

Contents

Contributors	xiii
Preface	xv
1 General transcription factors and the core promoter: ancient roots	1
WILLIAM B. GURLEY, KEVIN O'GRADY, EVA CZARNECKA-VERNER and SHAI J. LAWIT	
1.1 Introduction	1
1.2 Origins of the eukaryotic promoter	1
1.3 Organization of the eukaryotic promoter	4
1.3.1 TATA-less promoters	8
1.4 Transcription factor IID	8
1.5 Role of TFIID in development	9
1.6 Mediator	11
1.6.1 Tail module	12
1.6.2 Middle complex	15
1.6.3 Head module	16
1.6.4 CDK8/Srb8-11 module	16
1.6.5 Mediator subunits unique to metazoans and plants	17
1.7 Transcription factor IIB	18
1.8 Summary	19
References	21
2 Transcription factors of <i>Arabidopsis</i> and rice: a genomic perspective	28
JOSÉ LUIS RIECHMANN	
2.1 Introduction	28
2.2 <i>Arabidopsis</i> and rice genomes: the angiosperm complement of transcription factors	29
2.2.1 General considerations for genome-wide analyses	29
2.2.2 <i>Arabidopsis</i> transcription factors	30
2.2.3 Rice transcription factors: a comparison to <i>Arabidopsis</i>	35
2.2.4 Gene duplications, functional redundancy, and the transcription factor phenome	38
2.3 Plant promoters	40
References	43

3	Chromatin-associated architectural HMGA and HMGB proteins assist transcription factor function	54
	KLAUS D. GRASSER and DORTE LAUNHOLT	
3.1	Introduction	54
3.2	HMGA proteins	55
3.2.1	Structure and expression	55
3.2.2	DNA and chromatin interactions	57
3.3	HMGB proteins	59
3.3.1	Structure and expression	59
3.3.2	DNA and chromatin interactions	64
3.4	Dynamic interaction of histone H1 and HMG proteins with chromatin	66
3.5	HMGA and HMGB proteins as architectural assistant factors	67
	Acknowledgements	72
	References	72
4	Histone modifications and transcription in plants	79
	YII LENG CHUA and JOHN C. GRAY	
4.1	Introduction	79
4.2	Histone acetylation and transcriptional activation	83
4.2.1	Plant histone acetyltransferases	85
4.2.1.1	GNAT/MYST family	86
4.2.1.2	TAF _{II} 250 family	87
4.2.1.3	P300/CBP family	87
4.2.2	Bromodomain proteins	88
4.2.2.1	Bromodomain extra-terminal proteins	89
4.2.2.2	Plant bromodomain proteins	90
4.2.3	Plant histone deacetylases	90
4.2.3.1	RPD3/HDA1 family	90
4.2.3.2	HD2 family	92
4.2.3.3	SIR2 family	92
4.2.4	Histone acetylation/deacetylation and environmental adaptation	93
4.3	Histone methylation	93
4.3.1	Plant SET-domain proteins	95
4.3.1.1	E(Z)- and Trithorax-type HMTases	96
4.3.1.2	Su(var)3-9-type HMTases	97
4.3.1.3	ASH1-type and plant-specific HMTases	99
4.3.2	Histone demethylase	99
4.4	Interplay between histone acetylation and methylation in transcriptional regulation	100
4.5	Conclusions	102
	References	103

5	Chromatin remodeling and histone variants in transcriptional regulation and in maintaining DNA methylation	112
	J.C. REYES, J. BRZESKI and A. JERZMANOWSKI	
5.1	Introduction	112
5.2	ATP-dependent chromatin remodeling	113
5.2.1	SWI/SNF-like complexes in plants	115
5.2.2	Other ATPases of the SNF2 family that control plant development	119
5.3	Chromatin remodeling and DNA methylation	120
5.3.1	The effects of <i>ddm1</i> mutation differ from those caused by <i>met1</i>	121
5.3.2	The model of <i>DDM1</i> action	121
5.3.3	<i>DDM1</i> and methylation of histone H3	123
5.3.4	Models of <i>DDM1</i> targeting	124
5.3.5	DRD1 – another SNF2 family protein involved in control of DNA methylation	124
5.4	Histone variants in the regulation of chromatin functions	125
5.4.1	Occurrence and functional role of core histone variants	125
5.4.2	Role of H1 histone in chromatin and significance of nonallelic H1 variants	128
	References	130
6	Matrix attachment regions and transcriptional gene silencing	136
	WILLIAM F. THOMPSON, STEVEN SPIKER and GEORGE C. ALLEN	
6.1	Introduction	136
6.2	Costs and consequences of transgene expression variation	137
6.3	Position effects	137
6.4	Gene silencing	138
6.4.1	Post-transcriptional gene silencing	138
6.4.2	Transcriptional gene silencing	139
6.4.3	Repeats and rearrangement effects	140
6.5	Matrix attachment regions	140
6.6	MARs and transgene expression	142
6.6.1	MARs reduce gene silencing	142
6.6.2	MARs have a dual effect	148
6.6.3	Hypotheses to explain MAR effects	149
6.7	MAR effects in <i>Arabidopsis</i>	151
6.7.1	Testing the effect of developmental stage	152
6.7.2	How might MARs decrease net transgene expression?	152
6.7.3	MAR effects in PTGS mutants	153
6.8	Conclusions	153
	References	153

7	Polymerase I transcription	162
	JULIO SÁEZ-VÁSQUEZ and MANUEL ECHEVERRÍA	
7.1	Introduction	162
7.2	Organization of rRNA genes	162
7.3	Ribosomal RNA transcription and the nucleolus	163
7.4	rRNA gene promoters and transcription factors	166
7.5	RNA pol I holoenzymes: evidence and controversies	169
7.6	Coupling rDNA transcription and processing of pre-rRNA	171
7.7	Growth and hormonal control of RNA pol I transcription	172
7.8	Nucleolar dominance	173
7.9	Final remarks	176
	Acknowledgements	176
	References	177
8	Transcription of plastid genes	184
	KARSTEN LIERE and THOMAS BÖRNER	
8.1	Introduction	184
8.2	RNA polymerases	185
	8.2.1 NEP: Nuclear-encoded RNA polymerase	187
	8.2.2 PEP: Plastid-encoded RNA polymerase	188
8.3	Plastidial promoters	189
	8.3.1 PEP promoters	189
	8.3.2 NEP promoters	190
	8.3.3 tRNAs with internal promoters	192
8.4	Regulation	192
	8.4.1 Role of diverse and multiple promoters in developmental regulation of gene expression	193
	8.4.2 Transcription factors for selective promoter recognition	196
	8.4.2.1 Nuclear-encoded plastidial σ -factors	196
	8.4.2.2 Role of σ -factor diversity in transcriptional regulation	198
	8.4.2.3 NEP transcription factors	203
	8.4.3 Effects of environmental factors and crosstalk between plastids and nucleus	204
	References	209
9	Control of flowering time	225
	STEVEN VAN NOCKER and MARIA JULISSA EK-RAMOS	
9.1	Introduction	225
9.2	Regulation of <i>FLC</i> expression through the 'autonomous pathway'	225
9.3	Chromatin-related pleiotropic regulators of <i>FLC</i>	229
9.4	Vernalization-associated repression of <i>FLC</i>	232
9.5	Transcriptional repression of flowering by <i>FLC</i>	235

9.6	Transcriptional regulation in the photoperiodic induction of flowering	236
9.7	Activation of <i>SOC1</i> by <i>CO</i>	237
9.8	Chromatin-related mechanisms of photoperiod pathway regulation	238
9.9	Transcriptional activation of <i>API</i> by <i>FT</i> and <i>FD</i>	240
9.10	Transcriptional mechanisms in the promotion of flowering by GAs	242
9.11	PcG-mediated repression of floral homeotic genes	243
9.12	Summary and prospects	244
	Acknowledgements	244
	References	244
10	Combinatorial control of floral organ identity by MADS-domain transcription factors	253
	GÜNTHER THEIBEN and RAINER MELZER	
10.1	Introduction	253
10.2	ABC: early genetic models of floral organ identity	253
10.3	From the ABC to the ABCDE model	256
10.4	Elective affinities of homeotic proteins: the floral quartet model	257
10.5	Beyond the floral quartets <i>sensu stricto</i> : multimeric complexes of other MIKC-type proteins	260
10.6	Outlook: the devil is always in the details – what we still don't know about floral quartets	261
10.7	Summary	263
	Acknowledgements	263
	References	263
11	Networks of transcriptional regulation underlying plant defense responses toward phytopathogens	266
	IMRE E. SOMSSICH	
11.1	Introduction	266
11.2	Defense transcriptome	267
11.3	Regulatory sequences mediating defense gene expression	268
11.4	Transcription factors involved in defense gene regulation	270
11.5	Transcriptional networks	275
11.6	Defense gene suppression by pathogens	277
11.7	Summary and outlook	277
	Acknowledgements	279
	References	279
12	Temperature-regulated gene expression	285
	FRIEDRICH SCHÖFFL and TRESSA JACOB PANIKULANGARA	
12.1	Heat stress	285

12.1.1	Introduction	285
12.1.2	Heat stress sensing and signaling	285
12.1.3	Heat stress transcription factors: structure and function	286
12.1.4	Class A HSF: immediate early regulators of the heat-shock response	288
12.1.5	Second-level regulation	289
12.1.6	Heat stress target genes	290
12.1.7	Common stress-response genes and pathways	291
12.2	Cold stress	292
12.2.1	Introduction	292
12.2.2	Low-temperature sensing and signaling	292
12.2.3	Transcription factors in ABA-independent pathways	296
12.2.4	Transcription factors in ABA-dependent pathways	298
12.2.5	Cold stress target genes	298
12.3	Perspectives for plant biotechnology	300
	References	302
13	Applications of inducible transcription in plant research and biotechnology	309
	BRIAN TOMSETT, ANGELA TREGOVA and MARK CADDICK	
13.1	Introduction	309
13.2	Conditional expression of transgenes	309
13.2.1	The principles of regulated expression	310
13.2.2	Generic mechanisms	310
13.2.3	Physical stimuli for activation	312
13.2.4	Chemical activators related to plant metabolism	314
13.2.5	Chemical activators unrelated to plant metabolism	316
13.2.6	The conditional expression tool kit and its further development	319
13.3	Applications to plant functional genomics	320
13.3.1	Conditional over-expression	321
13.3.2	Conditional knockout/knockdown	321
13.3.3	Conditional complementation	322
13.4	Potential applications to plant biotechnology	322
13.5	Conclusions	324
	References	324
14	Modulation of transcriptional networks in crop plants	329
	TONG ZHU	
14.1	Introduction	329
14.2	Genes, regulatory factors, regulatory pathways, regulatory nodes, and regulatory networks	330
14.3	Functional characterization of transcription factor genes	331
14.4	Reverse engineering of transcription regulatory network	333

14.5	Transcription network in crop plants	337
14.6	Transcription factors as gene switches for genetic engineering	339
14.7	Perspectives	340
	References	342

Index	347
--------------	------------

The colour plate section appears after Page 142