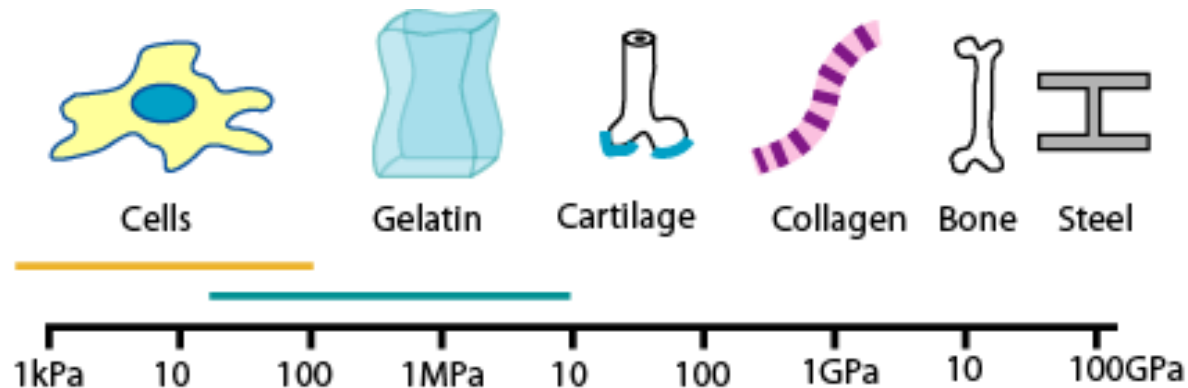


The elastic modulus changed from 10^9 Pa in the dry CW to 10^6 Pa after 3 h of soaking

Conclusions

- Swelling of the CW structure during soaking was monitored
- There was a reduction in the surface stiffness during soaking
- The mean elastic modulus changed from 10^9 Pa in the dry CW to 10^6 Pa after 3 h of soaking

Young's modulus



Acknowledgements



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