



RNA-based Logic Gates in *Escherichia coli*-based cell-free transcription-translation (TXTL) system

RNA is considered to be one of the most promising elements for developing dynamic genetic regulatory systems. RNA regulators have many great advantages in synthetic biology, such as a variety of functions, predictability, and most importantly light metabolic cost. However, despite the recent advances in synthetic biology, coupling different RNA-parts into complex genetic circuits continues to be experimentally challenging.

In this project, combinations of small transcriptional activator RNAs (STARs) and Toehold switches were used in designing genetic circuits. To characterise the different components and their dynamic range, an *Escherichia coli* (*E. coli*) cell-free transcription-translation (TXTL) system was used. STAR and Toehold systems can regulate gene expression in great dynamic ranges by providing high specificity. Due to the independent control of gene expression on transcriptional (STAR) and translational (Toehold) levels, there is a high chance of implementing the more complex circuits with high response level to the outside stimuli, such as sequential logic gates.

Aim

Aims of the project can vary, depending on the experience and career goals of the student. The first possibility is to experimentally evaluate the usability of designed genetic circuits. Another possibility is computational evaluation of the developed circuits, including microscopy image analysis.

Prerequisites:

- Knowledge of molecular biology
- Good spoken and written English
- For experiment-based project: experience working in wet lab environment and knowledge of MatLab are advantageous
- For computer-based project: experience working with MatLab is advantageous.

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