

# The intersubunit bridge B1b of the bacterial ribosome facilitates initiation of protein synthesis and maintenance of translational fidelity

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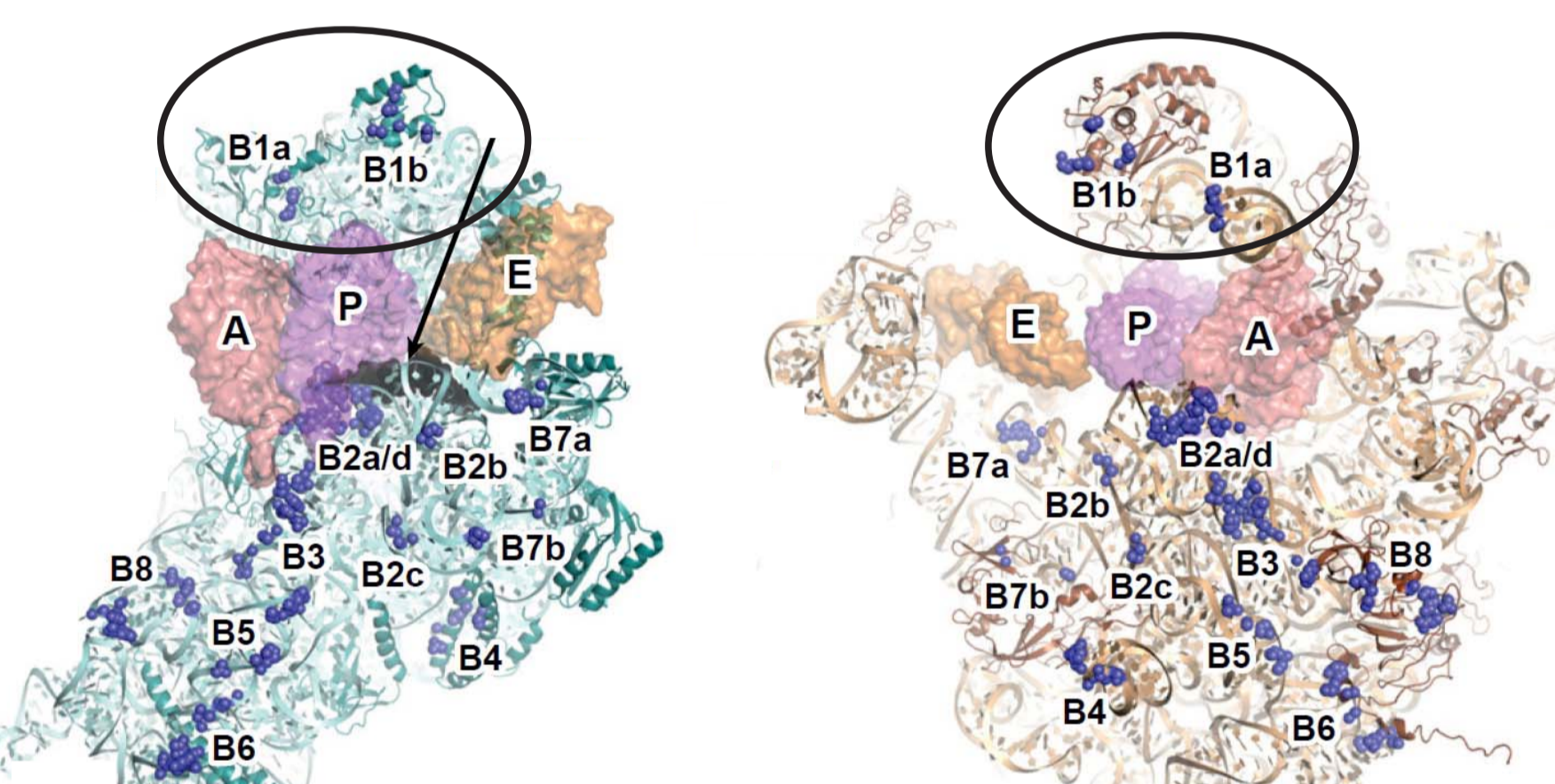
## INTRODUCTION

### Intersubunit bridge B1b of bacterial ribosome

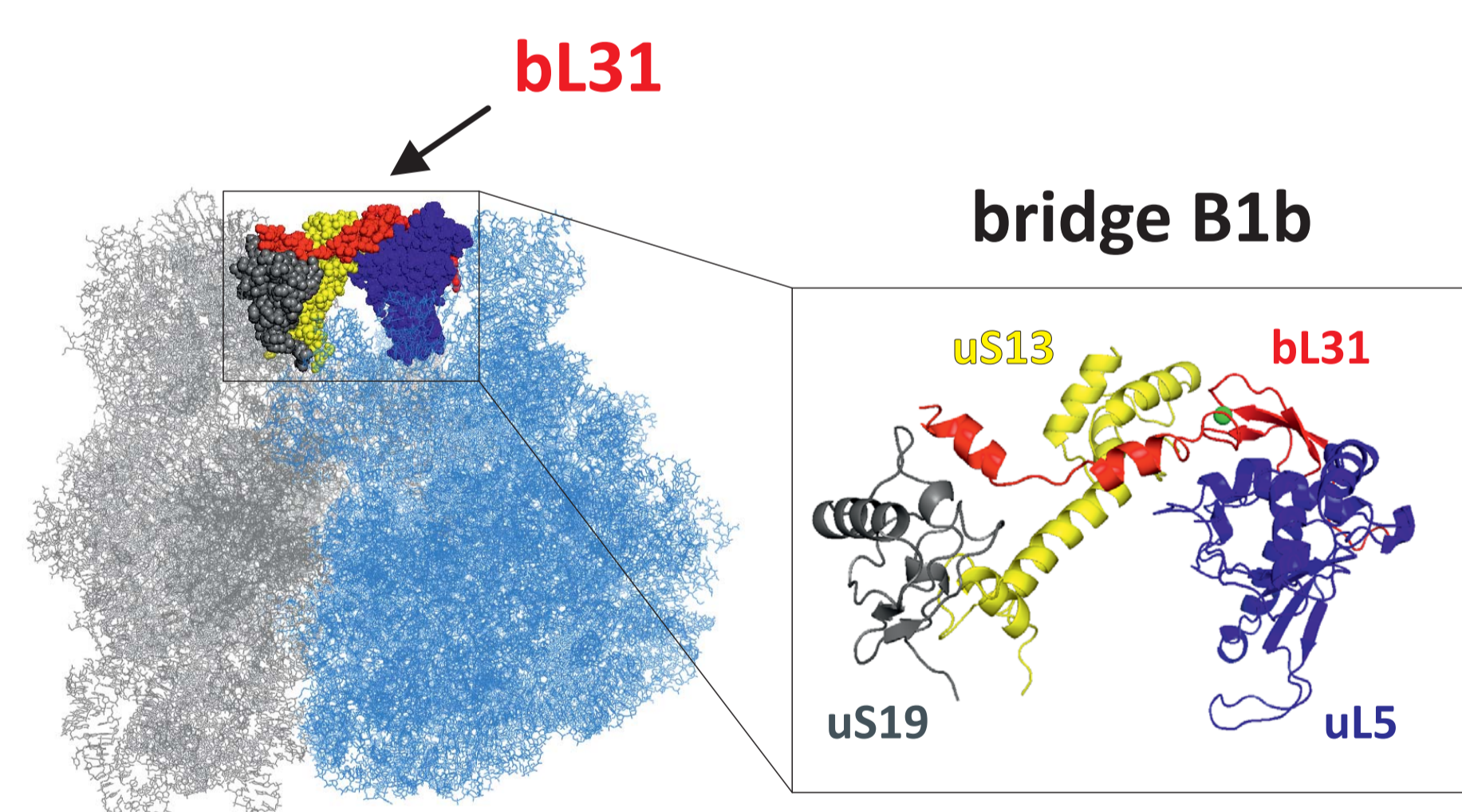
- one of the 12 intersubunit bridges
- joins the head domain of 30S subunit and the central protuberance of the 50S subunit (in addition to bridge B1a)
- the only protein-protein bridge, mainly composed of uS13 from the 30S subunit and bL31 from the 50S subunit
- the most dynamic bridge during translation (Zhang *et al.*, 2009)

### Ribosomal protein bL31

- bacteria-specific and widely conserved ribosomal protein among completely sequenced bacterial genomes
- positioned into the central protuberance (CP) of 50S subunit (Selmer *et al.*, 2006)
- duplicated genes in many bacterial species
- in *E. coli*, bL31 paralogs (<10 kDa) are 35,6% identical in sequence



*T. thermophilus*  
Liu & Fredrick, 2016



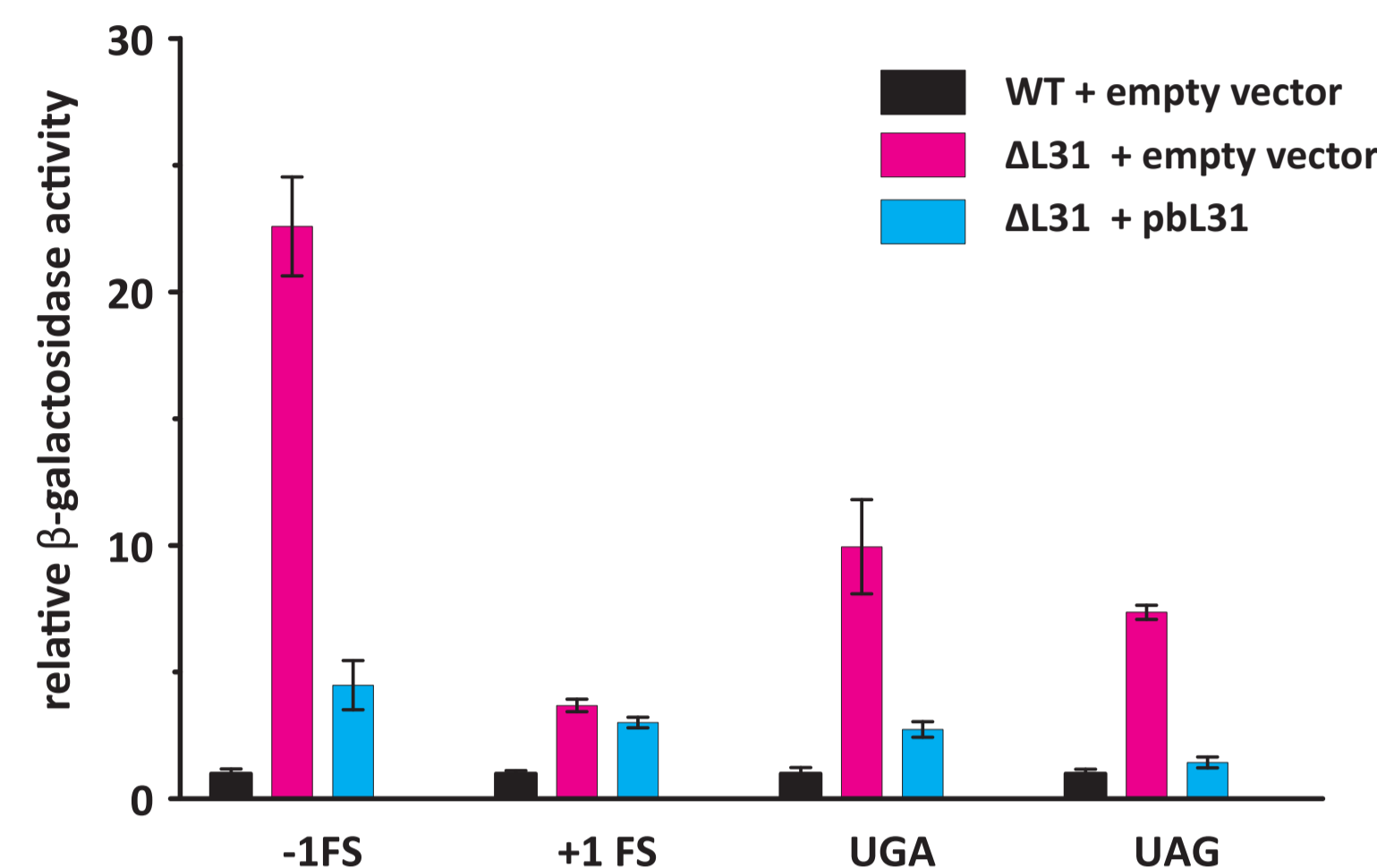
*E. coli*  
Fischer *et al.*, 2015

The aim of this study to elucidate the biological role of bacterial r-protein bL31 in translation

**Speculation**  
protein-protein bridge B1b is involved in maintaining translational reading frame by controlling the extent of the 30S head swivelling

## RESULTS

### Loss of bL31 reduces translational fidelity *in vivo*



MOPS, 37°C; n ≥ 3; mean values with SEM

bL31-deficient ribosomes display increased -1 frameshifting and nonsense suppression as demonstrated by β-galactosidase assay.

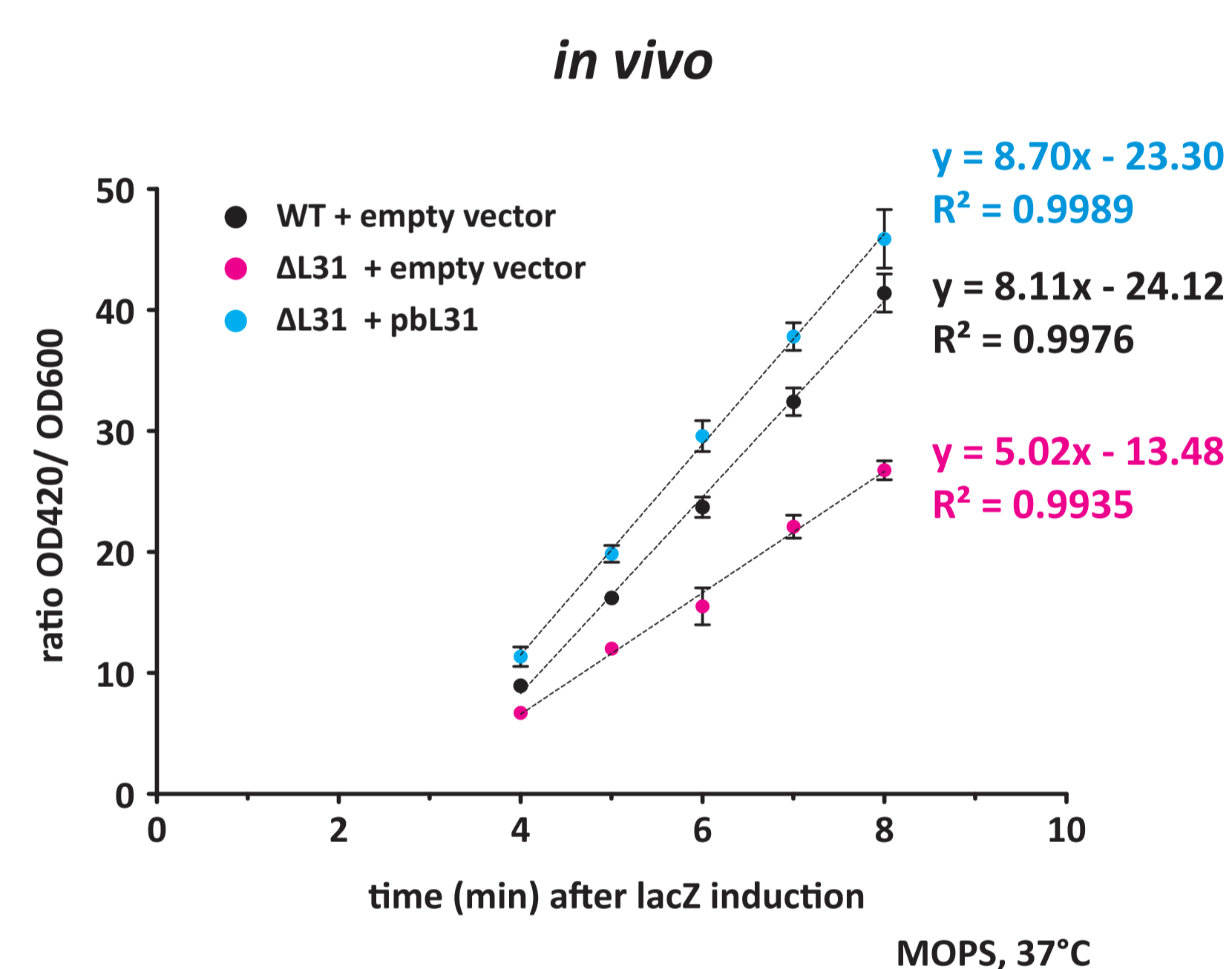
These results were confirmed by dual luciferase assay.

### Conclusions

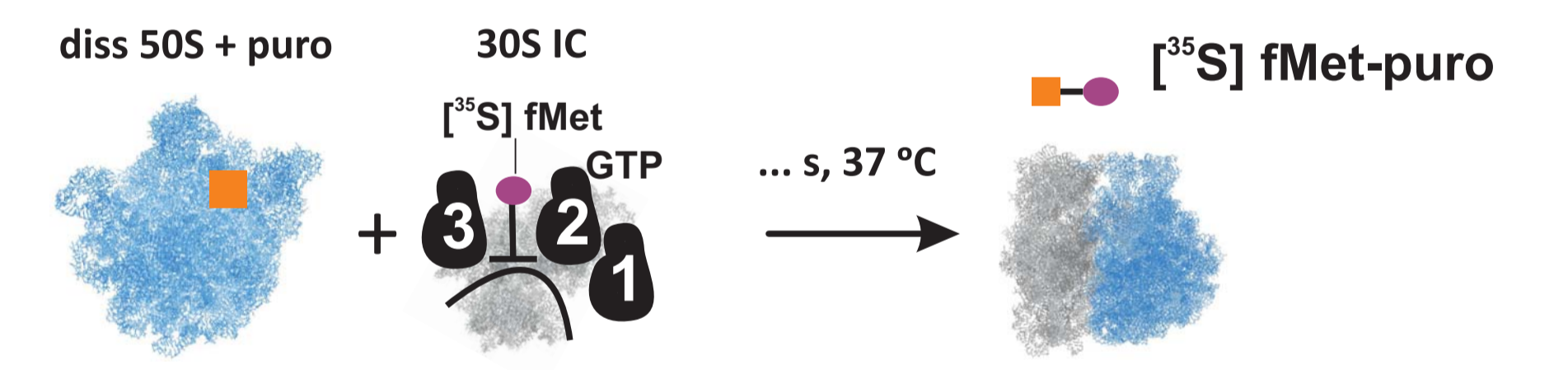
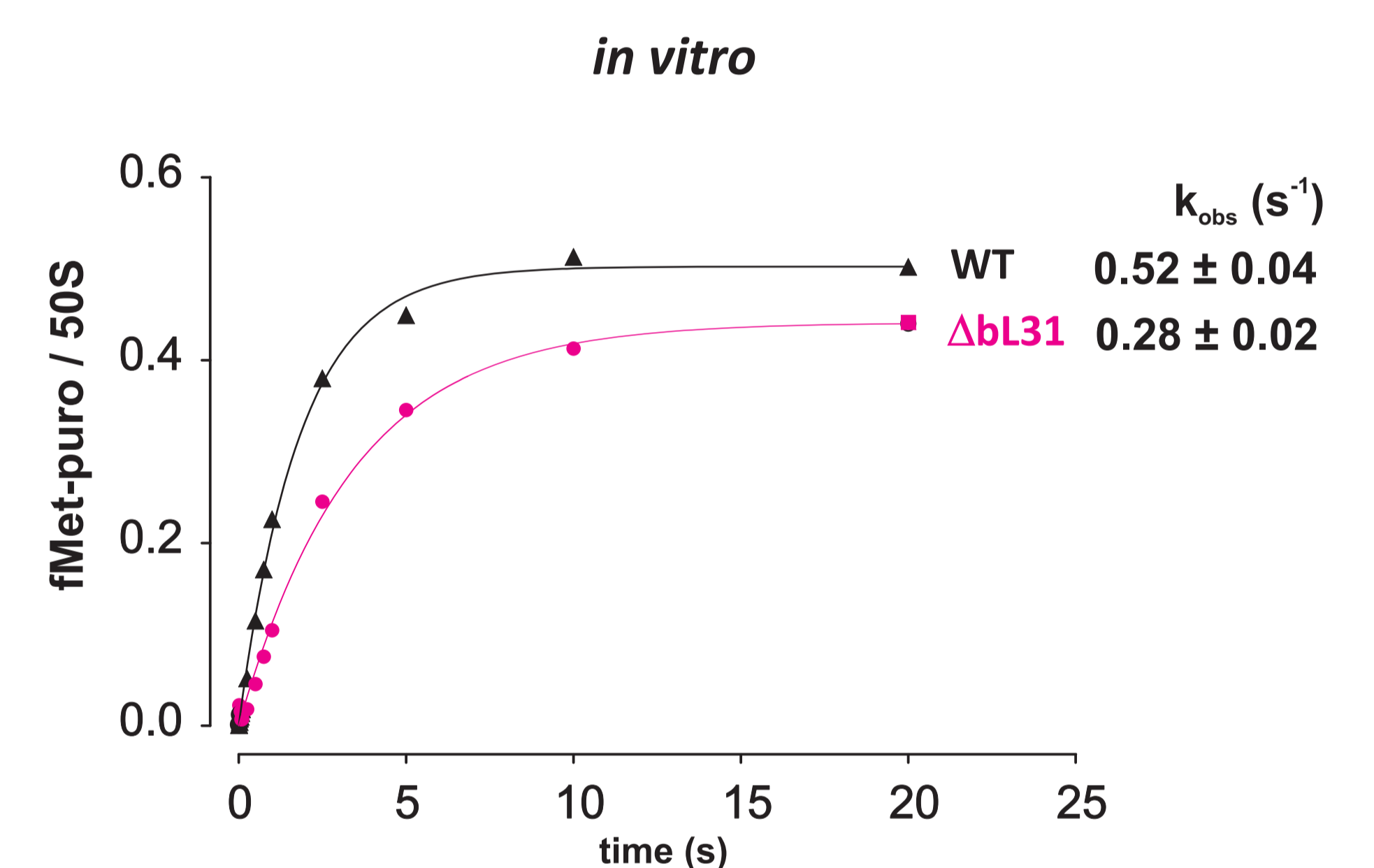
#### Ribosomal intersubunit bridge B1b

- is important for subunit association *in vivo* and *in vitro*
- facilitates translation initiation
- contributes to translational fidelity

### Loss of bL31 reduces the rate of translation initiation

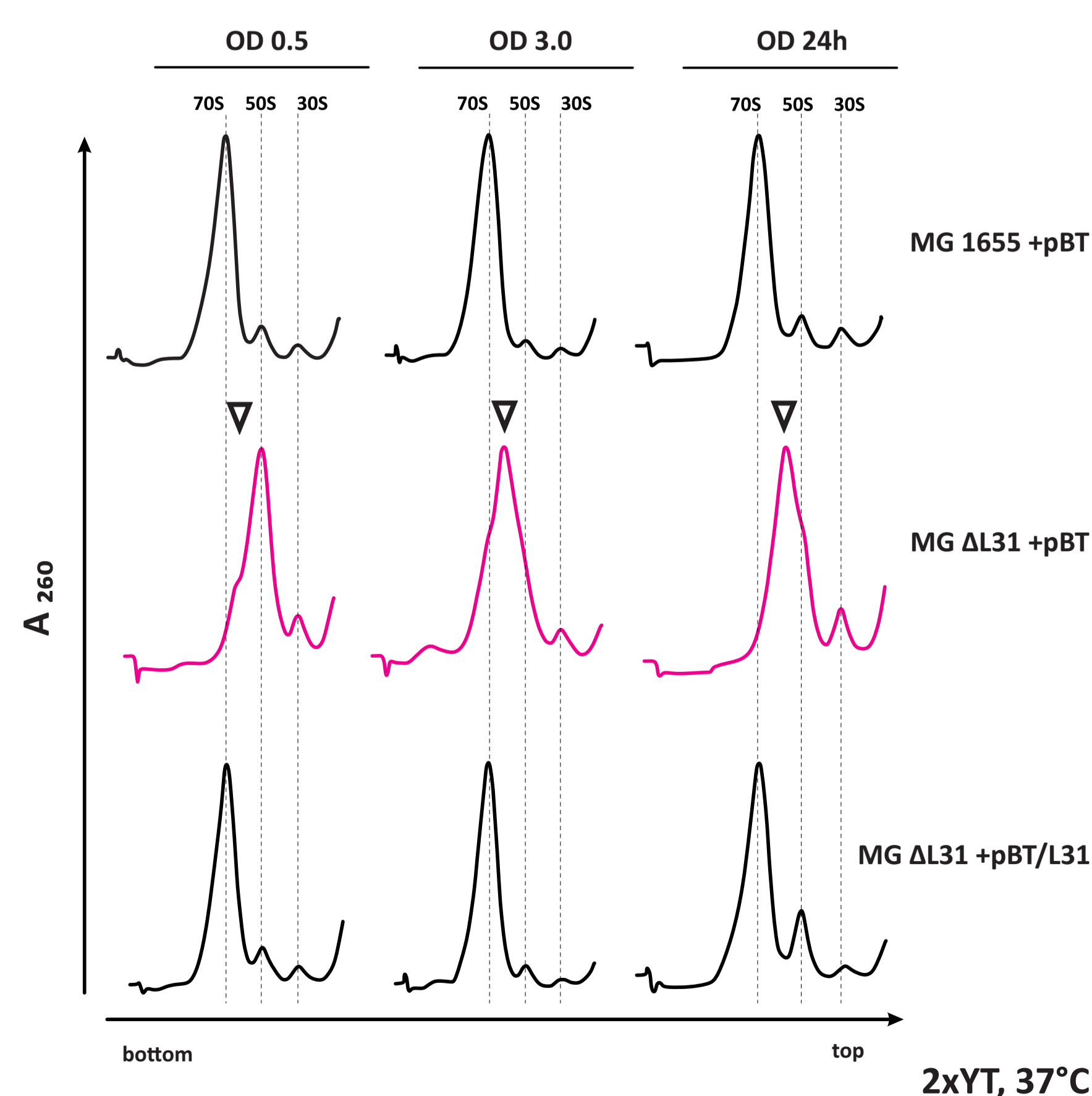


Ribosomes lacking bL31 exhibit about 1/3 slower translation initiation as demonstrated by β-galactosidase time course assay. However, the rate of elongation is not affected.



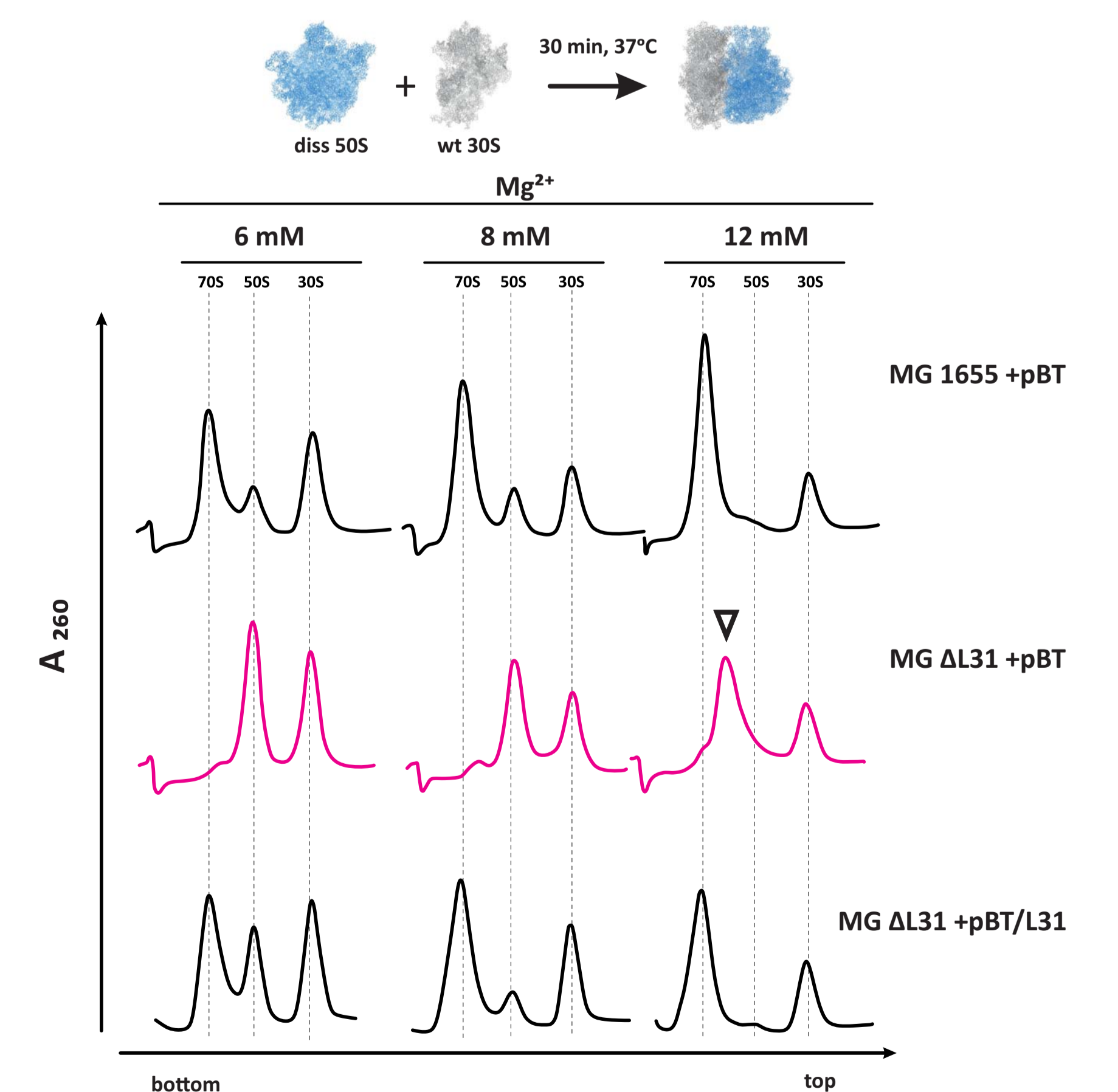
Pre-steady-state kinetics of active 70S initiation complex formation

### The effect of bL31 on subunit association *in vivo*



Ribosome profiles (10 mM Mg<sup>2+</sup>) indicate that the deletion of bL31 results in the decrease of 70S particle fraction.

### bL31 is important for subunit reassociation *in vitro*



Large subunits without bL31 are severely compromised in subunit reassociation *in vitro*.