

Preface

Intercellular communication in plants plays a vital role in the coordination of processes leading to the formation of a functional organism. The signalling systems must function at a local level to coordinate events of cellular differentiation over long distances to coordinate developmental and physiological responses in different parts of the plant, and they must even operate between separate individuals – for example, to control fertilisation as part of the evolutionary strategy of a particular species. To cope with the diverse requirements for intercellular signalling, plants have evolved a spectrum of molecular mechanisms, and significant progress has been made over the last few years in our understanding of these processes.

One intriguing area has been the identification and characterisation of novel signalling compounds, most notably the finding that polypeptides and RNA can move between plant cells and act in an instructive manner. Chapters 2 and 3 of this volume focus on the exciting progress being made in these new areas of signalling research. This does not mean that the classical growth factors previously implicated in intercellular signalling should be ignored. Indeed, fantastic new insights into the coordination of plant growth processes and organogenesis have arisen from research on auxin, which has been recognised as an important signalling molecule for almost 80 years. Chapter 1 describes the significant advances that have been made in this area. It has also become apparent that the plant cell wall plays an important role in intercellular communication, as a potential source and modulator of signals (Chapter 4) and because organelles embedded in the cell wall (the plasmodesmata) can act as regulators of signal movement (as described in Chapter 5).

The different signalling systems involved in intercellular communication must be integrated into particular biological systems, and particular systems will rely to different extents on different signalling systems. This cross-talk and integration of signalling systems is a major topic for future research, and the final chapters of this volume provide insights into different aspects of the plant where significant progress has been made. This ranges from local regulation of cell proliferation and differentiation in the shoot (Chapter 6), root (Chapter 8) and leaf (Chapter 9) to control the floral transition (Chapter 7) and pollen/stigma interactions (Chapter 10).

Intercellular communication in plants is a massive topic and, inevitably, a volume of this size can only focus on a few aspects. Topics have been selected to demonstrate research areas showing significant recent progress and promise. They have also been selected to focus on the actual process of intercellular signalling rather than on subsequent intracellular signal transduction. The signalling interactions of plants with other organisms (symbiotic and parasitic) are not covered because the focus here is on

the plant as an independent organism in which a developmental program is unfurled, which requires coordination (thus signalling) at several levels of organisation.

Intercellular communication is a major topic in plant biology and one in which fantastic progress is being made, providing novel and often unexpected insights into basic biological processes. The aim of this book is to provide a taste of this excitement, an idea of how much is there still to discover, and to act as an encouragement to researchers, old and new, to tackle the fascinating problem of how plant cells communicate with each other.

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