

Preface

Mitochondria have evolved from an α -proteobacterial endosymbiont into vital eukaryotic organelles. It is almost 60 years since mitochondria were discovered to be the sites of oxidative energy metabolism, and in the intervening years further discoveries have demonstrated that mitochondria perform a variety of fundamental, essential functions, in addition to energy production.

As with most areas of life science research, plant mitochondrial research has benefited greatly from the genomics revolution. The last decade has seen the publication of both the mitochondrial and nuclear genome sequences of several plant species, and the concomitant developments in functional genomics technology have underpinned some tremendous advances in our understanding of mitochondrial form and function. This book documents the complex biology of plant mitochondria from a cell biological, biochemical and molecular biological perspective.

Chapter 1 describes the emerging field of plant mitochondrial dynamics, encompassing mitochondrial division, fusion, cellular inheritance and distribution. The dynamic mitochondrial genome is discussed in the Chapter 2, including a discussion of the role of recombination in shaping mitochondrial genome structure. The mitochondrial genome remains the subject of Chapter 3, which provides a comprehensive discussion of plant mitochondrial genome expression and its control. Functional mitochondria require the controlled expression of mitochondrial and nuclear genes and, in the case of nuclear genes, import of the translated protein into mitochondria. The sequence and structural determinants for protein import into mitochondria are the subjects of Chapter 4, which also provides a full review of the protein import and processing machineries of plant mitochondria. Chapter 5 considers the interplay between nuclear and mitochondrial gene expression and how this is controlled to effect biogenesis of the large multisubunit respiratory complexes while the supramolecular structure of these complexes is discussed in Chapter 6. Mitochondrial electron transport is the subject of Chapter 7 with a focus on the unique NAD(P)H dehydrogenases of plant mitochondria. This chapter also addresses the unavoidable production of reactive oxygen species as a consequence of aerobic respiration, the damage caused by ROS and the ways by which mitochondria repair the damage. Despite the involvement of mitochondria in a number of fundamental processes, it is their central role in primary metabolism for which they are best known. Chapter 8 provides a comprehensive analysis of plant mitochondrial metabolism. Cytoplasmic male sterility (CMS) (Chapter 9) is a phenomenon of considerable agricultural importance and is also an intriguing model for studying mitochondrial–nuclear coordination. The book ends with a discussion of the emerging role of mitochondria in plant programmed cell death, bringing us full circle in the life of

a plant mitochondrion, the organelle that provides not only the energy for life but also the trigger for death.

I take this opportunity to thank all the authors for their hard work in producing an excellent set of chapters, and also to thank the publishers for commissioning this volume and for their support during the editing process. Together I think we have produced an excellent volume that will provide researchers and plant science professionals with a valuable and timely monograph on plant mitochondria. I also record my thanks to Lydia, Peter and Florence for their unwavering support.

I would like to dedicate this book to Professor Christopher J. Leaver, FRS, FRSE, CBE, currently Sibthorpiian Professor of Plant Science at the University of Oxford. The impact Chris has had in the field of plant science research in general, and plant mitochondrial research in particular, should not be underestimated. I was very lucky to start my research into plant mitochondria as a postdoctoral fellow with Chris just over 10 years ago, by which time Chris had been working on plant mitochondria for over 25 years. However, the reason this book is dedicated to Chris is neither because of his longevity in the field, nor does it simply reflect my gratitude to him for that first opportunity. Instead it is because, as an author, Chris is referenced in every chapter of this book (an honour he alone holds), with an average citation of four papers per chapter. While this is impressive in its own right, and indicative of the breadth of his research interests within the plant mitochondrial field, what is so much more impressive is that even as Chris approaches retirement (Autumn 2007), the majority of the references to his work are to papers he has published in the past 5 years. I am sure I write for all authors when I thank Chris for all he has done for the field of plant mitochondrial research. His input and presence will be sorely missed and we wish him a long and happy retirement.

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