Bacterial surfaces display an impressive variation in physico-chemical properties. Apart from the chemical nature of the surface constituents and the organization of these constituents within the cell wall, these properties are determined by the conformational degrees of freedom of the polymeric surface constituents. Detailed knowledge of the bacterial surface properties is of major practical importance, as they determine the propensity of a bacterium to adhere to surfaces, to bind polymeric constituents of the growth medium and they are implied in bacterial (auto) aggregation and clustering. Of a number of lactic acid bacteria, the physico-chemical surface properties are studied in relation to the conformational properties of the surface polymers. Techniques giving coarse-grained information on the whole bacterial cell wall, like electrophoretic mobility, Dynamic Light Scattering and adhesion to liquid interfaces, are combined with Atomic Force Microscopy from which information on the morphology, elasticity and interactions of the bacterial surface on nanometer scales is extracted. The S-layer, which is an important constituent of the cell wall of many lactobacillus strains and which consists of a para-crystalline layer of globular proteins, contributes strongly to the overall surface properties if present on the outer layers of the cell wall, like in L. crispatus, but not if polymers protrude through this layer, like in L. helveticus. Polymers at the bacterial surface can vary widely in their chemical nature, physico-chemical properties and macromolecular conformations, as witnessed for instance by L. johnsonii DSM20533, which has a rough, heterogeneous surface consisting of neutral polysaccharides, L. johnsonii ATCC33200 which is covered by a homogeneous layer of single polymers and L. johnsonii ATCC332 which is covered by lipoteichoic acids.