

THERMOPHILES

The keys to molecular evolution
and the origin of life?



Edited by
Juergen Wiegel and Michael W. W. Adams

Thermophiles The Keys To The Molecular Evolution And The Origin Of Life

Mauro Degli Esposti



Thermophiles The Keys To The Molecular Evolution And The Origin Of Life:

Thermophiles Juergen Wiegel, Adams W.W. Michael, 1998-08-27 Late 1990s developments in the study of thermophiles have had considerable significance on theories of evolution These micro organisms are able to thrive at temperatures near or even above 100 degrees Celsius and scientists have begun to study their biology in an attempt to provide clues about the beginnings of life on our planet Researchers

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Thermophiles Juergen Wiegel, Adams W.W. Michael, 2002-09-11 Late 1990s developments in the study of thermophiles have had considerable significance on theories of evolution These micro organisms are able to thrive at temperatures near or even above 100 degrees Celsius and scientists have begun to study their biology in an attempt to provide clues about the beginnings of life on our planet Researchers from diverse background such as biology genetics biogeochemistry oceanography systematics and evolution come together in this comprehensive volume to address questions such as Why did life originate Was the Earth at high temperatures when life began and if so how high What can we conclude about the origins of life from studying thermophilic organisms

Origins Joseph Seckbach, 2006-05-07 In this book forty eminent scientists examine the astrobiological origins of life and the emergence of biodiversity in extreme environments The coverage includes extremophiles microbes living in hostile conditions of high temperature psychrophilic UV radiation and halophilic environments Also discussed are the origin and history of Martian water and the possible biogeochemistry inside Titan

Origin of Life via Archaea Richard Gordon, 2024-08-26 This book surveys the models for the origin of life and presents a new model starting with shaped droplets and ending with life as polygonal Archaea it collects the most published micrographs of Archaea discovered only in 1977 which support this conclusion and thus provides the first visual survey of Archaea Origin of Life via Archaea s purpose is to add a new hypothesis on what are called shaped droplets as the starting point for flat polygonal Archaea supporting the Vesicles First hypothesis The book contains over 6000 distinct references and micrographs of 440 extant species of Archaea 41% of which exhibit polygonal phenotypes It surveys the intellectual battleground of the many ideas of the origin of life on earth chemical equilibrium autocatalysis and biotic polymers This book contains 17 chapters some coauthored on a wide range of topics on the origin of life including Archaea s origin patterns and species It shows how various aspects of the origin of life may have occurred at chemical equilibrium not requiring an energy source contrary to the general assumption For the reader s value its compendium of Archaea micrographs might also serve many other interesting questions about Archaea One chapter presents a theory for the shape of flat polygonal Archaea in terms of the energetics at the surface edges and corners of the S layer Another shows how membrane peptides may have

originated The book also includes a large table of most extant Archaea that is searchable in the electronic version It ends with a chapter on problems needing further research Audience This book will be used by astrobiologists origin of life biologists physicists of small systems geologists biochemists theoretical and vesicle chemists Geomicrobiology: Molecular and Environmental Perspective Alexander Loy, Martin Mandl, Larry L. Barton, 2010-07-23 The interaction of microorganisms with geological activities results in processes influencing development of the Earth's geo and biospheres In assessing these microbial functions scientists have explored short and longterm geological changes attributed to microorganisms and developed new approaches to evaluate the physiology of microbes including microbial interaction with the geological environment As the field of geomicrobiology developed it has become highly interdisciplinary and this book provides a review of the recent developments in a cross section of topics including origin of life microbial mineral interactions and microbial processes functioning in marine as well as terrestrial environments A major component of this book addresses molecular techniques to evaluate microbial evolution and assess relationships of microbes in complex natural communities Recent developments in so called omics technologies including meta genomics and meta proteomics and isotope labeling methods allow new insights into the function of microbial community members and their possible geological impact While this book summarizes current knowledge in various areas it also reveals unresolved questions that require future investigations Information in these chapters enhances our fundamental knowledge of geomicrobiology that contributes to the exploitation of microbial functions in mineral and environmental biotechnology applications It is our hope that this book will stimulate interest in the general field of geomicrobiology and encourage others to explore microbial processes as applied to the Earth

The Genetic Code and the Origin of Life Lluís Ribas de Pouplana, 2007-04-03 Early Thoughts on RNA and the Origin of Life The full impact of the essential role of the nucleic acids in biological systems was forcefully demonstrated by the research community in the 1950s Although Avery and his collaborators had identified DNA as the genetic material responsible for the transformation of bacteria in 1944 it was not until the early 1950s that the Hershey Chase experiments provided a more direct demonstration of this role Finally the structural DNA double helix proposed by Watson and Crick in 1953 clearly created a structural framework for the role of DNA as both information carrier and as a molecule that could undergo the necessary replication needed for daughter cells Research continued by Kornberg and his colleagues in the mid 1950s emphasized the biochemistry and enzymology of DNA replication At the same time there was a growing interest in the role of RNA The 1956 discovery by David Davies and myself showed that polyadenylic acid and polyuridylic acid could form a double helical RNA molecule but that it differed somewhat from DNA A large number of experiments were subsequently carried out with synthetic polyribonucleotides which illustrated that RNA could form even more complicated helical structures in which the specificity of hydrogen bonding was the key element in determining the molecular conformation Finally in 1960 I could show that it was possible to make a hybrid helix *The Origin and Nature of Life on Earth* Eric

Smith, Harold J. Morowitz, 2016-03-31 Uniting the conceptual foundations of the physical sciences and biology this groundbreaking multidisciplinary book explores the origin of life as a planetary process Combining geology geochemistry biochemistry microbiology evolution and statistical physics to create an inclusive picture of the living state the authors develop the argument that the emergence of life was a necessary cascade of non equilibrium phase transitions that opened new channels for chemical energy flow on Earth This full colour and logically structured book introduces the main areas of significance and provides a well ordered and accessible introduction to multiple literatures outside the confines of disciplinary specializations as well as including an extensive bibliography to provide context and further reading For researchers professionals entering the field or specialists looking for a coherent overview this text brings together diverse perspectives to form a unified picture of the origin of life and the ongoing organization of the biosphere *Practical Aspects of Computational Chemistry I* Jerzy Leszczynski, Manoj Shukla, 2012-01-13 Practical Aspects of Computational Chemistry I An Overview of the Last Two Decades and Current Trends gathers the advances made within the last 20 years by well known experts in the area of theoretical and computational chemistry and physics The title itself reflects the celebration of the twentieth anniversary of the Conference on Current Trends in Computational Chemistry CCTCC to which all authors have participated and contributed to its success This volume poses and answers important questions of interest to the computational chemistry community and beyond What is the historical background of the Structural Chemistry Is there any way to avoid the problem of intruder state in the multi reference formulation What is the recent progress on multi reference coupled cluster theory Starting with a historical account of structural chemistry the book focuses on the recent advances made in promising theories such as many body Brillouin Wigner theory multireference state specific coupled cluster theory relativistic effect in chemistry linear and nonlinear optical properties of molecules solution to Kohn Sham problem electronic structure of solid state materials development of model core potential quantum Monte Carlo method nano and molecular electronics dynamics of photodimerization and excited states intermolecular interactions hydrogen bonding and non hydrogen bonding interactions conformational flexibility metal cations in zeolite catalyst and interaction of nucleic acid bases with minerals Practical Aspects of Computational Chemistry I An Overview of the Last Two Decades and Current Trends is aimed at theoretical and computational chemists physical chemists materials scientists and particularly those who are eager to apply computational chemistry methods to problem of chemical and physical importance This book will provide valuable information to undergraduate graduate and PhD students as well as to established researchers **Life in the Cosmos** Manasvi Lingam, Abraham Loeb, 2021-06-29 A rigorous and scientific analysis of the myriad possibilities of life beyond our planet Are we alone in the universe This tantalizing question has captivated humanity over millennia but seldom has it been approached rigorously Today the search for signatures of extraterrestrial life and intelligence has become a rapidly advancing scientific endeavor Missions to Mars Europa and Titan seek evidence of life Laboratory experiments have made

great strides in creating synthetic life deepening our understanding of conditions that give rise to living entities And on the horizon are sophisticated telescopes to detect and characterize exoplanets most likely to harbor life Life in the Cosmos offers a thorough overview of the burgeoning field of astrobiology including the salient methods and paradigms involved in the search for extraterrestrial life and intelligence Manasvi Lingam and Abraham Loeb tackle three areas of interest in hunting for life out there first the pathways by which life originates and evolves second planetary and stellar factors that affect the habitability of worlds with an eye on the biomarkers that may reveal the presence of microbial life and finally the detection of technological signals that could be indicative of intelligence Drawing on empirical data from observations and experiments as well as the latest theoretical and computational developments the authors make a compelling scientific case for the search for life beyond what we can currently see Meticulous and comprehensive Life in the Cosmos is a master class from top researchers in astrobiology suggesting that the answer to our age old question is closer than ever before

Thermodynamic Inversion Vladimir N. Kompanichenko, 2017-03-02 This book discusses the theory general principles and energy source conditions allowing for the emergence of life in planetary systems The author examines the material conditions found in natural hydrothermal sites the appropriate analogs of prebiotic environments on early Earth He provides an overview of current laboratory experiments in prebiotic materials chemistry and substantiation of a new direction for the experiments in the origin of life field Describes thermodynamic inversion and how it relates to the living cell Examines the current direction of experiments on prebiotic materials chemistry Introduces and substantiates necessary conditions for the emergence of life Metals, Microbes, and Minerals - The Biogeochemical Side of Life Peter Kroneck, Martha Sosa Torres, 2021-01-18 One of the biggest questions in today's biochemistry is how biological molecules became essential for the processes that occur within living cells This new book from outstanding Metal Ions in Life Science series gives an overview about biochemical evolution of organic molecules and metabolic pathways in living systems and outlines the vital biochemical processes in microbial cells in which metals are involved **Science and Christianity** Henry F. Schaefer, 2003 In Science and Christianity CONFLICT OR COHERENCE Dr Henry F Schaefer's university lectures have been expanded to full length essays Thus we have a first hand account of the lively current science Christianity discussions by one of the major participants Science and Christianity describes why and how Dr Schaefer became a Christian as a young professor of Chemistry at the University of California at Berkeley Throughout the book retains the highly personal character of the university lectures general respect for those with whom the author disagrees and a delightful sense of humor

Polyextremophiles Joseph Seckbach, Aharon Oren, Helga Stan-Lotter, 2013-05-13 Many Microorganisms and some macro organisms can live under extreme conditions For example high and low temperature acidic and alkaline conditions high salt areas high pressure toxic compounds high level of ionizing radiation anoxia and absence of light etc Many organisms inhabit environments characterized by more than one form of stress Polyextremophiles Among them are those who live in

hypersaline and alkaline hot and acidic cold hot and high hydrostatic pressure etc Polyextremophiles found in desert regions have to cope with intense UV irradiation and desiccation high as well as low temperatures and low availability of water and nutrients This book provides novel results of application to polyextremophiles research ranging from nanotechnology to synthetic biology to the origin of life and beyond *Phylogeny and Evolution of Bacteria and Mitochondria* Mauro Degli Esposti, 2018-10-26 Life on earth began with bacteria which now colonize every corner of the planet As the ancestors of mitochondria bacteria are also fundamental for our cells Most bacteria look alike but have very different functions Therefore knowing the functional profile of bacteria helps understand their impact on our life This book provides a wealth of information on the functional evolution of bacteria in a novel and coherent way The book is aimed towards scientists as well as those who are curious about the world of bacteria and their relationships with mitochondria the powerhouses of our cells and us

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

Extremophiles Om V. Singh, 2012-10-16 Explores the utility and potential of extremophiles in sustainability and biotechnology Many extremophilic bio products are already used as life saving drugs Until recently however the difficulty of working with these microbes has discouraged efforts to develop extremophilic microbes as potential drug reservoirs of the future Recent technological advances have opened the door to exploring these organisms anew as sources of products that might prove useful in clinical and environmental biotechnology and drug development Extremophiles features outstanding articles by expert scientists who shed light on broad ranging areas of progress in the development of smart therapeutics for multiple disease types and products for industrial use It bridges technological gaps focusing on critical aspects of extremolytes and the mechanisms regulating their biosynthesis that are relevant to human health and bioenergy including value added products of commercial significance as well as other potentially viable products This groundbreaking guide Introduces the variety of extremophiles and their extremolytes including extremozymes Provides an overview of the methodologies used to

acquire extremophiles Reviews the literature on the diversity of extremophiles Offers tools and criteria for data interpretation of various extremolytes extremozymes Discusses experimental design problems associated with extremophiles and their therapeutic implications Explores the challenges and possibilities of developing extremolytes for commercial purposes Explains the FDA s regulations on certain microbial bio products that will be of interest to potential industrialists Extremophiles is an immensely useful resource for graduate students and researchers in biotechnology clinical biotechnology microbiology and applied microbiology *Photosynthesis* Suleyman I. Allakhverdiev, 2015-11-02 Photosynthesis is one of the most important processes that affects all life on Earth and even now in the twenty first century it is still being studied and tested by scientists chemists and botanists Regardless of politics or opinion climate change is one of the most polarizing and important potentially dangerous issues facing the future of our planet and a better understanding of photosynthesis and how it is changing with our global climate could hold the answers to many scientific questions regarding this important phenomenon This edited volume written by some of the world s foremost authorities on photosynthesis presents revolutionary new ideas and theories about photosynthesis and how it can be viewed and studied at various levels within organisms Focusing on the molecular cellular and organismic levels the scientists who compiled this volume offer the student or scientist a new approach to an old subject Looking through this new lens we can continue to learn more about the natural world in which we live and our place in it Valuable to the veteran scientist and student alike this is a must have volume for anyone who is researching studying or writing about photosynthesis There are other volumes available that cover the subject from textbooks to monographs but this is the first time that a group of papers from this perspective has been gathered by an editor for publication It is an important and enlightening work on a very important subject that is integral to life on Earth

A Science Strategy for the Exploration of Europa Committee on Planetary and Lunar Exploration, Commission on Physical Sciences, Mathematics, and Applications, Space Studies Board, Division on Engineering and Physical Sciences, National Research Council, 2000-01-05 Since its discovery in 1610 Europa one of Jupiter s four large moons has been an object of interest to astronomers and planetary scientists Much of this interest stems from observations made by NASA s Voyager and Galileo spacecraft and from Earth based telescopes indicating that Europa s surface is quite young with very little evidence of cratering and made principally of water ice More recently theoretical models of the jovian system and Europa have suggested that tidal heating may have resulted in the existence of liquid water and perhaps an ocean beneath Europa s surface NASA s ongoing Galileo mission has profoundly expanded our understanding of Europa and the dynamics of the jovian system and may allow us to constrain theoretical models of Europa s subsurface structure Meanwhile since the time of the Voyagers there has been a revolution in our understanding of the limits of life on Earth Life has been detected thriving in environments previously thought to be untenable around hydrothermal vent systems on the seafloor deep underground in basaltic rocks and within polar ice Elsewhere in the solar system including on Europa environments thought

to be compatible with life as we know it on Earth are now considered possible or even probable Spacecraft missions are being planned that may be capable of proving their existence Against this background the Space Studies Board charged its Committee on Planetary and Lunar Exploration COMPLEX to perform a comprehensive study to assess current knowledge about Europa outline a strategy for future spacecraft missions to Europa and identify opportunities for complementary Earth based studies of Europa See the preface for a full statement of the charge

Sedimentology James L. Best, C. R. Fielding, Ian Jarvis, Peter Mozley, 2009-05-11 Sedimentology has seen many significant advances and changes over the past 40 years ranging from facies modelling to sequence stratigraphy chemostratigraphy to basin analysis and the integration of studies of physical chemical and increasingly biological processes in the interpretation and prediction of sedimentary environments and products The subject is becoming ever more interdisciplinary and applied and now has far more links to other physical sciences Research and debate are continuing afresh as we move into this new interdisciplinary phase and promise many developments and increased uses of our subject Now seemed a good time to publish a series of review papers concerning some key current areas of research We hope that these papers will provide comprehensive starting points for those wishing to become acquainted with an area act as stimuli for debate and provide awareness and ideas for future research avenues No issue of this sort can of course ever be truly comprehensive in its coverage these reviews concern only selected snippets from the wide scope of sedimentology and each has of necessity been selective in its own area

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