Session: Emerging technologies

Engineering bacterial multicellularity with synthetic adhesins for green applications

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Synthetic bacterial consortia with desired morphologies and patterns promise the realization of many applications such as programmable biomaterials, metabolic consortia, and 'build-to-understand' approaches for natural biofilms. Our ability to rationally engineer such 'synthetic consortia' is still limited, in particular regarding control over cell adhesion and other biomechanical aspects. My lab developed the first synthetic and optogenetic approaches to control cell-cell and cell-surface adhesion for bacterial self-assembly and patterning ('Biofilm Lithography'). I will discuss the biophysical characterization of these tools. I will then demonstrate a synthetic cell-cell adhesin logic to experimentally program and mathematically model complex two-dimensional interface patterns. These interfaces are generated through a swarming adhesion mechanism that enables precise control over interface geometry as well as adhesion-mediated analogs of developmental organizers and morphogen fields. I will also discuss how resulting synthetic consortia aid our understanding of cooperative antibiotic responses in biofilms as well as green applications like methane capture and conversion.