departmental jealousies and bureaucratic inertia, together with valid doubts about the merits of the changes, combined to prevent their adoption.

Only two years have elapsed under the new organizational setup, so that a critical evaluation of the success of the reorganization in increasing the efficiency and effectiveness of the component agencies is premature, and indeed the author of the work under review does not attempt to make one. Rather he devotes himself to accounts of the history of each of the agencies (Coast and Geodetic Survey, Weather Bureau, and Central Radio Propagation Laboratory); a description of their reorganization under ESSA; and discussions of their roles in serving aviation, participating in the nation's war efforts, warning against environmental hazards, including hurricanes, tornadoes, floods, and earthquakes, and cooperating with other nations and international agencies in the study of the physical environment.

The United States government entered scientific activities in 1807, under President Jefferson's administration, when Congress authorized and appropriated funds ($50,000) for surveying the coasts of the United States. For many decades the Coast Survey and its successor after 1878, the Coast and Geodetic Survey, followed a rocky course to do an adequate job with restricted authority and insufficient funds. The federal weather service was established in 1870, although there were meteorological activities during the first half of the 19th century under the Army Surgeon General, the Naval Observatory (at Matthew Maury's initiative), and the Smithsonian Institution (directed by Joseph Henry). Initially under the Signal Corps of the War Department, in 1891 it became a civilian agency in the Department of Agriculture. In 1940, with the growth to dominance of its service to aviation, the Weather Bureau was transferred to the Department of Commerce. The third component agency of ESSA, the Central Radio Propagation Laboratory (renamed Institute for Telecommunications Sciences and Aeronomy under ESSA) was not established until 1946, although radio propagation studies had begun in the Bureau of Standards in 1909.

Under ESSA parts of the component agencies remain under their original designations, but other parts have been separated from them and brought together into new groupings. For instance, the research activities formerly conducted by the Weather Bureau have been put under the Institutes for Environmental Research, and the climatological section and national weather records center have been shifted to the Environmental Data Service. The coordination of research and weather records with the forecasting and observational activities is thereby shifted from an internal level in the Weather Bureau to an interbureau level. Whether the ease of coordination of research and operational activities is thereby reduced, and whether bringing the research activities of the Weather Bureau together with those of the other agencies under the Institutes for Environmental Research results in benefits which offset the reduction, remain to be seen.

The book is one of a series, the Praeger Library of U.S. Government Departments and Agencies, written to give the general reader an understanding of the development, scope, and operation of the components of the executive branch of the U.S. government. It succeeds reasonably well in this objective, although the scientific operations are mostly listed rather than described. The histories of the agencies include some interesting though brief accounts of some of the colorful personalities who contributed to their development. The discussion of the impact on the public of the hurricane and tornado warning services of the Weather Bureau is the most graphic part of the book, perhaps because the author, as an official of the National Red Cross, has had personal experience in using the warnings to reduce the human suffering resulting from these disasters.

No important errors of fact were obvious to the reviewer. However, such careless errors as the acknowledgment in the preface to "Dr. Leonard Machta," whose name really is Dr. Lester Machta, the statement on page 78 that "Robert S. White was named to head the [Weather] Bureau" (although in other places the present ESSA Administrator's name is given with the correct middle initial, M.), and the contradictory statements on page 83 regarding the number of districts the flood forecasting system was reorganized into just prior to World War II (eight in line 6 and nine in line 30) make one just a little uneasy about the reliability of other information in the book.

An appendix is devoted to a description of career opportunities in ESSA.

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Microwave Spectroscopy

Rotational Spectra and Molecular Structure. JAMES E. WOLLRAB. Academic Press, New York, 1967. xvi + 468 pp., illus. $20. Physical Chemistry Monographs, No. 13.

This is primarily an expository review of the theory developed to deduce molecular parameters from microwave spectra. The scope of the book is fairly deliberately bounded. Less than 30 pages are devoted to instrumentation and to the frequently difficult problem of identifying observed spectra. The observed, measured, and identified spectral lines are taken as features to be fitted by the theory. This theory, which fills the remainder of the book, permits evaluation of such molecular parameters as rotational constants, nuclear quadrupole coupling coefficients, and molecular dipole moments. Interpretation of molecular parameters and molecular structures in chemical terms is not a concern of the book, so that listings of structures and molecular parameters appear rarely and only incidentally.

In his preface the author places particular emphasis on those subjects which have developed significantly since 1955, when Townes and Schawlow's excellent *Microwave Spectroscopy* (McGraw-Hill) appeared. It is worth remarking that even though most of the relevant theory had been developed prior to this and is adequately covered in the earlier work, it is included by Wollrab. The treatment of the rigid asymmetric rotor by King, Hainer, and Cross which, quite properly, provides Wollrab's review of the rigid asymmetric rotor spectrum was published before the first high-resolution microwave spectrum was observed. Again, the early microwave spectrum studies showed that phenomena different from those previously encountered were involved and that substantial development was required. As early as 1948 Bardeen and Townes presented the theory required to interpret the nuclear hyperfine structure, carrying their treatment far enough to include the complicated spectra which characterize a molecule having two nuclei with comparable quadrupole moments. Wollrab's treatment follows theirs.

As the field of microwave spectroscopy has matured, problems of more complexity and difficulty have been approached and mastered. The influence of molecular vibrations on molecular structure determinations has been extensively studied. The Kivelson-Wilson

treatment of centrifugal distortion has been applied to several molecules. A good deal of the more recent work in microwave spectroscopy has involved internal rotation. Such refinements and advances were not dwelt on by Townes and Schawlow, but are covered here.

The text is clearly written. Equations, matrix elements, symmetry tables, and the like abound. The treatment is detailed enough for a reader fluent in quantum mechanics to follow, yet rarely complete enough to eliminate the need to refer to the original literature. Citations are made to a list of 1710 references.

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Animal Disease

Pathology of Laboratory Rats and Mice. Papers presented at a conference, London, April 1966. ERNEST COTCHIN and FRANCIS ROE, Eds. Davis, Philadelphia, 1967. xxiv + 848 pp., illus. $29.

This volume contains 24 papers which were prepared for presentation at a conference sponsored by the Nuffield Foundation. The conference was convened expressly to compile knowledge about spontaneous lesions in rats and mice. The papers, on chosen topics, are reviews of current knowledge, with emphasis on description of gross and microscopic lesions. The rather lengthy papers were made possible through the means of precirculation among the invited participants with only brief presentations during the conference itself.

With one exception the first 16 chapters are developed from a systematic view. The last eight chapters deal with infectious conditions and age-associated lesions. Some chapters are devoted exclusively to the rat or the mouse and some to both species. Naturally, the chapters tend strongly to reflect the special interests of the authors, and this results in some deficiencies. For example, the discussion of the digestive tract is limited to neoplasms, and a chapter is devoted to cardiovascular disease in rats, while the mouse is neglected.

The authors are well known and well qualified, and the papers are well written and detailed. Most authors have documented their material thoroughly. Some, however, list as few as a dozen references; others give several hundred. The book is generously illustrated with excellent photomicrographs that are well reproduced. Although related material tends to be scattered throughout several chapters the reader is directed to this material in the text. The chapter on fungal disease in rats and mice is the first review published on this subject. The subject index takes up 17 pages. This is followed by lists of references to specific strains of rats and mice.

While it can be said that much of the material presented in this book has been published elsewhere, this after all is a characteristic of textbooks and reference books. It should be emphasized that this book far surpasses the published proceedings of many previous conferences on diseases of laboratory animals. The length alone is some indication of this, but more important are the planning and organization, the many illustrations, and the detailed index and strain reference lists.

I feel that *Pathology of Laboratory Rats and Mice* admirably fulfills the avowed purpose of bringing together widely scattered information on spontaneous diseases. It should be useful to all who interpret lesions in rats and mice, especially to the relatively uninitiated.

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Cytology Technique

Tritium-Labeled Molecules in Biology and Medicine. LUDWIG E. FEINENDEGEN. Academic Press, New York, 1967. x + 430 pp., illus. $17. Monograph Series on Radiation Biology.

The analysis of growth processes is one of the major historic challenges to experimental biology. Until recently, techniques were lacking for analyzing quantitatively the complex chemical reactions inherent in the kinetics of cellular growth or cell proliferation, but now a most productive technique is afforded by isotope-labeled compounds. The implications of this development for the understanding of the hereditary makeup of all organisms, including man, are immeasurable.

Tritium, the radioactive isotope of hydrogen, has played a prominent role in this development because of its particularly favorable physical and chemical properties: Tritium-labeled compounds of relatively high specific activity can be obtained by simple and comparatively inexpensive methods. Autoradiographs can be made that allow the localization of radioactivity at the intracellular level because of the short range of the tritium beta particles. The amount of tritium in biological materials can be accurately measured with relatively simple techniques such as liquid scintillation counting. Last, and probably most important, high resolution autoradiography and liquid scintillation counting can be combined in what may be considered an attempt to bridge the existing gap between radiochemical and morphological investigations.

Biological and medical researchers have been quick to exploit tritium-labeled precursors as these have become available or been recognized, and the resulting literature is voluminous and growing rapidly. It is therefore appropriate that a comprehensive reference is finally available that not only deals with "advances" in tritium technology but also supplies comprehensive detail and a somewhat critical review. Feinendegen emphasizes that critical attention should be paid to the cell cycle and its control mechanisms in evaluating the various factors that influence the cellular incorporation of tritium-labeled precursors of nucleic acids and proteins. He also draws attention to the mechanism of cell reproduction and the role of labeled compounds in investigations of cell differentiation. In addition, he focuses on the maintenance of balance between cell loss and cell reproduction, this in relation to aging, malignancy, and tissue replication.

The book will be a valuable addition to the bookshelf of any scientist engaged in studies in which radioactive tracers are used to examine cellular systems and their regulatory mechanisms. The investigator will not, however, find immediate solutions to the questions that have been raised concerning how tritiated precursors are incorporated into key biological macromolecules. These questions revolve around the interpretation of quantitative biological effects of such incorporation, the estimation of energy absorption by these molecules during the decay process, and the comparison of the effects of this type of radiation with other ionizing radiation. Perhaps the greatest contribution to be expected from this monograph is the invitation to the biologist who is not acquainted with radioisotopes as tools in cell studies to explore the applicability of tritium to his problem.

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