Precise Gene Expression Control at the Glyoxylate Cycle for Improved Production of Biochemicals

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The glyoxylate cycle is a bypass of the TCA cycle without carbon loss and enables microorganisms to utilize simple organic compounds as their sole carbon source. Although its role is highly important in anaplerosis, the engineering of the cycle is limited to a few examples. In addition, the previous strategy has been only limited to inactivation of a transcriptional regulator (IclR). Here, we introduce two examples of improved biochemical production via engineered the glyoxylate cycle in *Escherichia coli*. In the first part, we used glyoxylate cycle to utilize acetate, a potential feedstock with low cost, for production of itaconic acid. In the second part, we also employed the glyoxylate cycle to improve 5-aminolevulinic acid production from glucose. During both studies, we precisely regulated the activity of the glyoxylate cycle to find optimal flux which maximizes production. The strategy has been highly successful and we observed the significantly increased production of itaconic acid (6.5-fold) and 5-aminolevulinic acid (1.5-fold). These results suggest that elaborated tuning of the cycle can be a powerful strategy to facilitate efficient production of many TCA derivatives.