Advances in Photosynthesis and Respiration, Vol. 22, Photosystem II: The Light-Driven Water: Plastoquinone Oxidoreductase. Thomas J. Wydrzynski and Kimiyuki Satoh (eds); Govindjee (Series Editor). Springer, Dordrecht, The Netherlands. 2005. 786 pp. Price: 295 Euro, UK £227, US$ 385.

Aerobic life on earth requires oxygen for its sustenance. All organisms, including humans require oxygen. The only source of oxygen on this earth are green plants, algae and cyanobacteria. This oxygen is generated through photosystem II (PS II) by these oxygenic organisms. This volume of the series on *Advances in Photosynthesis and Respiration* deals with the understanding of the PS II enzyme, which catalyses the oxidation of water using light as the source of energy. This book documents almost all aspects of structure, function and molecular architecture of PS II. Thus, this book, that deals with biochemistry, biophysics, molecular biology, structural biology and biotechnology, will be extremely useful to all students, teachers, researchers in these areas, as well as the people engaged in industries who are interested in developing future energy sources.

The editors of this volume, Thomas J. Wydrzynski (Australia) and Kimiyuki Satoh (Japan), have done a marvellous job by compiling such a great amount of information on the oxygen-producing photosystem under 34 chapters, that include authoritative and critical evaluation of the various subtopics, written by 75 international scientists from this field.

This volume begins appropriately with a dedication to Gerald T. Babcock (1946–2000), written by Charles F. Yocum, Robert E. Blankenship and Shelagh Fergusson-Miller. Babcock's work on photosynthesis (both PS II and PS I) and respiration is immense. This volume is a fitting tribute to him.

The text of the volume starts with a single chapter (Chapter 1) 'Introduction to Photosystem II' under its Part I (Perspectives of photosynthesis research). Here, Kimiyuki Satoh, Thomas J. Wydrzynski and Govindjee summarize the critical work done by different researchers on all aspects of PS II, starting from the discovery of 'oxygen' to isolation of pigment protein complexes and finally 3D structure of PS II. The future of PS II research and its application in biotechnology are also discussed.

The next five chapters in Part II of the book discuss the protein constituents of PS II and their known functions. Antennas are the pigment–protein complexes that absorb light energy and transfer it to reaction centres of photosystems. Chapter 2 by Beverley R. Green and Elisabeth Gantt deals with extrinsic proteins of PS II antennae from cyanobacteria and red algae, where phycobiliproteins are organized into complex phycobilisomes to function as antennae. The Light Harvesting Complex (LHC) superfamily of PS II from higher plants, phycobilins from cryophyte algae and unique peridin/Chl *a* from dinoflagellates are reviewed. Both the organization and the functioning of these proteins are discussed. CP47 and CP43 form the proximal antennae of PS II, which channels the excitation energy in the LHCs to the reaction centres. These are the points of focus in Chapter 3 by Julian J. Eaton-Rye and Cindy Putam-Evans. Peter J. Nixon, Mary Sarcina and Bruce A. Diner discuss the reaction centre proteins of PS II, the D1 and D2, in Chapter 4. Chapter 5 focuses on extrinsic proteins of PS II, which act as enhancers of oxygen evolution and shield the Mn cluster from exogenous reductants in the aqueous phase. These proteins include 33 kDa Mn-stabilizing protein, 24 and 16 kDa extrinsic proteins from higher plants, cyt c_{550} and 12-kDa extrinsic proteins from cyanobacteria. These are reviewed by Terry M. Bricker and Robert L. Burnap. Chapter 6 focuses on minor small proteins in PS II from higher plants, algae and cyanobacteria, by Leeann E. Thornton, Johnna L. Roose, Himadari B. Pakrasi and Masahiko Ikeuchi.

Part III of the book includes nine chapters on the organization of the functional sites in PS II. Chapter 7 by Gernot Renger and Alfred R. Holzwarth, reviews our current knowledge on the primary electron transfer in PS II. This chapter focuses on the basics of excitation energy transfer, electron transfer, charge separation and pigment–pigment and pigment–protein interactions. In Chapter 8, Vasili Petrouleas and Antony R. Crofts discuss the structure and function of the iron–quinone complex and the two-electron gate system, located on the acceptor site of PS II. Chapter 9 by Bruce A. Diner and R. David Britt, provides an insight into the interaction and functioning of the Y_z and Y_D redox-active tyrosines for electron transfer in PS II. Vittal K. Yachandra discusses the current understanding of the manganese cluster and organization of the metal ions in this cluster using a multitude of spectroscopic techniques in Chapter 10. Summarizing the site-directed mutagenesis studies, Richard J. Debus adds to our understanding of the protein ligands of the manganese cluster in Chapter 11. Discussing different spectroscopic techniques, Karin A. Åhrling, Ronald J. Pace and Michael C. W. Evans provide a different view of the structure and function of Mn cluster in PS II in Chapter 12. Besides Mn, the other metal ions involved in PS II functioning are Ca^{2+} and Cl^-. Hans J. van Gorkom and Charles F. Yocum discuss in Chapter 13, these two cofactors and their association with the Mn cluster of PS II. Jack J. S. van Rensen and Vyacheslav V. Klimov examine the role of bicarbonate ions at both the acceptor and donor sides of PS II. Chapter 15 by Peter Faller, Christian Fufezan and A. William Rutherford, provides us with the current understanding of side-path electron donors like Cyt b_{559}, Chl_z and β-carotene and their role in dissipating extra energy.

The next six chapters in Part IV of the book describe the structure of PS II by (a) using vibrational spectroscopy (Chapter 16 by Takumi Noguchi and Catherine Berthomieu); (b) electron paramagnetic resonance spectroscopy (Chapter 17 by Robert Bittl and Asako Kawamori); (c) electron microscopy (Chapter 18 by Ben Hankamer, James Barber and Jon Nield); and finally (d) X-ray structure analysis (Chapter 19 by Horst T. Witt, Chapter 20 by Jia-Ren Shen and Nobuo Kamiya and Chapter 21 by James Barber and So Iwata). Finally we have a good idea of the current understanding of the 2D and 3D structures of PS II from cyanobacteria and plants, and the interaction among different components of PS II. This has opened a major field of study, as now we can begin to understand the function of even specific amino acids, and groups of them, in PS II.

The structure of PS II is followed by a section on 'Molecular dynamics of photosynthesis' in Part V of the book. This part includes four chapters. Chapter 22, written by Laura M. Barter, David R. Klug and Rienk van Grondelle, reviews our current understanding of energy trapping mechanisms, rate-limiting steps in energy transfer, and charge separation and its regulation. This is followed by a review on the role of carotenoids in photo-protection under adverse environmental conditions in Chapter 23, by Barry J. Pogson, Heather M. Rissler and Harry A. Frank. In Chapter 24, Vladimir Shinkarev discusses the unique flash-induced oscillatory processes which lead to oxygen production from water. On the basis of current knowledge on energetic and kinetic aspects of photosynthetic water oxidation, Warwick Hillier and Johannes Messinger discuss the mechanism of oxygen production in Chapter 25. The black box of 'the oxygen clock' is finally being opened before our very eyes.

Part VI of the book on the 'Assembly and biodynamics of photosystem II' includes four chapters. This part discusses the processes involved in sustaining PS II functions *in vivo*. In Chapter 26, G. Charles Dismukes, Gennady M. Ananyev and Richard Watt discuss the assembly of manganese cluster in the presence of light. This is followed by a review on the mechanisms and regulation of photoinactivation and recovery of D1 protein by light in PS II in Chapter 27 by Wah Soon Chow and Eva-Mari Aro. Chapter 28 discusses the regulation of transcription and translation of gene expression of the *PS II* genes, Kenichi Yamaguchi, Stephen P. Mayfield and Mamoru Sugita. Chapter 29 covers protein import and post-translational modifications of PS II proteins, by Steven M. Theg and Lan-Xin Shi.

Part VII of this volume discusses the comparison of PS II with artificial and other natural systems. Chapter 30 in this section reviews the origin and evolutionary aspects of oxygen evolution by PS II, by G. Charles Dismukes and Robert E. Blankenship. In Chapter 31, Gary W. Brudvig and Marten Wikstrom compare the PS II to the cytochrome oxidase of mitochondria. Two totally opposite reactions are catalysed by these enzymes: the process of water oxidation/oxygen production by PS II and oxygen reduction/water production by cytochrome c oxidase. In Chapter 32, the point of focus is on the models and experimental evidences for evolutionary development of PS II from purple bacteria to higher plants, by Laszlo Kalman, JoAnn C. Williams and James P. Allen. This provides evidence that PS II development was a unique one-time event in the history of the earth. The next two chapters (33 and 34) provide experimental details of mimicking photosynthesis in *de novo* proteins and artificial systems. These are by Brian R. Gibney and Cecilia Tommos, and by Ann Magnuson, Stenbjörn Styring and Leif Hammarström respectively.

Other features that deserve special mention and make the book more impressive and informative, are discussions of instrumentation and methodology of different spectroscopic techniques like Mn X-ray absorption near edge spectroscopy, Mn Kβ X-ray emission spectroscopy, Fourier transform infrared vibrational spectroscopy, electron paramagnetic resonance, electron crystallography, and X-ray crystallography and their implications in the understanding of PS II structure and functioning. This should be useful to students at both undergraduate and graduate levels as well as researchers. The 16 coloured plates at the beginning of the book, and different illustrative figures in the text are not only eye-catching, but necessary for in-depth understanding of PS II structure and excitation energy and electron transfer within this enzyme. All the chapters are scholarly and provide the readers with leads into the literature through their extensive and complete references. Inclusion of short biographies and photographs of the Series Editor; the Editors, Assistant Editor and typesetter, gives this volume a personal flavour. If one examines the list of authors of this book, it is the 'who's who of photosystem II researchers in the world'.

Thus this book is impressive in all aspects. Such plentiful knowledge on PS II can be explored in the bioengineering of PS II to provide photo-protection and generation of new non-polluting fuels from solar energy and water. As this is a topic of global interest nowadays, this book is informative and has been published at an appropriate time. Further, this book is a molecular guide to future protein engineers and bio-mimetic chemists working in the field of generating fuel cells. This remarkable book is a must read for all students and researchers involved in the field of photosynthesis, biochemistry, biophysics, molecular biology and biotechnology. We recommend this book to all the major science and engineering libraries as well as people working in industry and researchers in PS II bioengineering.

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Plant diseases significantly influence world economy. According to FAO estimates, plant diseases could cost the US alone $33 billion per year (Maor and Shirasu, 2005). Among all plant pathogens, fungi probably cause the most devastating damage, with it being estimated that more than 13,000 fungal pathogens and 75,000 plant–fungal combinations exist in the world. A recent record of the plant pathogens in the world showed that 12 of the 19 most threatening pathogens listed are fungi (Maor and Shirasu, 2005). Recent advances in molecular biology, especially the use of model plant–microbe systems, have significantly increased our understanding of the complexity of the ongoing plant–pathogen war. Plant pathologists are working around the world to develop new, more efficient and environmentally sustainable methods to manage plant diseases. In this context, the present volume of *Annual Review of Phytopathology* provides a broad conceptual, in-depth analysis and persuasive arguments on various fascinating aspects of plant–pathogen interactions and effective, durable control measures against harmful pathogens.

This volume contains detailed accounts written by leading researchers on a wide variety of topics that are of contemporary and prime importance in the field of plant pathology and global food security. The volume offers an excellent compendium of articles in the diverse field of phytopathology. The most impressive fea-