HelmholtzZentrum münchen
German Research Center for Environmental Health

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☒ co-ordinated with the Director of the Institute / Research Unit

Analytical BioGeoChemistry

PSP-Element:
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Title of the highlight:
Diverse Serum Manganese Species Affect Brain Metabolites Depending on Exposure Conditions

Keywords:
Manganese speciation, Parkinson like disease, inflammation, oxidative stress, brain metabolome

Central statement of the highlight in one sentence:
Varying Mn exposure conditions result in different serum Mn species and affect brain metabolites differently.

Text of the highlight:
Occupational and environmental exposure to increased concentrations of manganese (Mn) can lead to an accumulation of this element in the brain. The consequence is an irreversible damage of dopaminergic neurons leading to a disease called manganism with a clinical presentation similar to the one observed in Parkinson's disease. Human as well as animal studies indicate that Mn is mainly bound to low molecular mass (LMM) compounds such as Mn-citrate when crossing neural barriers. The shift toward LMM compounds might already take place in serum due to elevated Mn concentrations in the body. In this study, we investigated Mn-species pattern in serum in two different animal models by size exclusion chromatography–inductively coupled plasma mass spectrometry (SEC-ICP-MS). A subchronic feeding of rats with elevated levels of Mn led to an increase in LMM compounds, mainly Mn-citrate and Mn bound to amino acids. In addition, a single i.v. injection of Mn showed an increase in Mn-transferrin and Mn bound to amino acids 1 h after injection, while species values were more or less rebalanced 4 days after the injection. Results from Mn-speciation were correlated to the brain metabolome determined by means of electrospray

ionization ion cyclotron resonance Fourier transform mass spectrometry (ESI-ICR/FT-MS). The powerful combination of Mn speciation in serum with metabolomics of the brain underlined the need for Mn-speciation in exposure scenarios instead of the determination of whole Mn concentrations in blood. The progress of Mn-induced neuronal injury might therefore be assessed on the basis of known serum Mn-species.

Publication:
Diverse Serum Manganese Species Affect Brain Metabolites Depending on Exposure Conditions; Katharina Neth,*,† Marianna Lucio,† Alesia Walker,† Basem Kanawati,† Julia Zorn,‡ **Philippe Schmitt-Kopplin**,†,§ and **Bernhard Michalke**†; Chemical Research in Toxicology

Taking account of the HMGU mission:
The highlight provides important contributions to the mechanisms of neurodegenerative diseases with essential significance for human health.

The internal HMGU co-operation partners with whom the highlight was compiled, if appropriate:
Research Unit Comparative Medicine, Research Center for Environmental Health