

## Book review

### **Astrobiology: the quest for the conditions of life**

G. Horneck and C. Baumstark-Khan, eds

Springer, Berlin (2002)

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For those, like this reviewer, who can recall (just) the late 1960s, when popular discussion of ‘exobiology’ was common, but academic respectability less so, it is very satisfying to see how far the pendulum has swung. An index of this progress is this handsome new book from Springer, with contributors drawn partly from participants of the *1st Symposium on Exo/Astrobiology* held during March 2000 in Bremen.

The book begins by reviewing the evidence for organic material in space and the availability of habitable planets. Ehrenfreund and Menten review the range of organic molecules found in interstellar clouds and circumstellar shells, and present evidence that “a substantial fraction of the Earth’s prebiotic inventory of organic molecules and water may have been of extraterrestrial origin”. Udry and Mayor recount the dizzying progress of the last 6 years, describing how Mayor and Queloz’s discovery of the extrasolar planet orbiting 51 Pegasi has been followed by the detection of a total of 63 objects with minimum mass below 10 Jupiter masses. Their article gives particular detail to recent announcements by their Geneva group. Franck *et al.* present plots that show the estimated habitable zones around main-sequence stars as a function of central star mass, while Horneck *et al.* consider whether viable microbes could have spread from planet to planet.

The next section is concerned with the importance of water to living organisms. Brack describes several possible contributions made by water to the origins of life, while Jaumann *et al.* describe the increasing evidence of water-related erosion on Mars. Greenberg *et al.* discuss the evidence for a thin-ice rather than thick-ice covering on Europa, and the consequent creation of habitable niches. Gilichinsky considers the extent to which permafrost may be a model for extraterrestrial situations, a theme extended by Wagner *et al.* Stackebrandt and Brambilla, meanwhile, describe results from Antarctic Cold Lakes, setting the stage for future investigations of Lake Vostok. Stetter and Kunte *et al.* consider heat-seeking (hyperthermophilic) and salt-seeking (halophilic) organisms.

The third section returns to physics, and the effect of ionizing radiation on the viability of life, both on planetary surfaces, and being transported across space in scenarios such as those

discussed earlier by Horneck *et al.* Lammer *et al.* discuss how recent evidence for Mars once having had an intrinsic magnetic field of 10–100 % of the present Earth affects the rate of loss of the Martian atmosphere and the shielding of its surface from cosmic rays and UV. Cockell compares the UV radiation environment of Earth and Mars, while Wynn-Williams and Edwards describe how terrestrial organisms living in extreme environments use protective and photosynthetic pigments to minimize UV damage, motivating the use of laser Raman spectroscopy to determine the presence and position of such pigments. Baumstark-Khan and Facius describe the effect of the space radiation environment on life, while Braucker *et al.*, Schnabl, and Anken and Rahmann discuss the importance of gravity to cells, plants and animals, respectively.

The final section on Complexity, is introduced by a summary of recent developments in the theory of complex systems, by Perez-Mercader, while Heckl discusses molecular self-assembly and Schidlowski describes the search for fossil life in extraterrestrial locations.

This book is a comprehensive summary of a fascinating area. It is not clear how well it will appeal to the interested laymen mentioned in the introduction, this will I think depend on how they feel about phrases such as ‘ $m_2 \sin(i) < 17M_{Jup}$ ’, but its main target seems to me to be well served. My only real concern is the issue touched on by Baruch Blumberg in his introduction, where he notes drily that when testing for life in space (as elsewhere in science) “it is easier to maintain an unbiased view if both outcomes ... [of a hypothesis test] ... are interesting”. An example of this is the extensive discussion by Perez-Mercader of self-regulating ‘complex’ systems as the origin of power-law behaviour in nature, with much less attention being paid to the less ‘interesting’, though no less important, power-law aspects of random walks (for a discussion in the context of queues in the UK’s National Health Service see Freckleton & Sutherland, *Nature*, 27 September 2001, page 382; a much more detailed review is given by Didier Somette in another excellent recent Springer book, *Critical Phenomena in Natural Sciences*). However astrobiology challenges science in unique ways, in particular the well-known problem of identifying life when we only have one prototype to work from, and I’m sure that newcomers to this field and established workers will both find this book very rewarding.

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