DISCOVERING THE SELENIUM METABOLISM AND ITS IMPACT FOR HEALTH PREVENTION BY TXRF

Armin Gross[a], Hagen Stosnach[a], Kostja Renko[b], Thomas Behrends[b] and Lutz Schomburg[b];
[a]Bruker Nano GmbH, 12489 Berlin, Germany; [b]Institute for Experimental Endocrinology, Charité Berlin, 13353 Berlin, Germany; armin.gross@bruker-axs.de

This presentation will highlight the physiological role of selenium (Se) and its quantitative detection in different tissues by total reflection X-ray fluorescence (TXRF) spectrometry.
Se represents one of the few essential elements for humans. It is the only trace element for which the position within proteins is defined precisely by the genetic code. Among the intensively studied selenoproteins, Selenoprotein P controls serum Se concentration and transport in rodents and humans [1]. The individual Se status, dietary Se intake and SePP expression are interrelated and become increasingly recognized as an important pathophysiological parameter for disease risk and prognosis [2]. While the role of SePP for storage and transport of Se have convincingly been proven by respective analyses with transgenic mice [1, 3], similar direct evidence on the physiological importance of SePP for other metabolic functions is missing.

Recently, we have established transgenic mouse models of modified Se metabolism and SePP expression including SePP-knock out and transgenic SePP overexpressing mice. For the analysis of Se and other element concentrations we developed protocols and improved sample handling for TXRF spectrometry. In pilot studies, TXRF allowed the parallel quantification of several trace metal elements from minute amounts of murine starting material without laborious sample preparation. Tissue-specific preparation procedures were developed and first results of metal concentrations in different matrices were obtained. Reliable Se determination and quantification was achieved with as little as 1 thyroid gland lobe of an adult mouse. For serum analyses, as little as 10 µl of serum sufficed for the simultaneous duplicate analyses of Se, Zn, Cu and Fe. The advantage of TXRF becomes obvious when different trace metals are compared and physiological meaningful correlations are deduced. To this end, we are currently studying the importance of Se status for heavy metal detoxification, the potential interrelation of Se with other physiological relevant trace elements (Zn, Cu, Fe) in male fertility and the metabolic changes that take place upon the acute phase response in mice.

We conclude that TXRF-based analysis in combination with biochemical methods and molecular biology techniques opens new doors for a fast and sensitive multi-element analysis of a variety of biological matrices. Our analyses clearly demonstrate that selenoproteins represent important endogenous factors controlling male fertility, heavy metal metabolism and acute phase response offering new opportunities in prevention and health care.

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[3] Schweizer, U., Schomburg, L. (2005), IUBMB Life. 57: 1-8.