

The 14th International Congress on Photosynthesis proved to be a happy and successful occasion for the 800 or so participants who congregated at the Scottish Exhibition and Conference Centre (SECC) in Glasgow in July. The organisation of PS07 marked the first collaborative venture between the International Society for Photosynthesis Research (ISPR) and the Society for Experimental Biology (SEB) and was supported by a wide range of organisations including the BBSRC (UK). This congenial gathering of international leaders, researchers and students provided a forum for exceptional and dynamic plenary lectures as well as the large number of individual sessions spanning a comprehensive range of topics that fall under the umbrella of current photosynthesis research. The sessions were lively, interactive and energetic, addressing recent developments, changes and advances in current concepts, providing a dynamic forum for exchange of information and research from all areas. The conference had a large number of student delegates, for many of whom this was the first experience of an International forum of scientific exchange. The vibrant city of Glasgow provided an excellent backdrop for the exceptional scientific and education programme, with sessions covering topics that ranged from molecular structures and artificial photosynthesis to improving stress tolerance and applications in food and bio-energy crop production. With its perfect combination of advanced technical facilities and professional service experience across a broad spectrum of events, the SECC lived up to expectations as one of the World's finest conference venues, with a very good range of lecture halls and ample space for informal discussions, posters and stands for exhibitors. In addition to the excellent science, PS07 was an occasion for meeting old friends and making new ones. The abstracts for all the oral and poster presentations at PS07 are published in *Photosynthesis Research*, volume 91. The Congress Proceedings Volume received 350 submissions and there are a number of Journal Special Issues arising from the meeting including one in the *Journal of Experimental Botany*.



Left to Right: Robert Blankenship (Past President, ISPR; Chair Selection Committee for the Awards); Eva-Mari Aro (President, ISPR); Jan Anderson (The Lifetime Achievement Award); Warwick Hillier (The Robert Hill Award); Govindjee (The Communication Award); Junko Yano (The Robert Hill Award); Julian Hibberd (The Melvin Calvin Award); Ulrich Schreiber (The Innovation Award)

On behalf of the International Society of Photosynthesis Research (ISPR), I heartily thank Prof. Christine Foyer and her outstanding team of associates for organizing the 14th International Congress on Photosynthesis, held on July 22-27, 2007, in the Scottish Exhibition and Conference Centre, Glasgow, UK. We had a successful and enjoyable time since the organizers had produced one of the best programs in the history of our congresses, with a clear vision for the future of the Society of Photosynthesis Research in our changing world. We went home not only with new ideas for solving problems in photosynthesis research that may ultimately contribute to meeting the needs of our increasing population for energy and food, but also with fond memories of new friendships made during the successful social events of the congress. I thank the Society of Experimental Biology (SEB) for conducting this Congress on behalf of the ISPR.

Eva-Mari Aro  
ISPR President (outgoing)

Photosynthesis research has a long and distinguished record which is not unexpected given the importance of the subject. Photosynthesis catalyses the conversion of sunlight into chemical energy, a process which supports essentially all life on our planet and is the origin of the fossil fuel reserves. Our understanding of the various reactions of photosynthesis is now at the molecular level and can be exploited, not only for improving food production, but for investigating new ways of generating renewable energy. The threat of global

Christine Foyer  
Chair, Organising committee

climate change, due to increasing atmospheric CO<sub>2</sub> levels, coupled with the need to sustain long term energy supplies, places photosynthesis research at the top of the agenda. The challenges are to efficiently exploit biomass and biofuel production at levels far exceeding those at present while at the same time using the 'blue print' of the photosynthetic reactions to design new generations of photovoltaic, photo-electrochemical and photochemical systems. The excitement of these challenges was evident at the 14<sup>th</sup> International Congress on Photosynthesis Research held in Glasgow this July. An opening plenary lecture by Daniel Nocera, Professor of Energy at MIT, set the scene. This was followed by a large number of contributions related directly or indirectly to the energy problem or to the consequences of not finding successful alternatives to the present, and almost uncontrollable, use of fossil fuels. During the Congress there was an open public debate on the importance of photosynthesis research in addressing the development of new technologies and the topic was also covered by radio and press. The next international congress on this subject will be held in China in 2010 and I have no doubt that by that time photosynthesis research will have contributed further knowledge for developing new and exciting technologies to exploit solar energy and in so doing, contribute to the endeavours of the developed world to reduce its carbon emissions while at the same time maintaining global stability.

James Barber, FRS  
President of ISPR (from July 2007).



# ISPR International Society of Photosynthesis Research



**Hill award** (sponsored by Springer): for studies of Mn complex of PSII.

Shared by:  
**Warwick Hillier** Photobioenergetics Group, Research School of Biological Sciences, Australian National University, Canberra.  
**Junko Yano** Lawrence Berkeley Laboratory, University of California, Berkeley.

**Calvin award** (Sponsored by Springer): for novel approaches to the evolution of C4 photosynthesis.

**Julian Hibberd** Plant Sciences Department, University of Cambridge, Cambridge.

**Lifetime achievement award**  
(Life membership of ISPR):

**Jan Anderson**, Emeritus Professor, Photobioenergetics Group, Research School of Biological Sciences, Australian National University, Canberra.

**Communication award**  
(Life membership of ISPR):

**Govindjee**, Professor Emeritus, Biochemistry, Biophysics & Plant Biology, Department of Plant Biology, University of Illinois, Urbana.



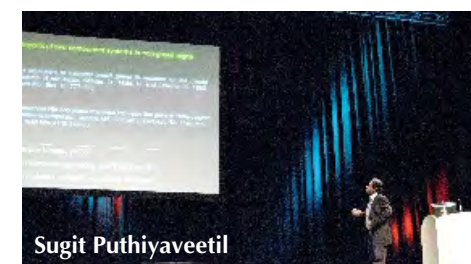
## Poster Prizes

### Agrisera Awards:

- **Hideyuki Adachi** *et al.* (Okayama University) PS4.40 Purification and crystalization of PSII complexes from a red alga (*Cyanadinium*).
- **Andrea Bräutigam** *et al.* (Universität Düsseldorf-Michigan State University) PS10.22 Comparative proteomics of C3 and C4 mesophyll chloroplast envelopes and characterization of a novel transport protein, Mep 1.

### Walz Award:

- **Hardy Schön** *et al.* (Universität Münster) PS25.95 The role of light and photosynthesis during pathogen defence in tobacco leaves.



### Gatsby Awardees

Sugit Puthiyaveetil (Queen Mary College, London)  
Sophie Janecek (Cambridge University)  
Richard Webster (University of Essex)  
Elizabeth Carmo Sivo (Rothamsted Research)  
Tatas Brotosudarmo (Glasgow University)  
Irene Ng (Sheffield University)  
John Timney (Sheffield University)  
Dan Canniffe (Sheffield University)

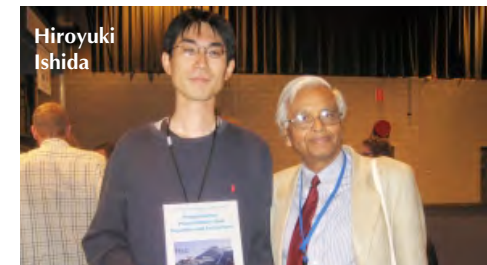
## Poster Book Prizes

Book Prizes donated by Govindjee for best Posters were to:

- 1) **Dimitri Shevela** *et al.* (Max Planck Institut at Muelheim): PS4.61 "Hydrogencarbonate binding to Photosystem II" [Donated book: "Photosystem I", edited by John Golbeck, Volume 24, Advances in Photosynthesis and Respiration (Series Ed, Govindjee)].



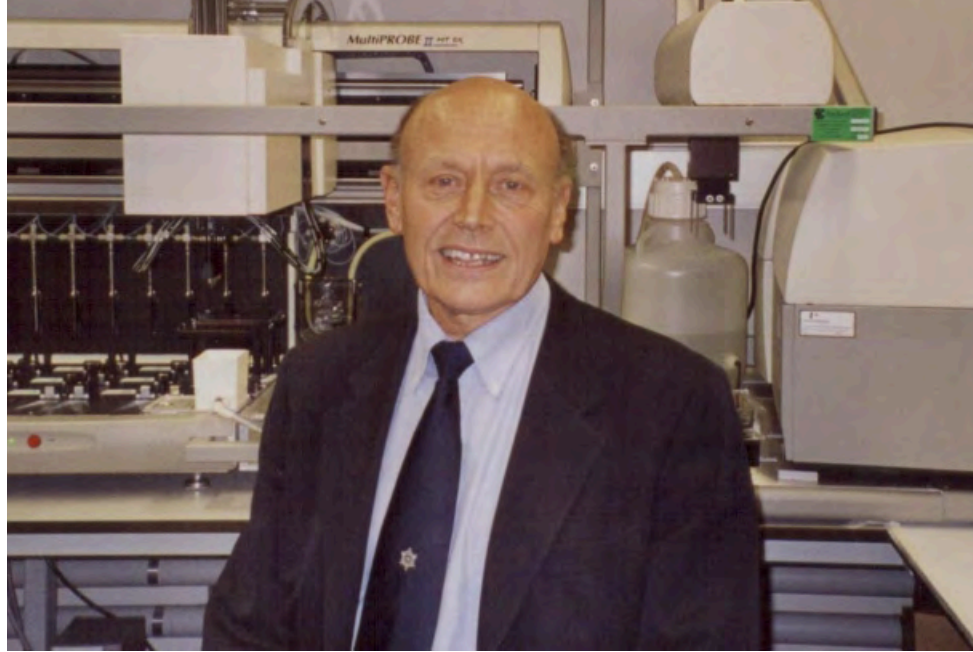
- 2) **Ben Long** *et al.* (Australian National University): PS 9.14 "A Structural role for CcmM in beta-carboxysome shell formation" [Donated book: "Chlorophylls...", edited by B. Grimm *et al.*, Volume 25, Advances in Photosynthesis and Respiration (Series Ed, Govindjee)].



- 3) **Hiroyuki Ishida** *et al.* (Tohoku University): PS 19.8 "Visualisation of Rubisco-containing bodies derived from chloroplasts in living cells of Arabidopsis" [Donated book: "Photoinhibition and Photoprotection, etc", edited by Barbara Demmig-Adams *et al.*, Volume 21, Advances in Photosynthesis and Respiration (Series Ed, Govindjee)].

- 4) **Georgia Zahariou** *et al.* (Institute of Materials Science NCSR Athens): PS4.56 "Temperature Dependence of the intermediate states of Photosystem II" [Donated book: "Discoveries in photosynthesis", edited by Govindjee *et al.*, Volume 20, Advances in Photosynthesis and Respiration (Series Ed, Govindjee)].

## Symposium on Artificial Photosynthesis



Chair: **Professor James Barber FRS** (Imperial College London)  
Co-chair: **Professor Thomas Moore** (University of Arizona, Tempe)

### Membrane Dynamics and Organisation

The molecular processes of photosynthesis are being revealed in great detail and providing a blue print for developing new technologies to capture and use solar energy. This symposium focused on advances being made in mimicking the natural system with particular emphasis on the water splitting reaction of photosystem II (PSII). Much effort at present is directed at constructing multielectron charge transfer systems as a prerequisite for the production of molecular hydrogen and oxygen. In PSII, Mn ions are used to accumulate charge and presentations by Magnusson (Uppsala) and Herrero (CEA, Saclay) suggested that this tactic could be successfully used in an artificial water splitting system. Moser (Philadelphia) and Conlan (Canberra) emphasized the importance of having a protein-like environment as the scaffold for constructing the appropriate arrangement of the redox-active centres. The four presentations were followed by an enthusiastic and optimistic discussion within the spirit of "If the leaf can do it we can do it!".

Professor James Barber FRS  
Imperial College

Session chair (Conrad Mullineaux) gave a brief introduction to the topic, followed by four excellent talks, each of which reflected a major development in the area since the Montreal congress of 2004. Ziv Reich (Weizmann Institute) discussed the use of cryo-electron tomography to probe the 3D architecture of green plant thylakoid membranes, with some exciting new information on changes in membrane architecture induced by light. Helmut Kirchhoff (Muenster) spoke on the use of Fluorescence Recovery after Photo-bleaching and atomic force microscopy to probe the organisation and dynamics of grana membranes, and the influence of macromolecular crowding on protein diffusion and membrane function. Shigeichi Kumazaki (Kyoto) spoke on the use of a line-scanning fluorescence spectromicroscope to probe the distribution of pigment-protein complexes at high resolution in cyanobacterial cells. Paula Braun (Muenchen) discussed a specific lipid interaction with the LH2 light-harvesting complex of purple photosynthetic bacteria. The Discussion session included two short invited contributions: Raoul Frese (Leiden)

presented his dynamic simulation illustrating how self-organisation in the chromatophore membranes of purple bacteria could ensue simply from size differences among the complexes present. Gyozo Garab (Szeged) presented his results on grana structure from thin-section electron microscopy and cryo-electron tomography, leading to a structural model somewhat different from that of Prof Reich. A lively general discussion followed, with most debate centred on the structure and function of grana in the thylakoid membranes of higher plants.

Conrad Mullineaux  
Queen Mary College, London

### Water Oxidising Enzyme

Session Chairs: **Bill Rutherford** (Saclay) and **Rick Debus** (UC Riverside)  
Invited discussion leader **Gary Brudivig** (Yale)  
Sponsored by Bruker.

All four speakers in this session were young and dynamic. The same could not be said for the session chairs who, while sometimes dynamic, are no longer "les poulets de printemps" (as the French don't say). The whole session reflected a buzz of excitement in the subject: there was the feeling that things are advancing in what remains one of the greatest challenges in the field: to understand the mechanism of water oxidation. After the wonderfully lucid plenary lecture on the same subject from Rick Debus earlier, Junko Yano (UC Berkeley), Victor Batista (Yale), James Murray (IC London) and Johannes Messinger (MPI Mulheim) talked on some of the hottest areas, reporting their findings and models from a range of physico-chemical methods (X-ray absorption, molecular (QM/MM) calculations, X-ray crystallography, magnetic resonance etc). Each talk triggered debate that had to be curtailed for time reasons, while the formal discussion session ran on for nearly double its allotted time and ended only to allow the sound technicians to go for lunch. The discussions included important contributions from Felix Ho (Uppsala) adding to the picture of channels for water, protons and O<sub>2</sub>, as presented in the talks of Batista and Murray. There was of course

much debate about the exact geometry of the Mn<sub>4</sub>Ca cluster with contributions from Barber (I.C. London) and Dau (T.U.Berlin), adding to (but mainly disagreeing with) the models presented in the talks. It seems that the models are still somewhat ambiguous but it is clear that they are coming together and the scope for error is diminishing. Chemical mechanism and substrate binding were also addressed by Kusunoki (Meiji U.), W. Hillier (Canberra) and Mino (Nagoya) among others and new data (re-) implicating Cl<sup>-</sup> in O<sub>2</sub> evolution was presented by Boussac (Saclay). Many others made contributions and a fun time was had. For this most important of enzymes, plenty of fundamental aspects have yet to be understood and it seems likely that many surprises have yet to be discovered. But things are moving rapidly so stay tuned.

Bill Rutherford  
Commissariat à l'Energie Atomique,  
France

### Metabolite transport and intracellular interactions session

Organisers: **Graham Noctor** (Paris) and **Andreas Weber** (Köln)

A key theme of the session was that photosynthesis is a whole cell process. This was emphasized in a short introduction by Graham Noctor with particular attention paid to the importance of mitochondria in the optimization of photosynthesis. In the first talk, Per Gardeström (Umea, Sweden) summarized insights from recent work on various mitochondrial transformants and mutants, and presented data highlighting the importance of the glycine decarboxylase reaction in influencing cellular redox states. The next speaker, Friederike Hörmann (Carnegie Institute, USA), described the development of *in vivo* sugar sensors able to provide compartment-specific information on metabolite pools, with particular

emphasis on measurement of cytosolic glucose concentrations. Agepati Raghavendra (Hyderabad, India) underlined the importance of the chloroplast-mitochondria interaction in photosynthesis. He also showed that leaf ascorbate levels can influence this interaction, and described how CO<sub>2</sub> released in the mitochondria during photorespiration may be important in sustaining Rubisco carboxylation under some conditions. The final speaker, Cornelia Wiklund (Linköping, Sweden), presented recent work on the characterization of thylakoid nucleotide and solute transporters, and outlined potentially important roles in stress responses. In the concluding discussion, led by Andreas Weber, a number of issues were debated, including transporter specificity and function, redox cycling between different compartments, and the need for improved spatial resolution in the analysis of metabolite contents.

Graham Noctor (Paris)

## Women in Science Dinner

### Excitation and relaxation during a career in electron transfer

Researchers attending Photosynthesis 2007 joined together by the banks of the Clyde for the Women in Science Dinner which was held at the Crowne Plaza Hotel, Glasgow. It was rewarding to see both women and men from different career stages joining in enthusiastic discussions over dinner to exchange experiences of our lives in research. After the meal the guest speaker, Alison Telfer from Imperial College (London), told us how her current interests in the structure and function of PSII reaction centres developed from work she began at Kings College (London) on photosynthetic electron acceptors. Alison described herself as a perennial post-doc, explaining further that her career wasn't structured in the traditional way of thinking, but has relied on her ability to "stick at it" through a succession of short term contracts which have enabled her to carve a career as a highly respected researcher. She acknowledged that she has been fortunate because a supportive Head of Department made it possible for her to retain focus and continue working while dealing with the conflicting demands of work and family. Many of us are all too aware of the uncertainties associated with obtaining continued funding, and obviously not every Head of Department has the flexibility of funds to support staff in this way even if the will is there. Although it is difficult to work on short term funding for a prolonged period, this system did work for Alison and enabled her to develop and maintain a good publication record.

The discussions that followed clearly demonstrated that for anyone aiming for a career in science, maintaining a continuum in your work is the critical factor to being successful. This suggests that together with packages to entice qualified researchers back to work after a career break, funding agencies should seriously consider sponsoring part-time work as a component of their funding portfolio. Finally, thanks to

Susanne von Caemmer (Australian National University), Jon Nield (Queen Mary College, London), Christine Raines (University of Essex), Jim Barber, Alison Telfer (Imperial College, London), Christine Foyer (Newcastle University), Alison Kingston-Smith (IGER, Aberystwyth)



Alison, not just for a stimulating talk but also for the enticing final images showing her achieving her ambition of performing photosynthesis research amid swaying palm trees and glistening clear blue seas, so reminding us to hold on to our goals because you never know what could be possible in the future.

Alison Kingston-Smith  
IGER, Aberystwyth