Geometrical and mechanical fine structure of peptidoglycans in living *Streptococcus* bacteria studied by AFM nanomechanical mapping

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Abstract

Bacterial peptidoglycan is an important component of the cell wall, maintaining turgor pressure and cell shape. The peptidoglycans are responsible for the transitions between different physiological states of bacteria: from biofilm formation to active growth and division and other functional properties of bacterial cell. Moreover the distribution of surface proteins contributing to the infection process is directly coupled to the peptidoglycan three-dimensional structure [1-2]. We studied the nanoscale architecture of peptidoglycan and associated proteins at the surface of living *Streptococcus* bacteria by atomic force microscopy (AFM). The bacterial cells were trapped in filter pores and imaged in DD water and buffer in PeakForce QNM (quantitative nanomechanics) mode allowing to acquire a topography and elasticity and adhesion maps simultaneously [3]. The topographical surface structures exhibit typical glycan strands arranged in helical manner and decorated by proteins of various sizes. We found that aside from the synthesis centers the strands can be interrupted by spots with net-like structures which interconnect a few neighbor strands. Furthermore it was observed that large proteins cover separated parts of the strands and net-like structures are covered by much smaller species. The analysis of adhesion maps suggests that there exists a set of adhesive bands directed perpendicularly to the glycan strands. The results are supplemented by elements of flooding analysis enabling to visualize and quantify these features.

References

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