

# Glutathione

Glutathione is a tripeptide ( $\gamma$ -glutamylcysteinylglycine, or GSH, SH emphasizes the functional group). It participates in the removal of reactive oxygen species, it is important from this point of view in erythrocytes for maintaining the redox environment and membrane stability. It also participates in the detoxification of some xenobiotics, with which it conjugates and increases their solubility in water.

The thiol group of cysteine acts as a reducing function. When glutathione is oxidized, a disulfide bridge can form between two of its molecules (the resulting dimer of glutathione is aptly named GSSG). GSSG can be reduced back to two molecules of GSH, usually with the participation of NADPH.

## Synthesis

Synthesis takes place with the consumption of ATP in two steps:

1. Synthesis of  $\gamma$ -glutamylcysteine from glutamate and cysteine by  $\gamma$ -glutamylcysteine synthetase.
2. Synthesis of glutathione from  $\gamma$ -glutamylcysteine and glycine by glutathione synthetase.

## Role in erythrocyte metabolism

Glutathione synthesis takes place in erythrocytes. It is necessary for the removal of ROS constantly generated in their metabolism and thus protects them from oxidative damage. The removal of hydrogen peroxide by the glutathione peroxidase and glutathione reductase system is considered important:

- $H_2O_2$  is reduced by glutathione peroxidase to water against two molecules of GSH to form GSSG,
- GSSG is regenerated back to 2 GSH by the enzyme glutathione reductase against NADPH, the main source of which is the pentose phosphate pathway.

Similarly, glutathione is used to regenerate ascorbate.

## Role in biotransformation

After the first phase of biotransformation, i.e. after hydroxylation of the xenobiotic, glutathione is conjugated with its electrophilic group (e.g. methylene group). The reaction is spontaneous. In the liver, however, it is facilitated by glutathione-S-transferase due to great need. Glutathione conjugates are further metabolized to mercapturic acid.

## Other reactions of glutathione

- It participates in the synthesis of leukotrienes
- In the  $\gamma$ -glutamyl cycle, it serves as a carrier of free amino acids into the cell, with the help of  $\gamma$ -glutamyl transferase anchored in the cell membrane.

## Links

### Related Articles

- Coenzymes
- Biotransformation
- Vitamin C
- Erythrocytes

### References

- MATOUŠ, Bohuslav, et al. *Fundamentals of medical chemistry and biochemistry*. 1st edition. Prague: Galén, 2010. 540 pp. ISBN 978-80-7262-702-8.
- MURRAY, Robert K. *Harper's Biochemistry*. 2nd edition. Jinočany: H&H, 2002. 871 pp. ISBN 80-7319-013-3.