

Synthetic protein quality control system in bacteria

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Coupled transcription and translation processes in bacteria cause indiscriminate translation of intact and truncated mRNAs, inevitably generating non-functional polypeptides. Here, we devised a synthetic gene-expression cassette that can enhance the quality of protein synthesis in bacteria. This protein quality control (ProQC) system enables translation only when both ends of mRNAs are present and followed by circularization based on sequence-specific RNA-RNA hybridization. We demonstrated that the ProQC system dramatically improved the synthesis of full-length proteins by providing high-quality intact mRNA and reducing abortive translation. As a result, a 1.7-fold increase in full-length protein synthesis occurred, compared to a conventional expression cassette, without changing the transcription or translation efficiency. Furthermore, we applied the ProQC system for 3-HP production from malonyl-CoA by functionally expressing malonyl-CoA reductase, resulting in 1.6-fold greater 3-HP production. We believe that our ProQC system can be universally applied to improve not only the quality of recombinant proteins production but also efficiencies of metabolic pathways.