

# The Role of Metal Ions in Biology, Biochemistry and Medicine

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Metal ions are fundamental elements for the maintenance of the lifespan of plants, animals and humans. Their substantial role in biological systems was recognized a long time ago. They are essential for the maintenance of life and their absence can cause growth disorders, severe malfunction, carcinogenesis or death. They are protagonists as macro- or microelements in several structural and functional roles, participating in many biochemical reactions, and arise in several forms. They participate in intra and inter cellular communications, in maintaining electrical charges and osmotic pressure, in photosynthesis and electron transfer processes, in the maintenance of pairing, stacking and the stability of nucleotide bases, and also in the regulation of DNA transcription. They contribute to the proper functioning of nerve cells, muscle cells, the brain and the heart, the transport of oxygen and in many other biological processes up to the point that we cannot even imagine a life without metals.

In the present work, the 10 papers published in this Special Issue are summarized, providing a picture of metal ions uses in Biology, Biochemistry and Medicine, but also pointing out the toxicity impacts on plants, animals, humans, and the environment.

Metals (Cobalt (Co), Nickel (Ni) and Chromium (Cr)) are used in prosthesis manufacturing because of their high mechanic stability and good biological compatibility, but their corrosion products have been shown to elicit biological responses [1]. Monocytes and macrophages are the first barrier of the innate immune system, which interact with abrasion and corrosion products, leading to the release of proinflammatory mediators and reactive oxygen species (ROS) [1]. The inflammation-relevant changes in monocytes and macrophages after exposure to several concentrations of metal salts ( $\text{CoCl}_2$ ,  $\text{NiCl}_2$ ,  $\text{CrCl}_3 \times 6\text{H}_2\text{O}$ ) were studied by analyzing viability, gene expression, protein release and ROS production [1]. It was proved that monocytes and macrophages react very sensitively to corrosion products and that high concentrations of bivalent ions lead to cell death, while lower concentrations trigger the release of inflammatory mediators, mainly in macrophages [1].

Metal particles, as well as their corrosion products, have been shown to elicit a biological response in the aseptic loosening of endoprosthetic implants [2]. Owing to different metal alloy components, the response may vary depending on the nature of the released corrosion product [2]. Human osteoblasts were incubated with different metal salts ( $\text{CoCl}_2$ ,  $\text{NiCl}_2$  and  $\text{CrCl}_3 \times 6\text{H}_2\text{O}$ ) in order to compare the biological effects of different ions released from metal alloys [2]. The results demonstrated the pro-osteolytic capacity of metal ions in osteoblasts, while the metal ions examined intervene much earlier in inflammatory processes compared to  $\text{CoCr}_{28}\text{Mo}_6$  particles [2].

Titanium (Ti), being one of the most abundant elements in the earth's crust with many examples of bioactive properties, is widely used in the cosmetic industry. Titanium dioxide ( $\text{TiO}_2$ ) nanoparticles (NPs) are often incorporated in sunscreens as physical sun blockers absorbing ultraviolet (UV) radiation [3]. By examining the reactivity of  $\text{TiO}_2$  NPs in the presence and absence of UV, Sharma et al. [3] reassessed in a review article what their seepage into bodies of water can cause to the environment and aquatic life, and examined  $\text{TiO}_2$  NPs' effects on human skin and health in general, and especially on the human body and the bloodstream.

Phenolic compounds play a significant role in plant tolerance to toxic metals, together with the prevention and reduction of biotic and abiotic oxidative stress [4]. Chlorogenic acid



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# **Metal Ions In Biology And Medicine**

**Philippe Collery, Peter Brätter, Lylia  
Khassanova, Virginia Negretti De  
Bratter**



## **Metal Ions In Biology And Medicine:**

**The Role of Metal Ions in Biology, Biochemistry and Medicine** Michael Moustakas, 2021 Metal ions are fundamental elements for the maintenance of the lifespan of plants animals and humans Their substantial role in biological systems was recognized a long time ago They are essential for the maintenance of life and their absence can cause growth disorders severe malfunction carcinogenesis or death They are protagonists as macro or microelements in several structural and functional roles participating in many bio chemical reactions and arise in several forms They participate in intra and intercellular communications in maintaining electrical charges and osmotic pressure in photosynthesis and electron transfer processes in the maintenance of pairing stacking and the stability of nucleotide bases and also in the regulation of DNA transcription They contribute to the proper functioning of nerve cells muscle cells the brain and the heart the transport of oxygen and to many other biological processes up to the point that we cannot even imagine a life without metals In this book the papers published in the Special Issue The Role of Metal Ions in Biology Biochemistry and Medicine are summarized providing a picture of metal ion uses in biology biochemistry and medicine but also pointing out the toxicity impacts on plants animals humans and the environment Metal Ions Maria Carmen Alpoim, 2006-07-13 This is Volume 9 of the ninth International Symposium on Metal Ions in Biology and Medicine that was held in Lisbon Portugal in May 2006 It comprises a host of papers from internationally regarded authorities in the field **Metal Ions in Biology and Medicine** Philippe Collery, Peter Brätter, Lyliya Khassanova, Virginia Negretti De Bratter, 1998-06-05 Every two years the world's leading specialists meet to exchange information on the most recent advances in understanding metals and the part they play in treating some diseases especially cancer Most of the elements in our environment are metals Some are essential for life such as copper iron magnesium manganese nickel and zinc others are toxic such as arsenic cadmium lead and mercury This book aims to help advance our knowledge of the role of metal ions in a number of fields in biology and medicine It reproduces the papers given at the International Symposium on Metal Ions in Biology and Medicine organised in Munich in May 1998

Metal Ions in Biology and Medicine P. Collery, Lionel A. Poirier, Michael Manfait, Jean-Claude Etienne, 1990 **Ions Métalliques en Biologie Et en Médecine** Philippe Collery, 1990 Contains proceedings of the First International Symposium on Metal Ions in Biology Medicine held in Reims France on 16 to 19 May 1990 *The Role of Metal Ions in Biology, Biochemistry and Medicine* Michael Moustakas, 2021-09-06 Metal ions are fundamental elements for the maintenance of the lifespan of plants animals and humans Their substantial role in biological systems was recognized a long time ago They are essential for the maintenance of life and their absence can cause growth disorders severe malfunction carcinogenesis or death They are protagonists as macro or microelements in several structural and functional roles participating in many bio chemical reactions and arise in several forms They participate in intra and intercellular communications in maintaining electrical charges and osmotic pressure in photosynthesis and electron transfer processes in the maintenance of pairing

stacking and the stability of nucleotide bases and also in the regulation of DNA transcription They contribute to the proper functioning of nerve cells muscle cells the brain and the heart the transport of oxygen and to many other biological processes up to the point that we cannot even imagine a life without metals In this book the papers published in the Special Issue The Role of Metal Ions in Biology Biochemistry and Medicine are summarized providing a picture of metal ion uses in biology biochemistry and medicine but also pointing out the toxicity impacts on plants animals humans and the environment

**Metal Ions in Biology and Medicine** Lylia Khassanova,1990-05 Proceedings of the Seventh International Symposium on Metal Ions in Biology Medicine held in Saint Petersburg State University Saint Petersburg Russia on 5 9 May 2002

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**Metal Ions in Biology and Medicine** Philippe Collery,L. Poirier,1990-01-01 *Metal Ions in Biological Systems* Astrid Sigel,2004-03-26 Metal ions are currently used for such applications as diabetes anti inflammatory rheumatoid arthritis psychiatric and anti ulcer medications using compounds of vanadium copper and zinc gold lithium and bismuth respectively This text explores these applications in addition to an assessment of chelation therapy uses in environmental sciences and the human health effects of metal ion deficiency for several elements magnesium calcium zinc and iron Featuring contributions from 29 internationally recognized experts this book offers a timely authoritative look at ionic complexes in medicine

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Metal Ions in Biology and Medicine Maria Agnes Cser,2004 8th International Congress on Metal Ions in Biology and

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