and who are concerned with problems of "purity" and homogeneity of substances. Every section concludes with an ample bibliography, so that the book serves as an excellent guide to the basic literature of immunochemistry.

With due respect to the present controversy over the terms serology, immunochemistry, and immunology, *Experimental immunochemistry* by Drs. Kabat and Mayer is a book every worker in these fields should have.

SANFORD S. ELBERG

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The hormones: physiology, chemistry and applications. (Vol. 1.) Gregory Pincus and Kenneth V. Thimann. (Eds.) New York: Academic Press, 1948. Pp. xi + 886. (Illustrated.) $13.50.

The hormones is a work designed for the serious student of general biochemistry and physiology. This volume and its forthcoming companion are intended to provide a well-organized and critical description of the chemistry, physiology, and applications of the hormones.

We are in this book treated to a "stock-taking," by experts in their respective studies, of the hormones of plants, insects, and invertebrates. There are excellent discussions of the parathyroid and the gastrointestinal hormones, a somewhat less thoroughgoing treatment of the pancreas, and a very good chapter on the recognized hormones of the anterior pituitary. More than 300 of the nearly 800 pages of text are occupied by accounts of the chemistry and metabolism of the various steroid hormones. (The biology of these hormones, as well as those of the pituitary, will be treated in Volume II.)

Two final chapters, by Folley and Malpress, furnish a most competent guide to the labyrinthine ways of mammary gland development and the control of lactation. From the book as a whole and these last chapters in particular, two essentials to rapid progress in endocrinology are made clear. The first is the need for developing accurate and specific methods of assay. The second is the need for pure hormones in amounts adequate for detailed and extensive study. On the whole, this volume sets a high standard and fulfills its purpose. It is well printed and illustrated, and thoroughly indexed, and its 3,441 references will be invaluable to the student. The editors are to be congratulated both upon their selection of contributors and upon the realization of a needed, useful work.

JANE A. RUSSELL and ALFRED E. WILHELMI

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The chemistry of penicillin. Hans T. Clarke, John R. Johnson, and Sir Robert Robinson. (Editorial Board.) Princeton, N. J.: Princeton Univ. Press; London: Geoffrey Cumberlege, Oxford Univ. Press, 1949. Pp. x + 1094. (Illustrated.) $36.00.

This book records in detail the results of experimental and theoretical studies carried out by a group of American and British chemists, under the joint sponsorship of the U. S. Office of Scientific Research and Development and the Medical Research Council, London, to determine the chemical constitution and structure of penicillin and to devise synthetic methods for its production. The material published was compiled under the auspices of the National Academy of Sciences, Washington, D. C., under contract with the OSRD and is presented under the following 29 chapters: Brief History of the Chemical Study of Penicillin, by Hans T. Clarke, John R. Johnson, and Robert Robinson; The Earlier Investigations relating to 2-Pentenylpenicillin, by E. P. Abraham, W. Baker, W. R. Boon, C. T. Calam, H. C. Carrington, E. Chain, H. W. Florey, G. G. Freeman, R. Robinson, and A. G. Sanders; The Chemistry of n-Amylpenicillin up to December 1943, by A. H. Cook, and I. M. Heilbron; Status of the Research on the Structure of Benzylpenicillin in December 1943, by Robert L. Peck, and Karl Folkers; Isolation and Characterization of the Various Penicillins, by O. Wintersteiner, W. R. Boon, H. C. Carrington, D. W. MacCorquodale, F. H. Stodola, J. L. Wachtel, R. D. Coghill, W. C. Risser, J. E. Philip, and O. Touster; Penillic Acids and Penillamines, by A. H. Cook; Review of Certain Investigations on the Structure of Benzylpenicillin during 1944–1945, by Robert L. Peck, and Karl Folkers; Some Inactivation and Degradation Reactions of Penicillin, by O. Wintersteiner, H. E. Stavely, J. D. Dutcher, and M. S. Spielman; Desthiobenzylpenicillin and Other Hydrogenolysis Products of Benzylpenicillin, by Edward Kaczka, and Karl Folkers; The Thiocyanate Derivative of Benzylpenicillin Methyl Ester, by Vincent du Vigneaud, and Donald B. Melville; The X-Ray Crystallographic Investigation of the Structure of Penicillin, by D. Crowfoot, C. W. Bunn, B. W. Rogers-Low, and A. Turner-Jones; Identification and Crystallography of Penicillins and Related Compounds by X-Ray Diffraction Methods, by G. L. Clark, W. I. Kaye, K. J. Pipenberg, and N. C. Schieltz; Infrared Spectroscopic Studies on the Structure of Penicillin, by H. W. Thompson, R. R. Brattain, H. M. Randall, and R. S. Rasmussen; Other Physical Methods, by R. B. Woodward, A. Neuberger, and N. R. Trenner; The Constitution of Penicillins, by John R. Johnson, Robert B. Woodward, and Robert Robinson; Penicillamine, Its Analogs and Homologs, by Harry M. Crooks; Penilloaldehydes and Penaldic Acids, by Ellis V. Brown; The Penilloic and Penicilloic Acids and Their Derivatives and Analogs, by Ralph Mozingo, and Karl Folkers; Biosynthesis of Penicillins, by Otto K. Behrens; Chemical Modifications of Natural Penicillins, by R. D. Coghill, F. H. Stodola, and J. L. Wachtel; Oxazoles and Oxazolones, by J. W. Cornforth; Attempted Syntheses of Penicillins, by W. E. Bachmann, and M. W. Cronyn; The Condensation of Oxazolones and D-Penicillamine and the Resultant Antibiotic Activity, by V. du Vigneaud, J. L. Wood, and M. E. Wright; Methyl Benzylpseudopenicillinate, by J. H. Hunter, J. W. Hinman, and H. E. Carter; Thiazolidines, by A. H. Cook, and I. M. Heilbron; The Chemistry of β-Lactams, by S. A. Ballard, D. S. Melstrom, and C. W. Smith; The γ-Lactam of Benzylhomopenicilloic Acid and Related Compounds, by Vincent du Vigneaud and Frederick H. Carpenter; Synthetic Benzylpenicillin, by Vincent du Vigneaud, Frederick H. Carpenter, Robert W. Holley, Arthur H. Livermore, and Julian R. Rachele; Assay of Penicillins, by John V. Scudi, and H. B. Woodruff. There is also an appendix and an index.

During the past three years chemists have looked forward with great expectation to the appearance of this monograph, in which for the first time there would be presented in its entirety a description of the work connected with one of the important war projects, namely, the determination of the structure of the antibiotic peni-

cillin, and development of methods for its synthesis. In the opinion of this reviewer, however, there will be many who will be keenly disappointed; for the final chapter has yet to be written. After some 1,042 pages the careful reader is forced to the conclusion that there are still doubts as to the true structure of this highly important compound, and when one considers the detailed description of the experimental studies on synthesis one cannot help but wonder why prior release for publication was given to this phase of the work, and why it was heralded in the public press, especially since the method of synthesis was suggested by the supposedly wrong formula and the yields obtained were practically insignificant. From this point of view the compendium under review will go down in chemical history as a monument to what must be considered a failure. This failure, however, to achieve the objective should by no means reflect upon the efforts of a large group of chemists in American and British Laboratories which resulted in an unusual degree of cooperation.

In certain instances the choice of authors for particular chapters and the stress of their importance in the compendium will appear surprising inasmuch as the selection was supposed to be made on the basis of contributions made, and familiarity with the subject as a whole.

Admittedly, the task of compiling material from hundreds of reports must have been enormous and editing a first-class monograph is necessarily very time-consuming; yet it is disappointing to discover that chapters are often not in sequence and that, whereas in some cases the discussion is incomplete, and consists only of reference to other chapters, in other cases there is a great deal of repetition which easily could have been avoided. Thus Chapter V, which is concerned with the isolation and characterization of the penicillins, would normally be either the first or second chapter. Chapters II, III, IV, and VII, which are separate historical episodes, could well have been combined and condensed into one chapter. Chapters VI, VIII, IX, X, XV, XVI, XVII, XX and XXIV, which are primarily concerned with the reactions of penicillin, certainly should have been better integrated, and possibly combined into two chapters. If this had been done a great amount of material which has little or nothing to do with the structure of pencillin could have been deleted and much space could have been saved. It is also the opinion of this reviewer that the material in Chapters XXI, XXV, XXVI and XXVII, interesting and scientifically valuable as it is, does not justify its separation into four chapters. It is relevant only when considered in connection with degradation and synthetic studies, which are described in other chapters. Chapters XXII, XXIII, XXVIII, and XIX, which deal with the problem of synthesis, could well have been combined and the numerous unsuccessful attempts summarized or tabulated. Chapters XI, XII, XIII, and XIV, which deal with the physicochemical techniques of the structural investigations, are placed for no apparent reason in the middle of the book. They are repetitious and most of the findings should have been reported in their proper place in other chapters.

Certain other features are perhaps unfortunate. Divergent views often appear with different interpretations of the same results. Although the instances are not glaring, they are subtle. The chronological development of the chemistry of penicillin is handled differently by the British and the American authors. In this respect the American authors appear the more disinterested. It is also noteworthy that, whereas American investigators were apparently not allowed to sign their reports, British reports are known under their authors' names.

The index will also give concern to some readers. Although it represents a tremendous task, in some instances it will prove to be unsatisfactory, since the same compounds, reactions, and topics are often scattered throughout the book from cover to cover, and yet only one or two references are given. Names of compounds in the text are not always the same as names in the index, but to those familiar with the field this presents no serious difficulty. Also, for some compounds there are references in the index to experimental sections but no references to the discussion sections, which might be concerned with the explanation. In general, however, the index is workable. Most of its faults result from variations in nomenclature employed by the various authors and by the workers responsible for the work on penicillin.

Finally, there will be some who think that all this material should have been published in learned society journals, in the usual standard manner. Such an opinion deserves respect. Failing this, however, they will say that the format is too large and that the book should have appeared in several volumes. A good argument can be given for this point of view, although this reviewer is inclined to believe that for a reference book the format of the *Journal of the American Chemical Society* is better.

In all other respects the compendium is well prepared. Taken as a whole, the book contains a wealth of knowledge on heterocyclic chemistry, but whether it all belongs in a book on the chemistry of penicillin is debatable. As a reference book, it will be very valuable, especially to those who plan future research work in this field. The book will also be useful for patent purposes. Primary sources are cited, and it is now possible to go to them easily.

Consideration of the shortcomings of this present publication necessitated by the restrictions imposed by Wartime Censorship may afford a lesson for future would-be controllers of scientific thought in times of national emergency.

Special praise and commendation should be given the publishers who were responsible for the design, and manufacture of the book. It is bound with extra strong materials and the printing is excellent. Princeton University Press handles the distribution in the U. S., and Oxford University Press acts as its agent for distribution in England, India, S. Africa, Australia, New Zealand, Pakistan, Burma and Ceylon. Other agents are distributors for the book in Central Europe, Canada, Latin America, the Near and Far East. Thus the desires of the National Academy of Science for International distribution are well met.

The manuscript submitted ran to over 400 pages. The book was set in type chapter by chapter. Early portions of the book were in galley proof before the end was set in type. The double column design adopted was modeled after the Journal of the American Chemical Society on the theory that chemists are familiar with this type of format. The small print for the experimental sections made further compression possible. The size of the book was chosen so that it would fit in the same shelves as the Journal of the American Chemical Society bound volumes. The book weighs five and one-half pounds. The entire cost of publication was borne by Princeton University Press. Dr. Clarke edited the American sections; Sir Robert Robinson edited the British sections and Dr. Johnson was responsible for the Index.

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General endocrinology. C. Donnell Turner. Philadelphia-London: W. B. Saunders, 1948. Pp. xii + 604. (Illustrated.) $6.75.

There has long been a need for this book. Most texts on endocrinology have been written to fit the needs of the advanced investigator and physician, with no effort to interest a more general group of readers and afford them a good background and bibliography. This volume will probably do more to stimulate work in the field than many weightier and more specialized tomes.

Turner has fitted many of the arguable points into the first two chapters. His introduction, for example, includes a general survey of backgrounds and methods and the generalized features and glands of uncertain endocrine function. The second chapter is mainly centered about the biology of secretion, and here we find some strange companions such as chemical coordinators, inductors, and evocators (embryonic), phytohormones, chemical mediators (nervous), autolyzing tissues, parahormonics, and vitamins. The space devoted to these components is not great and serves to advantage in bringing diverse phenomena together even though they cannot all be catalogued as cell secretions. The accent of the chapter is directly on the physiology of the secretion and if occasionally substances which are normally cell bound are included under this head, it is of advantage to notice the analogies of functional condition which may pervade the reactions of the products.

The succeeding chapters from three through twelve deal in the main with individual glands in as complete a manner as is possible in a work of this size. There are excellent bibliographies at the end of each chapter, giving a sequence to the total work performed in organizing the information presented. In Chapter VI, succeeding that treating the pancreas, there is a short and succinct treatment of the alimentary secretions and their relation to the generalized picture of reaction.

Chapter XI is taken up completely with the interaction of the hormones during pregnancy and lactation and an excellent review of what we know about the interacting constituents during these processes.

After a concise treatment of the hypophysis (pituitary) the last 75 pages of text are devoted to a review of endocrine mechanisms in the invertebrates. This is an admirable presentation of the diverse mechanisms and how they work. While one might argue about some of the implied correlations between the activity of vertebrate and invertebrate materials, this in no way detracts from the presentation as a whole. The fact that it is presented in arguable form is a compliment to the ingenuity of the author, for these reacting substances do not have the clarity of result or the known chemistry of the vertebrate secretions.

The book as a whole is informative, carefully prepared, and extremely intriguing. It is a unique treatment of this very interesting field.

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Pathology. W. A. D. Anderson. (Ed.) St. Louis, Mo.: C. V. Mosby, 1948. Pp. xii + 1453. (Illustrated.) $15.00.

This book is not just another textbook of general pathology. Neither does its virtue lie in any unique manner of presenting its subject, since it follows in general the standardized order, with chapters on the fundamental pathological processes, their variations with etiology, and their manifestations as related to the various parts of the body. The text will have outstanding value for teachers and graduate students of pathology, who will find therein an unusual amount of useful information ordinarily gleaned only by extensive search through periodical literature.

Most of the chapters are written by well-known authorities in the various fields, who have carefully evaluated data from many sources, and have recorded the salient facts in concise, convenient form. The use of headings, spacing, varied printing, and numerous illustrations gives emphasis to the more important subjects and facilitates ready reference. Each chapter is concluded with a generous bibliography, arranged conveniently according to subjects. Most authors have placed commendable emphasis upon relationships between pathology and the other basic sciences, and between pathological changes and clinical phenomena.

The changing order in our modern world justifies the