Preface

Plant cells, like those of all eukaryotes, are divided into subcellular compartments, or 'organelles'. This compartmentation serves a number of functions. It may concentrate a metabolite and provide a more favourable environment in which the enzymes may operate. It may separate intermediates from enzymes and, hence, avoid futile cycles or unwanted by-products. It may also enable pathways to interact more efficiently by bringing together a number of enzymes within the same organelle. Compartmentation, however, also poses a number of potential problems. The substrate required by a mitochondrial enzyme, for example, may be manufactured in the chloroplast. There is thus a requirement for controlled and coordinated fluxes of intermediates between organelles. Similarly, most proteins are nuclear-encoded and synthesised in the cytoplasm and those localised within organelles will have to cross at least one boundary membrane. This book addresses the way in which the metabolism of photosynthetic tissue is compartmentalised between organelles and how this compartmentation leads to controlled interaction between the organelles.

In 1991, a meeting was held on the topic of 'metabolic interactions of organelles in photosynthetic tissue' as part of the annual meeting of the Society for Experimental Biology, at the University of Birmingham (jointly organised by the Intracellular Co-ordination Group and the Plant Metabolism Group of the SEB). Invited speakers were asked to contribute a review of their subject area and these have been collected together to produce this volume. The first chapter, by Wiskich and Meidan, is a general overview of the field. There then follows a review of the fluxes of metabolites between plant cells, by Heldt and Flügge, with particular emphasis on the phosphate translocator, which was discovered and characterised in their laboratories. It was once thought that the chloroplasts could carry out photosynthesis in complete independence from the rest of the cell. This is not, however, the case as there is now ample evidence that the photosynthetic products, three carbon phospho-

esters, are exported to the cytosol in exchange for an import of inorganic phosphate from the cytosol. The characterisation of the phosphate translocator, which is responsible for this exchange, has led us to a greater understanding of the interactions which occur between organelles during photosynthesis. This theme is expanded upon in subsequent chapters. David Turpin reviews current schemes for the integration between photosynthetic and respiratory carbon and nitrogen metabolism in a model photosynthetic system, the green alga *Selenastrum*. There then follows a series of reviews on metabolic interactions during different photosynthetic processes, such as photorespiration (Wallsgrove *et al.*), C4 photosynthesis (Edwards and Krall), C3–C4 (Rawsthorne *et al.*) and CAM photosynthesis (Smith and Bryce). The last of these involves considerable flux of metabolites into and out of the vacuole. Aspects of the control of ion transport across the vacuolar membrane are then discussed in detail by Sanders *et al.*

The respiratory activity of photosynthetic tissue has often proved difficult to quantify, particularly when plants are in the light. Moore *et al.* discuss the mechanisms which may operate to regulate mitochondrial respiration in photosynthetic tissue. The final sections of the book deal with lipid metabolism, in terms of biosynthesis and assembly of some of the enzymes involved (Slabas *et al.*) and with the role of carnitine in lipid biosynthesis and degradation within different organelles (Wood *et al.*) Protein import from the cytosol to the chloroplast is discussed by Meadows *et al.* Finally, there are considerations of the interactions which occur between organelles in specific cells of a leaf: the guard cells (Schnabl) and developing and differentiating leaf cells (Tobin and Rogers).

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