Gated channels[1]

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So the persistient Potassium channel has gating probability n^4, the transient sodium channel, m^3h. The n, m and h satisfy

$$\frac{d\ell}{dt} = \alpha_\ell(V)(1-\ell) - \beta_\ell(V)\ell \tag{1}$$

which can be rewritten as

$$\tau_\ell \frac{d\ell}{dt} = \ell_\infty - \ell \tag{2}$$

where

$$\tau_\ell = \frac{1}{\alpha_\ell + \beta_\ell} \tag{3}$$

and

$$\ell_\infty = \frac{\alpha_\ell}{\alpha_\ell + \beta_\ell} \tag{4}$$

A standard example set of functional forms for the alpha and beta are givin in Dayan and Abbott:

$$\begin{aligned} \alpha_n &= \frac{.01(V+55)}{1-\exp(-.1(V+55))} \\ \beta_n &= .125\exp(-.0125(V+65)) \end{aligned} \tag{5}$$

for n, for m

$$\begin{aligned} \alpha_m &= \frac{.1(V+40)}{1-\exp(-.1(V+40))} \\ \beta_m &= 4\exp(-.0556(V+65)) \end{aligned} \tag{6}$$

and for h

$$\begin{aligned} \alpha_h &= .07\exp(-.05(V+65)) \\ \beta_h &= \frac{1}{1+\exp(-.1(V+35))} \end{aligned} \tag{7}$$

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