

## Contents

---

	Preface	ix
	<b>Section I. Chemical and biochemical aspects</b>	
1	Light and colour	3
	1.1 Introduction	3
	1.2 Colour and colour perception	4
	1.3 Colour in living organisms	6
	1.4 Light absorption	8
	1.5 Spectroscopic methods in natural pigment research	15
	1.6 The significance of colour in Nature	19
	1.7 Conclusions and comments	20
	1.8 Suggested further reading	20
	1.9 Selected bibliography	22
2	Carotenoids	23
	2.1 Introduction	23
	2.2 Structures and nomenclature	23
	2.3 Properties	31
	2.4 Distribution	39
	2.5 Carotenoproteins	45
	2.6 Biosynthesis	46
	2.7 Regulation and control of biosynthesis	63
	2.8 Metabolism of carotenoids by animals	66
	2.9 Functions of carotenoids	67
	2.10 Carotenoids as food colorants	68
	2.11 Medical uses of carotenoids	68
	2.12 Other polyene pigments	69
	2.13 Conclusions and comments	70
	2.14 Suggested further reading	71
	2.15 Selected bibliography	72
3	Quinones	74
	3.1 Introduction	74
	3.2 Structures	74

vi	<i>Contents</i>	
	3.3 Properties	76
	3.4 Occurrence and distribution	79
	3.5 Contribution to colour	85
	3.6 Biosynthesis	85
	3.7 Functions and biological effects	97
	3.8 Industrial and medicinal uses	99
	3.9 Conclusions and comments	100
	3.10 Suggested further reading	101
	3.11 Selected bibliography	101
4	<i>O</i> -Heterocyclic pigments - the flavonoids	102
	4.1 Introduction	102
	4.2 Structures and nomenclature	102
	4.3 Properties	107
	4.4 Distribution	112
	4.5 Contribution to plant colours	113
	4.6 Biosynthesis	115
	4.7 Metabolism of flavonoids by animals	125
	4.8 Microbial degradation of flavonoids	125
	4.9 Functions of flavonoids in plants	125
	4.10 Use of anthocyanins as food colorants	126
	4.11 Conclusions and comments	127
	4.12 Suggested further reading	128
	4.13 Selected bibliography	128
5	Tetrapyrroles	130
	5.1 Introduction	130
	5.2 General structural features	130
	5.3 General light-absorption properties	132
	5.4 Chlorophylls	133
	5.5 Haem and haemoproteins	140
	5.6 Free porphyrins in animals	152
	5.7 Vitamin B <sub>12</sub>	154
	5.8 Linear tetrapyrroles - bilins	155
	5.9 Biosynthesis and metabolism of tetrapyrroles	163
	5.10 Disorders of porphyrin metabolism	183
	5.11 Functions of tetrapyrrole pigments	184
	5.12 Conclusions and comments	185
	5.13 Suggested further reading	186
	5.14 Selected bibliography	187
6	Other non-polymeric <i>N</i> -heterocyclic pigments	189
	6.1 Introduction	189
	6.2 Purines, pterins and flavins	189
	6.3 Phenazines	204

Cambridge University Press

978-0-521-10531-6 - The Biochemistry of Natural Pigments

G. Britton

Table of Contents

[More information](#)

	<i>Contents</i>	vii
6.4	Phenoxazines	209
6.5	Betalains	213
6.6	Miscellaneous <i>N</i> -heterocyclic pigments	217
6.7	Conclusions and comments	219
6.8	Suggested further reading	219
6.9	Selected bibliography	220
7	<b>Melanins</b>	222
7.1	Introduction	222
7.2	Chemistry	222
7.3	Distribution	229
7.4	Biosynthesis	230
7.5	Factors affecting melanogenesis	235
7.6	Functions	238
7.7	Conclusions and comments	238
7.8	Suggested further reading	238
7.9	Selected bibliography	239
	<b>Section II. Functional aspects</b>	
8	<b>The importance of colour in Nature</b>	243
8.1	Introduction	243
8.2	Colour and pattern in animals	244
8.3	Animal pigment cells - chromatophores	245
8.4	Animal colour changes	248
8.5	Colour in plants	252
8.6	Conclusions and comments	254
8.7	Suggested further reading	255
8.8	Selected bibliography	255
9	<b>Pigments in vision</b>	257
9.1	Introduction	257
9.2	The eye	257
9.3	Visual pigments	262
9.4	Functioning of the visual pigments - the visual cycles	268
9.5	Some aspects of colour vision	276
9.6	Accessory pigments in vision	277
9.7	Conclusions and comments	281
9.8	Suggested further reading	281
9.9	Selected bibliography	282
10	<b>Photosynthesis</b>	283
10.1	Introduction	283
10.2	The photosynthetic apparatus of eukaryotes: the chloroplast	284

viii	<i>Contents</i>	
	10.3 Plant photosynthesis – a general outline	288
	10.4 Light harvesting – the primary process of photosynthesis	289
	10.5 Secondary events – the photosynthetic electron transport system	296
	10.6 The dark reactions	300
	10.7 Photosynthesis in eukaryotic algae	301
	10.8 Photosynthesis in the prokaryotic blue-green algae	306
	10.9 Bacterial photosynthesis	307
	10.10 Pigment synthesis in relation to chloroplast development	310
	10.11 Development of the photosynthetic apparatus of photosynthetic bacteria	314
	10.12 Fate of photosynthetic pigments during chloroplast degeneration	315
	10.13 Conclusions and comments	316
	10.14 Suggested further reading	317
	10.15 Selected bibliography	317
11	Other photofunctions of natural pigments	319
	11.1 Introduction	319
	11.2 Phytochrome	319
	11.3 Phototaxis	323
	11.4 Phototropism	324
	11.5 Bacteriorhodopsin	325
	11.6 Extra-ocular and extra-retinal photoreceptors in animals	327
	11.7 Photoprotection	330
	11.8 Bioluminescence	333
	11.9 Conclusions and comments	336
	11.10 Suggested further reading	337
	11.11 Selected bibliography	338
	Problems	340
	Answers	348
	Index	355