BOOK REVIEWS

Mars and the Development of Life, Anders Hansson, Second Edition, John Wiley and Sons. xx+208 pp., £19.95 paperback, £45.00 hardcover.

This book is a 1997 update of information about the planet Mars, exploration of Mars, possible life on the neighboring planet and a number of other topics about the solar system, and the origin of life. Packing all of this into 218 generously illustrated pages, of necessity, makes this a collection of essays and mini reviews of relevant material. Chapter 1 includes a chronology of past Mars missions and a discussion of the Viking results. This is followed in Chapter 2 by a somewhat conventional discussion of biogenesis. Chapters 3 and 4 deal with a series of biophysical perspectives. Chapters 5 and 6 are a somewhat speculative discussion of clay and water. The remaining chapters then move to Martian life, real and virtual, past and future. The book concludes with a discussion of policy and politics of Martian exploration and future uses of the planet.

This is an evenhanded review as the author weaves his way through often very divergent views. Since much of the science is, of necessity, uncertain it is well to have all views represented. The subject material is in a state of rapid flux so that this work stands as a current report. One might think of it as a Mars Almanac, a function which its serves well. Hansson is an advocate for the future of the study of Mars, and his enthusiasm shows through in every chapter. For anyone wanting to know, what's new on Mars, this book is a good place to begin.

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Chemical Evolution: Physics of the Origins and Evolution of Life, Proceedings of the 4th Trieste Conference on Chemical Evolution, Trieste, Italy, 4–8 September 1995. Kluwer Academic Publishers, 1996, $190.00 (US)
Edited by Julian Chela-Flores and François Raulin.

The 4th Trieste Conference on Chemical Evolution which took place in September 1995 was dedicated to the memory of Cyril Ponnamperuma. It was really a nice gesture to dedicate the symposium to a scientist who showed so many captivating

qualities. He was a preeminent member of the first generation of pioneers who opened the experimental approach of the origin of life and exobiology. Originally from a country lacking in strong scientific traditions, he spent much time and energy promoting science within the Third World. He initiated the Trieste Conferences on Chemical Evolution and the Origin of Life and co-organized the first three events. Excerpts from letters read at the conference and addresses from scientific academies and foundations of which Cyril was a member are presented in the last chapter and testify the worldwide influence of Cyril Ponnamperuma.

The scientific contributions to this volume are assembled into ten sections. The physical aspects of the origin of life was chosen as a general guideline. This is not an obvious way to arrange the papers since the real continuity is given through the chemical nature of organic compounds. In Section 1, two pioneers in the field, Juan Oro and Sidney Fox, have been honored. Juan Oro retraces the whole story from the Big Bang to life in the Universe with his usual talent. Sidney Fox gives the history of the thermal copolyamino acids. Everybody in our scientific community will mentally temper Sid's enthusiasm when reading the chapter. However, for readers not very well up on the subject, claims that thermal polymers can carry out the crucial act of self-organization to cells having the essential properties of protoneurons could be misleading , if taken literally.

In Section 2, entitled 'Origins', George Coyne brings arguments for a Universe in evolution, including Big Bang cosmologies. Mayo Greenberg and Aigen Li present interesting IR absorption features analogies between the diffuse cloud interstellar dust and laboratory photoprocessed low temperature ices exposed to long term solar ultraviolet radiation in Earth orbit. The model core-mantle particles proposed for interstellar dust along with the possible presence of chiral organic molecules and the fluffy structure, may provide an adequate environment for prebiotic chemical evolution within the comet dust particles. The paper by Jean Schneider on strategies for the search of life in the Universe closes this broad section of the book. The author enumerates requirements to help define what could be recognized as life and describes tools to detect habitable planets.

Section 3, 'From geophysics to prebiotic chemistry', contains a diversity of contributions including the description of the West Greenland oldest fragmentary record of terrestrial surface environments (S. Moorbath and M. Whitehouse), a review on clays as natural catalysts in prebiotic processes (A. Negron-Mendoza, G. Albarran and S. Ramos-Bernal), an inventory of transient and stable molecules in chemical evolution (Mohindra Chadha) and the role of lightning associated to Archean volcanic ash-gas clouds in prebiotic synthesis (R. Navarro-Gonzales, V. Basiuk and M. Rosenbaum).

Section 4 presents physicochemical aspects of the origins of life. The bioenergetics of inorganic pyrophosphate and of adenosine triphosphate in biological energy conversion and in prebiotic evolution are outlined by Herrick and Margareta Baltscheffsky. According to M. S. Kritsky, M.G. Vladimirov, V.A. Otroshchenko and V.A. Bogdanovskaya, pyrite minerals could have participated in the synthesis

and evolution of organic matter via electrochemical processes. In a paper entitled 'Thermal peptides as the initial genetic system', Aristotel Pappelis and Sidney Fox argue that self-ordering of amino acids during the thermal protein synthesis resulted in the first genetic system when thermal proteins self-organized to form protocells. According to Benoît Prieur, the formation of RNA occurred by chelation of the sugars with heavy cations. In the following paper, the author gives a possible synthesis of fatty acids from sulfur ylides.

Section 5 contains general biophysical aspects of the origins of life. In 'Oxygen and the rapid evolution of life on Mars', Chris McKay speculates that Mars may have been more readily oxidized than the primitive Earth, thus accelerating oxygenic photosynthesis, endosymbiosis and multicellularity. In 'First steps in eukaryogenesis', Julian Chela-Flores discusses the origin and evolution of chromosome structure with a special attention devoted to chromosome inactivation. Joseph Seckbach presents open questions in eukaryogenesis and proposes that some unicellular primitive algae may have been among the nucleated pioneers. The three following papers concerns the thermodynamic approach of the origin of life. Georgi Gladyshev presents a macrothermodynamic model describing the evolution of supermolecular structures and chemical composition of living objects in the course of ontogenesis and at long periods of biological evolution. Koichiro Matsuno suggests that a process enhancing energy concentration locally in addition to that of synthesizing prebiotic molecules could have constituted an evolutionary significant event on the primitive Earth. Finally, L. Moiseeva elaborates on open catalytic systems to understand the early stages of the emergence of life.

Section 6 is devoted to the very important problem of biomolecular chirality. David Cline discusses possible physical origins of homochirality (one handedness) in life including fundamental interactions, amplification through bifurcation processes and the possible influence of these effects in presolar dense molecular clouds. Curiously, the two following papers have no direct connection with chirality. J. Wu, H. Jin and W. Wenqing describe the two excited states obtained when tributylphosphate is subjected to photolysis, gamma-radiolysis and pulse radiolysis and their possible role in chemical evolution. For Yu-Fen Zhao and Pei-Sheng Cao, the co-evolution of nucleic acids and proteins was achieved through the self-assembly of N-phosphoamino acids in the presence of nucleosides. Chirality reappears in the last paper by A. Bakasov, T.-K. Ha and M. Quack who propose an improved ab initio calculation of the parity violating interaction energy in chiral molecules. They obtain energies 1-2 orders of magnitude larger than those obtained with the previous calculations.

Evolutionary aspects are presented in Section 7. In a paper entitled 'Prebiotic chemical evolution and Darwinian revolution', Frederick Eirich proposes a model scenario reconstructing a plausible sequence of events supposed to have begun in the prebiotic era and led to the development of cells capable of Darwinian evolution. Model scenarios are always a little bit frustrating for a bench chemist because their authors just added what they need, when needed. In the

second paper, Florence Cerceau-Raulin presents 'la Grande Galerie de l'Evolution' in Paris. Wonderful example of science popularization, its description is refreshing. Two papers deal with information theory in Section 8. In 'New approaches in mathematical biology: information theory and molecular machines', Thomas Schneider uses classical information theory to study genetic systems. K. Tahir Shah, in 'Information-processing genes: Molecular biology in the computational paradigm', reviews various models of information processing by macromolecules and presents progress in the model of information processing genes. After several attempts to understand these two papers, the reviewer must confess that he is unable to judge their pertinence.

Some relaxation after the two preceding papers is provided in Section 9 which offers two straight forward papers on 'Communications'. Frank Drake recommends important technological improvements of SETI systems including the Project Phoenix. Jean Heidmann proposes that crater Saha on the farside of the Moon be protected as dedicated implementation zone for SETI.

Section 10 is devoted to instrumentation in exobiology and Mars exploration. Francois Raulin and 8 co-authors present the Cassini-Huygens mission to Titan and the Rosetta mission to a comet aimed to study large-scale organic chemical processes which take place in their natural environment. The search for homochirality is documented by Alexandra MacDermott and 19 co-authors. The chemical exploration of Mars is studied by three Japanese laboratories. A strategy for the detection of bioorganic compounds on Mars is proposed by Kensei Kobayashi and 4 co-authors while the Martian soil analysis is described by Y. Ishikawa, K. Kobayashi and T. Saito.

In summary, the book has both scientific interest as well as a sentimental character because of Cyril Ponnamperuma. The scientific interest is not always topical and the referees should have been more critical in some occasions. The book cannot be read straight forward as one would a mystery thriller because of its organization, several topics being often mixed together. Nevertheless, it constitutes a helpful vehicle for the broad scope of scientific information contained in most of the papers.

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Exploration of Mars was put on hold for more than two decades. When examination of the planet resumed, scientists focused more on the search for habitable environments than for life, and specifically on the search for water. The slew of rovers, orbiters, and landers revealed evidence of water beneath the crust, hot springs â€” considered an excellent potential environment for life to evolve â€” and occasional rare precipitation.Â The idea of such seeding is not limited to interactions with Mars. Some have proposed that debris from outside the solar system could even be responsible for spawning life on Earth. But in terms of the Red Planet, it is possible that scientists might one day find life on Mars â€” and it could be a close relation. The possibility of life on Mars is a subject of huge interest in astrobiology due to its proximity and similarities to Earth. To date, no proof has been found of past or present life on Mars. Cumulative evidence shows that during the ancient Noachian time period, the surface environment of Mars had liquid water and may have been habitable for microorganisms. The existence of habitable conditions does not necessarily indicate the presence of life. Early highlights of Mars missions include NASA's Mariner 4 spacecraft, which swung by Mars in July 1965 and captured the first close-up images of this foreign world. In 1971, the Soviet space program sent the first spacecraft into Martian orbit. Called Mars 3, it returned roughly eight months of observations about the planet's topography, atmosphere, weather, and geology.Â They also revealed some truly dramatic features: the small world boasts the largest volcanoes in the solar system, and one of the largest canyons yet discoveredâ€”a chasm as long as the continental United States. Dust storms regularly sweep over its plains, and winds whip up localized dust devils. In 1976, NASAâ€™s Viking 1 and 2 became the first spacecraft to successfully operate on the planetâ€™s surface, returning photos until 1982. 2004: Twin Mars Exploration Rovers named Spirit and Opportunity are dispatched to do scientific experiments, finding evidence that long ago Mars had liquid water on its surface. 2006: Mars Reconnaissance Orbiter sends back images of Mars that are high-resolution and studies the Mars seasonal changes and water history of Mars. 2008: Phoenix mission presence of liquid water and good soil chemistry as part of its mission for potential future habitation.Â Of all of the planets in the solar system, only Earth has confirmed life and Mars is believed to possibly be hospital for life. Earth and Mars are the only to planets in the solar system with polar ice caps. Mars does have seasons but they are twice as long as the seasons on Earth due to Marsâ€™ axis tilt.