International Journal of Astrobiology 6 (2): 181–183 (2007) Printed in the United Kingdom

Book reviews

The following are three reviews from recent titles published by Springer as part of their *Advances in Astrobiology & Biogeophysics Series*.

Between Necessity & Probability: Searching for the Definition and Origin of Life

Radu Popa

Springer Advances in Astrobiology & Biogeophysics Series, Berlin Heidelberg, Germany (*2004*)
252 pages · ISBN 3-540-20490-3
10.1017/S1473550407003643

This is an interesting book that attempts to systematize life and its origin in an information-theoretic manner. Its chief promise is that, unlike most information-theoretic approaches, it does not ignore the material world and attempts to reconcile the chemistry of life. Popa does not discuss information theory divorced from the physical media but fully integrated with it. The two most important themes are hierarchies and phase transitions as properties of life. Most intriguing to me was the continual reference to encryption of biological information, which is relatively unexplored yet may be fundamental. The book begins with a brief introduction which attempts to offer numerous and varied definitions of life to set the scene, favouring a more basic approach. The second chapter on the history of bioenergy emphasizes the importance of physical energy and introduces feedback, reflexivity, autocatalysis and energy transduction whilst discussing briefly many specific models for the origin of life. This chapter essentially sets the tone for the book as a whole. The third chapter on the origin of cell boundaries and metabolism discusses encapsulation and its thermodynamic implications as well as the nature of lipids, self-assembly and ion channels. The fourth chapter on the origin of specificity introduces information/entropy theory in the context of order and complexity, taking its heritage from Schrödinger's '*What is Life?*'. This was quite a difficult chapter to follow. The fifth chapter on the origin of handedness described a number of different possible mechanisms that might yield chirality – this was a very interesting chapter. The sixth chapter on the history of bio-information discusses the origin genetic information in information-theoretic terms (including some maths), particularly the Manfred Eigen's hypercycle ideas in the context of the RNA world. Other theories – proteins/nucleic acids first and mineralogical origins – are also discussed in the context of information theory. The seventh chapter on the purposefulness of life embraces the teleological notion of purpose but attempts to characterize it as a product of energy-dissipative structures (see comment later). The eighth chapter on more general issues of life brings together the earlier chapters, including replication, and a general discussion of the key characteristics of life. The ninth chapter on astrobiological implications postulates that over-specific emphasis on terrestrial-like biomarkers is doomed to failure and that more general signatures are required and proposed. Four appendices follow, containing origin of life models, definitions of life, a dictionary of technical terms and a list of abbreviations.

Occasionally punctuating the text are references to the 'driving force' behind life, expressions that will worry biologists who are reflexively repelled by anything that smacks of *élan vital* but, to be fair to the author, he lays out his cards in Chapter 7. This book is a specialist and highly technical text requiring considerable background knowledge from biology, chemistry, physics and information theory. It is not an easy read and would not be suitable for an undergraduate course (or possibly even an MSc course) but there are very fascinating gems within the work. It is written very much like a vast journal paper and in several places I wished the author had explained a few things in one or two sentences rather than merely providing a reference. The book-sized journal paper impression was reinforced by a lack of an index and a 572-member reference list. In conclusion, a book for the specialist astrobiologist – trained in both biochemistry and biophysics – in search of novel ideas.

Alex Ellery
Surrey Space Centre, University of Surrey,
Guildford, UK

Intelligent Life in the Universe: From Common Origins to the Future of Humanity

Peter Ulmschneider

Springer Advances in Astrobiology & Biogeophysics Series, Berlin Heidelberg, Germany (*2004*)
240 pages · ISBN 3-540-43988-9
10.1017/S1473550407003655

This book is divided, fairly conventionally, into three sections, the first covering the astronomical background, the second covering the origin and evolution of life, and the third covering intelligence and intelligent activities. The first chapter on stars, galaxies and the origin of chemical elements provides a brief summary of stellar populations, including the hypothesized Population III stars, molecular clouds and stellar evolution in a reasonable level of detail. The second