Homework 2.2: Hodgkin-Huxley model - gating dynamics

Gating dynamics

2/2 points (graded)

Often the gating dynamics are formulated as $\frac{dm}{dt} = \alpha_m(u)(1-m) - \beta_m(u)\,m$.

Reminder: Previously we had $\frac{dm}{dt} = -\frac{m-m_0(u)}{\tau_m(u)}$.

1. Calculate $m_0(u)$ and $\tau_m(u)$ based on $\alpha_m(u)$ and $\beta_m(u)$.

$m_0(u) =$

○ $m_0(u) = \beta_m(u)$

○ $m_0(u) = \alpha_m(u)$

○ $m_0(u) = \frac{\alpha_m(u)}{\beta_m(u)}$

● $m_0(u) = \frac{\alpha_m(u)}{\alpha_m(u)+\beta_m(u)}$

✓

$\tau_m(u) =$

○ $\tau_m(U) = -(\alpha_m(U) + \beta_m(U))$

● $\tau_m(U) = \frac{1}{(\alpha_m(U)+\beta_m(U))}$

○ $\tau_m(U) = \frac{1}{\alpha_m(U)}$

○ $\tau_m(U) = \frac{1}{\beta_m(U)}$

✓

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✓ Correct (2/2 points)

Equivalent expression

1/1 point (graded)

2. Assume $\alpha_m(u) = \beta_m(u)^{-1}$. If $m_0(u) = 0.5\{1 + tanh[\gamma(u-\theta)]\}$, then what would be the expression for $\alpha_m(u)$?

$\alpha_m(u) =$

○ $\alpha_m = \exp[\gamma(\Theta - u)]$

● $\alpha_m = \exp\left[\gamma\left(u-\Theta\right)\right]$

○ $\alpha_m = 0.5\exp\left[\gamma\left(u-\Theta\right)\right]$

○ $\alpha_m = 2\exp\left[\gamma\left(\Theta-u\right)\right]$

○ $\alpha_m = \frac{\exp[\gamma(u-\Theta)]}{\exp[\gamma(\Theta-u)]}$

○ $\alpha_m = 0.5\frac{\exp[\gamma(u-\Theta)]}{\exp[\gamma(\Theta-u)]}$

○ $\alpha_m = 2\frac{\exp[\gamma(u-\Theta)]}{\exp[\gamma(\Theta-u)]}$

○ $\alpha_m = \frac{\exp[\gamma(\Theta-u)]}{\exp[\gamma(u-\Theta)]}$

○ $\alpha_m = 0.5\frac{\exp[\gamma(\Theta-u)]}{\exp[\gamma(u-\Theta)]}$

○ $\alpha_m = 2\frac{\exp[\gamma(\Theta-u)]}{\exp[\gamma(u-\Theta)]}$

✓

Submit You have used 1 of 1 attempt

✓ Correct (1/1 point)

Time constant

1/1 point (graded)

3. What is the time constant $\tau_m\left(u\right)$?

$\tau_m\left(u\right) =$

○ $2\ csch\left[\gamma\left(u-\theta\right)\right]$

○ $0.5\ csch\left[-\gamma\left(u-\theta\right)\right]$

● $0.5\ sech\left[\gamma\left(u-\theta\right)\right]$

○ $2\ sech\left[-\gamma\left(u-\theta\right)\right]$

✓

Submit You have used 1 of 1 attempt

✓ Correct (1/1 point)

Discussion

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