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ANNOUNCEMENT

# Advances in Photosynthesis and Respiration, Volume 24 (Photosystem I) and Volume 25 (Chlorophylls and Bacteriochlorophylls)

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I am delighted to announce, in *Advances in Photosynthesis and Respiration* (AIPH) Series, the publication of two new volumes. Volume 24 (*Photosystem I: The Light-Driven Plastocyanin:Ferredoxin Oxidoreductase*) integrates the biochemistry, biophysics and molecular biology of Photosystem I, the reaction center that provides the necessary reducing power for carbon fixation in plants, algae and cyanobacteria, while volume 25 (*Chlorophylls and Bacteriochlorophylls: Biochemistry, Biophysics, Functions and Applications*) discusses in detail the key pigments that play many crucial roles at the heart of Photosystem I (Volume 24), Photosystem II (Volume 22) and anoxygenic photosynthesis (Volume 2 and a forthcoming volume).Volume 24 was edited by a distinguished authority John H. Golbeck (University Park, PA, USA), and volume 25 by four distinguished authorities: Bernhard Grimm (Berlin, Germany), Robert (Bob) Porra, (Canberra, Australia), Wolfhart Rüdiger (Munich, Germany) and Hugo Scheer (Munich, Germany).

These books on *Photosystem I* and on *Chlorophylls & Bacteriochlorophylls* follow the following 23 volumes.

## Published Volumes (1994–2006)

For a link to description of volumes 1–18, see http://www.life.uiuc.edu/govindjee/newbook/Vol1–18.html, and for a link to description of volumes 19–22, see http://www.life.uiuc.edu/govindjee/newbook/Vol19–25.html.

*Volume 1: Molecular Biology of Cyanobacteria* (28 chapters; 881 pages; 1994; edited by Donald A. Bryant, from USA; ISBN: 0-7923-3222-9);

*Volume 2: Anoxygenic Photosynthetic Bacteria* (62 chapters; 1331 pages; 1995; edited by Robert E. Blankenship, Michael T. Madigan and Carl E. Bauer, from USA; ISBN: 0-7923-3682-8);

*Volume 3: Biophysical Techniques in Photosynthesis* (24 chapters; 411 pages; 1996; edited by the late Jan Amesz and the late Arnold J. Hoff, from The Netherlands; ISBN: 0-7923-3642-9);

*Volume 4: Oxygenic Photosynthesis: The Light Reactions* (34 chapters; 682 pages; 1996; edited by Donald R. Ort and Charles F. Yocum, from USA; ISBN: 0-7923-3683-6);

*Volume 5: Photosynthesis and the Environment* (20 chapters; 491 pages; 1996; edited by Neil R. Baker, from UK; ISBN: 0-7923-4316-6);

*Volume 6: Lipids in Photosynthesis: Structure, Function and Genetics* (15 chapters; 321 pages; 1998; edited by Paul-André Siegenthaler and Norio Murata, from Switzerland and Japan; ISBN: 0-7923-5173-8);

*Volume 7: The Molecular Biology of Chloroplasts and Mitochondria in Chlamydomonas* (36 chapters; 733 pages; 1998; edited by Jean David Rochaix, Michel Goldschmidt-Clermont and Sabeeha Merchant, from Switzerland and USA; ISBN: 0-7923-5174-6);

*Volume 8: The Photochemistry of Carotenoids* (20 chapters; 399 pages; 1999; edited by Harry A. Frank, Andrew J. Young, George Britton and Richard J. Cogdell, from USA and UK; ISBN: 0-7923-5942-9);

*Volume 9: Photosynthesis: Physiology and Metabo-*

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*lism* (24 chapters; 624 pages; 2000; edited by Richard C. Leegood, Thomas D. Sharkey and Susanne von Caemmerer, from UK, USA and Australia; ISBN: 0-7923-6143-1);

*Volume 10: Photosynthesis: Photobiochemistry and Photobiophysics* (36 chapters; 763 pages; 2001; authored by Bacon Ke, from USA; ISBN: 0-7923-6334-5);

*Volume 11: Regulation of Photosynthesis* (32 chapters; 613 pages; 2001; edited by Eva-Mari Aro and Bertil Andersson, from Finland and Sweden; ISBN: 0-7923-6332-9);

*Volume 12: Photosynthetic Nitrogen Assimilation and Associated Carbon and Respiratory Metabolism* (16 chapters; 284 pages; 2002; edited by Christine Foyer and Graham Noctor, from UK and France; ISBN: 0-7923-6336-1);

*Volume 13: Light Harvesting Antennas* (17 chapters; 513 pages; 2003; edited by Beverley Green and William Parson, from Canada and USA; ISBN: 0-7923-6335-3);

*Volume 14: Photosynthesis in Algae* (19 chapters; 479 pages; 2003; edited by Anthony Larkum, Susan Douglas and John Raven, from Australia, Canada and UK; ISBN: 0-7923-6333-7);

*Volume 15: Respiration in Archaea and Bacteria: Diversity of Prokaryotic Electron Transport Carriers* (13 chapters; 326 pages; 2004; edited by Davide Zannoni, from Italy; ISBN: 1-4020-2001-5);

*Volume 16: Respiration in Archaea and Bacteria 2: Diversity of Prokaryotic Respiratory Systems* (13 chapters; 310 pages; 2004; edited by Davide Zannoni, from Italy; ISBN: 1-4020-2002-3);

*Volume 17: Plant Mitochondria: From Genome to Function* (14 chapters; 325 pages; 2004; edited by David A. Day, A. Harvey Millar and James Whelan, from Australia; ISBN: 1-4020-2339-5);

*Volume 18: Plant Respiration: From Cell to Ecosystem* (13 chapters; 250 pages; 2005; edited by Hans Lambers and Miquel Ribas-Carbo; from Australia and Spain; ISBN: 1-4020-3588-8);

*Volume 19: Chlorophyll a Fluorescence: A Signature of Photosynthesis* (31 chapters; 818 pages; 2004; edited by George C. Papageorgiou and Govindjee, from Greece and USA; ISBN: 1-4020-3217-X);

*Volume 20: Discoveries in Photosynthesis* (111 chapters; 1210 pages; 2005; edited by Govindjee, J. Thomas Beatty, Howard Gest and John F. Allen, from USA, Canada and Sweden (& UK); ISBN: 1-4020-3323-0);

*Volume 21: Photoprotection, Photoinhibition, Gene Regulation, and Environment* (21 chapters; 380 pages; 2006; edited by Barbara Demmig-Adams, William W. Adams III and Autar K. Mattoo, from USA; ISBN: 1-4020-3323-0);

*Volume 22: Photosystem II: The Light-Driven Water: Plastoquinone Oxidoreductase.* (34 chapters; 786 pages; 2005; edited by Thomas J. Wydrzynski and Kimiyuki Satoh, from Australia and Japan; ISBN: 1-4020-4249-3); and

*Volume 23: Structure and Function of the Plastids* (27 Chapters; 575 pages; 2006; edited by Robert Wise and J. Kenneth Hoober, both from USA; ISBN: 1-4020-4060-1).

Comments on the AIPH Series by Robert Blankenship are at: http://www.life.uiuc.edu/govindjee/newbook/Quotation.html, and by Susan Golden at: http://www.life.uiuc.edu/govindjee/newbook/Quotation-s.html.

Further information on these books and ordering instructions can be found at http://www.springeronline.com under the Book Series ''Advances in Photosynthesis and Respiration''. Special discounts are available to members of the International Society of Photosynthesis Research, ISPR (http://www. photosynthesisresearch.org/). You may also want to look at: http://www.life.uiuc.edu/govindjee/newbook/Vol%2024.html> for information on volume 24, and http://www.life.uiuc.edu/govindjee/newbook/Vol%2025.html > on volume 25.

## About Volume 24: Photosystem I: The Light-Driven Plastocyanin:Ferredoxin Oxidoreductase

This book summarizes, in 40 authoritative chapters, the advances made in the last decade in the biophysics, biochemistry and molecular biology of the enzyme known as Photosystem I, the light-driven plastocyanin:ferredoxin oxidoreductase. Photosystem I participates along with Photosystem II in harvesting solar energy to supply photosynthetic organisms with stored chemical energy in the form of ATP and stored reducing power in the form of NADPH for metabolism, growth and reproduction. This volume is unique as it is the first such book on Photosystem I ever produced: it contains chapters that include information on molecular architecture, protein–pigment interactions, excitation and electron transfer dynamics, protein–cofactor interactions, kinetics of electron transfer and bio-assembly of proteins and cofactors. The volume begins with a series of historical perspectives that provide a solid background to the field, and ends with information on modeling of light harvesting and electron transfer reactions, and the evolution of the reaction center. Particular attention is paid to spectroscopy, including the theory of the measurement and the interpretation of the data. The book is a

comprehensive and up-to-date source of background information on the Photosystem I reaction center for seasoned researchers, those who are just entering the field, Ph.D. students, researchers and undergraduates in the fields of biophysics, biochemistry, microbiology, agriculture, and ecology. I remain in awe at the encyclopedic knowledge provided in this Bible of Photosystem I. It complements ''Photosystem II: The Light Driven Water:Plastoquinone Oxidoreductase'' edited by Thomas J. Wydrzynski and Kimiyuki Satoh (Volume 22, published in 2005). Electrons are transferred from water to plastoquinone by Photosystem II and plastoquinol transfers these electrons to Photosystem I via the cytochrome $b_6f$ complex and plastocyanin, and Photosystem I reduces $NADP^+$. The book 'Photosystem I: The Light-Driven, Plastocyanin:Ferredoxin Oxidoreductase' is divided into the following topics:

Historical Perspectives (4 chapters);
Molecular Architecture (4 chapters);
Pigment–Protein Interactions (3 chapters);
Excitation Dynamics and Electron Transfer Processes (2 chapters);
Modification of the Cofactors and their Environments (2 chapters);
Spectroscopic Studies of the Cofactors (8 chapters);
Kinetics of Electron Transfer (6 chapters);
Biosynthetic Processes (3 chapters);
Modeling of Photosystem I Reactions (4 chapters);
Cyclic Photophosphorylation (1 chapter);
Photoinhibition (1 chapter); and
Evolution (2 chapters).

For Table of Contents of this extraordinary book, see: http://www.life.uiuc.edu/govindjee/photosynSeries/volume24.pdf>. This book is written by 80 international authorities from 13 countries (Canada, Denmark, France, Germany, Israel, Italy, Japan, Russia, Spain, Switzerland, The Netherlands, United Kingdom and the United States of America); it is, thus, an international book.

I thank each and every author by name (listed in alphabetical order) that reads like a 'Who's Who in 'Photosystem I research':

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## About Volume 25: Chlorophylls and Bacteriochlorophylls: Biochemistry, Biophysics, Functions and Applications

In the past, AIPH volumes included, by necessity, functions of chlorophylls and bacteriochlorophylls acting as key components of both antenna and reaction centers, but none of these volumes focused on all the aspects of the properties and of the roles played by these key pigments, not only in the natural process of photosynthesis, but also in such applications as the photodynamic treatment of cancerous tumors and the detection and measurement of chlorophyll-bearing phytoplankton from satellites in outer space. This book integrates all this knowledge on these pigments essential for life on earth.

Chlorophylls are the most obvious natural pigments on Earth being observable, as they are, from outer space; they also sustain all life on Earth by their involvement in photosynthesis. With 37 concise chapters, this book reviews recent progress and current status of studies of the chemistry, metabolism and spectroscopy of both chlorophylls and chlorophyll–protein complexes. Also discussed is the progress on the applications of the chlorophylls as photosensitizers in photodynamic therapy of cancerous tumors, as molecular probes and as reporters on the physiological status of whole plants and ecosystems. The last book

dedicated to chlorophylls was published in 1991, and is out of print since 1995; thus this book fills a gap by summarizing the chemical, physical, biological and medical aspects of chlorophyll research and development with a focus on the tremendous progress achieved over the past 15 years. The book is aimed equally at advanced students and both novice and experienced researchers: each of the five sections has an up-to-date introductory overview, which is followed by a series of concise well-focused and fully referenced chapters written by relevant specialist chemists, biochemists, biophysicists, photobiologists and pharmacologists.

This book has 37 authoritative chapters written by 70 international authorities from 18 countries (Australia, Austria, Belarus, Czech Republic, Denmark, France, Germany, Indonesia, Israel, Japan, Malaysia, Mexico, The Netherlands, Russia, Spain, Switzerland, United Kingdom and the United States of America). It is, therefore, a truly international book and the editors deserve our thanks and our congratulations for providing this gift for our future. It was a Herculean task that Hugo Scheer and his co-editors Bernhard Grimm, Bob Porra and Wolfhart Rüdiger have accomplished. I still marvel at the diversity and depth of knowledge provided in this most recent and authoritative text on chlorophylls and bacteriochlorophylls.

Chlorophylls and Bacteriochlorophylls: Biochemistry, Biophysics, Functions and Applications is divided into the following topics:

Structures; chemistry and analysis (9 chapters);
Metabolism (9 chapters);
Native environment (9 chapters);
Functions (4 chapters); and
Applications (6 chapters).

For Table of Contents of this extraordinary book, see: http://www.life.uiuc.edu/govindjee/photosynSeries/volume25.pdf>.

I thank each and every author by name (listed in alphabetical order) that reads like a 'Who's Who in 'chlorophyll and bacteriochlorophyll research':

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*The Web Site for the Chlorophyll and Bacteriochlorophyll Book*. A unique innovation introduced by the editors for this book has been the construction of a web site that hosts the supplementary material including several colored figures. It is located at http://epub.ub.uni-muenchen.de/archive/00000776/.

Our readers will really appreciate this contribution by the editors.

## A Bit of History—From there to here

### Photosystem I

Just to give a flavor of history, I list below some discoveries. [For historical perspectives, I refer the readers to chapters 1–4 (Anthony San Pietro; Richard Malkin; Bacon Ke; and Paul Mathis and Kenneth Sauer) in volume 24.]

Discovery of P700, the reaction center of Photosystem I (PS I) by: Bessel Kok (1918–1978; see Kok, Biochim. Biophys. Acta 22: 399–401, 1956). In Wageningen, in The Netherlands, Kok discovered, in several photosynthetic organisms, a light-induced absorbance decrease that had its highest long-wavelength peak at 700 nm (labeled as P700).

Discovery of the Two-Light Effects occured in USA in Urbana (IL) and Baltimore (MD) and a formulated hypothesis in Cambridge, UK. In 1957, Robert Emerson discovered two-light effect in photosynthesis (Proc. Natl. Acad. Sci. USA 43: 133–143, 1957); it was to be later called the Emerson Enhancement effect. In 1959, Bessel Kok (Plant Physiol. 34: 184–192, 1959) showed, in cyanobacteria, that red light oxidized P700 and orange light reduced oxidized P700. Robin Hill and Fay Bendall, in UK,

published, in 1960, their now famous Z-scheme (Nature 186: 136–137, 1960). Bessel Kok and George Hoch, from Baltimore, MD, presented in 1960 (see W.D. McElroy and B. Glass (eds) (1961) A Symposium on Light and Life, pp 397–423. The Johns Hopkins Press, Baltimore, MD) a two-light reaction scheme, based on a multitude of experiments.

In 1961, Louis N. M. Duysens, Jan Amesz and B.M. Kamp (Nature 190: 510–511, 1961) provided the crucial evidence for the two light reaction two-pigment system scheme, working in series. In the red alga *Porphyridium cruentum*, red light absorbed by chlorophyll *a* oxidized a cytochrome. When green light, absorbed by phycoerythrin, was superimposed, the oxidized cytochrome became reduced. Duysens called the red light 'light 1,' and the chlorophyll a—containing system, 'system 1.' The other light, they had called 'light 2,' was absorbed by 'system 2.'

Crystal structure of Photosystem I in Berlin, Germany: P. Jordan et al. (Nature 411: 909–917, 2001) were the first to resolve the X-ray crystallographic structure of Photosystem I of a thermophilic cyanobacterium at 2.5 Å resolution.

## Chlorophylls and Bacteriochlorophylls

### *Discoveries*

In 1818, two French scientists Pierre Joseph Pelletier (1788–1842) and Joseph Bienaimé Caventou (1795–1877) named the green plant pigment chlorophyll ('green of leaf').

In 1877, the Russian physiologist Climent A. Timiriazeff (1843–1920) established the red maximum of the absorption spectrum of chlorophyll and showed that red light absorbed by chlorophyll is the most efficient for photosynthesis. On the basis of this experiment, he claimed that chlorophyll is an optical and chemical photosensitizer of photosynthesis. He proposed that light absorption by chlorophyll causes its chemical transformation, which induces further reactions leading to photosynthesis.

In 1906, the Russian botanist, Mikhail Semenovich Tswett (1872–1919), separated the plant pigments (chlorophylls and carotenoids) by passing a solution containing the natural pigment mixture through glass columns packed with finely-divided calcium carbonate, thereby inventing a new technique appropriately called chromatography ('color representation' or 'color writing').

In 1915, Richard Martin Willstätter (1872–1942), of Munich (Germany), received a Nobel Prize in Chemistry for his detailed chemical investigations on chlorophyll, including its chemical nature; he suggested that chlorophylls play an active role in photosynthesis. Willstätter's close collaborator in these studies was Arthur Stoll (1887–1971) of Switzerland.

In 1930, Hans Fischer (1881–1945), also of Munich, Germany, received a Nobel Prize in Chemistry: he had made new inroads into the chemistry of chlorophyll, the structure of which he elucidated in the subsequent 12 years. The award recognized his researches into the constitution of porphyrins, hemins and chlorophylls.

In 1965, Robert Burns Woodward (1917–1979), of Harvard University, USA, received a Nobel Prize in Chemistry for the synthesis of many organic compounds including chlorophyll, the topic of this book (volume 25).

Shortly after, in 1966, the terpenoid specialist Basil C. C. Weedon of Imperial College, London, published a full record of the synthesis of phytol, the esterifying alcohol of most chlorophylls that comprises about 1/3 of their mass.

### *The Books*

The appearance over the past 100 years of several books dedicated to chlorophylls emphasizes the importance of and continuing interest in the subject.

In 1913, the first concise account of chlorophyll research was published in a 423 page book *Untersuchungen über Chlorophyll* (*Investigations on Chlorophyll)* by Richard Willstätter and Arthur Stoll (Verlag Julius Springer, Berlin).

Between 1934 and 1940, Hans Fischer and Hans Orth published a monumental work *Die Chemie des Pyrrols* (*The Chemistry of Pyrroles*, Akademische Verlagsgesellschaft, Leipzig). The 2nd half of volume 2, by Hans Fischer and Adolf Stern, published in 1940, was entirely dedicated to chlorophylls. The relevance of this book is witnessed by its repeated reprinting, first in 1943 (Edwards Brothers, Ann Arbor, Michigan) and again in 1968 (Johnson Reprint Corporation, New York and London).

In 1966, Leo P. Vernon and Gilbert R. Seely, both from USA, edited a 679 page book *The Chlorophylls* (Academic Press, New York); they had 22 authors, but none appear in the current Grimm et al. book (volume 25).

In 1991, one of the editors of the current book, Hugo Scheer (from Munich, Germany), edited a 1257 page detailed and beautiful opus (Chlorophylls, CRC Press, Boca Raton). This book had 72 authors and 42 chapters. I am delighted to see that among these 72 authors,

8 (Sam Beale, Masami Kobayashi, Tony Larkum, Bob Porra, Wolfhart Rüdiger, Hugo Scheer, Avigdor Scherz, Yuzo Shioi, and Tadashi Watanabe) are also authors in the current book (volume 25).

For a time-line on oxygenic photosynthesis, see Govindjee and David Krogmann (2004) Photosynthesis Research 80: 15–57, and on anoxygenic photosynthesis, see H. Gest and R. E. Blankenship (2004) Photosynthesis Research 80: 59–70.

## Future AIPH and Related Books

The readers of the current series are encouraged to watch for the publication of the forthcoming books (not necessarily arranged in the order of future appearance):

- Biophysical Techniques in Photosynthesis II (Editors: Thijs J. Aartsma and Jörg Matisyk);
- The Purple Photosynthetic Bacteria (Editors: C. Neil Hunter, J. Thomas Beatty, Fevzi Daldal and Marion Thurnauer);
- Photosynthesis: A Comprehensive Treatise; Biochemistry, Biophysics, Physiology and Molecular Biology, Part 1 (Editors: Julian Eaton-Rye and Baishnab Tripathy);
- Photosynthesis: A Comprehensive Treatise; Biochemistry, Biophysics, Physiology and Molecular Biology, Part 2 (Editors: Baishnab Tripathy and Julian Eaton-Rye)
- The Chloroplast: Biochemistry, Molecular Biology and Bioengineering. Part 1. The Chloroplast System: Pigments, Lipids, Pigment-Protein and Molecular Complexes (Editors: Constantin A. Rebeiz, C. Benning, Hans Bohnert, Henry Daniell, J. Kenneth Hoober, Hartmut Lichtenthaler, Archie R. Portis and Baishnab C. Tripathy);
- The Chloroplast: Biochemistry, Molecular Biology and Bioengineering. Part 2. Genes, Genomes, Proteomes, Regulation, Transformation, Bioengineering and Stress (Editors: Constantin A. Rebeiz, C. Benning, Hans Bohnert, Henry Daniell, J. Kenneth Hoober, Hartmut Lichtenthaler, Archie R. Portis and Baishnab C. Tripathy);
- C4 Photosynthesis and Related $CO_2$ Concentrating Mechanisms (Editors: Agepati S. Raghavendra and Rowan F. Sage);
- Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation (Editors: Ashwani Pareek, Sudhir K. Sopory, Hans J. Bohnert and Govindjee); and
- Sulfur Metabolism in Phototrophic Organisms (Editors: Ruediger Hell, Christiane Dahl, Thomas Leustek and David Knaff)

In addition to these contracted books, we are in touch with prospective Editors for the following books:

ATP Synthase
Photosynthesis In Silico: Modeling of Photosynthesis
Interactions between Photosynthesis and other Metabolic Processes
Molecular Biology of Cyanobacteria II
Systems Biology of Photosynthesis: Genomics and Proteomics
Hydrogen Evolution
Global Aspects of Photosynthesis
Artificial Photosynthesis

Readers are encouraged to send their suggestions for future volumes (topics, names of future editors, tentative table of contents, and of future authors) to me by E-mail (gov@uiuc.edu) or fax (1-217-244-7246).

In view of the interdisciplinary character of research in photosynthesis and respiration, it is my earnest hope that this series of books will be used in educating students and researchers not only in Plant Sciences, Molecular and Cell Biology, Integrative Biology, Biotechnology, Agricultural Sciences, Microbiology, Biochemistry, and Biophysics, but also in Bioengineering, Chemistry, and Physics.

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