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Responses of Staphylococcus aureus to mechanical and chemical stresses

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Chapter 1.2

Aim of This Thesis

AIM OF THIS THESIS

Initial bacterial adhesion to soft or hard surfaces in the human body and emergent properties leading to biofilm formation play a critical role in bacterial infections, which can occur when bacteria adhere to mammalian cells, bone, teeth, or to biomaterial implant surfaces. One of the most common, clinically-relevant infectious bacteria are staphylococci. *S. aureus* is a biofilm-forming organism involved in infection [1] associated with biomaterial implants and devices [2], pneumonia [3], skin abscesses [4], meningitis [5], endocarditis [6] and osteomyelitis [7] amongst others. While as such difficult to treat already due to their biofilm-mode of growth, further challenges in infection control and prevention are constituted by the development of "superbugs" [8,9], resistant to multiple antibiotics.

Hitherto, the majority of *in vitro* studies on antibiotic efficacy has been performed on planktonic bacteria [10], thus neglecting the protection offered by the biofilm-mode of growth occurring when bacteria are adhering to a surface, and the nanoscopic deformations of the bacterial cell wall arising from the adhesion forces between bacteria and the surfaces to which they adhere. Therefore, further research is needed into effects of mechanical stress on bacteria adhering to a surface, in addition to the chemical stress arising from antibiotic treatment.

The aim of this thesis is to gain insight into the response(s) of *S. aureus* strains to mechanical and chemical stresses, as governed by the physico-chemical properties of the substratum surfaces to which they adhere, grow and form a biofilm on. Accordingly, this thesis represents the first comprehensive description of the role of physico-chemistry in explaining biofilm formation from initial adhesion to emergent surface-programmed properties of a biofilm.

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