An Important Branch of Chemistry

History of Analytical Chemistry. FERENC SZABADVÁRY. Translated from the Hungarian edition (Budapest, 1960) by Gyula Svehla. Pergamon, New York, 1966. 429 pp., illus. $18.50.

Although analysis is the key to the development of knowledge in all areas of chemistry, the history of analytical chemistry has been sadly neglected. Not only has there been no book dealing with the subject; there have been few histories of chemistry that have given attention to analytical chemistry, and few papers dealing with the subject have been published. Therefore Szabadváry's book is a welcome addition to the history of science. Not only does it fill a conspicuously empty niche, it does so in brilliant fashion. The author shows a deep sensitivity toward the relations between analytical problems and the development of chemistry. He is knowledgeable on all phases of analytical chemistry and understands these phases in their historical context.

The book looks briefly at chemical tests in antiquity, then quickly moves to the origins of quantitative work by the Renaissance assayers. Much attention is given to the application of knowledge of chemical reactions to the growth of qualitative, gravimetric, and volumetric methods. Extensive treatment is given to instrumental methods, and the subject of analysis is brought up to the present era.

The book was originally published in Hungarian and has also appeared in German translation. It is unfortunate that the publishers of the English edition have not extended to the author the care and thoughtfulness that his book deserves. Some of the mechanical errors, such as misplacement of word spacing, are quite inexcusable. Considering the price of the book, the publishers should have sought a conscientious reader of proof. They should also have had the manuscript read by a chemist whose native tongue is English. This would have eliminated certain ambiguities and misuse of synonyms which were introduced by the translator. In general, the translation is adequate, but in places a clearer phraseology would be desirable. Despite these technical shortcomings the book is a notable contribution to the history of chemistry. The author communicates a deep understanding of his subject.

AARON J. IHDE
Department of History of Science, University of Wisconsin, Madison

Textbook for General Education

Physical Science: Its Structure and Development. Vol. 1, From Geometric Astronomy to the Mechanical Theory of Heat. EDWIN C. KEMBLE. M.I.T. Press, Cambridge, Mass., 1966. 520 pp., illus. Cloth, $12.50; paper, $5.95.

Today, as ever, educational freedom is a lively subject of debate on American university campuses. Much of this debate concerns the nature of the curriculum needed for a "liberal" education. Increasing criticism is being heaped upon the adoption of general education courses as a mechanism for providing the liberal education appropriate to today's needs. It is easy to be sympathetic with this criticism, in view of the watered-down, superficial courses offered as parts of many "general education" programs in American universities. Yet the alternative of a smorgasbord of professors' unrelated offerings doesn't have much appeal either. It is a real pleasure, therefore, to note the appearance of a new and substantial contribution to general education in the form of a textbook by Edwin C. Kemble, of Harvard, entitled *Physical Science: Its Structure and Development.*

Kemble, who is well known as a scholar in the field of quantum mechanics and a teacher of graduate courses, decided after World War II that the education of future citizens for a society undergoing massive change —as a result of the impact of a swiftly moving science and technology upon it—was too important to be left to chance. In 1945, in collaboration with Gerald Holton, he plunged wholeheartedly into the general education program at Harvard being led so vigorously by President Conant. The present text grew out of his experiences in teaching introductory physical science in this program to nonscience majors in liberal arts.

The book leans heavily on physics and would serve equally well as an introductory physics text. A second volume is planned. The present volume starts with geometric astronomy, goes through Newton's laws of motion, and ends with the second law of thermodynamics and the molecular theory of matter and heat. It does not presuppose a knowledge of the calculus but does make frequent use of the idea of "rate of change" and introduces the usual calculus notation for it.

Kemble believes strongly that to prepare for the future one must be aware of the past. His approach therefore is primarily a historical one with a good deal of philosophy thrown in. Neither his history of science nor his philosophy is superficial. References to recent historical findings are abundant, as, for example, Hawkins' evidence that Stonehenge was used to keep track of eclipses as well as the solar and lunar calendars. Near the middle of the volume are two excellent short chapters on "The spirit and methods of physical science" and "The impact of Newtonian science on the intellectual world of the eighteenth century." Kemble is especially to be commended for his description of the impact of science upon religion and for his willingness to venture (his words!) into a discussion of the relation of Newtonian ideas to the metaphysical problem of mind and matter. Also this reviewer found the story, near the end of the book, of the gradual evolution of early steam-pump technology into a science of thermodynamics especially interesting.

The fundamental question Kemble seeks to answer is, "What instruction in physical science should be given today to college students who do not plan to enter scientific careers?" Obviously, there is no single answer to this question. Kemble writes, "To disregard the history of science and the human meaning of the scientific enterprise is to cut off the part of the story most appealing to students whose interest is not professional." He is convinced that "by uniting a rigorous study of the basic scientific conceptions with a historical and human context" the story can be made "more interesting to most students and more meaningful to all." Unfortunately, in providing such a beautifully clear and lucid historical background, he must, as he freely admits, leave out many interesting and timely topics which nonscience students will want to know about and discuss in an introductory course. The fact that this is so, combined with the overwhelming importance to society of a scientifically literate citizenry, furnishes ample justification for other approaches than the one used by Kemble. That he has succeeded so well gives one renewed confidence that such education may indeed be carried out within the framework of a general education program.

ELMER HUTCHISSON
*Stanford University,
Stanford, California*

Summer Schools in Theoretical Physics

Tokyo Summer Lectures in Theoretical Physics, 1965. Part 1, Many-Body Theory. RYOGO KUBO, Ed. Syokabo, Tokyo; Benjamin, New York, 1966. 166 pp., illus. $6.75.

In the past 15 years summer institutes in theoretical physics have become an essential feature of the pattern of communication in the subject. To the first well-known sessions at Ann Arbor and Les Houches (still flourishing) have been added—to name only a few—semipermanent schools in Italy, Scotland, Corsica, India, Turkey, Canada, and South America and at Brandeis and the University of Colorado in the United States. The value of these institutes to the graduate students and postdoctorals participating has long been apparent. The schools provide an opportunity for the participant to form friendships with young people at their own stage of scientific development. They are brought to the frontiers of research without time-consuming and frequently aimless grappling with the "literature." For those who do not attend the sessions the printed lecture notes have largely taken over the function of indicating what the experts consider to be the results achieved and the outstanding unsolved problems in a field.

In view of the outstanding contributions of Japanese theoretical physicists, it is good to be able to add to the growing list the Tokyo Summer Institute of Theoretical Physics directed by R. Kubo. The first part of the proceedings, devoted to many-body physics, is a slim volume of some 160 pages—a good deal less than the norm. Yet it covers an astonishingly wide range of topics and conveys a lively sense of where worthwhile research can be done. It can indeed be recommended for perusal by a research student looking for something to work on. The price paid is that most of the contributions are sketches and guides to the literature rather than self-contained accounts.

The first lecture is by Kubo and is entitled "The fluctuation-dissipation theorem and Brownian motion." It continues Kubo's successful efforts to bring about a closer relation between the theory of random processes and many-body theory. H. Mori's article deals with relaxation phenomena near critical points. Although the equilibrium phenomena have been studied intensively, the understanding of transport processes in the immediate vicinity of critical points represents a fresh problem. Many students may find it necessary to read Mori's account with his original articles close at hand. There are three short contributions by K. A. Brueckner. The first one describes calculations of the properties of liquid He^3. It is emphasized that even in the normal phase the Landau theory of Fermi liquids is incomplete. "The theory of correlated crystals," by Brueckner and Frohberg, outlines a method of treatment of the ground-state energy of crystals of helium isotopes. This is an important problem conceptually, since the large zero-point motion implies the inadequacy of the Born-Oppenheimer approximation that is at the basis of most of solid-state physics. This subject has been slighted in the past—perhaps because the crystals have no properties that are as spectacular as superfluidity and superconductivity. Finally, Brueckner provides a report on the present status of the theory of the ground state and low-lying levels of nuclei.

W. Kohn presents a new simple yet rigorous formulation of the inhomogeneous electron gas problem. J. R. Schrieffer analyzes the limitations of the quasi-particle approximation in metals. J. M. Luttinger gives the first account the reviewer has seen of the Kohn-Luttinger theory that a sharp Fermi surface implies that even a system of fermions with purely repulsive interactions becomes superconducting at sufficiently low temperatures. Finally there are two more extensive and very readable articles by D. Pines and P. G. de Gennes. Pines analyzes the implications of inelastic neutron scattering data for the theory of finite temperature excitations in superfluid and normal liquid helium. De Gennes describes the use of the Landau-Ginsburg equations and the properties of type II superconductors.

In sum this volume is a pleasing package. The accounts may be too brief for complete newcomers, but they provide a good perspective on the present concerns of many-body theorists. Here also is a partial answer to the question, "What is there left to be done?"

EUGENE P. GROSS
Physics Department, Brandeis University, Waltham, Massachusetts

Recent Developments in Particle Symmetries. Proceedings of the International School of Physics "Ettore Majorane," Erice, Sicily, 1965. A. ZICHICHI, Ed. Academic Press, New York, 1966. 472 pp., illus. $12.

Tokyo Summer Lectures in Theoretical Physics, 1965. Part 2, High Energy Physics. GYO TAKEDA, Ed. Syokabo, Tokyo; Benjamin, New York, 1966. 127 pp., illus. $5.75.

In theoretical physics 1965 was above all the year of long debates on symmetry principles in strong and weak interactions of fundamental particles, on their consistency, validity, and violations. Not only were there bold introductions of larger and larger approximate symmetry groups containing internal and external symmetries, including those containing an infinite number of particles, but serious doubt arose over some of the very firm symmetry principles such as time-reversal invariance and symmetry between particles and antiparticles. The first volume under review clearly reflects this trend. In their lectures A. Pais, J. S. Bell, N. Cabibbo, and L. A. Radicati discuss the significance, successes, and difficulties of the so-called broken symmetries in particle physics. These approximate higher symmetries involve the internal quantum numbers of particles (charge, hypocharge, isotopic spin), whose real nature is still quite elusive to the physicist. The time-reversal invariance problem (actually *CP* invariance, which is generally accepted as equivalent to time reversal) is discussed in lectures by J. Prentki and J. Steinberger. In a brief closing speech V. F. Weisskopf remarks, "Sci-