

Book reviews

Book Review: Impossible Extinction – Natural catastrophes and the supremacy of the microbial world

Charles S. Cockell

Cambridge University Press, Cambridge (2003)
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Like all good books, *Impossible Extinction* is a journey – a cosmic journey as the Earth and the solar system travel around the centre of our Galaxy in a galactic year of 225 million years. During this epic journey, there are numerous hazards and dangers to be encountered. Rather than taking a human perspective, as in most books on natural or man-made catastrophes, the heroes of *Impossible Extinction* are the smallest of Earth's creatures – the microbes. The first and second chapters provide a delightful introduction to our Galactic environment to set the scene. The third chapter introduces the main characters of the story, the vast array of bacterial organisms that inhabit our planet. These microbes have adapted to survive within a huge range of different environments inaccessible to us more “evolved” creatures. They utilise a host of different methods of extracting energy from their environment for their survival. The following four chapters describe the most important, potentially destructive, cosmic events that may be encountered on this 225 million year voyage around the Galaxy. Earth's geological history provides testament to the vagaries of life on Earth with potentially catastrophic consequences on terrestrial life. Since the evolution of multi-cellular creatures some 600 million years ago, there have been at least five mass extinction events in which huge swathes of creatures were annihilated, never to be seen again. The most famous of these mass extinction events was the KT extinction 65 million years ago which wiped out the dinosaurs, believed to have been caused by an impacting asteroid or comet. Such bolide impacts are just one possible source of annihilation. A nearby supernova explosion is also a possibility during our cosmic traverse but so far there is no direct evidence of such having caused a mass extinction. There is also the possibility of super-volcanic eruptions on Earth, such as the eruption of the Deccan Traps some 65 million years ago, which appear to have occurred nine times during the last 225 million years of geological history. The final, potentially catastrophic event is that produced by humans – the degradation of our environment through pollution has added a further danger to the survival of our fellow creatures (and ourselves).

Yet, despite all these hazards with their devastating effects on animals and plants, microbes appear to survive, and perhaps even thrive. This is the linking thread throughout

the whole book – that microbial life is ubiquitous and this ubiquity, from the depths of the oceans to the bowels of the Earth's crust, provides the key to microbes' survival. Hence the title of the book – despite all the insults to which the Earth may be subjected, microbes survive and prosper. The versatility of their lifestyles ensures their continued survival under the most extreme conditions that would annihilate more “evolved” lifeforms. The final chapter suggests that perhaps microbes may even survive the Earth itself – indeed, it is conceivable that Mars or Europa may be home to microbes. Even when the Earth is swallowed up, some 5 billion years hence, as the Sun swells into a red giant, microbes may survive, encapsulated within pieces of rock ejected into space from the impacts that have occurred through geological history. Perhaps these rocks may be slung out of the solar system altogether, eventually to impact onto the surfaces of other planets around other stars to colonise a new home. If so, then microbes do truly represent life as an inextinguishable cosmic phenomenon.

I thoroughly enjoyed this book, and the author has an engaging style, uncluttered with jargon, lending it to a wide general readership. From a more scientific viewpoint, it was refreshing to see biology treated within a cosmological context – a readily accessible introduction to the science of astrobiology which brings alive the world of the microbe in its proper context, the cosmos as a whole.

Alex Ellery

Kingston University, London, UK

Alone?: A Discovery Sourcebook for Astrobiology

By students from the International Space University (ISU) Summer Session Programme, Pomona, California, 2002

International Space University, Strasbourg (2002)
225 pages · Free, postage is £15 or \$15 in Europe, £21 or \$20 elsewhere (see http://www.isunet.edu/library/student_reports.htm)
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This book, designed by one of two International Space University (ISU) project teams for the 2002 summer school programme, tackles the broad topic of astrobiology with a particular focus on space mission issues. Before reviewing the content of the book, however, it is worth mentioning the book's context and authorship, as it would appear that this has had significant influence on its content. The ISU summer school is a 10-week structured postgraduate school in space studies (with an emphasis on space science and engineering) for young scientists, engineers, architects, lawyers and social scientists from across the globe. The structured programme is

based around a series of lecture programmes augmented by a design project – this book was the result of the design project for 48 of those postgraduate students.

The coverage of the book is broad, going beyond the traditional boundaries of science and technology in making forays into the sociological, educational and legal implications of astrobiology and associated disciplines. Furthermore, the book covers aspects of the SETI (search for extraterrestrial intelligence) programme and its relationship to the astrobiology quest. As outlined in the Executive Summary, which is available as a separate document, the book addresses issues associated with the search for extraterrestrial life rather than reviewing the biology of extremophiles. This is a welcome focus as few astrobiology books cover this important area, although the exclusion of extremophile biology as a primary topic in astrobiology was not justified, given the coverage devoted to more peripheral aspects of the subject. However, the space mission aspect is after all a prime concern for the discipline of astrobiology as it directly addresses the experimental/observational component of the core discipline. Even so, this still leaves a huge area of the subject to be covered. By necessity, the coverage can only be superficial within the 225 pages, and this is reflected in the level of technical detail.

The core of the book is concerned with space missions and the technology to support astrobiology missions, their target planets and associated issues. The degree of integration of the book could have been better given its structure but this is a minor issue. The Executive Summary is highly superficial and appeared to give the impression of a series of disjointed bullet points. The Introduction was short but adequate to the task. The second chapter gave a cursory review of previous, current and planned space missions of relevance to astrobiology. The review of the SETI programme in this chapter was superficial and added little to the book beyond extending its nominal coverage. Chapter three made brief forays into extremophiles in the context of the planetary habitable zone but the most interesting and valuable aspect of the book was this chapter's coverage of space instrumentation, past, present and future (supported by an appendix). Unfortunately, the coverage was brief and confined to “conventional” planetary instrumentation only, but nonetheless stressed the difficult nature of biomarker definition. The fourth chapter built on the previous one in considering future space missions to astrobiologically interesting targets and the necessary supporting technology, again with a conventional coverage, but with too little consideration of the surface segment technology required for

astrobiological investigation of planetary bodies. Planetary protection and associated legal issues was well treated in chapter five, and indeed I would recommend the book on this basis alone. The sixth chapter on the sociological impact of contact (which is more traditionally associated with SETI literature) was misplaced in this book as it yielded no great revelations. I suspect that these topics were included to ensure sufficient participation from the non-technical members of the ISU author team. The impact of astrobiology on education was well covered in chapter seven and revealed some interesting insights. The book concludes with a case study for an astrobiology-focused mission to Europa – this was frustrating as the coverage was necessarily sketchy and more detailed coverage of trade-offs and design selection would have been of great value.

In all, this book represents a brave attempt at tackling a huge field of study but its coverage is variable – some aspects are covered well while other aspects less so. Furthermore, the range was unusual in that topics that I would have placed at a high premium (such as extremophile biology) were omitted, while topics of only peripheral relevance (such as sociology of ETI contact) took up significant sections. I am sure that these more peripheral aspects of astrobiology will have more general appeal, although this does not sit well with the primary audience for the technical aspects. However, the book for the most part managed to avoid descending into trivial reportage, so easy to do when coverage is so broad-based.

There are also a few minor errors of fact, but my chief criticism is on the poor bibliographical support to the book. The majority of references were taken from internet sources – although understandable from the authorship context of the book, this really devalues it as a sourcebook. Furthermore, many of the minority references to published literature were incomplete and did not conform to any consistent standard of citation. There were also notable omissions of well-accepted review and landmark journal papers, which would have compensated for the bibliographic emphasis on internet sources. As a sourcebook, this book fails on this important count. However, as a broad based coverage of an important aspect – the space mission – of astrobiology, this book has done reasonably well given the severe limits on book length. Indeed, the reader could do a lot worse in utilising this book as their first point of call, for gaining an appreciation of many of the technical aspects involved in designing a space mission for astrobiological investigation of our solar system.

Alex Ellery
Kingston University, London, UK