Changes in mechanical properties of live cell wall during turgor regulation monitored by atomic force microscopy

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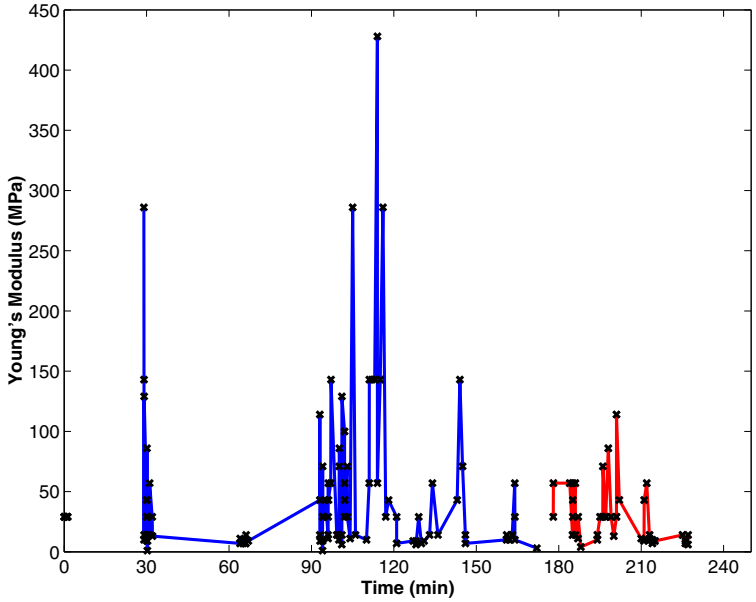
Plant cells display mechanosensitivity (Shepherd *et al.*, 2001). Monitoring these mechanical signals *via* changes in the cell wall is important in the study of control pump activation during hypotonic turgor regulation (Bisson & Beilby, 2002).

The atomic force microscope (AFM) has become a useful tool in the study of surface mechanical properties (Burnham & Colton, 1989). In the study of biological samples its great advantage is allowing real-time study of samples in their native state (Radmacher, 1997). We have used the AFM to monitor changes in mechanical properties of the cell wall as the cell is subject to osmotic stress.

We report on experiments conducted on small live cells (2-3mm) of *Ventricaria ventricosa (Valonia)*, a well characterised, large single-celled alga. Measurements were taken on the resting cell in artificial seawater (ASW 990 mOsmol•kg^{-1}) prior to initiating turgor regulation. Hypotonic stress of 200 mOsmol•kg^{-1} was then imposed on the cell. After stabilisation, measurements were collected on the cell surface for approximately 2 hours. The procedure was repeated for an additional hypotonic shock of 590 mOsmol•kg^{-1}.



The figure shows the time response of the cell stiffness. The cell appears to respond to hypotonic shock by rapidly altering its wall. Soon after the onset of hypotonic shock, wall strengthening is observed, then a period of large oscillations between wall strengthening and weakening is seen followed by a period of smaller oscillations. A weak wall compared to the resting cell's was observed after the oscillation period. The cells examined survived the two levels of hypotonic shock.

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