

## Book review

**Advances in Photosynthesis and Respiration**, Series Editor: Govindjee, University of Illinois, Urbana-Champaign, published by Kluwer Academic Publishers (now Springer), Dordrecht, The Netherlands [1994–2004].

‘Raining on an idea for a decade: A sustainable series on photosynthesis and now respiration as well’ is the way I visualize the AIPH series of books and I present here my perspective on this series. To students of botany and plant sciences, photosynthesis had been an esoteric subject at least for students in most Indian Universities. Today, of course, the situation has improved a lot, but it was awful in the 1950s when I was an undergraduate student at Ravenshaw College, Cuttack. The books on plant physiology of the time dealt with biochemical aspects of photosynthesis, but there was hardly anything on biophysical aspects. In most of India, manometric techniques were then used for measuring fruit ripening (respiration), but not so much for photosynthesis. The famous volumes (Volume I; Volume II, part 1; Volume II, part 2) ‘Photosynthesis and Related Processes’ by Eugene Rabinowitch (1945, 1951, 1956) were not available or known to the then Indian students of botany. Exceptions were: Calcutta (now Kolkata), Benares (now Varanasi) and Allahabad, where photosynthesis research was then carried out.<sup>1</sup>

The scope of photosynthesis research is very vast, extending from photon capture to productivity, from molecular biology to landscaping – the subject is important to physicists, chemists, biologists, town planners and economists. The global research output of photosynthesis is explosive! For such a ‘bubbling’ subject, it is natural to have volumes appearing at regular intervals on one or more aspects of *Photosynthesis Research*. At the initiative of Govindjee, Kluwer Academic Publishers began publishing, in 1994, ‘Advances in Photosynthesis (AIPH)’ that catered to such a need. The series editor Govindjee and his team of international editors have brought out 19 exciting

volumes on photosynthesis and respiration within a decade (1994–2004). Earlier, a series of 12 volumes on ‘Topics in Photosynthesis’ edited by James Barber, of the Imperial College, London<sup>2</sup> were published by Elsevier, also of The Netherlands, during a period of 16 years (1976–1992); these books were quite popular with the readers, but the series was aborted and now the current series of volumes on photosynthesis and respiration by Kluwer (now Springer) have gained popularity among the researchers and general readers. The series editor has paid rigorous attention to novel topics and front line research areas, and has chosen internationally-renowned expert editors; Kluwer (now Springer) has maintained the quality in production. The volumes on carotenoids, lipids, light harvesting antennas, algal photosynthesis and carbon–nitrogen regulation represent the new outlook of the series.

The first volume of the series ‘Molecular Biology of Cyanobacteria’, edited by Donald A Bryant, made a thunderous appearance in 1994. It was an instant hit at the ‘target’. Photosynthesis researchers globally were looking for such a book<sup>3</sup>. The second volume, edited by Robert E. Blankenship, Michael T. Madigan and Carl Bauer discussed all aspects of bacterial photosynthesis in ‘Anoxygenic Photosynthetic Bacteria’; this book, published in 1995, filled the void for the requirement of a text, and acted as a reference source for courses in microbiology and biotechnology.<sup>4</sup> The third volume, ‘Biophysical Techniques in Photosynthesis’ (edited by the late Jan Ames and the late Arnold Hoff) appeared in 1996. Biologists working on one or more aspects of photosynthesis needed such a volume for their laboratories.<sup>5</sup> Familiarity with biophysical techniques for photosynthesis research is essential and newer physical techniques shall be used in the future.

In 1996, the fourth volume ‘Oxygenic Photosynthesis: The Light Reactions’ (edited by Donald Ort and Charles F. Yocum) was published and it captured the market.<sup>6</sup> I found this volume in many libraries in spite of its high cost. Evolution of

oxygen from water, driven by Photosystem II, is still a miracle of nature and the advancement of techniques now permits us to take a closer look at the *sanctum sanctorum* of oxygenic photosynthesis; This is now available as a new AIPH book 'Photosystem II: The Light-Driven water: Plastoquinone Oxidoreductase' (edited by Thomas J. Wydrzynski and Kimiyuki Satoh). The next in the series 'Photosynthesis and the Environment' (Volume 5, edited by NR Baker) was also published in 1996; in my opinion, it was a rather low key resource affair. The environmental aspects discussed in the book<sup>7</sup> did not measure up to the needs of ecology and environment readers. However, within a short span of two years, Kluwers' AIPH series became a familiar name for students and researchers across the field, around the world.

Authors of volume 6 discussed exclusively the role of lipids in photosynthesis. This volume 'Lipids in Photosynthesis: Structure, Function and Genetics', edited by Paul-André Siegenthaler and Norio Murata, encouraged the researchers to look at the specific role of lipids<sup>8</sup> on oxygen evolution. Many functions of lipids in photosystem II are being studied now.

The next volume (7, 1998) was devoted to a pet organism, the *Chlamydomonas*, whose genetics has been a fond subject for photosynthesis researchers. 'The Molecular Biology of *Chlamydomonas*', edited by Jean-David Rochaix, Michel Goldschmidt-Clermont and Sabeeha Merchant proved also to be a favourite volume of the series, among many researchers I know.<sup>9</sup> The green alga *Chlamydomonas* (for short, Chlamy) 'reigns' in photosynthesis research just as the prokaryotic queen *Synechocystis* sp. PCC 6803 does. The volume 8 of the series was on carotenoids – the pigments which are no longer relegated as having only accessory function in photosynthesis. The volume 'Photochemistry of Carotenoids', edited by Harry A. Frank, Andrew J. Young, George Britton and Richard Cogdell, was published in 1999; it is a lovely book of the series<sup>10</sup>. *The Photochemistry of Carotenoids* sharpened our understanding of the role of carotenoids in nonphotochemical quenching and photoprotection. The topic of regulation of plant's life by light is so crucial that another book 'Photoprotection, Photoinhibition, Gene Regulation and Environment' (edited by Barbara Demmig-Adams, William Adams III and Autar Mattoo) is now at the typesetters.

Volume 9 'Photosynthesis: Physiology and Metabolism', edited by Richard C. Leegood, Thomas D. Sharkey and Susanne Von Caemmerer, has literally become a text book of photosynthesis in the new millennium in several parts of the World.<sup>11</sup> It bridged the gap between metabolism and physiology and between biochemistry and ecology. This book is very popular among photosynthesis researchers in India.

Bacon Ke's 'Photosynthesis: Photobiochemistry and Photobiophysics' is unique (Volume 10, 2001) in the AIPH series.<sup>12</sup> The book represents masterly presentation of developments in electron transfer processes in photosynthesis. The paperback edition of this book is a bargain for the low price, and I recommend it to all students in the field of photosynthesis. (If Springer runs out of copies, they should be requested to print more copies.)

Starting with volume 11, published in 2001, the name of the series changed to include 'and Respiration' to express the commonality and the differences between the two bioenergetic processes that remain intertwined in photosynthetic systems. This volume of the series 'Regulation of Photosynthesis', edited by Eva-Mari Aro and Bertil Andersson, provides the images of current research in photosynthesis – it discusses how a complex subject like photosynthesis is regulated.<sup>13</sup> Volume 12 of the series 'Photosynthetic Nitrogen Assimilation and Associated Carbon and Respiratory Metabolism', edited by Christine Foyer and Graham Noctor, was published in 2002; it extends the approach of elucidating the valves and the knots in the networking of carbon and nitrogen assimilation – the two important plant processes holding key for our sustainability.<sup>14</sup> In 2003, Beverley Green and William Parson's edited volume 13 'Light Harvesting Antennas' appeared. This book brought out one of the most unique aspects of photosynthesis, the antennas and their development and evolution.<sup>15</sup> This volume is bound to have a long shelf life.

Volume 14 'Photosynthesis in Algae', edited by Anthony Larkum, Susan Douglas and John Raven, represents a new outlook of the AIPH series. Aquatic photosynthetic organisms occurring both in fresh and salt water represent the richness of photosynthetic biodiversity and biore-sources. Thus, in 2003, this volume was a timely publication.<sup>16</sup> This volume shall be very useful to researchers in many developing countries.

The 'and Respiration' part of the series has begun to appear. Four volumes have now been produced: Volumes 15 and 16 (edited by Davide Zannoni<sup>17</sup>, 2004) deal with 'Respiration in Archea and Bacteria'; and volumes 17 and 18 are on *Plant Respiration*. David A. Day, Harvey Millar, and James Whelan have edited volume 17 (*Plant Mitochondria: From Genome to Function*); and Hans Lambers and Miquel Ribas-Carbo have edited volume 18 (*Plant Respiration: From Cell to Ecosystem*), this one is still to appear.

Finally, volume 19 (*Chlorophyll a Fluorescence: A Signature of Photosynthesis*), edited by George C. Papageorgiou and Govindjee, has appeared. This volume is likely to serve as a guide book, not only for photosynthetic researchers, but also for crop physiologists, forest biologists, environmental scientists and even for architects and town planners. Reviews on volumes 15–19 are still to appear, although a review of volume 15 by Robert Gennis has just appeared in *Photosynthesis Research* (83: 363–364). I expect these new volumes will enhance the hue and glamour of the series.

Photosynthesis research in the past decade has made monumental progress. The structure of photosynthetic apparatus is being seen at atomic distances. The regulatory control of photosynthesis, together with other assimilatory processes, and their networking are being discovered at a rapid pace in plants and algae. Studies on the environmental effects of various types, and their synergistic effects, have received priorities with the hope of increasing global productivity. This series of volumes published by Kluwer Academic Publishers (now Springer) has documented this progress with pristine clarity. Although many series of volumes on photosynthesis and other aspects of plant biology have been published earlier, only a few have made such an impact on the readers within such a short time. The effort by Kluwer (Springer) and the series editor Govindjee is historic. This series contains expert and authoritative views on the current state of art of photosynthesis research and these would guide students and teachers all over the globe in their pursuit of knowledge and initiate a new line of research. In the age of explosion in knowledge, no book can claim a long shelf life, but it is almost certain that some of the volumes of this series shall last for many years. I encourage all to look at the volumes

of this series; if you do not, you may miss something interesting.

The web site of the Series is at: <http://www.springeronline.com/> (please type Advances in Photosynthesis in the *Search* box, and select 'Series' in the 'Search by' box). Table of Contents of many of the volumes can be found at: <http://www.life.uiuc.edu/govindjee/photosynSeries/ttoes.html>. In addition, I recommend another site (maintained by Larry Orr) for a listing of these books (<http://photoscience.la.asu.edu/photosyn/books/advances.html>).

I wish to end my review by quoting Robert Blankenship, Arizona State University, USA from the backcover of the forthcoming volume 20 (*Discoveries in Photosynthesis*, edited by Govindjee, J. Thomas Beatty, Howard Gest and John F. Allen):

Congratulations on another volume in the Advances in Photosynthesis and Respiration (AIPH) series. Govindjee's mentor Eugene Rabinowitch wrote the story of photosynthesis in the 1940s and 1950s. No one could ever hope to do that again; the amount of information is just too vast for any one person to ever hope to do a proper job of giving the real state of knowledge. However, Govindjee has really duplicated Rabinowitch's accomplishment in the only way it could be done nowadays, by enlisting editors who are experts in areas of the field and having them in turn enlist expert authors. When I look at the AIPH books on my shelf I am struck with how effectively they collectively summarize the field. I am continually impressed with how Govindjee has added new books to the series that make sense and really provide the level of detail that is needed.

I thank B.Vani, Sujata Mishra, Manoj Joshi and S. Rajagopal for giving me help in preparing this perspective on Springer's AIPH series.

## Notes

- <sup>1</sup> Rabinowitch EI (1945) *Photosynthesis and Related Processes*, Vol. I. Interscience Publishers, New York; Rabinowitch EI (1951) *Photosynthesis and Related Processes*, Vol. II, Part 1, Interscience Publishers, New York; Rabinowitch EI (1956) *Photosynthesis and Related Processes*, Vol. II, Part 2, Interscience Publishers, New York; Raghavendra AS, Sane PV and Mohanty P (2003) *Photosynthesis research in India: from yield physiology into molecular biology*. *Photosynth Res* 76: 435–450.

- <sup>2</sup> Volumes in the series 'Topics in Photosynthesis' (series editor, J. Barber), published by Elsevier, Amsterdam, are: Barber J (ed) (1976) *Intact Chloroplast* (Vol. 1); Barber J (ed) (1977) *Primary Processes of Photosynthesis* (Vol. 2); Barber J (ed) (1979) *Photosynthesis in Relation to Model Systems* (Vol. 3); Barber J (ed) (1982) *Electron Transport and Photophosphorylation* (Vol. 4); Baker NR and Barber J (eds) (1986) *Chloroplast Biogenesis* (Vol. 5); Barber J and Baker NR (eds) (1986) *Photosynthetic Mechanisms and the Environment* (Vol. 6); Baker NR and Long SP (eds) (1986) *Photosynthesis in Contrasting Environments* (Vol. 7); Barber J (ed) (1987) *The Light Reactions* (Vol. 8); Kyle DJ, Osmond CB and Arntzen CJ (eds) (1987) *Photoinhibition* (Vol. 9); Baker NR and Percival MP (eds) (1991) *Herbicides* (Vol. 10); Barber J (ed) (1992) *Photosystems: Structure, Function and Molecular Biology* (Vol. 11); Baker NR and Thomas H (eds) (1992) *Crop Photosynthesis: Spatial and Temporal Determinants* (Vol. 12) For a complete list of all edited volumes from 1951–2003, see Govindjee (2004) *Photosynth Res* 80: 447–460.
- <sup>3</sup> Mohanty P (1996) Book Review, *Molecular Biology of Cyanobacteria* (Bryant DA, ed) *Curr Sci* 70: 1101–1101.
- <sup>4</sup> Knaff DB (1996) Book Review, *Anoxygenic Photosynthetic Bacteria* (Blankenship RE, Madigan MT and Bauer C, eds) *Photosynth Res*, 47: 199–200.
- <sup>5</sup> Beck WF (1996) Book Review, *Biophysical techniques in photosynthesis* (Amez J and Hoff A, eds) *Photosynth Res* 50: 285–286.
- <sup>6</sup> Mohanty P (1997) Book Review, *Oxygenic Photosynthesis: The Light Reactions* (Ort D and Yocum CF, eds) *Curr Sci* 72: 523–523; Kramer DM (1997) reviewed it in *Photosynth Res* 51: 245–246.
- <sup>7</sup> Mohanty P (1998) Book Review, *Photosynthesis and Environment* (Baker NR, ed), *Curr Sci* 74: 258–258.
- <sup>8</sup> Mohanty P (1999) Book Review, *Lipids in Photosynthesis-Structure, Function and Genetics* (Siegenthaler PA and Murata N, eds) *Curr Sci* 77: 457–458; Hooper K (1999) reviewed it in *Photosynth Res* 59: 257–258.
- <sup>9</sup> Niyogi KK and Casper-Lindley C (1999) Book Review, *The Molecular Biology of Chloroplasts and Mitochondria in Chlamydomonas* (Rochaix J-D, Goldschmidt-Clermont M and Merchant S, eds) *Photosynth Res* 61: 97–98.
- <sup>10</sup> Mohanty P (2000) Book Review, *The Photochemistry of Caotenoids* (Frank HA, Young AJ, Britton G and Cogdell R, eds) *Curr Sci* 79: 1115–1117.
- <sup>11</sup> Mohanty P (2000) Book Review, *Photosynthesis: Physiology and Metabolism* (Leegood RG, Sharkey TD and Von Caemmerer S, eds) *Curr Sci* 79: 1730–1730; Migniac-Maslow M (2000) has also reviewed it in *Photosynth Res* 65: 101–102.
- <sup>12</sup> Mohanty P (2002) Book Review, *Photosynthesis – Photochemistry and Photobiophysics* (Ke B, author) *Ind J Exp Biol* 40: 971–972; Malkin R (2005) has reviewed this book in *Photosynth Res* 83: 97–98.
- <sup>13</sup> Mohanty P (2003) Book Review, *Regulation of Photosynthesis* (Aro E-M, and Andersson B, eds) *Curr Sci* 84: 235–235.
- <sup>14</sup> Mohanty P (2003) Book Review, *Photosynthetic Nitrogen Assimilation and Associated Carbon and Respiratory Metabolism* (Foyer CH and Noctor G, eds) *Curr Sci* 85: 674–674.
- <sup>15</sup> Mohanty P (2004) Book Review, *Light Harvesting Antennas in Photosynthesis* (Green BR and Parson W, eds) *Curr Sci* 86: 1030–1031; Frank HA (2004) also reviewed it in *Photosynth Res* 82: 109–109.
- <sup>16</sup> Mohanty P (2004) Book Review, *Photosynthesis in Algae* (Larkum A, Douglas SE and Raven JA, eds) *Curr Sci* 87: 1301–1301.
- <sup>17</sup> *Respiration in Archaea and Bacteria: Diversity of Prokaryotic Electron Transport Carriers*. Edited by Zannoni D, *Advances in Photosynthesis and Respiration*, Vol. 15, 2004, 350 pp, ISBN-1-4020-2001-5.

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