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# **MICROBIAL MATS**

**Physiological Ecology of  
Benthic Microbial Communities**

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— Editors —

**YEHUDA COHEN and EUGENE ROSENBERG**

# Microbial Mats Physiological Ecology Of Benthic Microbial Communities

**B.A. Whitton, M. Potts**



## **Microbial Mats Physiological Ecology Of Benthic Microbial Communities:**

*Microbial Mats* Yehuda Cohen, Eugene Rosenberg, Microbial Mats Lucas J. Stal, Pierre Caumette, 2013-06-29

Microbial mats are benthic communities of a variety of microorganisms. Their investigation requires multidisciplinary studies and close cooperation between microbiologists, biogeochemists, and geologists. Reported here are recent advances in the study of structure, development, and ecological relationships. The methodology described includes microensors as well as new molecular techniques for the detection and identification of microorganisms. Increasing interest exists for applied aspects, e.g., the possibility to use natural or constructed microbial mats for the degradation of xenobiotics for site remediation, etc.

**Systems biology and ecology of microbial mat communities** Martin G. Klotz, Donald A. Bryant, Jim K.

Fredrickson, William P. Inskeep, Michael Kühl, 2016-04-11 Microbial mat communities consist of dense populations of microorganisms embedded in exopolymers and/or biomineralized solid phases and are often found in mm-cm thick assemblages which can be stratified due to environmental gradients such as light, oxygen, or sulfide. Microbial mat communities are commonly observed under extreme environmental conditions, deriving energy primarily from light and/or reduced chemicals to drive autotrophic fixation of carbon dioxide. Microbial mat ecosystems are regarded as living analogues of primordial systems on Earth and they often form perennial structures with conspicuous stratifications of microbial populations that can be studied in situ under stable conditions for many years. Consequently, microbial mat communities are ideal natural laboratories and represent excellent model systems for studying microbial community structure and function, microbial dynamics and interactions, and discovery of new microorganisms with novel metabolic pathways potentially useful in future industrial and/or medical applications. Due to their relative simplicity and organization, microbial mat communities are often excellent testing grounds for new technologies in microbiology, including microsensor analysis, stable isotope methodology, and modern genomics. Integrative studies of microbial mat communities that combine modern biogeochemical and molecular biological methods with traditional microbiology, macroecological approaches, and community network modeling will provide new and detailed insights regarding the systems biology of microbial mats and the complex interplay among individual populations and their physicochemical environment. These processes ultimately control the biogeochemical cycling of energy and/or nutrients in microbial systems. Similarities in microbial community function across different types of communities from highly disparate environments may provide a deeper basis for understanding microbial community dynamics and the ecological role of specific microbial populations. Approaches and concepts developed in highly constrained, relatively stable natural communities may also provide insights useful for studying and understanding more complex microbial communities. The Ecology of Cyanobacteria B.A. Whitton, M. Potts, 2007-05-08 Cyanobacteria make a major contribution to world photosynthesis and nitrogen fixation but are also notorious for causing nuisances such as dense and often toxic blooms in lakes and the ocean. The Ecology of Cyanobacteria: Their Diversity in Time and Space is the first book to

focus solely on ecological aspects of these organisms. Its twenty two chapters are written by some thirty authors who are leading experts in their particular subject. The book begins with an overview of the cyanobacteria or blue green algae for those who are not specialists then looks at their diversity in the geological record and goes on to describe their ecology in present environments where they play important roles. Why is one of the key groups of organisms in the Precambrian still one of the most important groups of phototrophs today? The importance of ecological information for rational management and exploitation of these organisms for commercial and other practical purposes is also assessed. Accounts are provided of nuisances as well as the ecology of the commercially successful *Spirulina* and the role of cyanobacteria in ecosystem recovery from oil pollution. Many chapters include aspects of physiology, biochemistry, geochemistry and molecular biology where these help general understanding of the subject. In addition there are three chapters dealing specifically with molecular ecology. Thirty two pages of colour photos incorporate about seventy views and light micrographs. These features make the book valuable to a wide readership including biologists, microbiologists, geologists, water managers and environmental consultants. The book complements the highly successful *The Molecular Biology of Cyanobacteria* already published by Kluwer.

*Microbiology and Biogeochemistry of Hypersaline Environments* Aharon Oren, 1998-09-16. This book intended for researchers and students in the fields of microbiology, biochemistry and biogeochemistry details the biology and biogeochemistry of various halophilic microorganisms that live in high density saline environments worldwide. These organisms are especially important to biodegradation and hazardous site clean up. Topics include the biochemistry, genetics and molecular biology of these organisms, new methods to type them and osmotic adaptation.

*Advances in Microbial Ecology* K.C. Marshall, 2013-11-11. The International Committee on Microbial Ecology (ICOME) sponsors both the International Symposium on Microbial Ecology held in various parts of the world at three year intervals and the publication of *Advances in Microbial Ecology*. *Advances* was established to provide a vehicle for in depth critical and even provocative reviews in microbial ecology and is now recognized as a major source of information for both practicing and prospective microbial ecologists. The Editorial Board of *Advances* normally solicits contributions from established workers in particular areas of microbial ecology but individuals are encouraged to submit outlines of unsolicited contributions to any member of the Editorial Board for consideration for publication in *Advances*. Chapters in Volume 11 of *Advances in Microbial Ecology* include those on microbial transformations of chitin by G W Gooday, organic sulfur compounds by D P Kelly and N A Smith and phosphorus including its removal in waste water treatment plants by D F Toerien, A Gerber, L H Lotter and T E Cloete. The importance of diffusion processes in microbial ecology is discussed by A L Koch and I I Prosser reviews the application of mathematical modeling to nitrification processes. Considerations of particular ecosystems include the Antarctic by D D Wynn Williams and Australian coastal microbial mats by G W Skyring and I Bauld. Other chapters include the regulation of N<sub>2</sub> fixation by H W.

**Thermophiles: Biodiversity, Ecology, and Evolution** Anna-Louise Reysenbach, Mary Voytek, Rocco

Mancinelli,2012-12-06 These are indeed exciting times to be a microbiologist With one of the buzzwords of the past decade Biodiversity and microbes are reveling in the attention as they represent by far most of the biodiversity on Earth Microbes can thrive in almost any environment where there is an exploitable energy source and as a result the possible existence of microbial life elsewhere in the solar system has stimulated the imaginations of many Extremophiles have taken center stage in these investigations and thermophiles have taken on the lead roles Consequently in the past decade there has been a surge of interest and research in the Ecology Biology and Biotechnology of microorganisms from thermal environments Many of the foundations of thermophile research were laid in Yellowstone National Park primarily by the research of Professor Thomas Brock s laboratory in the late 1960s and early 1970s The upper temperature for life was debated the first thermophilic archeum discovered although it was only later shown to be an archeum by ribosomal cataloging and the extremes of light temperature pH on the physiology of microorga nisms were explored Interest in thermophiles increased steadily in the 1970s and with the discovery of deep sea hydrothermal vents in 1977 thermophilic research began its exponential explosion The development of Taq polymerase in the polymerase chain reaction peR focused interest on the biotechnological potential of thermophilic microorganisms and on the thermal features in Yellowstone National Park

**Ecology of Cyanobacteria II** Brian A. Whitton,2012-07-05 Cyanobacteria have existed for 3 5 billion years yet they are still the most important photosynthetic organisms on the planet for cycling carbon and nitrogen The ecosystems where they have key roles range from the warmer oceans to many Antarctic sites They also include dense nuisance growths in nutrient rich lakes and nitrogen fixers which aid the fertility of rice fields and many soils especially the biological soil crusts of arid regions Molecular biology has in recent years provided major advances in our understanding of cyanobacterial ecology Perhaps for more than any other group of organisms it is possible to see how the ecology physiology biochemistry ultrastructure and molecular biology interact This all helps to deal with practical problems such as the control of nuisance blooms and the use of cyanobacterial inocula to manage semi desert soils Large scale culture of several organisms especially Spirulina Arthrospira for health food and specialist products is increasingly being expanded for a much wider range of uses In view of their probable contribution to past oil deposits much attention is currently focused on their potential as a source of biofuel Please visit <http://extras.springer.com> to view Extra Materials belonging to this volume This book complements the highly successful Ecology of Cyanobacteria and integrates the discoveries of the past twelve years with the older literature

**Microbial Mats** Joseph Seckbach,Aharon Oren,2010-07-17 This book provides information about microbial mats from early fossils to modern mats located in marine and terrestrial environments Microbial mats layered biofilms containing different types of cells are most complex systems in which representatives of various groups of organisms are found together Among them are cyanobacteria and eukaryotic phototrophs aerobic heterotrophic and chemoautotrophic bacteria protozoa anoxygenic photosynthetic bacteria and other types of microorganisms These mats are perfect models for biogeochemical

processes such as the cycles of chemical elements in which a variety of microorganisms cooperate and interact in complex ways They are often found under extreme conditions and their study contributes to our understanding of extremophilic life Moreover microbial mats are models for Precambrian stromatolites the study of modern microbial mats may provide information on the processes that may have occurred on Earth when prokaryotic life began to spread

**Advances in Microbial Ecology** J.G. Jones,2013-11-11 There were many who joked when we took over *Advances in Microbial Ecology* at Volume 13 perhaps they should have reserved their expressions of superstition for Volume 14 As an example of British understatement I think it would be fair to say that we have had a little bad luck Never have I known a volume so bedeviled with misfortune but we have been similarly fortunate in the patience exhibited by our authors particularly those who were first in line with their chapters It would be inappropriate to burden the reader with the catalogue of accidents and illnesses suffice it to say that considerable experience has been gained in contingency planning We feel particularly delighted that the final product is a balanced volume maintaining the tradition of *Advances in Microbial Ecology* in providing something for everyone The chapters range from the strategies of growth to the role of microbes in maintaining sustainable agriculture the significance of a single biochemical process to the complexities of coping with a wide range of substrates

Secondary Metabolites Derek J. Chadwick,Julie Whelan,2008-04-30 A comprehensive review of current thinking on the biosynthesis function and evolution of secondary metabolites in animals plants and microorganisms Examines the traditional context of secondary metabolites as natural products having no obvious part to play in the producing organism s life cycle Covers issues related to genetic and antibiotic applications

*Atlas of Microbial Mat Features Preserved within the Siliciclastic Rock Record* Juergen Schieber,Pradip K. Bose,P.G. Eriksson,Santanu Banerjee,Subir Sarkar,Wladyslaw Altermann,Octavian Catuneanu,2007-09-14 Drawing on a combination of modern occurrences and likely ancient counterparts this atlas is a treatise of mat related sedimentary features that one may expect to see in ancient terrigenous clastic sedimentary successions By combining modern and ancient examples the connection is made to likely formative processes and the utilization of these features in the interpretation of ancient sedimentary rocks The first full compilation of microbial mat features structures preserved in the siliciclastic rock record High quality full color photographs fully support the text Modern and ancient examples connect the formative processes and utilization of mat related features in the interpretation of sedimentary rocks

**Bacterial Adhesion** Madilyn Fletcher,1996-09-21 BACTERIAL ADHESION Molecular and Ecological Diversity Edited byMadilyn Fletcher Over the last twenty years research has revealed the enormous complexity underlying the phenomenon of bacterial adhesion The initial research goal was to understand the mechanism of attachment and its effects on the bacteria as well as the host As research progressed however it became evident that many different attachment mechanisms exist These diverse forms of adhesion are the results of numerous evolutionary pressures and each may be part of a larger behavioral strategy This comprehensive overview details how diversity in habitat and ecological requirements has led

to enormous variety in adhesive cell components underlying genetic determinants and behavioral strategies. It presents the latest research on adhesion mechanisms and strategies found in diverse environments and microorganisms including the new environment of biomaterials. Bacterial Adhesion: Molecular and Ecological Diversity examines adhesion as a strategy for nutrient access and as a phase in the complex behavior of life cycle processes. It covers the latest research and innovative approaches in the field including: Conceptual advances in research on the adhesion of bacteria to oral surfaces; Enhancing colonization in a fluctuating environment; The cellulosome: a cell surface organelle for the adhesion to and degradation of cellulose; *Pseudomonas aeruginosa*: versatile attachment mechanisms; Sensing response and adaptation to surfaces; *Myxococcus*: coadhesion and role in the life cycle. Edited by a leading authority on bacterial adhesion and featuring contributions from the field's leading experts, this book speaks to researchers in all areas of microbiology, biotechnology, environmental technology and environmental science as well as urology, immunology and infectious diseases. Bacterial Adhesion: Molecular and Ecological Diversity is the latest addition to the Wiley Series in Ecological and Applied Microbiology. Recent books in the series include: Microbial Transformation and Degradation of Toxic Organic Chemicals edited by Lily Y. Young and Carl E. Cerniglia; Wastewater Microbiology by Gabriel Bitton; Environmental Microbiology edited by Ralph Mitchell; Biotechnology in Plant Disease Control edited by Ilan Chet; Antarctic Microbiology edited by E. Imre Friedmann; Effects of Acid Rain on Forest Processes edited by Douglas L. Godbold and Aloys Huttermann.

**Biological and Environmental Chemistry of DMSP and Related Sulfonium Compounds** M.D. Keller, R.P.

Kiene, G.O., Kirst, P.T., Visscher, 2012-12-06. An essential book for people working in the area of sulfur compounds in the environment and should be in all institutional libraries. Well indexed, well presented. SGM Quarterly November 1997. Extremely useful and well produced symposium volume that should be of interest to many environmental scientists, microbial and plant physiologists and aquatic ecologists. The Quarterly Review of Biology June 1998. Stress Biology of Cyanobacteria Ashish Kumar Srivastava, Amar Nath Rai, Brett A. Neilan, 2013-03-01. A significant component of many different ecosystems, cyanobacteria occupy almost every niche of the earth including fresh and salt waters, rice fields, hot springs, arid deserts and polar regions. Cyanobacteria, along with algae, produce nearly half the global oxygen, making assessment of their ecophysiology important for understanding climate impacts and potential remediation. Stress Biology of Cyanobacteria: Molecular Mechanisms to Cellular Responses is a compilation of holistic responses of cyanobacteria ranging from ecological and physiological to the modern aspects of their molecular biology, genomics and biochemistry. Covering almost every aspect of cyanobacterial stress biology, this book is divided into two parts: Bioenergetics and Molecular Mechanisms of Stress Tolerance and Cellular Responses and Ecophysiology. The first few chapters focus on the molecular bioenergetics of photosynthesis and respiration in cyanobacteria and provide a clear perspective on different stress tolerance mechanisms. Part I also covers the effect of specific stresses including heavy metal, high and low temperature, salt, osmotic and UV B stress.

on a wide range of vital physiological biochemical and molecular processes of cyanobacteria Part II describes mechanisms of symbiosis stress induced bioproducts and the role of environmental factors on nitrogen fixation which along with photosynthesis is a major contributor to the current geochemical status of the planet The text also covers mutation and cyanobacterial adaptation and the most widely studied cyanotoxin microcystin which has effects on both human and animal health With contributions from experts around the world representing the global importance of cyanobacteria this book provides a broad compilation of research that deals with cyanobacterial stress responses in both controlled laboratory conditions as well as in their natural environment

**Biofouling** Simone Dürr, Jeremy C. Thomason, 2009-12-21 Biofouling the colonisation of an interface by a diverse array of organisms is almost always a problem where it occurs as it negatively affects surfaces the materials that they are made from and the structures that they form and can even destroy them This comprehensive book covers in detail in its first section the processes involved in marine freshwater and medical biofouling including coverage of settlement by larvae and spores biofouling community processes epibiosis biofouling on living organisms and microbial fouling including biofilms deleterious to human health The book s second section encompassing biofouling processes with industrial implications includes coverage of biofouling on artificial substrata paints and coatings technology for the control of marine biofouling biofouling and antifouling in the maritime industries such as shipping offshore oil and aquaculture and in power stations and other industries The impacts of both biofouling and biofouling control and details of current legislation of relevance to biofouling issues are fully covered The book s final section looks at methods for the measurement of biofouling and future prospects for biofouling including in depth coverage of the changes anticipated in biofouling worldwide due to global climate change and likely future directions in antifouling research technology and legislation Biofouling which includes contributions from many international experts is an essential reference for all those working in the antifouling industry including those involved in formulation of antifouling products such as paints and other coatings Aquatic biologists ecologists environmental scientists and lawyers marine engineers aquaculture personnel chemists and medical researchers will all find much of interest within this book All universities and research establishments where these subjects are studied and taught should have copies of this important work on their shelves

*Adaptation to Life at High Salt Concentrations in Archaea, Bacteria, and Eukarya* Nina Gunde-Cimerman, Aharon Oren, Ana Plemenitaš, 2005-12-28 Salt is an essential requirement of life Already from ancient times e g see the books of the Bible its importance in human life has been known For example salt symbolizes destruction as in Sodom and Gomorra but on the other hand it has been an ingredient of every sacrifice during the Holy Temple periods Microbial life in concentrated salt solutions has fascinated scientists since its discovery Recently there have been several international meetings and books devoted entirely to halophiles This book includes the proceedings of the Halophiles 2004 conference held in Ljubljana Slovenia in September 2004 [www.uj.si/bfbhaloph/index.html](http://www.uj.si/bfbhaloph/index.html) This meeting was attended by 120 participants from 25 countries The editors have



selected presentations given at the meeting for this volume and have also invited a number of contributions from experts who had not been present in Ljubljana This book complements Halophilic Microorganisms edited by A Ventosa and published by Springer Verlag 2004 Halophilic Microorganism and their Environments by A Oren 2002 published by Kluwer Academic Publishers as volume 5 of Cellular Origins Life in Extreme Habitats and Astrobiology COLE and Microbiology and Biogeochemistry of Hypersaline Environments edited by A Oren and published by CRC Press Boca Raton 1999 Salt loving halophilic microorganisms grow in salt solutions above seawater salinity 3.5% salt up to saturation ranges i.e. around 35% salt High concentrations of salt occur in natural environments e.g. **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)

**Antarctic Communities** Bruno Battaglia, Jose Valencia, David Walton, 1997-08-28

The study of Antarctic communities can provide a valuable step forward in investigating the control of community development the utilization of habitats and the interaction among species in both species rich and species poor communities This book contains chapters characterizing the present approaches to both aquatic and terrestrial communities in the Antarctic From biodiversity to trophic flows from ecophysiological strategies to the impacts of environmental change and the effects of human disturbance this volume provides an up to the minute overview of community studies in an area covering ten percent of the Earth's surface **Microbial Sediments** Robert E. Riding, Stanley M. Awramik, 2013-06-29 This volume

provides a comprehensive overview of the rapidly developing field of microbial sediments featuring excellent artwork It contains authoritative and stimulating contributions by distinguished authors that cover the field and set the scene for future advances

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