THIRD INTERNATIONAL CONFERENCE ON THE ORIGIN OF LIFE, PONT-À-MOUSSON, FRANCE, APRIL 20-25, 1970

(Conference Report)

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All people like to enjoy themselves. If any of the delegates at the recent Third International Conference on the Origin of Life (April 19–25, Pont-à-Mousson, France) did not enjoy themselves, it was certainly not the fault of the co-organizers of the conference, Professor René Buvet of the University of Paris and Dr. Cyril Ponnamperuma of NASA's Ames Research Center and Stanford University. The organizers are to be congratulated for their superior handling of this international meeting. The hospitality of the French people was appreciated by all. Accommodations as well as scientific sessions were all located in the Centre Culturel de l'Ancienne Abbaye des Prémontres at Pont-à-Mousson, which is situated on the Moselle River in the province of Lorraine. Ninety-two participants from 18 countries were in attendance.

The introductory session consisted of a historical review by Academician A. I. Oparin on the scientific problem of the origin of life and a discussion by M. Florkin on the progress which has been made in paleobiochemistry. This was followed by a session which stressed thermodynamic considerations for prebiological evolution. Madame A. Babloyantz presented an interesting mathematical analysis for biological 'flip-flop' phenomena which are best exemplified by the changes in membrane potential which occur in neuronal impulse transmission. H. J. Morowitz discussed the probability for organization in far-from-equilibrium systems and H. H. Pattee talked about the importance of linking functionality to spontaneous structuralization. R. Buvet proved himself to be very much *le professeur plus* by his engaging presentation of possible primordial archetypes of present-day biological reactions.

The report of Madame A. Amariglio on her negative results in attempts to resolve racemic mixtures through the mediation of optically-active quartz crystals sparked a lively discussion by members of the audience on the relevance of many experiments which have been conducted for the purpose of explaining the origin of optically-active molecules. Madame Amariglio maintained that the optical activity which some investigators have observed in such quartz-mediated experiments was due to finely divided quartz particles which remained in suspension and could be removed by centrifugation.

The session on syntheses of small molecules began with the reporting of some rigidly conducted and rigorously analyzed experiments by G. Toupance of the Uni-

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versity of Paris, on the products formed in the primordial gas mixtures which contained varying amounts of oxygen. M.S. Chadha described the unique experiments being conducted at NASA's Ames Research Center on the chemistry of simulated Jovian atmospheres. The volatile fractions from these experiments had been previously shown to contain aminonitriles. Chadha identified several of the components from the acid hydrolysate of the non-volatile viscous fraction as amino acids. The identifications were based on GLC retention times and the mass spectra of the *N*-trifluoroacetyl-*n*-butyl ester derivatives. In a related paper H. Noda reported work from the same laboratory suggesting that the viscous material was a polymer resulting from the aminonitriles and may have a relationship to the colors on the planet Jupiter. Madame T. E. Pavlovskaya presented a summary of the experiments in which volatile low molecular weight aldehydes had been used as the substrates in simulated abiogenic syntheses. S. L. Miller discussed the syntheses of the aromatic amino acids tyrosine and phenyl-alanine and of tryptophane and cysteine. A. R. Hochstim presented a theoretical discussion on the synthesis of organic matter by the atmospheric shock waves which could be produced by meteorite impact. A. Bar-Nun presented some experimental evidence in support of this theory. L. Orgel outlined work in his laboratory leading up to the template synthesis of oligonucleotides.

There was unusual interest at this conference on the subject of phosphorylations. Five papers were presented in that session. The role of orthophosphates in the possible origin of condensed phosphates and the phosphorylation of nucleosides was discussed by C. Ponnamperuma. The presentations by I. S. Kulaev and H. Baltschefsky on the role of inorganic polyphosphates in the evolution of phosphorus metabolism were enthusiastically received. Kulaev has established that many contemporary microorganisms possess an enzyme which catalyzes the transfer of phosphate from 1,3-diphosphoglyceric acid directly to high molecular weight polyphosphate rather than to ADP to form ATP. Some microorganisms have also been shown to possess polyphosphoglucokinase activity. This enzyme catalyzes the transfer of phosphate from polyphosphate directly to glucose to form glucose-6-phosphate without the participation of ATP. Kulaev is of the opinion that the chemical characteristics of polyphosphates provided a polyfunctionality to emerging life-forms which were later superseded by more sophisticated organic polymers. Baltschefsky reported the participation of inorganic pyrophosphate in the light-induced energy transfer reaction in the photosynthetic bacterium *Rhodospirillium rubrum*. These reactions may be considered to be 'metabolic fossils'. N. W. Gabel described how under dilute aqueous conditions, polyphosphate chains, alkaline earth cations, and alkali metal cations form a metastable, macromolecular coordination complex capable of exhibiting excitation phenomena similar to viable neuronal membranes. M. Halmann presented a thorough mechanistic study of the cyanogen mediated phosphorylation of D-glucose in dilute aqueous solutions. The main product is the natural α-D-glucopyranose-1-phosphate. Halmann proposed the formation of a cyclic transition state involving both the glycosidic hydroxyl group and the cyanogen-phosphate adduct to explain the product distribution.

F. Lipmann reported the recent research of his collaborators on what may be a primitive process of peptide synthesis. Their particulate-free bacterial extracts contained a polyenzyme system for the synthesis of Gramicidin S which was not inhibited by any of the known inhibitors of ribosomal protein synthesis and was not destroyed by predigestion with pancreatic ribonuclease.

The earliest evidence for life as shown in the microfossils of the Fig Tree series (over 3×10^9 years old) was illustrated in a series of dramatic slides by E. S. Barghoorn of Harvard University. Lynn Margulis of Boston University discussed a provocative yet logical approach to the origin of the Eukarotic cells. The possibility that complex organic matter is of extraterrestrial origin was discussed by V. G. Fesenkov, P. C. Sylvester-Bradley, and G. P. Vdovykin. V. A. Otrotchenko and R. S. Young described the proposed efforts of the search for extraterrestrial life in the space programs of the U.S.S.R. and the U.S.A. G. Eglinton summarized the analysis of the lunar samples from Apollo 11 and K. Biemann gave a lucid explanation of the instruments which have been designed for *in situ* analyses of planetary surfaces.

This correspondent is indebted to B. Durand of the Institut Français du Pétrole for conducting an informal opinion poll of the many young European graduate students and scientists who attended the conference to listen and learn. They felt that the organization of the conference was very good (a credit to Drs. Buvet and Ponnamperuma) and that such rare occasions as this meeting in which there was a convergence of so many different specialties to examine an important scientific problem should be more frequent. There was a good general level of communication and they are optimistic about future research in this area. On the negative side, they found that very few strikingly new ideas were put forth, especially on the question of precellular organization. They would have liked to have had the session on membranes expanded with more explanatory background being given to this area. They also felt that the thermodynamic approach to the problem with emphasis on statistical probability should be further developed. In general they enjoyed the conference and would have liked to have seen more NASA films and hear more talks on the general aspects of exobiology. They were fascinated by the U.S. space program and felt a little sad that they could not participate in it.

An International Society for the Study of the Origin of Life was inaugurated. Academician Oparin was acclaimed President. A group of 15 was nominated by those present to assist the president in setting up the new society: Akabori (Japan), Bernal (U.K.), Buvet (France), Dose (Germany), Eglinton (U.K.), Florkin (Belgium), Fox (U.S.A.), Krasnovsky (U.S.S.R.), Kreps (U.S.S.R.), Miller (U.S.A.), Ponnamperuma (U.S.A.), Rutten (Holland), Sylvester-Bradley (U.K.) Urey (U.S.A.), and Young (U.S.A.).

Before the closing address of the conference, Sylvester-Bradley suggested that since the meeting was being held in an abbey, the delegates should acclaim Academician Oparin as their Father abbot. In his valedictory speech, Oparin outlined the development of thought and the changes of approach to the problem of the origin of life which had occurred between the first conference in 1957 in Moscow and the present

one at Pont-à-Mousson. At the first conference there was a great deal of enthusiasm but the delegates were perhaps overly confident about the solution to the problem. At the third conference the enthusiasm was still there, but there was more skepticism and introspection. This he believed was good. The ceremonies closed with a dinner *à l'ancienne. On nous a donné, en France, un accueil sans égal.*