merit, which is no small one, of making Rush appear the natural denizen of his intellectual milieu, a somewhat perfervid specimen, perhaps, but a genuine child of his time—which is what the title of the book should be taken to mean. It ought to be said, too, that the author of these 300 pages is good company to the last. If we feel that he sometimes labors a trifle over his brief, this is the best of defects in a biographer. To twist a saying of Dr. Johnson's, an apologetic tone is what a great many of Benjamin Rush's biographers cannot help. Rush himself wrote: "My opinions upon many subjects and my innovations in the practice of medicine have so much divided my fellow citizens upon the subject of my talents and character, that it will be impossible for many years to decide the controversy respecting either of them." It has not been decided yet.

LLOYD G. STEVENSON
Yale University,
New Haven, Connecticut

Luminescence Conference

Bioluminescence in Progress. Proceedings of the Luminescence Conference, Kanagawa-ken, Japan, September 1965. FRANK H. JOHNSON and YATA HANEDA, Eds. Princeton University Press, Princeton, N.J., 1966. 664 pp., illus. $15.

This thoughtfully compiled volume is dedicated to the memory of the late E. Newton Harvey. Such a dedication is appropriate, not only because that benevolent and brilliant biologist laid many conceptual foundations upon which much of the current rapid progress in bioluminescence is based, but also because so many of the outstanding contributors to this memorial volume are his scientific heirs—his students and their students. The editors as well as the sponsors of the symposium (the Japan Society for the Promotion of Science, and the National Science Foundation) are to be congratulated on the generally high quality of the science presented in these collected papers.

The liaison between Japanese and American scientists is particularly close and productive in the field of bioluminescence. The editors of this volume are to a considerable extent responsible for this scientifically rewarding collaboration, a collaboration that might have been implicit in the work of Harvey, carried out in the 1920's on the lumino-biochemistry of the ostracod crustacean *Cypridina hilgendorfii,* a species abundant in the waters about Japan. One of the outstanding related contributions of this volume is, appropriately, a definitive report of the structure of *Cypridina* luciferin by Kishi, Goto, Hirata, Shimomura, and Johnson. I view with mixed delight the successful application of mass spectrographic cracking patterns to the problem of the structure of *Cypridina* luciferin, a resolution which was in my own hands unsuccessful in providing a unique clue to the structure of firefly luciferin. (This structure was subsequently determined by White, McElroy, and collaborators.)

A complete listing of the topics covered is not feasible in a review of this length. Of particular interest to biologists and biochemists are the considerable progress on *Cypridina* luciferin, luminous fungi, *Noctiluca miliaris,* dinoflagellates, protochordates, luminous earthworms, a freshwater limpet, fireflies, a New Zealand glowworm, and certain luminous shrimps, and the morphological and biochemical studies on the light organs of teleosts. All in all, this is a most worthwhile book and a fitting tribute to Harvey, who would also have been delighted by the surrealistic photograph on the cover—a cleverly disguised New Zealand cave, illuminated by glowworms and diffuse daylight.

B. L. STREHLER
National Institutes of Health,
Bethesda, Maryland

Electronics

Nonlinear Electron-Wave Interaction Phenomena. JOSEPH E. ROWE. Academic Press, New York, 1965. 605 pp., illus. $18.

Nonlinear interaction is a subject which has reached maturity only in the past decade. The need to understand the behavior of microwave devices for large radio-frequency signal levels has motivated theoretical work in the nonlinear regime. The present book is written by a leading investigator, and it should serve as a basic research monograph. It also may find some use as a graduate textbook, although it presupposes a sound knowledge of linear devices.

The treatment is almost entirely theoretical, although some experimental data are quoted in support of certain calculations. The material is related mainly to those devices which utilize an injected particle stream of some type. The nonlinear interaction is between a directed stream and an electromagnetic wave. Particle and wave velocities both small and comparable with the velocity of light are considered. The specific interaction mechanisms considered are pertinent to klystrons, traveling-wave amplifiers, backward wave oscillators, crossed field oscillators, multibeam devices, and electron-beam-plasma devices. As is not the case in a linear treatment, second- and higher-order terms are retained in the appropriate interaction equations. The solutions are usually obtained by resorting to high-speed computers. As indicated by the author, real insight into the interaction phenomena is obtained only through a detailed study of the reams of the digital computer output. Only in a few cases are closed-form solutions available.

JAMES R. WAIT
Division of Engineering and Applied Physics, Harvard University,
Cambridge, Massachusetts

New Books

Abstract Theory of Groups. O. U. Schmidt. Translated from the second Russian edition (Moscow, 1933) by Fred Holling and J. B. Roberts. J. B. Roberts, Ed. Freeman, San Francisco, 1966. 184 pp. $5.

Acoustics. Alexander Wood. Dover, New York, 1966. 608 pp. Illus. Paper, $3.50. Reprint, ed. 2, 1960.

Advances in Control Systems: Theory and Applications. vols. 3 and 4. C. T. Leondes, Ed. Academic Press, New York, 1966. vol. 3, 356 pp.; vol. 4, 334 pp. Illus. $14.50 for each volume. Twelve papers.

Astronautics Year. An international astronautical and military space/missile review of 1965. David Howard, Ed. Pergamon, New York, 1966. 336 pp. Illus. $10.

Basic Microscopic Technics. Ruth McClung Jones. Univ. of Chicago Press, Chicago, 1966. 348 pp. Illus. $6.50. Based on Michael F. Guyer's *Animal Micrology* (ed. 5, 1953).

Brandeis University Summer Institute in Theoretical Physics, 1965. vols. 1 and 2. vol. 1, *Axiomatic Field Theory,* 528 pp. $32.50; vol. 2, *Particle Symmetries,* 703 pp. $35. M. Chrétien and S. Deser, Eds. Gordon and Breach, New York, 1966. Illus. Eleven papers.

Carnegie Institution of Washington Year Book 1965–1966. vol. 65. Carnegie Institution, Washington, D.C., 1966. 642 pp. Illus. $1.50.

Celestial Mechanics. vols. 1 to 4. Marquis de LaPlace. Translated, with a com-

(Continued on page 921)