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

the author. It features elegant calculations, of binding mechanisms, lifetimes, and scattering cross sections for ions on vortex lines, which are then applied to experiments.

Students of theoretical physics will find particularly useful the derivation of the generalized hydrodynamic equations, from conservation laws and the Galilean transformation, and the discussion of Bogolyubov's theory of a weakly interacting Bose gas, in which second quantization is used. These are carried through with several of the usually elusive intermediate steps displayed so that the treatments are clear, detailed, and interesting.

A strong point of the entire work is the clear presentation of the theory in close association with important experimental data. This leads to a large collection of interesting and useful figures. In fact, the figures and references in this book form by themselves a good introduction to modern liquid-helium physics. These figures are supplemented by an excellent appendix which is a small storehouse of experimental and theoretical data on the properties of liquid helium.

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Comparative Neurology

The Central Nervous System of Vertebrates. HARTWIG KUHLENBECK. Vol. 1, Propaedeutics to Comparative Neurology (320 pp., illus.). Vol. 2, Invertebrates and Origin of Vertebrates (380 pp., illus.). Academic Press, New York, 1967. Each volume, $17.50.

The two volumes under review represent the introductory chapters of an intended five-volume treatise on the comparative morphology of the vertebrate nervous system. These two volumes, however, belie their title and have little to do with vertebrate neuromorphology. Accordingly it seems legitimate to consider each on its own merits as an independent work without prejudice to the following three volumes. Presumably these latter will deal more specifically with the subject of neuroanatomy and will represent a contribution to comparative neurology.

Volume 1 begins with a brief and unexceptional discussion of basic neurological concepts. A third of the volume is then devoted to a brief outline of the major phyla of the plant and animal kingdoms and a somewhat lengthy account of various aspects of organic evolution. The final half of the volume is undoubtedly of most interest, for in it Kuhlenbeck presents in detail a discussion of the history, philosophy, and methodology of comparative morphology. He is an advocate of the form-analytic approach, in which primary attention is directed to topologic location and orderliness of structure. *Homology* and *analogy* acquire purely morphological definitions in terms of the relation of a structure to a composite ideal form or *Bauplan*, and have neither functional nor phylogenetic connotations. Such a strict separation of form and function represents an approach which is perhaps foreign to many active neuroanatomists today, and many of the issues raised in the final sections of volume 1 seem of less immediate importance than they might have 30 years ago. Nevertheless, the approach advocated is logically valid, and the question of its usefulness to current neurological thought will be determined only upon the appearance of the final three volumes which embody it.

Despite the encyclopedic work of Bullock and Horridge on invertebrate nervous systems, there remains a definite place for a modest, competent summary of invertebrate neuroanatomy. Volume 2 purports to be such a review, but unfortunately it fails decisively. The treatment, which is on the level of an elementary zoology text, is diffuse and unorganized, with extensive interruptions for unconnected or irrelevant observations. Much of the material seems derived from secondary sources, and literature citations are too frequently neither the best nor the most recent. Although undoubtedly much of the work on invertebrate neuroanatomy was done before 1930, the omission of adequate discussion of many more recent findings, such as those of Pantin and Horridge on coelenterate nerve nets or of Alexandrowicz on arthropod ganglia and receptors, seems remarkable. In many places implications of the findings of comparative neurophysiology for structural organization seem to be misunderstood or ignored, and obsolete or unusual terminology may cause some confusion. Illustrations are profuse but of uneven value; many are poorly integrated with the text and many have been extensively modified or simplified from the original. The volume ends with a review of theories of the origin of the vertebrates.

I have difficulty in imagining the audience for either of these volumes. Those interested in the history or philosophy of morphological thought as exemplified by the German school may find the first volume of value. The second volume, however, is not sufficiently authoritative to serve as a reference for any professional scientist, and it is too poorly organized and written to be recommended as an introduction to invertebrate neuroanatomy for scientist, student, or layman.

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Books Received

Aerial Discovery Manual. Carl H. Strandberg. Wiley, New York, 1967. xvi + 249 pp., illus. Paper, $14.95. Wiley Series on Photographic Science and Technology and the Graphic Arts.

By Prescription Only. Morton Mintz. Beacon Press, Boston, 1967. xlvi + 446 pp. Cloth, $6.95; paper, $3.95. Revised edition of *The Therapeutic Nightmare*, 1965.

Challenge to the Court. Social Scientists and the Defense of Segregation, 1954–1966. I. A. Newby. Louisiana State University Press, Baton Rouge, 1967. xiv + 239 pp. $6.50.

The Changeless Order. The Physics of Space, Time and Motion. Edited with introductions by Arnold Koslow. Braziller, New York, 1967. viii + 328 pp., illus. $7.50.

Characteristics and Operation of MOS Field-Effect Devices. Paul Richman. McGraw-Hill, New York, 1967. x + 150 pp., illus. $10.

Chemical Engineering in Medicine and Biology. Proceedings of the 33rd annual chemical engineering symposium of the Division of Industrial and Engineering Chemistry of the American Chemical Society, Cincinnati, Ohio, October 1966. Daniel Hershey, Ed. Plenum, New York, 1967. x + 658 pp., illus. $25.

Courtship. An Ethological Study. Margaret Bastock. Aldine, Chicago, 1967. viii + 220 pp., illus. $6.

The Craters of the Moon. An Observational Approach. Patrick Moore and Peter J. Cattermole. Norton, New York, 1967. 160 pp., illus. $5.95. Amateur Astronomer's Library.

Handbook of Filter Synthesis. Anatol I. Zverev. Wiley, New York, 1967. xiv + 576 pp., illus. $19.95.

High Energy Physics. Vol. 2. E. H. S. Burhop, Ed. Academic Press, New York, 1967. xii + 483 pp., illus. $24.

Indians of Brazil in the Twentieth Century. Edited and with parts translated from the Portuguese by Janice H. Hop-