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An Introduction To Astrobiology

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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,

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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

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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

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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.

A comprehensive and authoritative text on the formation and evolution of planetary atmospheres, for graduate-level students and researchers.

Asteroid science is a fundamental topic in

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planetary science and is key to furthering our understanding of planetary formation and the evolution of the Solar System. Ground-based observations and missions have provided a wealth of new data in recent years, and forthcoming missions promise further exciting results. This accessible book presents a comprehensive introduction to asteroid science, summarising the astronomical and geological characteristics of asteroids. The interdisciplinary nature of asteroid science is reflected in the broad range of topics covered,

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including asteroid and meteorite classification, chemical and physical properties of asteroids, observational techniques, cratering, and the discovery of asteroids and how they are named. Other chapters discuss past, present and future space missions and the threat that these bodies pose for Earth. Based on an upper-level course on asteroids and meteorites taught by the author, this book is ideal for students, researchers and professional scientists looking for an overview of asteroid science.

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Astrobiology, the study of life and its existence in the universe, is one of the hottest areas of scientific research. Lewis Dartnell considers some of the fascinating questions facing researchers today. Could life exist anywhere else in the universe? What might aliens really look like? Dartnell explains why Earth is uniquely suited for life and reveals our profound connection to the cosmos.

A Multidisciplinary Approach

An Introduction to the Solar System

What is Life? On Earth and Beyond

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An Introduction to Astrobiology

An Introduction to Galaxies and Cosmology /

An Introduction to Astrobiology

Informed by new planetary discoveries and the findings from recent robotic missions to Mars, Jupiter, and Saturn, scientists are rapidly replacing centuries of speculation about potential extraterrestrial habitats with real knowledge about the possibility of life outside our own biosphere—“if it exists, and where. This second edition of Kevin W.

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Plaxco and Michael Gross's widely acclaimed text incorporates the latest research in astrobiology to bring readers the most comprehensive, up-to-date, and engaging introduction to the field available. Plaxco and Gross expand their examination of the origin of chemical elements, the developments that made the Universe habitable, and how life continues to be sustained. They discuss in great detail the formation of the first galaxies and stars, the diverse chemistry of the primordial planet, the origins of

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metabolism, the evolution of complex organisms, and the feedback regulation of Earth's climate. They also explore life in extreme habitats, potential extraterrestrial habitats, and the current status of the search for extraterrestrial life. Weaving together the relevant threads of astronomy, geology, chemistry, biophysics, and microbiology, this broadly accessible introductory text captures the excitement, controversy, and progress of the dynamic young field of astrobiology. New to this edition is a glossary of terms

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and an epilogue recapping the key unanswered questions, making Astrobiology an ideal primer for students and, indeed, for anyone curious about life and the Universe.

A truly interdisciplinary endeavor, astrobiology looks at the evidence of astronomy, biology, physics, chemistry, and a host of other fields. A grand narrative emerges, beginning from the smallest, most common particles yet producing amazing complexity and order. Lucas Mix is a congenial guide through the

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depths of astrobiology, exploring how the presence of planets around other stars affects our knowledge of our own planet; how water, carbon, and electrons interact to form life as we know it; and how the processes of evolution and entropy act upon every living thing.

This updated third edition explores the origin and nature of life, habitable environments in our solar system and exoplanet discoveries.

How can life begin? How common is it elsewhere in the Universe? Written and

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edited by planetary scientists and astrobiologists, this textbook is an introduction to the origin and nature of life, the habitable environments in our Solar System and the search for exoplanets. This new edition has been thoroughly revised to take into account the latest developments in this field. It now covers arsenic-tolerant extremophiles, burgeoning successes in exoplanet detection, results of the Cassini-Huygens mission to Titan and a re-examination of the habitability of Mars. Ideal for

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introductory courses on the subject, the textbook is also suitable for self-study. It highlights important concepts and techniques in boxed summaries. There are questions and answers throughout the text, as well as exercises with full solutions. Online resources include electronic versions of figures from the book, example assignments and suggested answers and links to websites containing relevant video clips and news stories.

An Evolutionary Approach

Our Search for Life in the Universe

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The Transits of Extrasolar Planets with Moons

Discovering the Connections Between Stars, Cells, and How Life Began

Evolution of a Habitable World

Astrobiology is an expanding, interdisciplinary field investigating the origin, evolution and future of life in the universe. Tackling many of the foundational debates of the subject, from discussions of cosmological evolution to detailed reviews of common concepts such as the 'Rare Earth' hypothesis, this volume is the first systematic survey of the philosophical aspects

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and conundrums in the study of cosmic life. The author's exploration of the increasing number of cross-over problems highlights the relationship between astrobiology and cosmology and presents some of the challenges of multidisciplinary study. Modern physical theories dealing with the multiverse add a further dimension to the debate. With a selection of beautifully presented illustrations and a strong emphasis on constructing a unified methodology across disciplines, this book will appeal to graduate students and specialists who seek to rectify the fragmented nature of current

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astrobiological endeavour, as well as curious astrophysicists, biologists and SETI enthusiasts. Astrobiology is an interdisciplinary field that asks profound scientific questions. How did life originate on the Earth? How has life persisted on the Earth for over three billion years? Is there life elsewhere in the Universe? What is the future of life on Earth? Astrobiology: Understanding Life in the Universe is an introductory text which explores the structure of living things, the formation of the elements for life in the Universe, the biological and geological history of the Earth and the habitability of other planets in our own

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Solar System and beyond. The book is designed to convey some of the major conceptual foundations in astrobiology that cut across a diversity of traditional fields including chemistry, biology, geosciences, physics and astronomy. It can be used to complement existing courses in these fields or as a stand-alone text for astrobiology courses. Readership: Undergraduates studying for degrees in earth or life sciences, physics, astronomy and related disciplines, as well as anyone with an interest in grasping some of the major concepts and ideas in astrobiology.

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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

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companionship.

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

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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 Natural Philosophy of Alien Life

A Beginner's Guide

The Astrobiological Landscape

Encyclopedia of Astrobiology

The Living Cosmos

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

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elsewhere continues to be a subject of scientific and philosophical examination. The

Presents an exploration of the origin of life, including when and where life began, how cells are built, and evolution.

Approaches from the sciences, philosophy and theology, including the emerging field of astrobiology, can provide fresh perspectives to the age-old question 'What is Life?'. Has the secret of life been unveiled and is it nothing more than physical chemistry? Modern philosophers will ask if we can even define life at all, as we still don't know much about its origins here on Earth. Others regard life as something that cannot simply be reduced to just physics and chemistry, while biologists emphasize the historical component intrinsic to life on Earth. How can theology constructively interpret scientific findings? Can it contribute constructively to scientific

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discussions? Written for a broad interdisciplinary audience, this probing volume discusses life, intelligence and more against the background of contemporary biology and the wider contexts of astrobiology and cosmology. It also considers the challenging implications for science and theology if extraterrestrial life is discovered in the future.

From Habitability to Life on Mars explores the current state of knowledge and questions on the past habitability of Mars and the role that rapid environmental changes may have played in the ability of prebiotic chemistry to transition to life. It investigates the role that such changes may have played in the preservation of biosignatures in the geological record and what this means for exploration strategies. Throughout the book, the authors show how the investigation of terrestrial analogs to early Martian habitats

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under various climates and environmental extremes provide critical clues to understand where, what and how to search for biosignatures on Mars. The authors present an introduction to the newest developments and state-of-the-art remote and in situ detection strategies and technologies that are being currently developed to support the upcoming ExoMars and Mars 2020 missions. They show how the current orbital and ground exploration is guiding the selection for future landing sites. Finally, the book concludes by discussing the critical question of the implications and ethics of finding life on Mars. Edited by the lead on a NASA project that searches for habitability and life on Mars leading to the Mars 2020 mission Presents the evidence, questions and answers we have today (including a summary of the current state of knowledge in advance of the ESA ExoMars and NASA Mars 2020 missions)

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Includes contributions from authors directly involved in past, current and upcoming Mars missions Provides key information as to how Mars rovers, such as ExoMars and Mars 2020, will address the search for life on Mars with their instrumentation

Astrobiology

From Habitability to Life on Mars

How Can Life Begin on Earth and Other Habitable Planets?

Frontiers of Astrobiology

Earth

This book collates papers presented at two international conferences (held at the Australian National University in 2018 and Birkbeck College London in 2019) exploring the relationships

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between big history and astrobiology and their wider implications for society. These two relatively new academic disciplines aim to integrate human history with the wider history of the universe and the search for life elsewhere. The book will show that, despite differences in emphasis, big history and astrobiology share much in common, especially their interdisciplinary approaches and the cosmic and evolutionary perspectives that they both engender. Specifically, the book addresses the unified, all-embracing, nature of knowledge, the impact of big history on humanity and the world

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at large, the possible impact of SETI on astrobiology and big history, the cultural signature of Earth's inhabitants beyond our own planet, and the political implications of a planetary worldview. The principal readership is envisaged to comprise scholars working in the fields of astrobiology, big history and space exploration interested in forging interdisciplinary links between these diverse topics, together with educators, and a wider public, interested in the societal implications of the cosmic and evolutionary perspectives engendered by research in these fields.

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Considering the development of life on Earth, the existence of life in extreme environments and the potential for life elsewhere in the Universe, this book gives a fascinating insight into our place in the Universe. Chris Impey leads the reader through the history, from the Copernican revolution to the emergence of the field of astrobiology – the study of life in the cosmos. He examines how life on Earth began, exploring its incredible variety and the extreme environments in which it can survive. Finally, Impey turns his attention to our Solar System and the planets beyond, discussing whether there may be life

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elsewhere in the Universe. Written in non-technical language, this book is ideal for anyone wanting to know more about astrobiology and how it is changing our views of life and the Universe. An accompanying website available at www.cambridge.org/9780521173841 features podcasts, articles and news stories on astrobiology.

Engagingly introduces marine chemistry and the ocean's geochemical interactions with the solid earth and atmosphere, for students of oceanography.

Examines humanistic aspects of astrobiology,

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exploring approaches, critical issues, and implications of the discovery of extraterrestrial life.

Rare Earth

Astrobiology, Discovery, and Societal Impact

From Biosignatures to Technosignatures

Understanding Life in the Universe

Why Complex Life is Uncommon 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

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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,

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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.

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

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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

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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

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.

Publisher Description

Assembling Life

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**Expanding Worldviews: Astrobiology, Big
History and Cosmic Perspectives**

Lonely Planets

Astrobiology for Everyone

The Search for Life Elsewhere in the Universe

This book bridges a gap in the literature by bringing together leading specialists from different backgrounds. It addresses the specific need for a readable book on this very interdisciplinary and new topic at research level.

Astrobiology is an exciting interdisciplinary field that seeks to answer one of the most important and profound questions: are we alone? In this volume, leading international experts explore the frontiers of

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astrobiology, investigating the latest research questions that will fascinate a wide interdisciplinary audience at all levels. What is the earliest evidence for life on Earth? Where are the most likely sites for life in the Solar System? Could life have evolved elsewhere in the Galaxy? What are the best strategies for detecting intelligent extraterrestrial life? How many habitable or Earth-like exoplanets are there? Progress in astrobiology over the past decade has been rapid and, with evidence accumulating that Mars once hosted standing bodies of liquid water, the discovery of over 500 exoplanets and new insights into how life began on Earth, the scientific search for our origins and place in the cosmos continues.

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From neutron star mergers to the survival skills of tardigrades, this fascinating book is an ideal primer for students or anyone curious about life and the Universe.

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

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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.

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An introduction to astrobiology

Asteroids

A Brief Introduction

Life in Space

Extrasolar Planets and Astrobiology

Can we detect the moons of extrasolar planets? For two decades, astronomers have made enormous progress in the detection and characterisation of exoplanetary systems but the identification of an "exomoon" is notably absent. In this thesis, David Kipping shows how transiting planets may be used to infer the presence of exomoons through deviations in the time and duration of the planetary eclipses. A detailed account of the transit model, potential distortions, and timing techniques is covered before the analytic forms for the timing

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variations are derived. It is shown that habitable-zone exomoons above 0.2 Earth-masses are detectable with the Kepler space telescope using these new timing techniques. A rigorous and scientific analysis of the myriad possibilities of life beyond our planet. “Are we alone in the universe?” This tantalizing question has captivated humanity over millennia, but seldom has it been approached rigorously. Today the search for signatures of extraterrestrial life and intelligence has become a rapidly advancing scientific endeavor. Missions to Mars, Europa, and Titan seek evidence of life. Laboratory experiments have made great strides in creating synthetic life, deepening our understanding of conditions that give rise to living entities. And on the horizon are sophisticated telescopes to detect and characterize exoplanets most likely

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to harbor life. Life in the Cosmos offers a thorough overview of the burgeoning field of astrobiology, including the salient methods and paradigms involved in the search for extraterrestrial life and intelligence. Manasvi Lingam and Abraham Loeb tackle three areas of interest in hunting for life “out there”: first, the pathways by which life originates and evolves; second, planetary and stellar factors that affect the habitability of worlds, with an eye on the biomarkers that may reveal the presence of microbial life; and finally, the detection of technological signals that could be indicative of intelligence. Drawing on empirical data from observations and experiments, as well as the latest theoretical and computational developments, the authors make a compelling scientific case for the search for life beyond what we can

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currently see. Meticulous and comprehensive, Life in the Cosmos is a master class from top researchers in astrobiology, suggesting that the answer to our age-old question is closer than ever before.

The interdisciplinary field of Astrobiology constitutes a joint arena where provocative discoveries are coalescing concerning, e.g. the prevalence of exoplanets, the diversity and hardiness of life, and its increasingly likely chances for its emergence. Biologists, astrophysicists, biochemists, geoscientists and space scientists share this exciting mission of revealing the origin and commonality of life in the Universe. The members of the different disciplines are used to their own terminology and technical language. In the interdisciplinary environment many terms either have redundant meanings or

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are completely unfamiliar to members of other disciplines. The Encyclopedia of Astrobiology serves as the key to a common understanding. Each new or experienced researcher and graduate student in adjacent fields of astrobiology will appreciate this reference work in the quest to understand the big picture. The carefully selected group of active researchers contributing to this work and the expert field editors intend for their contributions, from an internationally comprehensive perspective, to accelerate the interdisciplinary advance of astrobiology.

It's been nearly four decades since Carl Sagan first addressed the general public from a scientist's perspective, confronting the possibility of extraterrestrial life. We've learned a lot in those years, and planetary scientist David

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Grinspoon is well prepared to explore this field with a new generation of readers. In *Lonely Planets*, Grinspoon investigates the big questions: How widespread are life and intelligence in the cosmos? Is life on Earth an accident or in some sense the "purpose" of this universe? And how can we, working from the Earth-centric definition of "life," even begin to think about the varieties of life-forms on other planets? In accessible, lively prose, and using the topic of extraterrestrial life as a mirror with which to view human beliefs, evolution, history, and aspirations, Grinspoon takes readers on a three-part journey. History is an overview of our expanding awareness of other planets, from the observations of seventeenth-century natural philosophers to modern-day space exploration. It traces the history of our ideas on alien

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life to the earliest days of astronomy, and shows how these beliefs have changed with humanity's evolving self-image. Science tells the story of cosmic evolution and the evolution of life on Earth. Here, Grinspoon disputes the recent "Rare Earth hypothesis," which argues that Earth is unique for sprouting advanced life-forms, maintaining instead that life is likely to be well adapted to a wide variety of planets. He questions conventional assumptions of what is required for a planet to come to life, scrutinizing current ideas and evidence for life on Mars, Venus, and the moons of Jupiter, and challenging readers to think about other life-forms that may exist on other worlds. Belief discusses the limits of our abilities to conceptualize or communicate with intelligent aliens living on planets circling distant stars. Grinspoon

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speculates on what intelligent life might become, eventually, on Earth and elsewhere, and the implications, both scientific and philosophical, of these far-future evolutionary possibilities. Written with authority and edge, and rich in personal, often amusing anecdotes, Lonely Planets explores the shifting boundary between planetary science and natural philosophy and reveals how the search for extraterrestrial life unites our spiritual and scientific quests for connection with the cosmos.

Life Everywhere

First Life

An Introduction

An Introduction to the Chemistry of the Sea

Philosophical Foundations of the Study of Cosmic Life

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Updated third edition introduces undergraduates to the Solar System's bodies, the processes upon and within them, and their origins and evolution.

"This book: Provides extensive grounding in key issues of astrophysics, chemistry, biology and geophysics; over 150 images and illustrations; exercises for each chapter, ranging from straightforward calculation problems to more far-ranging research-oriented exercises; an online component for users that includes new exercises and a continually updated blog of late-breaking scientific news items, fully cross-referenced with the book; and extensive bibliographies for each chapter."--BOOK JACKET.

Extraterrestrial life is a common theme in science fiction, b

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is it a serious prospect in the real world? Astrobiology is the emerging field of science that seeks to answer this question. The possibility of life elsewhere in the cosmos is one of the most profound subjects that human beings can ponder. Astrophysicist Andrew May gives an expert overview of our current state of knowledge, looking at how life started on Earth, the tell-tale 'signatures' it produces, and how such signatures might be detected elsewhere in the Solar System on the many 'exoplanets' now being discovered by the Kepler and TESS missions. Along the way the book addresses key questions such as the riddle of Fermi's paradox ('Where is everybody?') and the crucial role of DNA and water – they're essential to 'life as we know it', but is the same true of all

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life? And the really big question: when we eventually find extraterrestrials, will they be friendly or hostile?

Life in the Universe By Jeffrey O. Bennett

Planetary Astrobiology

An Introduction to Galaxies and Cosmology

Life in the Cosmos

Atmospheric Evolution on Inhabited and Lifeless Worlds

Astrobiology: A Very Short Introduction

This work is aimed at the upper-level astrobiology course and places a strong emphasis on the astronomy perspective.

To many people, the main question about extraterrestrial life is whether or not it exists.

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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

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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.

Life in the Universe

The Quest for the Conditions of Life

Handbook of Astrobiology