cage and beyond his reach, but he also sees a stick that he can use to push the banana within range.

As Polya points out, each procedure depends for its success on some helpful idea, which may flash on us unexpectedly, but more often is long in coming. This leads him to discuss the working of the mind, and how it can be disciplined, and to speculate on other favorite topics, the question whether there are rules of discovery and the role of guessing in the scientific method. In between there is a long and instructive chapter on learning, teaching, and learning teaching, which every teacher should take to heart. It includes 20 pages of notes from which I single out a quotation from Anatole France: "Do not try to satisfy your vanity by teaching a great many things. Awake their curiosity. It is enough to open their minds, do not overload them. Put there just a spark. If there is some good inflammable stuff, it will catch fire."

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Virology

Techniques in Experimental Virology. R. J. G. Harris, Ed. Academic Press, New York, 1964. xiv + 450 pp. Illus. $15.

In the preface to this volume the editor informs us that the book is intended for use in the laboratory rather than in the library. Prospective purchasers of this book are advised that, in my opinion, the main use of this book will be in the library.

The volume is a collection of reviews partially covering the preparation and properties of plant virus proteins, infective viral RNA, assay of plant and animal viruses, insect viruses, purification of animal viruses, serological techniques, electron microscopy, hemagglutination, interference, and tissue culture technique.

My task of reviewing is lightened by the fact that the reviews are, for the most part, collections of references to techniques, with a minimum of advice from the "acknowledged experts" (I borrow the phrase from the dust jacket) to the laboratory worker. There is little that can be said for or against such a compilation of references. To the book's credit, well-written and practically useful discussions are given by Dougherty on animal virus titration technique, by Fiset on serological technique, by Parsons on electron microscopy, and by Sanders on infective RNA from animal viruses.

A chapter by C. H. Knight, on the preparation and properties of plant virus protein, contains a very good but very brief outline of techniques for the preparation of TMV protein. But I doubt if the details of standard biochemical techniques for determining the primary amino acid sequence of a protein warrant three-quarters of the whole chapter.

This raises the question of who are the people for whose use this volume is intended. The editor states that it is for "those galloping enthusiastically into a new field . . ." and "for all virologists . . . for whom the selection of the right technique is as important as the choice of the right wife." The latter, I fancy, is a comparatively small group of virologists. For those trained in formal virology, the volume is deficient in articles as detailed in biochemical techniques as that presented by C. H. Knight; for those venturing into virology for the first time, many of the contributors assume a knowledge of virology so that there is insufficient discussion of such procedures as preparation of virus stocks, single-step growth conditions, and the culture and infection of animal cells.

Noticeably absent in a modern volume of techniques in virology are discussions of the physical and chemical characterization of DNA and RNA, of the application and implication of in vitro RNA-DNA hybridization, of autoradiography, of the preparation of radioactive virus, and of other techniques now used to study the mechanism of viral replication.

Sadly lacking is a well-organized, up-to-date chapter by an acknowledged expert on the culturing of animal cells, surely one of the most important techniques of modern virology. There is indeed a chapter entitled "Tissue culture techniques" which is padded with recipes for some culture media and with brief mention of less frequently employed cell culture methods. However, this chapter says almost nothing of practical value about spinner culture technique or about the subculturing of cells as monolayers. One gains the impression that the author of the chapter in question is not as familiar as he should be with recent developments in his subject or that he is reticent about providing the reader with any useful information.

For those authors who might be in the process of, or even contemplating, writing a book on techniques in experimental virology, this volume should be an encouragement to continue. For those virologists for whom the selection of the right technique is important, this volume will provide some useful references that will help them to start searching the literature.

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Nonlinear Mechanics

The Dynamic Stability of Elastic Systems. V. V. Bolotin. Translated from the Russian edition (Moscow, 1965) by V. I. Weingarten, L. B. Greszcuzuk, K. N. Trirogoff, and K. D. Gallegos. Holden-Day, San Francisco, Calif., 1964. xii + 451 pp. Illus. $12.95.

This translation of Bolotin's monograph provides further access to Russian developments in nonlinear mechanics and emphasizes a specialized class of dynamic stability problems of interest in the design of structures, particularly the more efficient ones. If a compression member such as a strut or column is subjected to a periodic longitudinal force, transverse vibrations in the buckling modes occur for certain values of the disturbing frequency. Specifically, when the disturbing frequency is twice that of a natural frequency of bending vibrations, a so-called parametric resonance occurs. The author examines this problem and the corresponding problems involving curved bars, frames, plates, and other structural forms.

The well-written text, with a pleasing format, is in three parts. In part 1 the Mathieu-Hill equation is discussed, with applications to the straight bar and to modifications thereof. A general treatment of parametrically excited vibrations, and methods for determining frequency boundaries and vibration amplitudes, are given in part 2. Consideration of the more complex structural elements and frames, which reflect the researches and contributions of the author, complete the text.

The mathematical developments are quite elaborate in parts 2 and 3. Alternate methods of analysis, by the

work principle, for example, would complement some of the formal treatments and approximations. The practical implications of the theory are not well covered. The suggestions made with respect to the failure of the Tacoma Narrows bridge seem oblique to the generally accepted explanation of that disaster.

Some 170 references, mainly Russian and German literature, are cited. The index is adequate, the printing of good quality, and the figures excellent. I noted a few misspelled words. The translators have performed an excellent service. Engineers, teachers, and others who are interested in vibrations and structures should acquaint themselves with the contents of this volume. To the research worker in the field this monograph is indispensable.

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Analytical Chemistry

Automatic Methods in Volumetric Analysis. D. C. M. Squirrell. Van Nostrand, Princeton, N.J., 1964. x + 201 pp. Illus. $6.75.

This book is a compilation of assorted volumetric (that is, titrimetric) determinations and techniques that have been adapted to automatic methods. The automatic methods discussed include titrations to preset potentiometric end points and the automatic recording of titration curves involving potentiometric, amperometric, spectrophotometric, thermometric, and conductometric detection.

Details of many individual methods are provided, including, in places, rather trivial equations for calculating results, but neither the theoretical basis of the determinations nor equations for the titration reactions are given. Instrumentation for automatic titrations is not discussed, with the exception of some apparatus that originated in the author's laboratory. The coverage of the literature is certainly not exhaustive, and the author fails to point out that many of the methods found in the classic monographs on potentiometric and amperometric titrations can easily be adapted to automatic recording methods. Another serious shortcoming is the lack of a list of references to texts in which the principles and limitations of these methods are discussed—for example, Lingane's *Electroanalytical Chemistry*—and to annual reviews of these methods.

Probably the most serious omission in the book is the lack of reference to coulometric titrations. A large number of coulometric methods, in which the titrant is generated electrically either externally or *in situ*, have been developed and described. Because these methods eliminate the difficult mechanical problems associated with buret addition of reagents and are uniquely suited for small-scale determinations, they will probably be the choice of many workers in the future. The one brief reference to coulometric titrations is in connection with the determination of sulfur dioxide in a continuous analyzer. This discussion, like many others in the book, completely neglects all of the previous work on this coulometric reaction as well as the many other continuous analyzers that date back to the original work of Shaffer, Briglio, and Brockman (1945).

In general this book may be of use to analysts and technicians who are seeking a specific automatic titration method. It has little in it to recommend it to students of analytical chemistry. Most modern analytical chemists would probably prefer a more exhaustive and rigorous treatment of the subject and would want to understand these methods more thoroughly before adopting them for routine use.

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New Books

Mathematics, Physical Sciences, and Engineering

Advances in Photochemistry. vol. 3. W. Albert Noyes, Jr., George S. Hammond, and J. N. Pitts, Jr., Eds. Interscience (Wiley), New York, 1964. 296 pp. Illus. $12.50. Four papers: "Unimolecular decomposition and some isotope effects of simple alkanes and alkyl radicals" by B. S. Rabinovitch and D. W. Setser; "Gaseous photooxidation reactions" by D. E. Hoare and G. S. Pearson; "Vacuum ultraviolet photochemistry" by J. R. McNesby and H. Okabe; and "Electronic energy transfer between organic molecules in solution" by F. Wilkinson.

Advances in Space Research. Proceedings, First Inter-American Symposium on Space Research (Buenos Aires), November 1960. Edited by T. M. Tabanera and the Technical Staff of the Argentine National Commission on Space Research. Pergamon, London; Macmillan, New York, 1964. 446 pp. Illus. $17.50. Twenty-three papers.

Chemical Reactions of Polymers. E. M. Fettes, Ed. Interscience (Wiley), New York, 1964. 1326 pp. Illus. $40. Sixteen papers.

Chemical Reactor Theory. An introduction. Kenneth Denbigh. Cambridge Univ. Press, New York, 1965. 196 pp. Illus. $6.50.

Combustion Theory. The fundamental theory of chemically reacting flow systems. Forman A. Williams. Addison-Wesley, Reading, Mass., 1965. 463 pp. Illus. $15.

Condensation and Evaporation of Solids. Proceedings of an international symposium (Dayton, Ohio), September 1962. Emile Rutner, P. Goldfinger, and J. P. Hirth, Eds. Gordon and Breach, New York, 1964. 721 pp. Illus. $38. Forty-five papers prepared for the symposium which was sponsored by the Directorate of Materials and Processes, U.S. Air Force.

Elementary Coordination Chemistry. Mark M. Jones. Prentice-Hall, Englewood Cliffs, N.J., 1965. 489 pp. Illus. $18.60.

Friction and Wear of Materials. Ernest Rabinowicz. Wiley, New York, 1965. 254 pp. Illus. $12.

Fundamentals of Physical Chemistry. H. D. Crockford and Samuel B. Knight. Wiley, New York, ed. 2, 1964. 429 pp. Illus. $7.50.

Fundamentals of Vacuum Science and Technology. Gerhard Lewin. McGraw-Hill, New York, 1965. 262 pp. Illus. $11.50.

The Mechanical and Physical Properties of the British Standard En Steels (B.S. 970–1955. vol. 1, *En 1 to En 20*. Compiled by J. Woolman and R. A. Mottram. Pergamon, London; Macmillan, New York, 1964. 462 pp. Illus. $20.

Nonlinear Optics. N. Bloembergen. Benjamin, New York, 1965. 236 pp. Illus. Paper, $4.95; cloth, $9. A lecture note and reprint volume.

Principles of Inverter Circuits. B. D. Bedford and R. G. Hoft. Wiley, New York, 1964. 429 pp. Illus. $12.75.

Probability: A Programed Workbook. Frederick Mosteller, Robert E. K. Rourke, and George B. Thomas, Jr. Addison-Wesley, Reading, Mass., 1965. 88 pp. Illus. Paper, $4.95.

Quasi-Stellar Sources and Gravitational Collapse. Proceedings of a symposium (Dallas, Tex.), December 1963. Ivor Robinson, Alfred Schild, and E. L. Shucking, Eds. Univ. of Chicago Press, Chicago, 1965. 493 pp. Illus. $10.

Radioisotopic Power Generation. William R. Corliss and Douglas G. Harvey. Prentice-Hall, Englewood Cliffs, N.J., 1964. 318 pp. Illus. $14.75.

Silurian and Devonian Corals of the Falls of the Ohio (*Mem. Geol. Soc. Am.* No. 93). Erwin C. Stumm. Geological Soc. of America, New York, 1964. 194 pp. Plates. $8.50.

Stratigraphy and Life History. Marshall Kay and Edwin H. Colbert. Wiley, New York, 1965. 748 pp. Illus. $9.75.