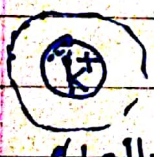
Potassium Molybdenum. Where as vanadium silicon, boron, Nickel are still controversial.

Na^+/K^+ Pump

Introduction:→ Consider Na^+ and K^+ ions. Red blood cells, infact all animal cells normally have a high intracellular K^+ Concentration and a low Na^+ concentration i.e. 4.5 mg/ml. (K) in cellular fluids but only 0.16 mg/ml in the plasma. ~~but less than 0.5 mg/ml in the~~ The opposite is true of Na^+, which have Concentration of about 3.2 mg/ml in the plasma and less than 0.5 mg/ml in the cellular fluids



K^+ conc. high cellular fluid

Na^+ conc. low in cellular fluid

- This is essentially needed for the survival of the cells. High cellular K^+ is Cellular fluids, needed for the optimal

glycolysis (pyruvate kinase is dependent on K^+) and for protein biosynthesis.

Na^+ and K^+ gradients across plasma membrane are required for the transmission of nerve impulse. This is maintained (high intracellular K^+ conc. and low intracellular Na^+ concentration) by a protein in the cell membrane called Na^+-K^+-ATPase or the Na^+ K^+ Pump.

Na^+/K^+ ATPase is an enzyme found in the membrane of all animal cells. It performs several function in cell physiology. The sodium-potassium pump uses active transport to move molecules from a high concentration to a low concentration. The sodium-potassium pump moves sodium ions out of and K^+ into the cell. Na^+ ions bind to the pump and a phosphate group from ATP attached to the pump, causing it to change its shape.

The ATPase is an integral membrane protein and requires phospholipids for activity and is the phosphorylation and dephosphorylation of the ATPase which leads to the transport of Na^+ and K^+ across the membrane.

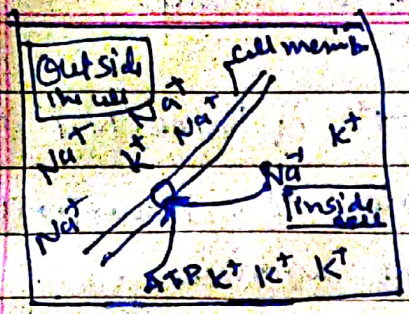
Working of Na^+ K^+ ATPase Pump

The sodium Potassium pump is a specialized type of transport protein found in our cell membranes. The cell membrane is the semi-permeable outer barrier of many cells. The Na K Pump's job is to move K^+ into the cell while simultaneously moving sodium ions out of the cell. The ATP Powered the pump moves Na^+ and K^+ in opposite direction, each against its ions gradients. In a single cycle of pump, three Na^+ are Extruded from and two K^+ are imported into the cell.

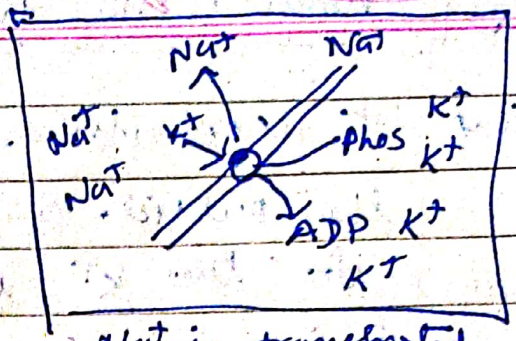
(5)

We can see it in 5 steps:

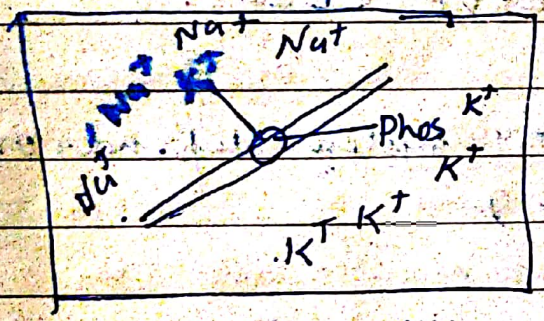
1. 3 Na^+ binds to the pump
2. A Phosphate from ATP is donated to the pump (energy used)
3. Pump changes shape and release sodium ions out side of cells
4. two K^+ bind to the pump and are transferred into the cell.
5. Phosphate group is released and Pump returns to its original shape



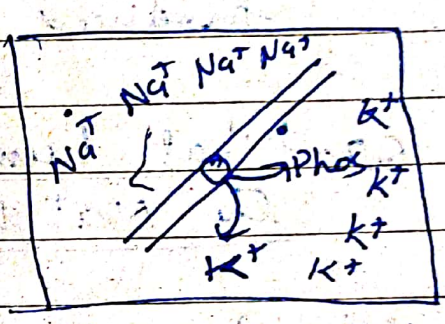
Na^+ and ATP bind to the pump ($Na^+ K^+$ ATPase)



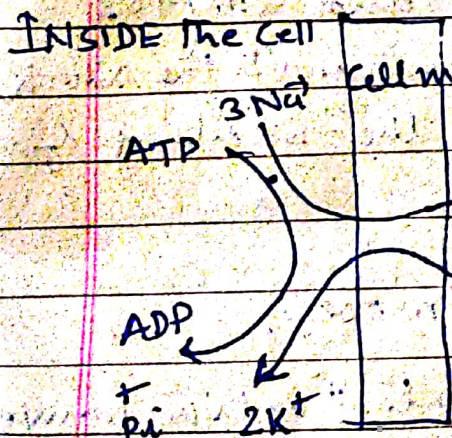
Na^+ is transported and ATP is hydrolyzed to form ADP, leaving phosphate bound to the pump.



K^+ is bound to the pump



K^+ is transported and phosphate is released from the pump



Stoichiometry of the Na^+-K^+ ATPase pump. This pump moves three Na^+ ions from inside the cell to the outside and brings two K^+ ions from the outside to the inside for every mol. of ATP hydrolyzed to ADP by the membrane associated ATP ase.

$$3Na^+ (in) + 2K^+ (out) + ATP \rightarrow 3Na^+ out + 2K^+ (in) + ADP + P_i$$