Nernst-Planck Equation

$$J_n(x,t) = -z_n F D_n \frac{\partial c_n(x,t)}{\partial x} - u_n z_n^2 F^2 c_n(x,t) \frac{\partial \psi(x,t)}{\partial x}$$

Continuity

$$\frac{\partial J_n(x,t)}{\partial x} = -z_n F \frac{\partial c_n(x,t)}{\partial t}$$

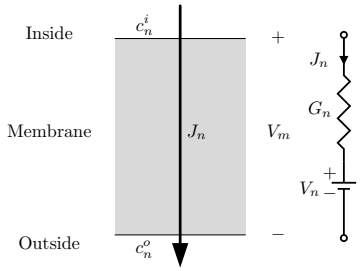
Poisson's Equation

$$\frac{\partial^2 \psi(x,t)}{\partial x^2} = -\frac{1}{\epsilon} \sum_n z_n F c_n(x,t)$$

Electrolyte solutions $\rightarrow$ Electroneutrality

$$\text{if } t >> \tau_r \text{ and } x >> \Lambda_D \text{ then } \sum_n z_n F c_n(x,t) = 0$$

Model of Steady-State Electrodiffusion through Membranes



$$\text{Nernst Equilibrium Potential } V_n = \frac{RT}{z_n F} \ln \frac{c_n^o}{c_n^i}$$

$$\text{Electrical Conductivity } G_n = \frac{1}{\int_o^d \frac{dx}{u_n z_n^2 F^2 c_n(x)}} \geq 0$$

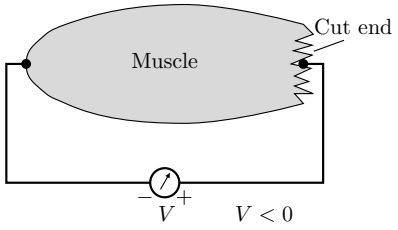


Figure 7.17

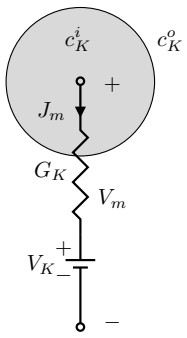


Figure 7.18

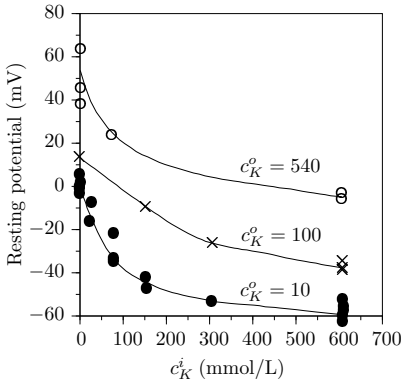


Figure 7.20

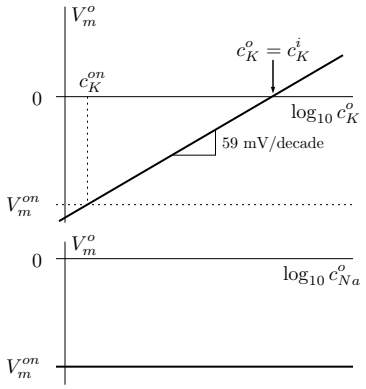


Figure 7.19

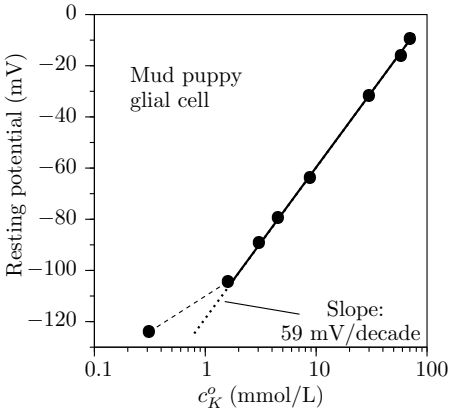


Figure 7.21

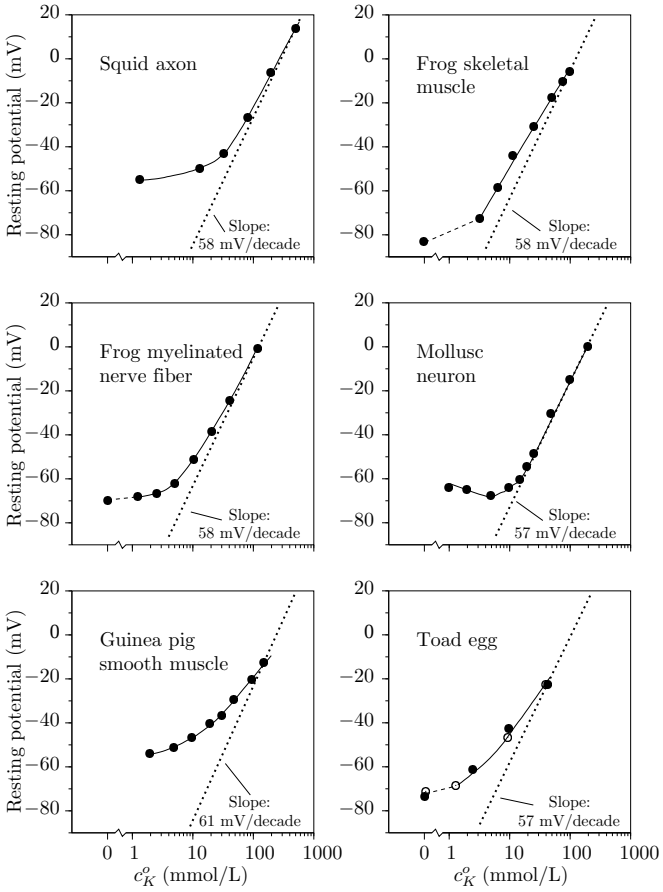


Figure 7.22

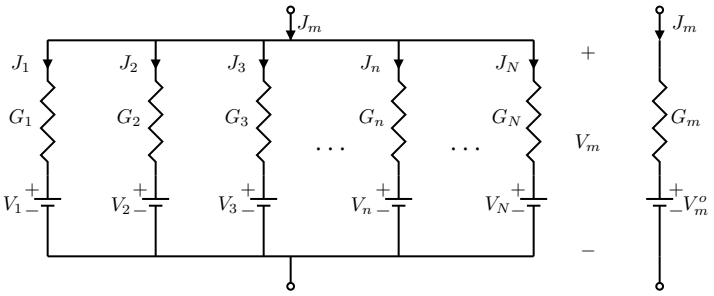
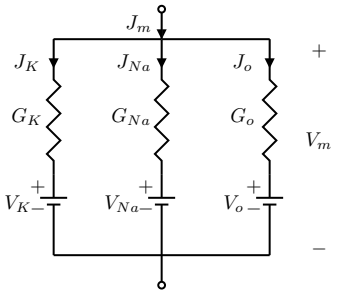


Figure 7.24



Ion	G_n (S/cm^2)	G_n/G_m	c_n^o/c_n^i	V_n (mV)
K^+	3.7×10^{-4}	0.55	0.05	−72
Na^+	1×10^{-5}	0.016	9.8	+55
leakage	3.0×10^{-4}	0.44	—	−49

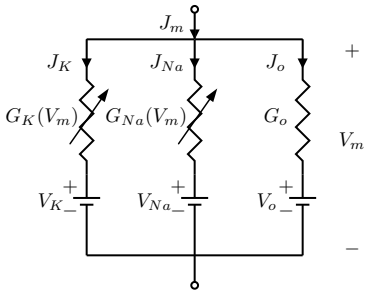


Figure 7.32

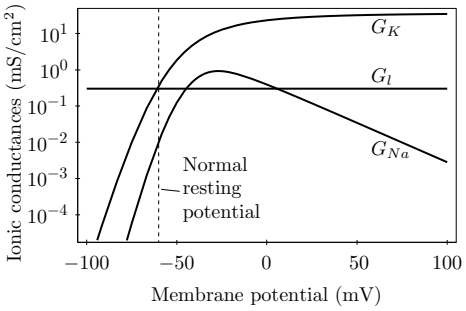


Figure 7.28

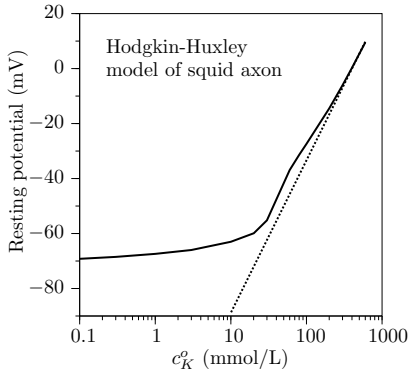


Figure 7.29

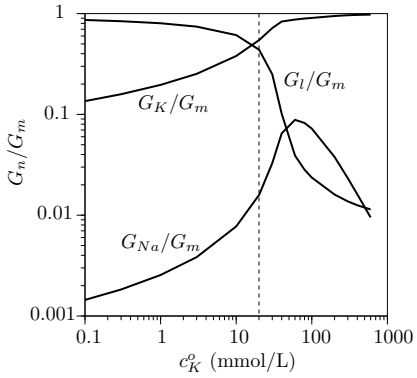


Figure 7.30

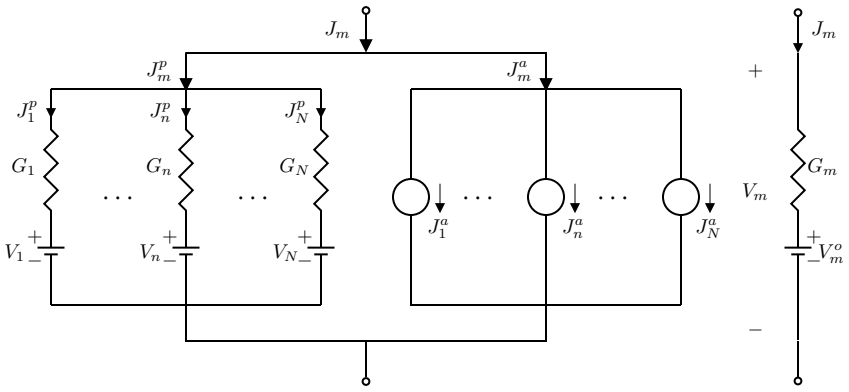


Figure 7.33