THE BIOLOGICAL SYSTEM OF ELEMENTS

Beneficial, essential and toxicological effects of chemical elements revisited

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ABSTRACT: For essentiality patterns (of specific plant species) via the Biological System of the Elements (BSE) three parameters are especially important:

1. The interelement relationships of single elements within an individual organism expressed as a linear correlation coefficient,
2. the physiological function paying attention to evolutionary development during the emergence of organic life from the inorganic environment, and
3. the uptake form of individual elements and their compounds by the living organism.

To fulfil above given requirements speciation and ultratrace analysis of chemical elements are a strong must for the future.

From the resulting configuration of the elements in the Biological System of the Elements it can be expected that in the future elements as Ba, Ge, Li, Sr, Te, and others will be classified as physiologically essential or beneficial at least, whereas elements as Tl, Pb, and Hg will continue to exercise exclusively toxicological functions on living systems in elevated concentrations and certain forms of bonding.

Stoichiometric Network Analysis (SNA) explicitly deals with which principal modes of dynamics may be open to such autocatalytic systems in various circumstances. This allows to us consider and analyze aspects of bioinorganic chemistry of metalloproteins including essentiality versus toxicity of element (speciation forms), testifying their roles as building blocks or controlling entities within or connected to autocatalytic feedback loops. The SNA theorems are used to produce a system of non-equations describing the possible or unlikely autocatalytic behaviour of certain metals within the framework of biology. This is meant to enable detailed statements and even predictions whether a certain element may be essential or beneficial to physiology, and, if so, whether there are certain ranges of redox potential or binding forms such as complexes or biomethylation products which might enable such behaviour.

Some „exotic“ element behaviour in living organisms as for Li (and others) will be presented here and a further research proposal for the future developed.

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