necessary, and it is expected that after reading in the first volume the sections pertaining to the special topic of interest one can pass directly to the more detailed treatment in the later volume, or indeed stop with the first volume if the technical details are not of interest. This scheme of presentation makes necessary a certain amount of duplication, which however the authors feel is no disadvantage if thereby the work can be made to serve its intended double purpose as a "review of the subject and a work of reference."

The scope of the book can perhaps be best indicated by the chapter headings: "The Crystalline State," "Diffraction by the Crystal Lattice," "Experimental Methods of Crystal Analysis," "Examples of Crystal Analysis," "Crystal Symmetry," "The Principles of Structure Analysis," "Chemical and Physical Crystallography," "Crystal Texture," "X-Ray Optics," "Applications of X-Ray Methods to Problems of Pure and Applied Science," "The Diffraction of Electrons," "Historical."

The exposition of the various symmetry properties of the crystal and the physical significance of the various methods of classification of crystals into 7 or 14 or 32 or 65 or 230 groups is much fuller and more lucid than one usually finds and will be illuminating after some of the rather muddy expositions that are to be found in the literature. But it is the detailed exposition of examples of crystal analysis in Chapter IV that is particularly happy and exemplifies the vivid physical visualization which is in the best tradition of the English school of physics, and which all those who have heard the author will remember as one of the most charming features of his lectures. Other notable features are the chapter on "Texture," in which a brief account is given of the results of a structure analysis of substances like rubber or cotton fiber which is coming to be so important in industry, and the historical chapter, which could have been written only by one who himself has played a foremost part in the developments which he describes.

One does not get the impression from reading the book that the subject of x-rays is in danger of becoming exhausted in the immediate future, as one so often hears, but on the contrary Bragg sees in the application of x-ray analysis to a determination of the structure of proteins the opening of an immense new field in which x-rays will play a unique part in helping to solve the problems of living matter.

P. W. BRIDGMAN

THE PROGRESS OF BIOCHEMISTRY

Annual Review of Biochemistry. Edited by JAMES MURRAY LUCK. Stanford University Press, Stanford University, California, Vol. III, 558 pages, $5.00, 1934.

THE increase in the literature concerned with the medical and biological sciences has of recent years been so great as to make almost impossible detailed and comprehensive study of even a small part of the important contributions. Abstract journals, many of which are available, fail to afford the necessary critical point of view. This need for critical interpretation of the literature in the field of the biological sciences has been met in part by such publications as the older Ergebnisse der Physiologie of Asher and the more recent Physiological Reviews, Biological Reviews and Medicine. The limitations imposed by the broad fields to be covered are obvious. Three years ago, under the editorship of Professor James Murray Luck, of Stanford University, there appeared the first volume of the *Annual Review of Biochemistry,* a publication which aimed to discuss critically the recent developments of the more important phases of biochemistry. The immediate success of the venture has encouraged both the editorial committee and the contributors to enlarge the scope of the work.

The present volume, the third of the annual reviews, continues along the lines which have made the earlier volumes so valuable. To readers familiar with the preceding reviews, it is sufficient to point out that, in freedom from errors of typography and in general excellence, the present volume conforms to the high standards already set. In addition to the discussion of broad general subjects treated yearly, the editorial committee has announced the policy of the inclusion of "occasional reviews on topics of timely nature in which a lively interest has recently developed and significant advance been made." In accordance with this policy, the present volume includes a discussion of the biochemistry of malignant tissues and another on biochemistry in relation to dentistry. The forthcoming volume is expected to contain reviews on choline, the possible importance of which as a hormone has been suggested, and on the growth substances of plants, the auxins of Went and related substances. Continuation of this new policy should add greatly to the value of the reviews. Those topics "which by universal consent constitute the traditional divisions of the subject" will continue to be reviewed at annual or biennial intervals, however.

"The diversity of interest and outlook which characterizes investigation in any of the numerous fields of biochemistry" is shown by a survey of the laboratories of the workers who have contributed reviews to the present volume. Of the twenty-six articles included, ten only are from workers in the United States, seven originate from British laboratories, four from Germany, while Czechoslovakia, Japan, Sweden, Switzerland and Canada are each represented. The review is truly international. The word "worker" has

been used intentionally in referring to the authors of the individual reviews. Each is an active contributor to the literature of his own particular field; it is unusual to find contributions of a critical character by such investigators as Kay, Pauli, Hans Fischer, Bloor, Waldschmidt-Leitz, Gortner, the Coris and Collip in a single volume.

The attempt to include within the compass of 550 pages the literature of the vast field of biochemistry has resulted in the omission of the discussion of many important papers. Harris, who writes concerning vitamins, although citing more than three hundred references to recent investigations, well presents the point of view which authors of reviews of this sort must of necessity accept. "The space allotted has enabled us to deal with no more than about one quarter of the total number of papers published during the year. It deserves to be said that of the large number thus crowded out the great majority represent some definite addition to knowledge, filling in some detail or other on the big canvas. We make this point because superficial critics so often suggest that out of this immense annual output of papers only comparatively few can be of real permanent value. This criticism seems to the reviewer to overlook the essential fact that (as all past experience goes to prove) progress is made only by the cumulative and cooperative efforts of many different workers, each adding his contribution to the general flow of knowledge. Solitary isolated advances are few. And much work is nevertheless useful and essential, although it represents no fresh development of theory, and finds no place in our review. . . ."

The editors believe that "even at the expense of omitting references to many papers,—critical surveys of the literature, though less comprehensive, are of more value to users of the Review than uncritical compendia." This ideal of a critical survey has been maintained with few exceptions. Unfortunately, one of these, which is little more than a catalogue of abstracts and references, is concerned with one of the most important subjects in biochemistry.

Space does not permit discussion of the individual reviews. The surveys of the difficult fields of hormones and vitamins are of the same excellent workmanship which has characterized the previous reviews by these authors in earlier volumes. Particular reference may be made to the valuable résumé of the important subject of energy metabolism in the review of nutrition by Professor Brody, an author who has not previously contributed to this work. The criticism, which has been made frequently, that biochemistry in America is considered chiefly in its relations to the animal organism and to medicine, finds no justification in the present volume. Plant chemistry and nutrition are amply covered by the discussion of the terpenes and saponines, the nitrogenous constituents of green plants, mineral nutrition, metabolism of carbohydrates and organic acids in plants and the chemistry of bacteria.

Professor Luck and his collaborators have again rendered valuable service to biochemistry and related sciences. The review well deserves the support of all those interested in these fields.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

RAPID STAINING METHODS

NEGATIVE STAINING OF MICROORGANISMS

THE so-called negative staining is frequently very useful in studying bacteria, yeasts and other microorganisms. To make mounts the organisms are transferred to a small drop of dye on a slide, spread in a thin layer and allowed to dry. They will then appear as colorless objects in a stained background. The dyes commonly used for this purpose are aqueous solutions of nigrosin (1 per cent.) or Congo red (2 per cent.). After the film of Congo red has dried, the color may be changed to blue by adding a drop of 1 per cent. hydrochloric acid in 95 per cent. alcohol. For examining such preparations either immersion oil or Nujol should be placed directly on the film.

In making negative preparations the writer has found that the addition of certain other dyes to aqueous nigrosin is very advantageous. The use of such mixtures results in various colors of background and, in some cases, in light staining of the organisms. Many dyes have been tried, but the most satisfactory ones are rose bengal, Magdala red, cotton blue and acid fuchsin. A 1 per cent. aqueous solution of any one of these dyes, excepting acid fuchsin, is added to a 1 per cent. nigrosin solution in the proportion of 1 to 3. Traces of acid may be added to the nigrosin-cotton blue mixture, but should not be added to the other two mixtures (nigrosin and rose bengal or Magdala red), although the addition of a little alkali to them may be advantageous. Of course the proportions of the dyes in the mixtures may be varied as desired. In the case of acid fuchsin 30 drops of the dye solution (1 per cent.) and 4 drops of concentrated hydrochloric acid are added to 40 cubic centimeters of aqueous nigrosin.