Planets And Life The Emerging Science Of Astrobiology

In Assembling Life, David Deamer addresses questions that are the cutting edge of research on the origin of life. For instance, how did non-living organic compounds assemble into the first forms of primitive cellular life? What was the source of those compounds and the energy that produced the first nucleic acids? Did life begin in the ocean or in fresh water on terrestrial land masses? Could life have begun on Mars? The book provides an overview of conditions on the early Earth four billion years ago and explains why fresh water hot springs are a plausible alternative to salty seawater as a site where life can begin. Deamer describes his studies of organic compounds that were likely to be available in the prebiotic environment and the volcanic conditions that can drive chemical evolution toward the origin of life. The book is not exclusively Earth-centric, but instead considers whether life could begin elsewhere in our solar system. Deamer does not propose how life did begin, because we can never know that with certainty. Instead, his goal is to understand how life can begin on any habitable planet, with Earth so far being the only known example.

Planetary atmospheres are complex and evolving entities, as mankind is rapidly coming to realise whilst attempting to understand, forecast and mitigate human-induced climate change. In the Solar System, our neighbours Venus and Mars provide striking examples of two endpoints of planetary evolution, runaway greenhouse and loss of atmosphere to space. The variety of extra-solar planets brings a wider angle to the issue: from scorching "hot jupiters" to ocean worlds, exo-atmospheres explore many configurations unknown in the Solar System, such as iron clouds, silicate rains, extreme plate tectonics, and steam volcanoes. Exoplanetary atmospheres have recently become accessible to observations. This book puts our own climate in the wider context of the trials and tribulations of planetary atmospheres. Based on cutting-edge research, it uses a grand tour of the atmospheres of other planets to shine a new light on our own atmosphere, and its relation with life.

This book provides concise and cutting-edge reviews in astrobiology, a young and still emerging multidisciplinary field of science that addresses the fundamental questions of how life originated and diversified on Earth, whether life exists beyond Earth, and what is the future for life on Earth. Readers will find coverage of the latest understanding of a wide range of fascinating topics, including, for example, solar system formation, the origins of life, the history of Earth as revealed by geology, the evolution of intelligence on Earth, the implications of genome data, insights from extremophile research, and the possible existence of life on other planets within and beyond the solar system. Each chapter contains a brief summary of the current status of the topic under discussion, sufficient references to enable more detailed study, and descriptions of recent findings and forthcoming missions or anticipated research. Written by leading experts in astronomy, planetary science, geoscience, chemistry, biology, and physics, this insightful and thought-provoking book will appeal to all students and scientists who are interested in life and space.

The past few years have seen an incredible explosion in our knowledge of the universe. Since its 2009 launch, the Kepler satellite has discovered more than two thousand exoplanets, or planets outside our solar system. More exoplanets are being discovered all the time, and even more remarkable than the sheer number of exoplanets is their variety. In Exoplanets, astronomer Michael Summers and physicist James Trefil explore these remarkable recent discoveries: planets revolving around pulsars, planets made of diamond, planets that are mostly water, and numerous rogue planets wandering through the emptiness of space. This captivating book reveals the latest discoveries and argues that the incredible richness and complexity we are finding necessitates a change in our questions and mental paradigms. In short, we have to change how we think about the universe and our place in it, because it is stranger and more interesting than we could have imagined.

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.

In Cosmic Biology, Louis Irwin and Dirk Schulze-Makuch guide readers through the range of planetary habitats found in our Solar System and those likely to be found throughout the universe. Based on our current knowledge of chemistry, energy, and evolutionary tendencies, the authors envision a variety of possible life forms. These range from the familiar species found on Earth to increasingly exotic examples possible under the different conditions of other planets and their satellites. Discussions of the great variety of life forms that could evolve in these diverse environments have become particularly relevant in recent years with the discovery of around 300 exoplanets in orbit around other stars and the possibilities for the existence of life in these planetary systems. The book also posits a taxonomic classification of the various forms of life that might be found, including speculation on the relative abundance of different forms and the generic fate of living systems. The fate and future of life on Earth will also be considered. The closing passages address the Fermi Paradox, and conclude with philosophical reflections on the possible place of Homo sapiens in the potentially vast stream of life across the galaxies.

Several major breakthroughs have helped contribute to the emerging field of astrobiology. Focusing on these developments, this fascinating book explores some of the most important problems in this field. It examines how planetary systems formed, and how water and the biomolecules necessary for life were produced. It then focuses on how life may have originated and evolved on Earth. Building on these two themes, the final section takes the reader on a search for life elsewhere in the Solar System. It presents the latest results of missions to Mars and Titan, and explores the possibilities of life in the ice-covered ocean of Europa. This interdisciplinary book is an enjoyable overview of this exciting field for students and researchers in astrophysics, planetary science, geosciences, biochemistry, and evolutionary biology. Colour versions of some of the figures are available at www.cambridge.org/9780521875486.

Offering an engaging and complete story of the hunt for new worlds, this volume fully details the detection and exploration of extrasolar planets. It examines the very wide range of extrasolar planets that have been discovered during the past ten years and looks at what can be learned about such planets by studying the bodies in our own solar system. It also discusses the formation of planetary systems, the way in which such systems may evolve and the final systems of planets that result. In addition, the authors demonstrate how life might evolve on an extrasolar planet and how such life might be detected.

Describes the science of planet hunters, the prospects for the discovery of alien life, and discusses the controversies surrounding extrasolar-planet research.

A guide to understanding the formation of life in the Universe The revised and updated second edition of Astrobiology offers an introductory text that explores the structure of living things, the formation of the elements required for life in the Universe, the biological and geological history of the Earth, and the habitability of other planets. Written by a noted expert on the topic, the book examines many of the major conceptual foundations in astrobiology, which cover a diversity of traditional fields including chemistry, biology, geosciences, physics, and astronomy. The book explores many profound questions such as: How did life originate on Earth? How has life persisted on Earth for over three billion years? Is there life elsewhere in the Universe? What is the future of life on Earth? Astrobiology is centered on investigating the past and future of life on Earth by looking beyond Earth to get the answers. Astrobiology links the diverse scientific fields needed to

understand life on our own planet and, potentially, life beyond. This new second edition: Expands on information about the nature of astrobiology and why it is useful Contains a new chapter “What is Life?” that explores the history of attempts to understand life Contains 20% more material on the astrobiology of Mars, icy moons, the structure of life, and the habitability of planets New ‘Discussion Boxes’ to stimulate debate and thought about key questions in astrobiology New review and reflection questions for each chapter to aid learning New boxes describing the careers of astrobiologists and how they got into the subject Offers revised and updated information throughout to reflect the latest advances in the field Written for students of life sciences, physics, astronomy and related disciplines, the updated edition of Astrobiology is an essential introductory text that includes recent advances to this dynamic field.

What determines whether complex life will arise on a planet, or even any life at all? Questions such as these are investigated in this groundbreaking book. In doing so, the authors synthesize information from astronomy, biology, and paleontology, and apply it to what we know about the rise of life on Earth and to what could possibly happen elsewhere in the universe. Everyone who has been thrilled by the recent discoveries of extrasolar planets and the indications of life on Mars and the Jovian moon Europa will be fascinated by Rare Earth, and its implications for those who look to the heavens for companionship.

Why should you buy this book for your child? Well, it contains carefully picked information and then presents that in a way that attracts a child. The inclusion of cool photos increase the efficiency of this book as a tool for learning. So what are you waiting for? Encourage your child to learn about the cosmos today!

Astrobiology is the study of the origin, evolution, distribution, and future of life in the universe. It is an inherently interdisciplinary field that encompasses astronomy, biology, geology, heliophysics, and planetary science, including complementary laboratory activities and field studies conducted in a wide range of terrestrial environments. Combining inherent scientific interest and public appeal, the search for life in the solar system and beyond provides a scientific rationale for many current and future activities carried out by the National Aeronautics and Science Administration (NASA) and other national and international agencies and organizations. Requested by NASA, this study offers a science strategy for astrobiology that outlines key scientific questions, identifies the most promising research in the field, and indicates the extent to which the mission priorities in existing decadal surveys address the search for life's origin, evolution, distribution, and future in the universe. This report makes recommendations for advancing the research, obtaining the measurements, and realizing NASA's goal to search for signs of life in the universe.

Presents a chronicle of the developments and initiatives that have transformed the idea of space colonization into an achievable goal, sharing arguments in favor of targeting Saturn's moon, Titan.

An argument that we have a moral duty to explore other planets and solar systems--because human life on Earth has an expiration date. Inevitably, life on Earth will come to an end, whether by climate disaster, cataclysmic war, or the death of the sun in a few billion years. To avoid extinction, we will have to find a new home planet, perhaps even a new solar system, to inhabit. In this provocative and fascinating book, Christopher Mason argues that we have a moral duty to do just that. As the only species aware that life on Earth has an expiration date, we have a responsibility to act as the shepherd of life-forms--not only for our species but for all species on which we depend and for those still to come (by accidental or designed evolution). Mason argues that the same capacity for ingenuity that has enabled us to build rockets and land on other planets can be applied to redesigning biology so that we can sustainably inhabit those planets. And he lays out a 500-year plan for undertaking the massively ambitious project of reengineering human genetics for life on other worlds. As they are today, our frail human bodies could never survive travel to another habitable planet. Mason describes the toll that long-term space travel took on astronaut Scott Kelly, who returned from a year on the International Space Station with changes to his blood, bones, and genes. Mason proposes a ten-phase, 500-year program that would engineer the genome so that humans can tolerate the extreme environments of outer space--with the ultimate goal of achieving human settlement of new solar systems. He lays out a roadmap of which solar systems to visit first, and merges biotechnology, philosophy, and genetics to offer an unparalleled vision of the universe to come.

With increasing frequency, scientists are finding evidence that planets and moons throughout the universe could be hospitable to life. Nearly 1,800 planets orbiting stars other than the sun have been confirmed since 1995, including more than 700 in February alone. Scientists now conclude that the Milky Way galaxy alone contains a trillion planets, and many believe microbial life, if not intelligent life, exists beyond Earth. Still, finding extraterrestrial life poses enormous challenges. Adequate instruments for observation and sufficient scientific understanding don't yet exist to determine whether distant planets -- or even potentially habitable moons in our own solar system -- harbor life. Moreover, scientists are split on whether sending robots or humans to explore distant worlds is more effective. The biggest challenge for space science, however, may be Washington budget-cutting, which has made it difficult to ensure stable, long-term funding for large scientific projects.

Learn the secrets of planet-hunters as they search for planets beyond our solar system. Is there more to a star than meets the eye? Take a trip to an alien world and encounter wobbling stars, frozen moons, and boiling oceans. Stunning illustrations and cutting-edge science make this book a first in the field. Includes a glossary and index.

Since its first publication more than twenty-five years ago, How to Build a Habitable Planet has established a legendary reputation as an accessible yet scientifically impeccable introduction to the origin and evolution of Earth, from the Big Bang through the rise of human civilization. This classic account of how our habitable planet was assembled from the stuff of stars introduced readers to planetary, Earth, and climate science by way of a fascinating narrative. Now this great book has been made even better. Harvard geochemist Charles Langmuir has worked closely with the original author, Wally Broecker, one of the world's leading Earth scientists, to revise and expand the book for a new generation of readers for whom active planetary stewardship is becoming imperative. Interweaving physics, astronomy, chemistry, geology, and biology, this sweeping account tells Earth’s complete story, from the synthesis of chemical elements in stars, to the formation of the Solar System, to the evolution of a habitable climate on Earth, to the origin of life and humankind. The book also addresses the search for other habitable worlds in the Milky Way and contemplates whether Earth will remain habitable as our influence on global climate grows. It concludes by considering the ways in which humankind can sustain Earth’s habitability and perhaps even participate in further planetary evolution. Like no other book, How to Build a Habitable Planet provides an understanding of Earth in its broadest context, as well as a greater appreciation of its possibly rare ability to sustain life over geologic time. Leading schools that have ordered, recommended for reading, or adopted this book for course use: Arizona State University Brooklyn College CUNY Columbia University Cornell University ETH Zurich Georgia Institute of Technology Harvard University Johns Hopkins University Luther College Northwestern University Ohio State University Oxford Brookes University Pan American University Rutgers University State University of New York at Binghamton Texas A&M University Trinity College Dublin University of Bristol University of California-Los Angeles University of Cambridge University Of Chicago University of Colorado at Boulder University of Glasgow University of Leicester University of Maine, Farmington University of Michigan University of North Carolina at Chapel Hill University of North Georgia University of Nottingham University of Oregon University of Oxford University of Portsmouth University of Southampton University of Ulster University of Victoria University of Wyoming Western Kentucky University Yale University

Are we alone in the universe? Are the planets our playground to treat as we will, or do we have a responsibility to other creatures who may inhabit or use them? Do we have a right to dump trash in space or leave vehicles on Mars or the moon? How should we interact with other life forms? Encountering Life in the Universe examines the intersection of scientific research and society to further explore the ethics of how to behave in a universe where much is unknown. Taking contributions from notable experts in several fields, the editors skillfully introduce

and develop a broad look at the moral questions facing humans on Earth and beyond. Major advances in biology, biotechnology, and medicine create an urgency to ethical considerations in those fields. Astrobiology goes on to debate how we might behave as we explore new worlds, or create new life in the laboratory, or interact with extraterrestrial life forms. Stimulated by new technologies for scientific exploration on and off the Earth, astrobiology is establishing itself as a distinct scientific endeavor. In what way can established philosophies provide guidance for the new frontiers opened by astrobiology research? Can the foundations of ethics and moral philosophy help answer questions about modifying other planets? Or about how to conduct experiments to create life in the lab or about? How to interact with organisms we might discover on another world? While we wait for the first echo that might indicate life beyond Earth, astobiologists, along with philosophers, theologians, artists, and the general public, are exploring how we might behave—even before we know for sure they are there. Encountering Life in the Universe is a remarkable resource for such philosophical challenges.

The early development of life, a fundamental question for humankind, requires the presence of a suitable planetary climate. Our understanding of how habitable planets come to be begins with the worlds closest to home. Venus, Earth, and Mars differ only modestly in their mass and distance from the Sun, yet their current climates could scarcely be more divergent. Only Earth has abundant liquid water, Venus has a runaway greenhouse, and evidence for life-supporting conditions on Mars points to a bygone era. In addition, an Earth-like hydrologic cycle has been revealed in a surprising place: Saturn’s cloud-covered satellite Titan has liquid hydrocarbon rain, lakes, and river networks. Deducing the initial conditions for these diverse worlds and unraveling how and why they diverged to their current climates is a challenge at the forefront of planetary science. Through the contributions of more than sixty leading experts in the field, Comparative Climatology of Terrestrial Planets sets forth the foundations for this emerging new science and brings the reader to the forefront of our current understanding of atmospheric formation and climate evolution. Particular emphasis is given to surface-atmosphere interactions, evolving stellar flux, mantle processes, photochemistry, and interactions with the interplanetary environment, all of which influence the climatology of terrestrial planets. From this cornerstone, both current professionals and most especially new students are brought to the threshold, enabling the next generation of new advances in our own solar system and beyond. Contents Part I: Foundations Jim Hansen Mark Bullock Scot Rafkin Caitlin Griffith Shawn Domagal-Goldman and Antigona Segura Kevin Zahnle Part II: The Greenhouse Effect and Atmospheric Dynamics Curt Covey G. Schubert and J. Mitchell Tim Dowling Francois Forget and Sebastien Lebonnois Vladimir Krasnopolsky Adam Showman Part III: Clouds, Hazes, and Precipitation Larry Esposito A. Määttänen, K. Pérot, F. Montmessin, and A. Hauchecorne Nilton Renno Zibi Turtle Mark Marley Part IV: Surface-Atmosphere Interactions Colin Goldblatt Teresa Segura et al. John Grotzinger Adrian Lenardic D. A. Brain, F. Leblanc, J. G. Luhmann, T. E. Moore, and F. Tian Part V: Solar Influences on Planetary Climate Aaron Zent Jerry Harder F. Tian, E. Chassefiere, F. Leblanc, and D. Brain David Des Marais

Astrobiology involves the study of the origin and history of life on Earth, planets and moons where life may have arisen, and the search for extraterrestrial life. It combines the sciences of biology, chemistry, palaeontology, geology, planetary physics and astronomy. This textbook brings together world experts in each of these disciplines to provide the most comprehensive coverage of the field currently available. Topics cover the origin and evolution of life on Earth, the geological, physical and chemical conditions in which life might arise and the detection of extraterrestrial life on other planets and moons. The book also covers the history of our ideas on extraterrestrial life and the origin of life, as well as the ethical, philosophical and educational issues raised by astrobiology. Written to be accessible to students from diverse backgrounds, this text will be welcomed by advanced undergraduates and graduates who are taking astrobiology courses.

Australopithecines, dinosaurs, trilobites--such fossils conjure up images of lost worlds filled with vanished organisms. But in the full history of life, ancient animals, even the trilobites, form only the half-billion-year tip of a nearly four-billion-year iceberg. Andrew Knoll explores the deep history of life from its origins on a young planet to the incredible Cambrian explosion, presenting a compelling new explanation for the emergence of biological novelty. The very latest discoveries in paleontology--many of them made by the author and his students--are integrated with emerging insights from molecular biology and earth system science to forge a broad understanding of how the biological diversity that surrounds us came to be. Moving from Siberia to Namibia to the Bahamas, Knoll shows how life and environment have evolved together through Earth's history. Innovations in biology have helped shape our air and oceans, and, just as surely, environmental change has influenced the course of evolution, repeatedly closing off opportunities for some species while opening avenues for others. Readers go into the field to confront fossils, enter the lab to discern the inner workings of cells, and alight on Mars to ask how our terrestrial experience can guide exploration for life beyond our planet. Along the way, Knoll brings us up-to-date on some of science's hottest questions, from the oldest fossils and claims of life beyond the Earth to the hypothesis of global glaciation and Knoll's own unifying concept of "permissive ecology." In laying bare Earth's deepest biological roots, Life on a Young Planet helps us understand our own place in the universe--and our responsibility as stewards of a world four billion years in the making. In a new preface, Knoll describes how the field has broadened and deepened in the decade since the book's original publication.

Winner of the 2019 Phi Beta Kappa Award for Science "A valuable perspective on the most important problem of our time." —Adam Becker, NPR Light of the Stars tells the story of humanity’s coming of age as we realize we might not be alone in this universe. Astrophysicist Adam Frank traces the question of alien life from the ancient Greeks to modern thinkers, and he demonstrates that recognizing the possibility of its existence might be the key to save us from climate change. With clarity and conviction, Light of the Stars asks the consequential question: What can the likely presence of life on other planets tell us about our own fate?

This thought-provoking book looks at the nature of red dwarf systems as potential homes for life. Realistically, what are the prospects for life on these distant worlds? Could life evolve and survive there? How do these planetary surfaces and geologies evolve? How would life on a planet orbiting a red dwarf differ from life on Earth? And what are the implications for finding further habitable worlds in our galaxy? The author provides readers with insight into the habitability of planets and how this changes as time progresses and the central star evolves. Since the previous 2013 edition Under a Crimson Sun, there has been a rise in newly discovered planets orbiting red dwarfs, accompanied by controversial areas of research that test what we think we know about these systems. This revised edition delves into the wealth of new material uncovered since that date. It explains the often conflicting results and analyses put forward and clarifies our understanding of these exciting new worlds. The chapters explore the full width of relevant scientific discovery and speculation on the potential for red dwarf planets to host life. New content includes improved atmospheric models, new understandings of the impact of stellar radiation on the atmosphere of red dwarf worlds, tidal-locking, and comparisons with terrestrial geology and climate.

Beneath dense gray clouds through which no sun shone lay a forgotten planet. It was a nightmare world of grotesque and terrifying animal-plant life. Gigantic beetles, spiders, bugs and ants filled the putrid, musty earth - ready to kill and devour anything in sight. There were men amidst this horror - men who cringed and ran from the ravening monsters and huddled in the mushroom forests at night. Burl was one of these creatures. But one day inspiration hit Burl. He would find a weapon - he would fight back. And with this idea the first step was taken in man's most desperate flight for freedom in this most horrible of all worlds. But it was only a first step.

Creative Stress reveals with precision how we can and must transmute negative stress so that we can evolve individually and collectively. It offers the reader a steady climb to the higher reaches of human creativity and fulfillment, and is packed with compelling stories from O'Dea's exceptionally rich experience.

This is an outstanding overview of the history of the Earth from a unique planetary perspective for introductory courses in the earth sciences. The book approaches Earth history as an evolution, encompassing the origin of the cosmos through the inner working of living cells. Earth: Evolution of a Habitable Planet tells how the Earth has come to its present state, why it differs from its neighboring planets, what life's place is in Earth's history, and how humanity affects the processes that make our planet livable. Today's human influences are contemplated in the context of natural changes on Earth. This book brings a fresh perspective to the study of the Earth for students who wish to learn how our planet evolved to its present form.

The history of life on Earth is, in some form or another, known to us all--or so we think. A New History of Life offers a provocative new account, based on the latest scientific research, of how life on our planet evolved--the first major new synthesis for general readers in two decades. Charles Darwin's theories, first published more than 150 years ago, form the backbone of how we understand the history of the Earth. In reality, the currently accepted history of life on Earth is so flawed, so out of date, that it's past time we need a 'New History of Life.' In their latest book, Joe Kirschvink and Peter Ward will show that many of our most cherished beliefs about the evolution of life are wrong. Gathering and analyzing years of discoveries and research not yet widely known to the public, A New History of Life proposes a different origin of species than the one Darwin proposed, one which includes eight-foot-long centipedes, a frozen “snowball Earth”, and the seeds for life originating on Mars. Drawing on their years of experience in paleontology, biology, chemistry, and astrobiology, experts Ward and Kirschvink paint a picture of the origins life on Earth that are at once too fabulous to imagine and too familiar to dismiss--and looking forward, A New History of Life brilliantly assembles insights from some of the latest scientific research to understand how life on Earth can and might evolve far into the future.

Are we alone in the universe? How did life arise on our planet? How do we search for life beyond Earth? These profound questions excite and intrigue broad cross sections of science and society. Answering these questions is the province of the emerging, strongly interdisciplinary field of astrobiology. Life is inextricably tied to the formation, chemistry, and evolution of its host world, and multidisciplinary studies of solar system worlds can provide key insights into processes that govern planetary habitability, informing the search for life in our solar system and beyond. Planetary Astrobiology brings together current knowledge across astronomy, biology, geology, physics, chemistry, and related fields, and considers the synergies between studies of solar systems and exoplanets to identify the path needed to advance the exploration of these profound questions. Planetary Astrobiology represents the combined efforts of more than seventy-five international experts consolidated into twenty chapters and provides an accessible, interdisciplinary gateway for new students and seasoned researchers who wish to learn more about this expanding field. Readers are brought to the frontiers of knowledge in astrobiology via results from the exploration of our own solar system and exoplanetary systems. The overarching goal of Planetary Astrobiology is to enhance and broaden the development of an interdisciplinary approach across the astrobiology, planetary science, and exoplanet communities, enabling a new era of comparative planetology that encompasses conditions and processes for the emergence, evolution, and detection of life.

Kaufman details the incredible true story of science's search for the beginnings of life on Earth and the probability that it exists elsewhere in the universe.

How did life on Earth begin? How common is it elsewhere in the Universe? Written and edited by planetary scientists and astrobiologists, this undergraduate-level textbook provides an introduction to the origin and nature of life, the habitable environments in our solar system and the techniques most successfully used for discovery and characterisation of exoplanets. This third edition has been thoroughly revised to embrace the latest developments in this field. Updated topics include the origins of water on Earth, the exploration of habitable environments on Mars, Europa and Enceladus, and the burgeoning discoveries in exoplanetary systems. Ideal for introductory courses on the subject, the textbook is also well-suited for self-study. It highlights important concepts and techniques in boxed summaries, with questions and exercises throughout the text, with full solutions provided. Online resources, hosted at www.cambridge.org/features/planets, include selected figures from the book, self-assessment questions and sample tutor assignments.

Simone Marchi presents the emerging story of how cosmic collisions shaped both the solar system and our own planet, from the creation of the Moon to influencing the evolution of life on Earth. The Earth emerged out of the upheaval and chaos of massive collisions in the infancy of the Solar System, more than four billion years ago. The largest of these events sent into orbit a spray of molten rocks out of which the Moon coalesced. As in ancient mythological tales, this giant catastrophe marks the birth of our planet as we know it. Space exploration has shown that signs of ancient collisions are widespread in the Solar System, from the barren and once-habitable Mars to the rugged asteroids. On Earth these signs are more subtle, but still cataclysmic, such as the massive asteroid strike which likely sparked the demise of the dinosaurs and many other forms of life some 66 million years ago. Signatures of even more dramatic catastrophes are concealed in ancient rocks. These events wreaked havoc on our planet's surface, influencing global climate and topography, while also enriching the Earth with gold and other rare elements. And recently, modern science is finding that they could even have contributed to developing the conditions conducive to life. In Colliding Worlds, Simone Marchi explores the key role that collisions in space have played in the formation and evolution of our solar system, the development of planets, and possibly even the origin of life on Earth. Analysing our latest understanding of the surfaces of Mars and Venus, gleaned from recent space missions, Marchi presents the dramatic story of cosmic collisions and their legacies.

Over the past ten years, the discovery of extrasolar planets has opened a new field of astronomy, and this area of research is rapidly growing, from both the observational and theoretical point of view. The presence of many giant exoplanets in the close vicinity of their star shows that these newly discovered planetary systems are very different from

the solar system. New theoretical models are being developed in order to understand their formation scenarios, and new observational methods are being implemented to increase the sensitivity of exoplanet detections. In the present book, the authors address the question of planetary systems from all aspects. Starting from the facts (the detection of more than 300 extraterrestrial planets), they first describe the various methods used for these discoveries and propose a synthetic analysis of their global properties. They then consider the observations of young stars and circumstellar disks and address the case of the solar system as a specific example, different from the newly discovered systems. Then the study of planetary systems and of exoplanets is presented from a more theoretical point of view. The book ends with an outlook to future astronomical projects, and a description of the search for life on exoplanets. This book addresses students and researchers who wish to better understand this newly expanding field of research.

Barrie Jones addresses the question "are we alone?", which is one of the most frequently asked questions by scientists and non-scientists alike. In The Search for Life Continued, this question is addressed scientifically, and the author is not afraid to include speculation. Indeed, the author believes beyond reasonable doubt that we are not alone and this belief is based firmly on frontier science of the most imaginative kind. The author concentrates on planetary systems beyond our own but starts with life on Earth, which is the only life we know to exist, and which provides guidance on how best to search for life elsewhere. Planets are the most likely abode of life and so we start the quest with the search for planets beyond the Solar System – exoplanets. The methods of searching are outlined and the nature of hundreds of exoplanetary systems so far discovered described. In the near future we expect to discover habitable Earth-like planets. But are they actually inhabited? How could we tell? All will be revealed. This full color book is written for everybody who wants to stay in close contact with the latest on possible life on other planets.

To many people, the main question about extraterrestrial life is whether or not it exists. But to the scientific community, that question has already been answered: It does. So confident are scientists of the existence of life on other planets that they've invested serious amounts of money, time and prestige in finding and studying it. NASA has started an Institute of Astrobiology, for instance, and the University of Washington, Seattle, began in September 1999 to accept graduate students into its Department of Astrobiology. Life Everywhere is the first book to lay out for a general reader what the new science of astrobiology is all about. It asks the fascinating questions researchers are asking themselves and one another: u What is life? u How does it originate? u How often does life survive once it arises?u How does evolution work?u What determines whether complex or even intelligent life will emerge from more primitive forms?Informed by interviews with most of the experts in this nascent subject, Life Everywhere introduces readers to one of the most important scientific disciplines of the coming century.

A trio of editors [Professors from Austria, Germany and Israel] present Life on Earth and other Planetary Bodies. The contributors are from twenty various countries and present their research on life here as well as the possibility for extraterrestrial life. This volume covers concepts such as life’s origin, hypothesis of Panspermia and of life possibility in the Cosmos. The topic of extraterrestrial life is currently ‘hot’ and the object of several congresses and conferences. While the diversity of “normal” biota is well known, life on the edge of the extremophiles is more limited and less distributed. Other subjects discussed are Astrobiology with the frozen worlds of Mars, Europa and Titan where extant or extinct microbial life may exist in subsurface oceans; conditions on icy Mars with its saline, alkaline, and liquid water which has been recently discovered; chances of habitable Earth-like [or the terrestrial analogues] exoplanets; and SETI’s search for extraterrestrial Intelligence.

Does life exist on other planets? This 1998 book presents the scientific basis for thinking there may be life elsewhere in the Universe. It is the first to cover the entire breadth of recent exciting discoveries, including the discovery of planets around other stars and the possibility of fossil life in meteorites from Mars. Suitable for the general reader, this authoritative book avoids technical jargon and is well illustrated throughout. It covers all the major topics, including the origin and early history of life on Earth, the environmental conditions necessary for life to exist, the possibility that life might exist elsewhere in our Solar System, the occurrence of planets around other stars and their habitability, and the possibility of intelligent extraterrestrial life. For all those interested in understanding the scientific evidence for and likelihood of extraterrestrial life, this is the most comprehensive and readable book to date.

Examines the origins of life on Earth and the search for extraterrestrial life, through an understanding of the factors that have allowed life to exist on this planet and the commonalities on others that may enable life elsewhere.

An in-depth view of the panspermia hypothesis examined against the latest knowledge of planetary formation and related processes. Panspermia is the concept that life can be passively transported through space on various bodies and seed, habitable planets and moons, which we are beginning to learn may exist in large numbers. It is an old idea, but not popular with those who prefer that life on Earth started on Earth, an alternative, also unproven hypothesis. This book updates the concept of panspermia in the light of new evidence on planet formation, molecular clouds, solar system motions, supernovae ejection mechanisms, etc. Thus, it is to be a book about newly understood prospects for the movement of life through space. The novel approach presented in this book gives new insights into the panspermia theory and its connection with planetary formation and the evolution of galaxies. This offers a good starting point for future research proposals about exolife and a better perspective for empirical scrutiny of panspermia theory. Also, the key to understanding life in the universe is to understand that the planetary formation process is convolved with the evolution of stellar systems in their galactic environment. The book provides the synthesis of all these elements and gives the readers an up-to-date insight on how panspermia might fit into the big picture. Audience Given the intrinsic interdisciplinary nature of the panspermia hypothesis the book will have a wide audience across various scientific disciplines covering astronomy, biology, physics and chemistry. Apart from scientists, the book will appeal to engineers who are involved in planning and realization of future space missions.