Preface

Photosynthesis is the process through which the energy inherent in sunlight is captured in the chemical bonds of reduced carbon compounds, thereby providing the food upon which almost all life depends. In addition, the production of oxygen as a result of the utilization of water as the ultimate electron donor to the photosynthetic electron transport chain has transformed our atmosphere, allowing for the emergence of oxygenic respiration, without which there would be no human life on Earth.

Photosynthesis is carried out in plants and algae in chloroplasts. Given their central role in energy transduction in the biosphere, chloroplasts have been the focus of attention for generations of scientists. This volume brings together many aspects of modern research into plastids relating to their biogenesis, functioning in photosynthesis and utility for biotechnology.

Plastids had their origins in free living photosynthetic bacteria and took up residence in the primitive eukaryotic cells through endosymbiosis. While they have lost most of their DNA to the nucleus, they retain a functioning genome and are capable of a limited but critical amount of semi-autonomous protein synthesis. Accordingly, we start this volume with a series of three chapters devoted to the handling of the genetic information contained within the plastid genome and crosstalk between the chloroplast and nucleus as the information encoded in both locations is decoded. Following this are five chapters that examine the biogenesis and differentiation of the plastid itself and the sub-structures found at the plastid surface and within the internal thylakoid system. Also included here is a treatment of the unusual non-photosynthetic plastids found within the Apicoplexa, a group of parasitic protists responsible for a number of important human diseases.

Despite having their own genomes, the vast majority of plastid proteins are synthesized in the cytosol and taken up into and subsequently distributed within the organelle. The next six chapters of the volume describe these processes, as well as the roles of molecular chaperones and proteases in protein homeostasis. This is followed by three chapters dedicated to critical aspects of chloroplast physiology relating to dissipation of excess light energy, control of electron transport and ion homeostasis. Finally, the book ends with two chapters discussing the emerging roles of plastids in biotechnology, one as a platform for synthesis of useful proteins, made

desirable because of the superior containment of transgenes within this organelle than when inserted in nuclear genomes, and the other as a source of hydrogen production to be used as biofuel.

Each of the chapters has been written by leading authorities in their respective research areas. Many chapters are the result of collaborations between experts in different laboratories, giving a broader than usual perspective on a given topic. In each case, readers will find well-crafted chapters containing information and insights for both novices and experts alike.

We are grateful to our many friends and scholars who contributed these outstanding chapters. The breadth of their knowledge and clarity of their writing have made for a unique and readable volume bringing together many disparate but interconnected topics relating to plastid biology. We are also indebted to those at Springer, especially Kenneth Teng and Brian Halm, who oversaw this project in its final stages of production.

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