overly terse, abstract, and dogmatic. He also has an annoying habit of citing people without keying the citation to the list of references at the end of the book. The failure to document experiments outside the "in-group" is especially serious in view of Ittelson's arbitrary summaries of these experiments. He spends more space on the details of the experiments of his own group, but warns that the reader should examine the original experiments. I second this warning.

Incidentally, a rough count of his 144 cited references shows that more than a quarter of them belong to what may loosely be called the Ames group and that Ittelson was author or coauthor of a dozen of them. So we may be led to accept this as a definitive summary of the neofunctional or transactional approach to perception. However, we may question whether it does full justice to the important insights that this approach has achieved.

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College Textbooks. Compiled by Jane Clapp. Scarecrow Press, New York, 1960. 1096 pp. $25.

A classified listing of 16,000 textbooks used in 60 colleges, with author-title and subject indexes. The books are classified under three major headings: humanities, sciences, professional and technical fields.

Biological Sciences

The Wellsprings of Life. Isaac Asimov. Abelard-Schuman, New York, 1961. 238 pp. Illus. $3.75.

The Long Road to Man. Robert L. Lehrman. Basic Books, New York, 1961. 200 pp. Illus. $3.95.

These two books are both intended to convey present knowledge of organic evolution to laymen, but otherwise they are extraordinarily different. Lehrman's book is simple both in language and in thought, at times to the point of naiveté, and it is pitched at a low scholastic level. It is published in a series advertised by the publisher as intended "for teen-agers (and grown-up readers as well)." Asimov's book, although equally comprehensible, is a sophisticated, intelligently adult work. Lehrman tells a straightforward story of the long phylogeny of man. Asimov slides quickly over that subject and is almost entirely intent on underlying functions, for the most part in terms of the research that has revealed them. The juxtaposition of the two books emphasizes the great complexity of their common subject, for there is little duplication between them and both together still omit large and important parts of the subject.

After an introductory chapter, Lehrman devotes the next 10 of his 14 chapters to a summary of the fossil record of the groups in or near the human ancestry. The 12th chapter deals with ways of supplementing the fossil record by evolutionary interpretation of recent animals, especially of their embryology, and then briefly discusses the origin of the chordates. Chapter 13 reviews the whole story from the origin of life to *Homo sapiens,* by a combined approach. The themes of the last chapter are that man's coming was an evolutionary revolution, that our biological evolution ends here, and that purely cultural evolution now takes over and alone determines our future.

This storybook restatement of the evolutionary history of man is welcome. Lehrman's book is also generally up-to-date, and it is admirable in some other respects, for example, in much of its handling of sequence and local variation in fossil hominids. It is usually accurate, but by no means wholly so. I noted more than 40 errors, by which I do not mean statements open to misunderstanding, exception, or dispute (which are also rather numerous) but such downright mistakes as the remark that reptiles have their skulls supported on two bony projections (occipital condyles) and amphibians on one, or that *Cynognathus* had flat-topped molars—not world-shaking errors, but they do count up.

It seems to be almost inevitable in popularization of this sort that a few pseudo-Lamarckian and anthropomorphic or teleological phrases slip in: the environment converts a creature into something else; an animal retains such of its heritage as it finds useful. Lehrman's remarks on evolutionary processes do properly stress the interplay of mutation and natural selection, but he misrepresents natural selection as tending always to eliminate variation and leading inevitably to overspecialization. His belief that no natural selection or indeed no biological evolution is occurring in modern man is shared by few biologists and will be considered a dangerous doctrine by many of them. The book would have been more satisfactory if it either had stuck entirely to its main, descriptively historical theme or had given a more adequate and more insightful interpretation of the history.

The book by Asimov, quite different in approach and intellectual content, has also different merits and shortcomings. Asimov is one of our natural wonders and national resources. By profession he is listed as a university professor of chemistry. It is presumably in his spare time that he turns out three or four books and one or two dozen articles per year. He was once one of the prolific pioneers of modern, literate science fiction. He has gone on to become probably the most prolific and certainly among the best of the literate popularizers of science fact and theory. He is most at home in the physical sciences, but his works now embrace practically all fields of natural science and some others.

In the present book, with important omissions to be noted later, Asimov briefly spans much of the field of evolutionary biology. Here, as usual, his style is clear without sacrifice of solid content. He is continuously interesting and occasionally amusing without condescension or jocular superficiality.

The organization of the book is by decreasing levels of complexity and integration, starting with species and higher aggregations of populations of whole organisms and ending at the molecular level and, in particular, with deoxyribonucleic acid or DNA, presented as the ultimate physiochemical basis of evolution. The approach at each level is in the main historical, in terms of the successive discoveries of about 100 biologists and physical scientists. An appendix telegraphically lists workers and events in the history of evolutionary biology chronologically from 1630 ("Archbishop James Ussher calculates date of Creation as 4004 B.C.") to 1960 ("O. Struve plans radio telescope survey to detect life in other stellar systems").

The bulk of the book is in three parts of five chapters each (a symmetry achieved at some sacrifice of logic): Life and the Species; Life and the Cell; Life and the Molecule. A final part, headed simply "Life," deals in one chapter with the origin of life, on earth and speculatively elsewhere. The scope and trend of the story may be suggested by a partial list of topics and authorities discussed in sequence. Spontaneous generation: Aristotle, Redi, van Leeuwen-

hoek, Schwann, Pasteur. Classification: the Bible, Aristotle, Ray, Linnaeus. Basic concepts of uniformitarianism and evolution: the Bible, Hutton, Bonnet, Smith, Cuvier, Lyell, Lamarck, Darwin, Spencer, Mendel, De Vries. Two chapters then review, in barest essentials and without illustrations, the historical sequences from "one-celled creatures" to, among others, man. Consideration of organisms as such practically stops there.

Discussion continues around the level of cells and formal genetics: van Leeuwenhoek, von Baer, Haeckel, Flemming, and so (with some others more briefly mentioned) back to Mendel, who then has a chapter to himself, and to mutations (Muller, Pauling). The third part is entirely biochemical and runs from the first organic synthesis (Wöhler) through carbohydrates (Kirchoff, Bernard), lipids (Chevreul), proteins (Braconnot, von Liebig), structural formulae (Kekule, Fischer), and enzymes (Réaumur, Pasteur, Buchner, Sumner and Northrop, Beadle) to viruses and nucleic acids (Levene, Stanley, Avery, Fraenkel-Conrat, Pollard, Crick and Watson, Gamow, Hoagland, Allfrey and Mirsky, among others). The chapter on the origin of life and life on other worlds then closes the book.

That is an exceedingly long and complex list of subjects to treat in few more than 200 uncrowded pages. That it is treated for the intelligent layman so interestingly and clearly is an admirable *tour de force*. It would be unreasonable to expect that there should be no oversimplifications, no faulty generalizations, and no errors. Suffice it therefore to say that there are a few but that they do not detract seriously from the overall view that will be gained by a nonspecialized reader.

Cleavage in Modern Biology

By one criterion, legitimate criticism of Asimov's book ends there. What more I have to say relates less to the author's inclusions and accomplishments than to his omissions and limitations. Yet these further remarks are pertinent and have an importance broader than this particular occasion, because they relate to an unfortunate cleavage in modern biology brought about by an attitude among some (not all) biochemists and molecular biologists. It is largely a matter of the definition of goals in biology. To me and to other nonchemical biologists, it seems obvious that the most important goal of biology is to understand organisms: their structure, their functions, their interrelationships (of all kinds), and their history. It is no less obvious that biochemistry and molecular biology are absolutely essential for further progress toward that goal. To the extent, however, that biochemists and molecular biologists approach their materials from a physicochemical point of view, not clearly related to organisms as such, their studies lack truly biological significance and, however fashionable they may be, can hardly be in the ultimate mainstream of the science of *biology*.

That failing becomes vital when, as in Asimov's present book, the subject is organic evolution, which certainly has its meaningful focus at the level of populations of integrated organisms. The fact is that as Asimov follows his sequence *away* from that level his hand becomes surer and his information more adequate and modern. On systematics and the over-all phenomena of evolution his exposition is dated by from 75 to more than 100 years. His concept of the basic evolutionary process is that of some 50 years ago. (Interestingly enough, this is also true of current science fiction.) Apart from one or two minor points and the strictly chemical aspects, the rest of his genetics is from 30 to 40 years out of date.

It is in one way somewhat refreshing but in another appalling to read a general book on organic evolution that includes no hint of the work and (although written so largely in terms of personalities) no mention of the name of a single one of those to whom modern knowledge of the evolution of *organisms* is due. The Wright in the index is not Sewall but Seth, a farmer immortalized because in 1791 his flock produced a mutant lamb. The Huxley is Thomas Henry, obiit 1895, not Sir Julian, so fortunately still with us. W. J. Bryan (of *Inherit the Wind*) is there and so are W. S. Gilbert (of *The Mikado*) and W. Shakespeare (of *Antony and Cleopatra*), but W. C. Allee is not, nor, to mention only a few others, among many, are either C. D. or P. J. Darlington, Dobzhansky, Fisher, Haldane, Hardy, Lerner, Mayr, Rensch, Schmalhausen, or Waddington.

Only when Asimov finally reaches DNA does his book really reflect the state of knowledge in 1960. Here was the opportunity, one might say the obligation, to circle back, to bring the rest of the story up to date, and to tie all together in the meaningful terms of what is ultimately to be explained. The author's final words are, "A nucleic acid molecule came accidentally into being that could somehow bring about the existence of another like itself—And from that all else would follow!" But he has not really shown at the level of organisms, of *ourselves,* how or why it followed.

The disappointment is not exactly that of seeing Hamlet played without the Prince of Denmark. We can grant Asimov's casting of DNA as the Hamlet of his drama. The stage is set most elaborately. The supporting cast is brought on, one by one, and an intricate plot is developed for eventual resolution by the hero. All builds up in a crescendo to the entrance of DNA —Hamlet. Finally the hero does enter, and—

Just stands there!

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Late-Pleistocene Environments of North Pacific North America. An elaboration of late-glacial and postglacial climate, physiographic, and biotic changes. Special Publication No. 35. Calvin J. Heusser. American Geographical Society, New York, 1960. 308 pp. Illus. Paper, $4; cloth, $6.

This is a comprehensive study of late-Quaternary pollen sequences and related chronologies for the Pacific coast from California to south-central Alaska and Kodiak Island. The province is that of the Pacific Coast Conifer Forest, a natural region possessing unifying features but extending over more than 20 degrees of latitude. The fossil pollen evidence upon which the study is based is original, and most of it is published here for the first time. Carefully integrated with the accumulated evidence from geology, glaciology, and phytogeography, these palynological data yield information about the history of the Pacific Coast Conifer Forest that is of fundamental importance to an understanding of late-Pleistocene events in northwestern North America.

Calvin Heusser began this study in 1950 in connection with work on the late-Pleistocene history of the Juneau Ice Field, Alaska. By 1958 he had extended these palynological investigations westward to Cook Inlet and Kodiak Island and southward to California. His aim was to reconstruct the post-ice age environments and history of the

Pacific Coast Conifer Forest throughout its range. Altogether 114 sections in peat and other sedimentary deposits were studied; they form the basis for this work. Seventy-eight sections and their pollen profiles are presented. Eleven sections were reported previously; they were restudied in light of the total evidence, and the results were included. Henry P. Hansen, the pioneer in Pacific Northwest palynological investigations and the professor with whom the author studied, wrote the foreword, which includes an appreciation of Heusser's accomplishments.

The book presents a highly satisfactory coverage of the manifold aspects of events during the last 13,000 years along this coast. The geographic setting is well described, with sections on late-Pleistocene geomorphology, modern climate and recent climatic trends, and characteristics of the modern vegetation within the seven districts distinguished. A succinct review of Quaternary palynology's principles, methods, and sources of error introduces the main section of the book, a detailed and critical description of the peat and pollen stratigraphy of the sections, grouped according to the five regions within which the sequences are similar.

The more significant conclusions from these individual investigations are summed up with a discussion of late-Pleistocene vegetation in the total area, the environments inferred, and correspondence of the vegetation history with chronologies of other events, especially sea level changes relative to the land. A final chapter examines major biogeographical problems of the area. An appendix contains detailed information about sampling sites and an account of the geology and landforms in the various physiographic divisions. Although its definitions are in some instances too terse, the glossary provided will be welcomed by the reader unfamiliar with the specialized terms that Heusser could not avoid using.

The author's interpretations of his pollen profiles are consistent with climatic interpretations of available vegetation chronologies for areas as distant as Japan, New Zealand, Fuego Patagonia, and the British Isles. Thus further support is given to our growing confidence in the synchrony of worldwide climatic fluctuations that resulted in a warming trend during the retreat of the last continental ice sheets (Late Glacial and Early Postglacial), a time when warmth exceeded that of the present (the Hypsithermal Interval), and a temperature regression leading to the present (Late Postglacial). However, the Hypsithermal Interval is shown here to be noticeably shorter at the high latitudes. The Late Postglacial began about 2500 years ago in California, but 4000 years ago on Kodiak Island.

Interpretations of the pollen profiles are brought together with evidence from glacial geology and physiographic studies to lend new support to two of Hultén's postulated ice-free refugia, namely those in south-central Alaska and in the coastal strip from southeastern Alaska to Washington and Oregon. This new palynological evidence is also used in an attempt to determine the outlines of late-Pleistocene plant migrations. Although definitive solutions will require additional evidence, good cases are made, for example, for the migration of lodgepole pine westward as far as the Yakutat flats during the Postglacial and for two migrations of Interior Forest elements onto the Kenai Peninsula from unglaciated central Alaska, the more recent of which probably occurred during the last 4000 years.

This very readable and well-designed book will be, for some years, a unique authoritative source for information on late-Pleistocene vegetation of the Pacific Coast of northwestern North America and its chronological relations. The book is indispensable to one concerned with biogeography and Quaternary history in that part of the continent.

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Animal Sounds and Communication. W. E. Lanyon and W. N. Tavolga, Eds. American Institute of Biological Sciences, Washington, D.C., 1961. 443 pp. Illus. Demonstration record (33⅓ rpm): Sounds of insects, fishes, frogs, and birds. 2 sides. Members, $8.50; others, $9.50.

Most of the papers in this book were presented at a symposium of the Ecological Society of America, organized by J. T. Emlen, Jr., at the annual meeting of the American Institute of Biological Sciences in 1958. It would be unfortunate to give the impression that this represents even a reasonably complete survey of the vigorous field of bioacoustics. There are no papers dealing other than superficially with sounds produced by mammals, by insects other than Orthoptera and cicadas, or by other invertebrates, and the coverage of receptive mechanisms involved in acoustical behavior is extremely scanty. Within its limited framework, the book offers interesting and challenging essays on the selected subjects.

The papers vary widely in length and coverage. Thus, an article by C. M. Bogert on sounds and behavior of amphibians and reptiles is 183 pages long, almost half the book; it is a broadly critical review with a detailed presentation of Bogert's own work. On the other hand, the article by D. J. Borror on the analysis of animal sounds is only 11 pages long, most of them devoted to analyses of bird songs; it deals with only one type of sound spectrograph, omitting discussion of even so basic a tool for acoustic analysis as the oscillograph.

The article by P. P. Kellogg on tape recorders and recording, which, with Bogert's, was added after the symposium, is a workmanlike discussion. Unfortunately some of the warnings given by Kellogg were not heeded by some of those who prepared samples for the demonstration record. The record is a novel and useful adjunct, but disappointingly marred by print-through echoes and by distortion caused by overloading in the original recordings in many of the sections.

R. D. Alexander, in a paper on acoustical communication in Orthoptera and cicadas, combines a brief review of the literature with interesting personal observations and a number of sweeping generalizations that should take a few life-times to test. W. N. Tavolga presents challenging observations on underwater communication in fishes and emphasizes the need for more research.

The ontogeny of vocalization in birds is considered by W. E. Lanyon in the light of recent studies in Europe and the United States. The place of bird songs in mate selection is discussed by P. Marler, particularly the many problems still to be investigated.

The last two essays in the book, as well as the brief introduction by J. T. Emlen, Jr., are more general in approach. N. E. Collias attempts an ecological and functional classification of animal sounds. This "outline for continued research," as he aptly calls it, recognizes sounds as related to food, enemies, sexual behavior, parent-young relationships, and group movements.

C. F. Hockett concludes the book with a stimulating paper on logical considerations in the study of animal communication, in which he compares animal signals with human signals in message-carrying capacity.

The fact that another book of at least this size could be produced with papers on acoustical communication in mammals, insects, and other invertebrates, on instrumentation and analysis, and on auditory mechanisms shows that the field of bioacoustics is lively. The call for more research made in most of the papers shows that the field should grow even more lively each year.

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Microbiology. Historical contributions from 1776 to 1908. Raymond N. Doetsch. Rutgers University Press, New Brunswick, N.J., 1960. xiv + 233 pp. Illus. $5.

If we agree with the author's book plan, this little volume rates as a valuable contribution. It provides material for general courses in microbiology and supplements study of a poorly documented branch of that subject. The period covered is from 1776 to 1908, although only one of 15 scientists considered was born before 1776 and nine lived beyond 1908. The papers cited are restricted to those revealing historical antecedents of microbiology before it was arbitrarily compartmentalized.

The text begins with the origin of microbes, considers their role in fermentation, moves on to laboratory methods, and discusses classification and, lastly, biological activity. Each chapter begins with a *brief* historical introduction by the editor; this is followed with an article by the scientist concerned.

Pasteur's report on lactic fermentation requires three pages, whereas 26 are given to Lister's paper on lactic fermentation and its bearing on pathology. Schloesing's two pages on nitrification by organized ferments is the briefest paper presented. Beijerinck's discussion of *Spirillum desulfuricans* requires 23 pages, and Cohn's lecture, "Bacteria, the smallest of living organisms," 22. Koch rates two chapters, both on methods, and two present Winogradsky's work on sulfur bacteria and nitrifying organisms.

Theobald Smith is omitted, but Erwin Smith's paper, "Are there bacterial diseases of plants," is a worthy selection. Orla-Jensen's 16-page paper, "Main lines of bacterial systems," concludes the book and should particularly interest taxonomists.

Eighteen full-page plates portray each of the 15 scientists, show "Cohn's first plate illustrating bacteria," a page from Beijerinck's notebook, and an illustration of apparatus and organisms from the Lister paper. There are also a number of smaller figures and a few tables. There is no index or bibliography, although each chapter ends with a short list of suggestions for further reading.

Though the book is intended for students of microbiology, it should be of considerable interest to all in the field. The less mature may need guidance in reading it, if they are to preserve a proper balance respecting the over-all place of the scientists discussed; the more mature will find their background greatly improved by its perusal.

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Mushrooms of the Great Smokies. A field guide to some mushrooms and their relatives. L. R. Hesler. University of Tennessee Press, Knoxville, 1960. xii + 289 pp. Illus. $5.50.

During his career of nearly 40 years at the University of Tennessee, Hesler has devoted as much time as official duties have permitted to the critical study of the fungi of Great Smoky Mountains National Park, an area noted for the number and diversity of the species present. The results of his studies have appeared heretofore as technical papers, but in the present volume he offers, in a more popular form, an account of some of the interesting species occurring in the park.

After a brief introduction covering such topics as edible and poisonous mushrooms, fairy rings, mycorrhizal associations, luminescent fungi, and even the hallucinogenic forms, nearly 200 species selected from the more than 2000 known to occur in the region are described, briefly but accurately, and illustrated. Each description involves macroscopic characters only, with particular reference to shape, size, color, odor, and taste and with comment on its edibility, if known. The illustrations (in black and white) are by the author, and they are uniformly excellent. The book is well designed, the presswork is excellent, and the waterproof binding will protect copies used in field work. The book will be useful not only to "inquiring amateurs," as the author suggests, but to anyone concerned with the larger fungi of the park or surrounding areas.

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Arizona Flora. Thomas H. Kearney, Robert H. Peebles, and collaborators. Second edition with supplement by John Thomas Howell, Elizabeth McClintock, and collaborators. University of California Press, Berkeley, 1960. viii + 1085 pp. Illus. $12.50.

This excellent standard work on the flora of Arizona is reprinted, and it is brought up to date through a 47-page supplement composed of additions and changes in the treatment of species and of references to literature which appeared between 1951 and 1960. The revision is based upon extensive notes and published papers by Thomas H. Kearney, upon research and review of the literature by the revising authors, and upon revision of individual genera and families by the specialists who contributed portions of the text for the first edition.

The death of Thomas Kearney and Robert Peebles, both in 1956, marked the passing of a remarkable research team, for these men collaborated not only in taxonomic work but also in breeding cotton, a field in which their contributions are among the most outstanding of all time.

The main text stands essentially as it was printed in 1951. Even without the supplement this is one of the great treatments of a regional flora. Unfortunately, because of the cost of making new plates, one change of form was not possible in this revision. In the next edition the cumbersome and difficult-to-use nonindented keys should be changed to indented keys. This, of course, is a mere matter of mechanical rearrangement, but it is an item of first importance.

The more extensive revisions appear in *Selaginella, Bromus, Yucca, Quercus, Chenopodium, Argemone, Lupinus, Astragalus, Lathyrus, Argythamnia, Fraxinus, Gentiana, Asclepias, Gilia, Lithospermum, Valeriana, Hymenopappus,* and *Cirsium.*

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Kingdom of the Octopus. The life history of the Cephalopoda. Frank W. Lane. Sheridan House, New York, 1960. 300 pp. Illus. $7.50.

A Biography of the Sea. The story of the world ocean, its animal and plant population, and its influence on human history. Richard Carrington. Basic Books, New York, 1960. xvi + 268 pp. Illus. $5.

Under the Sea. Maurice Burton. Franklin Watts, New York, 1960. 256 pp. Illus. $4.95.

These three books have one thing in common; their authors desire that nonscientists read and enjoy them. Lane attempted a more difficult task by writing for scientists and nonscientists alike.

Kingdom of the Octopus must rate as a classic. Lane's craftsmanship as a writer and his years of hard work on subject matter have indeed led to a book valuable to scientists; at the same time, the volume should make splendid reading for the interested layman and is to be recommended for content and style.

A Biography of the Sea is also worthwhile reading. It tells of the geological development of seas and of the life in them and includes chapters on man's exploration of things marine. I question whether Carrington has produced a book which can be handled by nontechnical laymen other than those willing to read by dictionary. Carrington could be a paleontologist. He shows sympathy for and interest in the wondrous evolutionary changes in animals and in the earth itself which are far more sensitive than trained paleontologists and geologists are likely to show. The field is in need of such a competent writer; let us encourage him to continue writing on scientific subjects.

Under the Sea unfortunately falls short of being a good popular book on marine science. Hypothesis is not clearly labeled as such, and the parade of short descriptions of animals makes one dizzy.

Two of these writers have attempted a difficult thing: to synthesize not just a field but a whole area of science into a single book which does not misrepresent fact. After reading all three books, I wonder if this is really possible. Carrington could not bear to write of oceans or environment without first discussing some of the elementary physics of heat transfer. His desire that readers understand the importance of this to oceanography is commendable. He also realized the importance of the entire field of historical geology in tracing the history or biography of the sea, but one cannot do justice to paleontology in a chapter or two. The result is crowded, delightful reading for a trained person but rough going for those without specialized vocabularies.

Lane, on the other hand, reduces the scope of his book to squids, cuttlefish, and octopuses, and in so doing he gets deeply involved in many basic marine problems, such as bioluminescence, coloration, and environmental relationships. One gets the feeling that the 900-odd titles in his bibliography probably cover the entire world reading list on these animals. The illustrations show the same selectivity, for they have been chosen as the finest from many pictures. The photographs alone are worth having in one's library.

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The Beetles of the United States (A manual for identification). Section 1. Ross H. Arnett, Jr. Catholic University of America Press, Washington, D.C., 1960. xi + 210 pp. Illus. $3.50. (To be completed in about 2 years, in approximately eight sections, at a subscription price of $25. Binder available for $3.95.)

The ecologist or general biologist should find this manual very useful for the identification of the beetles he encounters in his field studies. Amateur and professional entomologists will find it indispensable. It is the avowed successor to J. Chester Bradley's mimeographed "Manual of the genera of beetles of America, north of Mexico" (1930), a work somewhat out of date and almost unavailable.

Section 1 comprises a general introduction, brief sketch of beetle anatomy, a bibliography of general works, a key to families of the world, and nine family fascicles (for the families Cupedidae, Rhysodidae, Cicindelidae, Carabidae, Amphizoidae, Haliplidae, Dytiscidae, Noteridae and Gyrinidae). The largest family covered is the Carabidae or ground beetles; the treatment of this family is a major generic revision for the Nearctic region, prepared by George E. Ball of the University of Alberta.

The plan for the whole manual calls for a separate fascicle for each of the beetle families found in the area covered —the United States from Canada to Mexico. The families treated in section 1 are brought out in their generally accepted sequence. For each family there is a short synonymy of family names; a common name; description of general features in adult and larval stages; a superb habitus drawing of one species and often some drawings of details; a brief account of the ecology, general distribution, and number of species in the world; and an appraisal of the state of the taxonomy. This introduction is followed by a key to genera and higher categories, a listing by these categories which includes the number of described species and the range for each genus as it is represented in the United States and sometimes an account of the ecology, and a family bibliography. Some of the fascicles have been checked by specialists in the families concerned, and the Carabidae fascicle was completely written by a specialist. The first nine fascicles have been handled in a very scholarly manner.

When completed, this manual will be a valuable aid to beetle identification, at least to the level of the genus. In secondary schools it should become as much a part of the library as a manual of botany, so that the budding naturalist can get some specific information about any beetle he may encounter, for beetles make up at least a fifth of all organisims in most areas. Its place in college and departmental libraries is assured.

I am sure that the publishers regret the price that they must charge for this work, which should get into the hands of anyone interested in insects. We can only hope that the price will enable them to keep the manual in print for a reasonable number of years. The method of publication, on pages 6 by 9

inches, punched for a 3-ring binder, will certainly be hailed by the users and bemoaned by librarians. A more permanent binding than this loose-leaf notebook will have to be used on library copies, which are sure to see heavy use.

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Hackfruchtkrankheiten und Nematodenforschung. Festschrift anlässlich der Einweihung des Neubaues für das Institut für Hackfruchtkrankheiten und Nematodenforschung der Biologischen Bundesanstalt für Land- und Forstwirtschaft in Münster (Westf.). (*Mitteilungen aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft Berlin-Dahlem*, vol. 99). Parey, Berlin, 1960. 119 pp. DM. 13.50.

The dedication of a new buliding, like the baptism of a child, is an act of faith. It is an assertion that the purposes for which the building was erected will remain valid for years to come. It is also, like the religious ceremony, a celebration of the maturity of the parents. This *Festschrift* marks the dedication of a new building devoted to research on the diseases of truck farm crops and on the nematodes that are parasitic on plants. Three technical papers on nematodes and four on viruses report current research at the institute and are of interest to specialists in the field. Of more general interest is the brief history of the institute and the excellent review of phytonemotology in Germany.

Although soil-inhabiting nematodes have been known for many years, they have never been a part of the mainstream of biological research. Our scrutiny of the various groups of organisms about us has been strongly influenced by their size, brilliant coloration, or direct importance to man, either medically or agriculturally. The recent upsurge of work on the microscopic nematodes inhabiting soil and plants is a reminder that we still have an imperfect view of life on our planet. During the last two decades the number of workers in this branch of nematology has increased at least tenfold, but the field is still very small. The first German station for work in phytopathology was erected during the late 19th century to combat calamitous losses caused by nematodes in sugar beet crops. Little progress in understanding other plant diseases caused by nematodes was made until quite recently, when nematodes have been implicated in many plant diseases, both as direct pathological agents and as parts of complexes. The dedication of an institute having adequate space and facilities for research in this area represents an important step forward for German agriculture. We are happy to welcome this newest addition to research on nematology and look forward to the fulfillment of the promise of its new building.

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Physical Sciences and Engineering

Crystal Structure Analysis. Martin J. Buerger. Wiley, New York, 1960. 668 pp. Illus. $18.50.

Imperfections in Crystals. H. G. Van Bueren. North-Holland, Amsterdam; Interscience, New York, 1960. 676 pp. Illus. $16.75.

Here are two valuable additions to the summarizing literature of solid-state science. The two have different goals, but both will remain prominent sources of knowledge for a decade or more.

Martin Buerger, in addition to being an outstanding research investigator, is a pre-eminent teacher. His book is intended primarily to help the serious advanced student who wants to master the field of x-ray crystallography along his way. The volume grew out of nearly 15 years of experience in the lecture room and the teaching laboratory, and it represents a basic summary of generally valuable material. His recent book, *Vector Space and Its Application in Crystal Structure Investigation* (Wiley, New York, 1959) is in the nature of a supplement on more advanced topics.

Crystal Structure Analysis deals thoroughly and logically in a step-by-step way with each of the topics that the would-be professional crystallographer must have at his fingertips. The diffraction relations are treated both qualitatively and quantitatively. The ways for selecting and preparing specimens are described in detail. The various methods for measuring intensity and the factors that affect intensities are discussed thoroughly. The unit cell and its variations are described. The concept of the structure factor is developed, and, for illustrative purposes, the principles are applied to several simple crystal structures. The topics of Fourier synthesis, reciprocal lattice theory, and all of the implications of symmetry are treated in a direct and pragmatic way. The methods of determining the phases of Fourier coefficients, in both general and special cases, are reviewed; the results are applied to some of the standard problems.

The text is very clearly and painstakingly written, and it is profusely illustrated with clear figures and excellent tables. I do not believe the book has a rival, at least in the English language. It should become an indispensable aid in teaching basic x-ray crystallography wherever English is used.

Van Bueren's book on crystal imperfections represents the first really comprehensive attempt to discuss in detail the broad sweep of research on imperfections in crystals, particularly of the research since 1945. Other books, more specialized or otherwise, which are more critically written, may come in the future, but this book has all of the principal ideas laid forth in a very direct and readable manner. The author, a member of the Philips Research Laboratories (Eindhoven, Netherlands), obviously had the advantage of discussing the text with a substantial number of informed colleagues.

The book begins with a general account of the perfect crystal and the types of imperfections which it can sustain. The importance of temperature and the accidents of growth and chemical composition are described.

The second part deals with imperfections in metals, giving an account of the causes and effects of plastic deformation and of the importance of foreign atoms, diffusion, and the myriad of matters of interest in modern metal physics. It should be mentioned that almost two-thirds of the volume is concerned with the properties of metals. Part 3 deals with the salts and monatomic semiconductors, such as silicon and germanium. It uses the background of concepts introduced in discussing the metals, emphasizing the characteristic similarities and differences between metals and nonmetals.