Correlating bacterial interaction forces with biofilm structure

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Communities of bacterial cells can live together embedded within a slime-like molecular matrix as a biofilm. This allows the bacteria to hide from external stresses. A single bacterium can replicate itself and develop into a biofilm, and over time the bacterial cells in specific regions of the biofilm will start to interact with their neighbors in different ways. These interactions occur via structures on the surface of the bacterial cells, and the differences in these interactions resemble those that occur as cells specialize during the development of animal embryos. Previous research into embryonic development has shown how differences in the physical interactions between embryonic cells are essential for sorting the cells into their correct locations and shaping the embryo. Recently, we found that the basic physical principles are similar in bacterial biofilms.

In my talk I will discuss how mechanical interactions between bacteria govern the structure and dynamics of bacterial biofilms. We have generated a molecular toolbox that allows tuning the interaction forces systematically. Using this toolbox, we address the question how differential interaction forces govern cell sorting and biofilm structures in general. Currently, we are evaluating how biofilms might benefit from the structures that develop due to differential interactions.