

COMPLEXITY AND BIOLOGY

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Information and the Origin of Life

by Bernd-Olaf Küppers, *MIT Press*, pp 215, £20.25

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BERND-OLAF Küppers' *Information and the Origin of Life*, originally published in German several years ago, belongs to that handful of books, including Erwin Schrödinger's 1944 classic *What is Life?*, that confront the most fundamental conceptual problems of biology.

What are these fundamental problems? In a more practical domain, Sydney Brenner, I believe, put it succinctly. "Genetic engineering," he said, "is being able to build a centaur!" At a more conceptual level, the problem, a physicist might say, is to develop a thermodynamic or statistical mechanics theory of the origin and evolution of life; while a mathematician would say that it is to prove when life must arise and evolve, and what its rate of evolution is.

Such a theory would have to tell us how likely life is to appear and

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evolve, to give us a feel for how common life is in the Universe, and whether it is ubiquitous or extremely rare.

This book discusses the connection between biological information, the mathematical theory of information and the newer algorithmic version of information theory. I think it is fair to say that, in spite of the interesting points of contact between biology and information theory, much remains to be done and we are far from being able to answer the fundamental questions.

From where is progress likely to come?

On the one hand, rapid advances in understanding the molecular biology of embryogenesis and development may suggest new versions of algorithmic information theory more in tune with the actual “computer programming” language used by DNA to describe how to build organisms.

And I hope that one day we will visit other planets and other solar systems and get a feel for whether life is common or rare, so that even if theoreticians make no progress space exploration will eventually give us the answer. In the short term, I expect experiments with “artificial life” on massively parallel computers will lead to theoretical developments. [See STEVEN LEVY, *Artificial Life*, New York: Pantheon Books (1992).]

In summary, I would like to repeat a story from Abraham Pais’s forthcoming book *Niels Bohr’s Times* (Oxford University Press, pp 565, £25). According to Pais, Bohr told the following story: “Once upon a time a young rabbinical student went to hear three lectures by a famous rabbi. Afterwards he told his friends: ‘The first talk was brilliant, clear and simple. I understood every word. The second was even better, deep and subtle. I didn’t understand much, but the rabbi understood all of it. The third was by far the finest, a great and unforgettable experience. I understood nothing and the rabbi didn’t understand much either.’”

Information and the Origin of Life belongs to the latter class. It reminds us that in spite of the splendid achievements of molecular biology, there is still much that we do not understand and much to be done. □

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