GOVINDJEE, BARBER, J., CRAMER, W. A., GOEDHEER, J. H. C., LAVOREL, J., MARCELLE, R., ZILINSKAS, B. (ed.): EXCITATION ENERGY AND ELECTRON TRANSFER IN PHOTOSYNTHESIS. — Martinus Nijhoff Publishers, Dordrecht 1987. XX + 372 pp. Dfl. 145.—; US $ 64,—; £ 51.25.

For a friendly and high-brow person keeping an open house it is hardly a more distinguished pleasure than if friends gather around and discuss topics exciting all members of the party. Thus a Symposion of friends and followers gathered on the pages of the Journal Photosynthesis Research was without doubt the most appropriate form to commemorate Warren Butler. And we owe a debt of gratitude to the editors and publishers for having emphasized the significance of this achievement by letting appear Butler's memorial issue in a book form. It is first because it was a deed matching Warren who was at the same time a pioneer of the modern era in photosynthesis research and an adorable personality. This radiates among others from the personal tribute by Norman Bishop introducing the volume. But, in addition, as stated by Govindjee in the preface, the fact that about 90 international authorities in the field of excitation energy and electron transfer in photosynthesis gathered to present papers on the growing tips of their science, makes the volume an invaluable handbook, reference book and course book under one cover.

This is all the more prominent considering that 15 out of the 39 contributions overview some area of research related to Warren's activity and, in fact, most of these papers are masterpieces of the mini-review brand. Some of them focus on topical hot problems. Thus Geacintov, Brenton and Knox joined their experience to characterize the present state of the art in energy migration and exciton trapping in green plant photosynthesis. They emphasize the stimulative contribution of recent accurate measurements of fluorescence decay profiles with picosecond time resolution implying 3 to 4 decay components and the calculations and reasoning based thereon. On the whole, however, their message is that most principal questions including the origin of the variable component of PSII fluorescence still lack unequivocal solution. This is at variance with the decisive statements in the contributions by Schatz and Holzwarth on one hand and by Moya, Hodger, Briantais and Hervo on the other, who argue that various characteristics of the four fluorescence decay components resolved by picosecond techniques are not compatible with the recombination origin of $F_v$. Another hot point minireview is on regulation of energy transfer by cations and protein phosphorylation in relation to thylakoid membrane organization. Here Barber with the characteristic clarity of his style presents in the condensed form virtually all important facts on this topic including facts which spoil the pretty construction and challenge new approaches. The only contrary evidence not encompassed is that presented in the paper by Malkin, Canaani and Haraux. Using photoacoustic measurements on leaves of *Nicotiana tabacum* they see enhancement even when a large proportion of PSII centers is inhibited. This is at variance with the prevailing concepts on PSI and PSII separation between granal and stomatal thylakoids.

Amesz and Duysens elaborate on the present picture of primary and associated electron transport reactions in the two types of electron acceptor chains: the type "Q" found in purple bacteria, *Chloroflexus* and photosystem II of oxygenic photosynthesis and the "F" type found in green sulfur bacteria, *Heliobacterium* and photosystem I. Trebst and Draber discuss the molecular biological evidence that led to the proposal of a new concept of photosystem II reaction centre organization along with new aspects of the general features of PSII inhibitors (herbicides) which fall into two classes: the "classical" urea-triazine family and the "non-classical" phenol family.

Exceedingly useful are also the minireviews of the second type in which the author(s) tell the story of a problem that occupied an important place in his (their) research carrier. By a fateful coincidence we find here an account by George Akoyunoglou and Jolana Argyroudi-Akoyunoglou on the development in greening leaves of the organization of photosynthetic units, of electron transport and of excitation energy distribution. Included are also such topics as aggregation state of pigment protein complexes and changes in their representation in the leaves upon transfer to darkness — in brief all those themes in which George was a pioneer and which opened new vistas to photosynthesis research. From his personal angle of view chlorophyll-protein complexes are reviewed also by Kimiyuki Satoh. Strasser in the paper entitled "Mono-, bi-, tri- and polypartite models in photosynthesis" not only overviews his specific contribution to the development of Butler's ideas but also attempts to create something like a general termino logical, methodical, conceptual and mathematical frame for dealing with energy distribution problems. Various parts and functions of photosystem II recur in these reviews. Thus a detailed dissection of the steps of electron transfer connecting the oxidized primary donor $P^+680$ and the S states of the water cleavage clock is presented by Witt, Schloder, Brettel and Saygin. Although one is astonished by the amount of facts known on this short segment of electron transport the authors find still enough problems where a better knowledge appears desirable. The reader becomes similarly shocked finding that a five pages directory to 123 publications can now be produced dealing solely with the modification of oxygen evolving center by tris-washing. Thanks to Yama-

shita's unquestioned mastery in this field and the lucid and condensed style this will serve as a reference source for years to come. Similarly, 94 references accompany the overview by Govindjee and Eaton-Rye dealing with anionic interactions with the oxidoreduction reaction of photosystem II acceptors. The reward for careful reading of the paper is that one comes next to full understanding of all the complexities of the bicarbonate reversible stimulation/inhibition of PSII electron transport. One is lead to agree with the authors that this is a real phenomenon which provides an important gateway into the complex reaction of the PSII acceptor side. Last news on the possible molecular structure of cytochrome b 559 are summarized in the expert review by Cramer, Theg and Widger; attached is an attractive hypothesis on the possible function of this enigmatic PSII component in photoactivation of PSII or its repair from stress damage. Unfortunately, only one review pays attention to photosystem I. R. Malkin summarizes last development in our knowledge of the organization of chlorophyll-containing and chlorophyll-less polypeptides in PSI of higher plants chloroplasts. Any confusion the reader may feel concerning the optical cross section and absolute size of a photosynthetic unit will be expertly clarified by Mauzerall; at the same time the reader will learn how useful it is to know the exact value of the optical cross section.

The last mentioned review can already be ranked with the third class: papers that turn our attention to processes not enjoying a wide popularity at present but still offering excellent tools for solving important problems. In this sense Shahak and Avron deal with reverse electron flow in chloroplasts and point to many attractive questions raised by a cautios study of this phenomenon, such as "What form of energy links ATP hydrolysis and reverse electron flow?" Similarly we learn, when reading Knaff's review on active transport in photosynthetic bacteria that doubt has been cast by new studies on many questions taken for granted. This involves *e.g.* the general agreement that $\Delta\psi$, $\Delta$ pH or $\Delta$pNa provide the driving force for secondary transport: recent studies point to a possible direct interaction between electron transfer and active transport, perhaps by changing the redox state of dithiol/disulfide groups in the transport proteins. Finally I have to mention the review by Togasaki and Whitmarsh who examine, from all possible viewing angles, the contribution of the unicellular green alga *Chlamydomonas* to progress in photosynthesis research. They emphasize those aspects that have provided advantage over other photosynthetic organisms as is, in the first place, the combination of a microbiological object yielding to genetic manipulation techniques.

The original papers are no less interesting than the reviews and their broad variety of topics shows how diversely oriented scientists constitute the family willing "to keep and tend Warrens' garden of academic treasures" (Herbert Stern's words quoted according to the preface by Govindjee). In view of space limitation I have to comment them more concisely, however. In section I dealing with photosynthetic unit and its pigments the reader will learn that in *Chlorella* grown under various irradiances the characteristics of the photosynthetic unit and the value of the quantum yield change substantially only in cells with less than 0.2 or more than 0.8 fmol Chl; the extremes evaluated contained 0.022 and 1.57 fmol Chl, respectively (Ley). The "Anchor polypeptide", the high molecular mass terminal pigment, can be successfully solutilized from *Nostoc* phycobilisomes in 63 mmol formic acid, without denaturation or enzymic degradation (Mimuro and Gantt). Phycoerythrin trimer and hexamer were isolated from *Nostoc* phycobilisomes and the haxamer was aggregated into dodekamer *in vitro*; the implications of the spectral differences between the three aggregation forms for efficient energy transfer are discussed (Csatorday, Campbell, Zilinskas). Due to its high magnetic susceptibility the light harvesting chlorophyll a/b protein acts as a torque aligning chloroplasts in a magnetic field; functional importance of the putative liquid crystal like nature of LHCP is proposed (Kiss, Garab, Tóth and Faludi-Dániel). Relative sensitivity of various spectral forms of photosynthetic pigments to leaf senescence in wheat is reported (Grover, Sabat, Mohanty).

Section II includes papers on various aspects of excitation energy migration. Thylakoid protein phosphorylation enhances photosystem I dependent photophosphorylation catalyzed by phenazinmethosulfate even at high irradiances (up to 900 $Wm^{-2}$); this implies a specific stimulatory effect on cyclic photophosphorylation (Forti and Grubas). Kinetic data obtained by time resolved 77 K fluorescence emission at various wavelengths of *Porphyridium cruentum* in state 1 and state 2 support the concept of increased energy transfer from PSII Chla to PSI Chla in state 2 (Bruce, Hanzlik, Hancock, Biggins and Knox). The degree of photosynthesis enhancement by supplemental photosystem I enriched light in intact spinach chloroplasts reducing various substrates is correlated with the amount of ATP required for the various reductions (Horton and Lee). Under conditions of strong energization of the thylakoid membrane not only variable fluorescence but also dark level fluorescence is quenched; information on the quenching coefficient $q_Q$ is essential for correct determination of photochemical ($q_Q$) and energy dependent ($q_E$) quenching by the saturation pulse method (Bilger and Schreiber). Exposure to high irradiances of fronds of *Porphyra* or leaves of *Phytolacca* and *Echinodorus* for tens of seconds or several minutes brings about a

large decrease of variable fluorescence; this is not the same process as observed in photoinhibition but results from an increase in the rate constant of radiationless transition in the PSII RC (Fork, Bose, Herbert).

What concerns reaction centers and primary photochemistry, influence of magnetic fields on the P870 triplet states in *Rps. sphaeroides* RC's is reported (Vidal, Setif, Mathis) and the results are discussed in the framework of current theories of the radical-pair dynamics and of the mechanism of triplet decay. Photoreduction of pheophytin *a* accompanied by a decrease in chlorophyll fluorescence yield is observed in PSII of the whole cells of green algae and cyanobacteria under anaerobic conditions created by the glucose-glucose oxidase reaction in presence of catalase (Klimov, Allakhverdiev and Ladygin). This is an important continuation of earlier experiments performed with isolated chloroplasts and photosystem II particles.

As to the components of the photosynthetic electron transport chain the advantages offered by the ENDOR spectroscopy were used to unravel further details concerning the structure and environment of the $D^+/Z^+$ radical, which has been proposed earlier to have the nature of a plastosemiquinone cation (Chandrashekar, O'Malley, Rodriguez and Babcock). The pH dependence of emission peak temperature and decay time of thermoluminescence arising from $S_2Q_B^-$ and $S_2Q_A^-$ recombinations was measured (Vass and Inoue). It was found that $S_2Q_B^-$ becomes stabilized at low pH values and $S_2Q_A^-$ at high values. This implies that protonation of $Q_B^-$ increases $E_m$ ($Q_B/Q_B^-$) below pH 7.5, while above pH 7.5 either a decrease in $E_m$ ($S_2/S_1$) or an increase in $E_m$ ($Q_A/Q_A^-$) occurs. pH dependent conformational changes and electrostatic effects in plastocyanin indicate that the reduction of PC causes a change in the electric field at the surface of the molecule that can alter the affinity for Cyt f. Conversely, properties of the copper center are regulated by the charge on the surface of the molecule (Gross, Daheim, Anderson, Sanderson and Ketchner). The mechanism by which various anions (differing in their chaotropic properties) regulate the rate of electron transport through PSII was investigated with ion-permeabilized cells of *Anacystis nidulans* (Sotiropoulou and Papageorgiou).

In the section dealing with components and mechanisms of oxygen evolution one finds, apart from the reviews mentioned above, the following papers. A new photosystem II reaction center complex characterized by a four-fold enrichment in Mn and the electron transport components on a Chl a basis and with an activity of 1000 μmol $O_2$ $mg^{-1}$Chl $h^{-1}$ is described (Ghanotakis and Yocum). It has been isolated by exposure of PSII membranes to octylglucopyranoside in presence of high concentrations of NaCl. Light dependent inactivation of photosynthetic oxygen evolution during $NaCl^-$ treatment of PSII particles has been investigated (Miyao and Murata). A scheme is proposed for the mechanism of this process and for the function of the 24 kD protein in regulating the conformation of the putative $Ca^{++}$ binding intrinsic protein. The protective role of chloride ions against inhibition of the water splitting complex by amines was investigated with purified PSII particles from tobacco chloroplasts (Homann). The results show that, in spite of common traits, the response of PSII to $OH^-$, Tris and $NH_3$ cannot be explained by a common mechanism; the protecting effect of $Cl^-$ seems to result from the general role of this anion in the organization of the water oxidizing site.

The book is closed by a paper describing an activity performed by a photosynthetic bacterium that is of both theoretical and practical interest. *Chromatium vinosum* cultured in inorganic photographic processing solutions containing silver thiosulfate complex salt accumulated granular silver in the membrane to the amount of 30 % of dry cell mass (Kitajima).

I. Šetlík (*Třeboň*)

Munson, R. D. (ed.): Potassium in Agriculture. — American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, Madison 1985. XXIV + 1223 pp. Hardcover US $ 58.00 + 75c outside.

This book records the proceedings of "Potassium in Agriculture", an international symposium sponsored by the Potash & Phosphate Institute, American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, National Fertilizer Development Center, International Fertilizer Development Center, and Foundation for Agronomic Research. The symposium took place on July 7—10, 1985 in Atlanta, Georgia, USA as a part of the Potash & Phosphate Institute's 50th anniversary celebration.

This new book is a greatly expanded revision of "The Role of Potassium in Agriculture" published by ASA-CSSA-SSSA in 1968. The Symposium brought together technical experts from a wide range of disciplines and areas the world over to present coherent and authoritative treatises. All fifty one chapters of the new edition are an example of both the depth and breadth of expertise available in the modern science and how this can be focused on a single topic. Six chapters in the

first of five sections cover the practical aspects of potassium, starting with world reserves, mining, refining, technology, marketing, sources, and the current and future use. The second section deals in five chapters with the basic and practical aspects of potassium soil chemistry, potassium status of soils important to crop production, potassium availability and uptake by plant roots. To the readers of Biologia Plantarum thirteen chapters of the third section will be very interesting. They are devoted to fundamentals of potassium absorption by plant roots, its effects on plant and cellular structures, and its roles in enzyme catalysis, photosynthesis and respiration, assimilate transport, protein and oil metabolism, legume dinitrogen fixation and in crop quality. Interactions with plant diseases, other nutrients, crop varieties and hybrids, cultural and management practices are also discussed. The requirements, metabolism and functions in human and animal nutrition and the medical and clinical aspects of potassium are treated in three chapters of the fourth section. The last section, which occupies almost half of the volume, is introduced by a chapter on the use of potassium in maximum economic yield systems. It is followed by specific chapters on potassium nutrition of major crops of temperate as well as tropical regions *i.e.* corn, rice, wheat and other small grains, soybeans, rape, flax, sunflower, safflower, potatoes, cassava, cotton, alfalfa, and other forage legumes, forage grasses, vegetable crops, coffee, tea, tobacco, sugar cane, sugar beets, citrus, deciduous and small fruits, grapes and pecans. Potassium in intensive cropping systems on highly weathered soils and in the People's Republic of China and in Japan is the topic of the last two chapters. All chapters are written by internationally recognized authorities, are illustrated with tables, figures and photos and supplemented by lists of references.

The book is a good example of cooperation of scientists of different disciplines from universities, research institutes, scientific societies, industry and government. It will serve as a reference to researchers, educators and students for many years to come.

JARMILA SOLÁROVÁ (*Praha*)

FOKKEMA, N. J., VAN DEN HEUVEL, J. (ed.): MICROBIOLOGY OF THE PHYLLOSPHERE. — Cambridge University Press, Cambridge—New York—New Rochelle—Melbourne—Sydney 1986. 392 pp. H/C £ 30.00, US $ 54.50.

The microbiology of the phyllosphere, the environment created by the leaf and colonized by bacteria, yeasts and moulds, attracts scientists of different disciplines such as plant pathology, mycology and microbial ecology. The phyllosphere provides niches for a variety of bacteria, yeasts and moulds which influence the well-being of plants.

The book reviewed is based on selected reviews presented at the Fourth International Symposium on this subject held in September 1985 at Wageningen, the Netherlands. The book is divided into five sections. The first section "New techniques" includes four chapters dealing with population quantification, biological markers, autoradiography and quantitative serology. In the second section "Ecology of epiphytic fungi" the colonization theories, microbial adaptations, sooty moulds, microbial air pollution indicators and effects on yield are discussed in six chapters. The section three "Endophytic leaf fungi" with three chapters deals with the taxonomy and occurrence of endophytic leaf fungi, a newly discovered group of mutualistic non-pathogenic fungi and their beneficial role in plants. In section four containing four chapters the plant-pathogenic and saprophytic prokaryotes in relation to population variability, survival and host specificity, including the discovery of epiphytic mycoplasmas, are discussed. Five chapters of the last, fifth section "Biological control on aerial plant surfaces" deal with biological control of pathogens, including bacteria responsible for host damage, biotrophic and necrotrophic fungal pathogens, microbial metabolites increasing plant resistance and the prospects of genetic engineering of biocontrol agents.

In the volume many new developments in techniques on monitoring micro-organisms and in theoretical concepts on colonization are included as well as several new subjects not treated in previous symposium volumes.

Phyllosphere research is starting to benefit from genetic manipulation: new techniques that greatly improve the possibilities of tracing microorganisms, elucidating the role of particular traits of micro-organisms and preparing "ideal" biocontrol agents are now becoming available. Microbiologists, ecologists, mycologists and plant pathologists in both academic and applied research laboratories needing to keep pace with this expanding field will find this book essential reading.

VLASTA ČATSKÁ (*Praha*)

CHADWICK, C. M., GARROD, D. R. (ed.): HORMONES, RECEPTORS AND CELLULAR INTERACTIONS IN PLANTS. — Cambridge University Press, Cambridge—New York—Melbourne 1986. 375 pp. £ 40.00; $ 69.50.

This book is published in the series "Intercellular and intracellular communication" edited by B. Cinader, and deals with intercellular communications in higher and lower plants.

The phenomenon of intercellular communication, generally categorized under the term "cellular recognition", includes the binding between a cell and (1) another cell of the same or similar type, (2) a bacterium or foreign particle, and (3) a molecule. The common language of all types of cellular communication seems to be a complementary binding up of a ligand (as environmental stimulus) with a receptor located on the cell.

In Chapters 1—3 the current status of some phytohormone receptors (for auxins, ethylene and gibberellins) in higher plants is discussed. However any information about receptors for cytokinins and abscisic acid are completely omitted, although comparable progress has been made in their investigation. In Chapter 4 the role of cyclic AMP in higher plants is reviewed from the point of view of its occurrence, metabolism and the function as both the primary and secondary messengers. In the following chapters the present knowledge of the cell recognition and adhesion in lower plants (slime moulds and yeasts) is presented on cellular and molecular levels. Cell-surface receptors in interactions between pollen and stigma are reviewed in Chapter 9 with regard to the self-incompatibility phenomenon. There are also special and economically very important types of cell-cell recognitions in higher plants: host-pathogen interactions (Chapter 10) and positive *Rhizobium*-legume symbiosis (Chapter 11). Both these phenomena are nice examples of the interaction of higher plant cell and a bacterium or other foreign cell. In the book two more common chapters are also included: The plasma membrane of higher plant protoplasts (Chapter 7) and Possible functions of plant lectins (Chapter 12). Both these chapters give a general review of the matter.

In general, this book presents a very comprehensive survey of the types and mechanisms of cellular recognition in plants and may provide valuable stimuli to the workers not only in the research field of plant biology.

EVA ZAŽÍMALOVÁ (*Praha*)

LINSKENS, H. F., JACKSON, J. F. (ed.): IMMUNOLOGY IN PLANT SCIENCES. Modern Methods of Plant Analysis, New Ser., Vol. 4. — Springer Verlag, Berlin—Heidelberg—New York—London—Paris—Tokyo 1986. 263 pp., 90 figs. Hardcover DM 169.—.

The new volume of Modern Methods of Plant Analysis is relatively thin but of particular importance. In several last years the importance of immunological techniques in plant research has risen enormously and some problems could not have been approached at all without these techniques. The volume consists of the following reviews: Plant hormone immunoassays based on monoclonal and polyclonal antibodies (E. W. Weiler), Radioimmunoassay and gas chromatography / mass spectrometry for cytokinin determination (D. Ernst), Immunodetection of phytochrome: immunocytochemistry, immunoblotting, and immunoquantitation (L. H. Pratt, D. W. McCurdy, Y. Shimazaki, M.-M. Cordonnier), Radioimmunoassay for soybean phytoalexin (H. Grisebach, P. Moesta, M. G. Hahn), The measurement of low-molecular-weight, non-immunogenic compounds by immunoassay (R. J. Robbins), Radioimmunoassay and western blot analysis of acyl carrier protein isoforms in plants (T. M. Kuo, J. B. Ohlrogge), Immunofluorescent labelling of enzymes (G. Schmid, H. Grisebach), Quantitative immunocytochemistry of plant phosphoenolpyruvate carboxylases (J. Brulfert, J. Vidal), Immunochemical methods for higher plant nitrate reductase (A. Kleinhofs, K. R. Narayanan, D. A. Sommers, T. M. Kuo, R. L. Warner), Immunological-cytochemical localization of cell products in plant tissue culture (K. J. Wilson), Measurement of oat globulin by radioimmunoassay (D. S. Luthe), and Immunocytochemistry of chloroplast antigens (K. C. Vaughn). As the reader may see from the above survey, the volume deals with many aspects of plant immunochemistry and the individual chapters are written by excellent specialists. All the chapters contain detailed descriptions of the methods (in most cases in the form of an experiment scheme). In addition, all theoretical background necessary for understanding and using these methods is given.

The new volume of Modern Methods of Plant Analysis has come at the right time and will be appreciated by all plant research workers using or intending to use immunological techniques.

IVANA MACHÁČKOVÁ (*Praha*)