

Abstract

Most bacteria on earth live in heterogeneous surface-bound congregations called biofilms, and vast reaches of the earth are coated in these living films. In many cases, the microorganisms comprising this ubiquitous coating form complex, interactive communities called consortia. Microbial consortia are implicated in processes of great importance to humans, from environmental remediation and wastewater treatment to assistance in food digestion. Synthetic biologists are honing their ability to program the behavior of individual microbial populations, forcing the microbes to focus on specific applications, such as the production of drugs and fuels. Given that microbial consortia can perform even more complicated tasks and endure more changeable environments than monocultures can, they represent an important new frontier for synthetic biology. This thesis describes two engineered microbial consortia that live and perform their designed functions in biofilms. The biofilm consortium elucidated in Chapter 2 serves as a proof of concept for the development of the symbiotic biofilm consortium of Chapter 3. To provide a context for these two consortia, the first chapter highlights the salient features of microbial consortia that are of interest to synthetic biologists and reviews recent efforts to engineer synthetic microbial consortia, while the final chapter suggests challenges associated with and future directions for engineering microbial consortia.