Preface

Bioenergetics deals with the transformation of energy in biological systems. It is a branch of cell biology, biochemistry, and biophysics. In respiration, which is necessary for the survival of both plants and animals, complex organic molecules are broken down into simpler inorganic compounds. During the complete oxidation of glucose (with molecular oxygen), approximately 40% of the available chemical energy is stored in adenosine triphosphate. The energy of ATP is made available on hydrolysis and is used for various life processes (muscle contraction, biosynthesis, etc.). The complex organic molecules and oxygen, needed for respiration and therefore for life on earth, are replenished through the process of photosynthesis. In nature, the only plentiful continuously available source of energy is sunlight. In photosynthesis, this radiant energy is converted into chemical energy, with oxygen produced as a by-product, and energy stored in complex organic molecules.

The bioenergetic aspects of photosynthesis is the subject of this volume. The contributors have attempted to cover this topic in a complete and integrated fashion. Biochemical and biophysical aspects are emphasized. The work includes a review of the historical development of major concepts, analysis of experimental data, and an exposition of recent findings. The universal properties of photosynthesizing cells are emphasized; differences among green plants and photosynthetic bacteria are mentioned wherever possible. It is our hope that this volume will not only serve as a reference source for researchers but also as an introductory work for graduate students in cell biology, plant physiology, biochemistry, and biophysics.

The book begins with an introduction to photosynthesis by Govindjee and R. Govindjee (Chapter 1); followed by a discussion of the relation between

chloroplast structure and function by C. Arntzen and J.-M. Briantais (Chapter 2); the primary events (light absorption, energy transfer, and primary reactions) by K. Sauer (Chapter 3); the mechanism of excitation energy migration by R. S. Knox (Chapter 4); delayed light emission by J. Lavorel (Chapter 5); chlorophyll fluorescence by G. Papageorgiou (Chapter 6); electron transport pathway by M. Avron (Chapter 7); oxygen evolution by P. Joliot and B. Kok (Chapter 8); the mechanism of photophosphorylation by A. T. Jagendorf (Chapter 9); primary acts of energy conservation in chloroplast membranes by H. T. Witt (Chapter 10); the relation of the structure of chloroplast membrane to energy coupling and ion transport by S. Murakami, J. Torres-Pereira, and L. Packer (Chapter 11); and molecular organization of chlorophyll in living cells by F. Litvin and V. A. Sineshchekov (Chapter 12). I am thankful to all the authors for providing the readers with authoritative discussions on the various aspects of the bioenergetics of photosynthesis.

Each chapter has been read and criticized by several colleagues. I have also reviewed each chapter in the book. To the following reviewers I give my most sincere thanks: P. Boyer, W. Butler, B. Chance, R. Clayton, W. Cramer, R. Dilley, D. Fleischman, N. Good, D. Krogman, B. Mayne, P. Mitchell, J. Myers, P. Nobel, R. Park, R. Pearlstein, E. Racker, K. Sauer, C. Swenberg, and L. Vernon.

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Govindjee