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.

⋆This document is the result of the research project funded by the National Science Foundation.

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3.5. Sodium Phosphate Symporter (NaPO4)

Sodium Phosphate Symporter (NaPO4)	Ref
$$J^{M,N(net)}_{Na,NaPO_4} = [E]_t\left(\frac{R_{NN}\left(g^M_{ENa}Na^M + g^M_{ENaPO_4}Na^M PO^M_4 + g^M_{ENaPO_4Na}Na^M PO^M_4 Na''^M\right)}{R_M R_{NN} + R_N R_{MM}} - \frac{R_{MM}\left(g^N_{EA}Na^N + g^N_{ENaPO_4}Na^N PO^N_4 + g^N_{ENaPO_4Na}Na^N PO^N_4 Na''^N\right)}{R_M R_{NN} + R_N R_{MM}}\right) \quad (140a)$$ $$J^{M,N(net)}_{PO_4,NaPO_4} = [E]_t\left(\frac{R_{NN}\left(g^M_{ENaPO_4}Na^M PO^M_4 + g^M_{ENaPO_4Na}Na^M PO^M_4 Na''^M\right)}{R_M R_{NN} + R_N R_{MM}} - \frac{R_{MM}\left(g^N_{ENaPO_4}Na^N PO^N_4 + g^N_{ENaPO_4Na}Na^N PO^N_4 Na''^N\right)}{R_M R_{NN} + R_N R_{MM}}\right) \quad (140b)$$ where $[E]_t = [E]_M + [ENa]_M + [ENaPO_4]_M + [ENaPO_4Na]_M + [ENaPO_4Na]_N + [ENaPO_4]_N + [ENa]_N + [E]_N$ $Na^M = \frac{[Na]_M}{K^M_{Na}}$, $PO^M_4 = \frac{[PO_4]_M}{K^M_{NaPO_4}}$, $Na''^M = \frac{[Na]_M}{K^M_{NaPO_4Na}}$ | $Na^N = \frac{[Na]_N}{K^N_{Na}}$, $PO^N_4 = \frac{[PO_4]_N}{K^N_{NaPO_4}}$, $Na''^N = \frac{[Na]_N}{K^N_{NaPO_4Na}}$ $R_M = 1 + Na^M + Na^M PO^M_4 + Na^M PO^M_4 Na''^M$ | $R_N = 1 + Na^N + Na^N PO^N_4 + Na^N PO^N_4 Na''^N$ $R_{MM} = g^M_E + g^M_{ENa}Na^M + g^M_{ENaPO_4}Na^M PO^M_4 + g^M_{ENaPO_4Na}Na^M PO^M_4 Na''^M$ $R_{NN} = g^N_E + g^N_{ENa}Na^N + g^N_{ENaPO_4}Na^N PO^N_4 + g^N_{ENaPO_4Na}Na^N PO^N_4 Na''^N$	[34, 57]

Table 24: The corresponding equations describing the flux transported via sodium phosphate symporter across the cell membrane