

Introduction to the Special Issue dedicated to James Barber

It gives me great pleasure to write the introduction for this special issue of *Photochemical & Photobiological Sciences*, not only because it presents a unique collection of articles that provides the state of the art in current photosynthesis research, but also because it is dedicated to Professor James (Jim) Barber and his contributions to the research field on the occasion of his 65th birthday. The present collection of 23 specially invited papers covers structural, functional as well as evolutionary aspects of photosynthesis, in many ways reflecting the breadth of interest and expertise that Jim Barber has developed throughout his many years as an active researcher. Considering Jim's recent spectacular contributions to our understanding of the structure of Photosystem II (PSII) it is no surprise that various aspects of this photosystem, including the water-splitting process, are dominating topics among the presented articles. Jim's interactive nature is reflected in the joint publications and collaborations he has enjoyed with the majority of authors contributing to this unique exposure of photosynthesis research anno 2005.

When honouring a researcher in connection with the 65th birthday—in many countries the official retirement age—it becomes natural to reflect on the past and look in the back mirror. When it comes to Jim Barber, however, this does not feel appropriate. Although he has, as mentioned, a long and successful research career behind him, in the last seven to eight years his research has taken a dedicated step forward through the spectacular studies on the structure of PSII. In fact Jim started a new line of research at a fairly mature age, something that is not so common in the scientific community.

According to my own recollection, Jim's scientific mindset changed to having this strong focus on the PSII structure in 1995. That year, Paul Mathis successfully arranged the *Xth International Congress on Photosynthesis* in Montpellier. After an exciting day

during the conference, taking in new information through lectures, posters and discussions, that evening many of us wanted to enjoy *la cuisine française*, including a good year of Chablis or Côte du Rhône. About to join one of these nutritional expeditions, I realised my conference bag was lost. I ran upstairs to the poster hall to look for it, the doors were still open, some empty coffee cups and beer bottles stood on a table, witnessing the activity of earlier in the day, but now there was silence and emptiness. Except for one single man on a primitive wooden chair, taking notes in front of a poster with the title "Formation and characterization of 2D crystals of PSII" by Inoue and collaborators. No, this was not an ambitious young post-doc trying to keep up with all the new information. The man in splendid solitude in front of the poster was the established Professor Barber. I broke the silence, "Come on Jim, join us for dinner, let's call it a day." Jim looked up from his notes and it seemed that my attempt to distract his scientific focus was not very successful: "Bertil, there is nothing more essential today than solving the structure of PSII—it simply has to be done." I could feel an admiration for the work presented in the poster in front of us, but also an impatience that progress was not faster. Maybe it was there on the wooden chair, all by himself that evening in Montpellier, that Jim decided to join the efforts to elucidate the structure of PSII—the engine of life, as he often phrases it.

In any case, we know what has happened during the following years up until today. A very synergistic collaboration with Werner Kühlbrandt, using electron microscopy and 2D crystals, described PSII at a resolution of 8 Å. At the end of the 1990s this work provided the state of the art picture of PSII involving sub-unit location and organisation of trans-membrane helices. It was also possible to locate certain chlorophyll molecules and to give new insights into the nature of the reaction centre chlorophyll, P680. The first

successful 3D crystallisation of PSII by Zouni *et al.*, *Nature*, 2001, **409**, 739–744, and Kamiya and Shen, *Proc. Natl. Acad. Sci. USA*, 2003, **100**, 98–102, took this work further, but also corroborated the major conclusion of the Barber and Kühlbrandt 2D work. The excitement at present is again centred on the work of Barber and colleagues at Imperial College, who have now provided us with a 3.5 Å model of PSII, where the ligation of all co-factors, including those of the water-splitting catalytic site, is presented. Even if several aspects of this PSII model still need to be ultimately proven, it will undoubtedly play an important role for future experimental and theoretical studies to delineate the structural details of PSII, as well as the mechanism of photosynthetic water oxidation. Several of the papers in this special issue will give examples of these recent scientific developments.

It would be quite unnecessary in this introduction to draw up a chronological account of the milestones in Jim Barber's career, but it should be recognised that in 2005 he became a Fellow of the Royal Society. From a more personal perspective I would, however, like to highlight Jim's close connection with Sweden, manifested through his many active collaborations with Swedish research groups, and his election into the Swedish Royal Academy of Sciences. Actually, his connection with Sweden had already begun in the early 1960s when, in his Hillman car, he drove all the way to Sweden to take a job at the Stockholm sewage plant as a water sampler in the archipelago of the surrounding Baltic Sea. If it was the ambition to practise his skills in analytical chemistry or the attraction of "*vackra svenska flickor*" which brought him to Stockholm is, however, outside my sphere of knowledge. Professional life took Jim from the Stockholm sewage via university studies in Cardiff to a post-doctoral period with Professor Duysens in Leiden, to London and Imperial College where he has remained since 1969. Jim's contribution to

building up the Biochemistry Department at Imperial College as a top-ranking institution with a breadth of excellent research groups may not be manifest to all colleagues in the photosynthesis field. In recent years, Jim Barber made a dedicated effort to establish structural biology as a key competence in the department, an investment that also paved the way for the successful work on the structure of PSII.

Jim Barber has also made Imperial College a natural meeting place for researchers in the photosynthesis field. For many years he arranged meetings in London in which many participated; in a way these IC meetings spontaneously became European Gordon-type conferences for our field, but also, if you

went to see Jim at IC on any occasion, you could almost be sure to find another colleague there on a shorter or longer visit allowing for spontaneous exchanges of new ideas, often at a nearby pub in South Kensington. More importantly, Jim's laboratory has, through the years, been a stepping stone for many post-doctoral fellows from a large number of countries in Europe and elsewhere, some of whom have contributed to this volume. The successful progress of Jim's research, and his continuous dedication to science, suggest that his laboratory at the IC will remain a place where we can meet to become inspired by new ideas. I am certain this special issue of *Photochemical & Photobiological Sciences* will not only serve such an

inspiring function within the photosynthetic community, but will also bear witness to the general scientific community about the exceptional progress that photosynthesis research has made in recent years. We are currently experiencing a dramatic expansion of research with many spectacular successes within life sciences. Unravelling the blueprint of the photosynthetic machinery which we are currently experiencing is certainly a success story that is worth telling, and the papers presented below fulfil this task in a splendid way.

Bertil Andersson

Chief Executive, European Science Foundation, Strasbourg, October 2005