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INVITED LECTURE - Studies of Trace Element Species in Macromolecules and Protein Nanoclusters by Nuclear and X-Ray Techniques

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Trace elements play an important role in biological activities of living matter. A considerable amount of data on the total trace element levels in various biological tissues already exists in the literature. However, trace elements are mainly incorporated in proteins in these systems. It is important to separate these protein-bound trace elements for the identification as well as characterization of the chemical species in order to develop a mechanism and an understanding of their biological activities. We have used analytical and bioanalytical techniques such as dialysis, pH variation, ammonium sulphate precipitation, chromatofocusing, isoelectrofocusing and isotachophoresis, ion-exchange, hydroxyl apatite, size-exclusion, gas and liquid chromatography complemented by NAA, MS, and NMR to study macro-molecular species of As, Br, Ca, Cl, Cu, Fe, I, K, Mg, Mn, Mo, Na, Rb, S, Se, V, and Zn in bovine kidneys. Lately we are interested in a better understanding of the interaction of metal nanoparticles (NPs) with proteins through speciation analysis. Because of the size, some metal NPs can have significant effects on their quantum electronic and chemical properties. We are studying bio-functionalization of Au, Ag and a few other metal NPs on surfaces such as Ti that can be used for more efficient drug delivery and implant surface modification using SEM and element-specific X-ray techniques such as EXAFS, XANES and XPS.

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