

Project 9.5 From studying bacterial regulatory RNAs to repurposing them as gene regulation tools

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www: <https://bit.ly/3SZlc9l>

Background:

sRNAs play crucial roles in regulating gene expression and are involved in various cellular functions. In bacteria such as *Escherichia coli* and *Salmonella*, hundreds of sRNAs have been identified, and they are known to modulate the expression of a significant portion of the genome under different growth conditions. The interaction between sRNAs and mRNAs is facilitated by an RNA chaperone protein called Hfq, which assists in the base pairing between them. The rules for sRNA target recognition have been difficult to establish because of the heterogeneity in RNA sequence, structure, length, and the extent of the sRNA-mRNA base pairing region. Therefore, this project seeks to comprehensively understand the rules governing sRNA-mRNA pairing and leverage this knowledge to design customized regulators that can precisely control the expression of specific genes.

Aim:

The primary objective of this project is to gain a comprehensive understanding of the molecular mechanisms involved in the pairing of sRNAs with mRNAs in bacteria. The research will focus on elucidating the factors that influence sRNA-mRNA recognition, including the size and secondary structure heterogeneity of sRNAs, the variable length of sRNA-mRNA pairing, the role of thermodynamic stability, and the impact of RNA sequence motifs. Single-molecule TIRF microscopy will be employed to investigate the contributions of these factors to efficient sRNA-mRNA pairing. Furthermore, the project aims to investigate the influence of sRNAs directly on translation using a GFP fusion approach. This way the research will establish a comprehensive set of rules governing the regulation of bacterial transcriptome. The knowledge gained from this study can be utilized to predict targets of natural sRNAs and design artificial sRNAs for specific gene regulation. Thus, the realization of the project can have practical applications in the fields of synthetic biology and metabolic engineering.

Requirements:

- MSc degree in biology, biochemistry or related field,
- solid knowledge of the principles of molecular biology and biochemistry,
- hands-on experience in laboratory work and knowledge of basic molecular biology techniques,
- prior experience in recombinant protein purification or microscopy will be an advantage,
- proficiency in written and spoken English,
- excellent interpersonal skills, initiative, good work organization

Number of positions available: 1

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