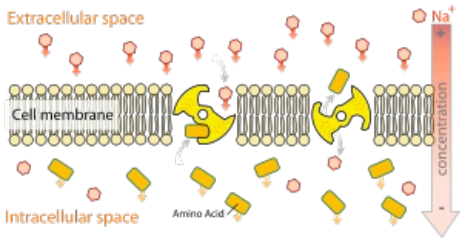
Secondary Active Transport

Secondary active transport, is transport of molecules across the cell membrane utilizing energy in other forms than ATP. This energy comes from the electrochemical gradient created by pumping ions out of the cell. This Co-Transport can be either via antiport or symport.



Secondary active transport

Mechanism

The formation of the electrochemical gradient which enables the co-transport is made by the primary active transport of Na^+. Na^+ is actively transport out of the cell creating a much higher concentration extracellular than intracellular. This gradient becomes energy as the excess Sodium is constantly trying to diffuse to the interior.

Antiport

Antiport or *Counter-transport* means that 2 different molecules or ions are being transported at the same time but opposite directions. One of the species is allowed to flow from high concentration to a lower concentration (often Sodium) while the other species is transported simultaneously to the other side.

Examples:

- Na^+-Ca^{2+} counter-transport where Na^+ binds to the transport carrier protein on its exterior side, and Ca^{2+} bound to the same protein on the membranes interior side. Once both are bound, a conformational change occurs which releases energy and the sodium ion is transported to the interior and calcium to the exterior. This transporter is situated on almost all cell membranes.
- Na^+-H^+ counter-transport. The mechanism is the same as the previous example. However the advantage of this transporter is clearly seen in the proximal tubules of the kidneys. The mechanism for concentrating H^+ is not nearly as powerful as Primary active transport, however it can transport extremely *large numbers* and thus making it a key in H^+ homeostasis in the body.

Symport

Symport or "Co-transport" means that a molecule is allowed to be transported from high to low concentration region while moving another molecule with it from low to high concentration. It in fact is pulling the other molecule with it into the cell.

Examples:

- Sodium-Glucose co-transport mechanism. On its exterior side the transport protein has 2 binding sites, one for sodium and one for glucose. When both of these bind to the protein there is a conformational change allowing the electrochemical gradient to provide the energy needed to transport both of these molecules into the cell.
- Sodium-Amino acid co-transport occurs in the same manner as for glucose, except that uses a different set of transport proteins, however its mechanism is the same.

These transporters occur especially through the epithelial cells of the intestinal tract and the renal tubules of the kidneys to enable absorption of these substances into blood.

References

GUYTON, Arthur C – HALL, John E. *Textbook of Medical Physiology.* 11th edition. 2006. ISBN 0-7216-0240-1.

See also

- Primary active transport