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Atomic Force Microscopy Measurements of the Mechanical Properties of Cell Walls on Living Bacterial Cells RICHARD BAILEY, NIC MULLIN, ROBERT TURNER, SIMON FOSTER, JAMIE HOBBS, University of Sheffield — Staphylococcus aureus is a major cause of infection in humans, including the Methicillin resistant strain, MRSA. However, very little is known about the mechanical properties of these cells. Our investigations use AFM to examine live S. aureus cells to quantify mechanical properties. These were explored using force spectroscopy with different trigger forces, allowing the properties to be extracted at different indentation depths. A value for the cell wall stiffness has been extracted, along with a second, higher value which is found upon indenting at higher forces. This higher value drops as the cells are exposed to high salt, sugar and detergent concentrations, implying that this measurement contains a contribution from the internal turgor pressure. We have monitored these properties as the cells progress through the cell cycle. Force maps were taken over the cells at different stages of the growth process to identify changes in the mechanics throughout the progression of growth and division. The effect of Oxacillin has also been studied, to better understand its mechanism of action. Finally mutant strains of S. aureus and a second species Bacillus subtilis have been used to link the mechanical properties of the cell walls with the chain lengths and substructures involved.

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