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Proton and metal adsorption clues to a universal surface chemistry for bacterial cells.

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The surface chemistry of bacterial cells determines cell surface reactivity with regard to metal adsorption, cell adhesion, biomineralisation and indeed many other processes, including antibiotic resistance. Throughout the last decade, the desire to develop a thermodynamic framework for modelling metal adsorption to bacterial cell surfaces has focussed efforts on defining a universal surface chemistry for cell surfaces. This is deemed necessary to obviate the need to define cell surface properties at single strain level, an impossible task given the large range of species present in most environments that will need to be modelled.

Our laboratory uses a combination of potentiometric titrations, spectroscopic analysis (IR and XPS) and zeta potential measurements to characterise bacterial cell suspensions in terms of proton active sites and surface charge. We find variations in surface chemistry of cells attributable to Gram classification, growth media/redox conditions, strain type and ionic strength. However, much of this variability is within the range of experimental errors typical of these studies and pales in significance when compared with the surface chemistry of the biofilm state that cells adopt in nature. Using such data, and additional metal adsorption experiments, we will argue for a generalised surface chemistry for bacterial cells that has been known for at least 20 years and perhaps longer.