

# Contents

<i>Abbreviations</i>	vii
<i>Preface</i>	xi
<b>1 Introduction</b>	1
<b>2 The natural light environment</b>	6
Light, its nature	6
Solar radiation	6
The earth's atmosphere	8
Atmospheric modification of solar radiation	9
Variations in atmospheric modifications	12
<b>3 Light-absorbing pigments</b>	23
Introduction	23
Photosynthetic pigments	23
Phytochrome, its nature	25
Blue-light-absorbing pigment (BAP)	34
BAP and phototropism	37
<b>4 Seed germination</b>	48
Introduction	48
Light within seeds	48
Perception of light quality and quantity by seeds	49
Light effects on the maturing seed	54
Light and seed burial	55
Germination in canopy shade	57
Germination and sunflecks	58
Light and temperature interactions	59
<b>5 Seedling development</b>	65
Patterns of seedling development	65
Light within the hypocotyl and the coleoptile	66
The Thomson hypothesis	67
Control of mesocotyl and coleoptile development	67
BAP and straight growth in cereal seedlings	70
The role of the coleoptile apex	71
Phytochrome control of ethylene biosynthesis in etiolated seedlings	72
Cell elongation	72
Leaf unrolling in cereals	73
Control of hypocotyl development	73
Development of the cotyledon	75

vi    *Contents*

Cotyledon as a light trap	75
Effect of light on radicle and root development	76
Hypocotylar and plumular hook openings	78
Epicotyl (first internode) development	78
Photocontrol of epicotyl and subsequent internodes	78
Effects of reflected radiation	82
Tiller formation in grasses	83
Petioles	83
Leaves as light traps	84
Light and lamina development	84
Sun and shade leaves	85
Light and chloroplast development	89
Photocontrol of chlorophyll synthesis	91
Chloroplast membrane organisation	92
Adaptation of photosynthetic apparatus	92
Chloroplast movement	94
Leaf orientation	96
Stomata	98
Leaf abscission	101
6 <b>The flowering process</b>	114
Introduction	114
Response types	115
Flowering and experimentation	115
Juvenility	116
Photoperception	116
A universal flowering hormone?	117
Hormone purification	117
Growth substances and flowering	117
The importance and relationship of dark and light periods	118
Vernalisation	120
Moonlight effects on flowering	121
7 <b>Endogenous rhythms</b>	124
Introduction	124
The influence of light on circadian rhythms	124
Circadian measurement of time	125
Photoperiodism	127
8 <b>Special situations</b>	131
Aquatic	131
Tropical rain forests	132
Climbing mechanisms and shade adaptation	133
Light and buds	134
Tuberisation of potatoes	135
Bulbing	135
Tap root	135
Tendrils	136
CAM metabolism	136
Frost tolerance	137
<i>Index</i>	141