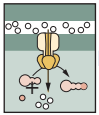
(A)

ATP synthesis



$$N_{\text{peptide bonds}} \approx 3\times10^{6}\ \text{proteins} \times \frac{300\ \text{peptide bonds}}{1\ \text{protein}} \quad \text{BNID: 115702} \quad \text{BNID: 108986}$$

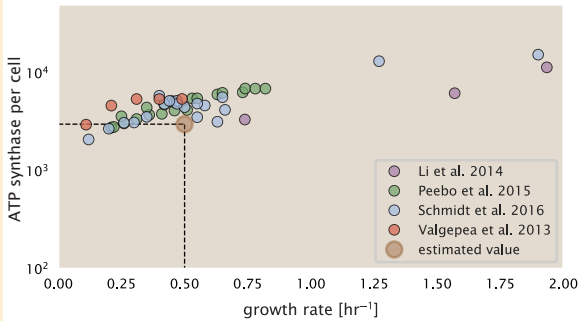
$$\approx 10^{9}\ \text{peptide bonds}$$

$$N_{\text{ATP}}^{(\text{prot.})} \approx \frac{5\ \text{ATP}}{\text{peptide bond}} \times 10^{9}\ \text{peptide bonds} \approx 5\times10^{9}\ \text{ATP} \quad \text{BNID: 107782}$$

$$N_{\text{ATP}}^{(\text{total})} \approx \frac{N_{\text{ATP}}^{(\text{prot.})}}{0.8} \approx 6\times10^{9}\ \text{ATP} \quad \text{BNID: 111918}$$

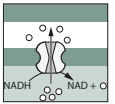
$$r_{\text{ATP synthesis}} \approx \frac{300\ \text{ATP / sec}}{\text{synthase}} \quad \text{BNID: 114701}$$

$$N_{\text{synthase}} \approx \frac{6\times10^{9}\ \text{ATP}}{1\ \text{cell}} \times \frac{1\ \text{sec}}{300\ \text{ATP}} \times \frac{1\ \text{cell}}{6000\ \text{sec}} \approx 3000\ \text{synthases}$$



(B)

maintenance of proton gradient



$$r_{\text{proton use}} \approx N_{\text{ATP synthases}} \times \frac{300\ \text{ATP}}{1\ \text{s}} \times \frac{4\ \text{protons}}{1\ \text{ATP}} \quad \text{BNID: 114701} \quad \text{BNID: 103390}$$

$$\approx 4\times10^{6}\ \text{protons / s}$$

$$r_{\text{transport}} \approx 1500\ \frac{\text{protons / s}}{\text{electron transport complex}} \quad \text{BNID: 114705} \quad \text{BNID: 114687}$$

$$N_{\text{transporters}} \approx \frac{4\times10^{6}\ \text{protons}}{1\ \text{s}} \times \frac{1\ \text{s}}{1500\ \text{protons}}$$

$$\approx 2500\ \text{electron transport complexes}$$