Light and plant responses

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A study of plant photophysiology and the natural environment

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Abbreviations

The abbreviations used in this book are specified here and the first time they are used within the text. Not specified are SI units, which are used wherever possible throughout this book.

Abbreviation	Meaning
ABA	Abscisic acid
A_{meso}/A	mesophyll to leaf area ratio
ATP	adenosine triphosphate
B	blue light
BAP	blue-light-absorbing pigment(s)
B-HIR	blue-light – high-irradiance response
CAM	Crassulacean acid metabolism
Chl-a	chlorophyll-a
Chl-b	chlorophyll-b
Chlide-a	chlorophyllide-a
CFC	chlorofluorohydrocarbon
C-W	Cholodny-Went model
DN	day neutral
DNP	day neutral plant(s)
EPP	phytochrome typical of etiolated material
FR	far-red light
FR-HIR	far-red – high irradiance
GA	gibberellic acid
GLI	gap light index
GPP	phytochrome typical of green tissue
HIR	high irradiance response
IAA	indol-3-acetic acid (auxin)

LAI	leaf area index
LD	long day
LDP	long-day plant
LFR	low fluence response
LHCI	light-harvesting complex I
LHCII	light-harvesting complex II
LHCP	light-harvesting chlorophyll-a/b binding protein
m-RNA	messenger RNA
LVDT	linear variable displacement transducer
n	refractive index
NAD	nicotinamide adenine dinucleotide
NADH	reduced form of NAD
NADP	nicotinamide adenine dinucleotide phosphate
NADPH	reduced form of NADP
PAR	photosynthetic active radiation (400 to 700 nm)
p-Chl	protochlorophyll
p-Chlide	protochlorophyllide
Pfr	far-red-absorbing form of phytochrome
Pfr/Ptot	photoequilibrium of phytochrome
phi	proportion of phytochrome in the Pfr form
PIR	per cent incident radiation
Pr	red-absorbing form of phytochrome
P700	reaction centre of photosynthetic unit
PSI	photosystem I
PSII	photosystem II
R	red light
R : FR	ratio of R to FR
Rubisco	ribulose 1, 5 bisphosphate carboxylase/oxygenase

SD	short day
SDP	short day plant(s)
SOX	low-pressure sodium lamps
UV	ultra-violet light
UV-A	320 to 400 nm
UV-B	280 to 320 nm
VLFR	very low fluence response
WEX	cell wall extensibility
WL	white light
zeta	ratio of R to FR

We trained hard, but every time we were beginning to form up into teams, we would be reorganised. I was to learn in later life that we tend to meet any new situation by reorganising and a wonderful method it can be for creating the illusion of progress while only producing inefficiency and demoralization.

Petronious Arbiter (AD 66)

Preface

Progress in any area of science can be limited by a number of factors, but cannot advance faster than the techniques available to tackle the problems. It would seem that research has two phases to its cycle. In the first a new technique surfaces or, as is often the case in plant sciences, a recent technique is applied to a new discipline. This leads to the elucidation of long-standing problems and often the establishment of new problems which were not previously apparent. This is followed by a phase of fact collection where these techniques are applied more widely, often with greater ingenuity, and the established models and hypotheses are modified or expanded.

The revolution that has occurred in the techniques of molecular biology has greatly encouraged those seeking an understanding of the mechanisms of plant development and this is an unimpeachable pursuit. Such enquiry leads to specialisation and the acquisition of detailed knowledge and it would be possible to lose sight of the way in which the whole plant develops. I thought I might start this book with the quotation 'Lo, though they stand before the pyramids they speak only of the heat of the desert', but after an extensive search of the literature, lasting several minutes, I was unable to make an attribution. Before these new approaches were thrust upon us, research workers tended to be associated with one or another aspect of light-plant interactions, and indeed some areas are so complex it is difficult to see how it could have been otherwise. Here, I have tried to draw together an understanding of how higher plants respond to the natural light environment throughout their life cycle in the hope that in our efforts to understand plant development we can continue the current tendency to take the more integrated approach required by the complex stimuli of the natural situation.

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T.H. Attridge
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