


Patrice Dion  
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Editors

SOIL BIOLOGY

# Microbiology of Extreme Soils

 Springer

# Microbiology Of Extreme Soils Soil Biology

**JG Myers**



## **Microbiology Of Extreme Soils Soil Biology:**

**Microbiology of Extreme Soils** Patrice Dion, Chandra Shekhar Nautiyal, 2007-12-22 My auxiliaries are the dews and rains which water this dry soil and what fertility is in the soil itself which for the most part is lean and effete Henry David Thoreau Walden Pond The concerns that Thoreau had about his beans were nothing to those that would face a similarly conscientious gardener in the Atacama Desert or on the planet Mars where dews are rare or frozen and rains are extremely rare or absent altogether Yet we live in a time when an appreciation of the differences and similarities among soils or regolith no organics detected on Mars as yet can provide a perspective on life at its most fundamental level that of microbiology Microbes are the Earth's finest chemists and most prodigious chemical engineers Beyond pure chemistry they know tricks with electrons that would make any Silicon Valley chip designer blush with pride And yet their size and association with human food good and diseases bad has for more than a century obscured their essential place in making the Earth a habitable planet for humans One of the most interesting facets of this book is that we are shown those chemists at work in one of their most important habitats Soils comprise both a pervasive environment on our planet and one of the most important even most fruitful of habitats with respect to human survival

**Microbes and Enzymes in Soil Health and Bioremediation** Ashok Kumar, Swati Sharma, 2019-11-23 Microbial enzymes play a vital role in maintaining soil health and removing pollutants from contaminated land Soil microflora is closely associated with maintaining soil fertility and the use of chemical pesticides fertilizers and other volatile sprays in agriculture threatens the health of the microbial population in the soil Every single particle of healthy soil contains millions of bacteria which interact with the nutrients available sustaining the nutrient cycle and making this microflora an essential component of life on earth How do microbes help in the nutrient cycle Either by intracellular digestion of macromolecules and converting these into smaller units in their metabolic pathways or by secreting enzymes into the extracellular environment to facilitate the conversion of complex macromolecules into micro molecules that can be easily absorbed by other living species To meet demands for energy and food for the growing global population it is important to protect agricultural land from contamination and maintain its productivity Heavy metal ions from contaminated land can enter crops fish or aquatic organisms via contaminated water and these are then taken up by the human body where they can accumulate and alter the normal microflora The microbiological component of the soil is a highly complex system and is still not fully understood How do microbes survive in the changing physicochemical environment of soil This book helps readers understand the mechanism various routes of microbial soil remediation the interactions of different genera and how microbial enzymes support the sustainable restoration of healthy soil

*Endospore-forming Soil Bacteria* Niall A. Logan, Paul De Vos, 2011-07-06 Aerobic endospore forming bacteria are found in soils of all kinds ranging from acid to alkaline hot to cold and fertile to desert It is well known that endospores confer special properties upon their owners and play dominant parts in their life cycles and dispersal and much has been written about the spores genetics and

economic importance of these organisms Much has also been written about soil ecology but there is a relative dearth of literature that brings together different aspects of the behaviour and characters of endospore formers with their contributions to soil ecosystems This Soil Biology volume fills that gap Following chapters that describe the current classification of these organisms that review methods for their detection and for studying their life cycles in soils and that examine their dispersal other chapters show that they are active and dynamic members of soil floras that interact widely with other soil inhabitants with roles in nitrogen fixation denitrification and soil remediation Advances in Applied Bioremediation Ajay Singh,Ramesh C. Kuhad,Owen P. Ward,2009-07-30 Bioremediation is a rapidly advancing field and the technology has been applied successfully to remediate many contaminated sites The goal of every soil remediation method is to enhance the degradation transformation or detoxification of pollutants and to protect maintain and sustain environmental quality Advances in our understanding of the ecology of microbial communities capable of breaking down various pollutants and the molecular and biochemical mechanisms by which biodegradation occurs have helped us in developing practical soil bioremediation strategies Chapters dealing with the application of biological methods to soil remediation are contributed from experts authorities in the area of environmental science including microbiology and molecular biology from academic institutions and industry **Geomicrobiology: Natural and Anthropogenic Settings** Lucian C. Staicu,Larry L. Barton,2024-05-27 This volume brings together leading international experts to offer a unique and timely perspective on geomicrobiology through their latest research and findings Chapters address interactions of marine and freshwater microorganisms contributing to geochemical cycles including biochemical mechanisms for mineralization and transformation of solid minerals and dissolved metals In addition the resilience and physiological elasticity of specific bacteria in extreme environments is discussed such as mechanisms of metal homeostasis and electrochemistry involving extracellular electron flow Further coverage includes resource recovery metals minerals using microbial driven processes and technologies with the aim to contribute to a better understanding of microbial potential within the framework of circular economy This book is designed for professionals and students including environmental engineers microbiologists and individuals studying the interaction of bacteria with metals and minerals in the environment It is also a resource for students in academic programs or short courses focused on bacterial diversity in the environment systems of bacterial energetics resource recovery and bacterial activities in extreme or nutrient stressed environments *Permafrost Soils* Rosa Margesin,2008-10-31 Most of the Earth s biosphere is characterized by low temperatures Vast areas 20% of the soil ecosystem are permanently frozen or are unfrozen for only a few weeks in summer Permafrost regions occur at high latitudes and also at high elevations a significant part of the global permafrost area is represented by mountains Permafrost soils are of global interest since a significant increase in temperature is predicted for polar regions Global warming will have a great impact on these soils especially in northern regions since they contain large amounts of organic carbon and act as carbon sinks and a temperature increase will

result in a release of carbon into the atmosphere Additionally the intensified release of the clima relevant tracer gas methane represents a potential environmental harzard Significant numbers of viable microorganisms including bacteria archaea p totrophic cyanobacteria and green algae fungi and protozoa are present in per frost and the characteristics of these microorganisms reflect the unique and extreme conditions of the permafrost environment Remarkably these microorg isms have been reported to be metabolically active at subzero temperatures even down to 20 C

**Biomanagement of Metal-Contaminated Soils** Mohammad Saghir Khan,Almas Zaidi,Reeta Goel,Javed Musarrat,2011-08-30 Heavy metal contamination is one of the world s major environmental problems posing significant risks to agro ecosystems Conventional technologies employed for heavy metal remediation have often been expensive and disruptive This book provides comprehensive state of the art coverage of the natural sustainable alternatives that use a wide range of biological materials in the removal detoxification of heavy metals consequently leading to the improvement of crops in these soils Novel environmentally friendly and inexpensive solutions are presented based on a sound understanding of metal contamination and the roles of plants and microbes in the management of these toxic soils Written by worldwide experts the book provides not only the necessary scientific background but also addresses the challenging questions that require special attention in order to better understand metal toxicity in soils and its management through bioremediation

**Nanobiotechnology** Alok Dhawan,Sanjay Singh,Ashutosh Kumar,Rishi Shanker,2018-03-26 This book combines the contributions from the experts of material science molecular biology toxicology bio organic and bio inorganic chemistry toxicologists and environmental and food technology etc to fathom the full scope of current and future of developments in the area of Nanobiotechnology Provides brief overview of nanobiotechnology for general readers who are not familiar with the research fields and presents a strong overview of most of the critical areas in field This book can also be used as text book for graduate students as an essential reference material and as an reading material for general readers having a curiosity in Nanobiotechnology

**Microbial Action on Hydrocarbons** Vivek Kumar,Manoj Kumar,Ram Prasad,2019-02-08 The book discusses ways to overcome the side effects of using hydrocarbon based products as energy sources Hydrocarbons produce raw crude oil waste of around 600 000 metric tons per annum with a range of uncertainty of 200 000 metric tons per year The various chapters in this book focus on approaches to reduce these wastes through the application of potential microbes in a process called bioremediation The book is a one stop reference resource on the methods mechanisms and application of the bio composites in the laboratory and field Focusing on resolving a very pressing environmental issue it not only provides details of existing challenges but also offers deeper insights into the possibility of solving problems using hydrocarbon bioremediation

**Microbial Biocontrol: Food Security and Post Harvest Management** Ajay Kumar,2022-02-23 This second volume of a two volume work reviews beneficial bioactive compounds from various microorganisms such as bacteria fungi cyanobacteria in plant diseases management and the postharvest management of fruits using microbial antagonists Furthermore it reviews the impact of

climate change on food security and addressed the legal aspects of microbial biocontrol applications. The two volume work *Microbial Biocontrol* introduces to mechanisms of plant microbe interactions and explores latest strategies of how microbes can be applied in biocontrol and management of plant pathogens replacing chemical fertilizers and pesticides. The book covers different groups of microorganisms such as bacteria, fungi, but also the interplay of entire microbiomes and reviews their specific benefits in crop growth promotion in enhancing the plants tolerance against biotic and abiotic stress as well as in post harvest management of various plant diseases. Novel tools such as CRISPR Cas9 and microbe derived nanoparticles are also addressed besides the legal aspects of biocontrol applications. Today rising global population and changing climatic conditions emerge as a major challenge for agronomist farmers and researchers in fulfilling the requirements of global food production. The conventional agricultural practices utilize undistributed use of chemical fertilizers and pesticides to enhance growth and yield of agricultural products and fresh foods but their extensive and continuous use have led to a range of negative consequences on the food quality and safety to environment as well as to human and animal health. Microbial biocontrol applications are presented as a solution paving the way to a sustainable agriculture in compliance with the UN Sustainable Development Goals (SDG). The book addresses researchers in academia and agriculture. Halophiles Dinesh K Maheshwari, Meenu Saraf, 2015-09-16. The world of halophiles is quite diverse and their representatives in three domains of life i.e. archaea, bacteria and eukarya. They are found all over the small subunit rRNA based tree of life and these microorganisms are adapted to salt concentration up to saturation hence able to grow at 300g/l NaCl concentration. Their metabolic diversity is high as well encompassing oxygenic and anoxygenic phototrophs, aerobic heterotrophs, denitrifiers, sulphate reducers, fermenters and methanogens. The proteins of halophiles are magnificently engineered to function in a milieu containing 2-5M salt that encodes genes represent a valuable repository and resource for reconstruction and visualizing processes of habitat selection and adaptive evolution. Search for new enzymes endowed with novel activities and enhanced stability continues to be desirable purpose for important commercial production of biotechnological significance. These poly extremophiles proved excellent source of enzymes and metabolites possessing inherent ability to function in extreme conditions of high salt, alkaline pH and facilitating catalysis for industrial application in food processing, industrial bioconversion, bioremediation etc. In fact it has just begun to realize the great potential and true extent of diversity and suitable applications if explored them judiciously. This book highlights current applications and research on halophiles to provide a timely overview. Chapters are written by expert authors from around the world and include topics of varied importance which include their role to play in enzyme production, restoration of soil fertility and plant growth, antimicrobial and biocatalytic potential, biomolecules in nanotechnology and aspects of quorum sensing. The book is divided into three sections dealing with biodiversity, biotechnology and sustainable exploitation of halophiles. This major new work represents a valuable source of information to all those scientists interested in microorganisms in general and extremophiles in particular.

with respect to their innovative products and applications

**Laboratory Methods for Soil Health Analysis (Soil Health series, Volume 2)** Douglas L. Karlen, Diane E. Stott, Maysoon M. Mikha, 2021-08-17 Laboratory Methods for Soil Health Analysis Analyzing comparing and understanding soil health data The maintenance of healthy soil resources is instrumental to the success of an array of global efforts and initiatives Whether they are working to combat food shortages conserve our ecosystems or mitigate the impact of climate change researchers and agriculturalists the world over must be able to correctly examine and understand the complex nature of this essential resource These new volumes have been designed to meet this need addressing the many dimensions of soil health analysis in chapters that are concise accessible and applicable to the tasks at hand Soil Health Volume Two Laboratory Methods for Soil Health Analysis provides explanations of the best practices by which one may arrive at valuable comparable data and incisive conclusions and covers topics including Sampling considerations and field evaluations Assessment and interpretation of soil test biological activity Macro and micronutrients in soil quality and health PLFA and EL FAME indicators Offering a practical guide to collecting and understanding soil health data this volume will be of great interest to all those working in agriculture private sector businesses non governmental organizations NGOs academic state and federal research projects as well as state and federal soil conservation water quality and other environmental programs

*Defensive Mutualism in Microbial Symbiosis* James F. White Jr., Monica S. Torres, 2009-05-26 Anemones and fish ants and acacia trees fungus and trees buffaloes and oxpeckers each of these unlikely duos is an inimitable partnership in which the species coexistence is mutually beneficial More specifically they represent examples of defensive mutualism when one species receives protection against predators or parasites in exchange for

Bioremediation and Phytoremediation Technologies in Sustainable Soil Management Junaid Ahmad Malik, Megh R. Goyal, Khursheed Ahmad Wani, 2022-06-30 This 4 volume set focuses on the use of microbial bioremediation and phytoremediation to clean up pollutants in soil such as pesticides petroleum hydrocarbons metals and chlorinated solvents which reduce the soil's fertility and renders it unfit for plant growth Volume 1 Fundamental Aspects and Contaminated Sites begins with an overview of phytoremediation and the role of environmental factors It goes on to introduce soil assessment techniques and offers methods of remediation designed to combat soil and agricultural degradation It discusses soils contaminated by heavy metals microbial and phytoremediation based removal of polycyclic aromatic hydrocarbons PAHs from coal crude oil and gasoline microbial bioremediation and amelioration of pesticide contaminated soils phytoremediation techniques for biomedical waste contaminated sites as well as biomediation processes for human waste sites Biopesticides are also explained as an alternative to conventional pesticides Other volumes in the 4 volume set Volume 2 Microbial Approaches and Recent Trends Volume 3 Inventive Techniques Research Methods and Case Studies Volume 4 Degradation of Pesticides and Polychlorinated Biphenyls Together these four volumes provide in depth coverage of the mechanisms advantages and disadvantages of the bioremediation and phytoremediation technologies for safe and sustainable soil

management     Bacterial Biogeochemistry Tom Fenchel, Gary M. King, Thomas Henry Blackburn, 2012-07-27 Bacterial Biogeochemistry Third Edition focuses on bacterial metabolism and its relevance to the environment including the decomposition of soil food chains nitrogen fixation assimilation and reduction of carbon nitrogen and sulfur and microbial symbiosis The scope of the new edition has broadened to provide a historical perspective and covers in greater depth topics such as bioenergetic processes characteristics of microbial communities spatial heterogeneity transport mechanisms microbial biofilms extreme environments and evolution of biogeochemical cycles Provides up to date coverage with an enlarged scope a new historical perspective and coverage in greater depth of topics of special interest Covers interactions between microbial processes atmospheric composition and the earth's greenhouse properties Completely rewritten to incorporate all the advances and discoveries of the last 20 years such as applications in the exploration for ore deposits and oil and in remediation of environmental pollution     **Life in Extreme Environments** Guido di Prisco, Howell G. M. Edwards, Josef Elster, Ad H. L. Huiskes, 2020-10-15 A diverse account of how life exists in extreme environments and these systems susceptibility and resilience to climate change     *Can J Microbiol*, 2013     *Biodesulfurization in Petroleum Refining* Nour Shafik El-Gendy, Hussein Mohamed Nabil Nassar, 2018-09-14 From basic tenets to the latest advances this is the most comprehensive and up to date coverage of the process of biodesulfurization in the petroleum refining industry Petroleum refining and process engineering is constantly changing No new refineries are being built but companies all over the world are still expanding or re purposing huge percentages of their refineries every year year after year Rather than building entirely new plants companies are spending billions of dollars in the research and development of new processes that can save time and money by being more efficient and environmentally safer Biodesulfurization is one of those processes and nowhere else it is covered more thoroughly or with more up to date research of the new advances than in this new volume from Wiley Scrivener Besides the obvious benefits to biodesulfurization there are new regulations in place within the industry with which companies will over the next decade or longer spend literally tens if not hundreds of billions of dollars to comply Whether for the veteran engineer needing to update his or her library the beginning engineer just learning about biodesulfurization or even the student in a chemical engineering class this outstanding new volume is a must have Especially it covers also the bioupgrading of crude oil and its fractions biodenitrogenation technology and application of nanotechnology on both biodesulfurization and biodenitrogenation technologies     Peatland Biogeochemistry and Watershed Hydrology at the Marcell Experimental Forest Randall Kolka, Stephen Sebestyen, Elon S. Verry, Kenneth Brooks, 2011-02-22 The Marcell Experimental Forest MEF in Minnesota serves as a living laboratory and provides scientists with a fundamental understanding of peatland hydrology acid rain impacts nutrient and carbon cycling trace gas emissions and controls on mercury transport in boreal watersheds Its important role in scientific research continues to grow as t     **Encyclopedia of Microbiology** Thomas M. Schmidt, 2019-09-11 Encyclopedia of Microbiology Fourth Edition Five Volume Set gathers both



basic and applied dimensions in this dynamic field that includes virtually all environments on Earth This range attracts a growing number of cross disciplinary studies which the encyclopedia makes available to readers from diverse educational backgrounds The new edition builds on the solid foundation established in earlier versions adding new material that reflects recent advances in the field New focus areas include Animal and Plant Microbiomes and Global Impact of Microbes The thematic organization of the work allows users to focus on specific areas e g for didactical purposes while also browsing for topics in different areas Offers an up to date and authoritative resource that covers the entire field of microbiology from basic principles to applied technologies Provides an organic overview that is useful to academic teachers and scientists from different backgrounds Includes chapters that are enriched with figures and graphs and that can be easily consulted in isolation to find fundamental definitions and concepts

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