or, if with an avowed purpose, failing to achieve it through use of an improper vehicle. Most non-books intruding upon our libraries today have resulted from unsuccessful attempts to transcribe into book form successful experiences in oral communication. Also making their appearance, however, are non-books that are based on the frank eschewal of both oral and literary traditions. Such a printer's exercise as *Marine Biology I: Proceedings of the First International Interdisciplinary Conference* (American Institute of Biological Sciences, 1963) skillfully transmutes dubious verbal communication into noncommunicable verbiage.

The foregoing criticism should not be construed as a blanket denial of the merits of the volume at hand. On the contrary, in this particular instance the components redeem the whole. Some of the contributions are unusually fresh in approach and in content, and a few are excellent. But the reader should not expect to find here an integrated account of the interrelationships of algae and man. Rather, he will puzzle over a review of the cytology of the Phaeophyta—irrelevant, however worthy in another context; he will discover that the ecology of plankton algae is treated by at least eight authors; he will find only four pages devoted to the role of algae in the purification of wastes and no mention of the fact that algae form an important part of the diet of more than a hundred million persons or that algal extracts enter the lives of hundreds of millions more through numerous industrial applications. The role of algae in agriculture and fisheries is barely noted. There is no index.

Of particular interest and value to me are G. W. Prescott's synthesis of the contributions of current research to algal systematics; C. van den Hoek's examples of modern taxonomy as practiced in two traditionally difficult groups, the Ulvaceae and *Cladophora*; Clyde Eyster's summary of micronutrient requirements; Ruth Patrick's discussion of natural and abnormal diatom communities; Olav M. Skulberg's account of the eutrophication of European water supplies; and Marcel Lefèvre's review of extracellular products. Algal toxicity is well covered in separate chapters by Paul R. Gorham and by David Schwimmer and Morton Schwimmer. The closing paper, "The future of phycology," by F. Evens, is disappointing. After some sophomoric observations, the author proposes the establishment of international cooperative programs, such as the regular compilation and dissemination of phycological bibliographies. Comprehensive literature lists have been published annually since 1954 and are widely used by phycologists, more than 600 of whom from 56 nations belong to the International Phycological Society, an organization apparently unknown to Evens.

PAUL C. SILVA
Department of Botany,
University of California, Berkeley

Statistical Methods

Methodes Statistiques dan les Sciences Humaines. P. Pèpe and M. Tisserand-Perrier. Masson, Paris, 1962. vi + 361 pp. Illus. F. 55.

This book is designed as a substantial introduction to statistical methods for practitioners in the "human" sciences, including demography, economics, sociology, psychology, biology, and anthropometry. In style, content, and mathematical level required of the reader, it is best described as a mixture of the better American textbooks, usually intended for use in only one field of application, and the British textbook by Yule and Kendall. Considering its level and universality of appeal, the book is quite concisely written and remarkably extensive in its coverage.

The first two parts of the book, consisting of 134 pages, are devoted to statistical description and can easily be read as required by the student. The next three parts contain the meat of the book and could form the basis of a one-semester course at upper college or beginning graduate level. The third part, on statistical probability, starts with a discussion of the basis of the calculus of probability and a fairly complete discussion of the ordinary binomial, Poisson, and normal distributions. It then continues with estimation problems, a brief but not very general discussion of testing of hypotheses, and concludes with a discussion of the χ^2 test. Part 4, a discussion of association, starts with a treatment of dependence of two quantitative variables in explicit geometrical fashion. Such an extremely intuitive approach could be very useful in developing a feeling for the meaning of dependence and of independence. The section continues with specialization to the case of linear dependence, developing the idea of the correlation coefficient as an estimate of the strength of relationship and developing also tests of significance for the coefficients. The last chapter of this part includes discussion of rank correlation and of association among variables described qualitatively, a brief introduction to factor analysis, and a discussion of covariation in time series. Part 5 is given over to sampling, under the principal headings of survey sampling and of analysis of variance as applied to statistical experimentation.

The sixth and final part of the book is unique in that it provides examples of statistical work in French government agencies and elsewhere. Five chapters present, respectively, discussions of work in the Ministry of Education on medical and educational statistics, on social security statistics, on epidemiological and other work of the National Institutes of Health, on the statistics of causes of death, and on population shifts in the National Institute of Demographic Studies. The construction of mortality tables and their use as basis for life insurance contracts is discussed in the last chapter.

LEO KATZ
Department of Statistics,
Michigan State University,
East Lansing

Ceramic Engineering

The Technology of Ceramics and Refractories. P. P. Budnikov. Translated from the Russian edition by Scripta Technica. M.I.T. Press, Cambridge, Mass., 1964. viii + 647 pp. Illus. $15.

The Western reader may consider the title of this book unusual because it implies division between ceramics and refractories and does not include glass as a ceramic material. The book was written as a textbook for students of ceramics and refractory technology in the U.S.S.R., but, as is mentioned in the preface, it could be useful to engineers and technical personnel working in ceramic industries. The author, P. P. Budnikov, professor at the Mendeleev Institute of Chemical Technology and a member of the Academy of Sciences of the U.S.S.R.,

is well known in the ceramic field, outside the U.S.S.R. as well as in the Soviet Union.

The book follows the traditional pattern of educational literature intended for ceramists—it is largely directed toward the production of useful products. Although Budnikov deals mostly with technical knowhow, some necessary theory is included.

In part 1, the production and properties of wall, roofing, and facing materials are described. Part 2 deals with the properties and uses of the polyphasic refractories. The techniques for preparing oxide and nonoxide refractories are also treated in this part. Part 3 refers to fine ceramics and includes detailed techniques for the production of such articles as chinaware, electric insulators, faience, and semiporcelain.

The translation is very good. The technical language is accurate, and the diagrams and photographs are better than those in the original Russian edition. Few technical errors can be found in the text. Very few references to foreign literature are mentioned.

The availability of this book gives the Western ceramist a good idea of the level of ceramic engineering in the U.S.S.R. Educators will probably find the book useful in teaching undergraduate courses in ceramic engineering.

V. S. STUBICAN
Department of Ceramic Technology, Pennsylvania State University

Nuclear-Structure Physics

Unified Theory of Nuclear Models. G. E. Brown. North-Holland, Amsterdam; Interscience (Wiley), New York, 1964. viii + 178 pp. Illus. $7.25.

Nuclear models as rough sculptures of nuclei grew in scope and success throughout a long period of symbiosis with experiment during the 1930's and the 1940's, culminating in the very fruitful extensions of the shell model following the introduction of (jj) coupling and collective deformations in the late 1940's and the early 1950's. Treatments of the coupling of several nucleons yielded satisfactory energy spectra, but configuration interaction was largely neglected.

There followed a new attack, inspired by enthusiasm for the analogy of a closed shell to the vacuum of electrodynamics, and here lies the main emphasis of Brown's book. With a flair for bringing out the main point, Brown presents well the methodology of second quantization in relation to the Hartree-Fock calculation and the great utility of this formalism in dragging in, through the concept of "quasiparticles," as much configuration interaction as may be conveniently associated with individual-particle coordinates. He highlights the preponderant role of pairing matrix elements and the importance of correlations of particle-hole excitations for collective electric moments. He unflinchingly pursues such demanding subjects as the influence of pairing on moments of inertia and the foundation of the optical model without, however, tackling the theory of nuclear matter.

This book is an important and very welcome addition to the literature of nuclear-structure physics, bringing together compactly most of the recent advances. It is a serious book, and for the most part very instructive in a rather unique and penetrating way. Yet the style of the author, which he greatly enjoys as he assures us in the preface, in addition to the very pleasant way that it bridges some conventionally difficult steps, displays an almost gay disregard for the needs of the likely reader at other spots. (One wonders if the class is approaching the end of the hour!) Complete detail about such sophisticated subject matter would of course make a ponderous tome, but it is a pity that a treatment containing so many neat conceptions does not go a little further in pursuit of continuous clarity. Where a discussion is started with a bare formal assumption or where it is later left to appear that an approximation is introduced solely for mathematical convenience, a less than assiduous reader is encouraged to be content with the all-too-common exhilaration of spotty understanding.

Rotations in simple even nuclei are covered, along with their moments of inertia, and the content is so up-to-date that it includes the author's recent interesting idea on the spectrum of excited states of that overworked nucleus, O^{16}, in terms of a deformation resulting from pair excitation in contrast with an undeformed ground state. However, all the "gory details," as he lightly calls them, of the wealth of phenomena accompanying the coupling of particle moments to nuclear rotation (so beautifully developed by his former colleagues at Copenhagen), as well as nuclear-model spectroscopy with vector-coupling schemes by direct matrix diagonalization and the revealing study of nuclei so light that their nucleons can be counted, are relegated to other treatises (or to the dead past!).

Thus, the prospective reader should not be misled by the title into expecting the complete theory of all nuclear models; a book of less than 200 pages could hardly cover them all and still give such deep consideration to some. But if the title is read to imply that the book supplies a sort of mortar (particularly the Hartree-Fock theory) to tie together the various treatments of nuclear models, without a concrete foundation but with the details of some of the most interesting and most modern of them, then the title is not too presumptuous.

D. R. INGLIS
Argonne National Laboratory, Argonne, Illinois

Creativity in Mathematics

Mathematical Discovery. On understanding, learning, and teaching problem solving. vol. 2. George Polya. Wiley, New York, 1965. xxiv + 191 pp. Illus. $5.50.

This second volume, which can be read independently, returns to the theme, "Towards a general method," to which two chapters were devoted in volume 1 [reviewed in *Science* **140**, 886 (1963)].

It soon appears that no single method is available, although one can try, often in very many ways, certain simple procedures that may be helpful. The splitting up of a problem into several stages is illustrated geometrically, and used to evaluate an elementary volume. The usefulness of a *plan*—which amounts to working backwards from the desired aim, whereas the execution proceeds forwards—is illustrated in finding the greater of two numbers, each given as a sum of two square roots. Another procedure that is discussed concerns an auxiliary problem which provides the key to a given one: a chimpanzee sees a banana outside his