Elongation factor P is required to maintain proteome homeostasis at high growth rate

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Elongation Factor P (EF-P) is a universally conserved translation factor that alleviates ribosome pausing at polyproline (PPX) motifs by facilitating peptide bond formation. In the absence of EF-P, PPX peptide bond formation can limit translation rate, leading to pleotropic phenotypes including slowed growth, increased antibiotic sensitivity, and loss of virulence. In this study, we observe that many of these phenotypes are dependent on growth rate. Limiting growth rate suppresses a variety of detrimental phenotypes associated with ribosome pausing at PPX motifs in the absence of EF-P. Polysome levels are also similar to wildtype under slow growth conditions, suggesting global changes in ribosome queuing in cells without EF-P which growth rate is decreased. Inversely, under high protein synthesis demands, we observe that E. coli lacking EF-P have reduced fitness. Our data demonstrate that EF-P functions as a housekeeping factor which prevents ribosome queuing at PPX motifs in conditions which require rapid protein synthesis.