COMMENTARY

CONGRESS REPORT ON THE 7TH INTERNATIONAL CONFERENCE ON THE ORIGIN OF LIFE, MAINZ (F.R.G.) 10 – 15 JULY 1983

The 7th Conference on the Origin of Life marks a 25-year-period of meetings that started with the "Symposium on the Origin of Life on Earth" in Moscow 1957, followed by conferences in Wakulla Springs (1963), Pont-à-Mousson (1970), Barcelona (1973), Kyoto (1977) and Jerusalem (1980). In the 70's, ISSOL (the International Society for the Study of the Origin of Life) evolved from an informal and spontaneously organized group of scientists who came from various disciplines between astronomy and biology and who had become more intensively involved in the research of the fascinating problem of how living systems came into existence from abiotic sources on Earth and/or elsewhere. Oparin's classic works had served in the beginning as a guideline; similar milestones were Urey-Miller's electric discharge experiments with methane-ammonia-water-hydrogen mixtures, the discoveries of the oldest living cell remnants in more than 3 billion-year-old sediments, the search for biotic matter on Moon (Apollo) and Mars (Viking), and other activities. On the occasion of the last triennial conference in Jerusalem (1980), the Society under the presidency of the late Professor Egami had voted unanimously for the Federal Republic of Germany as the country for the 1983 meeting. Mainz was selected by K. Dose (University of Mainz) and W. Thiemann (University of Bremen) to host the Congress to be held in the Electoral Palace from 10 – 15 July 1983. More than 250 scientists from all parts of the world contributed to the success. The main topics discussed in Mainz were arranged into 6 sessions:

- Cosmology and Cosmochemistry (Interstellar Clouds, Stellar Evolution, Planetary Surfaces and Atmospheres, Comets, Meteorites)
- Geology and Geochemistry (Early Paleontological Record, Ancient Sedimentary Habitats of Life, Evolution of the Environment)
- Simulation of Chemical Evolution in the Laboratory (Small Molecules, Macromolecules, Prebiotic Synthesis, Origin of Chirality)
- Theory on the Origin of Life: The Origin of Biological Information
- Biological Evolution: Energy Conversion
- Space Missions and Exobiology: Life under Extreme Conditions

A standing tradition in the history of the Society meetings was to exclude parallel sessions in order to emphasize the interdisciplinary character of the meeting by

encouraging all participants to attend each topical session. To realize this goal only introductory lectures were allowed for each topic given by reputed colleagues in the field, while other issues were presented within symposia with ample room for discussions and poster sessions.

From the admittedly rather biassed view of the writer these were the most fascinating topics that have stirred the progress of this rather young science: (1) 'Chemical' – or in the term preferred by the majority of the participants: 'pre-biological' – evolution, i.e., the period starting from atoms and small molecules abundant in the Universe and on Earth until the appearance of the first biological cells, cannot be understood without the dynamic approach introduced by the physico-chemical disciplines as outlined in an examplary overview by P. Schuster. (2) Surprisingly complex organic molecules have been formed in interstellar matter and are abundant in the whole Universe (Irvine, Greenberg, and others); they must hence be considered as the true precursors of life in the Universe. (3) The earliest sediments found so far on Earth in Isua, Greenland may contain cell-like structures which are considered by some as intermediates between pre-biological and biological structures (Schopf, Pflug, Schidlowski, and others). (4) Fundamental new insights into the evolution of information bearing molecules and their spontaneous accumulation of negentropy during terrestrial processes have been gained by impressive laboratory experiments by S. Fox, S. L. Miller, J. Ferris, L. Orgel, A. Brack, K. Dose, and others, including chemical in-vitro simulations of nucleotide-peptide interactions and clay-organic molecules interferences (Paecht-Horowitz, Cairns-Smith). (5) The prebiotic event of the acquisition of chirality (handedness) will stay still in a not-understood status, although interesting theories and experimental attempts have been presented and discussed vividly by several authors (Bonner, Keszthelyi, Rich, Zitzewitz, Thiemann, and others). This issue still presents one of the most challenging puzzles in the origin of life debate, – in spite of the large efforts invested into the solution of this enigma. Some people claim the dispute will be settled within the next 7 years or so, by either knowing the answer or discarding the whole matter as on experimentally not solvable problem: Parity violation in Weak Interaction as the driving force of the 'left-handed creator', physical fields (electric/magnetic), or pure stochastic processes, that is the question! (6) Space missions for the search for life outside the Earth up to the ambitious goal of a 'Mars Returned Sample Mission' have by no means lost their scientific fascination as outlined among other programs by De Vincenzi in the name of NASA. It was regretted that the European counterpart (ESA) could not engage in these projects, bound by constitutional and technical restraints put forward by the European sponsoring states.

In summary it may be concluded that one may never reach the zealous goal raised by the Society to solve the 'Origin of Life' although impressive steps forward toward the aim have been gained since the publication of Oparin's idea; however needless to say the search for the truth may be the essential part of Science as such and worth the sweat of the scientists.

The generous financial support granted by the ISSOL membership, the Deutsche Forschungsgemeinschaft, the Deutscher Akademischer Austauschdienst, the State of

Rheinland-Pfalz, the City, and the University of Mainz, and various private companies shall be mentioned here, without which this conference had not been realized. The donation of Herbert M. Phillips is very much appreciated which provided travel grants for five young scientists who otherwise would have been unable to attend the Congress.

The Oparin Medal award initiated and granted for the first time in 1980 to C. Ponnamperuma was awarded to S. L. Miller for his pioneering work in the simulation of Chemical Evolution through electric discharge experiments. The complete proceedings of the conference will be published as a two-volume special supplement to the journal *Origins of Life*. The San Francisco Bay area was selected by the ISSOL membership as the location for the 8th ICOL to be held in 1986.

Bremen, 25 July, 1983 WOLFRAM H. P. THIEMANN

IMPRESSIONS OF THE 7TH ICOL

The 7th ICOL in Mainz in 1983 was a watershed meeting for those studying the origins of life. Stanley Miller's classic studies on the electric discharge synthesis of amino acids were recognized by his being awarded the Oparin Medal by ISSOL. At this meeting he presented additional experiments, in which he examined the limits of amino acid synthesis in gas mixtures that model less reducing atmospheres on the primitive Earth. Miller's work and that of others studying the impact of discharge and other high energy sources on a variety of model atmospheres clearly demonstrates that examples of contemporary biomolecules are formed in discharge experiments performed under a variety of reaction conditions.

The emphasis in origins of life research has now shifted to the question of the polymerization of monomers. The initial success of Orgel and his coworkers in the template-directed synthesis of polyribonucleic acid derivatives of defined structure is an important start on the aqueous solution phase polymerization of biomonomers. Orgel is the first to point out that his chemistry is not currently being performed under 'prebiotic conditions' but it should also be noted that his conditions are not so far removed from those postulated for the primitive Earth conditions that it may be possible for him to achieve that goal rather soon. The theoretical studies of Schuster and Eigen, in which RNA strands similar to those prepared by Orgel are considered as the starting point for the first self-replicating system, also point to a promising area of research. In the past, the theoretician and experimentalist were working almost totally separated from each other and with negligible mutual benefit. It is very encouraging that these two groups are working in areas which are sufficiently close to each other that productive interactions are feasible.

An explanation for the origin of the genetic code based on anticodon-amino acid interactions has been developed by Lacey, Mullins and coworkers on the basis of binding studies. Here is an area in need of a more sophisticated theory to correlate

binding, activation and reaction of the amino acids and the nature of the primitive t-RNA. The simple hydrophobicity-hydrophilicity considerations first proposed by Woese in 1966 were sufficient for bringing the question of the origin of the code to this stage of development but a more elaborate theory is now required.

Ideas of potential importance in the future includes incorporation of cofactors into RNA to direct its replication and to serve as simple enzymes, an idea originally suggested by H. B. White, was elaborated by Visser at the Mainz meeting. Some experimental tests of this idea seem feasible with the recent developments in the chemical synthesis of nucleic acids. Another area of importance is the selective reaction of biomolecules in a mixture of the biological and non-biological molecules formed in primitive Earth simulation experiments. The initial results of Brach, Dose and Usher indicated that it may have been possible to select one structural type (e.g., α-amino acids) or enantiomer from the prebiotic soup.

The minimal participation by some of the disciplines which constitute the field of chemical evolution was noted. Very few reports on early biological evolution were presented. This will become an even more fruitful area of origins of life research now that research on the polymerization of biomolecules is proceeding so well. Work in evolutionary biology will also help the prebiotic chemist to more clearly define synthetic objectives. Hopefully these scientists will return to the fold at the San Francisco Meeting. Extensive participation by the astronomical and astrophysical community, whose contributions are needed to define the boundary conditions for primitive Earth scenarios, was also lacking.

Finally, it should be noted that a number of 'prophets' of doom and/or hope were wandering the halls of the Electors Palace in Mainz. Some were very critical of one approach (e.g., nucleic acids first) while others suggested alternatives to the conventional thinking. Cairns-Smith can be placed in the latter category. But, his 'clays-first' hypothesis has almost as many converts as the 'nucleic-acids-first' and 'proteins-first' camps so that he can now be considered as part of the origins of life establishment.

JAMES P. FERRIS