

Regenerative (non-oxidative) phase of the pentose cycle

The **pentose cycle** is a catabolic process that provides reduced cofactors NADPH and five-carbon carbohydrates, or pentoses. It is a metabolic conversion of glucose, which goal is not to create ATP.

Progress of the regeneration phase of the pentose cycle

In the regeneration phase, mutual transformations of phosphorylated monosaccharide molecules occur.

These reactions are **freely reversible** (reversible).

Basic Scheme

The basic diagram of the regeneration phase of the pentose cycle could be simply written as:



More detailed diagram

At a closer look:

1) Conversion of *ribulose-5-P* to *ribose-5-P* (ketosis is changed to aldose with the help of isomerase) or to *xylulose-5-P* (catalyzed by epimerase)

2) The following is a pair of reactions expressed by equations:



These reactions are catalyzed by two transferases – *transketolase* and *transaldolase*.

Transketolase transports two-carbon units from *xylulose-5-P* (ketose) to *ribose-5-P* to form *glyceraldehyde-3-P* and *sedoheptulose-7-P* (the cofactor of the enzyme is a derivative of vitamin B1 – *thiamine diphosphate*).

Transaldolase transfers three-carbon units from *sedoheptulose-7-P* (ketosis) to the aldehyde group of *glyceraldehyde-3-P*.

In general, carbon grafts (C3- and C2-units) are made from ketoses and aldoses become their recipient.

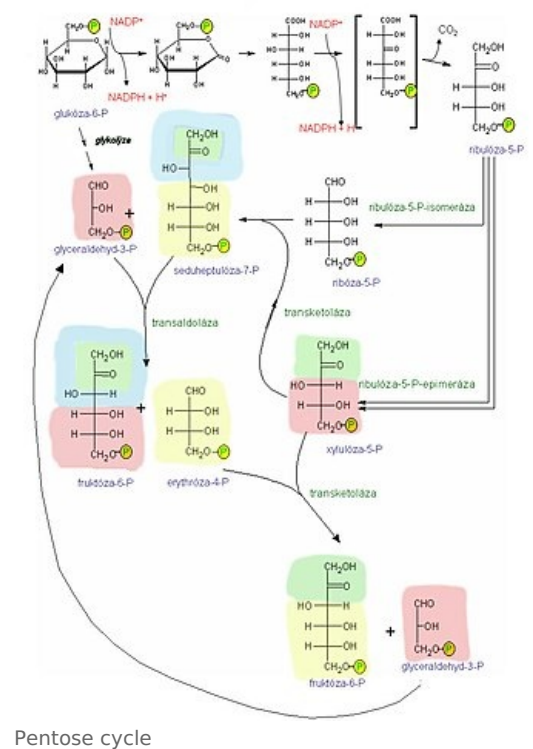
The result is that a shorter aldose is formed from ketose and a longer ketose is formed from aldose.

3) In order not to accumulate unnecessary *erythrose-4-P*, its reaction with *xylulose-5-P* follows:



The resulting products of the second phase, *fructose-6-P* and *glyceraldehyde-3-P*, can be either burned by the reactions of glycolysis and gluconeogenesis (also take place in the cytoplasm), or converted to *glucose-6-P*. This can again enter the oxidative phase of the cycle, and the pentose cycle is closed. At this point we can clearly see how glycolysis/gluconeogenesis is closely linked to the pentose cycle.

Sometimes we can even come across the claim that the pentose cycle is their divagation.



If we look at the pentose cycle as an **alternative pathway of glucose oxidation**, we can write the summary equation:



This occurs if the cell needs to **maximize NADPH gain**.

However, the pentose cycle can also serve as a source of *ribose-5-P* or other monosaccharides. If the cell needs them (and does not require NADPH), the second phase of the cycle can be reversed, and by the opposite sequence of reactions, *glyceraldehyde-3-P* and *fructose-6-P* are pumped out of glycolysis, and it gradually changes to *ribose-5-P* or other monosaccharides.

Links

Related Articles

- Oxidative phase of the pentose cycle
- Pentose cycle
- Glycolysis
- Gluconeogenesis

External links

- Pentose cycle (Czech Wikipedia) (https://cs.wikipedia.org/wiki/Pent%C3%B3zofosf%C3%A1tov%C3%BD_cyklus%7C)