Design principles of asymmetric cell division

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The design principle of establishing an intracellular protein gradient for asymmetric cell division is a long-standing fundamental question. While the major molecular players and their interactions have been elucidated via genetic approaches, the diversity and redundancy of natural systems complicate the extraction of critical underlying features. In this talk, I will describe how we took a synthetic cell biology approach to construct intracellular asymmetry and asymmetric division in Escherichia coli, in which division is normally symmetric. We demonstrated that the oligomeric PopZ from Caulobacter crescentus can serve as a robust polarized scaffold to functionalize RNA polymerase. Furthermore, by using another oligomeric pole-targeting DivIVA from Bacillus subtilis, the newly synthesized protein could be constrained to further establish intracellular asymmetry, leading to asymmetric division and differentiation. I will also describe our ongoing attempts to understand the role of mutual antagonism in asymmetric cell division

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