agree with both the approach and the emphasis of this book.

In the introduction the authors state that animal behavior is an analysis of the potentialities of the nervous system and that to understand behavior we must look first to certain aspects of the nervous system. I feel these statements are unnecessarily restrictive, especially when interpreted as narrowly as these authors do. Six of the nine chapters focus primarily on phylogenetic differences in nervous-system morphology. The quality of these presentations is good, but the relationship of the morphology of the nervous system to behavior seems more remote than does the relationship of that morphology to evolution. The final three chapters of the book have to do with stereotyped behavior, learning and intelligence, and social behavior. These chapters are entirely behavioral in emphasis and approach and give some validity to the title of the volume. The section on instinct is a model of clarity in an outstanding chapter. The topic of social behavior is treated too briefly for my taste, but obviously many matters cannot receive the treatment they would receive in an expanded work.

The authors are always mindful of their audience. The book is psychologically and physically attractive. It has wide margins for note-making, and the margins carry a topical outline of the text. The illustrations are good; most are in two colors.

Animal Behavior has both good and not-so-good features. I doubt that most behaviorists would find it a satisfactory introductory text, because of the excessive emphasis on comparative anatomy of nervous systems and the scant attention given to the comparative behavioral functioning of those systems.

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Botany

CONTROL MECHANISMS IN PLANT DEVELOPMENT, by Arthur W. Galston and Peter J. Davies. 1970. Prentice-Hall Inc., Englewood Cliffs, N.J. 199 pp. $3.95 softback, $6.95 hardback.

Advanced students of plant physiology, molecular biology, and plant and animal development will find here an engaging analysis of several concepts and problems of plant morphogenesis. This work is concerned primarily with how a green plant controls its activities and attunes its development to nature's seasons. Focusing on stimuli that control the developmental cycle of higher plants and the mechanisms through which they probably act, the authors examine the phytochrome system and the action of several plant hormones and inhibitors. Applications to practical problems are suggested throughout. Excellent illustrations and a rich collection of references enhance the book's usefulness to biology teachers. Teachers who are enthusiastic about the process of science can use material from this book to illustrate what is accomplished by the combined efforts of chemists, physicists, and biologists. If this is typical of other titles in the "Foundations of Developmental Biology" series, secondary and college teachers of biology will find it worth their time to examine the companion volumes.

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THE BIOLOGY OF HIGHER CRYPTOGAMS, by William T. Doyle. 1970. Macmillan Co., New York. 163 pp. $4.95 (softback).

The higher cryptogams include the bryophytes, psilopsids, lycopsids, sphenopsids, and ferns. This assemblage of spore-producing plants is treated as a natural evolutionary group. In presenting the life cycle of the group, the author describes the general morphology and function of the essential plant structures, leaving the anomalies and accessories to the more detailed textbooks in plant morphology. Each chapter is a skillful amalgam of classical morphology and current research in experimental plant development, all presented with an evolutionary overtone. Basic unresolved morphologic problems are pointed out to the reader. Many references are made to investigations utilizing axenic cultures. The discussions of apogamy, apospory, spore development, and spores are outstanding. One chapter is devoted to the morphologic adaptations of the higher cryptogams to their predominantly terrestrial existence. A useful summary of each higher cryptogam group provides a brief account of fossil forms; major characteristics, including those with particular evolutionary significance; and some little-known but interesting details about the group. The final chapter is a progress report on current topics relating to plant development—especially to the role environmental factors play in regulating the expression of genetic potential during development. Special topics include sex determination and sex expression; regulation of embryo development; bud initiation in mosses; regulation of sporangium induction; and spore germination.

This book is highly recommended for students of plant morphology and development. Developmental biologists who are not familiar with the research potential of some of the higher cryptogam systems should find the book informative and thought-provoking.

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SEAWEEDS AND THEIR USES, by V. J. Chapman. 2nd ed., 1970. Barnes & Noble, Inc., New York. 304 pp. $14.50.

This is the most recent, comprehensive, and up-to-date volume on the subject. Written by a well-known algologist, it deserves the attention of botanists, marine biologists, and persons interested in the living resources of the seas.

The first of 10 chapters is a general review of the occurrence and distribution of seaweeds of economic importance. (More detailed information on various groups and species of algae is scattered throughout the text.) Special attention is given to the early kelp industry, to iodine and potash production, and to algae as food for man and domestic animals. The tables of chemical analyses are of great value. Uses of algae as manures and fertilizers are discussed at some length. (The work of W. A. Stephenson—see the review of his *Seaweed in Agriculture and Horticulture, in Choice,* 6 [4]: 535—is an important and exciting supplement to Chapman's treatment.)

A whole chapter is devoted to laver and Irish moss; another, to agar-agar. Here again are useful tables on production and physical and chemical composition. The occurrence of algae from which algin and alginates are derived, together with data on occurrence, properties, and uses, is reviewed at length. Industrial, medical, and miscellaneous uses are covered in considerable detail. The world's supplies and potential supplies are estimated and the techniques used in making surveys are described.

The book has 66 tables and 56 figures, a 30-page bibliography listing about 1,200 papers, a five-page author and person index, a five-page plant index listing more than 150 genera, and a seven-page subject index.

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AN INTRODUCTION TO PLANT BIOLOGY, by Ross H. Arnett and Dale C. Braungart. 3rd ed., 1970. C. V. Mosby Co., St. Louis. 492 pp. $9.75.

This textbook is designed for a beginning college botany course but should prove useful as a reference book for high school teachers as well. According to the preface "complete rewriting" was deemed necessary because of the wealth of information available since 1965, when the second edition appeared. It is true that the organization of the material has been considerably revised, but it is disturbing to see passages lifted verbatim from previous editions and simply inserted under new headings, where their relevancy is questionable. For example, in the chapter entitled "Adaptive Structures

in Plants" we find the traditional discourse on leaf morphology (venation patterns, patterns of blade dissection, variability of leaf margins), floral structure, and types of inflorescences and fruits—but there is no indication of their adaptive value, if any, to the plant.

The text is divided into six major parts: organization of data, chemicals and cells, function and environment, reproduction and development, adaptation and evolution, and diversity. Each part contains several chapters, most of which have excellent photographs, drawings, and flow sheets. Several chapters contain "study boxes," each of which itemizes the important concepts of a particular portion of the chapter. These study boxes appear frequently in early chapters, occasionally in following chapters, and not at all in the last 13 chapters—which makes one wonder about their value to students. New terms are introduced in boldface type, are summarized at the end of each chapter, and are defined in a glossary at the end of the book.

Most of the chapters contain information that can be found in any up-to-date but traditional botany textbook. There are a couple of refreshing exceptions, however. Chapter 1 deals primarily with the processes of data-gathering, organization, and retrieval: it introduces the computer as a basic tool of data-processing. Chapter 4 is devoted exclusively to the economic aspects of plants, a topic frequently glossed over in other general textbooks. A distinctive feature (retained from the first edition) is the chapter devoted to representative life cycles from most of the 33 listed plant divisions. This chapter is printed on colored paper: it stands out for quick reference. Unfortunately the choice of representative organisms occasionally leaves something to be desired; for example, *Vaucheria* for Chrysophyta and *Selaginella* for Microphyllophyta.

Chapter 3 is likely to cause many a botanist to squirm: though entitled "Modern Botanical Sciences" it is devoted almost exclusively to taxonomy, even to the point of describing in detail the preparation of an herbarium specimen. And paleobotanists will be surprised to learn that woody psilophytes were well established and widely distributed during the Silurian.

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BOTANY: AN INTRODUCTION TO PLANT BIOLOGY, by T. Elliot Weier, C. Ralph Stocking, and Michael G. Barbour. 4th ed., 1970. John Wiley & Sons, New York. 717 pp. $12.50.

Like its earlier editions, this book gives a good, accurate overview of plant biology. It is divided into 30 chapters. An introductory chapter is followed by one on classification and relationships of plants. The next 14 chapters are devoted to the structure, function, nutrition, and development of the seed plant. Although one might expect the roles that hormones play in development to be included in this segment, this is postponed until chapter 20. The subject matter is handled in a traditional fashion, but every attempt has been made to reflect the latest available information.

Most of the second half of the book is a survey of the plant kingdom. It also includes chapters on inheritance, ecology, taxonomy, and evolution.

14 full-color plates, containing numerous photographs, most of which are outstanding, give the book a special appeal. Numerous excellent line drawings, shaded in greens and grays, are distributed throughout the book. There are also many black-and-white photographs; these are generally good, but they suffer somewhat from the grade of paper on which they are printed. On the whole, the book is profusely illustrated, and this is one of its strongest features.

While this work undoubtedly will have wide appeal, its rather slow-moving, traditional format and style are likely to have an adverse effect on some, especially among the younger set. Yet those who teach plant biology will surely find it to be one of the most authoritative and thorough works of its kind.

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Cell Biology

CELL FUSION, by Henry Harris. 1970. Harvard University Press, Cambridge, Mass. 108 pp. $6.00.

Henry Harris, professor of pathology at the Oxford University, gave the Dunham lectures at Harvard in 1969. They make a most remarkable book.

In 1965, Harris and J. F. Watkins reported that an inactivated virus inoculated into a culture of cells from different animal species caused fusion of the cells and that the multinucleated or multichromosomal hybrids were viable. (This remarkable discovery was heralded in the London press but did not have much impact on American biologists.) Subsequent evidence from other workers supports the view that the fusion is an energy-consuming reaction requiring calcium ions; that it is inhibited by the same conditions that interfere with oxidative phosphorylation in the normal cell; and that the more irregular is the normal-cell surface, the more likely is the possibility of fusion.

The book contains magnificent photographs of fused cells, showing distinctly different nuclei from different species within the same live cell. Beautiful autoradiographs show interspecific heterokaryons of known composition. Binucleate heterokaryons can go through mitosis and give rise to mononucleate daughter cells; these, Harris asserts, "contain within a single nucleus the chromosomes of both parent cells." A new term is introduced: synkaryon, meaning a hybrid monocleate daughter cell. "Over a wide range, species differences in the parent cells do not appear to affect the ability of synkaryons to multiply," Harris says. Parental properties that determine the occasional incompatibility in the hybrid cell are at present unknown. It appears, however, that within the cells of vertebrates there are no mechanisms for recognizing and expressing cytoplasmic or nuclear incompatibility similar to the mechanisms responsible for the recognition of and reaction to tissue or organ grafts, as in the antigen–antibody reaction between individuals.

The techniques and principles discussed in the book will undoubtedly lead to further breakthroughs in our understanding of the modes of expression of genetic information. It is "must" reading for every first-rate biologist or biology teacher.

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Environmental Education

THE INVISIBLE PYRAMID, by Loren Eiseley. 1970. Charles Scribner's Sons, New York. 173 pp. $6.95.

Today the environmental book shelves are cluttered with the rantings of polemicists. Half-truths and conjecture are written as fact. Opportunists exploit ecology as despoilers have exploited the environment. Impractical solutions to real problems and impractical problems for which there are no solutions are to be found in the plethora of volumes currently available. Thus, it is refreshing to find an intelligent book written by an intelligent man concerning space-age man and nature.

This is a beautiful book—both beautifully written and beautifully executed; a treat for the eye, the mind, and the soul. The title is derived from the fact that Eiseley views the building of the great pyramid at Giza, almost 5,000 years ago, as requiring great public sacrifice. He extrapolates that modern science is involved in the construction of a similar "invisible" pyramid that demands great sacrifice and persistence of purpose across the generations.

As an historian of science, Eiseley is conscious of the past and our current