Gold nanoparticle contact point density controls microbial adhesion on gold surfaces.

Dewald C, Lüdecke C, Firkowska-Boden I, Roth M, Bossert J, Jandt KD (2018) Gold nanoparticle contact point density controls microbial adhesion on gold surfaces. *Colloids Surf B Biointerfaces* 163, 201-208.

Details

Abstract

Surface structures in the nanometer range emerge as the next evolutionary breakthrough in the design of biomaterials with antimicrobial properties. However, in order to advance the application of surface nanostructuring strategies in medical implants, the very nature of the microbial repealing mechanism has yet to be understood. Herein, we demonstrate that the random immobilization of gold nanoparticles (AuNPs) on a material's surface generates the possibility to explore microbial adhesion in dependence of contact point densities at the biointerface between the microbe, i.e., Escherichia coli and the material's surface. By optimizing the contact point density defined by individual AuNPs, yet keeping the surface chemistry unchanged as evidenced by X-ray photoelectron spectroscopy, we show that the initial microbial adhesion can be successfully reduced up to 50%, compared to control (unstructured) surfaces. Furthermore, we observed a decrease in the size of microbial cells adhered to nanostructured surfaces. The results show that the spatial distance between the contact points plays a crucial role in regulating microbial adhesion, thus advancing our understanding of the microbial adhesion mechanism on

nanostructured surfaces. We suggest that the introduced strategy for nanostructuring materials surfaces opens a research direction for highly microbial-resistant biomaterials.

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doi: 10.1016/j.colsurfb.2017.12.037

PMID: 29304434