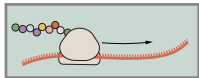


(A)

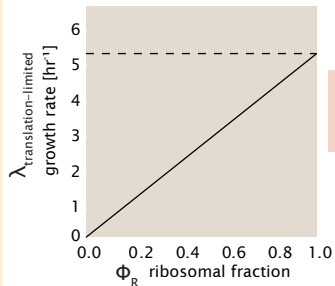
## translation-limited growth rate



$$\lambda_{\text{translation-limited}} = \frac{\ln(2) \times r_t \times R}{N_{\text{aa}}}$$

$$N_{\text{aa}} \approx m_{\text{protein}} \times \frac{1 \text{ aa}}{110 \text{ Da}} \times \frac{6 \times 10^{11} \text{ Da}}{1 \text{ pg}}, \quad \phi_R = \frac{m_R}{m_{\text{protein}}}$$

$$R \approx m_R \times \frac{1 \text{ ribosome}}{L_R \times 110 \text{ Da}} \times \frac{6 \times 10^{11} \text{ Da}}{1 \text{ pg}}$$



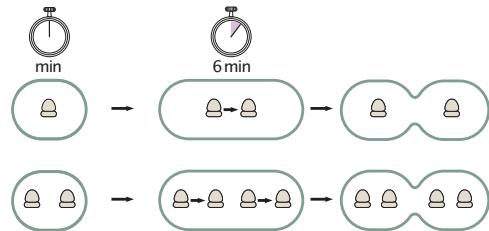
$$\lambda_{\text{translation-limited}} \approx \frac{\ln(2) \times r_t}{L_R} \phi_R$$

$$r_t \approx 17 \text{ aa/s}$$

$$L_R \approx 8,000 \text{ aa}$$

(B)

## maximum growth rate is set by ribosome



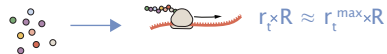
(C)

## maintenance of steady-state growth

$$r_t \times R \leq r_t^{\max} \times R$$

nutrient-rich:

$$r_{\text{aa}} > r_t^{\max} \times R$$



nutrient-limited:

$$r_{\text{aa}} \lesssim r_t^{\max} \times R$$

