Laisk, A., Nedbal, L., Govindjee (ed.): **Photosynthesis *in silico.* Understanding Complexity from Molecules to Ecosystems.** Advances in Photosynthesis and Respiration. Vol. 29. – Springer, Dordrecht 2009, ISBN: 978-1-4020-9236-7(HB), ISBN 978-1-4020-9237-4(e-book). Pp. 503, € 209.00.

Photosynthesis research has accumulated during the last more than fifty years a huge amount of data and many theories. It appeared necessary to arrange the data by some mathematical models describing the data relations and mechanistic events of the systems in space, time and amount and reflecting the environmental conditions. The models should not only explain the data but also to predict behaviour, test the hypotheses and explain the indirect measurements. Both the physical backgrounds and biological specificity should be comprised (*e.g.* reversibility, feedback, regulation, repair and acclimation processes). Each model is based on specific assumptions and reaches a certain level of complexity. The models are not fixed, but they are continuously under development and improvement.

The book with a typical white cover comprises in a form of reviews the most important regions of the model applications in photosynthesis. The book is divided into five parts and contains 20 chapters written by leading personalities in the particular fields. There are 44 authors including the founders of some very famous models and those contributing do the development of the relevant models.

The Preface describes the main contents of the book, followed by short profiles of the three editors, persons very well known in the photosynthesis research, modelling and chlorophyll fluorescence. The chapters are arranged mostly in the order of increasing dimensional level starting from the molecular one up to the global situation. Each chapter is presented by summary at the beginning and conclusion at the end.

Part I deals with the general problems of biological modelling. The basic features of the computational models are described and characterized. Discussed is for instance the sensitivity of the systems. The concept of Comprehensive Model Space is introduced. This approach aims to integrate partial models into one general system describing the whole photosynthetic process. An electronically based centre collecting and connecting individual models developed in individual laboratories is under preparation. The result will be publicly accessible (http://www.E-photosynthesis.org).

Part II concentrates on the primary photosynthetic events, light harvesting by photosynthetic antennas, energy transfer and primary charge separation in reaction centres. The nonlinear spectroscopy and modelling together reveal the energy transfer pathways in cases when not only the traditional Förster energy transfer can take place. The greatest progress has been reached in modelling the most simple antenna systems, the ring antennas of photosynthetic bacteria. Basics of quantum mechanics and concepts of solid state physics are used for modelling of excited states of the molecular aggregates.

Part III. This chapter is devoted to probably most frequently used models of the electron transport in thylakoid membrane reflected in the measured chlorophyll fluorescence or absorbance changes. Due to the commercially easily accessible instruments, these methods (*e.g.* the O-J-I-P curve) are largely spread among plant physiologists. Everyone using the OJIP (or OJDIP) curve should realize the complexity of the measured curve. The differences in fluorescence signals excited by single turnover flashes, multiple turnover flashes or continuous excitations are analyzed. Thermodynamics of electron transport and related movements of electron carriers within and along thylakoid membrane is explained.

Part IV. Another most frequently used models are those of the gas exchange on the level of whole leaves. These models describe the measured quantities as are the net photosynthetic rate, transpiration rate, stomatal conductance or intercellular CO_2 concentration. Two chapters are devoted to examples of Photosynthesis *in silico* comprising a computer model of C_3 and C_4 photosynthesis.

Part V. This part covers to some extent the models of canopy photosynthesis and photosynthesis of large-scale ecosystems.

The book will be more easily understandable for people with mathematical and physical background but it is written in such a way that everyone would appreciate the explanation of principles, applications and perspective development of the models.

This book is of basic importance for people in photosynthesis research. Using the models and computers is already indispensable and everyone should keep pace with this fast development. One important aspect of the book is a rigorous approach using mathematical correctness and physical exactness. This approach is not obeyed by some widely spread simple models, criticism of them might have been in higher extent. The book is of importance not only to biophysicists a biochemists of photosynthesis but even more to plant physiologists and ecophysiologists who are using chlorophyll fluorescence and gas exchange measurements nearly every day. I personally miss a chapter devoted to the leaf optical and spectral properties. Maybe, some of the next books of the series will fill this gap.

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