Available online at www.sciencedirect.com
SCIENCE DIRECT
Polyhedron 25 (2006) 1633–1645
POLYHEDRON
www.elsevier.com/locate/poly

Perspectives in bioinorganic chemistry of some metal based therapeutic agents

Saeed Ahmad [a,*], Anvarhusein A. Isab [b], Saqib Ali [c], Abdul Rahman Al-Arfaj [b]

[a] Department of Chemistry, Government Gordon College Rawalpindi, Pakistan
[b] Department of Chemistry, King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia
[c] Department of Chemistry, Quaid-i-Azam University, Islamabad, Pakistan

Received 15 June 2005; accepted 1 November 2005
Available online 20 December 2005

Abstract

The use of metals in therapeutic drugs have become increasingly important over the last couple of decades resulting in a variety of exciting and valuable drugs such as cisplatin and auranofin. The coordination chemistry of metallodrugs is strongly dependent on understanding the thermodynamics (equilibria and structures) and kinetics of the reactions of metal complexes under physiological relevant conditions. In this review, biocoordination chemistry of several metallodrugs (gold antiarthritic, silver antibacterial, vanadium antidiabetic and bismuth antiulcer, drugs) and their possible mechanism of action has been described. Various structure–activity relationships and biochemical aspects of metal binding to cellular targets have been explained. Advances in the bioinorganic chemistry are crucial for improving the design of these compounds to reduce toxic side effects and to understand their mechanism of action.

Keywords: Therapeutic agents; Gold antiarthritic; Silver antimicrobial; Vanadium antidiabetic; Bismuth antiulcer

1. Introduction

The field of bioinorganic chemistry, which deals with the study of role of metal complexes in biological systems, has opened a new horizon for scientific research in coordination compounds. A large number of compounds are important from the biological point of view. Some metals are essential for biological functions and are found in enzymes and cofactors required for various processes. For example, hemoglobin in red blood cells contains an iron porphyrin complex, which is used for oxygen transport and storage in the body. Chlorophyll in green plants, which is responsible for photosynthetic process, contains a magnesium porphyrin complex. Cobalt is found in the coenzyme B12, which is essential for the transfer of alkyl groups from one molecule to another in biological systems [1]. Metals such as copper, zinc, iron and manganese are incorporated into catalytic proteins (the metalloenzymes), which facilitate a multitude of chemical reactions needed for life [2,3].

Some metals have been used as drugs and diagnostic agents to treat a variety of diseases and conditions [2,4–7]. Platinum compounds, cisplatin (*cis*-$[Pt(NH_3)_2Cl_2]$), carboplatin and oxaliplatin are among the most widely used cancer therapeutic agents [8–10]. Gold drugs, myocrisin and auranofin are used for the treatment of rheumatoid arthritis [4,11,12]. Another important aspect of medicinal inorganic chemistry is the development of radiopharmaceuticals and diagnostic agents [4,5,13]. A technetium radiopharmaceutical, cardiolite supplies ^{99m}Tc, which is selectively taken up by myocardial tissue and is used to image the heart [4,14]. $^{186}Re/^{188}Re$ has been identified as important radionuclides with therapeutic potential [13,15]. The use of lanthanides and transition metals (Gd, Fe, Mn) as paramagnetic contrast agents for magnetic resonance imaging is becoming more exciting, with the

* Corresponding author. Present address: Department of Chemistry, University of Engineering and Technology, Lahore, Pakistan. Tel.: +92 333 5248570.
E-mail address: saeed_a786@hotmail.com (S. Ahmad).

0277-5387/$ - see front matter © 2005 Elsevier Ltd. All rights reserved.
doi:10.1016/j.poly.2005.11.004