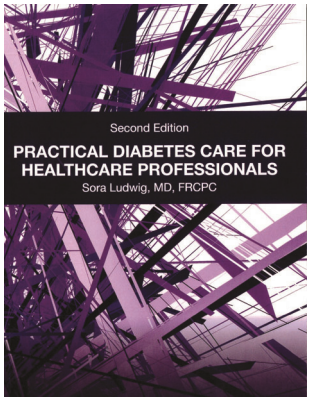

Practical Diabetes Care for Healthcare Professionals, Second Edition. Sora Ludwig. Elsevier, Radarweg 29, P.O. Box 211, 1000 AE Amsterdam, The Netherlands. 2021. vii + 188 pages. Price: US$ 100.

Diabetes mellitus has now assumed epidemic proportions all over the world and India is no exception. The country has over 77 million people with diabetes. This is mainly a lifestyle disorder and as such self-management is extremely important. It is also important for healthcare professionals to learn the basics of diabetes. Rapid advances are taking place in the therapy of diabetes with several new molecules being introduced. Technological advances are also occurring rapidly in the treatment of diabetes. It is therefore necessary for the healthcare professionals to keep themselves constantly updated about their knowledge of diabetes.

In this context, this book by Sora Ludwig would be a valuable table-top guide to anyone involved in treating diabetes. It is comprehensive covering organization of diabetes care, the fundamentals of glycaemic management of the disorders, including diet and physical activity, and a quick review of all the available antidiabetic agents in the world, both oral hypoglycaemic agents as well as insulin.

The book surprisingly starts off with the organization of diabetes care, something which people usually discuss at the end of such books. Ludwig probably wants to introduce the diabetes healthcare (DHC) team concept upfront as this is indeed central to successful diabetes management. Quite rightly, the author places the person with diabetes at the centre of the DHC team which usually consists of a diabetologist/endocrinologist, diabetes educator (a nurse and a dietician), but often includes a pharmacist, ophthalmologist, podiatrist and other specialists. Without such a team, providing holistic care to a person with diabetes on a continuous basis becomes difficult.

The book also includes a valuable section on what tests and investigations comprise a complete clinical assessment of diabetes. Many primary-care physicians are content with doing just a blood glucose assessment. This could lead to missing diagnosis of complications at early stages. It is therefore important to do an annual check-up of all the major organ systems like the eye, kidney, nerves, feet and heart. Thus complications, if present, can be identified at an early stage and appropriate treatment can be given. The book provides the essential tests which need to be done for persons with diabetes.

What I particularly liked about the book is the practical aspects of starting insulin and the various case studies which have been described in an interesting manner. It also deals with various complications of diabetes, and again, numerous case studies are introduced in various chapters to drive home the main messages clearly.

Quite rightly, emphasis has been given to lifestyle modifications, including diet and physical activity. The former includes attractive and colourful pictures introducing the 'plate concept' for selecting various food groups like vegetables, fruits, cereals and grains, meat and milk. The book also has a much needed section on carbohydrate counting. I like figure 4.2 which easily explains portion sizes. However, figures 4.1 and 4.2 on pages 24 and 25 have been repeated on page 130 and 131 as figures 9.1 and 9.2. Again, table 4.2 on page 28 is repeated as table 10.1 on page 147. These repetitions have affected the quality of an otherwise excellent book. The entire flow of the book is also slightly disjointed and disorganized.

The section on various types of insulin is good as the figures nicely summarize their actions. The explanations of the various insulin regimes which can be used in practice, again illustrated with case studies, are useful.

The size of the book is appropriate to be easily carried by anyone. The most attractive aspect of the book are the case studies. Normally, in a book of this size not many case studies are presented, and this is one of the highlights of the book.

The fact that the second edition has been published speaks volumes about the popularity of the book. Although the book is based on the Diabetes Canada Clinical Practice Guidelines for the prevention and management of diabetes, I find that most of these guidelines could be applied to the treatment of diabetes in India as well. I would therefore strongly recommend all healthcare professionals interested in learning the practical aspects of diabetes management to get a copy of this book. It would be of interest not only to practising physicians and budding diabetologists, but also to nurses, educators and even for the persons with diabetes.

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Annual Review of Plant Biology, 2019. Sabeeha S. Merchant, Wilhelm Gruissem and Donald R. Ort (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 70. xiv + 837 pages. Price: US$ 116.

It is a pleasure to read the *Annual Review of Plant Biology*, which covers the latest and best research topics in plant biology. It was a daunting task to review this volume containing more than 800 pages, and 28 reviews by the best-known authors in plant biology across the globe. It also has a semi-autobiographical piece written by Barbara Hohn, a leading plant biologist, as the opening article.

Hohn, a pioneer in *Agrobacterium tumefaciens* research, shares her marvellous scientific journey starting with her research on bacteriophages to *A. tumefaciens*-mediated DNA transfer to the plant genome and its environmentally induced changes. She meticulously describes her struggles in the scientific field being a woman scientist, and how she overcame them. She also mentions how working in different laboratories on different topics augmented her curiosity in plant sciences, though initially she had great interest in pursuing higher studies in the field of organic and inorganic chemistry. Barbara describes how studying plant tumour paved the way for plant transgenesis. She also fondly remembers the contributions of her colleagues and peers in shaping her career in the field of plant genetics and plant molecular biology. She feels honoured to have been involved via interactions with the founding director

Dieter Schweizer, in the establishment of the Austrian Gregor Mendel Institute of Molecular Plant Biology in Vienna, Austria, the country she hails from.

Several chapters in this volume are related to various aspects of plant metabolism. Oxidative phosphorylation is the process associated with ATP production. Meyer *et al*. describe in detail the different steps involved in the formation of each of the functional complexes and the regulatory mechanisms controlling these pathways. They also discuss the evolutionary dynamics that leads to the conservation of the ancestral pathways.

Chloroplasts are the important organelles of the plant cell where several biochemical pathways, including the synthesis of chlorophyll, aromatic amino acids and fatty acids takes place. Chloroplast lipids are indispensable for oxygenic photosynthesis as they are integral components of photosynthetic protein complexes and constituents of mechanisms to protect the photosynthetic machinery against high light intensity, abiotic stress and nutrient stress like phosphate starvation. All these mechanisms are reviewed in detail by Hölzl and Dörmann, mainly focusing on the biosynthesis of various constituents of chloroplast lipids. This review also provides one of the most comprehensive lists of all the genes involved in the biosynthesis of chloroplast lipids till date.

The N-degron pathway regulates the functions of regulatory proteins by impacting protein half-life and therefore directing the actual presence of target proteins in the cell. Overall, the comprehensive summary of various post-translational modifications (PTMs) via the Cys/Arg branch of the N-degron pathway, the underlying physiological principles of this branch and its biological significance in stress response are well explained by Dissmeyer.

The PTMs occur throughout the lifetime of proteins, with most PTMs involved in the synthesis, assembly, localization, function and degradation. Four different perspectives on PTMs and their roles have been explained in detail in the review by Millar *et al*., wherein they explain these by considering five classes of PTMs as examples in a broader context.

Further, several genes encoding non-functional, precursor-derived peptides are expressed in response to environmental or developmental cues. Olsson *et al*. focus their review on these precursor-derived plant peptides. They provide an overview of the regulatory steps involved in the production of these peptides. They also discuss how these can act as ligands to bind to their corresponding receptor(s) to activate specific cellular outputs. They describe how the diversification and expansion of peptide genes and families coincides with increasing complexity of the plant body and various environmental changes to which the plant is exposed and exploited by non-plant organisms by producing peptide mimics.

The perception of flavour involves a combination of taste, smell, appearance and texture. Among these, taste and smell are core contributors. The most effective way to identify flavour compounds is to integrate accurate metabolic profiling and suitable sensory rating strategies so as to reduce subjectivity and obtain reliable and reproducible results. However, genetic analysis has significantly expanded our knowledge of the synthesis and regulation of flavour metabolites. Zhu *et al*. give an account of omics-based analyses which have greatly contributed to our understanding of flavour till now, and have the potential to accelerate our understanding of pathway regulation. They conclude their review with the statement that the important contributions of cultivation, storage and post-harvest conditions to vegetable flavour have only begun to be examined with omics technologies.

In order to respond to environmental and developmental cues, living cells require coordinated action of multiple sensory modules. Some chapters in this volume cover in detail the signalling mechanisms involved. Among the various such known pathways, the G-protein and microRNA (miRNAs)-mediated signalling pathways play an important role in the perception and response of these cues in plants. Pandey describes in detail about the conventional as well as novel signalling mechanisms of plant G-proteins. Heterotrimeric GTP-binding proteins are key regulators of a multitude of signalling pathways. The physiological and genetic analyses have helped in uncovering the roles of G-proteins in almost every aspect of plant growth and development, and also their involvement in many agronomically important traits such as seed yield, organ size regulation, biotic and abiotic stress responses, symbiosis and nitrogen use efficiency. Song *et al*. deals with the regulatory and functional roles of miRNAs. These are a class of endogenous, small, non-coding RNAs that negatively regulate gene expression. Plant miRNA biogenesis is a multistep process that involves transcription of miRNA genes, processing of primary miRNA transcripts by DICER-LIKE proteins into mature miRNAs, and the loading of mature miRNA duplex into ARGONAUTE proteins to form miRNA-induced silencing complex (miRISC). Based on sequence complementarity, miRNAs direct target mRNA cleavage, translational repression and DNA methylation. They are involved in the regulation of phenotypic plasticity triggered by various environmental stimuli such as light, temperature and nutrients. Also, miRNA-mediated regulation of gene expression is an important mechanism of plant response to abiotic and biotic stresses.

Plant development has been a topic of research for a long time and this aspect has been covered in ten reviews. Livanos and Müller discuss the contributions of functionally conserved eukaryotic proteins in different stages of cell-plate biogenesis. They also discuss the coupling of cell-plate formation with phragmoplast expansion, and the complete process of cytokinesis in detail. The genetic networks which control the meristem initiation and stem cell maintenance are the main focus of the review by Kitagawa and Jackson, while Fischer *et al*. focus on the regulation of cambial activity by various signalling molecules. Both these reviews also emphasize the need for understanding the underlying mechanisms for crop improvement in terms of greater fruit size, higher yield and climate resilience. The developmental and mechanistic principles involved in long-distance water transport are discussed in detail by Branderson *et al*. They also provide an insight on the non-invasive methods to study these principles, specially focusing on woody plants.

All recent findings related to control of seed size have been exhaustively reviewed by Li *et al*. They have explained in detail each of the molecular mechanisms and related regulatory networks like G-proteins, MAPK, DA1, etc. which control seed size, and have provided an interesting list of all these pathways and regulators. Similarly, Matte *et al.* have comprehensively described all the molecular events related to each stage of root development. Johnson *et al*. bring together all the previous and current findings related to pollen-tube development. All authors seem to agree that it is necessary to understand and modulate the mechanisms related to development to devise better strategies for crop improvement.

Plants are sessile organisms that withstand a variety of climatic changes, temperature being the most important among them, in a world that is witnessing global warming. Casal and Balasubramanian describe the morphogenetic changes that plants undergo to evade and survive temperature fluctuations. They focus on how the search and further research into such climate-smart plants can provide an avenue to sustain crop productivity. Another aspect of the survival mechanism employed by the plants – leaf senescence – has been well documented by Woo *et al*. They enlighten the readers on the dynamics of various molecular networks involved in this process and their use to devise strategies to improve crop productivity. Plants also sustain wounds in a hostile environment and undergo reprogramming of somatic cells to regenerate wounded tissues. The detailed mechanism of reprogramming, genetic and epigenetic factors, along with their regulators have been reviewed in detail by Ikeuchi *et al*.

Crop biodiversity through domestication is essential for adaptation to continuously fluctuating conditions such as climate change and consumer preferences. Domesticated crops are biocultural artefacts. There is a cost of domestication, i.e. the accumulation of deleterious alleles because of limited recombination in reduced size population set, which needs to be eliminated through recombination or targeted genome editing. Due to their local traditional knowledge, farming practices and seed systems, farmers are central to crop domestication and are involved in participatory breeding of locally adapted varieties.

Crop yield is affected by temperature fluctuations and water limitations in the environment. Zhang *et al*. explain how two levels of cold stress, i.e. chilling (0–18°C) and freezing (<0°C) involve some common and distinct pathways. *ICE1* (inducer of CBF expression1), *CBF* (C-repeat binding factor) and *COR* (cold-responsive gene) are the key genes involved in the regulation of cold tolerance and together they form the regulon pathway. This regulon is the common key response pathway for cold stress and is regulated by the MAPK (mitogen-activated protein kinase) family. *COLD-1* (CHILLING-TOLERANCE DIVERGENCE 1) acts as a sensor and mediates chilling signalling along with RGA1 in rice. The effects of these genes on plants under freezing and chilling conditions are also different. Cyclic nucleotide gated calcium channels and receptor protein kinases such as ERECTA in rice and tomato act as thermal sensors in plants. Mitochondria and chloroplast are heat-sensitive organelles and also contribute to thermal tolerance in plants. Gametogenesis in rice is also heat-sensitive. Molecular modules with natural variations along with advanced techniques can be used to improve thermotolerance in plants. Zhang *et al*. enlighten the readers about the urgent need for breeding of thermo-tolerant crops because of climate change and global warming, which are negatively impacting crop yield.

Leakey *et al*. emphasize the concept and mechanisms related to water use efficiency (WUE). This is a complex multigenic trait having many definitions at different scales. The one which is emphasized here is the ratio of plant carbon gain to water use. Photosynthesis, stomatal (g_s) and mesophyll (g_m) conductance and canopy structure directly influence WUE. Phenotyping of WUE-related traits using high-throughput techniques, natural genetic variation studies and transgenic studies are some of the tools to evaluate WUE. In transgenic studies, stomatal patterning has been targeted effectively to improve WUE. It can also be improved directly by increasing photosynthesis or indirectly by drought stress avoidance. The response to rising atmospheric CO_2 by C3 and C4 crops is different, opening new pathways to improve WUE. Simulation studies performed on C3 and C4 model crops to examine WUE improvement by manipulating stomatal conductance and photosynthesis under ambient and elevated atmospheric CO_2 in different environments, xeric and mesic conditions, have shown some promising results which are context-dependent, and so cannot be extrapolated globally.

Recent advances in genomic resources such as advances in next-generation sequencing techniques, phylogenomics, etc. help in transferring the knowledge gained in reference organisms to the less characterized organisms. This also helps to study novel processes and proteins in different species. These aspects have been reviewed by Barco and Clay, Blabi-Haas and Merchant, and Chen *et al.* Barco and Clay explain the evolution of glucosinolate diversity via genomic events such as whole-genome duplications, gene rearrangements and substrate promiscuity in plants. They also explain the roles of glucosinolates in defence signalling, plant growth and development, etc. Blabi-Haas and Merchant review comparative and functional genomics of algal species. Chen *et al*. focus on the contribution of genomics in unlocking the knowledge related to genetic diversity of rice, its domestication, heterosis and other complex traits.

CRISPR/Cas is an efficient and targeted genetic modification tool for crop trait improvement in terms of yield, quality as well as abiotic and biotic stress resistance. The details and recent applications of genome editing are well explained by Chen *et al*., who dwell upon development of novel bioproduction processes through plant synthetic biology, crop domestication and gene drive-based control (suppression/elimination) of invasive species in agricultural fields. Genetically modified (GM) plants are associated with biosafety and different regulatory frameworks are employed by different countries.

Risk assessment is a multi-step process that involves identifying the possible risks posed by GM plants and also assessing the need for implementation of risk management measures. The current status and future challenges of risk assessment and regulation of GM crops are exhaustively explained by Schiemann *et al*. They highlight the point that the assessment of safety should be made on a case-by-case basis and emphasis should be given to the regulation of a specific product, rather than on the technology used to generate that product.

Reviewing this volume has been a good learning experience. We have tried to cover most chapters in this volume, although we may have missed mentioning a few. This in no way means that these reviews are any less important or interesting. This volume of the *Annual Review of Plant Biology* just like the previous ones, provides a comprehensive coverage of topics related to plant biology and coerces the readers to ponder about the recent global challenges in terms of climate change and crop productivity. The volume should find a place in every educational institution where plant biology is taught and researched upon.

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