Caemmerer, S. von: **Biochemical Models of Leaf Photosynthesis.** (Techniques in Plant Sciences No.2.) - CSIRO Publishing, Collingwood 2000. ISBN 0 643 06379 X. 165 pp., USD 42.00.

This book has appeared as the second volume of a new series of monographs "Techniques in Plant Sciences", launched by CSIRO Publishing in 1998 (*cf.* Photosynthetica **37**: 476, 1999 for review of the first volume).

Successful mathematical descriptions of photosynthesis are linked to rate equations of ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco) carboxylation and oxygenation. Thus, these equations form the basis for the biochemical models of photosynthesis presented in this book.

The book contains 6 chapters. In the first chapter, *in vitro* and *in vivo* responses of Rubisco are compared: kinetics and activation of Rubisco [activation of Rubisco in the absence and presence of ribulose-1,5-bisphosphate (RuBP), carbamylation ratio of Rubisco, Rubisco activase and model of its action, derivations of rate equations, *etc.*]. Chapter 2 is entirely devoted to the frequently used photosynthesis model of G.D. Farquhar *et al.* proposed in 1980 (simplifying assumptions, stoichiometry of C_3 photosynthesis, rate equations for CO_2 assimilation, CO_2 partial pressure in the chloroplast, parametrization of the model, CO_2 compensation concentration, CO_2 response curves at different irradiances, temperature, O_2 partial pressure, irradiance response curves at O_2 and CO_2 partial pressure, quantum yield, and temperature responses). This chapter also replies to the question "Does the activation state of Rubisco need to be incorporated into models of CO_2 assimilation", and discusses the problems of long-term effect of environment on photosynthesis (maximal Rubisco carboxylation rate, maximal electron transport rate, and the transition from Rubisco to electron transport limitation, effect of growth temperature, growth at elevated CO_2 concentration), and possibilities of engineering a better Rubisco.

The main topic of the third chapter is chlorophyll fluorescence and oxygen exchange during C_3 photosynthesis. Attention is paid on calculating electron transport rate from chlorophyll fluorescence (J_f), estimating electron transport rate from CO_2 assimilation rate, and calculation of mesophyll conductance to CO_2 transfer. Also relationships between J_f and incident irradiance, and between chlorophyll fluorescence in the light and maximal chlorophyll fluorescence during a saturating light pulse of a leaf in the light are discussed. Further, oxygen exchange during C_3 photosynthesis are dealt with in Chapter 3 (total oxygen evolution and uptake, the Mehler ascorbate peroxidase reaction, estimation of Rubisco carboxylation and oxygenation rates, CO_2, O_2, and temperature dependences of O_2 exchange, *etc.*).

Chapter 4 is focused on modelling of C_4 photosynthesis. The biochemical model described here (S. von Caemmerer and R.T. Furbank 1999) explores the relationships between gas-exchange characteristics and leaf biochemistry (enzyme-limited and light- and electron-transport-limited photosynthesis: analysis of CO_2 assimilation in the bundle sheaths, the rate of PEP carboxylation, rates of ATP and NADPH consumption, partitioning of electron transport rate between C_3 and C_4 cycles, light-dependence of electron transport rate). Then, the model is analysed: its parametrization, the model at high irradiance (PEP carboxylase and Rubisco activity, bundle-sheath conductance, CO_2 and O_2 response, CO_2 transfer inside the leaf, *etc.*), CO_2 fixation at limiting light, and modelling different decarboxylation types.

The Chapter 5 is devoted to models of C_3-C_4 intermediate photosynthesis in several species of the genera *Moricandia*, *Flaveria*, and *Panicum*. The model presented in this chapter is a synthesis of the earlier models by M. Peisker *et al.* and that by S. von Caemmerer in 1989 and 1992. Perhaps this chapter provides the best examples of how the biochemical models presented in this book can aid in the formulation of ideas. Author's conception of future activities in constructing and use of these models also completes the book in short "Concluding remarks". The bibliography presents 414 essential references to the world literature in the field.

The book is well produced and carefully edited. I can recommend it as a perfect guide to modelling photosynthesis.

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