A mathematical modeling toolbox for ion channels and transporters across cell membranes

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The following supplementary material is from " A mathematical modeling toolbox for ion channels and transporters across cell membranes" manuscript. It contains an overview of all equations related to Ion channels, Pumps, Cotransporters, and Symporters, organized in a table form. The detailed transporters along with the descriptions of their equatuons can be found from here.

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1.3. Calcium Channels

1.3.1. L-type Voltage-Gated Calcium Channels

L-type Voltage-Gated Calcium Channels	**Ref**
$\boxed{I_i^{Ca_l,M-N} = P_i^M \frac{z_i^2 F^2 V_m^{M-N}}{RT} \frac{\gamma_i^N C_i^N - \gamma_i^M C_i^M exp^{\frac{-z_i FV_m^{M-N}}{RT}}}{1 - exp^{\frac{-z_i FV_m^{M-N}}{RT}}}} \quad (54)$ $\boxed{I_{total}^{Ca_l,M-N} = I_{Na}^{Ca_l} + I_{Ca}^{Ca_l} + I_K^{Ca_l}} \quad (55)$	[12, 12, 17, 18]
$\boxed{I_{Ca,L} = g_{Ca_L}^{max} f_o^{Ca_l} f_d^{Ca_l} (V_m^{M-N} - V_{Ca,rev}^{M-N})} \quad (56)$ $f_o^{Ca_l} = C_f f_f^{Ca_l} + C_s \quad (57)$ $\frac{df_d^{Ca_l}}{dt} = \frac{\bar{f}_d^{Ca_l} - f_d^{Ca_l}}{\tau_{f_d}^{Ca_l}} \quad (58)$ $\frac{df_f^{Ca_l}}{dt} = \frac{\bar{f}_o^{Ca_l} - f_f^{Ca_l}}{\tau_{f_f}^{Ca_l}} \quad (59)$ $\bar{f}_d^{Ca_l} = \frac{1.0}{1.0 + exp\left(\frac{-(V_m^{M-N} + V_{1/2,f_d}^{Ca_l,M-N})}{k_{f_d}^{Ca_l}}\right)} \quad (60)$ $\bar{f}_o^{Ca_l} = \frac{1.0}{1.0 + exp\left(\frac{(V_m^{M-N} + V_{1/2,f_o}^{Ca_l,M-N})}{k_{f_o}^{Ca_l}}\right)} \quad (61)$ $\tau_{f_d}^{Ca_l} = A_{\tau_{f_d}^{Ca_l}}\, exp\left[\left(\frac{-(V_m + V_{\tau_{f_d}^{Ca_l}})}{k_{\tau_{f_d}^{Ca_l}}}\right)^2\right] + B_{\tau_{f_d}^{Ca_l}} \quad (62)$ $\tau_{f_f}^{Ca_l} = A_{\tau_{f_f}^{Ca_l}}\, exp\left[\left(\frac{-(V_m - V_{\tau_{f_f}^{Ca_l}})}{k_{\tau_{f_f}^{Ca_l}}}\right)^2\right] + B_{\tau_{f_l}^{Ca_l}} \quad (63)$ where $V_{1/2,f_d}^{Ca_l,M-N} = A_{f_d}^{Ca_l}$ and $V_{1/2,f_o}^{Ca_l,M-N} = A_{f_o}^{Ca_l}$.	[2, 4]

Table 4: The corresponding equations describing the flux and current transported via L-type voltage- gated calcium channels across the cell membrane