
Proceedings Paper:
Hobbs, J.K., Burns, J.M., Turner, R.D. et al. (5 more authors) (2017) Cell wall architecture and the development of cell shape in S. aureus and E. coli. In: European Biophysics Journal with Biophysics Letters. 19th IUPAB congress and 11th EBSA congress, 16-20 Jul 2017, Edinburgh, UK. Springer Verlag , S100-S100.

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Bacterial shape is largely determined by the architecture of the peptidoglycan cell wall. During cell growth and division the wall undergoes a process of both growth and remodelling to ensure that shape is preserved from mother to daughter cells. Here we have studied the interplay between molecular level peptidoglycan architecture, mechanical properties and shape throughout the cell cycle using atomic force microscopy. In *Staphylococcus aureus*, despite its primarily spherical shape, we observe an evolution of wall stiffness that corresponds to enzymatic activity, revealing a growth mechanism that depends on peptidoglycan degradation. Molecular resolution imaging reveals a corresponding change in architecture from tightly packed concentric rings to a random and highly porous mesh more akin to a gel. In *Escherichia coli* we have been able to clearly image the molecular organisation of the near two dimensional peptidoglycan wall, revealing unexpected variations in ordering and complexity. Correlative work with super-resolution optical microscopy (STORMForce) will also be presented as a route towards adding chemical detail to morphological and mechanical information from AFM.