Book Review


Astrobiology is an old science that is currently experiencing a new lease of life (no pun intended). Although humans have always wondered about their origins and whether they are the sole occupier of their universe, it is only recently that we have been able to investigate this subject systematically. There have been key milestones. For example, almost 150 years ago, Charles Darwin described a method by which we had evolved. Just over 50 years ago, Crick, Watson, Franklin, and Wilkins unravelled the structure of the DNA molecule, thereby giving us a mechanism by which evolutionary processes could be explained. Around 30 years ago, the first robotic probes landed on Mars and returned images of a desolate and windswept rocky landscape; experiments on board the lander designed to detect biological signatures gave ambiguous results that have been debated ever since. And ideas about the uniqueness of the solar system were swept away when planets orbiting sun-type stars were detected 10 years ago. Today, there is a fortunate convergence of many lines of investigation that has resulted in astrobiology becoming a mainstream and respectable subject rather than a fringe activity. Results from space missions, further observations of extrasolar planets, advances in genetics, and the discovery of microorganisms in hostile environments on Earth have all been brought together to place astrobiology firmly on the curriculum. Universities and colleges all over the globe are offering courses and qualifications in astrobiology and origin of life studies.

Life in the universe: Expectations and constraints by Dirk Schulze-Makuch and Louis N. Irwin is the latest in a plethora of books about astrobiology ranging from graduate level texts to popular accounts. Although it is short (nine chapters spanning less than 200 pages), it is an excellent addition to the canon. The book is not so much about life in the universe as it is about life on Earth and the conditions essential for its origin, evolution, and sustainability. The authors take four parameters—energy, solvents, chemistry, and habitat—and describe how they pertain to life on Earth. They then go on to explore other options that might be more appropriate for other planets.

The introductory chapter is a résumé of the contents of the book and the underlying rationale of its framework. In chapter 2, the authors discuss the difficulties in defining life and outline the different ways in which it has been previously defined. They give their own definition of life and point out the distinction between being alive and a living system. This is a distinction that needs to be made and that is sometimes overlooked. Chapter 3, “Lessons from the history of life,” looks at how life has arisen on Earth and describes some of the assumptions made when we extrapolate to how life might arise elsewhere. One of the criticisms I have of the text is that the authors continue with the opinion that life arose on Earth soon after the late heavy bombardment. They do not discuss the possibilities that life might have arisen and been wiped out during the bombardment more than once before becoming established, and neither do they give a fair covering of recent arguments that the oldest trace fossils might have a chemical, rather than biological, origin. The next four chapters cover in turn each of the four parameters that the authors regarded as necessary for life on Earth (energy, solvents, chemistry, and
habitat). The occurrence of or application to Earth of each parameter is described. Alternative possibilities are then considered, such as the utility of silicon rather than carbon for a molecular building block, polar solvents other than water, and so forth. Chapter 8, “Ideas of exotic forms of life,” takes the idea of life beyond the usual boundaries and considers life based on different forms of energy flow, such as might be generated through varying electron spin states, within brown dwarfs, or in molecular clouds. The chapter is short and could perhaps have been improved by including ideas on artificial neural networks. The final chapter, which could have benefited from being placed earlier in the book, covers signatures of life and how it could be detected.

This book is well written and illustrated with clear and concise prose (the rather flowery dedication being the main exception). I would be happy to use this as a text when teaching undergraduate level astrobiology and would certainly recommend it as a good introduction for postgraduates. One drawback, though, is the lack of an index that enables cross-referencing between chapters. And I would have preferred a single bibliography at the end of the book rather than each chapter. These, though, are minor quibbles with what is otherwise a good and valuable contribution to the rapidly growing field of astrobiology.

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