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# Unraveling the Structure-Function Relationships of Microbial Systems By High-Resolution *in vitro* Atomic Force Microscopy

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The elucidation of microbial surface architecture is critical to determining mechanisms of pathogenesis, immune response, physicochemical properties and environmental resistance. We have utilized *in vitro* AFM for studies of structure, assembly, function and environmental dynamics of several microbial systems including bacteria and bacterial spores. We have demonstrated[1-3], using various species of bacterial spores strikingly different species-dependent crystalline structures of the spore coat appear to be a consequence of crystallization mechanisms that regulate the assembly of the spore coat. Furthermore, we revealed molecular-scale transformations of the spore coat and cell outgrowth during the germination process. We will present data on the direct visualization of stress-induced environmental response of metal-resistant *Arthrobacter* oxydans bacteria to Cr (VI) exposure. These studies demonstrate that *in vitro* AFM can probe microbial surface architecture, environmental dynamics and the life cycle of pathogens at near-molecular resolution under physiological conditions. This work was performed under the auspices of the U.S.DOE at LLNL under contract number W-7405-ENG-48.

1. M.Plomp, T.J. Leighton, K.E. Wheeler and A.J. Malkin (2005). *Biophys. J.*, 88, 603-608. 2. M.Plomp, T.J. Leighton, K.E. Wheeler and A.J. Malkin (2005). Langmuir, 21, 7892. 3. M.Plomp, T.J. Leighton, K.E. Wheeler and A.J. Malkin (2005). Langmuir, 23, 10710.