Revealing contact formation characteristics of bacteria

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Bacteria exhibit an outstanding ability to adhere to various kinds of surfaces. Details of contact formation, however, are hard to gain and single cell AFM force spectroscopy has proven to be a powerful tool to quantify the acting forces if combined with a clever choice of substrates. On hydrophobic surfaces, the hydrophobic interaction plays the main role for the adhesion of bacteria [1] and the contact formation process is dominated by cell wall macromolecules. In our AFM study, we were able to observe the process of making contact by observing the snap-in process in detail [2]. To interpret the data, Monte Carlo simulations were set up, involving a simple model for a bacterium. The simulations yield strikingly matching results, corroborating the interpretation that the contact formation of *S. aureus* relies on thermally
fluctuation cell wall proteins that tether to a surface and subsequently pull the bacterium to the surface. That way, e.g. *S. aureus* is able to attach to surfaces over distances far beyond the range of classic surface forces! Our results therefore suggest that the bacterial adhesion process in general, can be described by solely taking into account the tethered macromolecules between a bacterium and a surface.

[1] N. Thewes et al, *Hydrophobic interaction governs unspecific adhesion of staphylococci: a single cell force spectroscopy study*, Beilstein J. Nanotechnol. 2014, **5,** 1501 – 1512.

[2] N. Thewes et al, *Stochastic binding of Staphylococcus aureus to hydrophobic surfaces*, Soft Matter 2015, **11**, 8913 – 8919.