mostly males, have tended to favor male-chauvinist theories. Anthropologists are all adults, and I suspect that they have favored adult-chauvinist theories also. Perhaps some young-in-heart female anthropologist could be persuaded to enlarge on G. E. Hutchinson's suggestion (*The Ecological Theater and the Evolutionary Play*, Yale University Press, 1965, pp. 91–94) that adult intelligence is an accidental and nonadaptive outcome of selection for minimal human intelligence arising as early as possible in childhood.

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A Theory of Biogenesis

Molecular Evolution and the Origin of Life. SIDNEY W. FOX and KLAUS DOSE. Freeman, San Francisco, 1972. xvi, 360 pp., illus. $16.

The title of this latest monograph on the beginnings of life suggests a general and balanced discussion of the subject as a whole. The book is better characterized as a detailed presentation of the thermal, or proteinoid, theory of origins embellished with only fragmentary excursions into other points of view. However, the authors' enthusiasm for the thermal theory is clearly based on the impressive body of experimental evidence reviewed in chapters 4 through 6. In fact, the chief merit of the book is that it presents in one continuous argument an array of carefully conducted, reproducible experiments spanning nearly the whole range of presumed prebiological events up to the appearance of microscopic structures. These "microsystems" exhibit a remarkable array of rudimentary analogs of cellular processes. In view of the considerable gap between the most complex microsystems and the simplest contemporary cells, however, the authors' direct application of such biological terms as "life-cycle," "replication," and "organism" to proteinoid microspheres is difficult to justify.

The authors stress the point that the heterogeneous, hypohydrous conditions often used in thermal experiments are more germane to prebiological evolution than the dilute aqueous model favored by other investigators. They point out that contemporary cells are not homogeneous aqueous systems but rather consist of numerous phase boundaries and hydrophobic regions. Convincing arguments are given that heat was a significant free energy source on the primitive earth (an idea which has been sharply criticized), and that specialized (for example simulated perivolcanic zones) rather than average geochemical conditions (for example the open seas) are preferable in origin-of-life research.

A major theme of the monograph is the extent to which nonrandom, internally directed ordering processes are detectable in the thermal experiments, especially in the pyrocondensation of amino acids. It is doubtful that such sequence ordering in the absence of nucleic acid represents prebiological accumulation of information as the authors imply. "Information" implies a choice among equally probable events, not simply the accumulation of order due to preferred chemical interactions. Of interest here are the recent results on primitive coding properties of microsystems containing synthetic homopolynucleotides (chapter 6). The authors claim that "conditions were found . . . which yielded for each of the four homocodonic amino acids . . . interactions suggestive of a stereochemical basis for the genetic code" (p. 231). This is sure to stimulate much critical discussion in view of the hitherto fruitless search for preferred direct interactions between amino acids and their respective codons.

An especially strong feature of this monograph is the authors' insistence on rigor in conducting and interpreting experiments. They aptly criticize claims of synthesis of biochemicals based on only a single analytical procedure and warn against premature judgments that go beyond the available hard data. Their discussion of the prebiotic synthesis of "micromolecules" (chapter 4) conforms admirably to their stated principles.

The high level of competence of chapters 4 through 6, which constitute the heart of the argument, is unfortunately not maintained in the rest of the text. Especially disappointing is the discussion of optical activity (chapter 8). The authors do little more than describe ways to resolve racemic mixtures. Much more can and should be said on this matter. The problem is not how stereoisomers might have separated on the primitive earth but how life came to "prefer" L- rather than D-amino acids and D- rather than L-sugars. This kind of cursory treatment of topics outside the thermal theory is one of the less appealing features of the book. Alternative pictures of biogenesis are often not adequately explored. The rich chemistry of ammonium cyanide, which includes the formation of dynamic microscopic units, deserves more extensive consideration as a major alternative model for protocell development.

In spite of its defects, this monograph is a major contribution to the literature of biogenesis. The sheer magnitude and scope of the laboratory evidence for the proteinoid theory of origins more than make up for the uneven quality of the writing.

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A Possible Phylogeny

Evolution of the Metazoan Life Cycle. A Comprehensive Theory. GÖSTA JÄGERSTEN. Translated from the Swedish edition (1968). Academic Press, New York, 1972. x, 282 pp., illus. $15.50.

No event exerted a more profound influence on all subsequent animal evolution than the origin of multicellularity. How many-celled animals originated and whether this step occurred one or more times and in one or more ways remain difficult and ever-debated questions that are perhaps, as John Corliss has said, "in the last analysis, quite unanswerable." Nevertheless, these questions continue to evoke interest among zoologists, and new evidence pertinent to the several competing theories of metazoan origin continues to accumulate, particularly as new sources (for example cell ultrastructure, comparative biochemistry, and genetics) are tapped.

In the 1950's the author of this book contributed a new theory of early metazoan phylogeny, based on Haeckel's 19th-century theory of origin via gastrulation of a flagellate protozoan colony. Jägersten proposed that metazoan origin was associated with the change from a pelagic *Volvox*-like colonial flagellate to a form which turned to life on or near the bottom, eventually crawling along with the aid of flagella. In connection with this change in habitat, it evolved an anterior-posterior axis of differentiation and a ventral side against the substratum. The ability to eat large food items would be advantageous to an organism with such habits, and the next stage was the arching up of the