

SL02

Life and Elements – Challenge to the Development of Metallopharmaceutics –

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Human beings found gold in the Stone Age. Following preparation of bronze in the Bronze Age around 4000B.C. they produced ironware opening the Iron Age in the south-west Asia around 3000B.C. Using the materials involving bronze and iron, human beings progressed their civilization. After inventing the electricity, they succeeded in producing light-metal aluminum, which brought the Aluminum Age by developing aircraft, motor car, and household electric applicants, and jumped up their civilization. Furthermore, human beings enhanced their daily life forming the Rare Earth Age by using the 21st element Sc, 39th element Y, and 51-71st elements (lanthanide elements), that brought them atomic cell, plasma and liquid crystal display televisions, high-quality of audio-speaker, headphone, cellular (mobile) phone, optical disc and so on. Without these functional metals, we can not live our daily life.

Our body is a kind of ultra-precision instruments consisting of around 70 elements. After appearance of the earth in the space, primitive life came into existence in the oceans, and after tremendous long time human beings was born. Our body is mainly consisted of the following elements, O, C, H, N, Ca, P, S, K, Na, Cl and Mg, total of these accounting 99.5% of the body weight of a normal adult. However, human will not be able live in health with these 11 elements. In addition to these, trace elements existing in the oceans such as Fe, Zn, Mn, Cu, Mo and Co were essential to live. Such elements formed metal complexes with proteins, enzymes, nucleic acids and sugars to obtain high functions and physiological activities. For instance, not only Fe but also Co and Zn were essential for hemoglobin synthesis, Ca and Zn for growth, Zn for immunity system acquisition and preservation, Ca Fe, Cu and Zn for their incorporation and transport in the cells. Such observations gain ground on the essential relationship between life and elements.

While, in treating some disorders and diseases, we have chances to take inorganic medicines (metallopharmaceutics), which deduce new physiological ability of elements, in addition to use of established natural medicines and synthetic drugs. For instance, several metallopharmaceutics are currently available such as Pt complexes to treat cancers, Au complexes to rheumatoid arthritis, Al and Zn for stomach ulcer, and As compound for a kind of leukemia. In this century, several potential metallopharmaceutics will be developed. However, the reasons why such metallopharmaceutics treat the disorders and diseases are still beyond our capacity.

In this lecture, the current state for the challenge to developing metallopharmaceutics will be introduced, centering on the relationship between life and elements.

Reference

Sakurai, H. et al.: Current state for the development of metallopharmaceutics and anti-diabetic metal complexes. *Chem. Soc. Rev.*, **37**, 2383-2392 (2008).