The life processes, which involve energy flow, are not only chemical reactions but also shifts in concentration gradient. The authors say: "The problems that face us now in biology are mainly those of the heterogeneous rather than the homogeneous system, and those who will contribute the most to their solution will combine an interest in physical flows and in the flows of chemical reactions. The rising concern that we conserve energy for our most basic and deeply felt needs requires that we know when we are conserving our potential for getting work done or effecting changes rather than in fact accelerating the increase of entropy. The biologist must of course understand energetics if his biological advice is to be valid." This learning program will contribute to that goal.

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Botany

THE LIVING PLANT, by Peter Martin Ray. 2nd ed., 1972. Holt, Rinehart & Winston, Inc., New York. 206 p. $3.50.

This edition should increase the book's usefulness for beginning students of biology. About 80 pages have been added, and much of this new material pertains to advances in photosynthesis, energy dynamics of leaves, and plant growth-regulation. Perhaps the most significant improvement is the increased emphasis on the relationship between the environment and the activities of plants; for example, photorespiration and C-4 photo synthesis, in addition to being concepts new to this book, are analyzed as adaptations to environmental conditions and stresses. The dynamics of gas exchange between plants and their environment is the theme of a new chapter on the functioning of leaves. Energy exchange and adaptation of leaves in different ecosystems are discussed.

The growth-regulation chapters are enhanced by creating an awareness for the reader of the importance of molecular-biologic principles to cell morphogenesis. The role of the environment in regulating the reproductive behavior of flowering plants is a new and needed addition to this book. Respiration is recognized by the author as an important plant activity, but meaningful discussion of it is given to other companion books in the Modern Biology Series.

The text is very readable, and each chapter ends with a revised list of suggested readings. Most illustrations are in two colors. The reproduction of electron micrographs is rather poor. The material is written to be understood by average students in an introductory course that enrolls biology majors and majors in allied sciences. This book should find its way into a course for nonmajors—particularly a course for those entering elementary education. Finally, the book may be helpful to high-school students of biology.

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BIOCHEMISTRY OF PHOTOSYNTHESIS, by R. P. F. Gregory. 1971. John Wiley & Sons, London. 214 p. $8.95.

The author has attempted to deal with the main biophysical and biochemical principles comprehensively and even comparatively (prokaryotic cells are discussed in several chapters) in a very few pages. This highly compressed treatment is difficult for the reader in matters he has not previously mastered. Electron transport is the topic dealt with most extensively (about one third of the book). Here the evidence (spectroscopic and other) favoring the familiar zig-zag, two-photosystem scheme is presented, as well as alternative schemes of electron transport. In dealing with photophosphorylation Gregory first presents the chemical intermediate and the chemiosmotic hypotheses, then examines the data in light of the two hypotheses. Other topics are of course included; among them are pathways of carbon metabolism (including the Hatch–Slack pathway and photorespiration) and a brief treatment of chloroplast structure, which benefits from 10 electronmicrograph plates.

The book has two parts. The first presents the modern overview of photosynthesis; the second is a more detailed and analytic examination, with many references to the original work. Between the two sections are 20 exercise problems; the answers to the nine numerical problems are given at the end of the book. There are numerous figures, several tables, and an extensive index.

I would recommend this book to students of biochemistry or physiology, but beginning students of general biology or botany would profit more from a book with a less comprehensive and abrupt treatment of the biochemical and biophysical aspects and dealing more with the ecologic and historical aspects of photosynthesis.

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LIGHTING FOR PLANT GROWTH, by Elwood Birkford and Stuart Dunn. 1972. Kent State University Press, Kent, Ohio. 230 p. $16.00.

Growing plants in artificial light is an interest shared by biology teachers, plant scientists, lighting engineers, and commercial growers. This comprehensive book introduces the physical, biologic, and practical aspects of the technique.

The initial chapters discuss the physics of light, photochemistry, electricity, light sources, and light measurement and control. These chapters are filled with clear definitions and conversion factors, spectral-energy distributions for various commercial lamps, and warnings about errors commonly found in the scientific literature.

The next section reviews the effects of light on photosynthesis, photomorphogenesis, and plant movements. The authors have not intended to analyze these subjects in exhaustive detail; rather, they introduce the reader to each subject through the discussion and the numerous references at the end of each chapter. The chapters are well illustrated with sample data as well as the interpretations. There is also a review of information on the growth of various plants under different light-sources.

The book concludes with chapters on the design of incubators, growth rooms, and greenhouses. To illustrate the completeness of this book: a chapter on growing plants indoors for home beautification describes such things as how to place lights in a bookcase, which species require different light-intensities (and how many fluorescent lamps are needed to produce each intensity), and what Kodak filter should be used to photograph plants growing under different commercial lamps.

A few points bothered me (for example, the random use of either millimicrons or nanometers to specify wavelength), but these are minor in relation to the overall completeness of the book. I highly recommend it for any person whose profession or pastime includes growing plants.

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Ecology

ENVIRONMENT: READINGS FOR TEACHERS, ed. by J. W. George Ivany. 1972. Addison-Wesley Publishing Co., Reading, Mass. 298 p. $3.50.

This book provides a comprehensive review of basic environmental problems. The lead article, by the editor, succinctly discusses the seriousness of the situation and the student disenchantment with science. Articles about different kinds of pollution provide good data for comparisons; for example, a critique of *Silent Spring* (1962) gives an excellent perspective and analysis of the many arguments presented by Rachel Carson that are still valid but also points out some of the weaknesses of her treatise.