

FRANCE, J., THORNLEY, J.H.M.: *MATHEMATICAL MODELS IN AGRICULTURE. A QUANTITATIVE APPROACH TO PROBLEMS IN AGRICULTURE AND RELATED SCIENCES.* — Butterworths, London — Boston — Durban — Singapore — Sydney — Toronto — Wellington 1984. 333 pp., hardcover £ 35.00.

Rapid evolution of agriculture and related scientific disciplines needs quantitative methods of experimentation, experiment evaluations, description of experimental results and comparison of them with current ideas and theories. The most appropriate tool — mathematics provides the only way of doing this. The authors of the book reviewed make it their goal to fill up an area where the universities have not so far been notably successful, and teach agricultural scientists when and how to attempt to express their ideas mathematically, how to solve the resulting mathematical model and compare its prediction with experimental data.

The text is divided into thirteen chapters, the first five, dealing with the matter in general, should be read before any of subsequent material will be tackled. The introductory chapter acquaints readers with the subject *i.e.* clears up what is a mathematical model, analyses the role of models in agriculture and agricultural research, explains term and system hierarchy, points out the differences between models for research and models for management and types of empirical, mechanistic, static, dynamic, deterministic and stochastic models, and summarizes the contribution of models to research and management. The second chapter deals with the technique of dynamic deterministic modelling, quantities in dynamic models which change with time and can be considered under four categories: state variables, rate variables, parameters and constants, differential equations, methods of numerical integration, Stiff equations, choosing of an integration method, six fitting procedures, and brings also a programmed example. The third chapter devoted to the technique of mathematical programming discusses mathematical formulation and graphical or computer solution, both illustrated by examples, is complemented by linear programming (matrix generators and report writers, parametric, integer, separable and dynamic programming) which have found application in agriculture. Testing and evaluation of models are treated in the fourth chapter, the shortest one of the book. Growth equations (simple exponential growth with an abrupt cut-off, the monomolecular equation, the logistic growth equation, the Gompertz growth equation, the Richards growth equation, the Chanter growth equation and exponential polynomials), allometry and growth functions in animal and plant modelling are subjects of chapter five. Chapter six concerns the expression of an approximate description of the average weather and its individual factors at the site in question. Chapters seven and eight discuss plant and crop processes, responses and models. In special subchapters light interception photosynthesis, respiration, partitioning of dry matter and its components, nutrient uptake, water use and uptake, fertilizer response, development as a function of heat-sums or the day-degree rule, day length and other environmental factors, vernalization and temperature dependence, response of crop yield to planting density, empirical and mechanistic models of crop growth are dealt with. In chapter nine some application of mathematics to plant diseases, pests, predators and parasites problems are discussed. The next two chapters on animal processes and products and succeeded by two on farm planning and control are out of scope of this journal and its readers.

All chapters are complemented with exercises, solutions of which are at the end of the volume, as well as references to individual subchapters. For most of the book a quite modest knowledge of algebra, calculus and ordinary differential equations should suffice; where more advanced techniques are employed an introductory account is given directly in the text and/or a useful Glossary at the end of the book will help the reader to acquire or refresh necessary knowledge. However, a certain level of previous mathematical education is assumed. The book is complemented with a rather short index (only four and half pages).

The book is highly recommended not only to the advanced undergraduates and to graduate students of Agriculture Faculties but also to research workers interested in agriculture and related sciences and mathematicians who intend to work in this field.

JARMILA SOLÁROVÁ (*Praha*)

JEAN, R. V.: CROISSANCE VÉGÉTALE ET MORPHOGÉNÈSE. — Masson, Paris, and Presses de l'Université de Québec 1983. 352 pp. US \$ 17.95.

Despite its broad title, the only subject of the book is phyllotaxis (almost exclusively of alternating primordia), a problem challenging every mathematical biologist. The first three chapters, forming the main part of the book, present a detailed treatment and description of phyllotactic patterns. After defining and discussing elementary concepts in phyllotaxis (Chapter 1), two alternative representations of phyllotactic patterns are described: cylindric (Chapter 2) and polar (Chapter 3). I personally find these chapters most satisfying. The matter is dealt with in an elegant way, though it is sometimes not easily readable for a biologist, and relies on the vast literature on the subject (Church, Snow, Richards, among other authors). It is almost exclusively an analysis of relations in an idealized geometrical representation of plants surprisingly bearing little relation to real world plants.

Chapter 4 (diffusion equations) and Chapter 5 (mathematical models of phyllotaxis) explore possible mechanistic explanations of phyllotaxis. Several published models are described, e.g. those based on available space (Adler), morphogen transport (Thornley, Veen and Lindenmayer, Young), and an interesting, though not directly explanative parallel between phyllotaxis and ramification (Jean). Such models are mostly designed to produce patterns of phyllotaxis observed in plants; however inspirational they may be, the testing of their premises remains an open question, thus making their link to plant physiology and biochemistry rather weak and lowering their heuristic value. Exercises, Prospects for future research, and an extensive Bibliography close the book.

It is an elegant and inspirational book; however, the handling of problems and even explicit suggestions for further research are suited more for a mathematician than for a plant physiologist. The book is not a simple reading for a biologist without mathematical training; at least partial knowledge of calculus, number theory and trigonometry is a necessary prerequisite for reading. But not only the intricacies of the mathematical apparatus may prevent the book from gaining wider acceptance; the phyllotaxis research presented here became a rather closed world of its own.

T. HERBEN (*Praha*)

SHROPSHIRE, W. JR., MOHR, H. (ed.): PHOTOMORPHOGENESIS. ENCYCLOPEDIA OF PLANT PHYSIOLOGY, New Series, Vol. 16A + B. — Springer Verlag, Berlin—Heidelberg—New York—Tokyo, 1983. 832 pp. Cloth DM 338,— ; approx. US \$ 139.60.

Phytochrome was recognized as a photoreceptor in 1949. It was the first protein having a regulatory function in plants other than enzymatic. The discovery of phytochrome incited the physicists, physical chemists, spectroscopists, biochemists and plant physiologists to study the influence of light on plant growth and development and to pay attention also to other photoreceptors. The knowledge of the events controlled by light in plants and microorganisms increased significantly during last decades. This is the reason why one volume of the Encyclopedia is devoted to photomorphogenesis. In the previous edition of the Encyclopedia (ed. by W. Ruhland 1955) data on photomorphogenesis are also included but they are scattered in many volumes.

This volume edited by W. Shropshire Jr. and M. Mohr is written by 42 contributors, experts in different fields of photomorphogenesis. Each individual chapter is more or less independent and the fact that the contents of some chapters overlap is to be appreciated as an advantage.

Several chapters deal only with phytochrome — its structure, extraction and purification (chapter 6 — W. O. Smith), rapid action (chapter 9 — P. H. Quail), mode of action (chapter 2 — S. B. Hendricks and Van Der Woude), and its role in light-grown plants (chapter 27 — M. Jabben and M. G. Holmes). Most chapters respect the complexity of photomorphogenetic reactions and deal also with other photoreceptors (cryptochrome, mycochrome, phycomycochrome and adaptachromes, e.g. chapter 7 — W. Rüdiger and H. Steer, chapter 28 — E. Schäffer and W. Haupt). Attention is directed not only to major aspects of photomorphogenesis in higher plants — control of germination (chapter 16 — J. A. De Greef and H. Frédéricq, chapter 17 — B. Frankland and R. Taylorson), influence of light on flowering (chapter 18 — D. Vince-Prue, chapter 20 — D. Vince-Prue and A. E. Canham), prevention of etiolation (chapter 12 — H. I. Virgin and H. Egnéus, chapter 13 — S. D. Schwartzbach and J. A. Schiff, chapter 25 — H. Kasemir), and the function of phytochrome in nature (chapter 17 — H. Smith and D. C. Morgan), but also to photocontrol of fungal development (chapter 23 — J. Gressel and W. Rau), photomorphogenesis of marine algae (chapter 21 — M. J. Dring and K. Lüning) and ferns (chapter 22 —

M. Furuya). The effects of UV radiation in photomorphogenesis are also included (chapter 29 — E. Wellmann).

This volume of the Encyclopedia is the best reading for everybody interested in photomorphogenesis.

LIBUŠE PAVLOVÁ (*Praha*)

McIVOR, J. G., BRAY, R. A. (ed.): GENETIC RESOURCES OF FORAGE PLANTS. — CSIRO, Melbourne 1983, 337 pp. US \$ 30.00.

As agriculture in northern Australia is based predominantly on animal production, there is a growing interest in the improvement of grazing lands. For this reason the Division of Tropical Crops and Pastures of Commonwealth Scientific and Industrial Research Organization organizes symposia with the purpose to bring together scientists from Australia and New Zealand and leading scientists from other countries to review knowledge of different aspects of this subject. The first symposium in 1976 dealt with competitive relations between plants in pastures (Wilson, J. R. [ed.]: *Plant Relations in Pastures*. CSIRO, Melbourne 1978 — see *Biol. Plant.* 22 : 240, 1980). The book here reviewed is based on the second symposium and summarizes current scientific knowledge of major aspects of the genetic resources of pasture grasses and legumes, but does not consider the very important forage plants that are cut before being fed to animals. The matter is divided into eight parts, the first of which — The Problems — contains one chapter on the collection and improvement of forage plants. The next part — The Resources — deals in four chapters with tropical and mediterranean legumes and grasses that would deserve to be considered for their forage potential. In the third part — Adaptation — knowledge of adaptation to environmental stresses and grazing is reviewed by F. L. Milthorpe, K. C. Hodgkinson, O. B. Williams, R. J. Clements, M. D. Hayward and D. E. Byth. The next three parts are appropriately named — Collection — Evaluation — and Breeding. In the last but one part — Analysis and Storage of Data — practical problems how to handle the mass of information about large collections of plant material by means of microcomputers and computers, and how to apply the pattern analysis to agricultural problems are treated. In the final part — The Future — A. H. Bunting overviews the main themes of the symposium, and adds some experience from his very wide knowledge of international cooperation in plant genetic resources. List of delegates to the symposium and subject index, including also plant species, close this very useful book on the neglected branch of agriculture.

JARMILA SOLÁŘOVÁ (*Praha*)

RODRICKS, J. V., TARDIFF, R. G. (ed.): ASSESSMENT AND MANAGEMENT OF CHEMICAL RISKS. — American Chemical Society, Washington D.C. 1984. 184 pp. US and Canada US \$ 34.95, export US \$ 41.95.

The objective of the 239th Volume in the ACS Symposium Series is to devise ways to protect humans from hazardous effects of environmental chemical pollutants that may produce genetic diseases, birth defects, cancer and aging. The publication is based on a Symposium that took place at the 184th meeting of the American Chemical Society, Kansas City, Missouri, 1982. It is divided into two main parts. The first part containing 6 chapters, deals with some of the central problems of risk assessment. New genotoxic tests are now available aimed at securing the needed information in a shorter time and less expensively. However, the basic problem remains: the uncertainties in transferring data from the test species to man. The topics covered include traditional and new concepts of safety assessment schemes, the use of toxicity test data in the estimation of risks to human health, interspecies extrapolation, basic concepts of the dose-response relationship and dose extrapolations. Government regulation to protect the public health and safety is not a recent phenomenon; regulations of *e.g.* food have been found in all recorded civilizations. As public concern about genotoxic risks rises, more and more stringent statutory controls are gradually imposed. The second part of the publication deals in 5 chapters with the management of chemical risks. The topics of interest include the use of safety/risk assessment in regulatory decisions, inter-risk comparisons, construction of a hazard index for chemicals (pesticides, dyes, pigments *etc.*), further uncertainty and quantitative assessment in risk management, procedures for evaluating the safety of food components *etc.*

The important recent developments in the field of chemical risk assessment will make this book essential reading to all engaged in public health and environmental decision making.

KATEŘINA PÁNKOVÁ (*Praha*)

LINSKENS, H. F., HESLOP-HARRISON, J. (ed.): *CELLULAR INTERACTIONS*. — PIRSON, A., ZIMMERMANN, M. H. (ed.): *Encyclopedia of Plant Physiology, New Series, Volume 17*. Springer-Verlag, Berlin—Heidelberg—New York—Tokyo 1984. 743 pp., 198 figs., cloth DM 360.—.

Specific interactions between cells being involved in many fundamental biological phenomena, have been attracting the attention of increasing numbers of researchers over the past two decades. This interest produced a large body of data, particularly in the area of sexual processes. The unifying aspect of various types and functions of cellular interactions considered in this book, consists in the property of cells to communicate by intermediary of the cell surface with their immediate environment. Such interactions occur between cells and tissues of different species (symbiosis, epiphytism, parasitism, *etc.*), between those of different, physiologically independent systems of the same species (*e.g.* most processes of sexual reproduction) and within the plant body, between cells which are, at least initially, genetically identical (short-range communications of high specificity involved in development and differentiation). The present volume organized in 28 self-contained chapters written by 33 experts represents a broad conspectus on various particular types of interactions of all these principal categories. It covers: Interactions of autotrophic eucaryotic fresh water and marine symbionts, lichen symbiosis and other endosymbiotic associations of cyanobacteria in multicellular and unicellular hosts, epiphytism with special reference to algal epiphytes, various aspects of recognition between higher plants and fungal pathogens, mycorrhizal associations, plant-bacterial interactions, mating systems in unicellular algae, cellular interactions during the life cycle of slime moulds, sexual interactions in fungi, pollen-pistil interactions and sexual incompatibility and incongruity in higher plants, cellular recognition systems in grafting, practical aspects of fusion of somatic cells, colony formation in algae, cellular polarity and its morphogenetic importance, and cellular interactions during early differentiation. In addition, general considerations on the topic and on evolutionary aspects of the eucaryotic cell and a survey of allergic interactions between plants and humans are included.

The book, the most comprehensive in the field of cellular interactions in plants, provides a broad spectrum of highly stimulating and instructive information of particular importance for many areas of research in experimental botany.

J. TUPÝ (*Praha*)

RICKWOOD, D. (ed.): *IODINATED DENSITY GRADIENT MEDIA: A PRACTICAL APPROACH*. — IRL Press Limited, Oxford — Washington DC 1983. 240 pp. £ 8.50.

The volume was published in the Practical Approaches in Biochemistry Series, known as modestly-priced practical guide books of exceptional usefulness for laboratory work in biochemistry, cell biology, molecular biology and associated fields. It covers all the main techniques that have been developed for biological separations in density gradients of iodinated compounds such as metrizamide and Nycodenz. These nonionic gradients have proved to be especially useful for separations of nucleoproteins, membranes and subcellular organelles and also as an efficient approach to analysis of macromolecules, cell fractionation and isolation of viruses. Written by 15 specialists in particular techniques, the book also contains a significant amount of new data not published elsewhere. As in the previous volumes, the description of the methods is accompanied by well-arranged detailed experimental protocols. Two appendix sections provide practical descriptions of assay procedures compatible with iodinated density gradient media for estimation of marker enzymes and compounds fractionated, and a bibliography of key references. This unique text will provide an invaluable aid especially to research workers in biology interested in density-gradient separations.

J. TUPÝ (*Praha*)