



BOOK REVIEW

E. Papageorgiou, G.C. Govindjee (Eds.), Chlorophyll *a* Fluorescence – A Signature of Photosynthesis. Advances in Photosynthesis and Respiration, vol. 19, Springer, Dordrecht, The Netherlands, ISBN 1-4020-3217-X, 2004 (820pp., price: Euro 270.00, GBP 187.00, USD 349.00).

The series 'Advances in Photosynthesis and Respiration' presents a volume totally devoted to chlorophyll (Chl) fluorescence as a signal for monitoring photosynthesis and plant function. Decades of essential research on this important topic are summarized in this book edited by two experts with long experience in this field. Many years had passed since the two earlier books on this topic ('Light Emission by Plants and Bacteria,' edited by Govindjee et al. in 1986 and 'Applications of Chlorophyll Fluorescence,' edited by Hartmut Lichtenthaler in 1988) had appeared. Thus, it was high time to summarize again the basics of Chl fluorescence and the large progress in this still developing field in a comprehensive new volume. After a short well covered historical overview (chapter 1) by Govindjee, many renowned expert authors involved in active research show in 30 chapters the present state of knowledge on chlorophyll fluorescence and the wide range of its applications in photosynthesis research as well as in eco- and stress physiology of plants including the latest developments in imaging and remote sensing of Chl fluorescence.

Five chapters deal with the 'Fluorescence of Photosynthetic Pigments', the application of 'Chl Fluorescence as a Probe of Photosynthetic Productivity' and with the different aspects of excitation energy migration, transfer and the trapping of light energy prior to the fluorescence emission. Chapter 7 covers the particular aspects of 'Photon Capture, Trapping and Fluorescence Emission in Cyanobacteria and Red Algae' which possess phycobilisomes and the fluorescing phycobilins. The following several chapters explain the basic relationship between Chl fluorescence and photosynthetic oxygen evolution, the light-induced state transitions of the photosynthetic apparatus as well as regulation

of the photosynthetic electron transport. Chapter 9 is focused on the Chl fluorescence emission of PS I which is particularly strong at liquid nitrogen temperatures. Three chapters are focused on the techniques: pulse amplitude modulation measurements (PAM-instrument), fluorescence transients measurements and delayed light emission and thermoluminescence (but there is no chapter on fluorescence decay). Various other chapters deal with different types of acclimation and stress responses (excessive light, UV, water deficiency, heavy metals) and their effect on Chl fluorescence. Chapter 28 presents in a well-balanced way, the light adaptation of the photosynthetic apparatus yielding sun and shade chloroplasts with quite different pigment composition, ultrastructure, photosynthetic activity and Chl fluorescence signals. It also demonstrates that the Chl fluorescence decrease ratio maximum fluorescence minus steady-state fluorescence, divided by steady-state fluorescence, called R_{Fd} , is a measure of the net CO_2 assimilation rate. The last 3 chapters expand the view from the leaves to the canopy and to marine ecosystems.

The former 'dogma' that – in contrast to liquid nitrogen temperatures – at room temperature Chl fluorescence exclusively originates from photosystem II (PS II) has been overcome by recent research showing that during the fast part of the Chl fluorescence induction kinetics (Kautsky effect) PS I fluorescence also contributes to a small extent to the overall Chl fluorescence emission. However, another dogma still exists, namely the view "that radiationless transitions need not be measured but can quantitatively be deduced from lacking fluorescence known as non-photochemical quenching". That the latter is correlated with or caused by non-radiative de-excitation of absorbed light energy (heat emission) is generally assumed. However, heat emission should be measured in parallel to non-photochemical Chl fluorescence quenching before the often too far going rather speculative conclusions are drawn.

All together this volume – dedicated to L.N.M. Duysens one of the pioneers in Chl fluorescence –

provides a good mixture of theoretical and applied information on this type of light emitted by plants and its non-invasive detection techniques. The text will help to improve the understanding of the Chl fluorescence signals and the interpretation of their measurement. Some of the 31 chapters written by 59 authors may represent more a personal view (sometimes partly excluding the results of others), whereas most of them cover very well the relevant scientific literature. The *Subject Index* is comprehensive and extends to 23 pages; it is somewhat heterogeneous and could include some more key words in order to give fast access to less prominent topics of research as well.

With 820 pages this volume is one of the largest in the whole series. Most of the figures have the usual high quality of the previous volumes. However, it is a great shortcoming that the colour plates were not directly included in the text in the individual chapters but concentrated on 9 colour plate pages behind the preface, whereas in the text only black and white photos are presented that do not at all possess the expressiveness of the colour images, e.g. of the high-resolution Chl fluorescence images of leaves. The refusal of the Kluwer publishing house to place the colour plates directly

into the proper chapters of a book of this price is not understandable since today the inclusion of colour plates in journals and books is an international standard. It is hoped that Springer, that includes Kluwer, will set a better standard in future books of this series.

This excellently composed book is primarily intended for readers from advanced undergraduates to researchers in plant sciences, microbiology, biochemistry and biophysics. It can be widely recommended to a large readership and is much welcomed by the scientific community. For many years to come, this book will be the basic standard work on Chl fluorescence providing not only a broad overview on all aspects and application possibilities but – in addition – it will be the starting point for future research in this fascinating field of photosynthetic energy conversion and plant biology.

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