Biophysical Techniques in Photosynthesis

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Advances in Photosynthesis and Respiration (AIPH), published by Springer, is a series of unique volumes on photosynthesis and respiration (Series Editor: Govindjee, UIUC, Illinois, USA) that has received worldwide appreciation of students, researchers and experts. These volumes report very critical views and outlooks on the developments in photosynthesis. Springer has already established its leadership in publishing quality volumes in plant sciences and the AIPH series appears to be Springer's flagship publication in this area.

Early events of photosynthesis involve ultrafast and fast photophysical and photochemical events that are probed by a variety of advanced biophysical techniques. Volume III of the AIPH series, edited by Jan Ames and Arnold Hoff was published in 1996, more than a decade ago. This is now followed by volume 26 "Biophysical Techniques in Photosynthesis-II, which elegantly describes how many novel biophysical methods and techniques have emerged and evolved to study bacterial, algal and plant photosynthesis.

This volume contains 24 chapters, packaged in to five sections. Section I is on the applications and theories of imaging. The use of Atomic Force microscopy (AFM) to visualize the architecture of bacterial photosynthetic apparatus (chapter 1), 3D imaging with electron microscopy (chapter 2), application of non-linear contrast mechanisms for optical microscopy (chapter 3) and magnetic resonance imaging (MRI) on entire plants and trees to estimate water balance and transport (chapter 4). The second section deals on probing "structures" of photosynthetic membranes and protein complexes. This includes crystallizing plant light harvesting complexes (chapter 5), x-ray crystallography on photosynthetic proteins (chapter 6), electron crystallography (chapter 7), use of x-ray scattering to characterize biomolecular structures (chapter 8), and mass spectrometry-based methods to monitor dynamics of biological systems (chapter 9). The third part discusses various developmental features of optical spectroscopy: Femtosecond time resolved infrared spectroscopy (chapter 10), non-linear femtosecond optical spectroscopy (chapter 11), use of a streak camera

for subpicosecond fluorescence spectral evolution (chapter 12), and optical spectroscopy of individual light harvesting complexes (chapter 13). Different aspects of techniques on magnetic resonance have been used in probing photosynthetic structures and functions, and the section IV contains chapters on these, such as high field/high frequency electron paramagnetic resonance (EPR) (chapter 14), high time-resolution EPR (chapter 15), distance measurements in photosynthetic reaction centers (16), spin labeling of photosystems (chapter 17) and photochemically induced dynamic nuclear polarization (CIDNP) NMR (18). The last section V deals on underlying theoretical calculations of electrostatic energy in proteins (chapter 20), excitation energy transfer (chapter 21), molecular dynamic method in bioelectronic systems (chapter 22), equilibrium and dynamic path integral methods in bacterial photosynthesis (chapter 23) and on density functional theory (DFT). This section appears to be difficult for readers lacking mathematical backgrounds, though reading these chapters repeatedly may allow the readers to obtain a flavour of its contents.

These twenty-four articles are authoritative and impressively comprehensive. Admittedly, these are written by the experts in the field. These fifty-five contributors and the two editors are to be greeted for the commendable job done in bringing out this timely volume. These articles would prompt the researchers working in general areas of biochemistry, physiology and molecular biology of photosynthesis to use biophysical techniques to get structural and dynamic details of functional biology. Students of interdisciplinary programmes would immensely benefit from such a reference book that contains a large list of recent publications. In the side line, I must state that plant biophysics is emerging as a robust discipline. Earlier, biophysics programmes were centered around radiation and medical biophysics and some environmental biophysics. With plant molecular biology coming up as a strong field of study and research, the development of plant biophysics that would include photosynthesis, transport and fluxes, bioenergetics and signal perception would be a required component of biophysics courses. I recommend this book to all those interested in plant and crop sciences, microbiology and environmental sciences. In spite of the prohibitory cost, the book should be at the desk of the researchers.

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