

D. P. S. Verma (ed.)

Signal Transduction
in Plant Growth and
Development

SpringerWienNewYork

Contents

List of Contributors x

Signal Transducing Proteins in Plants: an Overview

Z. Yang

- I. Introduction 1
- II. Signal Transduction Paradigm 2
- III. Conserved Signaling Proteins in Plants 5
- IV. Novel Plant Signaling Mechanisms 26
- V. Conclusions and Future Challenges 29
- VI. References 31

G-Protein Regulation of Plant K⁺ Channels

S. M. Assmann

- I. Introduction 39
- II. G-Protein Regulation of Animal Ion Channels: Background and Methodology 40
- III. G-Protein Regulation of Plant Ion Channels 45
- IV. Future Prospects 53
- V. References 55

Metabolite Sensing and Regulatory Points of Carbon and Nitrogen Metabolic Pathways and Partitioning in Plants

G.-H. Miao

- I. Introduction 63
- II. Global Regulatory Systems of Metabolic Pathways in Prokaryotes and Lower Eukaryotes 64
- III. Regulation of Carbon and Nitrogen Metabolism in Higher Plants 68
- IV. Future Prospects: Challenges for Metabolic Engineering of Crop Plants 79
- V. References 80

Regulation of C/N Interactions in Higher Plants by Protein Phosphorylation

S. C. Huber and W. M. Kaiser

- I. Introduction 87
- II. Regulation of Key Cytosolic Enzymes by Reversible Phosphorylation 91
- III. Control of C/N Interactions 99
- IV. Conclusions 106
- V. References 107

Phosphorylation and the Cytoskeleton

S. M. Ritchie and N. H. Battey

- I. Introduction 113
- II. Cytoskeletal Dynamics and Phosphorylation of the Polymer Proteins 114
- III. Phosphorylation of Cytoskeletal Associated Proteins During Interphase 121
- IV. Phosphorylation of Cytoskeletal Proteins During Cell Division 127
- V. Summary 132
- VI. References 133

The Regulatory Phosphorylation of C₄ Phosphoenolpyruvate Carboxylase: a Cardinal Event in C₄ Photosynthesis

J. Vidal, J.-N. Pierre, and C. Echevarria

- I. Introduction 141
- II. C₄ PEPC, a Highly Regulated Plant Enzyme 142
- III. Regulatory Phosphorylation of PEPC and Its Role in C₄ Photosynthesis 146
- IV. Conclusions and Outlook 159
- V. References 160

Salicylic Acid — an Important Signal in Plants

K. K. Wobbe and D. F. Klessig

- I. Introduction 167
- II. Salicylic Acid in Thermogenesis 168
- III. Disease Resistance 168
- IV. Salicylic Acid as a Signal in Plant Defense 170
- V. Salicylic Acid as the Translocated Signal 172
- VI. Salicylic Acid Metabolism 173
- VII. Mechanisms of Action of Salicylic Acid 175
- VIII. Salicylic Acid Signal Transduction Pathway 179
- IX. Perspectives 183
- X. References 186

Biologically Active Lipids and Lipid-modulated Protein Kinase in Plants

G. F. E. Scherer

- I. Introduction 197
- II. What Enzymes Do Generate Biologically Active Lipids in Animals and in Plants? 198
- III. Lipid-modulated Protein Kinase in Plants 202
- IV. References 210

S-Locus Receptor Kinase Genes and Self-incompatibility in *Brassica napus*

D. R. Goring and S. J. Rothstein

- I. Introduction 217
- II. Genetics of the Self-incompatibility System 218
- III. Molecular Biology of the Self-incompatibility System 219
- IV. Self-incompatibility in *Brassica napus* 220
- V. Self-compatibility in *Brassica napus* 222
- VI. Molecular Model for *Brassica* Self-incompatibility 224

VII. Conclusion	228
VIII. References	228

Mechanisms of Input and Output in Circadian Transduction Pathways

I. Carré and S. A. Kay

I. Introduction	231
II. Rhythmic Outputs	235
III. Interaction of Photoreceptors and Clocks	239
IV. Conclusion	243
V. References	243

Role of Plasmodesmata and Virus Movement Proteins in Spread of Plant Viruses

C. A. Fenczik, B. L. Epel, and R. N. Beachy

I. Introduction	249
II. Plasmodesmata	250
III. Virus Movement in Infected Plants	257
IV. Conclusions	272
V. References	272

Ex-Planta and In-Planta Signals in Legume–*Rhizobium* Interaction

Z. Hong and D. P. S. Verma

I. Introduction	281
II. Plant Flavonoid Signals and the Response of <i>Rhizobia</i>	282
III. Synthesis of Nod Factors by <i>Rhizobium</i>	285
IV. Other <i>Rhizobial</i> Signals Affecting Nodule Formation	290
V. Signals Produced by the Host in Response to Nod Factors	295
VI. Early Host Response to Bacterial Signals	296
VII. Plant Phosphatidylinositol-3-kinase	296
VIII. Endocytosis and Subcellular Compartmentation in the Host Cell	298
IX. Conclusions	299
X. References	300

Subject Index	311
---------------	-----