

# Examining the Mechanism of the Self-Regulation of *rpsU2* in *Francisella tularensis*



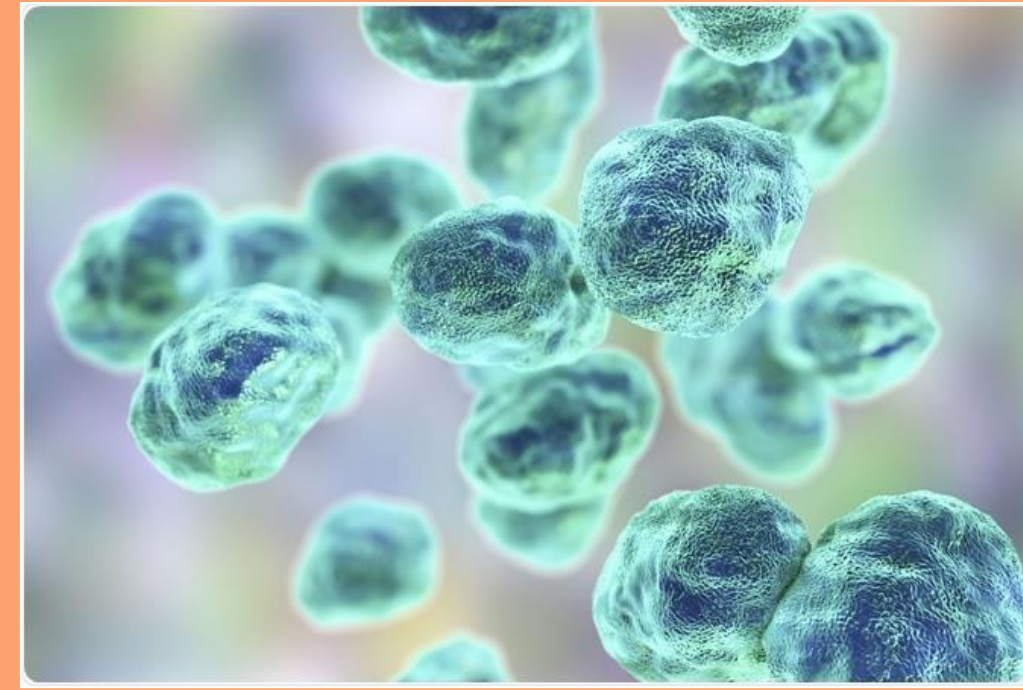
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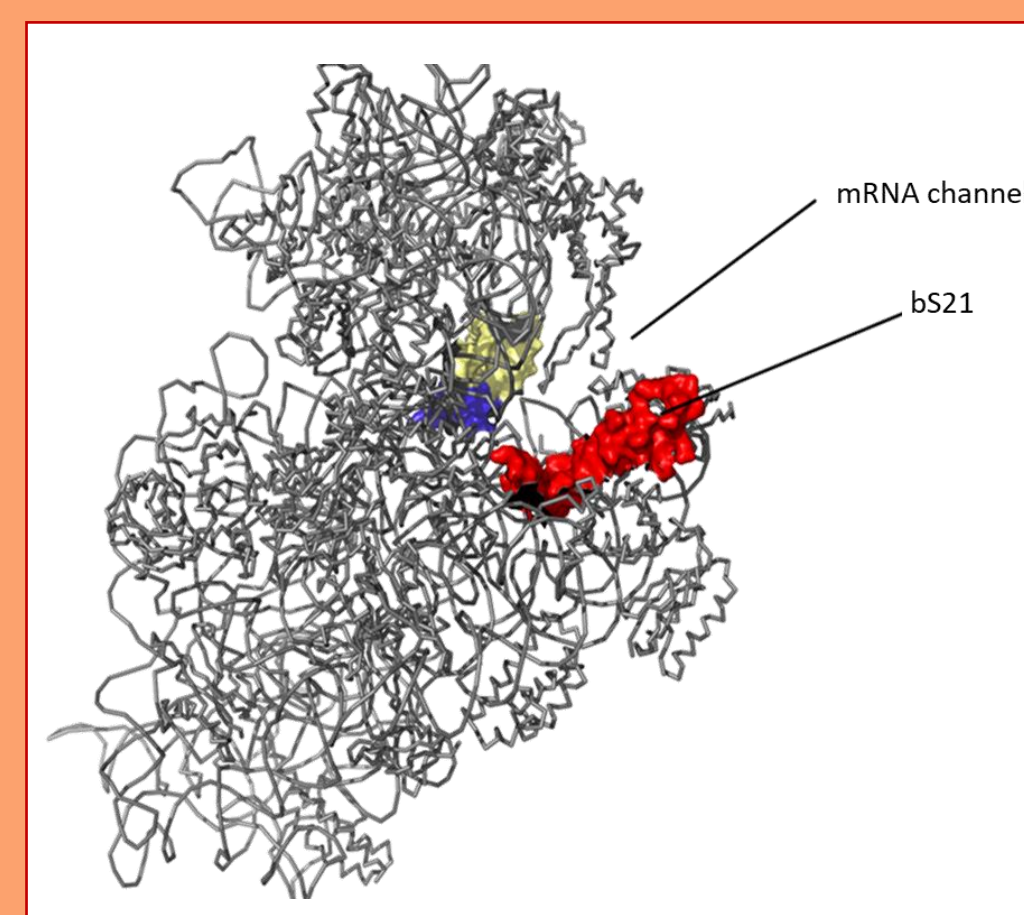
## Introduction

### *Francisella tularensis*

- Gram-negative
- Intracellular pathogen
- Causes tularemia
- Potential bioweapon



**bS21: a small subunit ribosomal protein involved in translation initiation**



Three homologs in *F. tularensis*

- Leads to ribosome heterogeneity
- Loss of bS21-2
  - Influences virulence factors and intramacrophage growth

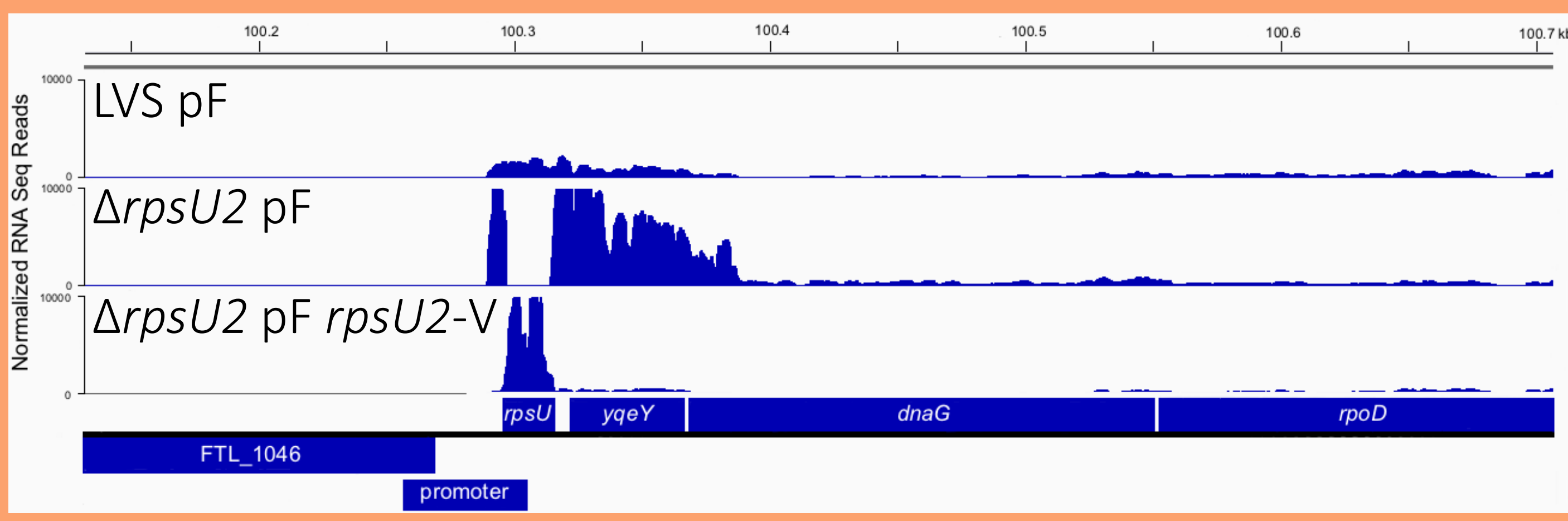
Location of bS21 in the small subunit of the *E. coli* ribosome

## Study Goals

Understand the regulation of the bS21 homologs

- How does bS21-2 affect itself?
- How do bS21-1 and bS21-3 affect bS21-2?

### bS21-2 Regulates its Own Expression

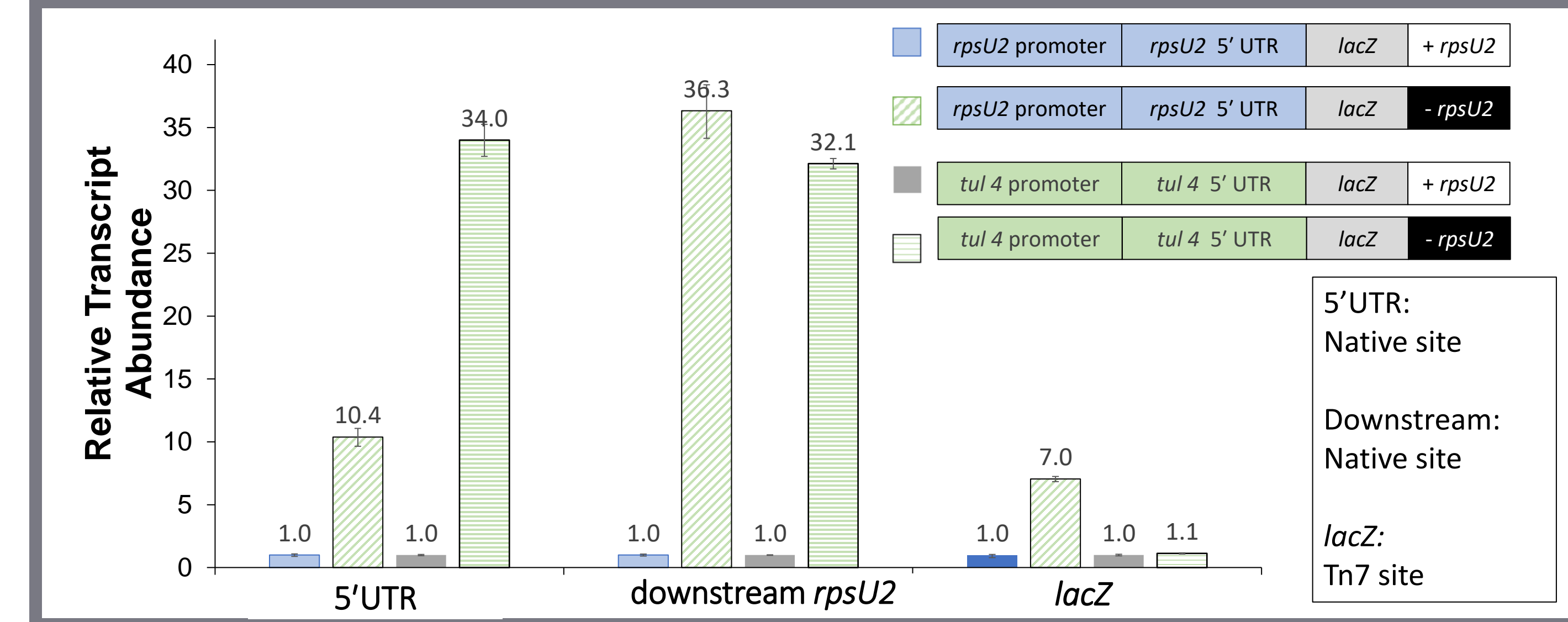


## Results

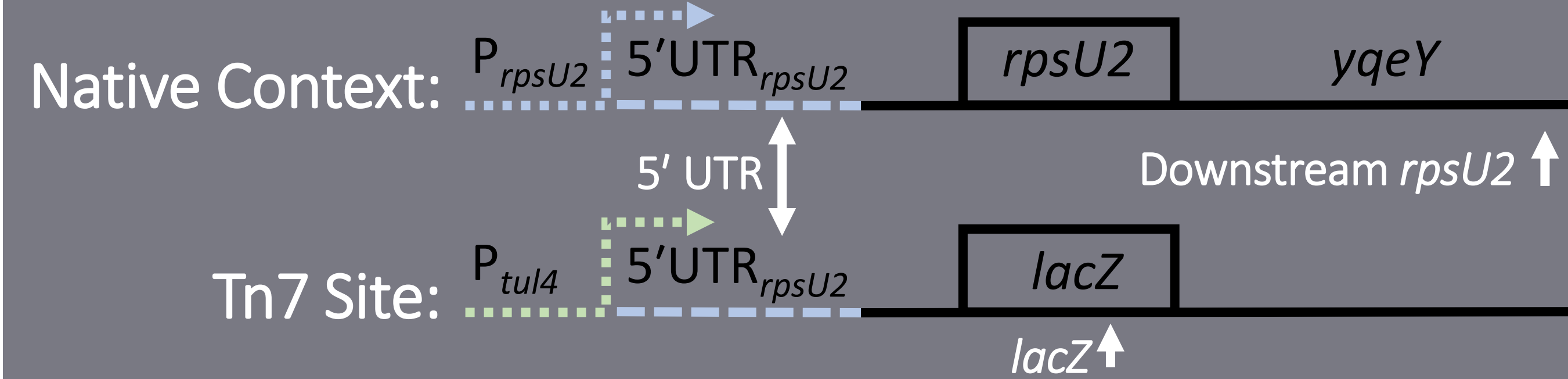
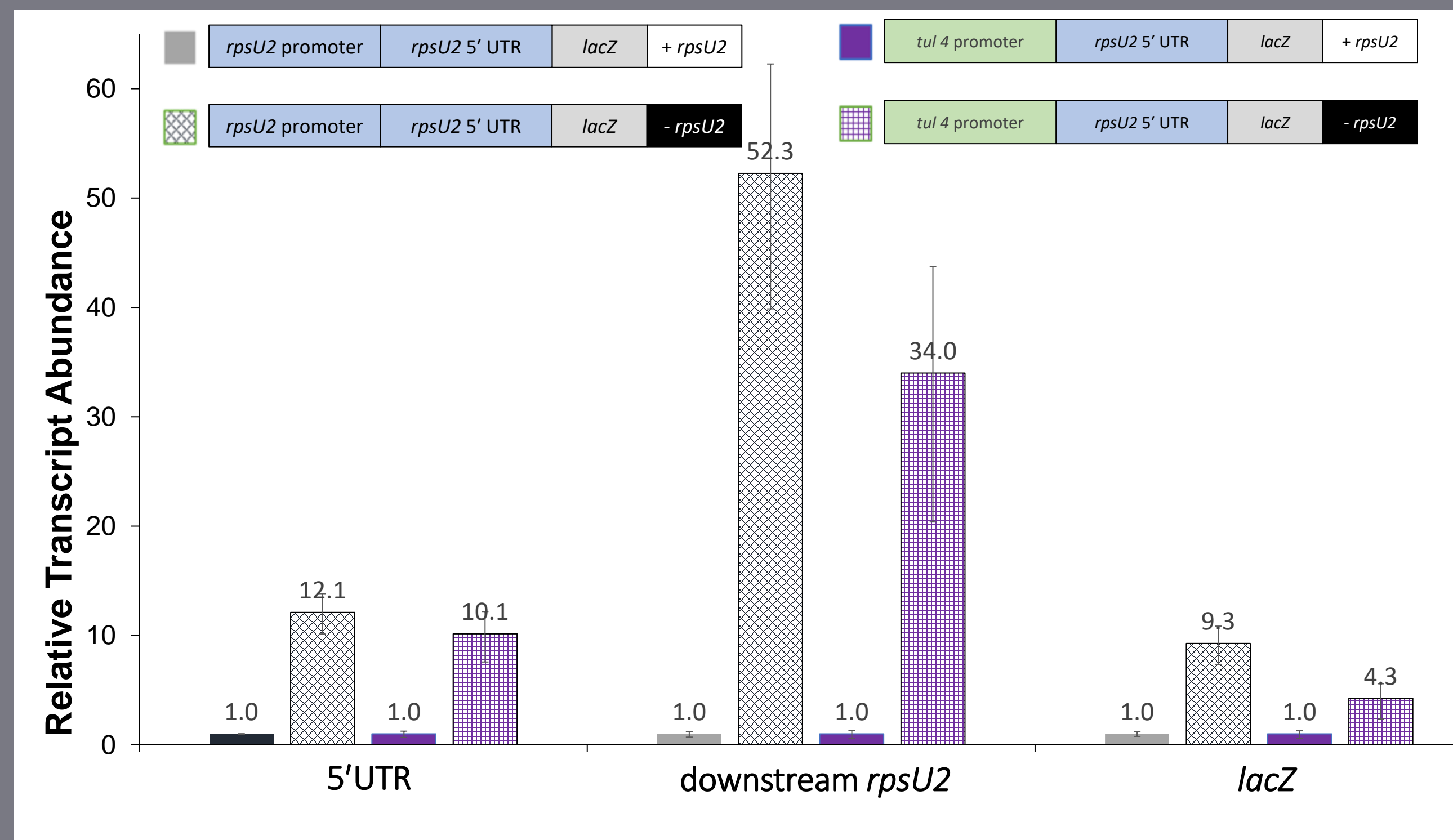
### Constructs and Predictions

			If in cells <b>with</b> bS21-2 (WT)	If in cells <b>without</b> bS21-2 ( $\Delta rpsU2$ )
<i>tul 4</i> promoter	<i>tul 4</i> 5' UTR	<i>lacZ</i>	+++	+++
<i>rpsU2</i> promoter	<i>rpsU2</i> 5' UTR	<i>lacZ</i>	+	+++++
<i>rpsU2</i> promoter	<i>tul 4</i> 5' UTR	<i>lacZ</i>	?	?
<i>tul 4</i> promoter	<i>rpsU2</i> 5' UTR	<i>lacZ</i>	?	?

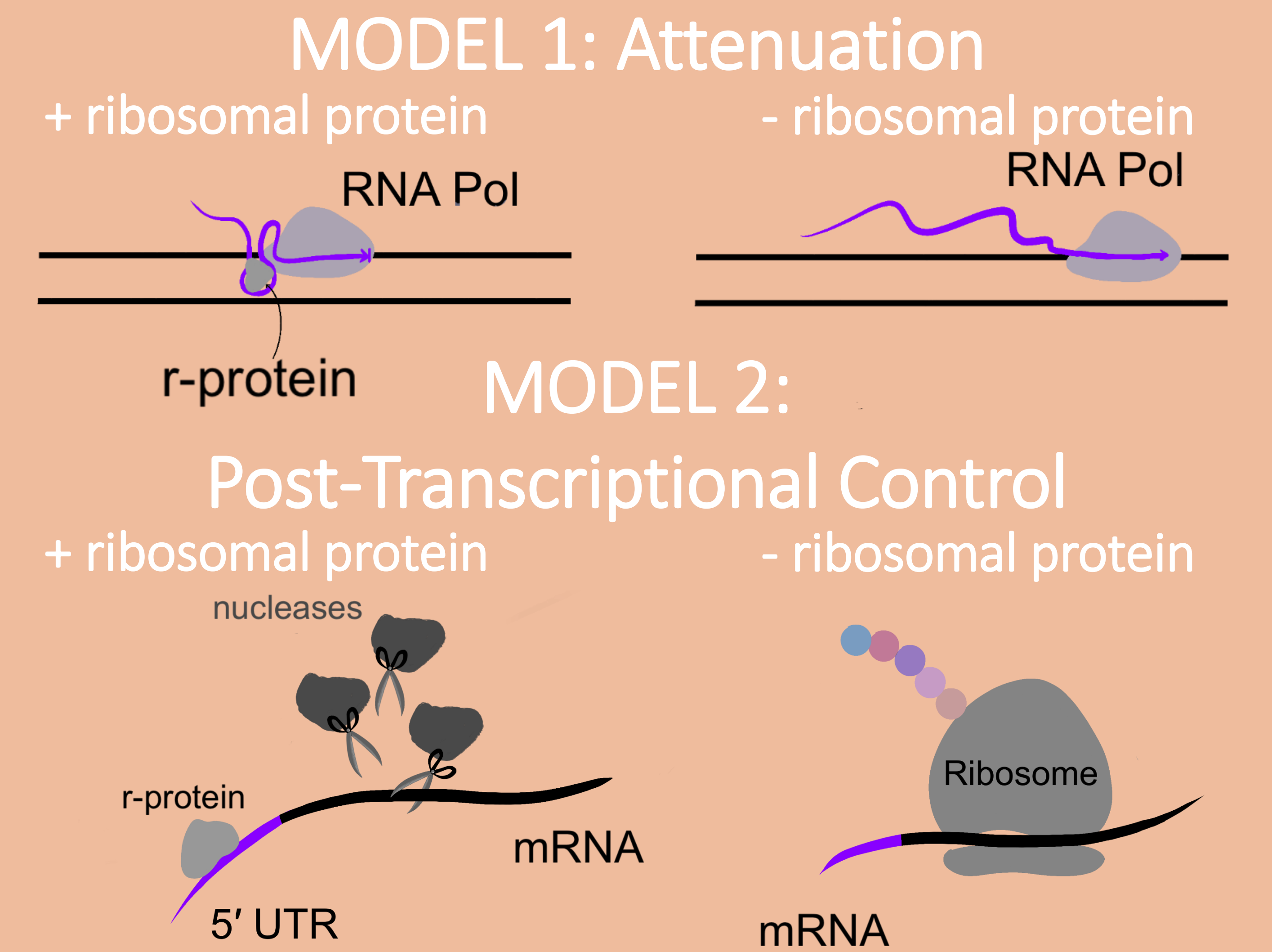
### *Ptu4* and 5' UTR Do Not Regulate



### *rpsU2* 5'UTR Permits Regulation by bS21



## Ribosomal Protein Regulation



## Conclusions

- The 5'UTR of the *rpsU2* gene leads to regulation by bS21

## Future Directions

- Test the *rpsU2* promoter's contribution to the regulation of bS21-2
- Assess the relationship between transcript and protein abundance with *lacZ*
- Examine post-transcriptional model via degradation assays

## References

- Burgos, H. L., O'Connor, K., Sanchez-Vazquez, P., & Gourse, R. L. (2017). Roles of Transcriptional and Translational Control Mechanisms in Regulation of Ribosomal Protein Synthesis in *Escherichia coli*. *Journal of bacteriology*, 199(21), e00407-17. <https://doi.org/10.1128/JB.00407-17>
- Lindahl, L., Archer, R., & Zengel, J. M. (1983). Transcription of the S10 ribosomal protein operon is regulated by an attenuator in the leader. *Cell*, 33(1), 241-248. [https://doi.org/10.1016/0092-8674\(83\)90353-7](https://doi.org/10.1016/0092-8674(83)90353-7)
- Trautmann H, Ramsey K. A ribosomal protein homolog governs gene expression and virulence in a bacterial pathogen. *J. Bacteriol* 2022. In Press.
- Nomura, M., Gourse, R., & Baughman, G. (1984). Regulation of the synthesis of ribosomes and ribosomal components. *Annual review of biochemistry*, 53, 75-117. <https://doi.org/10.1146/annurev.bi.53.070184.000451>
- Zengel, J. M., & Lindahl, L. (1994). Diverse mechanisms for regulating ribosomal protein synthesis in *Escherichia coli*. *Progress in nucleic acid research and molecular biology*, 47, 331-370. [https://doi.org/10.1016/s0079-6603\(08\)60256-1](https://doi.org/10.1016/s0079-6603(08)60256-1)