Phytochemistry, 1972, Vol. 11, p. 2127. Pergamon Press. Printed in England.

BOOK REVIEW

Photosynthesis and Photorespiration: edited by M. D. HATCH, C. B. OSMOND and R. O. SLATYER, Wiley–Interscience, New York, 1971. 565 pp. $19.00.

THIS book is interesting, even provocative, from several standpoints. In the first instance, it is an outgrowth of a political agreement between the governments of the U.S.A. and of Australia intended to encourage scientific and technical cooperation. Specifically, it is the record of a seminar that was held in Canberra in late 1970 at the invitation of the Australian Academy of Science. The principal topic of discussion was the botanical basis of agricultural productivity insofar as it relates to the efficiency and mechanics of conversion of atmospheric carbon dioxide to plant organic matter by photosynthesis. In this sense, the topical coverage is intensive yet wide ranging over the fields of biochemistry, biophysics, plant cytology and anatomy, genetics and evolution, and ecology. The book is definitely not for the general reader. Even the physical make-up of the volume is singular. The pages are apparently typewritten and then reproduced by photo-offset. Yet, the cover is hardboard. One may ask whether it should not have been issued more appropriately as a paperback with some attendant reduction in price.

The structure of the Canberra seminar was exemplary judging from the topical organization of this book. There are four sections. The first is entitled Environment, Adaptation and Evolution in Relation to Photosynthetic and Photorespiratory Gas Exchange; the second, Carbon Dioxide Assimilation; the third, Chloroplast Structure and Function; and the fourth Photorespiration and the Role of Microbodies. Each section is subdivided into Review Papers, Research Papers and Assessments in that order. Facile reading and comprehension are thus assured.

The principal theme of the seminar was the delineation and evaluation of two different carboxylation reactions that precede the photoreduction steps on the pathway to carbohydrate. One of these pathways utilizes phosphoenolpyruvate as carbon dioxide acceptor and results in the production of malic or of aspartic acids. The other is the so-called Calvin cycle which utilizes ribulose diphosphate as acceptor and leads to the net production of hexose sugars. All photosynthesizing cells of higher plants are believed to contain the enzymes and intermediates of the Calvin cycle. In some cells of some species of plants the malic/aspartic pathway supplements the Calvin cycle by increasing the volume of carbon dioxide pick-up from the atmosphere. The malic and aspartic acids are believed to move to the locus of the Calvin cycle there to yield their carboxyl carbon as carbon dioxide to ribulose diphosphate. Thus, the four-carbon acids are merely carriers of carbon dioxide, and it is interesting to note that those plants which utilize the C_4 pathway appear to confine it to the cells of the sheath that surrounds the vascular bundles. In many cases, the chloroplasts of these cells contain poorly developed grana, and Calvin's photosystem II may be lacking. Plants that carry the C_4 system in their sheath cells are alleged to carry on photosynthesis faster than those that lack it especially under conditions of high light intensity, high temperature and limited water supply. If this is so, the implications of the system for crop production in tropical and arid climates are obvious.

Despite the fact that there is clear disagreement on important points among participants in the seminar, this is an excellent collection of stimulating and well coordinated contributions.

Princeton, N.J. R. F. DAWSON