Antiporter	Equation (mol/mm^2)	Ref
Na/Ca	$$I_{NCX} = g_{NCX}^{max}\left(\frac{([Ca]_{i(M)})^{\eta_{Hill}}}{([Ca]_{i(M)}^{n_{Hill)}} + (K_{m,NCX}^{Ca})^{\eta_{Hill}}}\right)$$ $$\left(\frac{[Na]_i^n[Ca]_o exp\left(\frac{(n-2)rV_mF}{2RT}\right) - [Na]_o^n[Ca]_i exp\left(-\frac{(n-2)(1-r)V_mF}{2RT}\right)}{1 + d_{NCX}\left([Na]_o^n[Ca]_i + [Na]_i^n[Ca]_o\right)}\right) \quad [99]$$	(9, 71)
	$$i_{Ca}^{NaCa} = k_{NaCa}\left([Na]_{i(M)}^3[Ca]_{N(o)} exp\Big(\frac{rV_mF}{RT}\Big)\right.$$ $$\left. -[Na]_{N(o)}^3[Ca]_{i(M)} exp\Big(-\frac{(1-r)V_mF}{RT}\Big)\right) \quad [100]$$ $$E_{NaCa} = \frac{(nE_{Na} - 2E_{Ca})}{(n-2)} \quad [101]$$ $$[102]$$	(72–75)
	$$I_{NCX} = I_{NCX}^{max}\left(\frac{([Ca]_{i(M)})^{\eta_{Hill}}}{([Ca]_{i(M)}^{n_{Hill)}} + (K_{m,NCX}^{Ca})^{\eta_{Hill}}}\right)$$ $$\left(\frac{[Na]_{i(M)}^{n_{NCX}}[Ca]_{N(o)} exp\Big(\frac{rV_mF}{RT}\Big) - [Na]_{N(o)}^{n_{NCX}}[Ca]_{i(M)} exp\Big(-\frac{(1-r)V_mF}{RT}\Big)}{\lambda(1 + k_{sat} exp\Big(-\frac{(1-r)V_mF}{RT}\Big))}\right) \quad [103]$$ $$\lambda = [Na]_e^{n_{NCX(orNa)}}[Ca]_i + [Na]_i^{n_{NCX}}[Ca]_e + K_{m,Cae}[Na]_i^{n_{NCX}}$$ $$+K_{m,Nai}^{n_{NCX}}[Ca]_e(1 + \frac{[Ca]_i}{K_{m,Cai}}) + K_{m,Cai}[Na]_e^{n_{NCX}}\left(1 + \frac{[Na]_i^{n_{NCX}}}{K_{m,Nai}}\right)^{n_{NCX}} \quad [104]$$	(48, 55, 76)
	$$I_{NCX} = I_{NCX}^{max}\left(\frac{1}{1 + (\frac{K_{m,NCX}^{Ca}}{[Ca]_{md}})^3}\right)$$ $$\left(\frac{[Na]_{md}^3[Ca]_{out} exp\Big(\frac{rV_mF}{RT}\Big) - [Na]_{out}^3[Ca]_{md} exp\Big(-\frac{(1-r)V_m^{md}F}{RT}\Big)}{\lambda(1 + k_{sat} exp\Big(-\frac{(1-r)V_m^{md}F}{RT}\Big))}\right) \quad [105]$$ $$\lambda = [Na]_{out}^3[Ca]_{md} + [Na]_{md}^3[Ca]_{out} + K_{m,Cao}[Na]_{out}^3$$ $$+K_{m,Nao}^3[Ca]_{md}(1 + \frac{[Ca]_{md}}{K_{m,Cai}}) + K_{m,Cai}[Na]_{out}^3\left(1 + \frac{([Na]_{md}}{K_{m,Nai}})^3\right) \quad [106]$$	(30, 55)
	$$I_{NCX} = k_{NCX}\left(\frac{[Na^+]_o^3}{K_{m,Na}^3 + [Na^+]_o^3}\right)\left(\frac{[Ca^{2+}]_o}{[Ca^{2+}]_o + K_{m,Ca}}\right)$$ $$\times\left(\frac{\frac{[Na^+]_i^3}{[Na^+]_o^3}e^{\frac{\eta VF}{RT}} - \frac{[Ca^{2+}]_i^3}{[Ca^{2+}]_o^3}e^{\frac{(\eta-1)VF}{RT}}}{1 + k_{sat}e^{\frac{(\eta-1)VF}{RT}}}\right) \quad [107]$$	(51)

Table 40. The corresponding equations describing the flux and current transported via sodium calcium exchanger across the cell membrane

E.2. Sodium Calcium Exchanger (Na/Ca).

Table 41. NaCa Exchanger Parameters (equation 105)

Parameter	Description	Value	Types of Cells	References
I_{NCX}^{max}	Maximum Na/Ca exchange current	$200(\mu A \mu F)$		(30, 55)
$K_{m,Cai}$	Internal Ca half-saturation constant for Na/Ca exchange	$3.59(\mu M)$		(55)
$K_{m,Cao}$	External Ca half-saturation constant for Na/Ca exchange	$1.3(mM)$		(30, 55)
$K_{m,Nai}$	Internal Na half-saturation constant for Na/Ca exchange	$12.29(mM)$		(30, 55)
$K_{m,Nao}$	External Na half-saturation constant for Na/Ca exchange	$87.5(mM)$		(52, 55)
r	Na/Ca exchange saturation factor at negative potentials	0.27		(55)
r	Constant for voltage dependent of Na/Ca exchange	0.35		(52, 55)
$K_{m,NCX}^{Ca}$	Constant for Na/Ca exchange	0.256 (μM)		(55)

nomenclature for the TSs refers to the numbered species in the table.

Antiporter	Equation (mol/mm^2)	Ref
NHE	$$J_{NHE} = \frac{G_{NHE}([Na]_{bl}[H]_c - [Na]_c[H]_{bl})}{K_{Na}\ K_H \left((1 + \frac{[Na]_{bl}}{K_{Na}} + \frac{[H]_{bl}}{K_H})(\frac{[Na]_c}{K_{Na}} + \frac{[H]_c}{K_H})(1 + \frac{[Na]_c}{K_{Na}} + \frac{[H]_c}{K_H})(\frac{[Na]_{bl}}{K_{Na}} + \frac{[H]_{bl}}{K_H})\right)}$$ [108]	(61)

Table 42. The corresponding equations describing the flux and current transported via Sodium Hydrogene exchanger

Table 43. NHE Parameters (equation 108)

Parameter	Description	Value	Types of Cells	References
G_{NHE}	Membrane permeability per 1 cm^2	$5 \times 10^{-10}\ mol/(sec \cdot cm^2)$	Pancreatic Ductal Epithelium	(61)
K_{Na}		100 (mM)	Pancreatic Ductal Epithelium	(61)
K_H		$5 \times 10^{-4} (mM)$	Pancreatic Ductal Epithelium	(61)

nomenclature for the TSs refers to the numbered species in the table.

E.3. Sodium Hydrogen Antiporter (NHE).