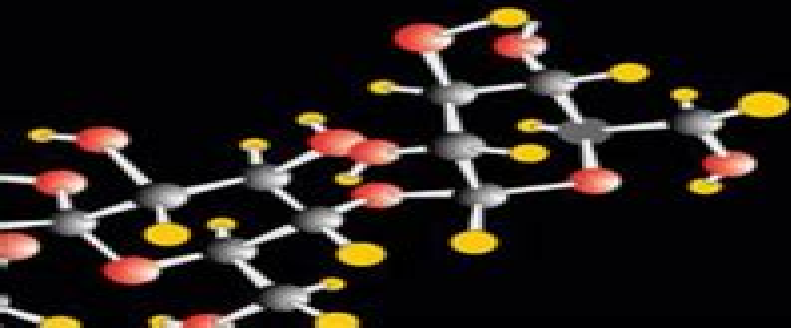




What
is Life?

How
Chemistry
Becomes
Biology



ADDY PROSS

What Is Life How Chemistry Becomes Biology

Bruce Sanford



What Is Life How Chemistry Becomes Biology:

What is Life? Addy Pross, 2012-09-27 Seventy years ago Erwin Schrödinger posed a profound question: What is life and how did it emerge from non-life? This problem has puzzled biologists and physical scientists ever since. Living things are hugely complex and have unique properties such as self-maintenance and apparently purposeful behaviour which we do not see in inert matter. So how does chemistry give rise to biology? What could have led the first replicating molecules up such a path? Now developments in the emerging field of systems chemistry are unlocking the problem. Addy Pross shows how the different kind of stability that operates among replicating molecules results in a tendency for chemical systems to become more complex and acquire the properties of life. Strikingly, he demonstrates that Darwinian evolution is the biological expression of a deeper, well-defined chemical concept: the whole story from replicating molecules to complex life is one continuous process governed by an underlying physical principle. The gulf between biology and the physical sciences is finally becoming bridged. This new edition includes an Epilogue describing developments in the concepts of fundamental forms of stability discussed in the book and their profound implications. Oxford Landmark Science books are must-read classics of modern science writing which have crystallized big ideas and shaped the way we think. What is Life? Addy Pross, 2012-09-27 Pross examines these issues from a chemical perspective, providing a new understanding of how the sciences of chemistry and biology relate to one another. *The Science of Why We Exist* Tim Coulson, 2024-07-02 From the Big Bang and the evolution of the genetic code to the birth of consciousness, this is the extraordinary story of the chain of events that led to human life on earth. Have you ever wondered why you exist? What had to happen for you to be alive and conscious? Scientists have come a long way in answering this question, and this book describes what they have found out. It also examines whether our existence was inevitable at the universe's birth 13.77 billion years ago or whether we are just incredibly lucky. The book is aimed at readers who are interested in science but are not experts. Written in an entertaining and accessible style, the narrative begins by describing how scientists discover facts before taking the reader on a journey from the Big Bang to the creation of the human genome. Covering physics, astronomy, chemistry, earth sciences, the emergence of life, evolution, consciousness, the rise of humanity, and how our personalities are moulded by genes, chance, and the environment, the journey explains how the universe started as a point of intense energy that over time, in our corner of the universe, resulted in our wonderful planet and in you. WHERE WHEN AND HOW ANCESTRAL (LUCA) TO ALL LIFE ORIGINATED Jagjit Singh Rawat, 2021-12-06 The book is all about the living beings. All living beings, including humans, have originated and evolved from the Last Universal Common Ancestor (LUCA) that was possible as a result of a spontaneous step-by-step chemical origin in about 3.75 billion years ago from the elements consisting of life body such as nitrogen bases: adenine, thymine, cytosine, guanine, and uracil, which are made up of the elements C, H, O, N, and ribose sugar. This life originated in the sediments of the palaeo floodplains at the palaeo mouths of fresh water flows (rivers) on the Hadean surface in the

Archaeon Eon This was a global phenomenon The life on the rocky planet like our Earth was possible because of existence of fresh water bodies over minerals metals and clay deposits which rested on Hadean surface and active geological processes and active environments The book also makes an attempt to explain as to how do the simple elements like C H O N S and P first change to simple chemistry H_2O NH_3 followed by CH_4 HCN and monomers monosaccharides amino acids glycerol s fatty acids nucleotides and polymers carbohydrates proteins lipids and nucleic acids There was not much development for about 3210 million years from 3750 million years to 540 million years and suddenly changed jumped to complex life forms in about 541 million years ago Here the life originated and evolved without head and heart from 3750 million years ago to 522 million years ago i e for about 3228 million years The head was originated and evolved in about 521million years ago However consciousness emerged along with bonding of carbon with hydrogen and other elements which were finally converted into nucleosides having nitrogenous base and ribose sugar The gravity and gravitational force intertwined with electromagnetic force were the reason there were bonding of carbon and hydrogen and other elements to originate and evolve LUCA which stayed away from thermodynamic equilibrium

The Deeper Genome John Parrington, 2017-10-06 Over a decade ago as the Human Genome Project completed its mapping of the entire human genome hopes ran high that we would rapidly be able to use our knowledge of human genes to tackle many inherited diseases and understand what makes us unique among animals But things didn't turn out that way For a start we turned out to have far fewer genes than originally thought just over 20 000 the same sort of number as a fruit fly or worm What's more the proportion of DNA consisting of genes coding for proteins was a mere 2% So was the rest of the genome accumulated junk Things have changed since those early heady days of the Human Genome Project But the emerging picture is if anything far more exciting In this book John Parrington explains the key features that are coming to light some such as the results of the international ENCODE programme still much debated and controversial in their scope He gives an outline of the deeper genome involving layers of regulatory elements controlling and coordinating the switching on and off of genes the impact of its 3D geometry the discovery of a variety of new RNAs playing critical roles the epigenetic changes influenced by the environment and life experiences that can make identical twins different and be passed on to the next generation and the clues coming out of comparisons with the genomes of Neanderthals as well as that of chimps about the development of our species We are learning more about ourselves and about the genetic aspects of many diseases But in its complexity flexibility and ability to respond to environmental cues the human genome is proving to be far more subtle than we ever imagined

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

Invitation To Generalized Empirical Method: In Philosophy And Science Terrance J Quinn,2016-12-28 Bernard Lonergan identified the need and possibility of what he called generalized empirical method in science and philosophy Implementation will be a future community achievement The book enters into details of a selection of examples in the sciences and philosophy of science These are provided not to engage in or blend the present aim with traditional philosophical debate but as points of entry to help reveal the possibility and need of balanced empirical method Taking words of Lonergan Questions of method are practical So my purpose in these chapters is not to demonstrate what is necessary It is not to forecast what is probable It is to invite you to share in the exploration of a proposal Bernard Lonergan A Third Collection 1985 114 The main examples are drawn from biochemistry and biology although heuristics envisioned will include all sciences

Prebiotic Chemistry and Life's Origin Michele Fiore,2022-06-29 How life originated from the inanimate mixture of organic and inorganic compounds on the primordial earth remains one of the great unknowns in science This origin of life or abiogenesis continues to be examined in the context of the conditions and materials required for natural life to have begun on Earth both theoretically and experimentally This book provides a broad but in depth analysis of the latest discoveries in prebiotic chemistry from the microscopic to the macroscopic scale utilising experimental insight to provide a bottom up approach to plausibly explaining how life arose With contributions from global leaders this book is an ideal reference for postgraduate students and a single source of comprehensive information on the latest technical and theoretical advancements for researchers in a variety of fields from astrochemistry and astrophysics to organic chemistry and evolution

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

Steering Human Evolution Yehezkel Dror,2020-05-07 Humanity must steer its evolution As human knowledge moves a step ahead of Darwin's theories

this book presents the emergence of human made meta evolution shaping our alternative futures This novel process poses fateful challenges to humanity which require regulation of emerging science and technology which may endanger the future of our species However to do so successfully a novel humanity craft has to be developed main ideologies and institutions need redesign national sovereignty has to be limited a decisive global regime becomes essential some revaluation of widely accepted norms becomes essential and a novel type of political leader based on merit in addition to public support is urgently needed Taking into account the strength of nationalism and vested interests it may well be that only catastrophes will teach humanity to metamorphose into a novel epoch without too high transition costs But initial steps such as United Nation reforms are urgent in order to contain calamities and may soon become feasible Being both interdisciplinary and based on personal experience of the author this book adds up to a novel paradigm on steering human evolution It will be of great interest to scholars and researchers of modern history evolution sciences future studies political science philosophy of action and science and technology It will also be of wide appeal to the general reader anxious about the future of life on Earth

Comments on the Corona pandemic add to the book s concrete significance **The Genesis Quest** Michael Marshall, 2020-11-20 A science journalist focuses on the chemical research into life s origins A fascinating and challenging story leavened with mini biographies Tim Flannery New York Review of Books From the primordial soup to meteorite impact zones the Manhattan Project to the latest research this book is the first full history of the scientists who strive to explain the genesis of life How did life begin Why are we here These are some of the most profound questions we can ask For almost a century a small band of eccentric scientists has struggled to answer these questions and explain one of the greatest mysteries of all how and why life began on Earth There are many different proposals and each idea has attracted passionate believers who promote it with an almost religious fervor as well as detractors who reject it with equal passion But the quest to unravel life s genesis is not just a story of big ideas It is also a compelling human story rich in personalities conflicts and surprising twists and turns Along the way the journey takes in some of the greatest discoveries in modern biology from evolution and cells to DNA and life s family tree It is also a search whose end may finally be in sight In *The Genesis Quest* Michael Marshall shows how the quest to understand life s beginning is also a journey to discover the true nature of life and by extension our place in the universe As lively in its telling as its subject is thought provoking *The Well read Naturalist* An historical review of the search for the origin of life an approachable introduction and also offers an interesting window on the lives of the scientists involved Recommended Choice *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

A Guide to Kant's Psychologism Wayne Waxman, 2019-01-16 This book presents an interpretation of Kant s Critique of Pure Reason as a priori psychologism It groups Kant s philosophy together with those of the British empiricists Locke Berkeley and Hume in a single line of psychologistic succession and offers a clear explanation of how Kant s psychologism differs from psychology and idealism The book reconciles Kant s philosophy with subsequent developments in science and mathematics including post Fregean mathematical logic non Euclidean geometry and both relativity and quantum theory It also relates Kant s psychologism to Wittgenstein s later conception of language Finally the author reveals the ways in which Kant s philosophy dovetails with contemporary scientific theorizing about the natural phenomenon of consciousness and its place in nature This book will be of interest to Kant scholars and historians of philosophy working on the British empiricists

Insignificant but Special Bruce Sanford, 2023-01-13 Life is a rarity We know of no other planet where life exists other than on Earth Life started out in a most simple form then proceeded along a labyrinth of evolutionary pathways that resulted in extraordinary and unfathomable designs This is a journey from the beginning of time to this very day guided by circumstances contingencies and chaos that has governed Earth s living assemblage But life s presence was not destined to just happen If it wasn t for our moon which gave Earth orbital and rotational stability life would not be as we know it today If it wasn t for volcanic eruptions Earth would be an ice clad frozen globe If it wasn t for one of the tiniest of living organisms that produced a toxic gas complex life would not have arisen If it wasn t for one particular extinction event Homo sapiens would not be walking this planet and you would not be reading this now If it wasn t for a million other things life would be much different or not at all Earth made life from the meek to the monstrous from the banal to the bizarre from the humblest to the haughtiest Strap yourself in alongside a window seat and witness the passing of time to view the episodes of change and how the making of life became the greatest story on Earth

A World Beyond Physics Stuart A. Kauffman, 2019 Explores the possibility and process of evolution beyond the standard and established scientific principles

Animal Locomotion Malcolm S. Gordon, Reinhard Blickhan, John O. Dabiri, John J. Videler, 2017-05-25 *Animal Locomotion: Physical Principles and Adaptations* is a professional level state of the art review and reference summarizing the current understanding of macroscopic metazoan animal movement. The comparative biophysics, biomechanics and bioengineering of swimming, flying and terrestrial locomotion are placed in contemporary frameworks of biodiversity, evolutionary process and modern research methods including mathematical analysis. The intended primary audience is advanced level students and researchers primarily interested in and trained in mathematics, physical sciences and engineering. Although not encyclopedic in its coverage, anyone interested in organismal biology, functional morphology, organ systems and ecological physiology, physiological ecology, molecular biology, molecular genetics and systems biology should find this book useful.

Niche Construction John Odling-Smee, 2024-09-03 *How niche construction theory extends evolutionary theory beyond natural selection to a more general theory about the coevolution of organisms with their environments*. In *Niche Construction*, John Odling-Smee, the leading authority on niche construction theory, extends evolutionary theory from an explanation of how populations of organisms respond to natural selection pressures in their environments to a more general theory about the coevolution of organisms with their environments. Organisms, he shows, cause changes in their local external environments by interacting with them, thereby contributing in fundamental ways to their own and one another's evolution. This book applies niche construction theory to current problems such as human induced global warming and suggests how humans might contribute positively to the future evolution of life on Earth. Odling-Smee explains how orthodox evolutionary theory falls short in two ways. First, it does not describe how organisms contribute to their own and one another's evolution through their environment-changing niche-constructing activities. Second, it fails to explain how genetic evolution can give rise to supplementary knowledge-gaining processes in many species. These include certain developmental processes in individual organisms and socio-cultural processes in animals, including humans. Neo-Darwinism, the author writes, assesses the fitness of individual organisms in populations in terms of their capacity to survive and reproduce but without attributing these capacities to the active, purposeful agency of organisms. He argues that the purposeful agency of individual organisms plays a central role in evolution. He also discusses the relationship of an organism's energy-consuming activities and the second law of thermodynamics.

The Incomputable S. Barry Cooper, Mariya I. Soskova, 2017-05-05 This book questions the relevance of computation to the physical universe. Our theories deliver computational descriptions but the gaps and discontinuities in our grasp suggest a need for continued discourse between researchers from different disciplines and this book is unique in its focus on the mathematical theory of incomputability and its relevance for the real world. The core of the book consists of thirteen chapters in five parts on extended models of computation, the search for natural examples of incomputable objects, mind, matter and computation, the nature of information, complexity and randomness and the mathematics of emergence and morphogenesis. This book will be of interest to researchers in the areas of theoretical computer science, mathematical logic.

and philosophy *The Human Condition* Stefan Wurm, 2020-03-10 Over a very short period only a few hundred years our understanding of the cosmos our planet Earth the evolution of life on it and the beginnings of our very own human endeavor have radically changed These revolutions in science and technology have dramatically altered our societies in many ways For quite some time it seemed as if our planets resources were unlimited Today we know that this is not the case Human civilizations are shaping our planets future in ways that have profound consequences for all other life on Earth as well as for us We need to reflect broadly on what defines our human condition if we wish our societies to be successful in navigating a future that cannot be just ours but must include the broad diversity of life on Earth without which humankind will not survive This book tells the story of how we discovered the universe how we learned about our planet and the life evolving on it how humanity emerged from pre history and what some of the future of our civilizations could hold *On the Riddle of Life* Bohang Chen, 2024-09-12 This book presents a historico logical study of vitalism It begins by uncovering previously unknown doctrines of vitalism from the history of science encompassing biological physical and social sciences and then subjects these doctrines to a thorough logical analysis Through this process the book offers a unified conceptual framework to understand the major doctrines of vitalism in the history of science ultimately relating vitalism to the question of life Following the classical methodological approach endorsed by Immanuel Kant nineteenth century philosopher scientists like Ernst Mach and early twentieth century logical analysts including logical empiricists British analysts pragmatists Husserlian phenomenologists and neo Kantians this work provides unconventional and valuable perspectives on vitalism and the riddle of life appealing to a broad audience including scientists historians and philosophers of science particularly those from biological backgrounds

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