

RHODANESE AND 3-MERCAPTOPYRUVATE SULFURTRANSFERASE – EVOLUTIONARY RELATED ENZYMES

Summary

Endogenous sulfur-containing compounds play an important role in numerous physiological processes in organisms, such as stabilization of protein structure, regulation of enzymatic activity, and they are engaged in redox reactions (glutathione, thioredoxine). Sulfurtransferases are enzymes widespread in nature. Rhodanese (thiosulfate sulfurtransferase, EC 2.8.1.1) and 3-mercaptopyruvate sulfurtransferase (MPST, EC 2.8.1.2) have been found in the majority of living organism. In animal cells, MPST is located in cytosol and mitochondria, while rhodanese distribution is restricted to mitochondria. In lower vertebrates, such as amphibians, reptiles and fish, it has been also detected in cytosol. Rhodanese transfers sulfur atoms from various donors (sulfane sulfur-containing compounds) to various acceptors. MPST catalyses the transfer of the sulfur atom from 3-mercaptopyruvate to various acceptors, producing sulfane sulfur containing compounds (e.g. thiosulfate), or releases it as hydrogen sulfide. Rhodanese and MPST are evolutionary related enzymes. Both of them have similar structure of gene, protein ter-

tiary structure and the structure of active site. Molecular weight is also comparable – about 33 kDa. Moreover, they have similar physicochemical and catalytic properties. The catalytic activity of these two enzymes participating in L-cysteine metabolism depends on cysteine residues in their active sites. During catalysis, enzymes cycle between two stable intermediates: a sulfur-free form and a sulfur-substituted enzyme containing a divalent sulfur atom bound by persulfide linkage to the sulfhydryl group of the active site. Pollutants and xenobiotics can bind to -SH groups and, therefore, lower the activity of enzymes and change the level of sulfane sulfur, a product of L-cysteine desulfuration. The catalytic site cysteine of a thiol enzyme is redox active; MPST and rhodanese could locally serve as antioxidant proteins. Reactive oxygen species modify signal proteins and/or transcription factors and have an impact on rhodanese gene expression. It is interesting from the point of view of molecular medicine because of potential therapeutic effects.