area, the nonlinear Schrödinger equation and the Korteweg–de Vries equation, which have wide applicability. Chapter 7 presents a discussion of higher-order interactions, quartets in particular, with applications in Taylor-Couette flow between rotating cylinders and Rayleigh-Bénard convection. Finally, in chapter 8, the author indicates some open questions on shear-flow instability and transition to turbulence, together with some of his own thoughts on how these problems should be approached.

This research monograph summarizes and reviews the large body of work on wave interactions that has accumulated over 25 years of intensive study. No effort is made to present the material in a pedagogical way. Accordingly, this is definitely not an elementary textbook; it could serve as a reference for researchers working in the field of wave interactions or in an advanced graduate course. I enjoyed reading this book; the discussion of the topics that I am familiar with served as a refreshing, integrated review; the rest of the discussion outlines the important developments and gives enough references to get someone started who is seriously interested in exploring the subject in more detail.

T. R. AKYLAS
Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA 02139

Productivity in Plants

On the Economy of Plant Form and Function. THOMAS J. GIVNISH, Ed. Cambridge University Press, New York, 1986. xviii, 717 pp., illus. $84.50. From a symposium, Harvard Forest, Aug. 1983.

This volume is the proceedings of a symposium on "Evolutionary Constraints on Primary Productivity: Adaptive Patterns of Energy Capture in Plants." The 27 contributors have produced 20 chapters that consider how a wide range of plant traits influence whole-plant productivity and usually, by inference, competitive ability. The biological coverage is very broad, ranging from photosynthetic cyanobacteria to angiosperms and, occasionally, herbivores. Though the majority of the text is allocated to terrestrial vascular plants, three chapters consider aquatic photosynthetic organisms.

Most of the chapters utilize some form of model to conduct a cost-benefit analysis of the traits considered. As might be expected, these analyses vary greatly in form, ranging from anecdotal to formal mathematical models. Several papers include nitrogen as a currency in the cost-benefit analyses (Field and Mooney, Cowan, and Pate). These analyses suggest that in the future leaf nitrogen content should be more routinely quantified during gas exchange studies, particularly in the plants' native habitats. It is clear that in most plants that have been studied nitrogen is an important determinant of the biochemical contribution to photosynthetic capacity. In a chapter that should be required reading for enthusiasts of biotechnology, Pate lists the potential benefits of symbiotic nitrogen fixation. He then proceeds to show in how many ways the costs of the symbiosis can be disadvantageous to the host plant except under relatively special ecological circumstances.

For the past 30 years the energy balance approach has been used to integrate the various energy transfer processes to explain the relationships between leaf morphology and other properties, environment, leaf temperature, transpiration rate, and metabolism. This quantitative approach to analyzing the adaptive significance of habitat-related changes in leaf structural, diffusional, and optical properties provides excellent agreement (Ehleringer and Werk; Nobel) with direct observations of the characteristics of arid zone plants in their native habitats. However, adaptation to existence in the profound shade of humid tropical forests (Lee) provides many future research opportunities. Models are now being used to extend our understanding of the relationship of variations in anatomy (Parkhurst) to metabolism, as well as the relationship of leaf gas exchange properties to whole-plant patterns of energy allocation (Givnish).

Quantitative understanding of the functional significance of whole-plant root systems remains a challenge although new methods of study (Caldwell and Richards; Fiscus) are providing hypotheses. The present level of understanding suggests that the timing and spatial distribution of root growth are important determinants of nutrient and water uptake.

In an appropriately cautious chapter, Baas points out the difficulty of testing hypotheses of the adapative significance of various characteristics of xylem. He calls for a great increase in experimental approaches to xylem studies.

Analyses of canopy architectural properties and biomechanical properties continue to provide useful quantitative insights into the costs and benefits of particular canopy designs over a range of different environments (Raven, Fisher, and Givnish). These analyses have been extended to marine seaweeds (Koehl, Hay) and have illustrated how sometimes apparently subtle variations in morphology can have potentially large effects on productivity and susceptibility to damage. As is the case with terrestrial plants, the available field observations for seaweeds show that the distributions of types of morphology do appear to be correlated with habitat differences as predicted by theory.

In a thoughtful essay Schulze, Küppers, and Matyssek point out in several ways how misleading it can be to attempt to construct an adaptive argument that is based on optimizing carbon gain alone. They point out that many plants with low photosynthetic rates can be successful competitors. Their chapter clearly points the way for a new level of integration of energy balance, carbon balance, nutrient balance, and water balance in physiological studies.

The direct and indirect costs of chemical defenses suggest that in short-lived plants only small amounts of carbon can be allocated to defense compounds, otherwise the loss of productivity could be disadvantageous (Gulmon and Mooney). This offers another view of the differences in defense chemistry between short- and long-lived plants.

In many of the chapters the (usually limited) available field observations agree with the predictions of theory. However, the authors repeatedly emphasize the need for experimental studies in the plants' native habitats to extend our understanding and to test the hypotheses more rigorously. In this regard this volume is a rich source of ideas and opportunities for future work. Most potential readers will already be familiar with some of its content. It is a good synthesis, and many of the chapters are good points of departure for new research or for graduate seminar discussions.

JAMES A. TEERI
Biological Station, University of Michigan, Ann Arbor, MI 48109-1048

Books Received

Acoustic and Electromagnetic Waves. D. S. Jones. Clarendon (Oxford University Press), New York, 1986. xx, 745 pp., illus. $145.

AIDS. Facts and Issues. Victor Gong and Norman Rudnick, Eds. Rutgers University Press, New Brunswick, NJ, 1986. xx, 388 pp. $25; paper, $10.95.

Biomedical Engineering V. Recent Developments. Subrata Saha, Ed. Pergamon, New York, 1986. xviii, 536 pp., illus. Paper, $70. From a conference, Shreveport, LA, Oct. 1986.

Biomimetic and Bioorganic Chemistry III. F. Vögtle and E. Weber, Eds. Springer-Verlag, New York, 1986. x, 166 pp., illus. $61.60. Topics in Current Chemistry, 136.

Biophysical Effects of Steady Magnetic Fields. G. Maret, J. Kiepenheuer, and N. Boccara, Eds. Springer-Verlag, New York, 1986. xii, 231 pp., illus. $46.20. Springer Proceedings in Physics, 11. From a workshop, Les Houches, France, Feb. 1986.

Biopolymers/Non-Exclusion HPLC. J. D. Andrade *et al.* Springer-Verlag, New York, 1986. x, 232 pp., illus. $82. Advances in Polymer Science, 79.

Biotechnology and the Environment. Research Needs. Gilbert S. Omenn and Albert H. Teich, Eds. Noyes, Park Ridge, NJ, 1986. x, 169 pp., illus. $36. A