Wydrzynski, T.J., Satoh, K. (ed.): **Photosystem II – The Light-driven Water: Plastoquinone Oxidoreductase**. – Springer, Dordrecht 2005. ISBN-10 1-4020-4249-3(HB); ISBN-13 978-1-4020-4249-2(HB); ISBN-10 1-4020-4254-X(e-book); ISBN-13 978-1-4020-4254-6(e-book). 756 + xxvii pp + 16 colour plates, € 315.65.

This book is the 22nd volume of the series "Advances in Photosynthesis and Respiration" that Govindjee (USA) edits and Springer (the Netherlands) publishes. This truly prestigious series, which began in 1994, under Kluwer (Netherlands), had its 23rd volume published in 2006, and more volumes are to follow thereafter.

Oxygenic photosynthesis, which appeared some time between 2.7 and 2.3 billion years ago (late Archaean and early Proterozoic eras; see chapter 30) was a momentous, unprecedented, and thermodynamically unthinkable event: a "big bang of evolution", according to J. Barber. It succeeded in changing gradually not only the chemical composition of Earth's atmosphere to its present day concentrations of O_2 and CO_2 and in oxidizing ferrous ores to ferric on its surface, but also to open a vast supply of metabolic energy to living organisms through the controlled exothermic recombination of the end products of oxygenic photosynthesis, *i.e.* of O_2 and of C(HOH) compounds.

The book views photosystem II (PSII) as a water-plastoquinone oxido-reductase consisting of a protein scaffold (~25 subunits; 260 MDa) on which (*a*) photon-capturing pigment system (antenna), (*b*) a light-redox potential transducing complex (reaction centre, RCII), (*c*) a water-oxidizing and oxygen evolving complex (OEC), and (*d*) a series of electron transporting cofactors are organized. This multifunctional assembly uses photon energy to achieve the thermodynamically unfavourable decomposition of water into molecular oxygen, protons, and electrons (that are placed on reduced plastoquinone molecules) and segregates the products physically in order to prevent their spontaneous recombination.

The book is divided into 7 parts that accommodate 34 chapters. It begins with a "Dedication/Perspective: A Tribute to Jerry Babcock", written for the late PSII pioneer G.T. Babcock (1946–2000) by C.F. Yocum, R.E. Blankenship, and S. Ferguson-Miller. It then proceeds to Part I (1 chapter), "A Perspective of Photosystem II Research" that was authored by the volume and series editors. This chapter is a portal to what will ensue in the following chapters, providing at the same time a historical backdrop on PSII. Part II (6 chapters), "Protein Constituents of Photosystem II", is devoted to the intra-membranous holochrome assemblies of the core complex and of the major and the minor light-harvesting antenna complexes, and to the extra-membranous protein constituents of PS2 and their functional roles. Part III (9 chapters), "Organization of the Functional Sites in Photosystem II", deals with the organization of various functional sites, focusing on primary electron transport in RCII initiated by exciton trapping, on the pre-RCII ($H_2O \rightarrow \{Mn_4Ca^{2+}Cl^-_x\} \rightarrow Tyr_Z \rightarrow P_{680}^+$) and post-RCII ($P_{680}^+ \rightarrow$ Pheo $a \rightarrow Q_A \rightarrow Q_B$(Fe) $\rightarrow \cdots$) electron transporting chains, as well as on Cyt b_{559}-harboring side electron carriers, and on the inorganic ion cofactor requirements (Ca^{2+}, Cl^-, and HCO_3^-). Part IV (6 chapters), "Structural Basis for Photosystem II", describes the three-dimensional topology of PSII as revealed by X-ray crystallography, cryoelectron microscopy, and complementing techniques, such as Fourier transform infrared (FTIR) difference spectroscopy, and electron paramagnetic resonance (EPR).

Four chapters in Part V, "Molecular Dynamics of Photosystem II", address themes on excited state and ground state molecular dynamics. The diffusion of excitons in the antenna and their photochemical trapping at RCII are examined here in detail, and also the regulated (*via* the so-called xanthophyll cycle) and the unregulated dissipation of excess excitation by carotenoids (non-photochemical quenching). A chapter on ground state dynamics of O_2 evolution is included here also. Selected topics in Part VI (4 chapters), "Assembly and Biodynamics of Photosystem II", address themes such as the regulation of PSII gene expression, at the transcriptional and the translational levels, the post-translational tailoring, transport and targeting of these proteins, as well as the mechanisms involved in their photoinhibitory damage and recovery. The last part, Part VII (5 chapters), "Comparison of Photosystem II with Other Natural/ Artificial Systems", examines the origin and the early evolution of PSII and compares it with other analogous natural and artificial systems, such as the cytochrome oxidase of respiratory metabolism, the reaction centres of non-oxygenic photosynthetic bacteria, and selected biomimetic systems of *de novo* protein design and artificial photochemical water-splitting and O_2 evolution (artificial photosynthesis) using transition metal oxides (ruthenium-manganese complexes in the present case).

Volume 22 parades 75 internationally-acclaimed experts from 13 countries in its pages as authors of its 34 chapters. Unfortunately, space restrictions do not allow this reviewer to refer to each one individually.

Although the concepts that are discussed in the book are truly frontline, the language used is not too technical as to bar their understanding by those who are not initiated in photosynthesis. The book is, therefore, strongly recommended not only to students, teachers, and researchers in areas that are relevant to its contents, but also to scholars of plant sciences and physicochemical sciences in general, who want to update their current understanding of photosynthesis. Also, I recommend this book to all the major libraries of universities and research institutes around the World. Members of the International Society of Photosynthesis Research (ISPR) receive 25 % discount (http://www.springer.com/home/life+sci/ispr+society+page).

G.C. PAPAGEORGIOU (*Athens*)