

## The Importance of Metal-Based Drugs in Medicinal Inorganic Chemistry to Improve Life Quality of Patients

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### Introduction

Most of metal ions are essential components to maintain human homeostasis and play crucial roles in many biological processes by involving as cofactors in the biological function of proteins, and operating many regulation, stabilization, completion courses of cellular functions [1-3]. Due to the important tasks of metals through continuity of many cellular events, a sophisticated and sensitive system has been developed by the human body for their transportation and distribution [4]. Medicinal inorganic chemistry is therefore the most attractive research area with the field of knowledge concerned with implementation of metal-based complexes to therapy or diagnosis of disease [4-6]. Although the historically proven use of metal-based remedies and drugs traces back to very ancient times, medicinal inorganic chemistry seems to be considered as a young discipline among the medicinal chemistry fields of biological drugs or small organic molecules. Silver, for instance, was used to treat wounds and ulcers by Greek physician Hippocrates, and gold was used to treat diseases thousands of years ago in China [7-9]. However, the modern era of metal-based complexes was heralded with the serendipitous discovery of cisplatin, a square planar platinum (II) complex, by Rosenberg and Vancamp (1965) [10], and its clinical success against various types of cancer such as ovarian, head and neck, lung, testicular and bladder cancers, opened up the way of second and third generation platinum drugs such as carboplatin, oxaliplatin, satraplatin, nedaplatin, lobaplatin etc. [10-14]. Despite the market for platinum-based drugs had showed rapidly global spread, classical platinum chemotherapy was limited due to the serious side effects such as vomiting, myelosuppression, nephrotoxicity and nephropathy, and drug resistance phenomenon after recurrent treatment [6,15-18]. To improve pharmacological profiles of metal-based complexes, scientists are taking a growing interest in the development of non-platinum metal compounds such as ruthenium, titanium, indium, gallium, gold, etc. [19-22]. The historical development and amazing broad uses of metals, and the importance of their complexes in the medical area were comprehensively reviewed by Medici et al. [23]. On the other hand, to improve aqueous solubility, controlled release, circulation time in human body, specific tumor delivery and long-term anticancer efficacy of metal-based complexes, scientists have been prompted to develop drug delivery strategies [24-27]. Beyond of these developments, the active structure, biological behavior and pharmacological activity mechanism of many metallo drugs on the market today still elusive due to the intrinsic complex nature of human body [4]. Metallomics and metalloproteomics studies in combination with molecular biology and

chemical approaches should, therefore, be expanded to conceive the scenarios of underlying biological, pharmacological and chemical mechanisms of cellular fate of metal-based drugs [4,5]. To develop medicinal inorganic chemistry and the knowledge about metallo drugs, many research councils across the world have been funding the metallo drug-related studies. European Cooperation in Science and Technology (COST) has, for example, an action named "CM1105 Functional Metal Complexes that Binds to Biomolecules", the U.S. National Institutes of Health (NIH) has an action named "Metals in Medicine".

Consequently, we think that in the future medicinal inorganic chemistry and metal-based complexes seem to be the one of the best therapeutic approaches to treat and diagnose the diseases as well as their medical usage in ancient times of Mesopotamia, India, Egypt and China. The field of medicinal inorganic chemistry and interdisciplinary researches related with metallo drug should, therefore, be exploited with a rapid acceleration to solve the biological and pharmacological profiles, and molecular activity mechanisms of metallo drugs in the complex biological systems. Thus, metallo drugs will certainly take a key part of drug development to improve the quality of life of patients. Special attention must also pay to eliminate the prejudices of "Big pharma" companies and the public about metallo drug, and to light them up the benefits of metallo drugs.

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