Engineering biological circuits by combining an intragenic riboswitch with a transcriptional regulatory element for biomedical applications

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Here, we present engineering of biological circuits by combining a theophylline-mediated riboswitch and a TetR-regulatory transcriptional control system, so the resulting biological circuits controllable at both transcriptional and translational levels can be regulated by theophylline. The synthetic gene circuit consists of two components, a sensor plasmid constructed by incorporating a theophylline aptamer sequence into a coding region of tetR gene and a reporter plasmid prepared by placing an egfp gene under the control of TetR repressor. We constructed six combinations of the two plasmids of different replication origins, so the resulting plasmid combinations show a varying number of plasmid copy number. We found that one combination among six showed the best circuit behavior, indicating that connecting the riboregulation and the transcriptional control requires subtle balancing of the two regulatory elements.