

Richard Egel · Dirk-Henner Lankenau
Armen Y. Mulkidjanian *Editors*

Origins of Life: The Primal Self- Organization

Origins Of Life The Primal Self Organization

**Yeliz Karaca,Dumitru Baleanu,Yu-Dong
Zhang,Osvaldo Gervasi,Majaz Moonis**

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Origins of Life: The Primal Self-Organization Richard Egel,Dirk-Henner Lankenau,Armen Y.

Mulkiidjanian,2011-08-31 If theoretical physicists can seriously entertain canonical standard models even for the big bang generation of the entire universe why cannot life scientists reach a consensus on how life has emerged and settled on this planet Scientists are hindered by conceptual gaps between bottom up inferences from early Earth geological conditions and top down extrapolations from modern life forms to common ancestral states This book challenges several widely held assumptions and argues for alternative approaches instead Primal syntheses literally or figuratively speaking are called for in at least five major areas 1 The first RNA like molecules may have been selected by solar light as being exceptionally photostable 2 Photosynthetically active minerals and reduced phosphorus compounds could have efficiently coupled the persistent natural energy flows to the primordial metabolism 3 Stochastic uncoded peptides may have kick started an ever tightening co evolution of proteins and nucleic acids 4 The living fossils from the primeval RNA World thrive within modern cells 5 From the inherently complex protocellular associations preceding the consolidation of integral genomes eukaryotic cell organization may have evolved more naturally than simple prokaryote like life forms If this book can motivate dedicated researchers to further explore the alternative mechanisms presented it will have served its purpose well **Origins of Life:**

The Primal Self-Organization Richard Egel,Dirk Lankenau,Armen Y. Mulkiidjanian,2011-09-10 If theoretical physicists can seriously entertain canonical standard models even for the big bang generation of the entire universe why cannot life scientists reach a consensus on how life has emerged and settled on this planet Scientists are hindered by conceptual gaps between bottom up inferences from early Earth geological conditions and top down extrapolations from modern life forms to common ancestral states This book challenges several widely held assumptions and argues for alternative approaches instead Primal syntheses literally or figuratively speaking are called for in at least five major areas 1 The first RNA like molecules may have been selected by solar light as being exceptionally photostable 2 Photosynthetically active minerals and reduced phosphorus compounds could have efficiently coupled the persistent natural energy flows to the primordial metabolism 3 Stochastic uncoded peptides may have kick started an ever tightening co evolution of proteins and nucleic acids 4 The living fossils from the primeval RNA World thrive within modern cells 5 From the inherently complex protocellular associations preceding the consolidation of integral genomes eukaryotic cell organization may have evolved more naturally than simple prokaryote like life forms If this book can motivate dedicated researchers to further explore the alternative mechanisms presented it will have served its purpose well *Conflicting Models for the Origin of Life* Stoyan K. Smoukov,Joseph Seckbach,Richard Gordon,2023-03-14 *Conflicting Models for the Origin of Life* *Conflicting Models for the Origin of Life* provides a forum to compare and contrast the many hypotheses that have been put forward to explain the origin of life There is a revolution brewing in the field of Origin of Life in the process of trying to figure out how Life started many researchers

believe there is an impending second creation of life not necessarily biological Up to date understanding is needed to prepare us for the technological and societal changes it would bring Schrodinger s 1944 What is life included the insight of an information carrier which inspired the discovery of the structure of DNA In Conflicting Models of the Origin of Life a selection of the world s experts are brought together to cover different aspects of the research from progress towards synthetic life artificial cells and sub cellular components to new definitions of life and the unexpected places life could have emerge d Chapters also cover fundamental questions of how memory could emerge from memoryless processes and how we can tell if a molecule may have emerged from life Similarly cutting edge research discusses plausible reactions for the emergence of life both on Earth and on exoplanets Additional perspectives from geologists philosophers and even roboticists thinking about the origin of life round out this volume The text is a state of the art snapshot of the latest developments on the emergence of life to be used both in graduate classes and by citizen scientists Audience Researchers in any area of astrobiology as well as others interested in the origins of life will find a modern and current review of the field and the current debates and obstacles This book will clearly illustrate the current state of the art and engage the imagination and creativity of experts across many disciplines

Origin of Life via Archaea Richard Gordon,2024-10-01 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

The Emergence of Life Pier Luigi Luisi,2016-09-15 This fully updated and expanded edition addresses the origins of biological and synthetic life from a systems biology perspective

How Molecular Forces and Rotating Planets Create Life Jan Spitzer,2021-02-09 A reconceptualization of origins research that exploits a modern understanding

of non covalent molecular forces that stabilize living prokaryotic cells Scientific research into the origins of life remains exploratory and speculative Science has no definitive answer to the biggest questions What is life and How did life begin on earth In this book Jan Spitzer reconceptualizes origins research by exploiting a modern understanding of non covalent molecular forces and covalent bond formation a physicochemical approach propounded originally by Linus Pauling and Max Delbrück Spitzer develops the Pauling Delbrück premise as a physicochemical jigsaw puzzle that identifies key stages in life's emergence from the formation of first oceans tidal sediments and proto biofilms to progenotes proto cells and the first cellular organisms

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

Guidebook for Systems Applications in Astrobiology Vera M. Kolb, 2023-12-20 This book addresses the timely subject of systems applications in astrobiology It demonstrates how astrobiology a multidisciplinary interdisciplinary and transdisciplinary field of science can benefit from adopting the systems approach Astrobiology draws upon its founding sciences such as astronomy physics chemistry biochemistry geology and planetary sciences However astrobiologists can encounter difficulties working across these fields The systems approach we believe is the best contemporary approach to consider astrobiology holistically The approach is currently used in other fields such as engineering which uses systems analysis routinely Such an approach needs to be learned both in principle and through examples from the field This book features chapters from experts across the field of astrobiology who have applied the systems approach It will be a valuable guide for astrobiology students at the advanced undergraduate and graduate levels in addition to researchers in the field both in academia and the space industry Key Features Offers a unique and novel approach to studying and understanding astrobiology Encourages astrobiologists to apply a holistic systems approach to their work rather than being bogged down in details Imparts practical knowledge to readers which can be adopted in different research and job opportunities in the field of astrobiology

The Physics of Living Systems Fabrizio Cleri, 2016-10-08 In this book physics in its many aspects thermodynamics mechanics electricity fluid dynamics is the guiding light on a fascinating journey through biological systems providing ideas examples and stimulating reflections for undergraduate physics chemistry and life science students as well as for anyone interested in the frontiers between physics and biology Rather than introducing a lot of new information it encourages young students to use their recently acquired knowledge to start seeing the physics behind the biology As an undergraduate textbook in introductory biophysics it includes the necessary background and tools

including exercises and appendices to form a progressive course In this case the chapters can be used in the order proposed possibly split between two semesters The book is also an absorbing read for researchers in the life sciences who wish to refresh or go deeper into the physics concepts gleaned in their early years of scientific training Less physics oriented readers might want to skip the first chapter as well as all the gray boxes containing the more formal developments and create their own la carte menu of chapters

RNA World Hypothesis and the Origin of Life: Astrochemistry Perspective Ashraf - Ali, André Canosa, David Leisawitz, 2022-09-26

Pathways to the Origin and Evolution of Meanings in the Universe Alexei A. Sharov, George E. Mikhailovsky, 2024-02-28 Pathways to the Origin and Evolution of Meanings in the Universe The book explains why meaning is a part of the universe populated by life and how organisms generate meanings and then use them for creative transformation of the environment and themselves This book focuses on interdisciplinary research at the intersection of biology semiotics philosophy ethology information theory and the theory of evolution Such a broad approach provides a rich context for the study of organisms and other semiotic agents in their environments This methodology can be applied to robotics and artificial intelligence for developing robust adaptable learning devices In this book leading interdisciplinary scholars reveal their vision on how to integrate natural sciences with semiotics a theory of meaning making and signification Developments in biology indicate that the capacity to create and understand signs is not limited to humans or vertebrate animals but exists in all living organisms the fact that inspired the integration of biology and semiotics into biosemiotics The authors discuss the nature of semiotic agents organisms and other autonomous goal directed units meaning signs information memory evolution and consciousness Also discussed are issues including the origin of life potential meaning and its actualization top down causality in physics and biology capacity of organisms to encode their functions the strategy of organisms to combine homeostasis with direct adaptation to new life cycle phases or new environments multi level memory systems increase of freedom via enabling constraints creative modeling in evolution and learning communication in animals and humans the origin and function of language and the distribution and transfer of life in space This is the first book on biosemiotics in its global conceptual and spatial scope Biosemiotics is presented using the language of natural sciences which supports the scientific grounding of semiotic terms Finally the cosmic dimension of life and meaning making leads to a reconsideration of ethical principles and ecological mentality here on earth and in space exploration Audience Theoretical biologists ethologists astrobiologists ecologists evolutionary biologists philosophers phenomenologists semioticians biosemioticians molecular biologists linguists system scientists and engineers

Untangling Molecular Biodiversity: Explaining Unity And Diversity Principles Of Organization With Molecular Structure And Evolutionary Genomics Gustavo Caetano-anolles, 2020-11-20 Untangling Molecular Biodiversity presents a unique global framework to explain molecular and organismal biodiversity that is grounded in evolutionary genomics This book will tackle important questions such as the origin of life the emergence of biochemistry the origin of viruses the nature of the last universal

common ancestor responsible for diversified life the role of information and thermodynamics in evolution the reason for having three cellular domains in life and the centrality of modules in biology This book will explore six themes 1 Explanatory frameworks for biological organization 2 Evolutionary patterns and biodiversity 3 Molecular structure and evolutionary genomics 4 A framework of persistence strategies that borrows from engineering and systems biology 5 Use of this framework to explain diversity in the molecular world and 6 Exploring the origin and evolution of cells and viruses Consequently this book represents a very unique collection of ideas that can attract the attention of a broad readership interested in life sciences biology *Semiotic Agency* Alexei Sharov, Morten Tønnessen, 2022-02-08 This book invites readers to embark on a journey into the world of agency encompassing humans other organisms cells intracellular molecular agents colonies populations ecological systems and artificial autonomous systems We combine mechanistic and non mechanistic approaches in the analysis of the function and evolution of organisms their subagents and multi organism systems and in this way offer a theoretical platform for integrating biosemiotics with both natural science and the humanities social sciences Agents are autonomous systems that incorporate knowledge on how to make sense of their environment and use it to achieve their goals The functions of all agents are supported by mechanisms at the lowest level however the explanatory power of mechanistic analysis is not sufficient for complex agents Non mechanistic methods rely on the goal directedness of agents whose dynamics follow self stabilized dynamic attractors The properties of attractors depend on stable or slowly changing factors and such dependencies can be interpreted as sign relations if they are adaptive in nature Agents can replace or redirect mechanisms on demand in order to preserve their functions for performing higher level semiotic functions mechanisms are thus only means We assume that mechanism and semiosis are not mutually exclusive and that simple agents can interpret signs mechanistically This assumption allows us to extend semiotic analysis to all agents including ribosomes in cells computers and robots This book challenges established traditions in natural science and the humanities social sciences semiotics no longer appears as restricted to humans and rational thinking and biology is no longer limited to rely exclusively on mechanistic reasoning *Advances in Applied Microbiology*, 2017-02-08 *Advances in Applied Microbiology* continues to be one of the most widely read and authoritative review sources in microbiology containing comprehensive reviews of the most current research in applied microbiology Users will find invaluable references and information on a variety of areas including protozoan grazing of freshwater biofilms metals in yeast fermentation processes the interpretation of host pathogen dialogue through microarrays and the role of polyamines in bacterial growth and biofilm formation Eclectic volumes are supplemented by thematic volumes on various topics including Archaea and sick building syndrome Contains contributions from leading authorities Informs and updates on all the latest developments in the field Includes discussions on protozoan grazing of freshwater biofilms metals in yeast fermentation processes the interpretation of host pathogen dialogue through microarrays and more **Astrobiology** Vera M. Kolb, 2014-08-22 *Astrobiology An Evolutionary Approach* provides a

full course in astrobiology with an emphasis on abiogenesis and evolution The book presents astrobiology both as a developing science and as the science of the future The origins of life and the possibility of life elsewhere continues to be a subject of scientific and philosophical examination The *The Minimal Self* Rupert Glasgow, 2017-06-13 Self is a term that is much used but often poorly understood or over hastily dismissed In *The Minimal Self* R D V Glasgow seeks to unearth the underlying nature of selfhood Glasgow's approach is based upon the notion of intrinsic reflexivity which manifests itself in three fundamental forms self maintenance self reproduction and self containment Through a conceptual analysis of selfhood Glasgow aims to ascertain what distinguishes full forms of minimal selfhood from entities such as genes and viruses that are merely selfish or self like The idea is to establish the logical prerequisites for the transition from a world bereft of selfhood to one populated by selves like us Minimal selfhood thus provides a bridge linking philosophy biology and other disciplines that have previously failed to coincide in their understanding of what a self is **Handbook of Astrobiology** Vera M.

Kolb, 2018-12-07 Choice Recommended Title August 2019 Read an exclusive interview with Professor Vera Kolb here Astrobiology is the study of the origin evolution distribution and future of life on Earth This exciting and significant field of research also investigates the potential existence and search for extra terrestrial life in the Solar System and beyond This is the first handbook in this burgeoning and interdisciplinary field Edited by Vera Kolb a highly respected astrobiologist this comprehensive resource captures the history and current state of the field Rich in information and easy to use it assumes basic knowledge and provides answers to questions from practitioners and specialists in the field as well as providing key references for further study Features Fills an important gap in the market providing a comprehensive overview of the field Edited by an authority in the subject with chapters written by experts in the many diverse areas that comprise astrobiology Contains in depth and broad coverage of an exciting field that will only grow in importance in the decades ahead

Multi-Chaos, Fractal and Multi-Fractional Artificial Intelligence of Different Complex Systems Yeliz Karaca, Dumitru Baleanu, Yu-Dong Zhang, Osvaldo Gervasi, Majaz Moonis, 2022-06-22 Multi Chaos Fractal and Multi Fractional Artificial Intelligence of Different Complex Systems addresses different uncertain processes inherent in the complex systems attempting to provide global and robust optimized solutions distinctively through multifarious methods technical analyses modeling optimization processes numerical simulations case studies as well as applications including theoretical aspects of complexity Foregrounding Multi chaos Fractal and Multi fractional in the era of Artificial Intelligence AI the edited book deals with multi chaos fractal multifractional fractional calculus fractional operators quantum wavelet entropy based applications artificial intelligence mathematics informed and data driven processes aside from the means of modelling and simulations for the solution of multifaceted problems characterized by nonlinearity non regularity and self similarity frequently encountered in different complex systems The fundamental interacting components underlying complexity complexity thinking processes and theory along with computational processes and technologies with machine learning as the

core component of AI demonstrate the enabling of complex data to augment some critical human skills Appealing to an interdisciplinary network of scientists and researchers to disseminate the theory and application in medicine neurology mathematics physics biology chemistry information theory engineering computer science social sciences and other far reaching domains the overarching aim is to empower out of the box thinking through multifarious methods directed towards paradoxical situations uncertain processes chaotic transient and nonlinear dynamics of complex systems Constructs and presents a multifarious approach for critical decision making processes embodying paradoxes and uncertainty Includes a combination of theory and applications with regard to multi chaos fractal and multi fractional as well as AI of different complex systems and many body systems Provides readers with a bridge between application of advanced computational mathematical methods and AI based on comprehensive analyses and broad theories

Disincanto del mondo e scienze della vita Gabriele Aleandri, 2024-05-31 Il legame tra scienze e filosofia collocato al cuore della cultura moderna da l potente e spesso invisibile influenza l organizzazione della societ le scelte e i rapporti degli esseri umani l idea che hanno di s stessi e del proprio posto nell universo Raramente tuttavia questo legame stato confuso e conflittuale come oggi Molti ritengono che le scoperte dell astronomia dell evoluzionismo e delle neuroscienze siano incompatibili con la tradizione filosofica occidentale che dovrebbe al massimo ottenere un posto onorevole nel cimitero delle idee Altri condividono quest impressione di incompatibilit ma ne traggono lezioni diverse che le scienze naturali siano mera tecnologia incapaci di parlarci delle questioni decisive oppure che l incompatibilit debba essere eliminata con qualche compromesso artificioso la morale alla filosofia e la verit alle scienze i fatti alle scienze e le interpretazioni alla filosofia Questo libro racconta una storia molto diversa Nella Prima Parte dedicata alla genealogia dell evoluzionismo e della psicologia moderni troverete una difesa dell idea che la separazione tra essi e la filosofia tradizionale sia stata costruita per ragioni estranee a entrambe e a discapito di entrambe Nella Seconda Parte pi speculativa e ispirata alle scienze della vita contemporanee troverete invece un tentativo di sistematica integrazione tra le due

Evolution, Development and Complexity Georgi Yordanov Georgiev, John M. Smart, Claudio L. Flores Martinez, Michael E. Price, 2019-06-25 This book explores the universe and its subsystems from the three lenses of evolutionary contingent developmental predictable and complex adaptive processes at all scales It draws from prolific experts within the academic disciplines of complexity science physical science information and computer science theoretical and evo devo biology cosmology astrobiology evolutionary theory developmental theory and philosophy The chapters come from a Satellite Meeting Evolution Development and Complexity EDC hosted at the Conference on Complex Systems in Cancun 2017 The contributions have been peer reviewed and contributors from outside the conference were invited to submit chapters to ensure full coverage of the topics This book explores many issues within the field of EDC such as the interaction of evolutionary stochasticity and developmental determinism in biological systems and what they might teach us about these twin processes in other complex systems This text will appeal to students and researchers within the

complex systems and EDC fields

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