

of spinor analysis and the application of twistor techniques.

The organization of the book is excellent. Penrose and Rindler present the important results on the use of spinors in general relativity and in the study of the structure and properties of asymptotically flat space-times side by side with those on the use of the twistor formalism in describing space-time geometry and fields on that geometry. Therefore, for those to whom the subject is new, a guide through the book would have been useful. In the preface, the authors indicate that Chapter 8 can be read independently. However, the first three sections of Chapter 7 form an introduction to that material. Also, much of Chapter 9 can be read before becoming involved with twistor theory. I don't mean to imply that the purely spinorial material should have been separated from the twistor applications—such an approach would have destroyed the coherence of the presentation noted earlier.

Although this volume makes use of the algebraic techniques and results of volume 1, geometrical ideas are emphasized throughout. There are more of Penrose's carefully drawn figures and this time they are more or less uniformly distributed. The volume also has an excellent index and list of references. In the appendix, the authors present a useful description of spinors in n -dimensional space.

Whether or not twistors ultimately live up to Penrose and Rindler's expectations, there is no doubt that the material in these two volumes will continue to be studied for many years and will lead to new results in differential geometry, general relativity and other parts of physics.

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General Biophysics, Volumes I and II

M. V. Volkenstein

(Translated from the Russian by I. C. Melamed and M. V. Volkenstein)
302 + 314 pp. Academic Press, 1983. Vol. I. \$61.00, Vol. II. \$51.00

The late George Gamow once said that he dreaded the day when physics would leave the era of Columbus and Magellan and enter into the era of *National Geographic*. No biophysicist need have such fears yet, and indeed, in his later years, even Gamow made contributions to this field.

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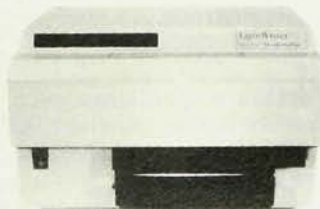
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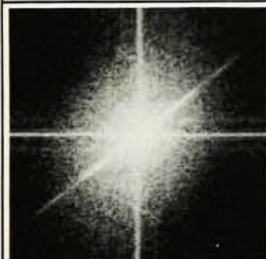
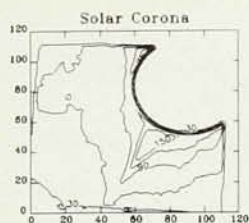
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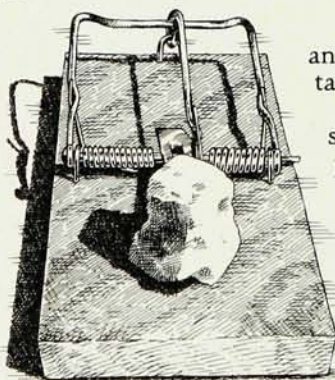
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tors may be narrowly defined, these levels are all interrelated. For example, one may study muscle motion and energy in athletes by investigating myograms of the muscles, or the motion and energy of single muscle fibers, or the interaction of troponin, myosin and actin at the molecular level, but no level is understandable without information from the other levels. Any attempt to describe all of the research results in biophysics, theoretical and experimental, must be encyclopedic in scope—and it should be in a loose-leaf binder to accommodate frequent updates reflecting the rapid advances in our understanding.

Mikhail Vladimirovich Volkenstein of the Institute of Molecular Biology of the Academy of Sciences in Moscow has previously written *Configurational Statistics of Polymer Chains* (Wiley, New York, 1963) and *Molecular Biophysics* (Academic, New York, 1977). The two volumes of *General Biophysics* represent his continuing interest in understanding macroscopic behavior from the molecular level. They were first published in Russian in 1978 and have been translated into superb English by I. C. Melamed and the author. Volkenstein states in the preface to *General Biophysics* that it and *Molecular Biophysics* "constitute in a sense, a single work, though the present volumes can also be read independently by those who have some acquaintance with proteins and nucleic acids. The three volumes can be used as a textbook for graduate and postgraduate students having the necessary knowledge of physics." I might also add that some acquaintance with organic and physical chemistry is desirable. Recognizing the author's continuing interest in molecular biophysics, one should not look for topics such as radiation biology, the design of cardiac pacemakers and the effects of pulsed electric fields on bone growth. Such topics lie outside the scope and direction of the volumes. *Molecular Biophysics* emphasizes the various physical measurements that have yielded an understanding of organic macromolecules and biopolymers; it thus has a rather different character from *General Biophysics*.

In the present two volumes, after an introductory chapter, Volkenstein begins by tersely establishing the mathematical background of the thermodynamics of nonequilibrium systems and nonlinear coupled chemical reactions in biological systems. This chapter is a good summary, but the novice would do better to start with a more extensive book on this topic, such as *Nonequilibrium Thermodynamics in Biophysics*, by Aharon Katchalsky and Peter F. Curran (Harvard U.P., Cambridge, Mass., 1965). Later chapters apply the

concepts of nonequilibrium thermodynamics to such areas as membrane transport, nerve impulse, muscular contraction, photobiology and even prebiotic and biological evolution. Although Volkenstein frequently refers the reader back to the second chapter, the later chapters provide still further mathematical development.

Chapter 8 is on nonlinear chemical dynamic processes in biology. To illustrate the kinetics of nonlinear processes Volkenstein discusses oscillatory chemical reactions, which result from autocatalytic reactions in which there is a periodic disturbance. He shows how such reactions can reduce the "biological clock" to a "chemical clock" controlled by periodic enzymatic reactions or photosynthesis. He also shows how these nonlinear chemical systems can be applied to such phenomena as membrane transport, enzymatic oscillations and the fibrillation of cardiac muscle membrane, and he suggests that other biological systems be examined in this way. Of particular interest is his well-illustrated summary of Russian work in this area. Oscillations in growth due to periodic disturbances are now being investigated as a cause of variations in animal populations as well as in plant growth.

The 600 pages of the two volumes are not sufficient space to develop all of the topics and concepts Volkenstein mentions, and he concentrates on those that are of immediate interest to him; he summarizes results in other areas with references and underived equations.

The volumes contain over 1300 references, with perhaps 95% of these in English-language journals and books. There are no problems or sample calculations as one would find in a conventional textbook.

These books represent a significant contribution to the literature of biophysics, and scientists in the field will appreciate the enormous amount of time that the author must have spent in assembling and summarizing this body of knowledge.

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