

CONTENTS

<i>Contributors</i>	ix
<i>Preface</i>	xi
1. General Introduction to Glucosinolates	1
B.A. Halkier	
1. Introduction	2
2. Biosynthesis	3
3. Localization of the Biosynthesis	5
4. Storage	6
5. Pathway Engineering	6
6. Transport Processes	8
7. Conclusions	11
References	11
2. Complex Environments Interact With Plant Development to Shape Glucosinolate Profiles	15
M. Burow	
1. Introduction	16
2. All Classes of Glucosinolates Can Change in Response to Pathogens and Herbivores	17
3. Changes in Abiotic Environmental Factors Modulate Glucosinolate Responses	20
4. Plants Integrate External and Internal Signals to Optimize Their Metabolism	23
5. Concluding Remarks	24
Acknowledgements	24
References	24
3. Nonlinear Selection and a Blend of Convergent, Divergent and Parallel Evolution Shapes Natural Variation in Glucosinolates	31
D.J. Kliebenstein and N.I. Cacho	
1. Introduction	32
2. Loci	34
3. Evolutionary Implications	44

4. Future Perspectives for Understanding Glucosinolate Variation	47
Acknowledgements	48
References	48
4. Glucosinolate Regulation in a Complex Relationship – MYC and MYB – No One Can Act Without Each Other	57
H. Frerigmann	
1. Introduction	58
2. Subgroup 12 R2R3-MYB Transcription Factors in Glucosinolate Regulation	59
3. Subgroup IIIe bHLH Transcription Factors in Glucosinolate Regulation	69
4. The MYC-bHLH Interact With the GSL-MYBs and are Thereby Crucial Regulators of IG and AG	76
5. HIG-MYB-Dependent Effects on IG-Related Indolic Compounds	79
6. Glucosinolate-Feedback Mechanism	80
7. HIG-HAG Crosstalk – Possible Reasons for the Reciprocal Regulation of Aliphatic and Indolic Glucosinolates	83
8. Further Regulatory Proteins in Glucosinolate Regulation	84
9. Summary and Future Perspectives	89
Acknowledgements	90
References	90
5. Glucosinolate Synthesis in the Context of Plant Metabolism	99
S. Kopriva and T. Gigolashvili	
1. Introduction	100
2. Connection of Glucosinolates With Sulphur Metabolism	101
3. Redox Regulation	107
4. Transporters in Glucosinolate Synthesis	109
5. Conclusions	117
Acknowledgements	118
References	118
6. Glucosinolate Breakdown	125
U. Wittstock, E. Kurzbach, A.-M. Herfurth and E.J. Stauber	
1. Introduction	126
2. Myrosinases	127
3. Specifier Proteins	134
4. Compartmentation	140

5. Structural Diversity of Breakdown Products Formed Upon Tissue Disruption and Their Impact on Plant Defence	145
6. Breakdown Inside Herbivores	151
7. Breakdown in Nondisrupted Tissue	153
8. Conclusions and Perspectives	158
Acknowledgements	159
References	159
7. The Function of Glucosinolates and Related Metabolites in Plant Innate Immunity	171
M. Pastorczyk and P. Bednarek	
1. Introduction	172
2. Aliphatic Glucosinolates in Plant Immunity	174
3. Pathogen-Triggered Indole Glucosinolate Metabolism	177
4. Functional and Biosynthetic Relationships Between Indole Glucosinolates and Brassicaceae Phytoalexins	185
5. Mode of Action of Glucosinolate-Derived Products	189
6. Concluding Remarks	192
Acknowledgements	193
References	193
8. Insect Detoxification of Glucosinolates and Their Hydrolysis Products	199
V. Jeschke, J. Gershenzon and D.G. Vassão	
1. Introduction: Glucosinolate Hydrolysis and Its Effects on Insect Herbivores	200
2. General Detoxification Strategies	207
3. Specialized Detoxification Strategies	217
4. Conclusion	230
References	232
9. Health Benefits of Glucosinolates	247
M.H. Traka	
1. Glucosinolate Structure and Metabolism	248
2. Metabolic Fate in Humans	250
3. Evidence for Health Benefits From Epidemiology	252
4. Diet-Gene Interactions and the Role of Glutathione-S-Transferase Genotypes	256

5. Evidence for Health Benefits From Human Interventional Studies	260
6. Mechanisms of Bioactivity From Animal and Cell Models	261
7. Conclusion	269
References	269
10. Glucosinolates – The Agricultural Story	281
E. Schnug and S. Haneklaus	
1. Introduction	281
2. Oilseed Rape – From Industrial to Food Plant	282
3. Consequences of an Abrupt Switch of Oilseed Rape Varieties in Agricultural Production	285
4. Knockout of Double Low Oilseed Rape Varieties by Severe Sulphur Deficiency	288
5. Genetic Changes in Glucosinolate Metabolism Modify Sulphur Utilization, Natural Plant Health and Wildlife Interactions	290
6. Epilogue	298
References	299
<i>Subject Index</i>	303
<i>Author Index</i>	317