

# *metal ions in biological systems*

volume 40

*the lanthanides and their interrelations  
with biosystems*

edited by

**Astrid Sigel  
and Helmut Sigel**

*Target DNA strand*

3'-GATATCACAGTGGATTAG-5'  
CTATAGTG CACCTAAATC



# **Metal Ions In Biological Systems Vol 40 The Lanthanides And Their Interrelations With Biosystems**

**Simon Cotton**



## **Metal Ions In Biological Systems Vol 40 The Lanthanides And Their Interrelations With Biosystems:**

**Metal Ions in Biological Systems** Helmut Sigel, 2003-03-27 Many may know lanthanides under the homier name of rare earth elements but that is less used scientifically because they are in fact not at all rare Highlighting fast moving research on lanthanides and their interrelations with biosystems this book emphasizes the recent impact of these metals in biochemical biological and medical research including in magnetic resonance imaging MRI The first two chapters outline their abundance and distribution chemical properties such as oxidation states and ionic radii and their mobilization through microorganisms like bacteria and fungi It is written by 38 internationally recognized experts and enriched with nearly 200 illustrations and 1900 references

**Metal Ions in Biological Systems, Volume 43 - Biogeochemical Cycles of Elements** Helmut Sigel, Roland Sigel, 2005-02-28 Metal Ions in Biological Systems is devoted to increasing our understanding of the relationship between the chemistry of metals and life processes The volumes reflect the interdisciplinary nature of bioinorganic chemistry and coordinate the efforts of researchers in the fields of biochemistry inorganic chemistry coordination chemis

**Metal Ions In Biological Systems, Volume 44** Helmut Sigel, Roland Sigel, 2005-03-01 Volume 44 devoted solely to the vital research areas concerning the biogeochemistry of metals and their transport in the environment and availability to living systems offers 9 timely and authoritative chapters on these fascinating topics by 19 internationally recognized experts

*Chemical Exchange Saturation Transfer Imaging* Michael T. McMahon, Assaf A. Gilad, Jeff W.M. Bulte, Peter C.M. van Zijl, 2017-01-12 This is the first textbook dedicated to CEST imaging and covers the fundamental principles of saturation transfer key features of CEST agents that enable the production of imaging contrast and practical aspects of preparing image acquisition and post processing schemes suited for in vivo applications CEST is a powerful MRI contrast mechanism with unique features and the rapid expansion it has seen over the past 15 years since its original discovery in 2000 has created a need for a graduate level handbook describing all aspects of pre clinical translational and clinical CEST imaging The book provides an illustrated historical perspective by leaders at the five key sites who developed CEST imaging from the initial saturation transfer NMR experiments performed in the 1960s in Stockholm Sweden described by Sture Fors n to the work on integrating the basic principles of CEST into imaging by Robert Balaban Dean Sherry Silvio Aime and Peter van Zijl in the United States and Italy The editors Drs Michael T McMahon Assaf A Gilad Jeff W M Bulte and Peter C M van Zijl have been pioneers developing this field at the Johns Hopkins University School of Medicine and the Kennedy Krieger Institute including contributions to Nature Medicine Nature Biotechnology Nature Materials and the Proceedings of the National Academy of Sciences As recognition for their initial development of the field Drs van Zijl and Balaban were awarded the Laukien Prize in April 2016 established in 1999 to honor the memory of Professor Gunther Laukien a co founder of Bruker Biospin GmbH

Interplay Between Metal Ions and Nucleic Acids Astrid Sigel, Helmut Sigel, Roland K. O. Sigel, 2012-01-02 Interplay between Metal Ions and Nucleic Acids provides in an authoritative and timely

manner in 12 stimulating chapters written by 24 internationally recognized experts from 8 nations and supported by nearly 1500 references about 20 tables and 125 illustrations many in color a most up to date view on metal ion nucleic acid interactions the characterization of which is covered in solution and in the solid state The volume concentrates on modern developments encompassing topics in the wide range from G quadruplexes via DNAzymes catalysis at the DNA scaffold and metal mediated base pairs to peptide nucleic acids PNAs being thus of relevance e g for chemistry and nanotechnology but also for molecular biology and genetic diagnostics

**Supramolecular Systems in Biomedical Fields** Hans-Jörg Schneider, 2013 Leading experts provide a timely and comprehensive overview of the use of supramolecular systems in biomedical applications

*Nuclear Magnetic Resonance* G A Webb, 2007-10-31 As a spectroscopic method nuclear magnetic resonance NMR has seen spectacular growth over the past two decades both as a technique and in its applications Today the applications of NMR span a wide range of scientific disciplines from physics to biology to medicine Each volume of Nuclear Magnetic Resonance comprises a combination of annual and biennial reports which together provide comprehensive coverage of the literature on this topic This Specialist Periodical Report reflects the growing volume of published work involving NMR techniques and applications in particular NMR of natural macromolecules which is covered in two reports NMR of Proteins and Nucleic Acids and NMR of Carbohydrates Lipids and Membranes For those wanting to become rapidly acquainted with specific areas of NMR this title provides unrivalled scope of coverage Seasoned practitioners of NMR will find this an invaluable source of current methods and applications Volume 34 covers literature published from June 2003 to May 2004 Specialist Periodical Reports provide systematic and detailed review coverage in major areas of chemical research Compiled by teams of leading authorities in the relevant subject areas the series creates a unique service for the active research chemist with regular in depth accounts of progress in particular fields of chemistry Subject coverage within different volumes of a given title is similar and publication is on an annual or biennial basis

Cadmium: From Toxicity to Essentiality Astrid Sigel, Helmut Sigel, Roland KO Sigel, 2013-02-26 Volume 11 provides in an authoritative and timely manner in 16 stimulating chapters written by 40 internationally recognized experts from 11 nations and supported by more than 2600 references 35 tables and over 100 illustrations many in color a most up to date view on the role of cadmium for life presently a vibrant research area MILS 11 covers the bioinorganic chemistry of Cd II its biogeochemistry anthropogenic release into the environment and speciation in the atmosphere waters soils and sediments The analytical tools for Cd determination its imaging in cells and the use of  $^{113}\text{Cd}$  NMR to probe Zn II and Ca II proteins are summarized as are Cd II interactions with nucleotides nucleic acids amino acids and proteins including metallothioneins The phytoremediation by Cd II accumulating plants etc the toxicology of Cd II its damage to mammalian organs and its role as a carcinogen for humans are highlighted

**Metallomics and the Cell** Lucia Banci, 2013-04-18 Metallomics and the Cell provides in an authoritative and timely manner in 16 stimulating chapters written by 37 internationally recognized experts from 9 nations and supported

by more than 3000 references several tables and 110 illustrations mostly in color a most up to date view of the metallomes which as defined in the omics world describe the entire set of biomolecules that interact with or are affected by each metal ion The most relevant tools for visualizing metal ions in the cell and the most suitable bioinformatic tools for browsing genomes to identify metal binding proteins are also presented Thus MILS 12 is of relevance for structural and systems biology inorganic biological chemistry genetics medicine diagnostics as well as teaching etc      Nucleoside Triphosphates and their Analogs Morteza Vaghefi, 2016-04-19 While adenosine triphosphate ATP is described as the universal currency of energy in all living organisms at the cellular level the actual power lies in its phosphate tail This book is the first dedicated to the field of nucleoside triphosphate NTP Its 13 chapters encompass the contributions of twenty scientists from both academia and industry It provides collective information on the chemical physiochemical and biological properties of both natural and modified NTP and their application in life sciences Three chapters review families of enzymes that depend on nucleotides for assembling DNA and RNA molecules The appendix includes supporting NMR data      Inorganic Photochemistry, 2011-07-14 The Advances in Inorganic Chemistry series present timely and informative summaries of the current progress in a variety of subject areas within inorganic chemistry ranging from bio inorganic to solid state studies This acclaimed serial features reviews written by experts in the field and serves as an indispensable reference to advanced researchers Each volume contains an index and each chapter is fully referenced Features comprehensive reviews on the latest developments Includes contributions from leading experts in the field Serves as an indispensable reference to advanced researchers      **Cerium Oxide (CeO<sub>2</sub>): Synthesis, Properties and Applications** Salvatore Scire, Leonardo Palmisano, 2019-08-21 Cerium Oxide CeO<sub>2</sub> Synthesis Properties and Applications provides an updated and comprehensive account of the research in the field of cerium oxide based materials The book is divided into three main blocks that deal with its properties synthesis and applications Special attention is devoted to the growing number of applications of ceria based materials including their usage in industrial and environmental catalysis and photocatalysis energy production and storage sensors cosmetics radioprotection glass technology pigments stainless steel and toxicology A brief historical introduction gives users background and a final chapter addresses future perspectives and outlooks to stimulate future research The book is intended for a wide audience including students academics and industrial researchers working in materials science chemistry and physics Addresses a wide range of applications of ceria based materials including catalysis energy production and storage sensors cosmetics and toxicology Provides the fundamentals of ceria based materials including synthesis methods materials properties toxicology and surface chemistry Includes nanostructured ceria based materials and a discussion of future prospects and outlooks      **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 *Interrelations between Essential Metal Ions and Human Diseases* Astrid Sigel, Helmut Sigel, Roland K.O. Sigel, 2014-01-27 MILS 13 provides an up to date review on the relationships between essential metals and human diseases covering 13 metals and 3 metalloids The bulk metals sodium potassium magnesium and calcium plus the trace elements manganese iron cobalt copper zinc molybdenum and selenium all of which are essential for life Also covered are chromium vanadium nickel silicon and arsenic which have been proposed as being essential for humans in the 2nd half of the last century However if at all they are needed only in ultra trace amounts and because of their prevalence in the environment it has been difficult to prove whether or not they are required In any case all these elements are toxic in higher concentrations and therefore transport and cellular concentrations of at least the essential ones are tightly controlled hence their homeostasis and role for life including deficiency or overload and their links to illnesses including cancer and neurological disorders are thoroughly discussed Indeed it is an old wisdom that metals are indispensable for life Therefore Volume 13 provides in an authoritative and timely manner in 16 stimulating chapters written by 29 internationally recognized experts from 7 nations and supported by more than 2750 references and over 20 tables and 80 illustrations many in color a most up to date view on the vibrant research area of the Interrelations between Essential Metal Ions and Human Diseases

**Lanthanide and Actinide Chemistry** Simon Cotton, 2024-07-10 LANTHANIDE AND ACTINIDE CHEMISTRY Lanthanides and actinides also known as f elements are a group of metals which share certain important properties and aspects of electronic structure They have a huge range of applications in the production of electronic devices magnets superconductors fuel cells sensors and more The cursory treatment of these important metals in most inorganic chemistry textbooks makes a book length treatment essential Since 2006 Lanthanide and Actinide Chemistry has met this need with a thorough accessible overview With in depth accounts of the lanthanides actinides and transactinides this book is ideal for both undergraduate and postgraduate students in inorganic chemistry or chemical engineering courses Now updated to reflect groundbreaking recent research this promises to continue as the essential introductory volume on the subject Readers of the second edition of Lanthanide and Actinide Chemistry will also find New and expanded subject areas including lanthanide enzymes single molecule magnets luminescence and upconversion organometallic and coordination chemistry and many more Up to date information on the myriad modern applications of f elements Lists of objectives and learning goals at the start of each chapter Lanthanide and Actinide Chemistry is ideal for advanced undergraduates and graduate students in f element chemistry inorganic chemistry or any related field INORGANIC CHEMISTRY ADVANCED TEXTBOOK This series reflects the pivotal role of modern inorganic and physical chemistry in a whole range of emerging areas such as materials chemistry green chemistry and bioinorganic chemistry as well as providing a solid grounding in

established areas such as solid state chemistry coordination chemistry main group chemistry and physical inorganic chemistry

**Lanthanide and Other Transition Metal Ion Complexes and Nanoparticles in Magnetic Resonance Imaging** Carlos F.G.C. Gerald, 2024-08-21 Since the development of the first clinical MRI contrast agent Gd DTPA or Magnevist in the early 1980s another three linear and three macrocyclic eg Gd DOTA Dotarem have been introduced in the clinic and inspired a huge number of researchers worldwide to perform preclinical research to obtain contrast agents for many kinds of clinical applications which are described in this book The most current research has been assembled here and can be used by the scientific community to continue increasing the relevance of metal containing molecules and nanomaterials for MRI based diagnosis and thus increase the practical use of these systems Presents the importance of metal containing molecules and nanomaterials for MRI based diagnosis and the practical use of these systems Discusses the structure and dynamics of Ln based contrast agents as well as computational studies related to these agents Endorses and stimulates research in the vibrant field of biological inorganic chemistry Reviews the most current research supporting the relevance of metal containing molecules and nanomaterials for diagnosis and therapy The authors are preeminent bioinorganic and medicinal inorganic chemists and review the most current research in this field

**The Alkali Metal Ions: Their Role for Life** Astrid Sigel, Helmut Sigel, Roland K. O. Sigel, 2016-02-09 MILS 16 provides an up to date review of the impact of alkali metal ions on life Their bioinorganic chemistry and analytical determination the solid state structures of bio ligand complexes and the properties of alkali metal ions in solution in the context of all kinds of biologically relevant ligands are covered this includes proteins enzymes and nucleic acids G quadruplexes Minerals containing sodium Na and potassium K are abundant in the Earth s crust making Na and K easily available In contrast the alkali elements lithium Li rubidium and cesium are rare and the radioactive francium occurs only in traces Since the intra and extracellular as well as the compartmental concentrations of Na and K differ significantly homeostasis and active transport of these ions are important this involves transporters carriers and pore forming ion channel proteins Systems like Na K ATPases H K ATPases or Na H antiporters are thoroughly discussed The role of K in photosynthesis and the role of Na in charging the battery of life are pointed out Also the relationships between alkali metal ions and diseases e g Parkinson or traumatic brain injury are covered and the relevance of Li salts in medicine pharmacology and mechanism is reviewed This and more is treated in an authoritative and timely manner in the 16 stimulating chapters of Volume 16 The Alkali Metal Ions Their Role for Life which are written by 44 internationally recognized experts from 12 nations The impact of this vibrant research area is manifested in nearly 3000 references over 30 tables and more than 150 illustrations two thirds in color MILS 16 also provides excellent information for teaching Astrid Sigel Helmut Sigel and Roland K O Sigel have long standing interests in Biological Inorganic Chemistry Their research focuses on metal ion interactions with nucleotides and nucleic acids and on related topics They edited previously 44 volumes in the series Metal Ions in Biological Systems

**Metals Ions in Biological System** Astrid

Sigel, Helmut Sigel, 2002-03-06 Volume 39 Molybdenum and Tungsten Their Roles in Biological Processes is devoted solely to the vital research area on molybdenum and tungsten and their role in biology. It offers a comprehensive and timely account of this fascinating topic by 40 distinguished international authorities. Topics include transport, homeostasis, regulation and binding of molybdate and tungstate to proteins, crystallographic characterization, coordination of complexes and biosynthesis.

**The Metal-Driven Biogeochemistry of Gaseous Compounds in the Environment** Peter M.H. Kroneck, Martha E. Sosa Torres, 2014-11-22 MILS 14 provides a most up to date view of the exciting biogeochemistry of gases in our environment as driven mostly by microorganisms. These employ a machinery of sophisticated metalloenzymes where especially transition metals such as Fe, Ni, Cu, Mo, W play a fundamental role that is in the activation, transformation and syntheses of gases like dihydrogen, methane, carbon monoxide, acetylene and those of the biological nitrogen and sulfur cycles. The Metal Driven Biogeochemistry of Gaseous Compounds in the Environment is a vibrant research area based mainly on structural and microbial biology, inorganic biological chemistry and environmental biochemistry. All this is covered in an authoritative manner in 11 stimulating chapters written by 26 internationally recognized experts and supported by nearly 1200 references, informative tables and about 100 illustrations, two thirds in color. MILS 14 also provides excellent information for teaching. Peter M. H. Kroneck is a bioinorganic chemist who is exploring the role of transition metals in biology with a focus on functional and structural aspects of microbial iron, copper and molybdenum enzymes and their impact on the biogeochemical cycles of nitrogen and sulfur. Martha E. Sosa Torres is an inorganic chemist with special interests in magnetic properties of newly synthesized transition metal complexes and their reactivity towards molecular oxygen, applying kinetic, electrochemical and spectroscopic techniques.

Metals, Microbes, and Minerals - The Biogeochemical Side of Life Peter Kroneck, Martha Sosa Torres, 2021-01-18 One of the biggest questions in today's biochemistry is how biological molecules became essential for the processes that occur within living cells. This new book from the outstanding Metal Ions in Life Science series gives an overview about biochemical evolution of organic molecules and metabolic pathways in living systems and outlines the vital biochemical processes in microbial cells in which metals are involved.



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