

# *metal ions in biological systems*

**volume 43**

*biogeochemical cycles of elements*

edited by

**Astrid Sigel  
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and Roland K. O. Sigel**



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# Metal Ions In Biological Systems Biogeochemical Cycles Of Elements

**Astrid Sigel, Helmut Sigel, Roland K.O.  
Sigel**



## **Metal Ions In Biological Systems Biogeochemical Cycles Of Elements:**

**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 chemistry **Metal Ions in Biological Systems: Biogeochemical cycles of elements** Helmut Sigel, Astrid Sigel, 1973 *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 *Metal Ions in Biological Systems* Helmut Sigel, 1984-09-12 **Biogeochemical Cycles** Katerina Dontsova, Zsuzsanna Balogh-Brunstad, Gaël Le Roux, 2020-04-14 Elements move through Earth's critical zone along interconnected pathways that are strongly influenced by fluctuations in water and energy The biogeochemical cycling of elements is inextricably linked to changes in climate and ecological disturbances both natural and man made Biogeochemical Cycles Ecological Drivers and Environmental Impact examines the influences and effects of biogeochemical elemental cycles in different ecosystems in the critical zone Volume highlights include Impact of global change on the biogeochemical functioning of diverse ecosystems Biological drivers of soil rock and mineral weathering Natural elemental sources for improving sustainability of ecosystems Links between natural ecosystems and managed agricultural systems Non carbon elemental cycles affected by climate change Subsystems particularly vulnerable to global change The American Geophysical Union promotes discovery in Earth and space science for the benefit of humanity Its publications disseminate scientific knowledge and provide resources for researchers students and professionals Find out more about this book from this Q A with the Author Book Review [http://www.elementsmagazine.org/archives/e16\\_6/e16\\_6\\_dep\\_bookreview.pdf](http://www.elementsmagazine.org/archives/e16_6/e16_6_dep_bookreview.pdf) *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

**Organometallics in Environment and Toxicology** Astrid Sigel, Helmut Sigel, Roland K.O. Sigel, 2015-07-24 Volume 7 devoted to the vital and rapidly expanding research area around metal carbon bonds see also MILS 6 focuses on the environment With more than 2500 references 35 tables and nearly 50 illustrations many of these in color it is an essential resource for scientists working in the wide range from organometallic chemistry inorganic biochemistry environmental toxicology all the way through to physiology and medicine In 14 stimulating chapters written by 29 internationally recognized experts Organometallics in Environment and Toxicology highlights in an authoritative and timely manner environmental cycles of elements involving organometalloid compounds as well as the analytical determination of such species This book examines methane formation involving the nickel coenzyme F430 as well as the organometalloid compounds formed by tin lead arsenic antimony bismuth selenium tellurium and mercury In addition it deals with the environmental bioindication biomonitoring and bioremediation of organometalloids and it terminates with methylated metalloid species occurring in humans by evaluating assumed and proven health effects caused by these compounds

Metal Ions in Biological Systems, 1986

**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 *Environmental Management Handbook, Second Edition - Six Volume Set* Sven Erik Jorgensen, Brian D. Fath, 2022-07-30 Bringing together a wealth of knowledge the Handbook of Environmental Management Second Edition gives a comprehensive overview of environmental problems their sources their assessment and their solutions Through in depth entries and a topical table of contents readers will quickly find answers to questions about pollution and management issues This six volume set is a reimagining of the award winning Encyclopedia of Environmental Management published in 2013 and features insights from more than 500 contributors all experts in their fields The experience evidence methods and models used in studying environmental management is presented here in six stand alone volumes arranged along the major environmental systems Features of the new edition The first handbook that demonstrates the key processes and provisions for enhancing environmental management Addresses new and cutting edge topics on ecosystem services resilience sustainability food energy water nexus socio ecological systems and more Provides an excellent basic knowledge on environmental systems explains how these systems function and offers strategies on how to best manage them Includes the most important problems and solutions facing environmental management today

**Sustaining Life on Planet Earth: Metalloenzymes Mastering Dioxygen and Other Chewy Gases** Peter M. H Kroneck, Martha E. Sosa Torres, 2015-02-23 MILS 15 provides an up to date review of the metalloenzymes involved in the activation production and conversion of molecular oxygen as well as the functionalization of the chemically inert gases methane and ammonia Found either in aerobes humans animals plants microorganisms or in anaerobes so called impossible bacteria these enzymes employ preferentially iron and copper at their active sites in order to conserve energy by redox driven proton pumps to convert methane to methanol or ammonia to hydroxylamine or other compounds When it comes to the light driven production of molecular oxygen the tetranuclear manganese cluster of photosystem II must be regarded as the key player However dioxygen can also be produced in the dark by heme iron dependent dismutation of oxyanions Metalloenzymes Mastering Dioxygen and Other Chewy Gases 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 7 stimulating chapters written by 21 internationally recognized experts and supported by nearly 1100 references informative tables and over 140 illustrations many in color MILS 15 provides excellent information for teaching it is also closely related to MILS 14 The Metal Driven Biogeochemistry of Gaseous Compounds in the Environment 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      *Environmental Microbiology* Eugene L. Madsen, 2015-07-06 New and expanded for its second edition  
Environmental Microbiology From Genomes to Biogeochemistry Second Edition is a timely update to a classic text filled with ideas connections and concepts that advance an in depth understanding of this growing segment of microbiology Core principles are highlighted with an emphasis on the logic of the science and new methods driven discoveries Numerous up to date examples and applications boxes provide tangible reinforcement of material covered Study questions at the end of each chapter require students to utilize analytical and quantitative approaches to define and defend arguments and to apply microbiological paradigms to their personal interests Essay assignments and related readings stimulate student inquiry and serve as focal points for teachers to launch classroom discussions A companion website with downloadable artwork and answers to study questions is also available Environmental Microbiology From Genomes to Biogeochemistry Second Edition offers a coherent and comprehensive treatment of this dynamic emerging field building bridges between basic biology evolution genomics ecology biotechnology climate change and the environmental sciences      Toxicology Research Projects Directory ,1980-04      **Metal Ions in Biochemistry** Pabitra Krishna Bhattacharya, Prakash B. Samnani, 2020-12-13 The second edition of Metal Ions in Biochemistry deals with the multidisciplinary subject of bio inorganic chemistry encompassing the disciplines of inorganic chemistry biochemistry and medicine The book deals with the role of metal ions in biochemistry emphasising that biochemistry is mainly the chemistry of metal biochemical complexes Hence the book starts with the structures of biochemicals and the identification of their metal binding sites Thermodynamic and kinetic properties of the complexes are explained from the point of view of the nature of metal ligand bonds Various catalytic and structural roles of metal ions in biochemicals are discussed in detail Features The role of Na and K in brain chemistry The role of zinc insulin in glucose metabolism and its enhancement by vanadium and chromium compounds Discussion of the role of zinc signals zinc fingers and cascade effect in biochemistry Haemoglobin synthesis and the role of vitamin B12 in it The role of lanthanides in biochemical systems A detailed discussion of the role of non metals in biochemistry a topic missing in most of the books on bio inorganic chemistry The study of bio inorganic chemistry makes biochemists rethink the mechanistic pathways of biochemical reactions mediated by metal ions There is a realisation of the role of metal complexes and inorganic ions as therapeutics such as iron in leukaemia thalassemia and sickle cell anaemia iodine in hypothyroidism and zinc vanadium and chromium in glucose metabolism The most recent realisation is of the use of zinc in the prevention and treatment of COVID 19      Environmental Health Perspectives ,1993      **Metal Ions and the Route to Life** Wolfgang Nitschke, Simon Duval, 2025-08-28 Volume 28 entitled Metal Ions and the Route to Life of the series Metal Ions in Life Sciences advocates for the prime importance of the recognition of metal ions and metal bearing minerals in the transition from inanimate matter to first life on our planet Unlike the relatively unreactive organic molecules the traditional protagonists of orthodox origin of life hypotheses metals and minerals are natural catalysts abundantly present in the

majority of settings on the early Earth considered as conducive to bringing forth life In these palaeogeochemical settings they may have catalyzed the anabolic conversions of inorganic precursor molecules into organics and may have converted redox disequilibria between environmental reductants and oxidants into the ordering i e the lowering of entropy of first living entities Far fetched Yet this is precisely what metal ions do in life today An unlikely coalition of biology biochemistry and bioenergetics and physics thermodynamics and condensed matter physics is growingly questioning the plausibility of the orthodox hypotheses while putting metal ions and minerals centre stage in their scenarios In this volume 29 internationally renowned experts from fields as diverse as microbiology biochemistry astrobiology electrochemistry ecology mineralogy geology and geochemistry shine light from their individual angles on this topic bringing home metal ions primordial importance to extant life presenting minerals with tantalizing reactivities appearing as look alikes of life s processes and sketching out plausible metal ion based scenarios for life s emergence on planet Earth Metal Ions and the Route to Life provides the empirical groundwork to interested researchers and the general public for revisiting their preconceived ideas about the origin of life and for appreciating the absolute indispensability of metal ions in life now just as at its beginnings

*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

*Encyclopedia of Astrobiology* Muriel Gargaud, William M. Irvine, Ricardo Amils, Philippe Claeys, Henderson James Cleaves, Maryvonne Gerin, Daniel Rouan, Tilman Spohn, Stéphane Tirard, Michel Viso, 2023-07-27 Now in its third edition the Encyclopedia of Astrobiology serves as the key to a common understanding in the extremely interdisciplinary community of astrobiologists Each new or experienced researcher and graduate student in adjacent fields of astrobiology will appreciate this reference work in the quest to understand the big picture The carefully selected group of active researchers contributing to this work are aiming to

give a comprehensive international perspective on and to accelerate the interdisciplinary advance of astrobiology The interdisciplinary field of astrobiology constitutes a joint arena where provocative discoveries are coalescing concerning e g the prevalence of exoplanets the diversity and hardiness of life and its chances for emergence Biologists astrophysicists biochemists geoscientists and space scientists share this exciting mission of revealing the origin and commonality of life in the Universe With its overview articles and its definitions the Encyclopedia of Astrobiology not only provides a common language and understanding for the members of the different disciplines but also serves for educating a new generation of young astrobiologists who are no longer separated by the jargon of individual scientific disciplines This new edition offers 170 new entries More than half of the existing entries were updated expanded or supplemented with figures supporting the understanding of the text Especially in the fields of astrochemistry and terrestrial extremophiles but also in exoplanets and space sciences in general there is a huge body of new results that have been taken into account in this new edition Because the entries in the Encyclopedia are in alphabetical order without regard for scientific field this edition includes a section Astrobiology by Discipline which lists the entries by scientific field and subfield This should be particularly helpful to those enquiring about astrobiology as it illustrates the broad and detailed nature of the field

**Interplay between Metal Ions and Nucleic Acids** Astrid Sigel, Helmut Sigel, Roland KO 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

**Bioinorganic Chemistry** Ei-Ichiro Ochiai, 2010-07-20 Written by a preeminent teacher and scientist in the field Bioinorganic Chemistry provides specialists students and general readers with an understanding of the basic chemistry of interactions of inorganic substances with biological systems at the molecular level The author presents bioinorganic concepts in context and brings a distinct chemistry perspective to the subject Provides the streamlined coverage appropriate for one semester courses or independent study with all of the necessary but none of the excessive information Prepares readers to move to the next level of study whether they continue on in the field or transition to medicine industry Presents concepts through extensive four color visuals appealing to a range of learning styles Promotes critical thinking through open ended questions throughout the narrative and at the end of each chapter

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