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The *Annual Review of Plant Biology* (*ARPB*) *2008* is yet another addition to a series well known for its most awaited and widely read accounts in frontier areas of research, put into perspective by the leading names in the field. The latest edition spans more than 800 pages and carries more than two dozen articles that can be broadly divided into themes like signalling, stress, plant development, plant–microbe interaction, frontier technologies and topics on cyanobacterial research.

Plant signalling is an area that has increasingly received research attention over the years, as reflected by the number of articles devoted to this fascinating field in *ARPB 2008*. Bae and Choi offer insights into photoperception and transduction by phytochromes, the best studied red-far red light receptors, their unity in diversity in terms of form and function, their dimerization, roles of their interacting proteins in their nuclear localization and modulation of light response at the gene level. Continuing on the theme of light signalling, Turck *et al.* provide a conclusive account of the light and dark circadian rhythms that control transition from the vegetative to reproductive stages through differential regulation of FT protein; a major component of florigen that is widely conserved among plants. Using high definition images and schematics, the authors offer a summative account of a host of regulatory factors that interact in hierarchical signalling pathways and feedback loops. The most notable feature of the review is the supplemental movies explaining intracellular organization and dynamics of pollen tubes.

The last decade has witnessed a revolution in our understanding of trehalose metabolism and signalling, largely driven by an explosion in high throughput approaches that have combined molecular physiology with genomics. The review by Paul *et al.* offers the readers an invaluable compendium of the salient findings of these approaches while putting the field into perspective. Equally perceptive is the account by Cheung and Wu, who review the mechanisms of plant growth and signalling events that trigger these processes. In the area of NO signalling, the review by Bard *et al.* offers unique perspectives that would appeal both to first-time readers as well as those actively involved in the area. Tracing basic concepts of NO signalling known from animals, the authors offer insights on the currently known mechanisms of NO synthesis and its wide ranging effects on plants while highlighting the role of nitrosylation as an important post-translational modification and modulation of enzyme activity.

The metabolic acclimations under abiotic stress are reviewed in detail by Serres and Voesenek, who also offer a critique on low-oxygen escape syndrome, while highlighting efforts to develop crops with combinations of submergence tolerance traits that are optimal at specific developmental stages and under particular flooding regimes. With altered aquaporin expression emerging as a target for biotechnological improvement of plant tolerance to water stress, the review by Maurel *et al.* is a timely addition to the *ARPB* series. Salinity stress is another major area of research, though; most of the reviews on plant responses to salinity have been documented two decades earlier. Munns and Tester impress upon the readers the need to marry together new molecular techniques with the body of literature on whole plant physiology to tap exciting prospects for ameliorating the impact of salinity stress on plants, and improving the performance of species important to human health and agricultural and environmental sustainability.

Green revolution in India has been largely driven by lodging-resistant semi-dwarf varieties of wheat and rice. Wang and Li summarize the salient findings on a series of mutants defective in plant architecture of dicotyledonous and monocotyledonous plants and several key genes that have been cloned and functionally characterized. Developmental processes are closely linked to plant architecture, especially the developmental aspects of shoots and reproductive apparatuses. Bowman and Floyd extrapolate the applicability of developmental processes discovered in *Arabidopsis* to other flowering and seed plants. The review by Samuels *et al.* covering formation of cuticular wax in *Arabidopsis thaliana*, complements mostly biochemical information obtained from other species to offer an authoritative summary of our present knowledge of wax biosynthesis and transport and the regulation of these processes during cuticle assembly. The emerging importance of glutathionylation reactions in plants and the recent exciting developments have been captured effectively by Rouhier *et al.* The review includes a comprehensive coverage of topics like synthesis and degradation of glutaredoxins (GRXs), its role in xenobiotic elimination, its role in cell signalling in interaction with other redox systems such as ascorbate or peroxides, and also its role in signalling pathways induced by jasmonic acid and other plant hormones.

The role of plant hormones in plant development is picked up by Yamaguchi's article, which summarizes the current understanding of the GA biosynthesis and deactivation pathways in plants and fungi and discusses the mechanisms of regulation of GA concentrations in plant tissues in response to developmental and environmental stimuli. Aptly titled, the review by Benjamins and Scheres offers an exceptional view of concrete auxin mediated regulatory mechanisms for plant development and behaviour. Starting from the individual molecular players in auxin perception and auxin distribution, the review literally traces auxin action that involves two intertwined regulatory loops.

Plants overcome nutrient limitations via symbiotic interactions with microorganisms, with the most widespread symbiosis being that of plants and mycorrhizal fungi. Several recent developments have added to our understanding of the signalling events in the epidermis associated with the perception of rhizobial nodulation factors and the role of plant hormones in the activation of cell division leading to nodule morphogenesis. Oldroyd and Downey focus on the tissue-specific nature of the responses that occur during nodulation and present evidences of coordinated root development during the process. Better manipulation of ecological functions and processes by integrating information on plant–microbe–soil N processes across scales and disciplinary boundaries is the theme that Jackson *et al.* present in their piece. The review also covers physiological events like N uptake and ecological functions like food web interactions that contribute to plant–microbe–soil N

cycling. One recurring theme in soil and plant interaction is the development of roots and trichomes. Trichomes and root hairs perform myriad functions that include conferring insect resistance by means of physical or chemical barriers and reduction of transcription. Ishida *et al.* have captured the essence of some of the most pathbreaking literature in this area, especially study of the developmental mechanisms of root hairs and trichomes using various approaches. The review also exposes lacuna in the current knowledge of mechanisms pertaining to root hair tip growth and their inter-relationships.

Summarizing the current knowledge on the diversity and underlying mechanisms of proteases, the review by Hoorn is an invaluable compilation of decades of research on different aspects of proteases. The ubiquitin pathway is a well-characterized method of protein modification, although certain areas like intracellular targeting, DNA repair, and other processes are less well understood, especially in plants. Hotton and Callis review published work from plants and draw the reader's attention to CRLs (Cullin RING Ligases) that are significant in plants because they are linked to hormonal signalling, developmental programmes, and environmental responses.

A notable feature of the current series of *APRB* is the focus on next generation technologies and emerging frontiers in plant biology. One such area is ionomics that has come a long way from the early days of Pauling and Robinson who propounded that the metabolite profiles of an organism contain a rich source of information; reflective of the physiological status of an organism. The review by Salt *et al.* is an account of the analytical and bioinformatics tools required to perform ionomics, and discusses how ionomics can be applied to advance our knowledge and understanding of biological systems. Fluorescence imaging has emerged as a tool for plant screening programmes and other areas of applied plant physiology. Baker addresses a number of issues pertaining to the use of fluorescence parameters in the evaluation of photosystem II (PS II) photochemistry, linear electron flux, and CO_2 assimilation *in vivo* while outlining the theoretical bases for the use of specific fluorescence parameters. Libourel and Hill's account on the recent developments in quantitative MFA (metabolic flux analysis) and predictive modelling is a worthy addendum to the recent issue on metabolic flux analyses of phytochemistry devoted to theoretical analyses, experimental findings, and methodological developments. Plant metabolic engineering has been severely hampered by a lack of understanding of metabolic network structure, function, and regulation. Drawing from the rationale used in microbial metabolic engineering, Libourel and Hill stimulate the interest of plant biologists in this exciting area of research, by extrapolating techniques developed in the microbial field. Genomics and high throughput analyses of whole plant genomes have contributed vastly to our understanding of a number of mechanisms that regulate plant growth and development. Naturally, the field of alkaloid biosynthesis and metabolism is no exception to this. Ziegler and Facchini merge evidences from multiple approaches that include large scale gene expression analyses, metabolic engineering and transgenic studies to elaborate on the regulatory architecture of alkaloid metabolism.

In an extensively researched article, Ian Graham traces the steps involved in the conversion of oil to sugar through extensive citation of pathbreaking studies in the area. Findings on storage oil mobilization, which is severely compromised in *Arabidopsis* mutants disrupted in either lipolysis of TAG (triacylglycerol), transport of FA (fatty acids) into the glyoxysomes, activation of FA inside the glyoxysome, or in any of the core reactions of β-oxidation are presented in the form of a colour coded table that simplify interpretation of voluminous literature.

Howe and Jander's account of early signalling events at the plant–insect interface and their involvement in insect recognition prompts readers to probe the basic mechanisms of plant–animal coevolution. Similarly, Finkelstein *et al.* present a scholarly piece covering voluminous literature on myriad aspects of seed biology that cover hormonal regulation of dormancy, involvement of proteins in inducing dormancy and genetic analysis of natural variation in dormancy.

Cyanobactrial research has received tremendous fillip in the last decade with whole genomes of more than 38 species released till date. Hagemann's review furthers our understanding of cyanobacteria with a focus on some of the mechanisms of a few selected algal photoreceptors and provides an in-depth account of the actual mechanisms involved along with its applications in diverse fields like neuroscience. Equally insightful is the review by Gould *et al.* who chart the origins, integration, and functions of the different plastid types with special emphasis on their biochemical abilities, transfer of genes to the host, and the back supply of proteins to the endosymbiont.

This volume also has an article by Peggy Lemaux, the first in a 2-part series, on the controversial topic of genetically engineered plants and foods. She attempted to answer some frequently asked questions related to GM (genetically modified) crops and foods backed with 260 references. Her second article in the series appeared in the 2009 issue of *ARPB*.

Last but certainly not the least is the opening essay that is unique to Annual Reviews and a major attraction to its readers. The article by Eric Conn on his group's work with cyanogenic plants chronicles the major milestones in his life and the people who shaped his career and contributed to the work on localization and metabolism of cyanogenic glycosides, especially in sorghum and flax. This work almost coevolved with plant biochemistry as a discipline in the universities, in which teachers like Conn played an important role. Students worldwide who benefitted from the famous textbook *Outlines of Biochemistry* by Conn and Stumpf would immediately relate to Eric Conn.

To conclude, all the authors of the current edition of *ARPB* have done full justice in reviewing the enormous body of literature that has accumulated over the years. *ARPB* is getting better and better in simplifying conventional hard science with the help of excellent images, schematics, tables and charts, making it an invaluable learning and teaching resource.

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