

Contents

List of Contributors	ix
Preface	xi
Chapter 1 Biochemistry of Fruit Ripening	1
Sonia Osorio and Alisdair R. Fernie	
Introduction	1
Central Carbon Metabolism	4
Ethylene in Ripening	7
Polyamines	9
Volatiles	10
Cell Wall Metabolism	11
Concluding Remarks	13
References	13
Chapter 2 Fruit—An Angiosperm Innovation	21
Sandra Knapp and Amy Litt	
Introduction	21
Fruit in the Fossil Record	30
Fruit Variation and Angiosperm Phylogeny	32
Fruit Development	33
Fruit as a Driver of Angiosperm Diversity	36
Acknowledgments	38
References	38
Chapter 3 Ethylene and the Control of Fruit Ripening	43
Don Grierson	
Introduction	43
Ethylene and Climacteric and Nonclimacteric Fruits	46
A Molecular Explanation for System-1 and System-2 Ethylene	48
Ethylene and Ripening Gene Networks in Flower and Fruit Development	53
Ethylene Perception and Signaling	54
Ethylene Response Factors	60

Ethylene and Ripening Gene Expression	60
Conclusions	67
Acknowledgments	68
References	68
Chapter 4 Carotenoid Biosynthesis and Chlorophyll Degradation	75
Peter M. Bramley	
Introduction	75
Distribution of Carotenoids and Chlorophylls in Fruit	75
Chlorophyll Degradation and Recycling	78
Carotenoids and Carotenoid Metabolites	82
Future Perspectives	100
Acknowledgments	102
Bibliography	102
Chapter 5 Phenylpropanoid Metabolism and Biosynthesis of Anthocyanins	117
Laura Jaakola	
Introduction	117
Cinnamic Acids	119
Monolignols, Lignans, and Lignin	120
Coumarins	120
Stilbenoids	122
Flavonoids	122
Engineering Elevated Levels of Flavonoids and Other Phenylpropanoids	128
Conclusion	129
References	129
Chapter 6 Biosynthesis of Volatile Compounds	135
Antonio Granell and José Luis Rambla	
Introduction	135
Metabolic Pathways	136
Identification of Quantitative Trait Loci for Volatiles	152
Metabolic Engineering of the Fruit Volatile Pathways	153
Future Perspectives	154
References	155
Chapter 7 Cell Wall Architecture and Metabolism in Ripening Fruit and the Complex Relationship with Softening	163
Eliel Ruiz-May and Jocelyn K.C. Rose	
Introduction	163
Building Blocks of Fruit Cell Walls	164

The Architecture of Fruit Cell Walls	168
Cell Wall Dynamics in Ripening Fruit	171
The Cuticular Cell Wall and Fruit Softening	177
Summary	179
Acknowledgments	180
References	180
Chapter 8 Regulatory Networks Controlling Ripening	189
Betsy Ampopho, Natalie Chapman, Graham B. Seymour, and James J. Giovannoni	
Hormonal Control	189
Genetic Networks	191
Epigenetic Regulation	200
References	201
Index	207