# An introduction to astrobiology

**by Iain Gilmour & Mark A. Sephton (Eds.)**

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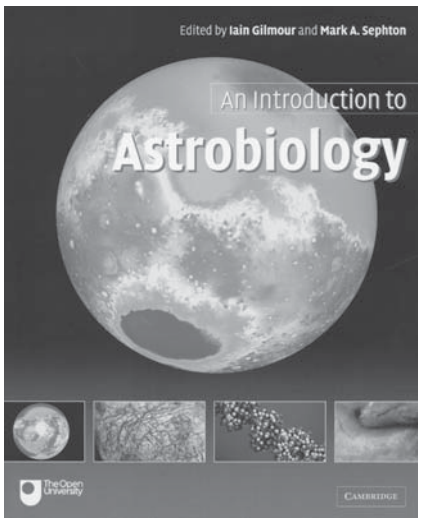
The authors of this book are to be congratulated on bringing scientific rigour to the concept of 'astrobiology'. What is astrobiology? The name seems to imply biology beyond the Earth; but many scientists remain unconvinced by a 'science' that does not evidently have any object of study. One wonders whether it has any more content than that famously disappointing article in *Nature* a few years ago entitled 'Progress in the search for extraterrestrial intelligence'. Nor does the origin of the name inspire confidence. According to Thomas Dobbins and William Sheehan (*Sky & Tel*., 2003 June, p.28, 'Mars Mania 1956'), the name was coined by a former Nazi scientist who devised decompression chambers to simulate Mars, having earlier been director of a Luftwaffe institute which used them for lethal experiments on prisoners.

Nevertheless NASA, under the maverick leadership of Daniel Goldin and the slogan 'Follow the water', has made astrobiology one of its main scientific themes. NASA's Astrobiology Institute, they say, 'seeks answers to these fundamental questions: How does life begin and evolve? Is there life elsewhere in the Universe? What is the future of life on Earth and beyond?' The first two, at any rate, are susceptible to scientific investigation, and NASA's well-focused programme, with its large budget and its internet institute, has made remarkable progress in discovering environments that might indeed have supported life, on Europa and on Mars.




To find a scientific basis and agenda for astrobiology, one could not do better than this book. It is one of a series of Open University textbooks on planetary sciences, and thus carries the imprint of the OU's expertise in relevant areas, ranging from organic matter in meteorites to the design of the experiments on Beagle 2. It also brings together authoritative contributors including John Zarnecki (Mars and Titan), Dave Rothery (icy moons), and Andrew Conway and Barrie Jones (exoplanets).

At first, one might be concerned that the authors accept a definition of life as 'a self-replicating chemical system capable of undergoing Darwinian evolution'. This definition does have the appealing corollary that it excludes creationists as well as crystals. But while self-replication is an obvious defining property of life, surely most people can recognise life without knowing anything about evolution, Darwinian or otherwise. I would prefer the second criterion to be 'capable of organising materials from its environment in a complex way to support its replication'. However, such definitions are moot as long as there is nothing to study other than life-as-we-know-it; and indeed, the authors thereafter focus solely on the prospects for life based like us on carbon and water, which is the only kind of life that we can consider scientifically at present.

The book focuses on the conditions under which life arose on the early Earth, and on aqueous conditions on other planetary bodies which might support life. It remains scientifically coherent by not rambling into other areas such as early terrestrial evolution, astronaut medicine, life-as-we-don't-know-it, or galactic empires. After a superficial overview of terrestrial biochemistry, the other chapters give thorough accounts of the possible environments on Mars, Europa, Titan, and exoplanets (planets orbiting around other stars). These include balanced accounts of topics such as the *Viking* biology experiments and the Martian meteorite ALH84001, and a good clear account of spectroscopic analysis of planetary atmospheres. Surprisingly, in view of the editors' expertise, there is very little about comets or carbonaceous meteorites, which may well harbour precursors of life. However, there is a brief concluding chapter on the search for extraterrestrial intelligence by means of radio signals.

Although this is a textbook, it is accessible for all BAA members. The text is always clear; there are definitions in the margins; there are many questions and answers (indeed, some of the most interesting discussions are in the 'answers' at the back); and all mathematics is confined to separate boxes or exercises. There are plenty of clear and colourful diagrams, and excellent images with preference for the most illuminating rather than the most familiar ones. So one can compare *Galileo* images of Europa with a radar image of Antarctica's Lake Vostok; gullies on Mars with gullies on Mt St. Helens; and purported fossils in the infamous Martian meteorite with similar structures produced on Earth by inorganic chemistry.

The book is up to date, at least to 2003. Of course, 2004 has been an *annus mirabilis*, with the stunning success of the Mars Exploration Rovers (especially *Opportunity* which has revealed that the thick layers covering Meridiani Planum were formed as sediments in water); the pickup of cometary samples by *Stardust*, now on its voyage home; the imminent probing of Titan by *Cassini* and *Huygens*; and new discoveries of exoplanets by means of microlensing, possibly in more habitable zones than those discovered earlier. So even if no life has yet been found, the science of potentially habitable planets is advancing much faster than many of us had dreamed it could.

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