Physical Properties of Macromolecules

Polymer Fractionation. MANFRED J. R. CANTOW, Ed. Academic Press, New York, 1967. 539 pp., illus. $22.50.

Long-chain molecules invariably consist of species of different chain lengths or molecular weights. Virtually all properties of such systems are dependent to some extent on the nature of the molecular weight distribution. It therefore becomes a matter of prime importance to characterize this distribution quantitatively and to be able to separate or fractionate the whole system into its constituent molecular species. The present volume is intended to be an aid to those concerned with the problem of selecting an appropriate fractionation method for a particular class of polymers. The book consists of 15 chapters, each written by a different set of authors, and encompasses virtually all aspects of the problem. The subject matter ranges from a highly mathematical discussion of procedures for calculating molecular weight distributions from polymerization kinetic schemes to detailed descriptions of the methods involved in preparing fractionation columns.

As seems to be inevitable in volumes of this kind, there is a great deal of unevenness and a lack of continuity from one chapter to the next. This is a natural consequence of the diversity of interests and background of the different sets of authors and the quite obvious appeal that is being made to different audiences. A major virtue of the book is its completeness, as far as subject matter is concerned; all the major topics are covered. The natural division between preparative and analytical methods is recognized.

Many of the available fractionation methods are based on the solubility properties of high polymers. The basic theory of polymer solutions and its application to fractionation problems are clearly set forth in the excellent first chapter by Huggins and Okamoto. The necessary distinctions are made in this chapter between crystalline and noncrystalline polymers and copolymers. Unfortunately, not all the subsequent chapters which are directly or indirectly concerned with solubility theory take proper account of the theoretical basis of solution theory. In another area, sedimentation techniques provide a useful analytical method for characterizing molecular weight distributions. This subject is given a detailed and critical review by McCormick. The various theoretical assumptions that are usually made are carefully delineated so that proper precautions can be taken in performing the experiments and analysis.

A highlight of the book is the chapter on "Gel permeation chromatography" by Altgelt and Moore. This is a relatively new and very potent fractionation method. The subject is given an exhaustive and authoritative discussion. A connection is made between the behavior of naturally occurring systems and synthetic polymers. Although the chapter is primarily operational or practical in content, the outlines of the underlying theory are set forth; this should certainly help in promoting a deeper understanding of the process.

On the whole, this book should be extremely useful to those engaged in setting up fractionation procedures and concerned with the multitude of technical detail that is involved. On the other hand, except for the last-mentioned chapter, it offers very little in the way of any new concepts or theoretical ideas.

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Arctic Ecology

Animals of the North. WILLIAM O. PRUITT, JR. Harper and Row, New York, 1967. 183 pp., illus. $5.95.

Contrary to popular belief, the site of these delightful sketches—the vast taiga or coniferous forest region of subarctic North America—is in reality a fragile zone of extremely low productivity. It has one of the world's simplest food webs, set in overwhelmingly powerful surroundings. During the numbing cold of weeks on end, only the moose and caribou, the wolf, lynx, and raven remain active; in summer, hordes of insects plague their hosts. This is a land of contrasts—warm and cold, humid and dry, dark and brilliant. This volume deals with the animals of this environment, their adaptations to survive in it, and their ways of life. It also carries a strong plea for the protection of these northlands as the destructive land-use practices of the temperate zone continue to move in from the south.

The book, practical ecology at its best, leads the reader "into the vole's tunnels, to see how the red squirrel and spruces are symbiotically entwined, to pad with the lynx along a hare's trail." We learn how the shrew and ptarmigan escape freezing in a subnivean retreat; how some maintain their body temperature by an increased metabolic rate, while for others an insulating fur eliminates this need; why wet fur may be fatal to voles; how young hares huddle to reduce the menace of mosquitoes. A fascinating chapter describes the culture and customs of the Dinje or Moose People, a nomadic band of Athapaskan Indians.

This is sound natural history presented in an unusually palatable style. Pruitt, with some 15 years of field experience from Alaska to Newfoundland, speaks with authority as a biologist and writes as a skilled dramatist. "This drama of life and death, of food-searching, killing and eating has no end. It continues with the unceasing cycle of the seasons. All living creatures enter it for a few scenes—the vole, the weasel, the jay, the caribou, the Indian, and the white man—while the eternal snow whispers down through the spruces, winter after winter."

Several of the chapters have been published previously in the *Scientific American, Holiday, Animals,* and *Harper's Magazine.* A short glossary defines some of the specialized terms employed. A dozen sensitive and accurate drawings by William D. Berry add greatly to the book's appeal.

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Magnetic Fields

Magnetism and the Cosmos. NATO Advanced Study Institute, Newcastle upon Tyne, England, April 1965. W. R. HINDMARSH, F. J. LOWES, P. H. ROBERTS, and S. K. RUNCORN, Eds. Elsevier, New York, 1967. 450 pp., illus. $27.50.

The present symposium report has the virtues as well as the defects of this familiar form of publication. There are five sections: 1, Geomagnetism (twelve papers); 2, Stellar Magnetism (six); 3, Solar Magnetism (six); 4, Planetary Magnetism (twelve); and 5, Solar System Magnetic Fields (three).

Magnetic fields in the universe are assuming an ever-growing importance both as dynamical agencies and for diagnostic purposes. The great virtue of this book lies in the fact that it covers almost all the aspects of cosmic magnetism (the prime exception being galactic magnetic fields, probably the most important dynamically). With a total of 39 papers, it becomes impossible to give a detailed account of the book's content, author by author. Although there have been monographs of various types on the earth's magnetism, there has not to my knowledge been a systematic collation of our knowledge relating to the magnetic fields of the sun, the stars, and the planets. Gratifyingly, most of the papers in sections 2 through 5 deal with analysis of empirical data rather than with theoretical speculations. Alfvén's *Cosmic Electrodynamics* introduced the subject in a pioneering fashion many years ago. The material has since grown so rapidly that in the absence of a new monograph we can be happy to have this exhaustive coverage of the field by a large number of competent specialists. The organizer of the symposium, S. K. Runcorn, has done the next best thing to devoting a lifetime to the writing of a monograph. Whoever wishes to work in the field of cosmic magnetism or to get acquainted with it will certainly have to have an acquaintance with this work of unusual breadth and coherence.

It is regrettable that by some legalistic quirk the sponsors of such symposia find it often difficult to contribute to the printing costs. The extravagant price is then unloaded on librarians and it becomes difficult for the active specialist who wants such a book here and now to buy it.

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Man and His Beliefs

The Biology of Ultimate Concern. THEODOSIUS DOBZHANSKY. New American Library, New York, 1967. 172 pp. $5.

This is the second of a series of books to appear under the general title Perspectives in Humanism. The introduction to the series seems to dedicate it to the idea that humanity has emanated from a fixed pattern, rather than having evolved for a million years or so as part of a more general pattern that has been evolving for very much longer. The present volume is founded on evolutionary theory and evidence, which give no support to the idea of a true discontinuity at the advent of man or of humanity; thus the author's approach would seem opposed generally to the dogma of the series.

In early chapters Dobzhansky stresses the "opportunistic" character of natural selection, which takes advantage of favorable mutations but does not create them to meet the exigencies of the environment. He also disposes of fallacies of vitalistic and orthogenic reasoning with regard to evolution, which though long abandoned by most biologists may linger tacitly in other areas. All this goes with modern Darwinism, understanding of which is essential to any approach to the problems taken up in this book.

Culture, however, is transmitted by a looser mechanism than genetic inheritance, and this confers greater freedom from the environment. Chance thus has a larger role in the evolution of culture than in biological evolution, and environment correspondingly less. Although Dobzhansky recognizes this, it would seem that he might have given the point greater emphasis because of its bearing on the evolution of our "ultimate concern." Can we expect to find a really close correlation of human customs and beliefs with biological adaptations?

In discussing awareness of life and death, and matters akin, Dobzhansky is on less certain ground than in his biological argument; but he has the company of all those who tread in this area, where both evidence and theory may be inadequate for the testing of hypotheses and opinions. The relationship of such concerns to biological evolution thus becomes the more vague. Here we may sympathize with much of the author's criticism of the concepts of others without necessarily subscribing to his.

Many readers may find that the "Teilhardian synthesis" receives overmuch praise. Teilhard de Chardin asked many cogent questions, but did he really make a synthesis in other than mystical terms?

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Theory of Wave Phenomena

Collective Oscillations in a Plasma. A. I. AKHIEZER, I. A. AKHIEZER, R. V. POLOVIN, A. G. SITENKO, and K. N. STEPANOV. Translated from the Russian edition (Moscow, 1964) by H. S. H. Massey. R. J. Tayler, Translation Ed. M.I.T. Press, Cambridge, Mass., 1967. 200 pp., illus. $8.50.

The study of wave phenomena in infinite homogeneous plasmas is the best-developed aspect of the recently crystallized discipline of plasma physics. Clearly the simplest situation to analyze, it has spawned a bewildering variety of phenomena: hosts of oscillations, novel collisionless damping, nonequilibrium fluctuation theory, and so on. Today the interest of investigators seems to be shifting to consideration of bounded systems and turbulent systems. Thus a summary of prior work is clearly in order, and this slender monograph is a useful effort in that direction.

The book is the joint venture of a number of Russian workers who have been major contributors to the field, and its style is clearly that of the Russian school. It is by no means an introductory work. Indeed, the reader would do well to approach it with good knowledge of the celebrated set of volumes by Landau and Lifshitz on theoretical physics, and the rudiments of plasma physics as they are supplied, for example, in Spitzer's *Physics of Fully Ionized Gases.* For someone with this background it is a very useful book.

The work would be somewhat more useful if it were not devoted to theory alone but made some effort to relate the results to experiment, and if the physical explanations of phenomena such as Landau damping were more extensive. Also, the characterization in the book of the contributions of various terms in the inversion by residues of the Laplace-transform solution as "eigen oscillations" is not in keeping with the usual mathematical usage, since they do not simply satisfy the system of homogeneous equations resulting from the *Ansatz* that all quantities vary like $e^{i(k\cdot v-\omega t)}$. Finally, the absence of a description of the integration of the linearized Vlasov equation in terms of its characteristics, the particle trajectories, is regrettable.

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