1 Change in Membrane Voltage

$$\frac{\delta V_m}{\delta t} = \frac{F}{C_m SA} \times w \times ([Na] + [K] - [Cl] + z[X]) \tag{1}$$

2 KCC2 Pump rate

$$E_K = RTF \times log(\frac{[K]_o}{[K]_i}) \tag{2}$$

$$E_{Cl} = RTF \times log(\frac{[Cl]_o}{[Cl]_i}) \tag{3}$$

$$J_{KCC2} = g_{KCC2} \times (E_K - E_{Cl}) \tag{4}$$

3 Changes in Intracelllar Ion Concentrations

$$\frac{\delta[Na]}{\delta t} = -\frac{SA}{w} \times (g_{Na} \times (V_m - \frac{RT}{F}log(\frac{[Na]_o}{[Na]_i}) + 3J_p) \tag{5}$$

$$\frac{\delta[K]}{\delta t} = -\frac{SA}{w} \times (g_K \times (V_m - \frac{RT}{F}log(\frac{[K]_o}{[K]_i}) + 2J_p - J_{KCC2}) \tag{6}$$

$$\frac{\delta[Cl]}{\delta t} = -\frac{SA}{w} \times (g_{Cl} \times (V_m - \frac{RT}{F}log(\frac{[Cl]_o}{[Cl]_i}) - J_{KCC2}) \tag{7}$$