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## FROM A DROP IN THE OCEAN?

### The Chemical Origin of Life

By Alexander I. Oparin. (A Monograph in American Lectures in Living Chemistry.) Pp. xxvii + 124. (Springfield, Ill.: Charles C. Thomas, 1964.) 6.75 dollars.

OPARIN has already made outstanding contributions to the most fundamental problem of biology, and *The Chemical Origin of Life* summarizes the present state of his thinking. Apart from being profound scientifically, it is scholarly in range and style, and it has the touch of poetic inspiration which belongs to all the best science.

Oparin observes that "the origin of life is an inalienable part of the general orderly process of development of the Universe in which each successive stage is inseparably bound up with the one before and can only be understood in the light of a study of that predecessor". Consistently with this view he devotes his first chapter to a broad description of astronomical and geological dating, the evolution of different stellar types, the origin of elements, and the formation of the Earth. About $2 \times 10^9$ years ago it probably possessed an atmosphere containing water vapour, hydrogen sulphide, ammonia and hydrocarbons, but no significant amount of oxygen. The atmosphere as we know it to-day is perhaps about half this age, and came into being by the action of various forms of life.

The second chapter is devoted to the way in which organic compounds were built up on the primeval Earth under conditions when the ultra-violet radiation was much more intense than now (in the absence of an ozone screen) and when there were no micro-organisms to devour the compounds which might be formed. The main reason, as Oparin remarks, why life cannot now arise *de novo* under natural conditions is that it has already arisen. To form an idea of the course of events, therefore, it is no good looking for evidence left over from the past, but we must rely on reconstruction experiments in the laboratory. These, in fact, show that compounds like amino-acids can be formed by the action of silent electrical discharges on mixtures of methane, ammonia, hydrogen and water vapour; thence in various ways of which analogues are known, optical asymmetry could have arisen. Elaboration and polymerization of the primary organic compounds can also be envisaged, and this now includes the possibility of non-enzymatic synthesis of polynucleotides. The various kinds of model experiment are discussed in some detail.

At the beginning of Chapter 3 we have reached by purely abiogenic means a 'nutrient broth' containing organic compounds similar to those which build up living matter to-day. How do self-reproducing organisms arise in this organic chemical free-for-all? Oparin considers that a key step in the evolution is the formation of 'coacervate droplets' from solutions containing polymerized substances. Polymers do, in fact, separate out from aqueous media in droplets well demarcated from their environment. This boundary formation is a first essential in the evolution of individual organisms. Numerous observations and experiments on coacervate droplets of various kinds are described and in some of these systems significant biochemical reactions can be made to take place efficiently. Coupled biochemical reaction in the droplets can also be believed in, and we arrive at the stage of what Oparin calls 'protobionts'. These could increase their mass at the expense of their environment. They can incorporate extra components, catalysts and so on. Presently an element of replication is introduced when polynucleotides engage in the now well-known game of 'base pairing'. The ordering of amino-acids then becomes coupled with this. "A mechanism of this sort could, of course, only have arisen in the course of the prolonged evolution of living systems. However, we now have fully grounds enough for believing that even at far earlier stages of the development of organic matter, the inclusion of polynucleotides in coacervate droplets or protobionts had a certain effect on the polymerization of the amino-acids in those systems". It must have needed some luck even in $10^9$ years. But Oparin's case, even if there are passages of superficiality, is well argued and, on the whole, well documented.

Chapter 4 covers a wide range of biochemical facts in a discussion of the course which the further evolution of the first living organisms may have taken, a central thesis being that the complex mechanisms known to-day must have been elaborated by a process of gradual addition and improvement.

The final section is devoted to a brief examination of geological evidence relating to the chronology of the whole story.

The book is beautifully written, and if we do not feel that all the mysteries are solved the questions are presented and much evidence is marshalled in a way which sheds real illumination. C. N. HINSHELWOOD

## PRIMATE EVOLUTION

### Evolutionary and Genetic Biology of Primates

Edited by John Buettner-Janusch. Volume 1. Pp. xiv + 327. 86*s*. Volume 2. Pp. xii + 330. 89*s*. 6*d*. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1963 and 1964.)

A NEW generation of students has moved into the field of primate research—not only new, but also a much more numerous one than we have ever known before. It makes its presence felt in ways far more novel than just the perennial debate about the relevance to human evolution of some fossil fragment which usually becomes known through the heat of partisan advocacy rather than as a result of dispassionate anatomical study. We have symposia on the behaviour, anatomy and physiology of the primates. We have new journals devoted to primate studies. Regional primate centres spring up in the United States at a cost of millions of dollars a year. Some enthusiasts are even trying to describe all this field of interest by the term 'primatology', although here we hope unsuccessfully, since this is scarcely a happy step in a far too rapidly fragmenting world of science.

The two volumes edited by Dr. J. Buettner-Janusch, and entitled *Evolutionary and Genetic Biology of Primates*, are the latest sign of this renaissance of interest in the primates. They are a valuable addition to the library of our knowledge of the mammalian order to which man belongs.

The opening chapter of Volume 1, written by the editor, describes the order and discusses its classification. It is followed by a critical and scholarly reappraisal of fossil primates deriving from Tertiary deposits, and from which we learn that more fossil genera are known in the order of Primates than in all but six of the thirty-three orders of mammal recognized by Gaylord Simpson.