tion of Migdal's work, it must be admitted that he has raised a number of interesting and provocative points.

Let me draw special attention also to the article of D. Brink, "The alpha-particle model of light nuclei," which is one of the most beautiful developments in this subject. Brink likes to sit on his work for years and, on the whole, doesn't even answer letters inquiring about it, so that one must either adopt the expedient of traveling to Oxford to talk with him, or invite him to lecture at summer schools. Both are worth while.

Systematic and conservative expositions of by now standard shell-model and "beyond" techniques are given by Gillet ("Approximate methods in nuclear-structure calculations") and J. P. Elliott ("Effective interactions in the shell model"). Both articles are carefully prepared and should become standard works in the subject. The new multipole and sum-rule methods in spectroscopy are described in detail by J. B. French. These are undoubtedly very useful, although I have not mastered them yet. It is nice to have a systematic exposition on hand. C. Bloch presents "An introduction to the many-body theory of nuclear reactions" in his characteristically elegant fashion. One should not forget to mention the excellent introduction to the Hartree-Fock formalism with which F. Villars begins the book. Finally, at the end come many seminars, some good, some bad.

In sum, this is an excellent book which should come into the shelf of every nuclear physicist who can afford it.

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Sound and Matter

Ultrasonic Absorption. An Introduction to the Theory of Sound Absorption and Dispersion in Gases, Liquids, and Solids. A. B. BHATIA. Oxford University Press, New York, 1967. 441 pp., illus. $13.60.

The scientist who measures the absorption and velocity of ultrasonic waves in bulk matter is an ultrasonic spectroscopist. His task, in addition to measuring these quantities, is to attempt to relate his data to the molecular nature of matter. In order to do this, it is usually necessary that his measurements be made over a range of values of some external parameters such as ultrasonic frequency, temperature, pressure, and magnetic field. The data so obtained provide him with such information as the strength and location of the absorption peaks and the magnitude of the velocity dispersion. From these he attempts to answer the question: Why does a gas, liquid, or solid absorb ultrasonic energy?

Ultrasonic Absorption by A. B. Bhatia is essentially a systematic collection and discussion of the various answers that can be given to this question. The processes or mechanisms responsible for the absorption are discussed, and, where one exists, the molecular theory describing the process is outlined. The book is aimed at scientists "who are interested in the study of the properties of matter and wish to acquaint themselves with the basic . . . results in this field. . . ." For the researcher who is actually carrying out ultrasonic investigations it will not be as useful as somewhat more detailed accounts such as *Absorption and Dispersion of Ultrasonic Waves,* by K. F. Herzfeld and T. A. Litovitz, or *Physical Acoustics,* edited by W. P. Mason.

After several introductory chapters the book treats systematically the theoretical ideas and experimental results in gases, liquids, and solids. The sections dealing with the fluid states of matter are essentially a condensed version of the material covered in the text by Herzfeld and Litovitz. The condensation is skillfully done, and these sections provide a coherent, well-written introduction to ultrasonic research in fluids. It is unfortunate that some of the more up-to-date developments in this field are not included, but perhaps any advantage gained by their inclusion would have been offset by a corresponding loss in the simplicity of presentation.

The chapters dealing with the attenuation of ultrasound in solids are equally good. In particular, the discussion of the interaction of ultrasonic waves with electrons and phonons deserves commendation. On the whole, though, the solid-state treatment is rather more abbreviated than one would like. And while I am sympathetic toward the author's attempt to emphasize the physical content of the subject, there are some sections where a slightly more rigorous approach would be preferable.

In evaluating any book there are two critical questions that must be answered: (i) Is there a need for a book designed to meet the specific objectives of the volume under consideration? and (ii) does this particular work fill that need? To the first question the answer here is a qualified "yes," the qualifications being those mentioned above; to the second it is an unqualified "yes."

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Aquatic Life

Aspects of Marine Zoology. Proceedings of a symposium, London, March 1966. N. B. MARSHALL, Ed. Academic Press, London, 1967. 280 pp., illus. $14.

The symposium reports of which this book is composed deal with a variety of topics, some broad and some specialized. Two articles present new observations on the vertical movements of pelagic animal communities which form acoustic scattering layers, and show how these movements may be controlled by natural light or influenced by artificial light. A paper dealing with the luminescence of fishes recommends an anatomical classification of light organs, presents a review of the control mechanism for integumental photophores, and discusses critically the various explanations that have been offered for the function of luminescence in this group of animals.

In two additional reports on fishes a survey of the olfactory organs of bathypelagic species is given and methods for sampling mesopelagic fishes are summarized. Various types of trawls, traps, and nets are evaluated, and the need is shown for supplementary information from high-speed samplers, fishing with lines and lights, photographs, and direct observation from deep submersibles.

The sensitivity of invertebrates to small changes in hydrostatic pressure in the shallow marine environment is discussed by another symposium participant; the mechanisms involved and behavior observed in both field and laboratory experiments are considered. Another investigator reports that the neuston of the warmer seas has predominantly blue and purple pigmentation, with similarities to crustacyanin,

and discusses the reasons for the occurrence of these pigments.

A description of a deep-sea squid, an account of the distribution of Pogonophora in the Atlantic Ocean, a summary of the results of the continuous plankton recorder survey of the North Atlantic, and an analysis of the seasonal movements of sperm whales are provided by other reports. Thus the volume as a whole, while not attempting to summarize or review the field, presents authoritative and reflective accounts of significant recent investigations. It is well worth the attention of those working in marine ecology and biological oceanography.

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Definitions and Derivations

The Dictionary of the Biological Sciences. PETER GRAY. Reinhold, New York, 1967. 612 pp., illus. $14.75.

Peter Gray is well known in the biological community as an indefatigable organizer, an encyclopedist, a gourmet, and, as the present volume confirms, a brave man. His introduction is a vigorous and enjoyable statement of definite purpose and convictions. The publisher's jacket informs us that the work contains 40,000 definitions, including botanical and zoological taxa down to families, mutant genes and their symbols, and organic compounds of biological importance: an impressive array.

Without question such a dictionary is needed. Our schools and colleges are full of students and teachers struggling (or so we hope) to master an increasingly diversified biological literature. The only similar volume of which I am aware is the much more restricted *Dictionary of Biological Terms* by Henderson and Henderson (revised by Kenneth; 8th edition, Van Nostrand, 1963).

An analytic arrangement has been adopted: entries are listed by roots wherever possible. An advantage of this sometimes cumbersome system is the attention called to derivation of words. Unfortunately, the typography and layout do not reinforce the organization. All headings are of the same size boldface type, and indentations are too inconspicuous to help the eye.

The essence of a dictionary, however, lies in the quality of definitions. A student asks for information, that is, clarity and accuracy of statement. One may also hope for some insight and some incisiveness. What one finds here too often is, according to my sampling, some carelessness of detail and an imprecision of focus that may be misleading. (Let me say at once that this failing is not limited to the present volume).

To illustrate by two random examples: *Dialysis* and its derivatives have a long history of ambiguous usage. Gray lists *dialysis* under *-lys-* and gives two meanings: "*1* . . . the separation of large from small molecules by their passage through a membrane of suitable pore size (*cf.* dialytic)" and "*2* . . . a separation of parts of a plant usually associated." Under *dialytic*, however, one finds only a botanical usage. There is no entry for *dialysate*. The Henderson dictionary defines *dialysis* as "Separation of dissolved crystalloids and colloids through semipermeable membrane, crystalloids passing more readily; permeation." *Dialysate* is defined as the substance passing through the membrane. *Webster's Third International New Dictionary* says, "*Dialysis* . . . the separation of substances in solution by means of semipermeable membranes . . . through which the smaller molecules and ions diffuse readily whereas the larger molecules and colloidal particles diffuse very slowly or not at all. . . ." *Dialysate* is defined as either the material passing through the membrane or that failing to do so. Second example: we all know what the cell nucleus is. Gray: "that organelle with [*sic*] the cell in which almost all of the nucleic acids are concentrated." Henderson: "Complex spheroidal mass essential to life of most cells." Webster's disquisition is too long to quote in the present space. Among these versions the reader may make his choice, or perhaps be impelled to write his own. We may agree that the essential qualities listed above are not universally displayed by people who write dictionary definitions.

Gray has asked for corrections. It is to be hoped that this undoubtedly useful volume will have a long career and will gain precision in the course of its use.

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Liquid Helium

Experimental Superfluidity. R. J. DONNELLY. Compiled by W. I. Glaberson and P. E. Parks. University of Chicago Press, Chicago, 1967. 272 pp., illus. Paper, $3.50. Chicago Lectures in Physics.

Now, 60 years after Kamerlingh-Onnes first liquefied helium and 30 years after Kapitza's experiments characterized superfluid flow in liquid helium II, there are still many deep, unsolved problems in the subject. Donnelly's book is an introduction to some of the important problems in superfluidity, with emphasis on problems of rotating helium and mobility of charges in liquid helium. It derives from notes taken during a course the author gave at the University of Chicago in 1966. Although the book is intended for experimentalists, the theoretical background is supplied in such detail and clarity that it can be recommended for all theorists as well.

The book provides first a brief chapter, of interest to everybody, on low-temperature physics. In it Donnelly discusses several ways of reaching low temperatures, including adiabatic demagnetization and He^3-He^4-mixture refrigerators, and of measuring the temperatures involved.

Experimental physicists will find that a particular charm of the treatment is the description of recent key experiments in close association with the appropriate theories. For example, a series of modern experiments on viscosity and critical velocities of He-II is used to introduce the two-fluid model of liquid helium, and details of the theory are brought out by reference to several experiments on fluid oscillations and isothermal flow. The treatment of the two-fluid model is naturally extended to a discussion of observed wave modes in bulk helium and helium films and then to a lucid description of the breakdown and modification of the model in application to macroscopic quantum effects. The quasi-particle model of liquid helium is used to calculate the phonon and roton contribution to thermodynamic properties in an elegant application of quantum statistical mechanics to the problems. These results are used to relate experiments on the mobility of ions to the excitation spectrum and liquid structure factor of liquid helium. The last chapter of the book is a detailed modern account of all aspects of ions in liquid helium, one of the specialties of