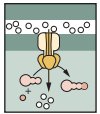
(A) **ATP synthesis** *Assuming protein synthesis primary consumer of ATP*



$N_{\text{peptide bonds}} \approx 3 \times 10^6 \text{ proteins} \times \frac{300 \text{ peptide bonds}}{1 \text{ protein}}$

$\approx 10^{10}$ amino acids

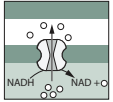
$N_{ATP} \approx \frac{4 \text{ ATP}}{\text{peptide bond}} \times 10^{10} \text{ peptide bonds}$ BNID: 101442

$\approx 5 \times 10^{10}$ ATP

$r_{\text{ATP synthesis}} \approx 300 \cdot sec^{-1} \cdot \text{synthase}^{-1}$ BNID: 114701

$N_{\text{ATP synthases}} \approx \frac{5 \times 10^{10} \text{ ATP}}{1 \text{ cell}} \times \frac{1 \text{ sec}}{300 \text{ ATP}} \times \frac{1 \text{ cell}}{6000 \text{ sec}} \approx 3 \times 10^6 \text{ synthetases}$

(B) **maintenance of proton gradient**



$r_{\text{proton use for ATP synthesis}} \approx N_{\text{ATP synthases}} \times \frac{300 \text{ ATP}}{1 \text{ sec}} \times \frac{4 \text{ protons}}{1 \text{ ATP}}$ BNID: 114701

$\approx 4 \times 10^7 \text{ protons} \cdot sec^{-1}$

$r_{\text{proton transport}} \approx 5000 \text{ protons} \cdot sec^{-1} \cdot \text{electron transport complex}^{-1}$

BNID: 114704; 114687

$N_{\text{electron transport complexes}} \approx \frac{4 \times 10^7 \text{ protons}}{1 \text{ sec}} \times \frac{1 \text{ sec}}{5000 \text{ protons}} \approx 10^4 \text{ complexes}$

(B)