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Race for the Surface: Simultaneous Growth of Bacteria and Mammalian Cells on DNA Polyelectrolyte Multilayer Coatings

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Abstract

We introduce a dip-and-rinse, DNA-based coating to reduce the risk of bacterial infection and promote tissue integration of implants, applicable to most common implant surfaces. Medical implants are used to restore the function of failed body parts, but their application is limited by implant-associated infections (IAI). IAI yield high mortality because bacteria that colonize implant surfaces form a biofilm, which protects them against immune cells and antibiotics1. In most cases, the final outcome of IAI is the removal of the infected implant from the body [1]. Bacterial contamination of implants frequently happens during the surgery (peri-operative contamination). Whether this contamination develops into an infection or not depends mainly on the outcome of the so-called 'race for the surface' between successful tissue integration of the implant and colonization of the surface by bacteria2. Bacterial attachment to the implant surface is the initial step of biofilm formation, and therefore a preventative strategy is to use antiadhesive coatings. However, truly antiadhesive coatings not only decrease bacterial colonization but also host tissue integration. The ultimate solution is therefore multifunctional coatings that are non-adhesive to microbes and simultaneously support tissue integration [2].

We hypothesized that polyanionic DNA could prevent bacterial adhesion and biofilm formation. In our recent study, we produced DNA coatings via the facile layer-by-layer technique alternating DNA with the biocompatible biopolymer chitosan. We showed that the LbL DNA coatings significantly reduced the adhesion of Staphylococcus and Pseudomonas to both PMMA and titanium implant surfaces. In addition, our DNA coatings demonstrated no cytotoxicity when cultured with SaOS-2 cells3 (Figure 1). Here, we continue to investigate the simultaneous growth of bacteria and mammalian cells on the DNA polyelectrolyte multilayer coated implant surface based on the race for the surface [3].

Biography

Guruprakash Subbiahdoss is affiliated to the Institute of Biologically Inspired Materials, Department of Nanobiotechnology, University of Natural Resources and Life Sciences (BOKU) Vienna, Austria. His research interests reflect in his wide range of publications in various national and international journals.

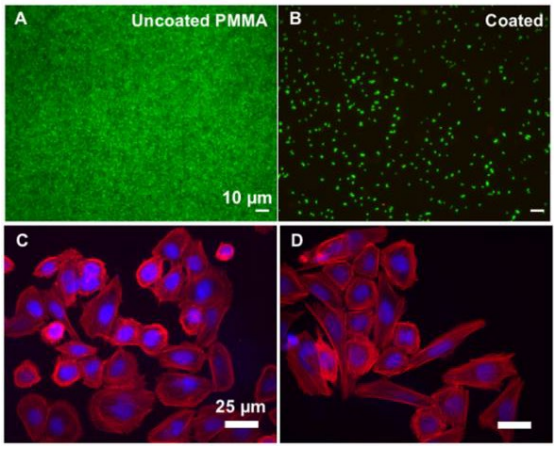

Figure 1: Adhesion of Staphylococcus epidermidis (green) on A) uncoated and B) coated PMMA surfaces after 24 h of incubation at 37ºC in tryptic soy broth. Adhesion and spreading of SaOS-2 cells after 48 h of growth on C) uncoated and D) coated PMMA surfaces3.

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