in adaptation or explored molecular or other mechanisms that might cause trade-offs. Trade-offs are central to current thinking not only about specialization and the limits to coevolution but also about the persistence of genetic variation in parasite-host interactions (Godfray and Hassell).

This volume may not fully reflect the state of its subject: for example, only May raises (and does not fully explore) the important point (taken up elsewhere by authors such as D. S. Wilson, P. Ewald, and H. Bremermann) that if many genotypes of a parasite infect individual hosts, the evolution of greater virulence is to be expected, unless it is strongly opposed by group selection (a term not found in this book). Overall, this volume strikes one as a typical symposium proceedings: a highly uneven, heterogeneous conglomerate, to be mined for the conceptual and empirical nuggets from which an evolutionary parasitology may yet be melded.

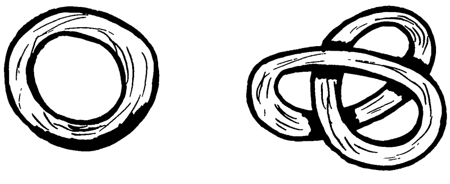
DOUGLAS J. FUTUYMA
Department of Ecology and Evolution, State University of New York, Stony Brook, NY 11794

Topological Ramifications

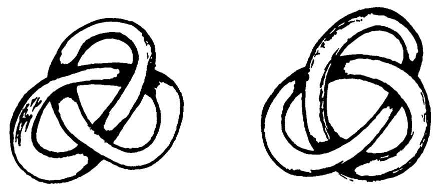
Knots and Physics. LOUIS H. KAUFFMAN. World Scientific, Teaneck, NJ, 1991. xii, 538 pp., illus. $65; paper, $34. Series on Knots and Everything, vol. 1.

During the last eight years a combination of excitement and bewilderment has enveloped much of the world of academic mathematics. In the beginning, V. F. R. Jones discovered a very simple but totally new way of associating a polynomial to any link of ordinary loops of string. That contribution to topology and knot theory was interpreted in terms of statistical mechanics, extended via the representation theory of algebras, and then amplified through the use of the methodology of quantum field theory and the language of differential geometry to produce results in the theory of manifolds. All these diverse subjects were thrown into a common turmoil with repercussions in many other parts of mathematics and theoretical physics.

In this book Louis Kauffman tackles all of this, and more besides, starting from very little indeed. So formidable a task is made possible by his cheerful approach of studied informality. His aim is to communicate and to teach; clearly he has had a lot of fun working in this area, and he is happy to pass on his enthusiasm. The first impression, on opening the book, is that it is awash with neat diagrams drawn with a thick pen. Not numbered, they form part of the text, often part of a sentence. But then the subject of discussion is usually how to combine, mathematically, little two-dimensional pieces of geometry; so why not draw them? The result is a very readable introduction to recent research on the interaction between mathematics and mathematical physics. The approach may, at times, seem elementary to those who already know much about the subject in hand. However, devotees of dreary sequences of symbols might reflect upon the fact that it was by manipulating little pictures that Kauffman was able both to produce the most stunning of the few known applications of the Jones polynomial (the solution of one of the 19th-century conjectures of P. G. Tait about ways of drawing alternating knots) and to discover one of its generalizations.



Two unknots. "For topology, the mathematical advantages of the closed form are overwhelming. We have a uniform definition of a knot or link and correspondingly, a definition of **unknottedness**. A standard ring, as shown [above left] is the canonical unknot. Any knot that can be deformed to this ring (without tearing the rope) is said to be unknotted." [From *Knots and Physics*]



T T^*

Trefoil and its mirror image. "I wish to emphasize the advantages of the closed loop form in doing experimental topological work. For example, one can form both the trefoil T . . . and its mirror image T^* . . . . The trefoil T **cannot** be continuously deformed into its mirror image T^*. It is a remarkably subtle matter to prove this fact. One should try to actually create the deformation with a model—to appreciate this problem." [From *Knots and Physics*]

The first part of the book describes combinatorial knot theory and ways of associating polynomials to knots and links together with some applications. Physics begins to appear with states models for these invariants, with Feynman diagrams, and with discussion of the Yang-Baxter equations. Wherever possible a diagrammatic interpretation of a tensor is used, and that approach extends even to a description of the Drinfeld quantum-double method of solving those equations. The three-manifold invariants of E. Witten are described in a section entitled "Integral heuristics" that features the Chern-Simons operator used as a Lagrangian. The Temperley-Lieb algebra makes frequent appearances; it is used to give a very elementary proof of the existence of those three-manifold invariants ($SL(2)_q$ case only) and later, in part 2, to establish the Turaev-Viro invariants using an extremely palatable version of the quantum *6j* symbols. Here the presentation could have been improved had the book waited a few months; that is the drawback of writing on material so close to the frontiers of research.

Part 2 claims to be "devoted to all manner of speculation and rambling." It is, in a way. The *6j* symbols appear as an ingredient of generalized Penrose spin networks. There are also detailed instructions for constructing, from cardboard and string, a machine to demonstrate the nature of the quaternion group; a discussion of the chromatic polynomial of a graph and its relationship to the Potts model of thermodynamics; some words about the efficacy of hitches for securing a horse with real rough rope; and a discussion of the relevance of knots in the theory of DNA and in dynamical systems. This peculiarly provocative potpourri betrays its conception in the form of individual lectures; it is fairly easygoing and is a rich source of ideas for student projects or tea-time conversation.

The book contains a few mistakes; it has a fine set of references with abysmal nomenclature; and it contains considerable idiosyncrasy. Nevertheless it succeeds in telling the story, in a way that maximizes its accessibility, of how knots and physics have recently come together.

W. B. R. LICKORISH
Department of Pure Mathematics and Mathematical Statistics, University of Cambridge, Cambridge CB2 1SB, United Kingdom

Books Received

Additive Number Theory of Polynomials Over a Finite Field. Gove W. Effinger and David R. Hayes. Clarendon (Oxford University Press), New York, 1991. xvi, 157 pp., illus. $45. Oxford Mathematical Monographs.

Advanced Wastewater Treatment and Reclamation. J. Kurbiel, Ed. Pergamon, London, 1991. xii, 294 pp., illus. Paper, $105. Water Science and Technology, vol. 24, no. 7. From a conference, Cracow, Poland, Sept. 1989.

Analogue Electronic Circuits and Systems. Amitava Basak. Cambridge University Press, New York, 1992. xiv, 361 pp., illus. $89.95; paper, $34.95. Electronic Texts for Engineers and Scientists.

Antigen Processing and Recognition. James McCluskey. CRC Press, Boca Raton, FL, 1991. viii, 257 pp., illus. $139.95.

Arctic Ecosystems in a Changing Climate. An Ecophysiological Perspective. F. Stuart Chapin III *et al.*, Eds. Academic Press, San Diego, CA, 1992. xviii, 469 pp., illus. $95. Physiological Ecology.

Banach Spaces for Analysts. P. Wojtaszczyk. Cambridge University Press, New York, 1992. xiv, 382 pp., illus. $89.95