T-type current

Activation gate (Wang et al $\overset{\text{model}}{1991}$, Kyunghwa $\overset{\text{fit}}{\text{et al}}$ 2015)

$$\frac{ds}{dt} = \frac{s_\infty(V) - s}{\tau_s(V)}$$

$$s_\infty = \frac{1}{1 + \exp\left[-(V - V_{1/2}^{(s)})/k^{(s)}\right]}$$

$$\delta_s = \frac{1}{a_{\delta_s} + \exp\left[-(V - V_{1/2}^{(\delta_s)})/k^{(\delta_s)}\right]}$$

$$\tau_s = \frac{s_\infty}{\delta_s}$$

$V_{1/2}^{(s)} \simeq -42.75$

$k^{(s)} \simeq 7.36$

$a_{\delta_s} \simeq 0.88$

$V_{1/2}^{(\delta_s)} \simeq -23.21$

$k^{(\delta_s)} \simeq 7.23$

Deactivation current

$$h_\infty = \frac{1}{1 + \exp\left[(V - V_{1/2}^{(h)})/k^{(h)}\right]}$$

$V_{1/2}^{(h)} \simeq -58.2$

$k^{(h)} \simeq 7.14$

$$\dot{h} = \frac{1}{\tau_1}\left[\frac{1-d}{1+K} - h\right]$$

$$\dot{d} = \frac{1}{\tau_2}\left[\frac{K(1-h)}{1+K} - d\right]$$

$\tau_1 = \tau_h$

$\tau_2 =$

$$\dot{h} = \alpha_1 (1 - h - d) - \beta_1 h$$
$$\dot{d} = \beta_2 (1 - h - d) - \alpha_2 d$$

$$\left.\begin{aligned} \tau_1 &= \frac{1}{\alpha_1 + \beta_1} \\ K_1 &= \frac{\beta_1}{\alpha_1} \end{aligned}\right) \Rightarrow \begin{aligned} &\beta_1 = \alpha_1 K_1 \\ &\tau_1 = \frac{1}{\alpha_1 + \alpha_1 K_1} = \frac{1}{\alpha_1 (1+K_1)} \end{aligned} \Bigg) \Rightarrow \boxed{\begin{aligned} \alpha_1 &= \frac{1}{\tau_1 (1+K_1)} \\ \beta_1 &= \frac{K_1}{\tau_1 (1+K_1)} \end{aligned}}$$

similarly: $\boxed{\begin{aligned} \alpha_2 &= \frac{1}{\tau_2 (1+K_2)} \\ \beta_2 &= \frac{K_2}{\tau_2 (1+K_2)} \end{aligned}}$ $\quad \boxed{K_1 = K_2}$

$$\dot{h} = \frac{1}{\tau_1 (1+K)} (1 - h - d) - \frac{K}{\tau_1 (1+K)} h =$$
$$= \frac{1}{\tau_1 (1+K)} \left[1 - h - d - Kh \right] =$$
$$= \frac{1}{\tau_1 (1+K)} \left[1 - h(1+K) - d \right]$$

$$\dot{d} = \frac{K}{\tau_2 (1+K)} \left[1 - h - d \right] - \frac{1}{\tau_2 (1+K)} d =$$
$$= \frac{1}{\tau_2 (1+K)} \left[K(1 - h - d) - d \right]$$

$$\dot{h} = \frac{1}{\tau_1 (1+K)} \left[1 - h(1+K) - d \right] = \frac{1-d}{\tau_1 (1+K)} - \frac{h}{\tau_1} =$$
$$= \frac{1}{\tau_1} \left[\frac{1-d}{1+K} - h \right]$$

$$\dot{d} = \frac{1}{\tau_2 (1+K)} \left[K(1-h) - d(1+K) \right] =$$
$$= \frac{1}{\tau_2} \left[\frac{K(1-h)}{1+K} - d \right]$$

$$\frac{d}{dt}\begin{pmatrix} h \\ d \end{pmatrix} = \begin{pmatrix} -\alpha_1 - \beta_1 & -\alpha_1 \\ -\beta_2 & -\alpha_2 - \beta_2 \end{pmatrix}\begin{pmatrix} h \\ d \end{pmatrix}$$