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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Potassium Chloride Cotransporter	Ref
Competitor Ammonium	[36]

$$J^{M,N(net)}_{K,KCC} = [E]_t \left(\frac{\left(g^M_{EKCl} K^M Cl^M\right) R_{NN} - \left(g^N_{EKCl} K^N Cl^N\right) R_{MM}}{R_M R_{NN} + R_N R_{MM}} \right) \tag{133a}$$

$$J^{M,N(net)}_{NH_4,KCl} = [E]_t \frac{\left(g^M_{ENH_4Cl} NH_4^M Cl^M\right) R_{NN} - \left(g^N_{ENH_4Cl} NH_4^N Cl^N\right) R_{MM}}{R_M R_{NN} + R_N R_{MM}} \tag{133b}$$

$$J^{M,N(net)}_{Cl,KCl} = [E]_t \frac{\left(g^M_{EKCl} K^M Cl^M + g^M_{ENH_4Cl} NH_4^M Cl^M\right) R_{NN} - \left(g^N_{EKCl} K^N Cl^N + g^N_{ENH_4Cl} NH_4^N Cl^N\right) R_{MM}}{R_M R_{NN} + R_N R_{MM}} \tag{133c}$$

Where

$[E]_t = R_M [E]_M + R_N [E]_N$

$K^M = \frac{[K]_M}{K^M_K}$, $Cl^M = \frac{[Cl]_M}{K^M_{Cl}}$, $NH_4^M = \frac{[NH4]_M}{K^M_C}$ $|K^N = \frac{[K]_N}{K^N_B}$, $Cl^N = \frac{[A]_N}{K^N_{Cl}}$, $NH_4^N = \frac{[NH_4]_N}{K^N_{NH_4}}$

$R_M = 1 + K^M + K^M Cl^M + NH_4^M Cl^M \mid R_N = 1 + Cl^N + K^N Cl^N + NH_4^N Cl^N$

$R_{MM} = g^M_E + g^M_{EKCl} K^M Cl^M + g^M_{ENH_4Cl} NH_4^M Cl^M \mid R_{NN} = g^N_E + g^N_{EKCl} K^N Cl^N + g^N_{ENH_4Cl} NH_4^N Cl^N$

Table 20: The corresponding equations describing the flux transported via potassium chloride symporters across the cell membrane