

Chemical Biology of Selenium

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Selenium (Se) is an essential micronutrient that is known to function as the active center of selenoenzymes, such as glutathione peroxidase, thioredoxin reductase and iodothyronine deiodinase. The physiological and toxicological effects of Se on the absorption, metabolism and excretion process strongly depend on its chemical form, and the chemical form is changed in its metabolism. Indeed, most Se forms originating in food are selenoamino acid derivatives. These selenocompounds are utilized and metabolized equally into inorganic selenocompounds, such as selenite and selenate, and then these selenocompounds are excreted into urine as a few kinds of selenometabolites. This indicates that the chemical reactions involved in Se metabolism result in the biosynthesis of various chemical forms of selenometabolites. Hence, the identification and speciation of selenometabolites are essential to reveal the chemical biology of Se. Recent developments in the analysis of Se, such as parallel detection by high-performance liquid chromatography (HPLC) coupled with inductively coupled plasma – mass spectrometry (ICP-MS) and electrospray ionization – tandem mass spectrometry (ESI-MS/MS), have provided novel insights to Se metabolism. An Se-containing sugar called selenosugar was identified by HPLC-ESI-MS/MS, and its chemical structure seemed to be chemically, biologically, toxicologically and nutritionally reasonable. Thus, the chemical biology of Se will be discussed from the viewpoint of the speciation and identification of selenometabolites.