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Tackling microbial biofilms one molecule and one cell at a time...  

The havoc caused by biofilm fouling and biofilm-related infections cannot be overemphasized. As initial attachment to surfaces is a crucial pre-requisite to biofilm formation, understanding how biofilms get started on the level of a single bacterium or even a single molecule, as well as how it escalates into mature biofilms, is imperative. In the first part of my talk, I will focus on how the surface appendage (pili) of a probiotic (L. rhamnosus GG or LGG) mediate bacterial adhesion. I will show, at the single-cell level, that LGG colonize abiotic surfaces through a nanospring behavior and formation of membrane tethers on host cells. Just as crucial as the nature of bacterial surface to biofilm formation are the properties of the underlying substrate. In the second part of my talk, I will then talk about bacterial rigidity sensing or how bacteria respond to the stiffness of the underlying substrate. Considering the different sectors where biofilm-related problems arise and its ever-increasing role in the development of bacterial resistance, understanding how substrate stiffness affect biofilm formation is a critical part of devising effective strategies to combat biofilm-related fouling problems. Lastly, I will present results of our current efforts in probing the nanomechanical properties of mature biofilms.