Selected research topics in Biomedical Engineering: Novel Phenotyping and Diagnostic Tools

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Stimuli-Responsive Polymer Systems for Rapid Diagnostics of Bacterial Infections and Contaminations.

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Abstract

In view of the threat of bacteria with multiple resistances against antibiotics, the rapid detection of bacteria and the discrimination of bacterial infections become ever more important. In this presentation novel sensing approaches that utilize designed polymeric nanomaterials and hydrogels that function as (*i*) autonomously bacteria sensing coatings as well as (*ii*) encapsulated sensing bacteria will be discussed. Both approaches tackle the detection of bacteria via the detection of secreted bacterial molecules. While the sensing coatings respond with a colorimetric change to the presence of selected bacterial enzymes, the hydrogel-encapsulated reporter bacteria express fluorescent protein in response to the presence of cell signaling molecules ("autoinducers). This effort is embedded in a larger program that also utilizes nanopore-based detection schemes. As will be discussed, these strategies allowed us to detect and quantitatively determine the concentration of bacterial enzymes of *Escherichia Coli* and of the pathogenic bacteria *Staphylococcus aureus* and *Pseudomonas aeruginosa* in bacterial supernatants and real samples with limits of detection in the lower nanomolar range for detection times < 10 minutes.

Curriculum: Holger Schönherr studied chemistry and polymer chemistry & physics at the Universities of Mainz and Toronto and obtained his Ph.D. at the University of Twente, The Netherlands in 1999. Following a postdoctoral stay at Stanford University, he joined MESA+ Institute for Nanotechnology in Twente as assistant (later associate) professor before joining the University of Siegen in 2008 as a University Professor in Physical Chemistry. In 2013 and 2019 he was also appointed guest professor at the Shanghai Jiaotong University. Holger Schönherr (ISI H-index 45) co-authored more than 225 papers in peer-reviewed journals as well as a monograph on "Scanning Force Microscopy of Polymers" (Springer). He was awarded, among others, with the Raphael-Eduard-Liesegang award of the German Colloid Society (2011), an ERC starting grant (2011), the POLYCHAR Materials Science Award 2013 and Research Prize of the School of Science and Technology of the University of Siegen (2013). His research interests comprise the modification and characterization of polymeric surfaces and (bio)interfaces, micro- and nanostructured polymeric materials, bacteria detection, 3D cell culture and surface analysis with atomic force microscopy (AFM) and combined AFM-optical methods.