at the same geomagnetic latitude and at an altitude of several thousand feet. Ceylon seems to enjoy a comparatively high degree of prosperity and the government has been quite liberal in its support of research in physics. The staff there would welcome visiting physicists who may wish to come for an extended stay and make use of facilities suited to their work. The other laboratory attracting my attention with respect to quality of equipment is at the Tata Institute for Fundamental Research at Bombay. This institute was started with private funds but now enjoys what is apparently generous support by the government. It has succeeded in bringing together a number of enthusiastic investigators who have acquired and assembled up-to-date equipment, particularly electronic devices, needed in the study of cosmic rays. Their specialty at present is the exploration of cosmic ray intensities at the high altitudes reached by balloons and the study of the variation of these intensities with geomagnetic latitude. The existence of these rather exceptional laboratories emphasizes that more adequate financial support on a much wider base is what is chiefly needed to increase greatly the productivity of physics in India. Although those responsible for such a program are striving to do what they can along this line it would seem that financial assistance from other countries not only would be welcome but would pay richer dividends for modest investment than perhaps anywhere else in the world. This conclusion assumes, of course, that a corresponding increase in opportunities for advanced training, in the universities and elsewhere, would accompany such a program. At present it is apparent that there are shortages of trained personnel to carry on expansions already under way.

Perhaps the most notable example of the efforts to improve the position of physics in India which came to my attention is the new National Physical Laboratory at Delhi. The whole institution is to be housed in a truly enormous modern laboratory building that is as yet less than half completed although construction has been proceeding several years and is in continuous progress. Careful study of laboratory buildings in other countries, particularly the more modern examples in the United States, preceded the planning of this building. Consequently it incorporates many of the best features of advanced laboratory design. The expense has been so great that as yet only a small amount of equipment has been acquired to equip the laboratories already completed. The small staff is nevertheless enthusiastically at work in an effort to fill this void. It is easy to predict that this laboratory will, when in full operation, contribute handsomely to the progress of physics not only for the benefit of India but the rest of the world as well. Even in its present incompleted state the building in size and attention to detail represents a structure that would form a prized acquisition by any government. In addition it seems to stand as a symbol of the kind of progress to be expected in a country which has already made valuable contributions to the advancement of physics.

Books

Photosynthesis and Related Processes (Volume II, Part 1). By E. I. Rabinowitch. 1208 pp. Interscience Publishers, Inc., New York, 1951. $15.00.

Photosynthesis, the utilization of light energy by green plants to convert carbon dioxide to organic compounds of high energy content, has been investigated experimentally for a century and a half by hundreds of biologists, chemists, and physicists. The mechanism of the natural process is not known, nor can it yet be reproduced outside of living material. The great diversity in objectives, in methods of attack, in language, and even in the experimental results of various workers with nearly the same objectives makes it a most difficult field to summarize thoroughly and critically. This, Rabinowitch has done with lucidity, elegance, and precision, both in Volume I, and in the present book. It is no longer possible for one who is primarily an experimental investigator to completely understand and appraise any large fraction of the publications in botany, biochemistry, chemical physics, photochemistry, and applied optics that are of relevance to this subject. Therefore the penetrating understanding, the completeness of coverage, and the author's good judgment in the handling of the subject make it seem likely that this book will be of value for a generation, as was true of the 1926 book on the subject by Spoehr.

Volume II, Part 1 begins with the absorption spectroscopy of purified pigments, goes on to consider the absorption by these substances in living cells, and then takes up their fluorescence in extracts as well as in the cells. The fluorescence spectra and the variation of fluorescence intensity of the pigments are discussed in relation to their photochemical activity.

To quote from the introduction to the second half of the book dealing with kinetics of photosynthesis: "What one measures as the 'yield of photosynthesis' is the net result of the operation of a complex mechanism. No simple kinetic equation can account for all the factors that influence this yield. It is comparatively easy, after having made a series of kinetic measurements on a selected system, to invent a model that would interpret these particular observations, or even to write down equations fitting the experimental results more or less closely. The literature on photosynthesis abounds in such formulations. Their limited significance is illustrated by the fact that practically nobody ever uses equations derived by somebody else; instead, every investigator starts anew, often without as much as re-

ferring to his predecessors, and—even more unfortunate—without making an attempt to correlate his formulae with any experimental results but his own.

"Photosynthesis is such a complex and heterogeneous process that it is probably impossible to make a complete analysis of its mechanism merely by measuring the rate of the over-all process under different conditions. However, this does not mean that kinetic measurements of photosynthesis are useless; but rather that they are most useful when combined with other biochemical and biophysical methods of approach. . . ."

The section on kinetics first discusses the limitations of the data that are imposed by various methods of measuring the rate of the reaction and the usable incident energy in "white" light. Some general considerations of the influence of external and internal factors on the rate of photosynthesis are followed by detailed chapters on the relation of rate to the concentration of carbon dioxide and of added chemicals that influence the rate of carbon dioxide uptake in plants.

The remainder of the book covers the kinetics with respect to light intensity and wavelength. The present state of the subject of kinetics of photosynthesis is well illustrated by the fact that the quantum yield of the process—apparently a simple bit of fundamental information—has for some years been a controversial issue of intensive investigation. The detailed considerations of both "sides" of this argument in which the results of the contestants differ by a factor of two are clearly and objectively presented. A final chapter on the action spectra of the reaction in leaves, algae, and bacteria brings the book to a close.

Particularly in Volume II, Part 1, the emphasis is upon the relevant and well-established facts of permanent value. The finely spun theories, in which the subject abounds, are neatly described and used to correlate various investigations, but are not allowed to obscure the sound information upon which further progress may be based.

This treatise is in no sense a handbook of laboratory technique, but serves the greater need of drawing the results of thousands of diverse papers together into an organized body of knowledge. The biological and biochemical parts of the subject, rather than being lightly brushed aside, are thoroughly covered and integrated with the physical and physico-chemical data. Let us hope that the completion of this series will not keep the author from continuing his creative organization of the field as it develops in the future.

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Briefly Noted

Semi-Conductors

Appearing under the title *Semi-Conducting Materials,* the *Proceedings* of an international conference held at the University of Reading in Great Britain under the auspices of the International Union of Pure and Applied Physics in cooperation with the Royal Society in July 1950 have recently been published in the United States and England. The conference was organized by R. W. Ditchburn, professor of physics at the University of Reading, and by N. F. Mott, professor of physics at the University of Bristol. It was attended by more than two hundred physicists and engineers interested in recent progress in that branch of solid state physics which deals with semi-conducting materials. The *Proceedings,* which were edited by Conference Secretary H. K. Henisch of the University of Reading, include twenty-seven papers reviewing the physical characteristics and behavior of semi-conductors. A number of scientists from this country attended the conference, many of whom are listed among the contributors to the published *Proceedings.* (281 pp. Academic Press, Inc., New York City, 1951. $6.80.)

Liquids

Table of Dielectric Constants of Pure Liquids, compiled by Arthur A. Maryott and Edgar R. Smith, is part of a program for critical examination of the data of physics and chemistry, sponsored by the National Bureau of Standards in cooperation with the Committee on Tables of Constants and Numerical Data of the National Research Council and the Commission on Tables of Constants of the International Union of Chemistry. In compiling the table, which contains sections on standard liquids, inorganic and organic liquids, and a complete list of references, the authors considered only the low frequency or "static" values. The available literature on more than 800 substances is examined in order to provide "best" values of the dielectric constant and an estimate is represented by a concise function of accuracy for each substance. (NBS Circular 514, 44 pp., U. S. Government Printing Office, Washington 25, D. C. $0.30.)

Solar Energy

Volume 79, No. 4 of the *Proceedings* of the American Academy of Arts and Sciences is a volume of the collected papers presented during the Academy's conference on "The Sun in the Service of Man" in February of last year (145 pp., $2.50). Held under the chairmanship of Harlow Shapley, the conference program included fifteen papers grouped under three major subdivisions: "The Biological Utilization of Solar Energy"; "Sun-Earth Relationships"; and "Survey of Energy Sources, Needs and Utilization". Paul C. Mangelsdorf, Donald H. Menzel, and Karl T. Compton were chairman, respectively, for each of the three sessions. Included among the contributors to this volume are Farrington Daniels, Richard L. Meier, Leo Goldberg, Newbern Smith, Jules Aarons, Richard A. Craig, George Gamow, Eugene Rabinowitch, and Arthur von Hippel. Orders should be addressed to: Committee on Publication, American Academy of Arts and Sciences, 28 Newbury Street, Boston 16, Massachusetts.