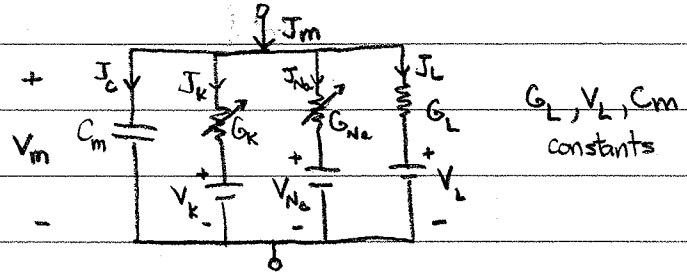


6.021
Recitation 10/31/06

① HH model review

① HH model review

② Examples



μfluids report due Thurs
HH proposal due next Thurs
QUIZ in two Thurs

$$V_K \approx (60\text{mV}) \log \frac{c_K^o}{c_K^i} \quad V_{Na} \approx (60\text{mV}) \log \frac{c_{Na}^o}{c_{Na}^i}$$

$$G_K = \bar{G}_K n^4 \quad G_{Na} = \bar{G}_{Na} m^3 h$$

m, n, h obey:

$$x + \tau_x \frac{dx}{dt} = x_{\infty} \quad \tau_x$$

where

τ_x, x_{∞} depend on V_m

② Example 4.8

$$I_{Na} = G_{Na} (V_m - V_{Na})$$

\uparrow \uparrow \uparrow \uparrow
 V_m, t V_m, t \pm const V_m, t

$$G_{Na} = \bar{G}_{Na} m^3 h$$

\downarrow \downarrow \downarrow
 $120 \frac{\text{ms}}{\text{cm}^2}$ V_m, t V_m, t

$V_m(t)$ is piecewise constant

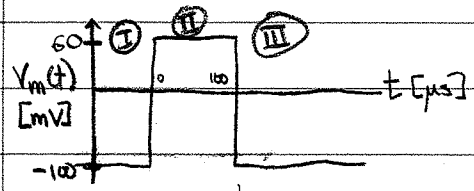
\Rightarrow separate

Notes:

$n_{\infty}, m_{\infty} \uparrow$ as $V_m \uparrow$

$h_{\infty} \downarrow$ as $V_m \uparrow$

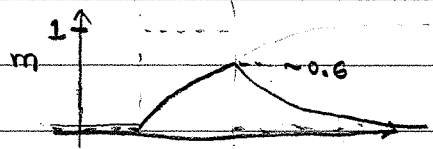
$\tau_m \ll \tau_h, \tau_n \ll \tau$



① at $t < 0$ $V_m = -100\text{mV}$ AND $m, h \rightarrow m_{\infty}, h_{\infty}$

$\Rightarrow m_{\infty} \approx 0$

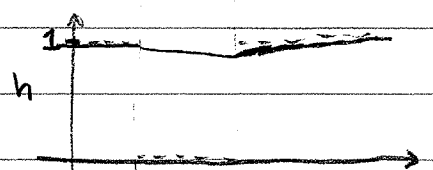
$h_{\infty} \approx 1$



② at $0 < t < 100\mu\text{s}$ $V_m = 60\text{mV}$ AND m, h change exp

$\tau_m \approx 0.1\text{ms}$ $m_{\infty} \approx 1$

$\tau_h \approx 1\text{ms}$ $h_{\infty} \approx 0$

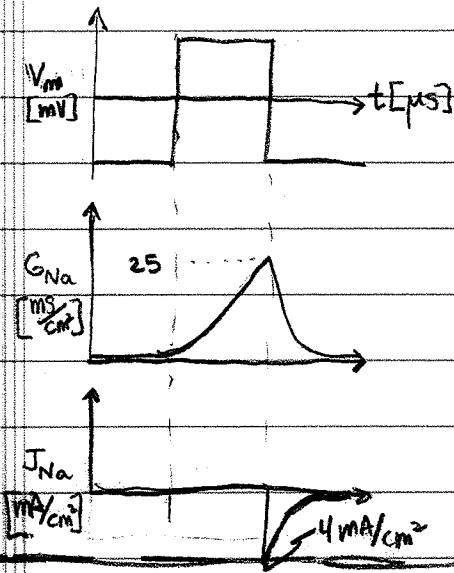


③ at $t > 100\mu\text{s}$ $V_m = -100\text{mV}$ AND m, h change exp

$\tau_m \approx 0.05\text{ms}$

$\tau_h \approx 2\text{ms}$

Recitation 10/31



$$G_{Na} = \bar{G}_{Na} m^3 h \approx \bar{G}_{Na} m^3(t)$$

$$G_{Na peak} = 120 \cdot (.6)^3 \approx 25 \frac{ms}{cm^2}$$

$$J_{Na} = G_{Na} (V_m - V_{Na})$$

60mV

Ⓘ $J_{Na} \approx 0$ b/c $G_{Na} \approx 0$

Ⓜ $J_{Na} = 0$ b/c $V_m - V_{Na} = 0$

ⓓ $J_{Na} = -160 mV \cdot G_{Na}$

$\left\{ \begin{array}{l} 160 mV \cdot 35 \frac{ms}{cm^2} \\ 160 mV \cdot 0.25 \frac{ms}{cm^2} \end{array} \right.$

ⓑ $C_{Na}^o \rightarrow \frac{1}{10} C_{Na}^o$

• m, h, G_{Na} DO NOT CHANGE

$$V_{Na}^i = 60 \log \frac{C_{Na}^o}{C_{Na}^i} = 60 mV$$

$$\Rightarrow C_{Na}^o = 10 C_{Na}^i$$

Now: Ⓘ $J_{Na} \approx 0$ b/c $G_{Na} \approx 0$

Ⓜ $J_{Na} = G_{Na} \cdot 60 mV$

ⓓ $J_{Na} = G_{Na} \cdot (-100 mV)$

IF $C_{Na}^o \rightarrow \frac{1}{10} C_{Na}^o$

$$\Rightarrow C_{Na}^o = C_{Na}^i \Rightarrow V_{Na}^i = 0$$

