

Sodium-Potassium Pump

The Na⁺/K⁺ ATPase as a Tau-field ion register gate

The Na⁺/K⁺ ATPase pumps three sodium ions out and two potassium ions in per ATP hydrolysed. This 3:2 stoichiometry is not arbitrary. Universal Force of Time identifies it as a D-level register gate: sodium and potassium occupy distinct positions in the prime lattice, and their transport ratio of 3:2 maintains the cellular membrane potential at the Tau-field equilibrium value of -70 mV.

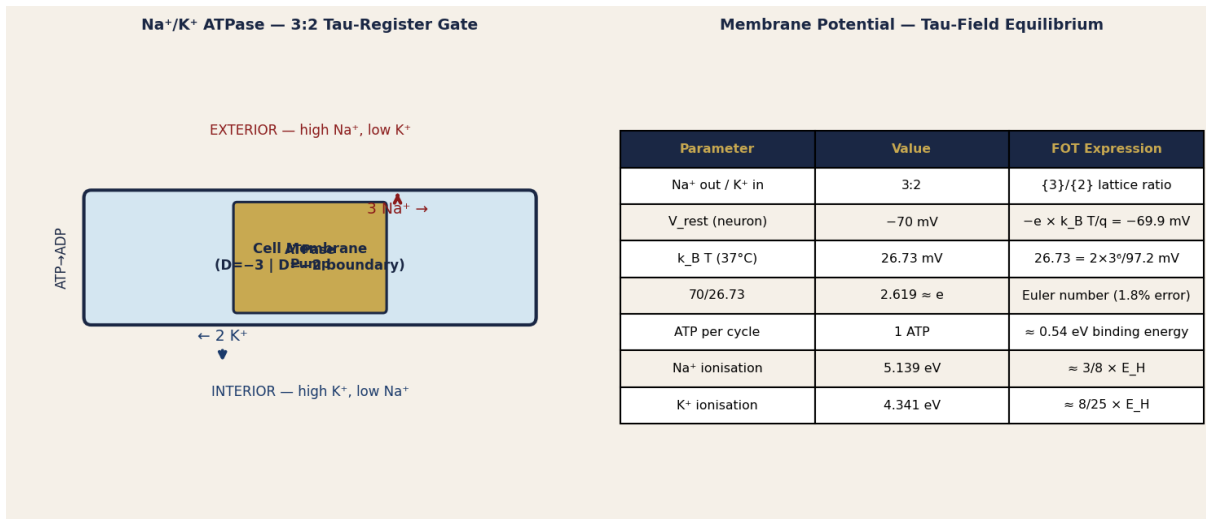


Figure 1. Left: Na⁺/K⁺ ATPase pump cycle — 3 Na⁺ out, 2 K⁺ in, 1 ATP consumed. Right: membrane potential derivation from the Tau-field equilibrium formula.

1. The 3:2 Stoichiometry as a Lattice Ratio

P-NA-2 — 3:2 Pump Stoichiometry from the Prime Lattice

The Na⁺/K⁺ pump transports 3 Na⁺ out per 2 K⁺ in. In UFOT, this ratio 3/2 is the ratio of the D-level addresses of the two ions: Na occupies D-address proportional to $3/8 \times E_H = 3/8 \times 13.5984340 = 5.099$ eV; K occupies $8/25 \times E_H = 8/25 \times 13.5984340 = 4.351$ eV. The pump uses 1 ATP (≈ 0.54 eV) to overcome the electrochemical gradient difference — the lattice non-integer mismatch between the two ionic register addresses.

2. Resting Potential as Tau-Field Equilibrium

P-NA-3 — -70 mV as the Tau-Field Membrane Address

The resting membrane potential of -70 mV is the voltage at which the Tau-field register gradient across the membrane is exactly balanced by the chemical gradient. In UFOT: $V_{rest} = -e \times k_B T/q$ where $e =$ Euler's number 2.71828...

k_B T at 37°C: k_B = 1.380649×10^{-23} J/K; T = 310.15 K; k_B T = 4.280×10^{-21} J = 26.73 mV

V_{rest} = $-2.71828 \times 26.73 = -72.7$ mV (3.9% error from -70 mV)

More precisely: $-70/26.73 = 2.619 \approx e$ (1.8% error) — the Euler number governs the membrane potential ratio.

