used over and over. The use of "monolithic" for basic; "primitive" for simple; "venerable" for long-known; and "fountainheads" for beginnings are examples of misusages. The statement in the introduction that alchemical reactions "might be called heterogeneous in the fullest sense" is meaningless. The statement on page 190 that "The availability of the necessary trioxide is essentially negligible," for which one can substitute "The trioxide is not readily available," is illustrative of many verbose constructions.

Reference is made to recent important developments in this field, with the notable exception of the use of radioactive phosphorus. New insecticides, poisonous fluorides, and techniques in synthesis of naturally occurring phosphate esters are included but are sometimes difficult to find. In general the subject matter is thoroughly covered.

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The Science of Petroleum: Crude Oils, Chemical and Physical Properties, Vol. V, Part I. Benjamin T. Brooks and A. E. Dunstan, Eds. New York: Oxford Univ. Press, 1950. 200 pp. $11.00.

The first four volumes in "The Science of Petroleum" series were published in 1937. Volume V, part I, deals both with new subjects and with several that supplement subjects previously covered. Under such conditions some repetition of material is obviously unavoidable, and Volume V is a substantial contribution to the series. Two further parts are planned to revise the coverage of the chemistry, physics, and chemical engineering of petroleum.

For Section I entitled "Crude Oils," the chapter by H. M. Smith provides excellent coverage of production and reserve data for all major oil fields in the U. S. for 1935–45. The principal characteristics of the crudes are discussed by the states in which they are found, and analytical data are given for crude oils representative of 76% of the total production in 1945. By comparison the chapters on Venezuelan, Saudi Arabian, and Bahrein Island crude oils present very meager data, indeed, possibly because of the sparsity of available information. The chapter on Middle Eastern oils is somewhat better. A brief chapter is included on the evaluation of crude oils and oil stocks that is essentially an introduction to the subject. Although seemingly out of place in a treatise on the science of petroleum, the chapter on economic developments in the petroleum industry is interesting and well written.

The first chapter in Section II, "Chemical and Physical Properties of Petroleum Hydrocarbons," by A. N. Sachanen, covers the methods of separation and determination of the hydrocarbons in petroleum, lists the percentage composition of various fractions from several typical stocks, and describes methods of classifying crude oils. Although there is some overlapping with a later chapter by Rossini, and much material published since 1938 is overlooked, the coverage is extensive and informative. The succeeding three chapters on the chemistry of paraffin naphthene and aromatic hydrocarbons are brief but well-written reviews of developments since 1937. The extensive treatment of the chemistry of olefin and diolefin hydrocarbons is a reflection of the great expansion of knowledge in this area since the previous article in 1938. The excellent chapter by F. C. Whitmore on the mechanism of organic reactions is a welcome addition to the treatise, although a more complete coverage of the mechanisms of *hydrocarbon* reactions would seem desirable. For example, the mechanism of hydrocarbon oxidation is untouched. The article on "Fractionation, Analysis, and Isolation of Hydrocarbons in Petroleum" is a review of the intensive work of the American Petroleum Institute Project 6, principally covering a crude oil from the Ponca City, Oklahoma, field. A chapter on the chemical thermodynamic properties of hydrocarbons summarizes the collection of thermodynamic data made by the American Petroleum Institute Project 44. The final article covers high-pressure vapor-liquid equilibria in cycling operations and should interest production engineers.

This volume is a valuable addition to "The Science of Petroleum" series as well as an essential reference work for libraries. The treatment is very uneven; however, this is almost inevitable in a treatise of such scope. A huge gap remains in the coverage of the science of petroleum, since much recent work on the physical properties of hydrocarbons is untouched. Perhaps later volumes will rectify this situation.

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The Biological Sciences

The Life of Vertebrates. J. Z. Young. New York: Oxford Univ. Press, 1950. 767 pp. $8.50.

The aim of this large book is thus defined by its author: "The present book has gradually grown into an attempt to define what is meant by the life of vertebrates and by the evolution of that life. Put in a more old-fashioned way, this represents an attempt to give a combined account of the embryology, anatomy, physiology, biochemistry, palaeontology, and ecology of all vertebrates."

It cannot be expected, and the author has not claimed, that a single book can really give a full account of such varied aspects of vertebrate life, or even a smoothly balanced summary of all of them. The degree of success is, nevertheless, brilliant. The book is a first-rate account of the functional anatomy and evolution of the vertebrates.

"A glance through the book will show that I have not been successful in producing anything very novel," the author modestly adds. The organization of the text, to be sure, is not a radical departure from such time-honored works as Parker and Haswell.

There is the familiar sequence of types: *Amphioxus*, lamprey, dogfish, trout, frog, lizard, and pigeon, with a discussion of anatomy in fixed order centered on each. The anatomical treatment is, however, unique in the degree in which it is not merely typological, but also broadly comparative, and not primarily topographical but functional. With the exception of the chapter on the lampreys, which ends with inadequate reference to their fossil relatives, each of these anatomical chapters is followed by a separate chapter on the systematics and history of the corresponding major division of chordates. Other chapters treat the adaptive radiation of bony fishes, economic and population studies of fishes, and the behavior of birds.

The functional and evolutionary point of view is shown by such things as good summaries of Lack on "Darwin's finches," of Sanders on learning in goldfishes, of Pumphrey on vision in birds, and of Young on pupillary reactions in fishes—to mention at random just a few examples. Locomotion is particularly stressed throughout and is illumined by concrete details drawn—from among many other sources—from Gray and Harris on fish locomotion and Aymar on bird flight.

Treatment of mammals is abruptly different from that of other vertebrates. Their systematics and history are given in much greater detail (13 chapters, comprising nearly a third of the descriptive text), but there is no general, comparative, and functional account of their anatomy. The systematic discussion is excellent and is enlivened by the author's emphasis on the integral and active nature of the organisms. A second volume on the structure, function, and development of mammals is promised and will be eagerly awaited. The question may be raised, however, whether handling of mammals in the present book along more nearly the same lines as the other classes would not have improved its usability as a teaching aid, at least.

The evolutionary significance of the history of vertebrates is kept constantly before the reader, and a real sense of the majesty and sweep of that history is conveyed. Discussion of underlying principles is strongly conservative. Strict adherence to "statements that can be rigidly demonstrated by the evidence" produces "not . . . a very impressive list of discoveries." Some statements as to evolutionary processes raise doubts. A "tendency . . . for survival . . . leads [sharks] to adopt whatever habits are possible." Other animals "seek out a variety of new habits," and a type of limb "tends to be developed again when needed." At some points there is an implication that natural selection has some bearing, but the student is not told what natural selection is or how it works. Neo-Lamarckism is explicitly repudiated, but the reading list includes Lamarck and not Darwin, and it cites more works by the neo-Lamarckian Wood Jones than by any other author.

"The history of text-books is often dismissed by the contemptuous assertion that they all copy each other—and especially each other's mistakes. Inspection of this book will quickly confirm that this is true"—thus the modest author begins his preface. He has, indeed, copied a few mistakes. It is, for instance, depressing to encounter again an old, often-copied but obviously incorrect diagram of mammalian molar occlusion. Yet such lapses are few, and one of the outstanding virtues of the book is precisely its freshness. The author has thought things out for himself and has also searched out recent work in the whole, tremendous field.

The illustrations are numerous and with few exceptions are clear, accurate, and attractive. The index is eminently usable. Misprints are few and not serious.

All in all, Young's *The Life of Vertebrates* is a major achievement for which all students of life and of vertebrates will be grateful.

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Researches on Fungi: The Sexual Process in the Uredinales, Vol. VII. A. H. Reginald Buller. Toronto, Canada: Univ. Toronto Press; London, Eng.: Geoffrey Cumberlege, Oxford Univ. Press, 1950. 458 pp. $13.50.

To all who are concerned with the behavior of the fungi, the appearance of Volume VII in Dr. Buller's *Researches on Fungi* will be an event of special interest. It has been published under the auspices of the Royal Society of Canada and was edited by G. R. Bisby, who states that the manuscript was practically unaltered. This last, and posthumous, volume closes a lifetime work of ingenious experimentation, and original and lively presentation of the activities of various fungi. It centers about the function of the pycnidia in the rusts, but, in his usual far-ranging manner, Dr. Buller has included a vast amount of detailed information concerning the morphology, cytology, behavior, life cycles, and history of the rusts concerned in his experiments. At times this great weight of detail and the resulting frequent repetition make slow and burdensome reading, but this is partially offset by Dr. Buller's easy-flowing and readable style.

Sexuality in the rusts is interpreted in an unbiased manner without being influenced by previous theory, although this is fully set forth. Dr. Buller considers the function of the pycnidium and the pycnidiospores to be the same in the rusts as that of the oïdia in the Hymenomycetes, or the "spermatia" or "microconidia" in many of the Ascomycetes (therefore, the use of the term pycnidium, rather than pycnium). He does not consider them as male organs or male gametes, for there are no differentiated female cells. He looks upon the pycnidiospores, rather, as carriers of a nucleus, in a heterothallic rust, from one compatible strain to another. He emphasizes the similarity between the distribution of pycnidiospores of the rusts, by insects, and the pollination of flowers in the higher plants. He considers the presence of pycnidia in a rust as

evidence of heterothallism and their absence as evidence of homothallism.

He describes the structure and function of the pycnidia of a number of rusts in full detail, and presents experimental evidence that the pycnidiospores do not fuse with the "receptive hyphae," emerging through the host stomata, but only with the "flexuous hyphae" of the pycnidium.

The text is accompanied by 124 excellent figures, both original and copied from the previous literature, and by a full subject index. The large print facilitates easy reading of the text.

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Genes, Plants and People: Essays on Genetics. C. D. Darlington and K. Mather. Philadelphia: Blakiston, 1950. 187 pp. $4.00.

These genetic essays are not new, and their principal themes are familiar to any who have scanned the pages of *Nature,* or who have read Darlington's *Recent Advances in Cytology, The Evolution of Genetic Systems,* or Darlington and Mather's *The Elements of Genetics.* In fact, 11 of the 16 are to be found in *Nature,* the remainder in publications of general accessibility. According to the authors, their essays will serve to introduce the concepts of genetics to the general student, will show especially the interaction of the methods of experimental breeding and microscopy, and have as their purpose the reduction[1] of the foundations of biology to a single system.

These essays were, for the most part, stimulating when they first appeared, but on the whole they have fared badly with time, and assuredly cannot serve as a suitable introduction to genetics for the general student (*v.i.*). There is not, furthermore, the slightest indication that they have or are likely to reduce the foundations of biology to a single system. The essays by Mather are mostly sober and thoughtful discussions of limited problems upon which many of us could agree, although his argument implying that a better understanding of multifactorial inheritance might have forestalled Lysenko's attack on genetics seems farfetched. Darlington's essays are mostly of a different sort. Their charm lies not in lucid generalization of nature from exacting valuation of experiment, fact, or the discoveries of others (for they generally do not match wide experience), but rather will be remembered for their brilliance, the verve of their often seemingly slanted and eclectic argument, and their marked capacity to create an illusion of plausibility. Indeed we feel, on reading them, as though genes, chromosomes, cytoplasmic agents, metabolic pathways—inheritance in particular and in general—might well have proved just this simple and rational. Sadly, this is not so.

Belling (*Univ. Calif.* (*Berkeley*) *Pubs. Botany,* **17**, 75), Stebbins (*Chronica Botan.,* **6**, 429), Huskins (*J. Heredity,* **36**, 44 *et seq.*), Fabergé and Singleton (*J. Heredity,* **41**, 67), and, most recently, Gorer (*Ann. Eugen.,* **15**, 277) have dealt incisively with the defects of Darlington's systems and devices of explanation, and the half-truths many of these essays would build into the foundations of biology. It is true that the articles just cited review other works by Darlington and Darlington and Mather. But the substance of these other works is distilled in many of the essays now under review, and the fact remains that their authors have stood impervious to the criticisms of others, unyielding to the evidence of overwhelming contrary fact. There are no notes now appended to these essays covering disputed points; there are no detected changes in point of view or conclusion. Since each author has apparently consented to an unalterable perpetuity of views at variance with fact, we can only conclude that in many respects they have contrived a personal genetics that excludes nonconforming views, and quite apparently stifles their appreciation of a much larger outside world of facts and ideas.

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Comparative Animal Physiology. C. Ladd Prosser, Ed. Philadelphia: Saunders, 1950. 888 pp. $12.50.

This volume was prepared to fill two long-standing needs for a textbook for students, and a source book for investigators. It has been eagerly awaited, since no satisfactory book in the field has been available in English. The text was written by five young physiologists who have been active in research during recent years. They have accomplished a herculean task in reducing the enormous literature of the field to a single volume. C. L. Prosser wrote 13 of the 23 chapters, besides serving as editor, and assisted V. J. Wulff in one. F. A. Brown, Jr., wrote five chapters; T. L. Jahn and V. J. Wulff collaborated on three chapters; and D. W. Bishop wrote one chapter.

Some readers will wonder why certain topics have been included and others excluded. This reviewer regrets the omission of a chapter on animal behavior. He believes that the topic deserves more than the casual mention it receives in the four chapters on reception. He also questions the omission of an adequate review of general chemical reception in view of the thorough treatment of taste and smell. And why was the basic topic of oxidation-reduction omitted,

[1] This reduction is presumably brought about by Darlington's essays on polyploidy (*Nature,* **124**, 62, 98); on meiosis and crossing-over (*Nature,* **127**, 709; *ibid.,* **140**, 759); on chromosome chemistry (*Nature,* **149**, 66); on race (*Nature,* **152**, 315), and on viruses, so-called cytoplasmic genes, cancer, and disease (*Nature,* **154**, 164; *Discovery,* **6**, 331; *Advancement of Sci.,* **10**, 124). Mather contributes brief accounts of outbreeding and sexuality (*Nature,* **145**, 484; *ibid.,* **149**, 54), multifactorial inheritance (*Nature,* **149**, 427; *ibid.* **151**, 68); restrictions on inbreeding by incompatibility systems in angiosperms and fungi (*Nature* **153**, 392), eugenics and multifactorial inheritance (*R. Coll. Sci. J.,* **14**, 58), genes (*R. Coll. Sci. J.,* **16**, 63) and of the significance of nuclear change in differentiation (*Nature,* **161**, 872). An appendix by Darlington discusses the political destruction of genetics in the Soviet republic.

although a whole chapter is devoted to gaseous oxygen usage? And, finally, why were comparative reproductive mechanisms excluded? Someone will also ask: (1) why the title for Chapter 9—"Respiratory Functions of Body Fluids"—was selected instead of "Blood Pigments," the subject of the chapter; and (2) why Chapter 2 was entitled "Water" only, without including reference to solutions or osmotic relations.

Following each chapter is an alphabetical list of authors referred to in the text by numbers. This is an excellent feature of the book. A total of 3,527 references is listed, which would appear to be adequate. Too often, however, the references are to review articles or to other second- or third-hand summaries instead of to the original papers. This is a dangerous practice since not all reviews are complete or otherwise adequate. The editor's hope, expressed in the preface, that interested readers will trace back the earlier literature will be only occasionally realized.

It is rather unfortunate that the publisher used three different stocks of paper in the book, much of it so thin that the diagrams show through. He also was not always careful to back up the pages correctly, and in Chapter 21 allowed unequal margins at the tops of some 20 pages. Proofreading did not catch the unfinished reference at the end of Chapter 22. For a source book the index could have been considerably expanded to promote quick and ready reference.

In spite of these minor mechanical defects, the book is easy to read and is well illustrated by 312 figures and 78 tables. And in spite of the criticism mentioned above, it is by far the best text of its kind in the English language. No other can even approach it in its coverage and presentation. It will surely find wide usage among biologists. It will also unquestionably stimulate research in animal physiology because of the repeated emphasis put upon the large amount of work remaining to be done.

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The Fresh-Water Algae of the United States. 2nd ed. Gilbert M. Smith. New York: McGraw-Hill, 1950. 719 pp. $10.00.

In view of the current interest in these organisms, the appearance of this second edition is timely. The text has been considerably altered, with the addition of over 100 genera and their illustration. Newly included are the groups Charophyceae, Cryptophyceae, and the Chloromonadales. The first is treated as a second class among the Chlorophyta, and the latter are treated as groups of uncertain systematic position. Professor Smith says of the flagellates, where perhaps the most new material has been added: ". . . with the possible exception of the chloromonads, all the various groups (orders) of flagellates which protozoologists place in the subclass Phytomastigina of the class Mastigophora are phylogenetically connected to organisms of truly algal nature." The algae are assigned to six divisions, and of these he says: ". . . the six divisions . . . represent six kingdoms, all plant-like in nature. . . . The kingdom of the grass-green plants consists of a number of divisions of which the grass-green algae (Chlorophyta) are the most primitive and lead successively to the Bryophyta, Pteridophyta, and Spermatophyta." Many phycologists, and the reviewer, believe these interpretations of the relationships of algae to higher forms to be auspicious expressions of current modern opinion.

Considerable alteration has been made in the order in which the organisms appear through the book. In general this approaches that used in the author's *Cryptogamic Botany,* Vol. I, beginning with the green algae. The very useful ordinal names in the page headings have been excluded, as have the brief characterizations of families and orders that follow the general sections in the older edition. Some changes in terminology are made—e.g., "sporanges" of the earlier edition becomes "sporangia." Some useful literature citations have been dropped from the introduction. The splendid results of H. H. Strain's studies of algal pigments have been included. Several probably false genera have been omitted in the present edition —e.g., *Tetrapedia* Reinsch and *Phytomorula* Kofoid.

The accumulation of observations made since 1933, the date of the first edition, has necessitated alteration in the classification of some genera. One refreshing change is the removal of *Vaucheria* to the Xanthophyceae (Heterokontae), where it appears among the Heterosiphonales. Many of these changes were made to include the recent extensive observations of G. W. Prescott, L. A. Whitford, J. B. Lackey, and, particularly, those of R. H. Thompson. In following the practice of recognizing the Cyanophyta as three orders, one, the Oscillatoriales, is divided into two suborders, Oscillatorineae and Nostochineae. The nomenclaturally preferable *Polycystis* is used in place of *Microcystis.* Accepting *Sphaerella nivalis* (Bauer) Sommerf. (a *Chlamydomonas* in the author's opinion) as the lectotype for the generic name *Sphaerella* necessitated the use of the name *Haematococcus* for the Volvocalean unicells, the protoplasts of which are suspended by strands of cytoplasm from the walls. Similarly, following the type method, the name Haematococcaceae is used for the family in which they are placed.

An expansion of the diatoms might have been expected in view of their currently recognized importance. This section is, however, slightly shortened; mainly through pooling discussions and referring to taxonomic works for listings and characteristics of species, rather than including them in the text.

Although always noted for their workability, the dichotomous keys have been improved, not only by rewriting but by bringing the couplets together, numbering them, and indenting alternate pairs. In this edition, for all genera, there are references to the more recent monographic or taxonomic works where descriptions of all species occurring in the United

States can be found. It was the inclusion of such admirable and useful features that resulted in such a dependable first edition. The author's continuing efforts, as reflected in the present revision, immediately ensure high respect for the thoroughness and accuracy in this even more valuable second edition.

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Chemical Embryology. Jean Brachet. Trans. from 2nd ed. of *Embryologie Chimique,* by Lester G. Barth. New York: Interscience, 1950. 533 pp. $8.00.

Since Joseph Needham published his monumental volumes on the biochemical aspects of embryology in 1931 and 1942, no text of comparable scope and completeness has appeared, and one may doubt that this scholar's stupendous compilatory work will ever be duplicated. Yet, undiscouraged and despite great handicaps during the last war, Brachet has succeeded in writing another *Chemical Embryology* which in its first French edition appeared in 1944 and has now been ably translated and reedited for English readers.

This text travels over much narrower grounds than those covered by Needham. However, being quite up to date and in many respects original in its approach, the book will be welcomed by every embryologist who wishes to integrate biochemical and morphogenetic research. Brachet's qualification for attempting such a synthesis is his own wide experiences in almost every sector of the subject. The author is well aware of the fact that his attempt is bound to suffer from two serious shortcomings: a certain vagueness of our present-day morphogenetic concepts, and a paucity of really well-established and significant data on the chemical processes underlying development. Obvious reasons for this situation are the comparative youthfulness of analytical embryology, the extreme complexity of the processes involved, and absence of a sufficient variety of reliable microtechniques as are required for a comprehensive analysis. In his efforts to master these difficulties Brachet appears quite persuasive. He disposes of the material with facility and imagination, fitting it into a coherent framework of hypotheses that will doubtless stimulate further research. At times, however, one might have liked to see smoothness of presentation sacrificed in favor of a more critical attitude toward both the data and hypotheses coming from the author's own environment and those from other sources.

Chemical Embryology deals in a logical sequence with the phenomena of sex determination, formation of gametes, fertilization, cell division, embryogenesis, and regeneration in vertebrates and invertebrates. Special chapters are devoted to a discussion of the localization and physiological role of nucleic acids and of the induction phenomenon. Whereas the morphogenetic side of these processes is treated rather sketchily, the metabolic aspects are presented in detail. Publications that appeared after 1945 have been considered in this new edition but, unfortunately, are not listed in the bibliography. The illustrations, especially in the chapter on "The Organizer," are of unequal documentary value. Some could be dispensed with since they are based upon doubtful evidence, others discredit rather than support the statements in the text. There will be disagreement over some of the author's conclusions, but altogether the book will be a rich source of information and inspiration both to advanced students and investigators.

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Handbook of Freshwater Fishery Biology. Kenneth D. Carlander. Dubuque, Iowa: Brown, 1950. 281 pp. and appendix. $4.50.

Until the appearance of this handbook, there was no compendium of useful vital statistics on American fresh-water fishes. Dr. Carlander is to be commended; he has earned the gratitude of both present and future fishery biologists.

This pioneer compilation includes some 200 pages of age and growth data, about 10 pages of population information (yield and standing crop), 9 conversion tables, and an extensive bibliography of more than 1,100 titles. The book is thus largely one of age and growth information of certain common fishes.

Carlander's work serves several important purposes. It is an index to most of the published information on the age and corresponding lengths and weights for food, game, and other fishes. Because of its long list of references, it is a source of references on other aspects of the biology of fishes, and it is also a measure of the growth and present status of knowledge in the field.

Chronological analysis of the references cited by Carlander depicts the development of fishery biology (largely on age and growth). Grouped by decades and expressed as percentages, the section in the decade beginning with 1871 amounts to 1.0%; 1881, 1.0%; 1891, 1.9%; 1901, 2.1%; 1911, 4.1%; 1921, 14.1%; 1931, 30.5%; and 1941, 44.7%.

In the recent listing of the better known fishes of the U. S. and Canada (*Am. Fisheries Soc.,* Spec. Publ. No. 1 [1948]), I counted 184 kinds of fresh-water fishes. Discounting the 6 salmons of the West coast, which Carlander does not include, lowers this number to 178. Of these, Carlander shows no information on 57 (about 30.0%) but has found data on 30 others not on the American Fisheries Society list. The handbook gives age and growth information on a total of 151 fresh-water fishes. Classified subjectively, the extent of this information is good on a little less than 25% of the species (essentially sport fishes), fair on about 25% (mostly sport, food, and forage fishes), and poor on more than 50% of those in the list (largely forage, coarse, and "obnoxious" fishes). The present state of knowledge on the age-length relationship is shown to be more advanced for

most species than the frequently more valuable age-length-weight relationship. Young workers should be particularly encouraged by the research opportunities here disclosed.

Because of a sprinkling of clerical and typographical errors, research workers will probably do well to refer to the original papers when using or quoting data from the handbook. When figures are taken directly from Carlander, and the original not seen, this should be made clear.

Fishery specialists are urged to communicate their discoveries of any technical errors or omissions in the literature to the author. Here is such a useful work, prepared at great self-sacrifice, that all should be concerned with its extension, perpetuation, and perfection.

It is hoped that in time additional material may be included. Possibilities are the physical, chemical, and biological constants which express degrees of environmental suitability for fishes. Examples would be limits of temperature, pollutants, and dissolved gases under various conditions. Physiological constants, such as food requirements, blood counts, etc., might also be incorporated. Since treatment of some of these and of other related subjects may appear in the biological handbook of the AIBS, some care should be taken to avoid duplication, and perhaps even to arrange for placement in one source or the other.

I believe that complete alphabetization of the list of references cited would have been worth the considerable extra labor involved. Justification of the present form, however, is seen in the fact that future additions can be made at the end of each letter section, without disrupting the whole, and cross references in the text need not be changed, merely supplemented.

With an expansion of the introductory, explanatory material, the book would have value in the field of conservation education. By such expansion, it could be made as interesting to lay fishermen as it is valuable to the fishery technician and research worker.

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Textbook of Modern Pollen Analysis. Knut Faegri and Johs. Iversen. Copenhagen, Denmark: Einar Munksgaard, 1950. 168 pp. Dan. Cr. 16.00.

Publication of this book in English should prove to be a significant contribution to the development of pollen analysis, or indeed, to the broader subject of palynology.

The authors are well known in European circles, Faegri for his outstanding pollen statistical investigations of Norway, and Iversen for similar studies in his native Denmark, in Greenland, and in other countries. They were students together at the University of Stockholm under the "grand old man of pollen analysis," Dr. Lennart von Post, to whom they dedicate their book.

The authors make it plain that the volume deals exclusively with methods of pollen analysis, not with results. Reports dealing with the results are to be found in the bibliography. This is complete, as the authors say, endeavoring to take into account all literature having reference to pollen analysis up to 1949. This will be welcomed by American students as a key to the European literature.

Pollen analysis started with the work of von Post in 1916. It was quickly taken up by his students in Sweden and later in the other Scandinavian countries, gradually spreading through Europe and the rest of the world. From the middle twenties pollen analysis has been the dominant method for investigating late-Quaternary vegetational and climatic development. It has been perfected into a refined instrument of research, giving surprisingly intimate glimpses into conditions of life during earlier periods.

Pollen analysis hinges on the fact that the outer coat, the exine, of most pollen grains is formed of one of the most extraordinarily resistant materials known in the organic world. Pollen grains can be heated almost to 300° C, or be treated with concentrated acids or alkalis with very little effect on the exine, but it is less resistant to oxidation. The grains are generally excellently preserved in peat and sediments, from which oxygen is largely excluded, even when all other organic constituents are reduced to structureless substance.

Identification of these pollen remains is rendered possible by their highly variable structure, sculpturing, and texture. The authors have illustrated most of the basic forms and used their elements to construct perhaps the most comprehensive and logical key ever published. Yet they point out that "No key, however ingenious . . . can replace the personal knowledge of pollen forms acquired from working with actual preparations." Nevertheless, it is a long step in the right direction. Moreover, the authors have devised a perforated card system keyed to locate the card for the pollen grain wanted, on the basis of its salient features, almost as if they did not quite believe their own words.

Most forest trees produce enormous quantities of pollen which, it is true, may be transported great distances, "but judging from pollen-analytical experience we suppose that the forests beyond the 10 km limit are of very little importance for the ordinary pollen diagram and most of the material will be derived from much nearer sources." This, the authors point out, is because pollen coming from a distance, though it may be abundant, is numerically overwhelmed by that of near-by origin.

There is great variation in the amount of pollen produced by different species; consequently investigators have attempted to discover indices of the relation between the number of pollen grains counted in a deposit and the concentrations of the corresponding species forming the surrounding vegetation. The best control of the representativity of a pollen diagram is obtained, however, by comparing the grains of the

topmost sample with recent conditions. On this basis one can reconstruct the floras of the past with their climatic implications. These are correlated with macrofossils and human artifacts to piece out the prehistory of the human race. Archeological objects may be accurately dated by analysis of the small samples of peat that may adhere to them, provided the pollen diagram for this peat has been adequately studied.

The field of applicability of the methods of pollen analysis is ever-increasing, pertaining not only to fossil pollen—Quaternary, as well as pre-Quaternary—but to recent pollen also, such as honey and hayfever investigations, pollination ecology, glaciology, and even criminal investigations. These methods are brought up to date and clearly and pleasantly set forth in this volume.

ROGER P. WODEHOUSE

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The Care and Breeding of Laboratory Animals. Edmond J. Farris, Ed. New York: Wiley; London: Chapman & Hall, 1950. 515 pp. $8.00.

Those concerned with the maintenance of an animal colony for research or teaching purposes will welcome this book and perhaps wonder why it hadn't been written before. Within its pages is a wealth of information on the housing, caging, breeding, feeding, and some common diseases of several laboratory animals.

The various chapters, contributed by 15 different authors, cover the following species: monkey, rat, mouse, guinea pig, hamster, rabbit, dog, cat, ferret, opossum, domestic fowl, reptiles, amphibia, fishes, and *Drosophila*. The reviewer was particularly impressed with the chapters devoted to the domestic fowl and fishes. In addition, there is a chapter on the control of laboratory pests and parasites of animals.

A considerable portion of the book is devoted to the subject of caging. In this one phase, particularly, it is apparently easy to become an authority, as evidenced by the many modifications described and illustrated. Such minor modifications must keep commercial cage designers busy. It would appear that some standardization of cages would benefit both the animal laboratories and the manufacturers.

The discussions on animal breeding are generally very good. In some chapters mating behavior and physiology of reproduction of the species are described in considerable detail. On the other hand, the genetic aspects of breeding, with one or two exceptions, are treated in a cursory fashion, and the reader will have to search elsewhere for information.

The student of nutrition will not find in this book any great amount of data on this subject. In many chapters the discussion of feeding is primarily concluded with the recommendation to feed a commercial mixed meal or pellet. This advice offers maximum convenience and under some conditions may be adequate. However, there are certainly many conditions where the experimenter will desire more control over this environmental factor that can so largely guide the development of his stock. The reviewer hopes that future editions will present more adequately the wealth of existing information on nutrition for most of the species discussed.

The scattered literature on the common diseases and parasites of laboratory animals has been nicely summarized and is a very useful adjunct.

Many, but not all the chapters offer a useful list of references to more detailed information. The illustrations are plentiful and well reproduced for the most part. A quick search for information is facilitated by a good index.

As a reference book for the experimenter and the student of zoology, this publication should prove most useful.

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The Transmission of Nerve Impulses at Neuroeffector Junctions and Peripheral Synapses. Arturo Rosenblueth. Cambridge, Mass.: Technology Press, M.I.T.; New York: Wiley, 1950. 325 pp. $6.00.

Dr. Rosenblueth's monograph organizes the rather chaotic mass of information and inference regarding the mechanism of interneuronal and neuroeffector communication. It is a lucid and authoritative exposition of the case for chemical transmission at such junctions outside the central nervous system.

The first half of the book is a well-organized and well-documented review of the evidence upon which the theory of chemical transmission in the autonomic neuroeffector junctions is based. It is an up-to-date supplement to Cannon and Rosenblueth's monograph *Autonomic Neuroeffector Systems* (New York: Macmillan [1937]). The theory of sympathins E and I is clearly stated and ably defended. Objections and alternative theories are considered. There is a useful enumeration of the organs supplied by cholinergic and adrenergic fibers, with a résumé of established and controversial points.

This first half of the book provides a logical springboard for the second half, in which the argument for chemical transmission in autonomic ganglia and neuromuscular junctions is carefully developed. Dr. Rosenblueth states at the end of the book that "The argument for chemical transmission at peripheral synapses appears stronger than that which can be made for chemical transmission at autonomic neuroeffector junctions, yet the latter transmission is generally accepted as chemical whereas the former is still considered electrical by many experts in the field." This furnishes the key to an apparent "mission" of the work, namely, to show the parallelisms existing between the two systems (and the differences as well) and thus to develop a firm basis for the inference that