known for a number of years, to the writer's knowledge it has not been made use of commercially. The past two years this practice has been carried out on an extensive scale in Denver greenhouses.

A greenhouse of 8,000 square feet of glass was equipped with black cloth shades that covered the entire crop of chrysanthemums in this house. These shades, or curtains, slid on rings on wires inside the house and could be quickly drawn off and on. The shading was begun on July 10 and continued until the terminal buds were well formed. The shade was placed over the plants about 4 P. M. and left there until about 8:30 A. M. the following morning. This practice brought chrysanthemums into bloom and on the market from 14 to 50 days earlier than the same varieties planted at the same time but not shaded.

Another house of 10,000 square feet of glass was arranged and similarly planted to the pompon type of chrysanthemum. These plants produced flowers from 16 to 30 days earlier than the same varieties without shade.

The quality of flower, length of stem and keeping quality is apparently unaffected by this practice of shading, especially in the midseason or late varieties. The earlier varieties, when shaded, however, tend to have smaller flowers and shorter stems.

The advance of the cutting period is of great economic importance, since it places flowers on the market when few or no flowers of that kind are to be had, with resultant favorable prices.

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SCIENTIFIC BOOKS

Bibliography of the Honourable Robert Boyle, Fellow of the Royal Society. By J. F. FULTON, M.A. Oxon. (Oxford Bibliographical Society, Proc. and Papers, Vol. 3, Pt. 1, 1931). Oxford, Oxford University Press, 1932.

THE handsome and scholarly publication before us for review calls vividly to mind the fact that the art and the science of bibliography have not as yet passed entirely from the minds of scholars. Nor has the appreciation of first-rate work waned because of the fact that so little bibliographical work is done. Of course there are "types" of bibliographical production ranging from a mere author-title compilation to extended and annotated lists and even abstracts. These, however, are good enough for ordinary scholarly and commercial use, but when it comes to preparing a bibliography such as has Dr. John F. Fulton, of the School of Medicine of Yale University, we are then dealing with the highest type of scholarly bibliography —compiled primarily for the critical scholar and librarian. Dr. Fulton has shown many fine traits in the preparation of his study of Honorable Robert Boyle's work. He not only has examined each of 258 items, but he has virtually weighed each one. There is a total of 367 entries in the bibliography. The results of his study are clearly shown by the exactness of the bibliographical data assembled. In his introduction, Dr. Fulton says:

> In order to disclose these things a modern bibliographer must "anatomize" his books: he dissects them with infinite patience, lifting their epidermis to find what lies beneath; he is concerned with their joints and ligaments, and has great delight in discovering parts which have been artificially replaced; he seeks for errors in the hand of the maker, but he views with charitable amusement all signs of human frailty. Bibliography is indeed an all-absorbing occupation, but its devotee is frequently face to face with those who fail to understand the source of his enjoyment. A mere list of bibliographical idiosyncrasies with mistaken signatures, pagination, and gatherings, has little appeal to any one not a collector of books; and however much a bibliographer may pride himself on "purity" he has difficulty in justifying his existence if he fails to make himself useful to those not pursuing his specialized field. He must reveal something more than the mechanics of bookmaking. He can endeavor to assess the importance of a book; he may say how the author came to write it, or investigate the influence which it exerted upon his contemporaries. With Boyle one can sometimes deal with these and related questions, and I have attempted to do so in the preliminary notes concerning each of his separate works. With his more obscure writings, however, the task has been difficult, and many of my notes will be found incomplete and inadequate.

The question as to the necessity of this sort of work is answered in the publication itself. The apparently growing interest in the life and work of Robert Boyle has called for further examination, particularly from the point of view of the historian of science. His work was the link between the alchemy of the Mediaeval Age and the chemistry of the modern period, which every reader of the "Sceptical Chymist" will discover for himself. He was one of the illustrious founders of the Royal Society of London, together with Wren, Hooke, Ashmole, Barrow, Wilkins and others, who represent the pioneer age of scientific progress in Great Britain.

The complete bibliography of the writings of Boyle reveals subjects of varied character, showing him to be almost encyclopedic in learning. Dr. Fulton has

had unusual opportunities to examine Boyle's work, and this bibliography is the result of his remarkable researches.

The preface of this bibliography states clearly how the work came to be compiled, together with the source or location of many of Boyle's works. This is followed by a table of contents, consisting of four divisions: (a) separate works of Boyle, which is divided into 42 sections, wherein is described each book, together with a historical account as to how the work became known; (b) contributions to other works, including papers in the Philosophical Transactions of the Royal Society; (c) collections with Opera Varia; (d) biography and criticism, together with Appendices and a General Index. There are twenty-two facsimiles of title-pages and other illustrations of importance, with a portrait bust of the Honorable Robert Boyle, by J. M. Rysbrack, as a frontispiece. At this point it may be suggested that Dr. Fulton should have included a list of all the famous portraits of Boyle, together with the artist's name, location of these paintings, etc.

It is very apparent that the compiler has taken into account every known copy of the various editions of Boyle's writings. He has revealed how rich the various college libraries of Oxford and Cambridge universities are, as well as the British Museum and several continental libraries, and a number of private collections. It is to be regretted that the initials "L. C." (Library of Congress) are not among these references. A most astonishing thing is the large number of titles contained in Fulton's own private library.

This is not the sort of bibliography to be criticized by merely a study of its pages and contents—one can not presume even to evaluate the various items, unless he himself has access to the collections. In other words, Dr. Fulton has left no room for attack upon any phase of the complete bibliography. The care which he has given each and every item is very evident. He has described in full each book, using the various bibliographical and typographical symbols. To the last, the reviewer had hoped to find a place for attack, but a check upon the index showed that it had been compiled with care and caution.

The bibliography is unusual also, from the point of view that it is readable, fascinating and entertaining. As well as being of great use to the scholar in literature and science, its references and information are a great help to the librarian, and its beauty in form, type and printing will be appreciated by the typographical student.

FREDERICK E. BRASCH

LIBRARY OF CONGRESS

Johann Kepler, 1571–1630. Special Publication No. 2 of the History of Science Society. xii + 133 pp.; two plates. The Williams and Wilkins Company, Baltimore, 1931.

THIS little book contains three addresses delivered in commemoration of the tercentenary of Kepler's death at a joint meeting of the History of Science Society and Sections A, D, and L of the American Association for the Advancement of Science at Cleveland in December, 1930; and a bibliography by the secretary of the editorial committee in charge of publication.

The first part, "Kepler as an Astronomer," by W. Carl Rufus, is a lively and interesting presentation of the most important biographical facts about Kepler and of his astronomical achievements. Professor Rufus' concluding remarks seem to imply that modern physicists are tending to return to the outlook on the universe which dominated him, and even that this is a good thing. It seems to the reviewer that only a very thorough-going and detailed analysis of the matter could justify either the implication or its evaluation. Such an analysis has not been given and is obviously beyond the scope of this part of the book.

Part 2, "Kepler as a Mathematician," is by D. J. Struik. This is an orderly, authoritative and liberally annotated account of Kepler's contributions to mathematics. These included important adumbrations of the methods of the differential and integral calculus, investigations in the theory of regular polygons, and tables of "Keplerian" logarithms. Like the Naperian logarithms, these last were quickly superseded by those of Briggs, but nevertheless remained long in view by virtue of being used in the Rudolphine Tables. In general Kepler's mathematics seems to have lacked rigor, but not usefulness.

Part 3, "Kepler and Mysticism," is by E. H. Johnson. It is one of the commonplaces of history that the esteem in which a pioneer holds his scientific discoveries may differ profoundly from that of his successors. No better exemplification of this can be found than Kepler. In his work the famous three laws appear to us at first sight like gems, surrounded by masses of irrelevancies and mistakes. To Kepler, they were integral parts of a unified scheme, no more necessary to it, and not more to be celebrated than the other parts. It is evident from this that Kepler's mind was dominated by a set of ideas (both expressed and tacitly assumed) which was in many ways far different from that which conditions the modern outlook on the universe. Kepler was thus driven to seek and find emotional satisfaction in constructing vast systems that now seem chimerical in comparison to our own, but which fortunately contain some elements