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Homework 2.2: Hodgkin-Huxley model - gating dynamics

Gating dynamics

2/2 points (graded)

Often the gating dynamics are formulated as $rac{dm}{dt}=lpha_{m}\left(u
ight)\left(1-m
ight)-eta_{m}\left(u
ight)m$.

Reminder: Previously we had $rac{dm}{dt} = -rac{m-m_0(u)}{ au_m(u)}$.

1. Calculate $m_{0}\left(u
ight)$ and $au_{m}\left(u
ight)$ based on $lpha_{m}\left(u
ight)$ and $eta_{m}\left(u
ight)$.

 $m_0\left(u
ight) =$

- $\bigcirc m_0\left(u\right)=\beta_m\left(u\right)$
- $\bigcirc m_0\left(u
 ight)=lpha_m\left(u
 ight)$
- $igcirc m_0\left(u
 ight)=rac{lpha_m\left(u
 ight)}{eta_m\left(u
 ight)}$
- $lefter{igoplus} m_0\left(u
 ight) = rac{lpha_m(u)}{lpha_m(u) + eta_m(u)}$

- $au_m\left(u
 ight) =$
 - $\bigcirc au_m\left(U
 ight) = -\left(lpha_m\left(U
 ight) + eta_m\left(U
 ight)
 ight)$
 - $left au_m\left(U
 ight) = rac{1}{\left(lpha_m\left(U
 ight) + eta_m\left(U
 ight)
 ight)}$
- $\bigcirc au_m \left(U
 ight) = rac{1}{lpha_m \left(U
 ight)}$
- $igcup au_m\left(U
 ight) = rac{1}{eta_m\left(U
 ight)}$

Submit You have used 1 of 1 attempt

✓ Correct (2/2 points)

Equivalent expression

1/1 point (graded)

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

 $lpha_m\left(u
ight) =$

 $\bigcap lpha_m = \exp\left[\gamma(\Theta - u)\right]$

$lacksquare egin{aligned} lacksquare & lpha_m = \exp\left[\gamma\left(u - \Theta ight) ight] \end{aligned}$	
$igcup_{m} = 0.5 \exp\left[\gamma \left(u - \Theta ight) ight]$	
$igcup_m = 2 \exp\left[\gamma(\Theta - u) ight]$	
$igcap lpha_m = rac{\exp[\gamma(u-\Theta)]}{\exp[\gamma(\Theta-u)]}$	
$igcap lpha_m = 0.5 rac{\exp[\gamma(u-\Theta)]}{\exp[\gamma(\Theta-u)]}$	
$igcap lpha_m = 2 rac{\exp[\gamma(u-\Theta)]}{\exp[\gamma(\Theta-u)]}$	
$igcap_{m} = rac{\exp[\gamma(\Theta-u)]}{\exp[\gamma(u-\Theta)]}$	
$igcap lpha_m = 0.5 rac{\exp[\gamma(\Theta-u)]}{\exp[\gamma(u-\Theta)]}$	
$igcap lpha_m = 2 rac{\exp[\gamma(\Theta-u)]}{\exp[\gamma(u-\Theta)]}$	
✓	
Submit You have used 1 of 1 attempt	
✓ Correct (1/1 point)	
Time constant	
1/1 point (graded) 3. What is the time constant $ au_m\left(u ight)$?	
$ au_{m}\left(u ight) =% {\displaystyle\int_{0}^{\infty}} \left\{ $	
$\bigcirc 2 \ csch \left[\gamma \left(u - heta ight) ight]$	
$0.5~csch\left[-\gamma\left(u- heta ight) ight]$	
$igoldsymbol{ig$	
$\bigcirc 2\ sech \left[-\gamma \left(u- heta ight) ight]$	
Submit You have used 1 of 1 attempt	
✓ Correct (1/1 point)	
Discussion	
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