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Book reviews

Life & Death of Planet Earth: How the new science of astrobiology charts the ultimate fate of our world

Peter Ward & Donald Brownlee

Judy Piatkus Publishers Ltd, London (*2002*)
240 pages · Price £16.99 · ISBN 0 7499 2425 X HB

The remarkable duet – geologist Peter Ward and astronomer Donald Brownlee – that brought us *Rare Earth* have teamed together again to write *Life & Death of Planet Earth* which in many respects may be regarded as a sequel to *Rare Earth*. Whereas *Rare Earth* focused on our past from an astrobiological perspective, so *Life & Death* looks to our future, again, from the point of view of astrobiology. In particular, their concern is climate change over the long-term future of our planet. My immediate impression is that though this book is good, it is no *Rare Earth*, which hit the bookstands amidst well-deserved fanfare. The tone of this book is much more geared towards the layperson rather than the scientist (no bad thing), whereas *Rare Earth* was as much value and interest to scientists as laypeople – the hallmark of a great popular science book. Furthermore, although both books are speculative in nature, *Rare Earth* amassed a wealth of detail to support its case while that of *Life & Death* is much more circumstantial and sketchy. That said, however, it is the only popular science book that I know of which attempts a systematic assessment of the long-term future of our planet and its potential implications for us and life itself.

The central premise of *Life & Death* is that as far as compatibility with life, the Earth is now in decline since an earlier, golden age some 300 million years ago, and that this decline will continue until the Earth becomes essentially inhabitable to animal life in around 500 million years. Most of the chapters of the book are devoted to filling in "the past", much of which was discussed in their former book *Rare Earth*. Chapter 2 is essentially a potted "life on earth" history as the context for the future. Chapter 3 covers plate tectonics on Earth and the importance of the regulation of the carbon dioxide content of the atmosphere. Chapter 4 considered ice ages through Earth's history including the "Snowball Earth" hypothesis. Chapter 5 describes changing configuration of the continents and how this has a dramatic impact on climate, particularly the formation of the Pangaea supercontinent and its potential for mass extinction. Chapter 6 was devoted to the Sun and its effect on climate through carbon dioxide variations. It considers how, as the Sun undergoes increasing energy output, complex variations in carbon dioxide levels will affect climate and plant life in the future. Chapter 7 considers the effects of increasing temperatures on animal life leading to its eventual demise. Chapter 8 discusses the evaporation of the oceans with increasing temperatures, and the effect in halting plate tectonics and the generation of a runaway greenhouse effect similar to that on Venus today. Chapter 9 considers how the Sun will eventually expand into a red giant star and its final death-throes as a white dwarf. Chapter 10 represents a slight aside in considering other possibilities that might threaten life even before the Earth's old age has its effects including bolide impacts and gamma ray bursts. Chapter 11 considers our legacy that might survive us, generally amounting to our off-world artefacts – currently, only the far-flung Pioneer and Voyager spacecraft. Chapter 12 offers a variation on the Drake equation, which replaces the lifetime of technological civilisation with the duration of habitability for multicellular lifeforms. The final chapter and epilogue conclude with the idea that the only way we can survive over the long-term is to emigrate from our planet.

This book *is* a very interesting read and in particular stresses the potential complexities and inter-relationships between different environmental processes. More detailed models will be required and there are as yet open questions explored in this book. Ward and Brownlee have a tough act to follow with their first book – I am not sure they succeeded, but *Life & Death* was nonetheless a brave attempt. However, I think that *Life & Death* will be more readily digestible by the public at large, which is, after all, the primary market for a popular science book.

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A Journey with Fred Hoyle: the search for cosmic life

Chandra Wickramasinghe

World Scientific (*2005*)
237 pages · ISBN 981 238 912 1 £20.00 (*paperback*)
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Fred Hoyle and Chandra Wickramasinghe enjoyed a 40-year collaboration working in what is now termed astrobiology. For much of that time their British colleagues, who dismissed their books and papers as the work of cranks, shunned their work. Most of their output appeared after Hoyle had resigned from the Plumian Professorship at Cambridge in 1972. For the next thirty years he appeared to work in isolation, despite having honorary positions at Cardiff and Manchester. In his 1993 autobiography *Home is Where the Wind Blows*

Hoyle passes over the 200 or so publications in astrobiology. Towards the end of his life he said to Wickramasinghe: "I have made only a passing reference to our long collaboration, because it seemed distant from the thesis I was developing there. Ours is an even bigger story that is certainly worth telling. Perhaps you would like to do that someday?"

Chandra responded to this invitation by writing this beautiful account of their work. When I wrote my recent biography of Fred Hoyle*, I too chose to leave the astrobiology to one side because I had already had sight of Chandra's typescript. Having quickly read the typescript I decided that the astrobiology theme in Hoyle's life was best left in the hands of Chandra, who writes with far greater insight on this investigation than any other biographer.

In 1941–45 Hoyle was engaged on secret war work with Tommy Gold and Hermann Bondi. The much-storied origin of the steady-state theory of the universe dates from this collaboration. What is less widely known is that Hoyle developed a taste for science fiction literature in this period, and he commented to Gold that he felt he should be able write much better science fiction novels than those available from the local library. He felt that the professional writers were actually very weak on science. By the late 1950s Hoyle had speculative ideas about the nature of the interstellar gas. Already one of the most famous astrophysicists in the world, he knew that no peer review journal would accept speculation. Instead he wrapped these notions inside his first, and best, science fiction novel, *The Black Cloud*. This novel is so highly realistic in its portrayal of scientists and politicians dealing with an unexpected problem – the arrival of a sentient cloud in the solar system – that the reader feels the events really did happen. This novel marks the start of Hoyle's interest in astrobiology.

Wickramasinghe graduated with first class honours from the University of Ceylon in 1960, and thereby won a PhD scholarship to study at Cambridge, where Hoyle was his supervisor. On a walking tour with Fred in the Lake District, a mutual interest in astrobiology began to form. Hoyle at this time was deep into scripting his spectacular television drama series, *A for Andromeda* (he cast Julie Christie in the star role as a boyish young girl), which gave his mind the opportunity to roam far beyond the groves of academe. As Fred's student, and then postdoctoral researcher, Chandra worked on interstellar ice and dust. Later they pursued a joint interest in alternative cosmologies. Their large programme in astrobiology really took off only after Hoyle's 1972 resignation.

This book is both a biography (Hoyle) and an autobiography (Wickramasinghe). The chapters on astrobiology are clearly written. The reader gets a sense of what motivated their many lines of enquiry; their motives are less easy to discover from reading the original papers. It remains the case that some of their themes led nowhere, for example, "*Archaeopteryx* is a fake!" Yet it is striking how much has become mainstream, particularly their ideas on panspermia. The Hoyle-Wickramasinghe collaboration was notable for the daring leaps over knowledge gaps they were prepared to make. This book is a valuable guide to their corpus, and can serve as a source of ideas and speculations.

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