A neuron has a membrane capacitance of 100 pF

How many coulombs of charge are separated across the membrane at a potential of -65 mV?

$Q_1 = C\,V = -65 \times 100 \times 10^{-15} = -6.5$ pC

What is the charge separation across the membrane at +50 mV (peak of the action potential)?

$Q_2 = 5$ pC

What is the net influx of positive charge to move the membrane potential from -65 to +50 mV?

11.5 pC

Assume that the cell has a volume of 92 pl and the total intracellular concentration of cations is 200 mM

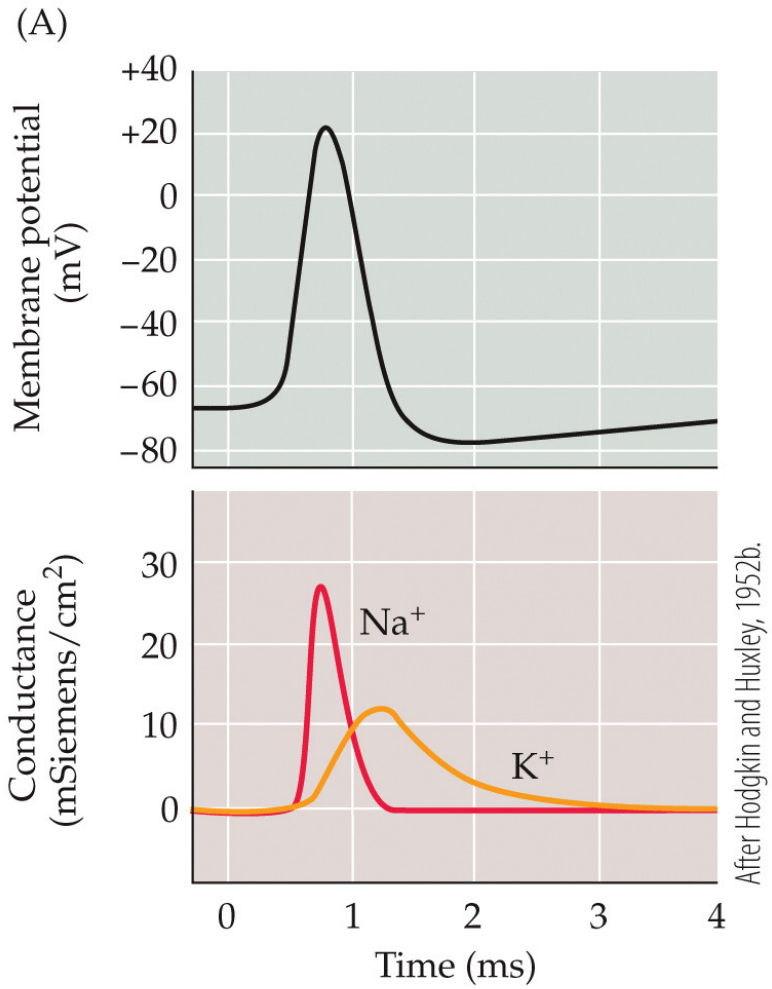
What is the percentage change in the total number of intracellular cations when the membrane potential moves from -65 to +55 mV?

There are 1.04×10^{-5} moles of univalent charge per Coulomb

Total cation transfer = $11.5 \times 10^{-12} \times 1.04 \times 10^{-5} = 0.12 \times 10^{-15}$ moles

Original amount of cation in the cell was $200 \times 10^{-3} \times 92 \times 10^{-12} = 18.4 \times 10^{-12}$ moles

Percentage Change = $0.12 \times 10^{-15} \times 100 / 18.4 \times 10^{-12} =$ 0.00065%



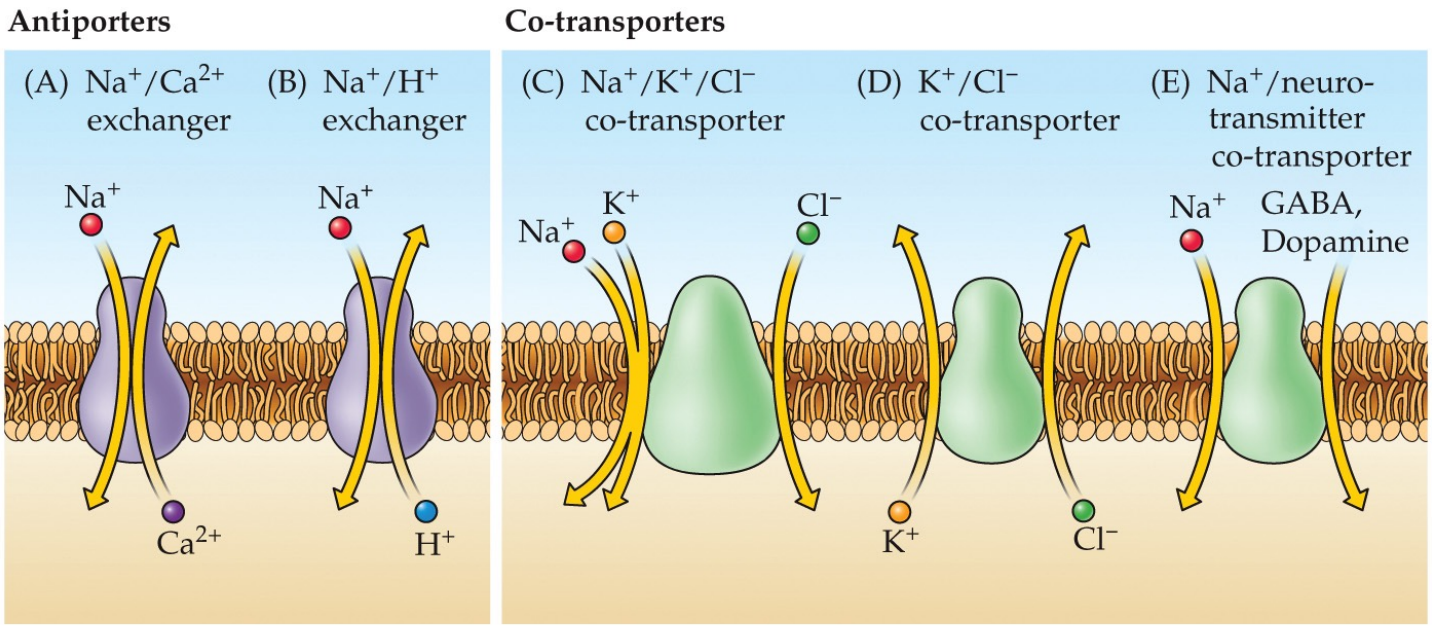
NEUROSCIENCE 6e, Figure 3.8 (Part 1)

$I_{Na} = g_{Na} (V_m - E_{Na})$

$I_K = g_K (V_m - E_K)$

$T = 18.5^oC$

Examples of ion exchangers



NEUROSCIENCE 6e, Figure 4.13