less numbers such as Reynolds or Peclet number, etc. In parallel, Vogel also covers swimming and flying in all sorts of aquatic and terrestrial animals, filter feeding, jet-propulsion, seed dispersion, water transport in plants, etc. A similar tone is maintained in the chapters on solid mechanics which deal with linear and nonlinear structural properties of composite tissues, fibre-reinforced materials, fracture mechanics, resilience, tensegrity, etc. Along the way, the readers will learn about blood vessels, sponge spicules, sea anemone body walls, bones and mollusk shells, reaction wood in trees, etc. He also discusses simple machines such as struts and levers, motors, brakes, four-bar linkages, etc. and again discusses their role in biomechanics of locomotion of animals. For good measure, Vogel also provides many thought-provoking questions at the end of each chapter as exercises.

All this makes for a heady and enjoyable mix and the book is as entertaining as it is educational. However, at almost 600 pages, it is also a formidable read in large part because its narrative style and lack of mathematical treatment does not permit any brevity at all. Despite this length, the following topics may be worth including in future editions. First, the biomechanics of life in non-continuum (granular) media such as sand or gravel is conspicuously absent. For example, lizards or insects burrowing through sand or sand-like media find no mention in the book at all. Second, whereas the book introduces physical concepts at an elementary level, it is necessary to acknowledge (perhaps as footnotes) that many of these concepts are more complex than the book may lead you to believe. The book does not mention, for example, that the bulk properties of matter are tensorial in nature. Third, more material on experimental methodology may be added in the book. In addition to the descriptions of classic physiology tools such as Scholander bomb or pitot tubes, brief descriptions of the more modern biomechanical techniques such as digital particle image velocimetry, sonomicrometry, nanoindentation, atomic force microscopy, etc. may be included, which are common tools of the trade.

In summary, this book is recommended as a necessary component of any undergraduate or beginning graduate coursework, especially those that seek to instill a multi-disciplinary outlook in biology education. Such coursework should emphasize the cautions and caveats that Vogel has incorporated in his book, so that the philosophical message of the book is not lost. One only hopes that a more accessible paperback edition book will soon become available to suit student budgets.

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Annual Review of Plant Biology, 2013. Sabeeha S. Merchant, Winslow R. Briggs and Donald R. Ort (eds). Annual Reviews, 4139, El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 64. x + 885 pp. Price: US$ 97.

It is both a pleasure and a challenge to review the *Annual Review of Plant Biology* (*ARPB*), the 64th (2013) volume of which has yet again come out with an excellent compilation of review articles covering a vast array of research topics of contemporary relevance in plant biology, contributed by leading names in the field. As always, it is an excellent starting point for young researchers and specialists alike, who seek authentic reviews of the literature combining the state-of-the-art as well as future perspectives in each of the topics covered. This volume starts with a frontpiece written by Elisabeth Gantt, whose contributions are well known in phycobilisome structure/function, photosystem II and carotenoid/isoprenoid biosynthesis using N-fixing cyanobacteria as model systems. She traces her scientific career and elaborates how the flexible and inclusive US education system has aided in her progress as a researcher and scientist. Her comments on funding for basic research, especially in plant biology, 'the war on…' as a dominant metaphor even to justify research funding, the recent 'assembly-line' model of funding large research networks rather than small laboratories, gender issues, etc. though mild and constructive, address some of the core concerns in American science. They are just as relevant for those who manage science and education in India, or perhaps any other large country. There are 32 other reviews spanning about 900 pages in this volume, which can be broadly divided into crop improvement, signalling, technical advancements, genome engineering, plant organelles and plant–microbe interactions, for the purpose of this review.

Nutrition in health and disease is often dealt with as a medical specialty, but it is interesting to see a review that explores its interface with plant biology. The article by Cathie Martin *et al*. addresses the inter-relationship between dietary habits and health/disease, plant products in the modern Western diet and the beneficial role of phytonutrients in fighting chronic diseases, and the underlying metabolic, signalling, redox, chemopreventive and other mechanisms, including the role of gut microflora and epigenetic factors. Crop improvement in terms of productivity, nutrient content and resource use efficiency is one of the solutions suggested by crop scientists worldwide. Many of the reviews in this volume deal with crop improvement. Oslen and Wendel review the genetic and genomic basis of crop plant phenotypes and the genes responsible for their evolution. They also nicely bring out the point as to how advancement of methods like QTL mapping has aided in identification of domesticated traits, the associated genes and their evolution, which can be modulated for improvement of crop plants. The reviews by Schnable and Springer, and Ouyang and Zhang dwell on the molecular mechanisms underlying heterosis and reproductive isolation for further improvements in crop plant species. The article by Fiorani and Schurr gives an overview of multidisciplinary research in plant phenotyping using non-invasive and minimal invasive methods, focusing on the traits assisting the selection of genotypes with increased resource use efficiency. This is an important area of research for India, as there is no credible ranking of the varieties of any of the major crops in terms of their use efficiencies of major resources such as nutrients, water, etc. especially combining both wild and cultivated genotypes, though interest is emerging in this direction of late. Our laboratory has been ranking some rice cultivars based on nitrogen-responsive germination rates, in the hope of developing this as a non-invasive

approach for screening/ranking N-use efficiency as a trait (unpublished data).

Voyters in his article reviews how sequence-specific nucleases like XXXXX have been used as a tool for genome engineering to develop or enhance the biosynthetic capacity of the plant, thereby improving crop plants. C4 plants normally grow in warmer climates, but few C4 plants have been found to grow under chilling conditions. The review by Long and Spence shows how understanding the mechanism underlying the process would aid in transferring this trait to other C4 crop plants to enable them to growing in colder climatic conditions.

Signalling has been a growing theme in plant biology, which is also reflected in several reviews on signalling in this volume. While Hughes describes how putative phytochromes are involved in other functions than regulation of transcription in light signalling and regulation of translation of specific mRNAs in the cytoplasm of higher plants, Casal reviews the role of various photoreceptors like UVR8, COP1 and PIFs, their interregulatory nature, the effect of phytohormones on them and their role in avoiding shade in plant canopy. Non-enzymatic membrane peroxidation is a key feature in stress-induced plants, which results in the genesis of reactive electrophile species (RES). RES were thought to be detrimental to plants, but Farmer and Mueller in their review argue that RES signalling pathway is actually beneficial, as RES promote cell rescue by stimulating genes encoding detoxification, regulation of cell cycle and chaperones. RES signalling also employs class-II TGA transcription factors. Howell reviews how the endoplasmic reticulum (ER) undergoes stress when a plant is challenged with stress and tries to mitigate the damage caused due to stress, thereby conferring stress tolerance. This article also brings out the role of unfolded protein response and the associated transcription factors like bZIP17 and bZIP28, and RNA splicing factor, IRE1, as an essential component of ER stress signalling.

Fruit diversity

Events related to potassium transport and signalling are reviewed by Wang and Wu. Potassium is one of the major micronutrients required by the plant for growth and development, and like nitrogen it also not only acts as a nutrient but also as a signal. The authors have given a detailed account of K^+ transport and the transporters involved. K^+ deficiency is detected as a signal at the root and is transduced into cytoplasm via Ca^{2+} and ROS signalling pathways, which in turn regulate the transcriptional and post-translational responses, that culminate into a series of physiological and morphological alterations. An interesting piece is presented by Chi *et al.* on retrograde signalling, i.e. signalling from organelles to nucleus, though the authors have restricted themselves only to retrograde signalling from plastids to nucleus. They discuss how recent advancements in identification of key components of retrograde signalling have helped in unravelling the signalling pathway that regulates nuclear gene expression. Thus, the section on signalling provides an elaborate review on the topic which encompasses a wide area involving stress, nutrients, light and retrograde signalling.

Various technologies are being developed and bettered each passing day, which has contributed immensely in our understanding of biological processes in better way. Several reviews in this volume have highlighted such developments. *Arabidopsis* was the first plant to be fully sequenced, followed by rice and then many other plants, owing to the development of genome sequencing technologies not only in terms of speed and robustness but also availability, accessibility and affordability. Hirsch and Buell in their review clearly bring out the features of various high-throughput sequencing technologies along with their pros and cons. They also hint at the complexities involved with the sequencing techniques and suggest possible methods to reduce them. They clearly highlight the point that obtaining genomic/transcriptomic sequences of a model plant is not sufficient for interpretation of complex genomes and comparative analyses of genome/transcriptome sequences obtained from differential germplasm and/or phylogenetically related species would provide better insight. Axtill in his review has classified regulatory small RNAs, which are the latest topic of research in plant biology, on the basis of their biogenesis and function. The article by Bailey-Serres raises questions regarding the study of expression pattern of genes at a single level and brings out the necessity of studying the expression patterns of genes at multiple levels in specific cell types, as well as the techniques available for such studies and their merits and demerits. The article by Braun *et al.* compares all available techniques/methods for protein interaction studies, their advantages and disadvantages, and various bioinformatics tools available for interaction network analysis.

The fast-growing fields of plant bioinformatics and systems biology have been well represented in this volume. Sreenivasulu and Wobus review the techniques of systems biology-based data analysis in the construction of complex metabolic networks involved with seed development in both monocots and dicots and how it brought out the key elements which are common and uncommon in seed development in both monocots and dicots. Vranová *et al.* review how network analysis and co-expression network have helped in the understanding of MEP and MVA pathways for isoprenoid biosynthesis. On a different note, a review by Shaw and Ehrhardt throws light on the advancement in the field of optical imaging which had enabled us to visualize many minute structures and processes with immaculate accuracy at molecular scales. They review how the optical imaging instruments have become smaller, faster and brighter with time and the associated improvements in molecular tools and specimen handling.

There are also reviews on plant–microbe interactions in this volume. The review by Keeling deals with the evolution of plants in conjunction with the impact of endosymbiosis on the development of organelles. The review by Udvardi and Poole dissects the unique and common features between the symbiotic partners, legumes and rhizobium, suggesting their role in evolution to develop effective symbiosis. Bulgarelli *et al.* discuss the structure, functions and diversity of the bacterial microbiota of plants and the factors responsible for the diversification of plant microbiota. They also discuss their beneficial and deleterious effects on plants, including the plant

growth promoting rhizobia (PGPRs) and the need to understand the mechanism of action of PGPRs.

There are a few reviews which discuss the structure, development and current state of research of various plant organelles/structures or processes like the endodermis, membrane microdomains, photosystem II assembly, pectin biosynthesis, development and ripening of fruit, growth mechanism of tip-growing plants and systemic acquired resistance. While it is not possible to provide a reasonable summary of all these in this review, it does not indicate that the topics that received little or no mention in this review are less important or interesting for the readers of *ARPB*. Overall, this volume, like many of its preceding volumes, contains a comprehensive coverage of subjects and issues challenging the plant science community and their growing interface with agriculture, industry and medicine.

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PERSONAL NEWS

Shah Vinodkant Chunilal (1929–2013)

Shah Vinodkant Chunilal, an outstanding biologist turned geneticist, passed away in the US on 25 March 2013.

An excellent teacher, Shah served on various academic positions. He taught at the universities in Sydney, Baroda, Delhi and Ahmedabad. He was Vice-Chancellor of Bhavnagar University and M.S. University of Baroda. He devoted much of his time to promote education in Gujarat. He took up teaching radiation biology and cell biology in the University departments at PG level while closely working with the well-known cell biologist Herbert Taylor.

After obtaining his M Sc from the M.S. University, Baroda, Shah went to the US to pursue MS where he also obtained a Ph D in 1961 from Columbia University, New York under the supervision of J. Herbert Taylor, followed by a D Sc from Arizona. He closely worked with the well-known geneticist, Monroe W. Strickberger. Shah was awarded the Chancellor's Gold Medal for his excellent academic record.

Using special culture media, Shah became one of the pioneers on amphibian cell cultures in association with S. R. V. Rao at Delhi University. He then moved to Department of Zoology, Gujarat University where he developed mammalian tissue and cell culture laboratories to work on genetic toxicology of antibiotics under *in vitro* conditions. Thereafter, he forayed into the field of cytogenetics, especially that of the genetic disorders like Down syndrome, infertility and others. He specialized in the study of 'Y' chromosome of humans and the genetics of chloroplast in plant cells.

Shah also helped in establishing human genetic laboratories and institutes in India. It was during this time that he linked up with numerous hospitals, medical colleges and institutes to promote human genetics research in Gujarat. He was associated with the Gujarat Cancer and Research Institute (GCRI) and the Jivraj Mehta Medical Foundation as a service to patients suffering from cancer and genetic disorders.

Shah was a life member of national and international journals like *Acta Histochemica*, *Nature Genetics*, *Cell Biology International* and others. He contributed significantly to the field of life sciences. He edited several books, chapters and published about 90 research articles. He was an elected fellow of the Indian National Science Academy and Fellow of the National Academy of Sciences.

Shah was a recipient of the Vikram Sarabhai Award, the Rotary Foundation Fellowship for Foreign Studies, University Fellowship and Scholar of Columbia University, British Council Fellowship and CSIR Professor emeritus.

He was advisor to the Government of Gujarat, Cadila Labs, GCRI, B. V. Patel Pharmaceutical Education and Research Development (PERD) Center, Ahmedabad and was President of Gujarat Science Academy as well as ex-Sessional President (Zoology), Indian Science Congress.

Shah was born on 27 November 1929 in Sankheda, district Baroda and is survived by his wife Rasila and three daughters, residing in USA.

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