

**INTERACTIONS OF  
MICROORGANISMS  
WITH RADIONUCLIDES**

*edited by*

**M.J. Keith-Roach  
F.R. Livens**

# Interactions Of Microorganisms With Radionuclides

**Irina S. Druzhinina, Christian P.  
Kubicek**



## **Interactions Of Microorganisms With Radionuclides:**

**Interactions of Microorganisms with Radionuclides** M.J. Keith-Roach, F.R. Livens, 2002-04-22 Many environmental processes are influenced if not controlled by microbial action and it is becoming increasingly important to develop an understanding of microbial roles in geochemistry This book brings together state of the art research into microbiological processes and the extent to which they affect or can be used to control radioactive elements The basic principles and fundamental mechanisms by which microbes and radionuclides interact are outlined the methodology described potential microbial influences on waste repositories examined direct and indirect effects on transport both on local and global scales considered and potential technological applications identified The book is directed towards advanced undergraduate students postgraduates and researchers in the areas of environmental radioactivity environmental microbiology biotechnology and radioactive waste management It will also be of interest to regulators policy makers and non governmental organisations This novel and timely book offers a fully integrated approach to a topical international issue

**Radionuclides in the Environment** Clemens Walther, Dharmendra K. Gupta, 2015-10-30 This book provides extensive and comprehensive information to researchers and academicians who are interested in radionuclide contamination its sources and environmental impact It is also useful for graduate and undergraduate students specializing in radioactive waste disposal and its impact on natural as well as manmade environments A number of sites are affected by large legacies of waste from the mining and processing of radioactive minerals Over recent decades several hundred radioactive isotopes radioisotopes of natural elements have been produced artificially including  $^{90}\text{Sr}$   $^{137}\text{Cs}$  and  $^{131}\text{I}$  Several other anthropogenic radioactive elements have also been produced in large quantities for example technetium neptunium plutonium and americium although plutonium does occur naturally in trace amounts in uranium ores The deposition of radionuclides on vegetation and soil as well as the uptake from polluted aquifers root uptake or irrigation are the initial point for their transfer into the terrestrial environment and into food chains There are two principal deposition processes for the removal of pollutants from the atmosphere dry deposition is the direct transfer through absorption of gases and particles by natural surfaces such as vegetation whereas showery or wet deposition is the transport of a substance from the atmosphere to the ground by snow hail or rain Once deposited on any vegetation radionuclides are removed from plants by the airstream and rain either through percolation or by cuticular scratch The increase in biomass during plant growth does not cause a loss of activity but it does lead to a decrease in activity concentration due to effective dilution There is also systemic transport translocation of radionuclides within the plant subsequent to foliar uptake leading the transfer of chemical components to other parts of the plant that have not been contaminated directly

The Microbiology of Nuclear Waste Disposal Jonathan R. Lloyd, Andrea Cherkouk, 2020-10-22 The Microbiology of Nuclear Waste Disposal is a state of the art reference featuring contributions focusing on the impact of microbes on the safe long term disposal of nuclear waste This book is the first to

cover this important emerging topic and is written for a wide audience encompassing regulators implementers academics and other stakeholders The book is also of interest to those working on the wider exploitation of the subsurface such as bioremediation carbon capture and storage geothermal energy and water quality Planning for suitable facilities in the U S Europe and Asia has been based mainly on knowledge from the geological and physical sciences However recent studies have shown that microbial life can proliferate in the inhospitable environments associated with radioactive waste disposal and can control the long term fate of nuclear materials This can have beneficial and damaging impacts which need to be quantified Encompasses expertise from both the bio and geo disciplines aiming to foster important collaborations across this disciplinary divide Includes reviews and research papers from leading groups in the field Provides helpful guidance in light of plans progressing worldwide for geological disposal facilities Includes timely research for planning and safety case development

Microbial Degradation Processes in Radioactive Waste Repository and in Nuclear Fuel Storage Areas J.H. Wolfram, Robin D. Rogers, Lajos G. Gázsó, 1997-03-31 Purpose of the Workshop In the spirit of enhancing developments in science and technology by facilitating international scientific cooperation the Science Committee of NATO is sponsoring AR W s in several selected priority areas The objective of this workshop was to discuss what microbial mediated problems have been experienced in the area of nuclear waste management and spent fuel storage Long term storage of high level wastes in repositories is just starting in some countries However low and medium level wastes have been stored for several decades In the area of spent fuel interim storage has been extended at many locations far beyond the intended time It was a priority of the workshop to examine and discuss what deleterious effects have been observed under these storage conditions or under conditions used in simulated trial tests for predicting material performance under the storage conditions For example one chronic problem that was discussed was possibility that microbial influenced corrosion MIC could be taking place in the wet storage of spent fuel thereby initiating or accelerating the process of corrosion Another discussion in the area of waste forms focused on the presence of biofilms which may be breaking down the structure of the waste form and thereby jeopardizing its integrity The meeting focused on discussing the observations and data collected relating to problems encountered in the storage of these types of wastes and sharing this information with others that have not monitored their facilities for similar problems

**Microbial Metabolism of Metals and Metalloids** Christon J. Hurst, 2022-04-24 This book explains the metabolic processes by which microbes obtain and control the intracellular availability of their required metal and metalloid ions The book also describes how intracellular concentrations of unwanted metal and metalloid ions successfully are limited Its authors additionally provide information about the ways that microbes derive metabolic energy by changing the charge states of metal and metalloid ions Part one of this book provides an introduction to microbes metals and metalloids It also helps our readers to understand the chemical constraints for transition metal cation allocation Part two explains the basic processes which microbes use for metal transport That section also explains the uses as well as the challenges associated

with metal based antimicrobials Part three gives our readers an understanding that because of microbial capabilities to process metals and metalloids the microbes have become our best tools for accomplishing many jobs Their applications in chemical technology include the design of microbial consortia for use in bioleaching processes that recover metal and metalloid ions from industrial wastes Many biological engineering tasks including the synthesis of metal nanoparticles and similar metalloid structures also are ideally suited for the microbes Part four describes unique attributes associated with the microbiology of these elements progressing through the alphabet from antimony and arsenic to zinc

**Radionuclide Contamination and Remediation Through Plants** Dharmendra Kumar Gupta, Clemens Walther, 2014-07-14 This book focuses on the mechanistic microscopic understanding of radionuclide uptake by plants in contaminated soils and potential use of phytoremediation The key features concern radionuclide toxicity in plants how the radioactive materials are absorbed by plants and how the plants cope with the toxic responses The respective chapters examine soil classification natural plant selection speciation of actinides kinetic modeling and case studies on cesium uptake after radiation accidents Radionuclide contaminants pose serious problems for biological systems due to their chemical toxicity and radiological effects The processes by which radionuclides can be incorporated into vegetation can either originate from activity interception by external plant surfaces either directly from the atmosphere or from resuspended material or through uptake of radionuclides via the root system Subsequent transfer of toxic elements to the human food chain is a concrete danger Therefore the molecular mechanisms and genetic basis of transport into and within plants needs to be understood for two reasons The effectiveness of radionuclide uptake into crop plants so called transfer coefficient is a prerequisite for the calculation of dose due to the food path On the other hand efficient radionuclide transfer into plants can be made use of for decontamination of land so called phytoremediation the direct use of living green plants for in situ removal of pollutants from the environment or to reduce their concentrations to harmless levels

Handbook of Metal-Microbe Interactions and Bioremediation Surajit Das, Hirak Ranjan Dash, 2017-04-07 Around the World metal pollution is a major problem Conventional practices of toxic metal removal can be ineffective and or expensive delaying and exacerbating the crisis Those communities dealing with contamination must be aware of the fundamentals advances of microbe mediated metal removal practices because these methods can be easily used and require less remedial intervention This book describes innovations and efficient applications for metal bioremediation for environments polluted by metal contaminants

**Radionuclide Behaviour in the Natural Environment** Christophe Poinssot, Horst Geckeis, 2012-09-20 Understanding radionuclide behaviour in the natural environment is essential to the sustainable development of the nuclear industry and key to assessing potential environmental risks reliably Minimising those risks is essential to enhancing public confidence in nuclear technology Scientific knowledge in this field has developed greatly over the last decade Radionuclide behaviour in the natural environment provides a comprehensive overview of the key processes and parameters affecting radionuclide mobility and migration After an

introductory chapter part one explores radionuclide chemistry in the natural environment including aquatic chemistry and the impact of natural organic matter and microorganisms Part two discusses the migration and radioecological behavior of radionuclides Topics include hydrogeology sorption and colloidal reactions as well as in situ investigations Principles of modelling coupled geochemical transport and radioecological properties are also discussed Part three covers application issues assessment of radionuclide behaviour in contaminated sites taking Chernobyl as an example estimation of radiological exposure to the population performance assessment considerations related to deep geological repositories and remediation concepts for contaminated sites With its distinguished editors and international team of expert contributors Radionuclide behaviour in the natural environment is an essential tool for all those interested or involved in nuclear energy from researchers designers and industrial operators to environmental scientists It also provides a comprehensive guide for academics of all levels in this field Provides a comprehensive overview of the key processes and parameters affecting radionuclide mobility and migration Explores radionuclide chemistry in the natural environment Discusses the migration and radioecological behaviour of radionuclides

**Introduction to Geomicrobiology** Kurt O. Konhauser, 2009-03-12

Introduction to Geomicrobiology is a timely and comprehensive overview of how microbial life has affected Earth's environment through time It shows how the ubiquity of microorganisms their high chemical reactivity and their metabolic diversity make them a significant factor controlling the chemical composition of our planet The following topics are covered how microorganisms are classified the physical constraints governing their growth molecular approaches to studying microbial diversity and life in extreme environments bioenergetics microbial metabolic capabilities and major biogeochemical pathways chemical reactivity of the cell surface metal sorption and the microbial role in contaminant mobility and bioremediation biorecovery microbiological mineral formation and fossilization the function of microorganisms in mineral dissolution and oxidation and the industrial and environmental ramifications of these processes elemental cycling in biofilms formation of microbialites and sediment diagenesis the events that led to the emergence of life evolution of metabolic processes and the diversification of the biosphere Artwork from the book is available to instructors at [www.blackwellpublishing.com/konhauser](http://www.blackwellpublishing.com/konhauser)

*Inorganic Contaminants and Radionuclides* Ravi Naidu, 2023-10-17 Inorganic Contaminants and Radionuclides is a single reference covering common inorganic contaminants in detail including their distribution in the environment challenges linked to management geogenic sources anthropogenic sources exposure and effects international agreements and legislation relating to the contaminant remediation options and global case studies In addition the book provides summaries of contaminated sites and key details about contaminants to present a more comprehensive understanding and improve remediation and management practices The book's clear consistent organization makes it a valuable resource for researchers students and practitioners working in environmental science environmental management and environmental engineering One of the major constraints to assessing and remediating contaminated sites is

the lack of awareness of the extent and severity of contaminated sites amongst the community regulators policymakers industry operators university graduates and environmental managers This book helps to manage these constraints Provides a one stop reference on the nature and properties of inorganic contaminants including a transdisciplinary approach to managing contaminated sites Includes global case studies covering contaminated site assessment management and remediation Presents in depth research and data on specific contaminants with a separate chapter for each contaminant

*Micro-organisms and Earth Systems* Hilary Lappin-Scott, 2005-10-13 There is growing awareness that important environmental transformations are catalysed mediated and influenced by microorganisms and geomicrobiology can be defined as the influence of microorganisms on geologic processes This is probably the most rapidly growing area of microbiology at present combining environmental and molecular microbiology together with significant areas of mineralogy geochemistry and hydrology This volume focuses on the function of microorganisms in the environment and their influence on global processes It will include state of the art approaches to visualisation culture and identification community interactions and gene transfer and diversity studies in relation to key processes This overview for researchers and graduate students will represent environmental microbiology in its broadest sense and help to promote exciting collaborations between microbiologists and those in complementary physical and chemical disciplines

**Radionuclide Uptake In Food And Consequences For Humans** Dharmendra Kumar Gupta, Clemens Walther, 2025-01-17 This book provides a comprehensive review on how radionuclides occur in the environment how radionuclides are distributed in soil how the migration of radionuclides in plants occurs and their consequences on human health It explains how the speciation of radionuclide interferes in the uptake and accumulation processes in fruits and includes case studies as well as reviews of modern and state of the art technology related to radioactive material uptake in plants This volume is a useful reference to researchers in the field of radionuclide contamination in foods and will also be helpful for graduate and undergraduate students specializing in radioactive waste disposal and its toxicity effects in food products and their consequences on humans

**Environmental and Microbial Relationships** Irina S. Druzhinina, Christian P. Kubicek, 2016-03-18 This volume provides insights into current research on fungal populations communities and their interactions with other organisms It focuses on fungal responses to the physical environment interactions with bacteria other fungi invertebrates and plants the role of fungi in ecosystem processes such as decomposition and nutrient cycling and aspects of biogeography and conservation Since the publication of the second edition of Volume IV in 2007 the massive use of omics methods has revolutionized our understanding of fungal lifestyles Highlighting these advances the third edition has been completely updated and revised Several chapters deal with various applications of genomics and transcriptomics in biological pest control as well as interactions with other living systems This is an invaluable source of information both for scientists who wish to update their knowledge of current advances and for graduate students interested in obtaining a comprehensive

introduction to this field of research      **Environmental and Microbial Relationships** Christian P. Kubicek,Irina S. Druzhinina,2007-09-10 This volume provides insight into current research on fungal populations and communities It focuses on fungal responses to the physical environment interactions with other fungi microorganisms and invertebrates the role of fungi in ecosystem processes such as decomposition and nutrient cycling and aspects of biogeography and conservation The second edition has been completely updated and revised to accommodate the introduction of molecular methods and the flood of new findings since then      *Behavior of Radionuclides in the Environment I* Kenji Kato,Alexei Konoplev,Stepan N. Kalmykov,2020-02-18 The 3 volume set highlights the behavior of radionuclides in the environment and focusing on the development of related fields of study including microbiology and nanoscience In this context it discusses the behavior of radionuclides released in areas of Lake Karachai in Ural and those released as a result of Chernobyl accident 1986 and in Fukushima 2011 Volume I presents the experiences gained in South Urals Mayak plant Lake Karachai providing a scientific basis for more precise understanding of the behavior of radionuclides in complex subsurface environments On the basis of monitoring data it examines the pathways of radionuclide migration and the influence of the geological environment and groundwater on the migration with a particular focus on particles from the nanoscale to microscale It also discusses the function of microbes and microscale particles from their direct interaction with radionuclides to their ecological role in changing the physic chemical condition of a given environment Lastly the protective properties of geological media are also characterized and mathematical modeling of contaminant migration in the area of Lake Karachai is used to provide information regarding the migration of radionuclides      **DOE Genomics** ,2005      *Mineral Transformation and Bioremediation by Geo-Microbes* Santa Ram Joshi,Pradeep Verma,Subhro Banerjee,2025-05-14 This book investigates the pivotal role of microorganisms in elemental cycling and degradation processes offering a comprehensive exploration of their chemical reactivity and metabolic diversity By examining the interaction of microorganisms with geological activities this volume highlights their influence on biotransformation and bioremediation Readers will find an in depth review of geo microbes applications in soil improvement and environmental restoration alongside discussions on bio sediment bioleaching and elemental cycling The chapters offer expert analysis and diverse perspectives in microbiology geology and environmental biotechnology Key concepts include the geomicrobiological interactions in extreme environments the transformation of toxic elements and the potential for extraterrestrial life models Chapters delve into the rehabilitation of saturated lands the role of geo microbes in arsenic transformation and the ecological restoration of wetlands The book is invaluable for researchers students and professionals in microbiology biotechnology geology and environmental sciences It also serves as a major reference for understanding the microbial processes that shape our planet and offers practical insights for harnessing the power of geo microbes for sustainable environmental solutions While comprehensively reviewing geo microbes in biotransformation processes the book provides the knowledge and tools necessary to advance the readers understanding of



geomicrobiology and its applications      Microbiome-Based Decontamination of Environmental Pollutants Ajay Kumar, Joginder Singh Panwar, Lucas Carvalho Basilio de Azevedo, 2024-04-04 *Microbiome Based Decontamination of Environmental Pollutants* explores the complex interactions of plant associated microbiomes providing insights into the pressing challenges of managing environmental resources such as soil water and waste Analysis has shown a formidable potential based in the network interactions between plant microbiota and environmental contaminants This book presents insights into the potential exploitation of these plant associated microbial functions This volume in the Plant and Soil Microbiome series summarizes microbiological aspects of environmental management from the basics to advanced theoretical as well as practical aspects of microbial based approaches The physical and chemical changes caused by pollution of an ecosystem can occur rapidly significantly impacting the functionality of ecosystem services in that environment Environmental contamination poses and increasingly global challenge through direct and indirect adverse impacts on the climate soil productivity and the health concerns of human beings Traditional remediation techniques are not consistently feasible in mitigating environmental contaminants challenges in terms of cost effectiveness limited land resources and toxic residual products The use of plant associated microbes as part of a network of tools opens a new door to explore an alternative eco friendly and economical technology to mitigate the challenges of environmental contamination Explores the emerging plant microbe interactive nexus for contaminants degradation Presents insights into the production and commercialization of plant microbiome based enzymes Includes engineered microbes and microbial products application in contaminant management Highlights the latest omics and technologies used in plant soil microbiome in contaminant management      *Encyclopedia of Marine Biotechnology* Se-Kwon Kim, 2020-08-04 A keystone reference that presents both up to date research and the far reaching applications of marine biotechnology Featuring contributions from 100 international experts in the field this five volume encyclopedia provides comprehensive coverage of topics in marine biotechnology It starts with the history of the field and delivers a complete overview of marine biotechnology It then offers information on marine organisms bioprocess techniques marine natural products biomaterials bioenergy and algal biotechnology The encyclopedia also covers marine food and biotechnology applications in areas such as pharmaceuticals cosmeceuticals and nutraceuticals Each topic in *Encyclopedia of Marine Biotechnology* is followed by 10 30 subtopics The reference looks at algae cosmetics drugs and fertilizers biodiversity chitins and chitosans aerophysinin 1 toluquinol astaxanthin and fucoxanthin and algal and fish genomics It examines neuro protective compounds from marine microorganisms potential uses and medical management of neurotoxic phycotoxins and the role of metagenomics in exploring marine microbiomes Other sections fully explore marine microbiology pharmaceutical development seafood science and the new biotechnology tools that are being used in the field today One of the first encyclopedic books to cater to experts in marine biotechnology Brings together a diverse range of research on marine biotechnology to bridge the gap between scientific research and the industrial arena Offers clear

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**Water-Rock Interaction** Oleg V. Chudaev, Yousif K. Kharaka, 2021-07-28 Water rock interactions play an important role in nearly all physical and chemical processes operating on the Earth's surface and subsurface This work contains the proceedings of the Eighth International Symposium on Water Rock Interaction WRI 8 held in Russia in 1995

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