

In triticales, usually the lagging chromosomes were not included in the nuclei after meiosis, but appeared as micronuclei in the quartet of spores. No micronuclei were observed in wheat or rye. According to PANDITA and KHOSHOO (1984), micronuclei formed at telophase and interphase might have been formed either by the fragments or laggards of the previous mitotic cycle or by extrusion of the chromatin material.

Decrease in pollen fertility could be due to abnormal divisions in the pollen mother cells. In our study, pollen sterility was directly correlated with an increase in meiotic abnormalities. TSUCHIYA and LARTER (1969) suggested that chromosome studies should be included in the breeding procedure in triticales and, most likely, also all other synthetic amphiploids which are cytologically unstable.

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BOOK REVIEW

TREES. STRUCTURE AND FUNCTION. Volume 1. — Springer Verlag, Berlin—Heidelberg 1986.

This journal started to be published by the Springer-Verlag in 1986. Each volume will have four issues per year. The reader will find original articles on physiology, biochemistry, functional anatomy, structure and ecology of trees and other woody plants, and also reviews on selected topics. Members of the editorial board are J. D. Aber, Madison; D. Binkley, Durham; W. Eschrich, Göttingen; K. Furukawa, Yatabe Tokukuba; F. Hallé, Montpellier; H. G. Jones, Maidstone; J. J. Landsberg, Queen Victoria Terrace; O. L. Lange, Würzburg; S. Linder, Uppsala; E.-D. Schulze, Bayreuth; H. Turner, Birmensdorf and R. H. Waring, Corvallis, and H. Ziegler, München as managing editor. Annual subscription rate is 248.00 DM plus carriage charges.

The journal will be of particular interest to botanists and ecologists but also to all those working in forestry, horticulture and landscape research.

INGRID TICHÁ (*Praha*)

STAEHELIN, L. A., ARNTZEN, C. J. (ed.): PHOTOSYNTHESIS III. PHOTOSYNTHETIC MEMBRANES AND LIGHT HARVESTING SYSTEMS. — In: Pirson, A., Zimmermann, M. H. (ed): *Encyclopedia of Plant Physiology* — New Series, Vol. 19. — Springer Verlag, Berlin — Heidelberg — New York — Toronto 1986. 802 pp. DM 498.

With the tremendous rate of progress in modern science up-to-date handbooks become a sort of problem. It is little encouraging and most unrewarding to write a chapter for such a handbook since this means to strive for capturing the elusive reality and for providing a meaningful record of facts that the author will see in a quite different light at the moment when the book will appear. The position of the editor is still much worse since he needs a good deal of foresight in order to solve the problem what to put in and what to leave out correctly. And yet, the handbooks are badly needed: just because of the horrible speed of progress for education of students and because of the overspecialization of modern science for proper orientation of scientists working "in the next door".

For all these and many other reasons Andrew Staehelin and Charles Arntzen have to be congratulated on successfully completing the present volume which rounds off photosynthesis treatment in the New Series of *Encyclopedia of Plant Physiology*. They are also to be praised for orienting the book on those areas that have seen major advances in recent years; for emphasizing the modern trend towards increased interaction of biochemical and biophysical approaches and towards the appreciation of structural parameters in elucidating various functions at the molecular level; and, finally, for the original conception of the formal arrangement of the handbook. The latter is namely divided into two complementary parts. In the first one five extensive chapters summarize the main broad topic areas of the volume. In the second 43 minireviews written by most competent specialists provide a more detailed analysis of the last development in specific limited areas. The editors succeeded in perfectly integrating the introductory chapters with the minireviews by extensive cross-referencing. And, along with the authors, they were successful in achieving one of their most creditable goals: to demonstrate the progress that occurs towards a molecular understanding of the diverse biochemical and biophysical processes in photosynthetic membranes.

The first part of the book is introduced by Staehelin's excellent treatise on chloroplast structure and supramolecular organization of photosynthetic membranes. The nearly hundred pages of this review should be ranked among "the set texts" for those researchers dealing with the biochemical and biophysical aspects of the thylakoid function. They provide an overview of the structural diversity of photosynthetic membrane systems, emphasizing the unifying construction principles and pointing out how architectural parameters help to define the functional ones. How this can be done is also nicely demonstrated in the following chapter in which Sauer deals with the physical aspects of photosynthetic light reactions: light capture, excitation transfer and charge separation in the reaction center. Even when cursorily skimming through this chapter the reader will learn from the pictures how tightly linked becomes at present the solution of these questions to structural considerations. Biochemical characterization of the pigment-proteins forming photosystems and the latest news on their structure are the topics of Chapter 3 written by Thornber. This chapter is remarkable by the complete coverage of pigment-protein complexes of higher plants, algae, cyanobacteria and photosynthetic bacteria and the attempt towards a unified terminology and "taxonomy" of the pigment-proteins, which have been a domain of much confusion. In line with the general objective of the book the next two chapters attempt to bring together current information about the organization of membrane proteins and about the molecular processes carried on by the various proteins. The reader keeps to realize that further progress in our understanding of photosynthesis is likely to be limited just by the capability of its students to combine these two aspects. Thus, chapters 4 and 5 represent an excellent and concise treatment on energy transduction in photosynthesis whose value is still increased by the many references directing readers to successive chapters dealing with individual topics in more detail. The topic is divided into two parts: In chapter 4 Ort deals with membranes of oxygenic photosynthesis while Dutton in chapter 5 concentrates on membranes of photosynthetic bacteria. As Ort points out, this separation is logical and much simplifies the discussion of each. Both authors, however, are well aware of the fact that the similarities far exceed the differences and they pay due attention to the many parallels that exist on levels both of structure and function.

The first group of the minireviews constitutes Chapter 6 of the book and deals with comparative biochemistry of light harvesting systems. Within this frame Zuber reviews existing information on the primary structure of phycobiliproteins and of the light harvesting pigment-protein complexes in purple photosynthetic bacteria. The latter are also the subject of the next review by Cogdell who concentrates more on their pigment content and spectra while Zuber's primary interest is protein structure homologies and their functional implications. The archi-

ture of phycobilisomes and their association with Photosystem II of cyanobacteria is analyzed by Gantt. Anderson and Barrett inform on the diverse ways used by various algal phyla to solve the problem of light harvesting. A detailed account of the most popular LHCa/bP of higher plants is missing in this chapter but the reader can find sufficient information on this complex, along with other LHCs, in Chapter 3.

Chapter 7 consists of minireviews which concentrate on the function of light-harvesting pigment beds. It starts with Knox's presentation of the theory of excitation delocalization and trapping and a description of the procedures available for modeling various types of excitation flow. The hot topic of fluorescence decay kinetics is taken up by Holzwarth. He nicely shows how recent advances in the field are intimately related to the progress in techniques for recording fluorescence decay in the subnanosecond and picosecond time range, which are: streak cameras, phase-shift techniques and single photon timing. The potential of the exciton annihilation methods for assessing the topological and size characteristics of various domains in the antenna pigment systems is evaluated by Geacintov and Breton. In the next section of Chapter 7 Breton deals with the precise orientation of the pigment molecules in the photosynthetic membrane and with the implications of this orientation for efficient excitation energy transfer and trapping. Scheer shows how the high efficiency of excitation energy transfer in phycobilisomes is determined by the highly ingenious structural arrangement of individual links in the energy transfer chain.

Within the last decade a tremendous progress was made particularly as to the understanding of structure-function relationships in the reaction centers *i.e.* of the strategy developed for efficient primary charge separation and their subsequent stabilization. These advances are reported in Chapters 8 and 9. The former is based mainly on the facts concerning the reaction centers of photosynthetic bacteria, the structure of which has recently become resolved with unprecedented precision. In the first section of this chapter Parson and Holten review energy and kinetic aspects of the short lived transient states. They use this term for the train of events starting with the excitation of the photochemically active BChl complex P and terminating with the formation of the first stable configuration of separated charges, *i.e.* $P^+Q_A^-$ (approximately the first 200 ps). Mutual orientation of the redox centers, their location in the membrane profile, the role of proteins in setting these structural preconditions for efficient function of the reaction centers and of the cytochrome *b/c*₁ complex — these are the topics analyzed by Tiede. Norris and Van Brakel show what the diverse magnetic resonance techniques offer for investigation of the structural and mechanistic properties of reaction centers. The bacterial photosystem with blocked secondary (Q_A) and tertiary (Q_B) electron transfer chemistry is introduced as a useful model system. Hoff in his exhaustive review emphasizes the advantages characteristic of the magnetic resonance methods using optical detection and describes their application to the detection of chlorophyll triplet states in the bacterial reaction centers. The triplets can be extremely useful as probes of local structure. Michel and Deisenhofer present the results of their classical study of reaction center structure in *Rhodospseudomonas viridis* by X-ray diffraction analysis at high resolution. These results provided an unusually strong stimulus to the present hectic research activity bringing fast progress in our knowledge of the bacterial reaction center. At the same time, Michel and Deisenhofer also incite meaningful speculations on the structure of the reaction center in Photosystem II. Such relationship is also considered in the subsequent review by Hearst who provides information complementing in some respect the paper of the Martinsried group. It brings data on the primary structure of reaction center polypeptides in *Rhodospseudomonas capsulata*. It further points to the homologies between L and M subunits of the bacterial reaction center and the D₁ and D₂ proteins in the core of Photosystem II. Blankenship and Fuller describe the curious properties of the photosynthetic apparatus in *Chloroflexus aurantiacus*. This bacterium combines a chlorosome structure similar in many ways to that found in *Chlorobiaceae* with a reaction center which is very different from that encountered in green sulphur bacteria. They point out that for these and other reasons (the 16 s RNA ranks with that of the most primitive true bacteria) *Chloroflexus* is extremely important to unravelling the evolution of photosynthesis.

In chapter 9 the focus shifts from the bacterial systems to the comparatively much less understood photosystems I and II of oxygenic photosynthesis and their reaction centers. The various aspects of Photosystem II reaction center which are the subject of the most active research at the present time are overviewed in a condensed form by Diner. Two minireviews deal with the oxygen evolving complex: Yocum presents the analysis of the components of the S-state system and considers factors influencing the sequential oxidation of H₂O. Andersson concentrates on the identification of proteins associated with the water oxidation side of photosystem II, both intrinsic and extrinsic. He emphasizes the role that inside thylakoid vesicles and highly active photosystem II particles have had for the progress made in this field. Polypeptide subunits and functional cofactors of the Photosystem II core complex and reaction centre

are discussed by Arntzen and Pakrasi. Overlooking all the firm experimental evidence available at the time of writing the review, they conclude that the idea of the Q_B and D2 proteins constituting the reaction center complex of PS II is still at the level of speculations. The most often encountered form of photoinhibition is based on photoinactivation of photochemistry in PS II; phenomenology of this damage and the conditions for its repair can tell much important for better understanding of PS II function. These topics are reviewed by Kyle and Ohad. Photosystem I is again treated from the two viewing angles that characterize the two fields of the most active research at the present time: Basic functional and structural properties and the controversial chemical nature of PS I primary donor P700 as well as the intricate assemblage of terminal, primary and "more primary" PS I electron acceptors are analyzed by Setif and Mathis. Wollman, on the other hand, deals with PS I proteins, i.e. with the constituents and architecture of RCI and LHCI, as well as with the sites of synthesis and mode of assembly of their subunits.

The components of the photosynthetic membrane involved in secondary electron and proton transport and their coupling to ATP synthesis as well as the mechanisms of all these processes are the topics of Chapter 10. In view of its central role in the secondary electron transport it is quite natural that the cytochrome *b/c*₁ or *b*₆/*f* complex is a subject of three minireviews. Hauska points out the ubiquitous occurrence and universal function of cytochrome *bc* complexes and concentrates on their composition both as to redox components and polypeptides. Joliet and Joliet on one hand and Prince on the other deal with the functional aspects of cytochrome *b*₆/*f* complex in oxygenic and cytochrome *b/c*₁ complex in anoxygenic photosynthesis, respectively. In both reviews the pathways of electron flow within the complex are considered as well as stoichiometry of electron and proton movement. It is shown that conclusive evidence in favour of any one of the functional models so far proposed is still to be awaited. In view of the rapidly increasing evidence of the spatial separation of PS I and PS II in the photochemical apparatus of higher plant chloroplasts, the problem of mobile electron carriers capable of fast electron transport mediation over comparatively long distances becomes highly relevant. It has been taken up in depth by Whitmarsh who produced a really exhaustive overview of both hard facts and speculations related to this theme. Haehnel has restricted his review to plastocyanin and on the diverse aspects of its synthesis and structure-function elaborates relationships, such as the importance of localized surface charges for the rate of electron transfer to and from the plastocyanin molecule. In the second half of Chapter 10 Melandri and Venturoli present new evidence concerning energy coupling in photosynthetic membranes. In particular, they treat such problems as localized and delocalized coupling and transient coupling phenomena. Dille discusses the interaction of protons with the membrane material (such as the acidic and basic groups of proteins) which occurs in localized domains sequestered from rapid equilibrium with the bulk aqueous phases. He also describes techniques used for detection of proton-binding groups in the membrane and of sequestered proton pools. The structure of chloroplast proton ATPase, its mechanism of action and its regulation are the topics reviewed by McCarty and Nalin. Strotman has chosen for his more specific review the topical problem of nucleotide binding sites in the chloroplast ATP-ase complex. He discusses the number and localization of these binding sites as well as their role in the regulation of the catalytic mechanism. Chapter 10 is terminated by a review of the recent progress in our knowledge of the sites and the mode of action of herbicide inhibitors. According to these two criteria, Sandmann and Böger divide the inhibitors into three groups: herbicides interfering with electron transport, with phosphorylation and with synthesis of various chloroplast components such as pigments or lipids.

The last chapter deals with the use of integrative approaches to study processes associated with the control of photosynthetic membrane assembly and maintenance. The minireviews included were chosen by the editors of the volume in anticipation of a development that will require more information about physical and chemical features of the membrane to solve problems of membrane biosynthesis and assembly, as well as a trend towards the use of genetic engineering tools to manipulate photosynthetic membranes. In the first section Sprague and Varga overview the membrane architecture of anoxygenic photosynthetic bacteria, thus complementing Staehelin's introductory chapter in which this topic has been left out. While emphasis in this section is on the morphology and location of thylakoids, the next one by Bachofen and Wiemken concentrates on the topology of the molecular components in the bacterial membrane: pigment-protein complexes, electron carriers and membrane lipids. Synthesis of the components of the photosynthetic membrane of the *Rhodospirillaceae* (the intracytosolic membrane, ICM) and the assembly of this membrane are reviewed by Donohue and Kaplan. They report on new evidence concerning the regulatory mechanisms of ICM induction and inhibition as well as ICM repression and derepression and on further areas of active research. The photosynthetic apparatus of cyanobacteria differs from that of higher plants not only in the nature of the light-harvesting antenna. It is therefore important to know which of the proteins constituting functional complexes

of the cyanobacterial thylakoid are similar to those in chloroplasts and which differ. This question is a subject of the review written by Bricker, Guikema, Pakrasi and Sherman. Simpson shows that a wealth of information on the location of individual thylakoid complexes can be gained from the investigation, by freeze-fracture electron microscopy, of thylakoid preparations from mutants lacking one or more of these complexes. The paper focuses only on barley plastid mutants but Simpson states that with mutants of other organisms similar results were obtained. Lütz reviews recent results on prolamellar bodies: the conditions favouring their development, the role of individual membrane lipids in their formation and questions raised by the occurrence of prolamellar bodies in differentiating tissues. Reconstitution of thylakoid components into artificial membranes is taken up by Ryrie. He starts with critically evaluating the advantages of the technique and then reports on reconstitutions attempted to date with individual thylakoid protein complexes: ATP synthase, the light-harvesting complex, Photosystem I and the cytochrome b_6/f complex. Barber deals with charge densities on the surface of the photosynthetic membranes, with methods available for their estimation and with the processes controlled by them. From the latter the control of excitation energy transfer is analyzed in more detail and a unifying explanation is provided for the effects of cations and of thylakoid protein phosphorylation. The last three minireviews in the book are concerned with lipids in photosynthetic membranes. Siegenthaler and Rawlyer look for the answer to the question how far specific properties of individual thylakoid lipids are required for their proper function. To this purpose they review available evidence for the distribution of acyl lipids in thylakoid membranes, as well as various experimental approaches used to investigate the possible involvement of lipid molecules in the action of functional protein complexes. Biosynthesis of chloroplast membrane lipids is reviewed by Keegstra. He states that our present knowledge emerged from research made in the last ten years and summarizes some of the recent developments with a more detailed account of galactolipids and a very brief one of other chloroplast lipids. Murphy emphasizes that thylakoid acyl lipids are not merely an inert matrix into which the various membrane proteins are inserted. In his review he examines what importance the chemical and physical structures of thylakoid lipids have for their orientation and distribution in the membrane and for their interaction with proteins.

I. ŠETLÍK (Třeboň)

BONGA, J. M., DURZAN, D. J. (ed.): **CELL AND TISSUE CULTURE IN FORESTRY**. — Martinus Nijhoff Publishers, Dordrecht — Boston — Lancaster 1987.

VOLUME 1, GENERAL PRINCIPLES AND BIOTECHNOLOGY. 422 pp., hard cover US \$ 78.50; Dfl. 170.00; £ 56.25.

VOLUME 2, SPECIFIC PRINCIPLES AND METHODS: GROWTH AND DEVELOPMENTS. 446 pp., hard cover US \$ 82.50; Dfl. 180.00; £ 59.50.

VOLUME 3, CASE HISTORIES: GYMNOSPERMS, ANGIOSPERMS AND PALMS. 416 pp., hard cover US \$ 76.50; Dfl. 170.00; £ 60.50.

This series of three volumes is a reflection of a remarkable progress in the field of cell and tissue culture technologies with woody perennials since the edition of the book "Tissue Culture in Forestry" of the same editors, five years ago. It is devoted to both theoretical and applied aspects of tree biotechnology and presents a compilation of 75 self-contained contributions by a wide range of specialists. Each volume is provided by a general and a tree species index.

The 1st volume deals with general aspects of *in vitro* technologies and of potential applications of tissue cultures in clonal propagation and breeding. Contributions on the media and physical environment for *in vitro* cultures separately examine the importance of the principal components and factors, such as basic mineral salts, micronutrients, forms of nitrogen, carbohydrates, polyamines, pH and temperature, and discuss the problem of vitrification frequently affecting plants during their *in vitro* vegetative propagation. Articles on the clonal propagation of trees are focused on the stability of juvenile and mature meristems and on use of *in vitro* culture as a rejuvenation technique, and describe the presently applicable techniques of *in vitro* propagation. Genetic aspects of potential use of tissue culture technology include genetic evaluation of clones, families or population-samples, possibilities and problems of application in tree improvement, genetic basis, mechanisms and measurement of somaclonal variation, application of recombinant DNA techniques, and possibilities of cytogenetic manipulations. The volume ends with 3 contributions on structural aspects of cells in culture with particular attention to organelles and cell wall and to the possible role of mitochondria in organogenesis.

Contributions of the 2nd volume are devoted to various specific topics concerned with cultural manipulations of growth and development of cells and tissues in woody plants *in vitro*, and with

properties and potential use of these cultures in physiological, biochemical and pathological studies. In addition to classical aspects of plant biotechnology, such as protoplast culture, *in vitro* morphogenesis, somatic embryogenesis, embryo culture, androgenesis and production of haploids, production of triploid plants *via* endosperm culture, cold storage and germplasm preservation, special attention is also paid to biochemistry of forest tree species in culture, to ammonia metabolism in relation to somatic embryogenesis and to applications in nursery handling of propagules, in mycorrhizae, in forest pathology and pest control, and in studies of forest tree tumors and cell senescence. The volume concludes with a theoretical chapter examining complex physiological and metabolic phenotypes in somatic and zygotic embryogenesis and construction and the use of models of embryogenic development.

In volume three, several of the emerging successful case histories of *in vitro* technology application in a wide range of species of gymnosperms, angiosperms and palms are described. The advancement of clonal procedures from the laboratory to the industrial level varies according to species, and examples are also given in which the initial large-scale field-testing is completed and micropropagation is practised on a commercial scale.

In summary, the three volumes provide a comprehensive survey of the state of research, theoretical and practical problems, and of potential and actual applications of cell and tissue cultures in forest and some other woody plants. It will certainly be of great interest to research workers within various theoretical and applied fields of experimental botany and can assist in achieving commercial exploitation of *in vitro* technologies.

J. TUPÝ (Praha)

SMITH, E. L. (ed.): **GENETIC IMPROVEMENT IN YIELD OF WHEAT**, — Crop Science Society of America, American Society of Agronomy, Madison 1986. 114 pp., US \$ 18.00 + 0.75 outside USA.

This volume, CSSA Special Publication Number 13, includes the updated papers presented at the symposium held in 1981 at the Annual Meeting of the American Society of Agronomy — Crop Science Society of America in Atlanta. In the introductory of eight chapters V. A. Johnson reviews the development of wheat production and yield increase since World War II in various countries, and shows opportunities for further yield advances in the years to come. Chapter 2, written by J. M. Key and C. O. Qualset, deals with conventional methods of wheat breeding *i.e.* with simple, convergent and composite crosses, backcrossing, by induction of mutations, population management and selection. In the following chapter D. R. Knott discusses modern approaches to wheat breeding, including wide crosses, somatic cell hybrids, doubled haploids, somaclonal variation, transformation, and N_2 fixation. The need of adequate sources of usable germplasm for a future wheat improvement is pointed out by W. E. Kronstad in Chapter 4. An integrated approach to breeding for disease resistance and the experience with wheat at the CIMMYT is presented by S. Rajaram and E. Torres. Genetic changes in the morphological characters in respect to breeding for increased wheat yield, that is to say root development, stem height, canopy structure, crop photosynthesis and potential productivity are compiled in Chapter 6 by S. Borojevic. In the last but one chapter K. A. Lucken presents a perspective on some of the major areas of hybrid wheat research. In conclusion V. A. Johnson summarizes future prospects in genetic improvement in yield of wheat.

This special publication is addressed to students and researchers in agronomy and related branches, interested in the improvement of wheat, a dietary mainstay for approximately 1.5 billion people in the world.

JARMILA SOLÁROVÁ (Praha)

FOLLETT, R. F., STEWART, J. W. B., COLE, C. V. (ed.): **SOIL FERTILITY AND ORGANIC MATTER AS CRITICAL COMPONENTS OF PRODUCTION SYSTEMS**. — Soil Science Society of America, Inc., American Society of Agronomy, Inc., Publishers, Madison 1987. 166 pp., US \$ 22.00 + 0.75 outside USA.

The acquaintance with dynamic of organic matter in the soil and its role in soil fertility is prerequisite of better soil managing and crop yield raising. To summarize the present state of knowledge in this field, rapidly progressing in recent years, the ASA and SSSA sponsored at the 1985 Annual Meeting a Symposium dealing with this subject. The booklet being reviewed, SSSA Special Publication Number 19, brings basic results informing about the complex of interactions

between physical and biological soil factors, climatic factors and economic soil agricultural management.

The matter is divided into nine chapters dealing with: 1. integration of organic matter and soil fertility concepts into management decisions (J. W. B. Stewart, R. F. Follett and C. V. Cole); 2. effects of soil and climate on crop productivity and nutrient use (R. W. Arnold and C. A. Jones); 3. conservation practices in relation to the management of plant nutrients for crop productivity (R. H. Follett, S. C. Gupta and P. G. Hunt); 4. management of organic matter and utilization of soil and fertilizer nutrients (J. W. Doran and M. S. Smith); 5. controls of dynamics of soil and fertilizer nitrogen (W. G. McGill and R. J. K. Myers), 6. phosphorus and sulphur (J. W. B. Stewart and A. N. Sharpley); 7. current and projected technical support systems for producers in competitive agriculture (R. A. Olson and J. D. Beaton); 8. new approaches for advisory services to improving crop management and farm profitability (R. C. Ward, A. D. Halvorson and K. Wisiol), 9. with nutrient and organic matter dynamics as a component of models of production systems (C. V. Cole, J. Williams, M. Shaffer and J. Hanson).

This special publication represents the current thinking of scientists concerned with soil fertility and organic matter as critical components of the production systems. It will be useful to agronomist as well as to everyone interested in soil fertility and organic matter conversion in soils.

JARMILA SOLÁROVÁ (*Praha*)

STEWART, F. C. (ed.): PLANT PHYSIOLOGY. A TREATISE. VOLUME IX (coedited by STEWARD, F. C., SUTCLIFFE, J. F., DALE, J. E.): WATER AND SOLUTES IN PLANTS. — Academic Press, Orlando — San Diego — New York — Austin — Boston — London — Sydney — Tokyo — Toronto 1986. 611 pp. US \$ 95.00.

The well-known series "Plant Physiology. A Treatise" continues by the ninth volume concerning the water relations, mineral nutrition and the transport of assimilates. Volume II concerning the similar topics appeared twenty-five years ago. However, due to intensive research in this very important field the approach to these questions based on present knowledge is quite different.

The first chapter deals with water relations on the cellular level. It repeats the conception of water, osmotic and pressure potentials based on irreversible thermodynamics and discusses their changes and control as well as the transport of water, the elastic properties of the cell walls and the relationship between pressure potential and growth. The second chapter is devoted to the transport of water in the whole soil-plant-atmosphere continuum. Main attention is given to water absorption by roots, water transport across roots to the xylem, the longitudinal water movement to evaporation sites and transpiration. The causes of the water deficit development and its consequences are also evaluated. The third chapter describes the stomata: the mechanisms of their functioning in response to environmental and internal factors. The fourth chapter gives useful information about the transport of ions on the cellular level and about the ion uptake by roots. Individual transport systems are compared and the regulation of transport is also considered. The salt relations of the whole plants (ion uptake and movement across the roots, transport in the xylem, the patterns of redistribution, etc.) are discussed in the fifth chapter. The sixth chapter is devoted to the phloem transport: sources and sinks, the mechanisms of translocation, its regulation. The seventh chapter is focused on the solutes in the cells during their growth and development, especially in *in vitro* culture, as affected by the composition of the medium.

It is very important that the water relations as well as the transport of inorganic and organic solutes are not regarded as isolated topics but in a close connection with the plant structure and ultrastructure and with other physiological processes. In all chapters a brief survey of methods and extensive bibliography are included. Many data are presented in the form of tables and schemes which enables easy orientation and understanding. The precise identification of plant material by using the whole Latin names is also to be appreciated. The book — as all volumes of this Series — is well arranged and printed. It is an excellent contribution to the literature on plant physiology.

JANA POSPÍŠILOVÁ (*Praha*)