

Synthesis of molecular devices for programming biological function

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The goal of “Synthetic Biology” is to synthesize whole biological system or its subsystem intentionally and designing elements such as the regulatory elements and functional gene should be necessarily predictable. Lack of the available regulatory elements for the precise expression control is a major hurdle to optimize the metabolic network by synthetic biology approach. To control the expression level precisely, post-transcriptional control has to be considered in addition to the transcriptional regulation by promoter strength. Unlike promoter strength, the effect of mRNA secondary structure is critical to predict the expression level. In this study, we constructed the library with the randomized 5'-UTR with superfolder GFP as a reporter and developed a stochastic model to predict the expression based on the primary structure of UTR. Additionally, two topics on “global translational machinery engineering” to accommodate a wide range of protein components and “intracellular metabolite sensor” to regulate metabolic distribution will be presented. The potentials of the platform technology developed in this study for the application to the production of biofuels and commodity chemicals including butanol, hydrogen, and amino acid.