tries. It shows how well the editorial committee framed the *Guide* and how carefully contributors restricted their descriptive terms to those widely understood.

Careful search revealed almost no typographical errors. The book is a model of concise writing. It gives the latest information about the taxonomy of most European vascular plants. It will be used extensively by botanists, professional and amateur, in many parts of the world. And these botanists look forward with eagerness to the appearance of the ensuing three volumes. Contributors, editors, advisers, consultants, printers, and others who labored on this book deserve praise. Taxonomists extend their thanks and best wishes to the men and women who have produced this outstanding work.

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Applied Statistics

Statistics and Experimental Design in Engineering and the Physical Sciences. vols. 1 and 2. Norman L. Johnson and Fred C. Leone. Wiley, New York, 1964. vol. 1, xvi + 523 pp., $10.95; vol. 2, x + 399 pp., $11.50. Illus.

A good comparison can be drawn between the set of books reviewed here, *Statistics and Experimental Design in Engineering and Physical Sciences*, and the volumes by Kendall and Stuart, *Advanced Theory of Statistics*: both are published in two volumes and written by two authors, both contain a wealth of worked examples and exercises, and both include a comprehensive selection of topics in their respective fields. Kendall and Stuart is frequently cited, but seldom used as a textbook. It is my opinion that Johnson and Leone will also serve as an excellent reference source, for students who have had some formal training in statistics and wish to work as consultants in the field of science and engineering, but that it will not serve as well as a textbook for students in science and engineering. To appreciate the many subtle ideas and useful techniques enthusiastically introduced by the authors (and in some places evidently addressed to professional statisticians), some prior training in statistics is almost surely desirable.

The first five chapters (154 pages) cover the necessary background, including descriptive measures, probability theory, and discrete and continuous distributions. In chapter 6, order statistics are discussed and the distribution of range and tolerance distributions are derived. Chapter 7 covers briefly theories of testing and estimation; chapter 8 gives some standard tests of significance, including a discussion on the use of noncentral distributions; and chapter 9 is on nonparametric tests. In chapter 10 on control charts, cumulative sum charts are treated in detail. Nineteen pages (chapter 11) are allotted to a discussion of prior probabilities and to decision and loss functions. Chapter 12 deals with regression and correlation. It seems to me that the eight pages devoted to the Doolittle and Choleski methods for the solution of normal equations could have been better utilized to provide a more detailed exposition of models of linear relationships. Twenty-six tables complete the first volume.

Three chapters (250 pages) on analysis of variance and the related experimental designs are the highlights of the second volume. The topics are thoroughly treated and illustrated with examples taken from statistical publications. Sequential analysis is introduced in chapter 16 and response surfaces in chapter 17, which is on multivariate observations. Chapter 18, on sampling structures, concludes the main part of the second volume. A selected bibliography of statistical tables and periodicals is given in chapter 19. At the end of each volume solutions are given for about ten exercises per chapter.

These volumes are encyclopedic, and probably cover more topics than any other single treatise on applied statistics—half-normal plot, ratio of standard deviation of trimmed and untrimmed means, Tukey's quick compact two-sample tests, moments of Wilcoxon statistic, and the Zeta distribution are a few examples of the topics included. On the other hand, the law of large numbers and the central limit theorem are not mentioned by name anywhere; apparently this was intentional.

I noted a considerable number of errors and misprints. Most of these are obvious and could have been corrected at the proof stage. For example, the formula for $\alpha_3(x)$ in section 5.6.3, and the equation (12.22) are incorrect; a data point discussed in the text is missing from figure 15.2; and figure 16.3 is missing altogether.

In summary, the authors have successfully presented in these two volumes an up-to-date collection of the many useful statistical techniques developed in recent years; the practicing statisticians in the field of science and engineering should find this publication a helpful and valuable reference.

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Chemistry

The Chemistry of Complex Cyanides. A literature survey. M. H. Ford-Smith. Her Majesty's Stationery Office, London, 1964 (order from British Information Services, New York). vi + 93 pp. Illus. $5.50.

In this useful book, Ford-Smith considers successively, in order of increasing atomic number, the 28 metallic elements that are known to form complex ions containing at least one cyano ligand. Under the heading of each individual element one may find two types of information. First, there is an outline, usually presented in a few sentences, of the methods of preparation and the reactions of the various complex ions, accompanied by the appropriate literature references. Then, for those complexes that contain only cyano ligands, the author presents in tabular form literature references to sources of information about the following topics: reaction kinetics, polarography, redox potentials, anion structures, the infrared spectrum, the visible and ultraviolet spectrum, formation constants, and magnetic moments. At the end of the book, after the coverage of the individual elements, there are six appendices and a four-page section in which Ford-Smith considers the overall state of development of the field and lists some areas in which he feels that future research would be particularly profitable. Each appendix contains the formulas of the known complexes of a given type—for example, Appendix A contains the formulas of carbonyl-cyanide complexes.

Most of the more than 450 references are to the original literature, but per-

haps 30 percent cite books, particularly the well-known treatises by Sidgwick and Remy, or *Chemical Abstracts*, the latter presumably when it was felt that a particular journal would not be available in most libraries. The latest references are to articles published in the latter part of 1962, an indication of the termination date of the literature search.

Those working in the field of complex ion chemistry should find the book useful as a convenient source of literature references, as a concise summary of preparative techniques and chemical reactions, and as an aid in the preliminary planning of future research projects.

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Theoretical Physics

The Eightfold Way. Murray Gell-Mann and Yuval Ne'eman. Benjamin, New York, 1964. xii + 317 pp. Illus. Paper, $3.95; cloth, $8.

This timely volume contains a collection of 30 papers on the physics of mesons, nucleons, and their "strange" companions in supermultiplets of the group SU_3. The particles of lowest mass fall into sets of eight so that their states form the objects on which the group adjoint to SU_3, which is of dimension eight, operates. Most of the papers have been published in journals within the past four years, and two-thirds of them are very brief research letters and the like. The authors have supplied editorial comments on the sections into which the papers are grouped. The general topics include basic theory, predictions and comparisons with observations on masses, selection rules, electromagnetic properties, spontaneous transformations, and attempts to account for mass differences in a supermultiplet. In addition to providing an authoritative collection of the achievements and speculations of the theory, the book is of value as a handy source of roughly 300 different references to the literature.

The reader who is looking for an introduction to the subject will find that the full length articles present a variety of approaches from which he can choose the one that best matches his preparation. He should try not to be disheartened at the outset by the short articles which necessarily do not convey much in the way of explanations and some of which are written in terms of that inevitable abomination, the specialist's patois. The longer papers (which constitute about half the total material) provide the necessary definitions, references, mathematical development, and general applications. However, with respect to the latter, it must be kept in mind that suggestions made in some of the earlier articles have since been discarded. One paper treats an interesting alternative to the eightfold way proper—the possible existence of "quarks" which, incidentally, provide an elementary approach to the theory of SU_3. This aspect of the theory has commanded attention recently in connection with the combination of the eightfold way and ordinary spin. It appears that representations of SU_6 are amazingly suitable for furnishing the particle quantum numbers, including spin, as well as those of SU_3.

The success of the unitary groups in particle theory is the most interesting development in theoretical physics in recent years. One has still to relate it to physics, however. This book will most likely hasten the day when we "understand" the eightfold way.

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Paleontology and Geology

Time in Stratigraphy. Alan B. Shaw. McGraw-Hill, New York, 1964. xiv + 365 pp. Illus. $10.50.

The main thesis of this work is the application of the statistical method of least squares to correlation of faunal successions. The first nine chapters deal with the lithic successions in epeiric seas; two types are recognized, called *allochthonous* and *autochthonous*, terms more familiarly applied in a tectonic context. The section is theoretical, thought provoking, and stimulating, but the reader will leave it so hopelessly confused that he will accept the conclusions brought together in chapter 10, or with so many reservations that he will reject all of them.

The second section deals similarly with the familiar methods of faunal evaluation. Its prelude is a restatement of genetic causes of evolution; from there Shaw proceeds to criticize previous methods of the index fossil, the faunal zone, and the hemera and epibole, and continues to a chapter labeled "The biozone or the search for the Holy Grail" and another entitled "Adequacy of the fossil record, or shades of Charles Darwin." In the latter chapter, Shaw begins by claiming that the fossil record is adequate, and then proceeds to deal mathematically with the probability of finding a fossil in a given location. In fact, the fossil record is inadequate, and our knowledge of it is incomplete. We have such anomalies as one Cincinnatian aglaspid, with no others known above the Trempealeauan; one Silurian piloceroid, with no others above the top of the Canadian; and the Mississippian Rayonnoceras, with nothing connecting them with other actinoceroids in the Middle or Upper Devonian. Countless other examples of odd, seemingly isolated, survivals could be added. The special conditions necessary for the preservation of ordinary chitin leaves us with a most incomplete record of the Crustacea in the Paleozoic, and the special conditions needed for the preservation of identifiable echinoderms leaves our record of that group most incomplete. However, the subsequent mathematical treatment is not completely invalid; rather its validity is merely more limited in scope than is claimed here.

The work then proceeds to the exposition of the "equation of correlation," the application of the statistical method of least squares to faunal successions. Here the average geologist, whose mathematics is rusty, will be left behind; clarity could have been improved by clearer explanation of symbols, even at the risk of some repetition. This method is developed, and in an appendix, which makes up nearly a third of the book, its application is shown. Most of the sections here treated are from the American Upper Cambrian, surely an ideal proving ground for the method. However, these sections are exceptional. They involve few lithic changes, and these are of a sort least likely to affect faunas. They yield relatively few species, mainly trilobites, which are obtainable easily in an identifiable condition and in some numbers, throughout the sections. One deals here also with species concerning which there are few problems at the specific level. But even here the method seems dubious, for it rests upon some questionable assumptions. That some fau-