

continued in the concluding symposium, in which J. K. W. Ferguson referred to the danger of demands for universal secondary and even higher education swamping facilities and debasing the product. Diversification of channels for post-primary education should be a practical aim and the maximum freedom of individual choice should be an ideal. Mass media had contributed much at the evocative level of education and they might possibly be used to do even more. L.-P. Dugal suggested that to restore the proper balance between liberal arts and science, thus uniting modern knowledge, was a main responsibility of our time and implied a pattern of education sufficiently flexible, especially in the early formative years, to satisfy later both the needs of the nation and the aspirations of the individuals. Finally, W. B. Lewis took up Dr. Steacie's challenge, how much efficiency did we want, and referred to the importance of finding new ways, especially by the improvement of our means of communication, of helping the universities to deal with increasing numbers without lowering standards. Further, the research institute and the university could and should be mutually helpful. We should ensure that adequate technical aids were available and that more care was taken to see that the tools were appropriate to the purpose so that man-power was used efficiently.

R. BRIGHTMAN

RECENT DEVELOPMENTS IN PLANT PHYSIOLOGY

Annual Review of Plant Physiology

Vol. 9. Edited by A. S. Crafts in association with Leonard Machlis and John G. Torrey. Pp. x+510. (Palo Alto, Calif.: Annual Reviews, Inc., 1958.) 7 dollars.

AS with previous volumes, the Annual Review of Plant Physiology for 1958 covers a wide range of topics. In this volume they extend from the physiology of salt tolerance, reviewed by L. Bernstein and H. E. Hayward, to post-harvest physiology of fruits, discussed by R. Ulrich; from the quantum yield in photosynthesis, dealt with by R. Emerson, to morphogenesis in lower plants, considered by L. F. Jaffe.

In the introduction to this volume, the editor refers to the changing emphasis with time in the field of plant physiology, and among a number of subjects on which emphasis has been laid in the past he includes auxin *a* and auxin *b*. If these have suffered eclipse, the interest in growth substances is as lively as ever, for no less than three of the fifteen reviews which make up this volume are concerned with auxins. J. A. Bentley deals with the naturally occurring auxins and inhibitors, P. M. Ray with the destruction of auxin, and A. C. Leopold with the uses of auxin in the control of flowering and fruiting. The related topic of herbicides is considered by E. K. Woodford, K. Holly and C. C. McCready. The extent of the bibliographies to these four articles, which contain respectively 231, 159, 190 and 357 references respectively, of which only a few are earlier than the year 1950, gives some indication of the current interest in growth-regulating substances.

Two reviews deal with special aspects of plant metabolism. In one of these, L. W. Mapson considers the function of ascorbic acid in plants. The

universal presence of this substance in active metabolizing cells suggests that it has some essential function and, although it is not by any means clear what this is, it is useful to have this statement of the present position. Perhaps in no aspect of plant metabolism does fresh information accumulate more rapidly than in nitrogen metabolism, and in this field E. W. Yemm and B. F. Folkes write on the metabolism of amino-acids and proteins in plants, the problems of the synthesis and interconversion of amino-acids and their relation to protein metabolism being dealt with particularly thoroughly.

An article by W. Reuther, T. W. Embleton and W. W. Jones on mineral nutrition of tree crops deals chiefly with the major nutrients, nitrogen, phosphorus, potassium, calcium and magnesium, including the effects of their deficiencies or excess and their relations to quality of fruit. Some data are also given with regard to micro-nutrients and the inter-relationships of the mineral nutrient elements.

The physiology of one particular plant, tobacco, is the subject of a contribution by R. A. Steinberg and T. C. Tso, while the physiology of a whole group of plants, the freshwater algae, is reviewed by R. W. Krause in a paper with a bibliography containing 467 references. The volume concludes with contributions on the biogenesis of flavonoids by L. Bogorad, and on cytochromes in plants by L. Smith and B. Chance.

This volume is well up to the high standard of its predecessors and will be invaluable as a work of reference for plant physiologists wishing to obtain a view of recent developments in those aspects of plant physiology outside their own specialist interests.

W. STILES

MATHEMATICS FOR THE PHYSICAL SCIENCES

Ancillary Mathematics

By Prof. H. S. W. Massey and H. Kestelman. Pp. xvi+990. (London: Sir Isaac Pitman and Sons, Ltd., 1959.) 75s. net.

IN the post-war revision of examination syllabuses in the University of London, much attention has been given to the amount and kind of mathematics required to-day by a student whose chief interest is in one of the sciences. While a good knowledge of calculus and differential equations is still necessary, there is an increasing demand for a wider scope and a deeper logical understanding: the scientist can no longer safely rely on a manipulative technique built on sketchy foundations. The present volume is designed to meet present-day needs in physics and chemistry, and should see the student from his A-level mathematics as far as the end of his first year at the university. Such a course cannot but be voluminous, since it includes, for example, three-dimensional geometry as far as the elements of differential geometry, spherical trigonometry, differential and integral calculus of functions of more than one variable, the elements of the calculus of variations, as well as a concise but comprehensive treatise on particle and rigid dynamics, using vectors and moving axes, and going as far as Lagrange's equations and variational principles such as Hamilton's. Yet there is nothing superfluous in the book's 1,000 pages; one may even regret that there is no mention of matrices or