Paleontology: Handbook of Techniques

Handbook of Paleontological Techniques. Bernhard Kummel and David Raup, Eds. Freeman, San Francisco, 1965. xii + 852 pp. $18.

Budgets for paleontological equipment are generally in the hundreds or at most thousands of dollars rather than the millions. Paleontologists do not at present require particle accelerators or space vehicles (although they are capable of finding uses for both). Nevertheless, no science uses a greater variety of techniques, and none is more dependent on them. Some are of course as old as the science itself. Others are just now changing its scope and potentialities. Despite those facts, there has hitherto been only one book on paleontological techniques. It is unduly brief, and it is now far out of date.

Acquisition of technical skills in paleontology has been almost entirely by the apprentice system. Dissemination of new techniques, to the extent that it occurred at all, has been by word of mouth or by unsystematic, dispersed, and often obscure mention in brief articles. All those considerations and some others prompted the Paleontological Society to initiate activities that have eventuated in the hefty handbook now before us. Some 5 years of committee and editorial work have gone into its making. In view of the complexity of the undertaking, that is a remarkably short time.

The main body of the handbook consists of 87 essays by 87 different authors. (The equality of numbers is a coincidence, since many authors have written more than one essay and many essays are by more than one author.) Most of the essays are supplemented by references, and the book further includes 124 pages of classified bibliographies compiled by Kummel. Without important exceptions, the 87 authors (and also the editors) are professional paleontologists who are themselves outstandingly expert in the techniques that they discuss.

Part 1 consists of 21 essays, all rather brief, on general procedures and techniques applicable to each of the most important groups of fossil protists and animals, plus one essay on plants. There is inevitably some overlap of one group with another and with later discussion of particular techniques, but in quite summary form this section successfully highlights methods peculiar to the major paleontological specialties.

Part 2, with six subsections, is devoted to descriptions of special techniques. The first group of 13 essays on collecting is a somewhat mixed bag. It includes such oddities as a downright inane article on collecting in sedimentary rocks ("Fossils are most commonly found in sediments . . . or sedimentary rocks. . . . Field clothing should be comfortable, durable, and functional. . . .") and an article on collecting fossils on tropical Pacific islands, which is interestingly esoteric but hardly an outstanding contribution to the purposes of the handbook. However, among other useful things, this section also includes an adequate exposition of the washing and screening technique responsible for some of the most remarkable recent advances in vertebrate paleontology.

The 18 essays on mechanical methods of preparation include do-it-yourself information on an astonishing variety of methods ranging from serial grinding to centrifuging and "Rotapping." This section alone would repay the project for this volume. The following section, on chemical methods, consists essentially of a single, short essay which does cover the subject but is nevertheless mildly disappointing. Chemical preparation is among the most widely applicable of paleontological techniques, is subject to considerable refinement and modification for special applications, and continues to have profound effects on the whole science. It might have been treated in even broader extension and to greater depth.

"Radiation and related techniques" includes not only x-ray and electron microscopy but also infrared and ultraviolet photography and a wide variety of analytical techniques. Casting and molding, discussed in three essays, play an even larger part in paleontological research than is here explicit, but the procedures and the new plastics and other compounds now available are clearly expounded. A section on illustrations, seven essays, is almost entirely devoted to photography. Comments on the drawing of specimens are competent but too brief to be of much real use, and other kinds of illustrations are not discussed.

Finally (except for the long classified bibliographies already mentioned) there is a section of 15 essays, 238 pages, on techniques in palynology. This subject is covered in much greater detail and from more points of view than any other aspect of paleontology. Here is a whole book within the handbook, and one wonders whether publication as a separate volume might not have been considered. Some other subjects might then have been given more exhaustive treatment. However, this section makes certain that palynologists *must* have the handbook, and that may increase the circulation of the whole work. What might otherwise be undue stress on palynology may also be justified by the current excitement of this "hot" subject and the novelty of some of its procedures.

Large as the book is, even aside from the sub-book on palynology, it could not have treated all the subjects that could be included under its title. There is a necessary truncation at both ends. The techniques covered do not include stratigraphy, mapping, or, in general, field records, without which collecting is virtually worthless. They also do not include such techniques as cataloging, measurement (except for a short bibliography), statistics (except in pollen analysis), and many others essential in systematics and other research.

What the book does include is a great amount of information of generally high quality; thus, it is an extremely useful volume. The authors, editors, and publishers deserve not only praise but also thanks.

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Physics: Scattering Experiments

Collision Theory. Marvin L. Goldberger and Kenneth M. Watson. Wiley, New York, 1964. x + 919 pp. Illus. $19.95.

The analysis of scattering experiments has played a significant part in the growth of nuclear and elementary particle physics, for scattering processes underlie nearly all of the interactions between particles. Although the development in the subject of collision phenomena itself has been extensive, the results, to a great extent, have been available only in the published literature. Summaries have been available in the report literature, or in lecture notes, but the texts and mono-

graphs that have been published have either ignored the changes in the formulation of the subject or have been rough compendia of papers from the literature. (Exceptions to this statement may be found in some of the more recent texts on quantum mechanics, in which very brief introductions to particle collision theory may be found.)

To fill this gap Goldberger and Watson seek, on the one hand, to provide the student with a more careful presentation of the physical description of scattering processes and, on the other hand, to provide the reader with a thorough exposure to the formal theory of scattering so as to enable him to read the current literature on the subject. The first aim is ably fulfilled in the first few chapters, using the language of wave packets. This formulation is most appropriate to particle scattering where the scattered particles are actually counted in finite-size counters. The remainder of the book is devoted to the second aim.

Following the introduction to the physical description, the formal theory of scattering is presented in detail, with some reliance on the previous, more physical presentation to clarify some of the more obscure points. The role of symmetry principles in scattering theory is also clearly presented and applied to the two-body problem, with both central and noncentral interaction forces. The presentation of the theory of the decay of unstable particles which follows serves to collect in a coherent form material that has been available only in the literature; some of the techniques developed here serve as a basis for a subsequent chapter on the detailed treatment of the scattering of systems of particles. The use of dispersion relations as an analytical tool in the treatment of scattering problems is then discussed in detail and applied to both nonrelativistic and relativistic problems, in particular, to the scattering of pi-mesons by nucleons.

Finally, a word of caution is necessary: this is not a book for the casual reader or the beginning graduate student. Its study, however, is a must for anyone interested in obtaining a greater insight into the theoretical description of collision phenomena. It is excellently written and will take its place with the other classics of the growing literature on physics.

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Molecular Genetics: An Introduction to Gene Action

Gene Action. Philip E. Hartman and Sigmund R. Suskind. Prentice-Hall, Englewood Cliffs, N.J., 1965. xiv + 158 pp. Illus. Paper, $2.95; cloth, $4.95.

The great and rapid changes that have occurred in certain areas of genetics during the last 20 years have made it impossible for any geneticist to keep up with even a small part of the advances being made in genetics. This has been particularly true of molecular genetics, however one may wish to define it. For the most part books and review articles covering this area have become outdated while in press. Now, however, signs of a plateau, not in cerebral and laboratory activity but in the rate of accumulation of significant basic facts that relate to the functioning of genes, are evident. The time has come to introduce gene action to the beginning student of genetics from the point of view of molecular genetics. This book, a volume in the Prentice-Hall Foundation of Modern Genetics Series, attempts to do just this, and it does it very well.

The authors present a well-written, clear discussion of protein structure and of protein synthesis as it is now believed to occur in vivo in cells under the dictation of DNA and messenger RNA. They also present clear descriptions of intragenic complementation and its probable significance, the current views of regulation of protein synthesis in microorganisms, the significance of the primary structure of proteins, and the current status of ideas and facts concerning the genetic code. The secondary consequences of gene action, as they are reflected in gene mutation, have been given short shrift, as has gene interaction; but this is understandable in view of the fact that the authors have made every attempt to present their analysis strictly from the molecular point of view.

The authors conclude with a short chapter on the application of the present knowledge of gene activity, as it has been determined in microorganisms, to problems, such as development, encountered in studying higher organisms.

The pedagogical value of this book, and of others of its type, remains to be tested by use in genetics courses. However, there is no doubt that it will enable any biologist who is not well acquainted with the field that it represents to obtain a logical, concise, authoritative description of our present ideas concerning gene action.

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Soils: Mineral Analysis, Morphology, Spatial Arrangement

Fabric and Mineral Analysis of Soils. Roy Brewer. Wiley, New York, 1964. xiv + 470 pp. Illus. $15.

This book, which is mainly an extension of the techniques of petrography to the descriptive study of soils (pedography), is a clear demonstration that the division of petrology and pedology into separate academic categories does not reflect any real barrier in the subject matter of earth science. Although intended mainly for students and practitioners of pedology, I strongly recommend the book to petrologists, for it puts the study of soils into a frame of reference with which they are familiar.

A third of the subject matter is concerned with mineral analysis; the remainder, with the morphology and spatial arrangements of soil features. Four chapters are used to summarize size, shape, and roundness of mineral grains, quantitative estimation of mineral proportions, and calculations of soil formation, mineral stability, and weathering. Much of this material is based on the work of sedimentary petrographers. Brewer devotes nine chapters to discussion of the analysis of structural and textural features observable in soils; these chapters are the culmination of his original work in this field during the last decade or so. The concluding chapter relates fabric and mineral analysis to soil genesis and classification. A useful appendix describes methods of collecting, preparing, and analyzing soil samples.

The treatment of fabric is largely descriptive, for the chapters are arranged by pedological features rather than by generic soil types. Although Brewer treats features that are ob-