Compartmentation of metabolic pathways

Compartmentation of individual **metabolic pathways** is an important element of metabolism regulation. The division of the cell into separate compartments allows opposing metabolic pathways to take place in the cell at the same time. It also simplifies the regulation of some lanes. For example, the regulation of β-oxidation is based on this principle, where the rate of fatty acid oxidation is dependent on the entry of fatty acids into the mitochondrion.

Organelle	Metabolic pathways
Cytosol	Glycolysis, part of gluconeogenesis, pentose cycle, glycogen metabolism Synthesis of fatty acids Synthesis of non-essential AMK, transamination, part of the ureosynthetic cycle Metabolism of purines and pyrimidines Part of heme synthesis
Mitochondria	The citrate cycle and the respiratory chain Beginning of gluconeogenesis β-oxidation of fatty acids Part of the urosynthetic cycle Start and end of heme synthesis
Rough endoplasmic reticulum	Proteosynthesis (on ribosomes) α- and ω-oxidation of fatty acids, transformation of xenobiotics Synthesis of TAG and phospholipids Cholesterol synthesis, steroid reduction
Golgi apparatus	Glycosylation and hydroxylation of proteins
Lysosomes	Hydrolases, acid phosphatase, lysozyme
Peroxisomes	Degradation of long-chain fatty acids

Transport of metabolites between compartments

Metabolites are substances that are often soluble in water and therefore cannot pass through the membrane on their own. This applies both to the cytoplasmic membrane and to the intracellular membranes delimiting individual compartments. Therefore, transport mechanisms are needed. Most metabolites have their carriers in the membranes – pyruvate, citrate, malate easily pass through the membrane. Considering that metabolites are often associated with large molecules, it would be useless to transport whole molecules and thus only their parts are transported.

Three transport systems are particularly important in metabolism:

- *carnitine transport system*;
- *malate-aspartate* and *glycerol phosphate shuttle*.

Compartmentation also complicates the onset of gluconeogenesis. The enzyme pyruvate dehydrogenase is only present in mitochondria. The resulting oxalacelate cannot pass through the membrane, so it must be transaminated to aspartate or reduced to malate, which pass through the membrane and are converted back in the cytosol.

Links

Related articles

- Regulation of metabolism at the cell level
  - Regulatory enzymes
  - Regulation of individual metabolic pathways

References

- DUŠKA, František – TRNKA, Jan. *Biochemistry in context Part I - basics of energy metabolism.* 1st edition edition. Karolinum, 2006. ISBN 80-246-1116-3.
- KVASNICOVÁ, Vladimíra. *Regulation of metabolism at the cellular level* [online]. ©2009. [cit. 2010-10-

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