Biofilms consist of bacteria immobilized in extracellular polymeric substances (EPS) with a complex three-dimensional morphology. This inevitably results in gradients (concentration, cell count, pH, etc.) directly affecting the overall behavior of biofilms. Yet, comparatively little is known about the influence of surface structures beneficial for biofilms as production platforms. This understanding is indispensable to establish stable and highly productive biofilm processes. In this study, the model organism *Lactococcus lactis* subsp. *lactis* was used, which produces the antimicrobial peptide nisin (E234). Even though its potential for clinical use has been recognized over the past two decades and the application extended to biomedical fields, its widespread use is restricted due to high production costs and relatively low yields. Within this study, microstructured metallic substrata were investigated. All surface structures were characterized via optical profilometry and *L. lactis* biofilms were cultivated in custom built flow cells. Biofilm morphology was analyzed via optical coherence tomography (OCT) and qRT-PCR was used to analyze relative gene expression levels of nisin genes. Biofilm thickness as well as mushroom count varied depending on the substratum used. This morphological dependency on the surface structure rather than solely on fluid dynamics was demonstrated with a hybrid substratum which was only partly structured. Two separate and morphologically distinct sections were further investigated in order to identify structure-based variations in gene expression. Increased gene expression levels were detected for all genes investigated in the sample of the mushroom rich biofilm section. For the structural gene *nisA* and *nisP*, a gene involved in nisin processing, particularly high levels were detected. This indicates an increased activity of the entire nisin gene cluster. Even though mRNA levels cannot directly be linked to respective product titers, it is rather interesting to see different behaviors of biofilm sections on the transcriptional level. In addition to the influence of the substratum surface on biofilm morphology, this knowledge can be used to design biofilm processes based on beneficial surface structures.

The financial support by DFG - Collaborative Research Center 926 (Microscale Morphology of Component Surfaces) is gratefully acknowledged.