trimer in membrane vesicles from *Cb. tepidum*, and W. Struve (USA) talked about excitation dynamics in FMO trimers from the same organism. D. Gulen (Turkey) showed a poster on excited state structure and subpicosecond excitation dynamics in the FMO protein from *P. aestuarii*. S. Neerken (The Netherlands) showed a poster on spectral hole-burning on the FMO and FMO-RC complex of the same organism, while T. Aartsma (The Netherlands) gave an interpretation of the steady state optical spectra of the FMO protein.

Mathis, P. (ed.): **Photosynthesis: from Light to Biosphere. Vol. I, II, III, IV, V.** - Kluwer Academic Publishers, Dordrecht - Boston - London 1995. ISBN 0-7923-3857-X, 0-7923-3858-8, 0-7923-3859-6, 0-7923-3860-X, 0-7923-3861-8; 0-7923-3862-6 (set). XXXIV + 1004, XXII + 988, XXII + 1050, XXI + 954, XXII + 1066 pp. NLG 2 200.00, USD 1 540.00.

With increasing amount of participants the sizes of congress proceedings increase as shown also in the reviewed set of five volumes that represent the Xth International Photosynthesis Congress in Montpellier (France) in August 1995 (for report see Photosynthetica **32**: 291-296, 1996). The volumes appeared before the end of the same year which could support early citing of the papers contained. Unfortunately, this did not happen, and references to these proceeding volumes are rare until now. The reason is that scientists prefer to cite papers published in peer reviewed journals to those published in unreviewed proceeding books.

Volume I is devoted to three topics. The first of them is "Antenna systems: structure and function" (91 papers). It contains a review paper on bilin attachment in phycobiliproteins. Other papers deal with various models, *e.g.*, of bacterial chlorosomes and excitation transfer therein, of light-harvesting complexes (LHC) and energy transfer, of the association of two LHCs in purple bacteria, of three-dimensional structures of phycocyanins, of LHC variance induced by mutation, models based on synthetic metallochlorin aggregates and other porphyrin derivatives, and also with carotenoids (Cars) in LHC, protein types and their phosphorylation, changes induced by mutation, bacteriochlorophyll analogues, LHC crystallisation and X-ray analysis of the complexes, *etc.* Schemes of devices for special measurements, such as fluorescence decay or non-linear polarisation in the frequency domain, are also included.

Second topic of the Vol. I is "Reaction centers: purple bacteria and PSII" (131 papers). The introductory reviews are on infrared and visible spectroscopy of bacterial reaction centres (RC), and on optical properties and energy transfer in RCs of photosystem (PS) 2. The papers contain energetic level schemes and models of PS2 conformation, deal with charge transfer and separation, function of Y_Z, low temperature chlorophyll (Chl) fluorescence kinetics, cavities in RCs, inhibitors of electron transfer and resistance to them, and even with the effects of herbicides on cell ultrastructure. Methodically oriented papers deal with the isolation of PS2 core complexes, complexes of cytochrome (cyt) with D1 and D2 proteins, oxygen evolving RCs, purification of RCs from purple bacteria and acid-base titration of RCs, they use electrodeposition films, model compounds such as pyropheophytins and anthraquinone, photon echo methods, work with RC-phospholipid reverse micelles, *etc.*

Last topic of this volume is "Evolution of photosynthesis" (only 10 papers). The introductory reviews are on the origin and phyllogeny of phosphorylating and non-phosphorylating glyceraldehyde-3-phosphate dehydrogenases, on the origin of plastids, and on the evolution of electron transfer chains. The remaining seven papers deal with various aspects of phyllogeny of photosynthesis.

Volume II is devoted to five topics. The first of them, "Reaction centers: green sulfur bacteria and PSI", contains 48 papers. The introductory reviews discuss the results of crystal structure analysis and modelling of PS1, and the models of RC in green sulfur bacteria. Further papers include models of distribution of Chl spectral types in PS1, of ferredoxin oxidation pathways, of subunit interactions in PS1, *etc.* New or improved methods include enrichment of PS1 particles with P700, preparation of purified RC complexes and subcomplexes, design of microcoaxial cell for photovoltage measurements, isolation of photoactive RC complexes from *Heliobacteria, etc.*

Next topic of this volume deals with oxygen evolution (66 papers). It starts with reviews on metallo-radical enzyme, and on manganese in the PS2 cluster studied in analogue models and using electron spin methods. Many papers try to model the complexes and the process, work with mutants modified in PS2, identify the respective proteins (by using extrinsic proteins), deal with cyt interaction, reduction of P_{680}^+, cofactors such as chloride, *etc.* The following topic (50 papers) is "Cytochrome complexes". The introductory review deals with the cyt bc_1 complex of *Rhodobacter*. Other papers are on the genetic basis (cloning and sequencing of genes) and mutants of the cyt complexes, purification (crystallisation) and determination of composition of cyt complexes from algae and photosynthetic bacteria, models of electrogenic reactions (protein displacements) in the complexes, stabilisation of high potential forms of cyt, cyt roles in photoreactivation of oxygen-evolving centres, inhibitors of cyt, differences in complexes isolated from appressed and non-appressed thylakoids, *etc.*

The following topic (38 papers) of Vol. II is electron transfer proteins. Individual papers deal mainly with their genetics, stereomodels, presence in mutants, sequencing, *etc.* The proteins analysed are enzymes, ferredoxins, ferredoxin:thioredoxin reductase, iron-sulfur proteins, ferredoxin-NADP reductase, proton translocating transhydrogenase, NAD(P)H-plastoquinone oxidoreductase, proteins from the multiprotein complex of PS1, cyt, Rieske proteins, *etc.* Plant materials used for studies are mostly algae and photosynthetic bacteria. In addition to traditional methods, some new ones are described (*e.g.*, to identify ferredoxin-interacting proteins by means of biotinylation). Last topic (40 papers) deals with alternative electron pathways and regulation. The introductory review is focused on photosynthetic and quasi-photosynthetic bacteria as a commonly used research object. Other papers are on electron transport to nitrogenase, CO_2 transporters, the Mehler-ascorbate peroxidase cycle, cyt complexes and mutants lacking them, cyclic electron transport, inhibitors of electron transport chains, Chl fluorescence quenching, tepidopterin (a pterin in *Chlorobium tepidum* that probably acts in growth and photosynthesis of the bacterium), migration of genes from chloroplast to nucleus, chlororespiration, proteins in chloroplast envelope, *etc.* One has a feeling that all papers the organisers were unable to classify properly were put in here. A combined method for *in vivo* assessment of alternative electron transfer, and a method of purification and characterisation of NADH dehydrogenase are also included.

Volume III contains papers on six topics. First of them (48 papers) is ATPase and transduction of protons and energy. The introductory reviews deal with structure, functions, genetics, and evolution of ATPases and their subunits. The papers deal with synthesis of ATP and effects of various factors on it, with characteristics of CF_0CF_1, with photophosphorylation studied *in vivo*, types and subunits of ATPases and their binding sites, flash induced changes in electric field, inhibitors of ATP synthesis and action, membrane permeability effects, *etc*. Methodical papers describe determination of the subunit CF_0II by the ELISA test, measurement of the H^+/ATP coupling ratio, compare methods for evaluating F-ATPase activation, *etc*.

Topic 10, "Organisation of the photosynthetic apparatus" (54 papers) includes a review on domains of the thylakoid membrane. Individual papers present three-dimensional models of PS2 architecture, cryo-electron microscopic analysis of PS2, formation of crystals in PS2, PS subunits, supramolecular organisation of electron transport chain, presence of lipids and phosphoproteins in thylakoid membranes, electric properties of thylakoids, protein phosphorylation and its protective role, changes induced by lanthanides or kinetin, spectra of pigment complexes *in vivo*, reconstitution of RCs, methods for isolation of kinase enriched thylakoid preparations, *etc*.

Next two topics are on expression and regulation of genes. Topic 11 deals with prokaryotes (27 papers), topic 12 with eukaryotes (39 papers). Genes for all electron transport carriers, pigments, polypeptides, enzymes, DNA-binding proteins, changes induced by mutagenesis, *in situ* spectroscopy of single colonies, *etc*. are dealt with. Some papers analyse changes during chloroplast, leaf or plant development. Mutants or transgenic plants are an often used material for these experiments.

Topic 13, "Protein translocation and assembly" (37 papers), contains reviews on nuclear-encoded thylakoid proteins and on protein import machinery. Epistatic effects on synthesis of cyt *f*, transport mediators, precursor proteins, processing enzymes (proteases, peptidases), the respective genes, incorporation of specific proteins such as the D1 protein into photoinhibited PS2 RCs, assembly of pigment-protein complexes and the oxygen-evolving complex, degradation of mistargeted complex, *etc*. are described here. Last topic of the Vol. III includes the biosynthesis of tetrapyrroles and lipid metabolism (34 papers). The introductory review is on the role of envelope membranes in plastid development and cell metabolism. The papers deal with light-stress proteins, mechanisms of greening, evolutionary and genetic relations of Chls of bacteria and karyotes, gene expression regulated by blue radiation, effects of irradiance, H_2O, mineral elements, and UV radiation on the formation of photosynthetic apparatus, phototransformation of protochlorophyllide forms, changes in pigments and PS activities during leaf senescence, hydrogenation of Chl alcohol side chains, Chl formation in mutants, biotin enzymes during leaf development, lipid desaturases, enzymes of pigment degradation such as pheophorbidase, participation of lipids in PS activities, *etc*.

Volume IV contains papers on four topics. The first one, "Carotenoids", comprises 35 papers. The reviews deal with pathways of Car biosynthesis and with their role in PS RCs. Original communications are on this subject as well as on Cars as quenchers of Chl excited states, on xanthophyll cycle and its enzymes, on Cars in light-harvesting complexes and RCs, Car mutants, electrochromic shift induced by charge separation, *etc*. The 16th topic, "Photoinhibition and oxidative stress", embraces 84 papers. Molecular basis of photoinhibition is reviewed, further papers deal with the participation in photoinhibition and repair of the photosynthetic apparatus of singlet oxygen, antioxidants, frost resistance, heavy metals, UV-radiation, ozone, herbicides, sporopollenin, pheophytin, and protein turnover, with mutated amino acids, with the role of grana margins, leaf hairs and waxes during the repair cycle, *etc*. Stresses induced by drought, salinity, and chemicals (heavy metals, herbicides, glycinebetaine, abscisic acid) are the next topic (64 papers). Effects on pigment contents, activities of PSs, carboxylases, conductances, and gas exchange are often determined, and parameters of Chl fluorescence induction are often used in testing the stress effects. Last topic of the Vol. IV is temperature stress (39 papers). The introductory review deals with genetic engineering of photosynthetic capability under temperature and salinity stresses. The papers deal with various effects of low and high temperature (often combined with other stresses) on individual photosynthetic characteristics.

Volume V contains last six topics of the Xth Photosynthesis Congress. They deal mainly with the metabolism of carbon. Part 19 (76 papers) is on enzymes of carbon cycles, protein phosphorylation, and synthesis of saccharides. The introductory reviews deal with cytosolic enzymes such as ribulose-1,5-bisphosphate carboxylase/oxygenase activase and the glycine decarboxylase system, their assembly, transport, and functions. Individual papers are also on other enzymes of carbon cycles. As experimental material antisense transformants are used frequently. Among others, a new route for ribulose-1,5-bisphosphate regeneration is proposed. Part 20 is on the integration of C, N, P, and S metabolisms (24 papers). Introductory reviews deal with the biosynthesis of branched-chain amino acids and cysteine, and with carbon control of the photosynthetic nitrate metabolism. Intra- and inter-cellular exchanges are the 21st topic (19 papers). The introductory reviews are on structural aspects of these exchanges and on the transport processes in plant cells in general. Topic 22 (CO_2 diffusion and concentration mechanisms) contains 24 papers. They deal mainly with conductances to CO_2 or water vapour, with the expression of genes for carbonic anhydrase, its purification and isoforms, control of stomatal conductance by messages from roots, with relationships of conductances and carboxylating activities, synthesis of starch, with CO_2 concentrating mechanisms in algae and aquatic plants, *etc.* In the following topic (Carbon partitioning) there are 23 papers. The reviews are on membrane control of assimilate transport, and on the effects of temperature on saccharose synthesis and plant yield. Part 24, "Ecosystems productivity and global aspects", includes 73 papers dealing with a mixture of questions. Review papers of this part deal with the effects of rising CO_2 concentration and acclimation to this factor on plant production, with changes in marine primary production induced by phagi and viruses, with variations in photochemical energy conversion efficiency of oceanic phytoplankton, *etc.* A new technique for measuring photosynthetic characteristics of individual algal cells is also introduced as well as monitoring of electron transfer reactions by diffuse-light dual-modulation fluorometer, automated phytoplankton analysis based on a four-wavelength PAM Chl fluorometer, and new Chl fluorescence sensing devices for routine sensing of plant stress. This part contains a large number of papers on the production of phytoplankton. I am pleased that many papers in this part respect changes in photosynthetic characteristics induced by leaf age.

The five reviewed volumes certainly give an overview of results of photosynthesis research as it was in 1995. The books were produced without any delay, but this is connected with the usual shortage of such proceedings: a subject index is missing. Only a good subject index would enable a rapid browsing through the voluminous books and finding the information one requires. Without such index, the proceedings will not be used too often as a basis for future research, because the same questions are often solved in different parts of the five-volume complex. Why not ask in advance the authors of contributions to the proceeding volumes of the next Congress to prepare a list of key words from which a subject index may be prepared by an experienced indexer in a due time? If there is a need to spare place, such subject index may replace the lists of authors printed now in every volume.

There are some editorial errors in contents lists and indexes, *e.g.*, in Vol. I for Wang J.L. read Wang S.-C. (this author is not introduced in the Author index under any name), and also some printers' errors, *e.g.*, on pp. 680 and 681 the same text is printed, but a page with results of the research is missing. Of course, there are many misprints in individual papers for which their authors are responsible.

In summary, browsing through the volumes brings a mixture of pleasure and discontent: both because the research in photosynthesis is so broad and it is not easy to understand everything which was more or less possible some forty-five years ago when I started as a student in the photosynthesis laboratory of Ivan Šetlík.

Z. ŠESTÁK (*Praha*)