Net Production

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TWO REVIEWS ON PLANT HORMONES

Plant Growth Regulation (Proceedings in Life Sciences), edited by P. E. Pilet, Springer-Verlag, New York, 1977, 305 p., illus., $28.20 (77-2880).

Hormone Action in the Whole Life of Plants, by Kenneth V. Thimann. University of Massachusetts Press, Amherst, 1977, 448 p., illus., $35.00 (76-26641).

Just over 50 years ago the first plant hormone was isolated. In the intervening period, an overwhelming number of papers have appeared, and new research papers concerned with many aspects of hormone action and physiology are being published at a rate that makes it almost impossible to keep abreast of the subject. Indeed, we might be hopelessly lost if it were not for review articles, summarizing and synthesizing this mass of research. The two books considered here demonstrate two different approaches to reviewing, each with its own merits and advantages.

Plant Growth Substances, edited by P. E. Pilet, contains 30 reports given at the 1976 International Conference on Plant Growth Substances in Lausanne. Rather than attempting to summarize the whole field, these articles tend to concentrate on the research being conducted in the author's own laboratory and are designed to inform the reader about the latest advances in selected areas of plant hormone research. The papers cover many aspects of plant growth substances, but some topics receive particular attention. Half the papers are devoted to just four topics: geotropism and root growth (5 papers), hormone binding (4 papers), senescence (3 papers), and cell walls (3 papers). Compared with previous conferences, there is a noticeable decrease in papers on hormone identification (2 papers), and gibberellins are represented only by MacMillan's outstanding review of their metabolism. There are reports, however, on the less familiar growth regulators fusicoccin and dikegulac and on phenolics.

The articles vary considerably in readability and interest; I was particularly impressed by the reviews on auxin binding (Venis), flower promoters and inhibitors (Chaylakhyan), the cytokinins in whole plants (Wareing), and the unusual phytotoxin fusicoccin (Marre). The reviews on cell wall structure (Albersheim) and geotropic mechanisms (Wilkins) are also informative and well written, but they contain the same information reviewed elsewhere. Although much of the information may be outdated in a year or so, at present this volume is a valuable source of information for anyone interested in the particular subjects included; every library will want to have a copy.

Hormone Action in the Whole Life of Plants represents a completely different approach to reviewing. The author, K. V. Thimann, is one of the most distinguished scientists in this field, and he has taken advantage of his wealth of knowledge and years of experience to place the whole subject in perspective. This book arises from a series of lectures given at the University of Massachusetts, with the result that it has the coherence and direction one expects from a textbook. This book is well written (no surprise to those who have read Thimann's previous writings) and attractively presented.

This book describes the role of hormones, and auxin in particular, in the various developmental processes that make up the life history of a plant. Processes considered in depth include cell enlargement, tropisms, root formation, xylem differentiation, apical dominance, flowering, and senescence. The author states in the Preface that the book emphasizes his own research and that of his students, and a glance at the bibliographies at the end of the chapters confirms this. One cannot help but be amazed at how many areas are included until one reflects on the contributions from this group to all aspects of hormone research. There are, however, areas which receive noticeably less attention. This is particularly true of the gibberellins; for example, while the natural history of auxins is discussed in 33 pages, the gibberellins rate less than 3 pages. The contributions of some of the major figures in the field also receive less than their deserved recognition.

The basic approach is historical, with the development of ideas and the presentation of older and now often forgotten background information receiving considerable attention. It may surprise some readers to find that nearly half the illustrations are taken from pre-1960 papers; nevertheless, this approach should be of value to newcomers to the field, who need some sense of the past accomplishments and failures. Students should realize, however, that Thimann is championing his own ideas, and these sometimes differ from current dogma; an example is the role of auxin in root geotropism. Although many currently held concepts are discussed, this is not a sourcebook for the latest ideas and most recent advances in the study of hormones.

Both books are in their own way valuable additions to our store of reviews on plant hormones, and both will be read with interest by both students and more established researchers. Which book one consults will depend on whether one wants the details of the latest research or the broader, more historical view of the field.

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NET PRODUCTION

Primary Productivity of the Biosphere (Ecological Studies: Analysis and Synthesis Vol. 14), edited by Helmut Lieth and Robert H. Whittaker. Springer-Verlag, New York, 1975, 339p., illus., $29.80 (74-26627)

Following IBP, a review book, rich in viewpoints, tabulations, and citations, deals with the stocks and rates of accumulation of organic matter in the biosphere and its main zones and biomass. There are two chapters on history, five reviewing methods, four on magnitudes in parts of the earth, and four interpreting the data. Authors are Helmut Leith, R. Whittaker, E. Likens, C. Hall, R. Moss, R. Whittaker, P. L. Marks, D. Sharp, D. Whigham, D. Sharpe, J. S. Bunt, P. G. Murphy, and E. Box. For those needing data for comparison, algorithms for making regional calculations, a summary of latest methods, an entry to literature, and possibly reasonable overall means, the book is excellent. Whittaker and Likens give efficiency of world production as 0.6% of visible light.

Most data and discussions are of net production and thus lack rigor. Net production is the rate of change of the difference of basic processes of photosynthesis and many pathways of consumption. There are as many kinds of net production as there are pathways and storages; comparing or adding them is a quagmire of semantic fallacy. Net production is as much a measure of the degree to which production and consumption are out of phase as a measure of biological work done, which is often greatest when net production is least.

Net production is a function of the time interval of accumulation. Data for waters done over short times should not be compared with data for land done over long periods, during which more production is made and used. The maps of world productivity with both land and water grossly underestimate the differences between land and sea. Correct use of net production data requires validating definition models that allow the basic flows of production and consumption to be evaluated. Out of step with IBP tradition, the book's use of models is primitive, mainly fitting Mitscherlich equations to two factor plots. Michaelis-Menton, Cobb-Douglas, and ones that include consumption and feedback pathways are not used. In one place the erroneous concept of species area curves becoming saturated was used.

Useful evidences are given that diversity increases with productivity, evapotranspiration is a major factor, land tropics are more productive than temperate zones, the conversion of solar energy in the real world is inherently small, and its carrying capacity for humanity is smaller than the present population. The world's balance of production and consumption was not really considered.

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