

Preface

Reactive oxygen species (ROS), which include superoxide, hydrogen peroxide and the hydroxyl radical, are produced during the interaction of metabolism with oxygen. ROS have the potential to cause oxidative damage by reacting with biomolecules. Accordingly, the emphasis of research on ROS has been on the oxidative damage that results from exposure to environmental stresses and on the role of ROS in defence against pathogens. More recently, it has become apparent that ROS have important roles as signalling molecules that contribute to the control of plant development and to the sensing of the external environment. A complex network of enzymatic and small molecule antioxidants control the concentration of ROS and repair oxidative damage. Interest in the function of small molecule antioxidants such as tocopherols (vitamin E), glutathione and ascorbic acid (vitamin C) is increasing, now that the details of their biosynthetic pathways have been uncovered. This research is revealing the complex and subtle interplay between ROS and antioxidants in controlling plant growth, development and response to the environment.

The book covers these new developments through a series of in-depth chapters, but it also provides, in one place, an overview of the subject for those outside the research area. The first six chapters cover the synthesis and function of antioxidants (glutathione, proteins involved in thiol homeostasis, ascorbate, tocopherol, carotenoids, phenolic compounds and catalase). Many of these antioxidants are important in the human diet, which provides additional impetus to understand their metabolism in order to manipulate their synthesis more effectively. The next three chapters consider the role of ROS in signalling, developmental processes and cell wall biochemistry. The final two chapters consider photosynthesis, which is a major source of ROS in leaves, and response to ozone, which has provided a useful model system for understanding the complex interplay of responses made by plants to ROS and oxidative stress. The subject matter is generally focussed on the molecular and biochemical details, as these have provided the basis for the large increase in research activity on ROS and antioxidants over the last decade. The antioxidant network is an ideal candidate for investigation on the genome-wide scale, using functional genomics and systems biology tools, and I hope that this volume will provide a background for this endeavour.

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