Sodium-potassium pump

The NA/K pump (also Na/K-ATPase, Na-K-ATPase, etc.) is the most widely used type of active carrier. It is found in the cell membrane of most cells of the human body.

Function

- Draws sodium from the intracellular space to the extracellular space.
- It pumps potassium from the extracellular space to the intracellular space.

The transfer of ions takes place against the concentration gradient. The pump works electrogenically because it transmits 3 Na against 2 K, thus maintaining an uneven distribution of sodium and potassium on both sides of the cell membrane. This fact is essential for the formation and spread of electrical signal in nerve and muscle cells. In addition, the pump regulates the volume of the cell – without its function, the cells would swell and could burst:

- Inside the cell there are macromolecular substances that can not pass through the membrane (e.g. proteins and other organic compounds). Most of these substances have a negative charge and therefore attract positive ions such as Na and K – this would in the absence of a sodium-potassium pump induce the transfer of water to the cell after the osmotic gradient. Na/K-ATPase depletes from cell 3 Na ions and pumps 2 K ions inwards. The membrane is little permeable to Na ions, which tend to remain outside the cell. This mechanism leads to the loss of ions from the cell and to the balancing of osmotic forces, thereby preventing the cell volume from increasing. Any swelling of the cell activates Na/K-ATPases.[1]

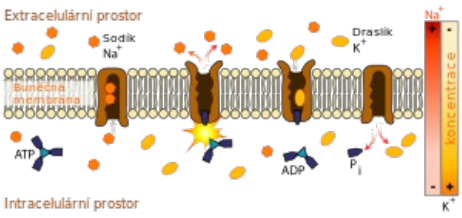
Construction

The pump consists of two subunits – alpha and beta. Both subunits are substances of a protein nature that pass through the cell membrane. Alpha subunit transports ions and has ATPase activity, the function of the beta subunit is probably to anchor the pump in the cell membrane. On the intracellular side of the alpha subunit there are binding points for Na and ATP, on the extracellular side there are binding places for K^{+}.

Transport mechanism

After binding 3 Na and 2 K, ATPase is activated – the released energy from the ATP split will cause a change in the structure of the protein and the transfer of sodium ions outside the cell and potassium inside the cell.

For nerve cells, up to 70% of their energy can be consumed by this pump.[2]



Sodium-potassium pump function scheme

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References

1. E. HALL, John. *Textbook of Medical Physiology.* 12. edition. Saunders, 2010. 1120 pp. ISBN 978-1-4160-4574-8.
2. E. HALL, John. *Textbook of Medical Physiology.* 12. edition. Saunders, 2010. 1120 pp. ISBN 978-1-4160-4574-8.

Sources

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