

taxa are preadapted to climate future whereas others can adapt *in situ*'. He also shows that high arctic vegetation will have a more important role in biogeochemical cycling of carbon and water towards the end of this century, if we continue to use fossil fuels and make continuous changes in land use. Ramanakutty *et al.* deal with the global trends that we observe on the changes in the agricultural land use and the consequent impact of this on environmental health and food security. They recommend that we will have to 'combine modern breeding technologies, including genomic solutions and genomic engineering, with geo-ecological farm practices'.

Lastly, the prefatory chapter in this volume is by Mary-Dell Chilton, one of the pioneers in the area of genomic engineering facilitated via *Agrobacterium*-mediated gene transfer. She has described her early life; how she studied chemistry, physics and biology, her science career as it moved from her Ph D to track position at the University of Washington, St Louis, USA, and then to the industry. Her whole write-up is very engaging for the reader. Lot of lessons to learn from her experience, and Chilton is an inspiration to many in the field of plant biology.

This volume has covered interesting and complex topics which have been intensely reviewed by experts. Though there is a lot of specialization these days and one tends to read only those topics that are directly related to their research, yet I advise our young plant biologists that in order to get an integrated view of plant life, they should read beyond their caged research topic. There is no better way than to read this volume of *ARPB*, as also recent previous volumes. One should make it a habit to read *ARPB* ever year; I have been doing so for the last 40 years.

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Annual Review of Cell and Developmental Biology, 2018. Ruth Lehmann, Jennifer Lippincott-Schwartz and Alexander F. Schier (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 34. xiv + 571 pp. Price: US\$ 112.

This volume has a new editor in Ruth Lehmann. The 'Introduction' section in this volume is a retrospective of the previous editor Randy Schekman's views, particularly on science policy and science-society relationships. The future volumes of the *Annual Review of Cell and Developmental Biology* should give insights into Lehmann's views and style.

This volume has 23 reviews covering various aspects of cell and developmental biology. The first article in several of the earlier volumes was a perspective, which is a first-person account of an eminent cell biologist. This volume does not have it. Perhaps future issues will have perspectives, as these articles give useful insights into how a research area was chosen, executed, and also how co-workers were mentored. Based on the titles and contents in this volume, I have broadly classified them into different areas. In cell biology, Sherman reviews cell biology of stellate cells which are resident lipid-storing cells of the pancreas and liver that transdifferentiate to a myofibroblastic state related to tissue injury. The importance of these cells in the context of cancer is highlighted and also possible applications in therapies are discussed. The review by Yamashita *et al.* deals with specialized intercellular communication via membrane protrusions known as cytonemes and tunnelling nanotubes. Cytonemes defined as 'filopodia of a special type' were initially observed in developing *Drosophila*. The usefulness of *Drosophila* as a model system in cell biology and relevance to higher organisms is evident. Tunnelling nanotube-like projections (TNTs) has been studied in cultured cells. The authors highlight the importance of TNTs in disease conditions. The relevance of programmed cell death in developmental biology of eukaryotes has been extensively researched and also reviewed. The review by Gudipaty *et al.* is not an update on well-known aspects of cell death or apoptosis. It is focused on unconventional forms of cell death and their relevance in cancer. The biogenesis of eukaryotic organelles

has been studied extensively and is also the subject of several reviews. The signalling events and proteins that assist eukaryotic organelle biogenesis have been established to a large extent. Organelles are not generally used to define structures in prokaryotes. Grant *et al.* in their review entitled 'Organelle formation in bacteria and Archaea' discuss lipid-bounded structures in bacteria that align and navigate along magnetic fields. They are referred to as magnetotactic bacteria and the organelles are referred to as magnetosomes. Protein sorting to magnetosomes makes interesting reading as it differs from protein sorting that takes place in bacteria. This process of organelle formation has no similarity with eukaryotes. Organelles in other exotic bacteria are also covered in this review. The figure that depicts organelles in bacteria and the chemical reactions that take place in them helps in appreciating these structures and their biology. Parton, who has made extensive contributions in the area of caveolae biology, reviews various aspects of caveolae. The review is focused on dynamics of caveolae and relationship to disease, which is being increasingly appreciated. The review by McCullough *et al.* deals with endosomal sorting complexes required for transport (ESCRT) pathway that modulates cellular membrane remodelling and fission. Of the five core complexes involved, the review is confined to ESCRT-III and Vps4. The authors describe the three-dimensional structures of proteins involved and how they mediate the membrane processes. The review highlights the importance of knowledge regarding the protein structures in order to get a deeper understanding of the membrane processes they mediate.

Various aspects of mammalian embryo development is perhaps one of the most extensively researched area. Zhang and Hiiragi discuss specifically, breaking of symmetry during embryo development. While the review is on mouse development, the authors also discuss similar and dissimilar aspects in other mammalian species. The excellent illustrations summarize the review well. This is perhaps one of the few reviews which does not discuss the role of signalling proteins or transcription factors involved.

Every volume of the *Annual Review of Developmental and Cell Biology* has reviews on immunology and plant. This one is no exception. There are two

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reviews in these areas. Hu and Shu review the innate immune response to microbial nucleic acids, specifically their recognition by host pattern recognition receptors. Pierre-Jerome *et al.* review regulation of division and differentiation of plant stem cells.

There are two reviews on nucleic acid biochemistry. The review by Rak *et al.* entitled 'Repertoire of tRNAs: the coup-ers of proteomics and genomics' is general in nature, unlike many of the other reviews and perhaps a little out of place as it covers a broad area of development. The review entitled 'Heterochromatin: guardian of the genome' by Janssen *et al.* is of general nature too. The authors discuss in general, aspects of heterochromatin structure and function along with defects observed in cancer and aging.

The networks formed by microfilaments, microtubules and intermediate filaments are crucial to metazoan cell architecture. There are two reviews in this area. Etienne-Manneville reviews various aspects of cytoplasmic intermediate filaments in cell biology, including dynamic cell behaviour. The review by Mogessie *et al.* entitled 'Assembly and positioning of oocyte meiotic spindle' highlights the role of actin and microtubule networks in the formation and dissociation of structures in mouse oocytes.

Protein biochemistry in cell and developmental biology takes centre stage in five reviews, underlying their importance in various facets of cell and developmental biology. They are diverse reviews such as 'Trafficking of adhesion and

growth receptor factors and their effector kinases' by Schoenherr *et al.*, role of mucins in aspects of mucin biology by Wagner *et al.*, ubiquitin-dependent signalling by Oh *et al.*, protein modifications *in vitro* and living cells by the transpeptidase sortase A by Pishesha *et al.*, and growth factor signalling pathways and transcription networks in kidney nephron determination by Oxburgh.

Neurobiology that is generally well-represented in the *Annual Review of Developmental and Cell Biology*, has five reviews in this volume. Furlanis and Scheiffele review the role of alternate splicing programme in neuronal development and plasticity. The area is an example of interphasing RNA biochemistry and physiological function. The review by Mountoufaris *et al.* is on neural circuit assembly. How protocadherin code is generated at the level of transcription and RNA splicing in relation to neural circuit assembly is discussed. Curcio and Bradke review axon regeneration in the central nervous system. After the introduction to nerve regeneration in mammals, invertebrates and fish, the authors focus on events such as calcium influx, mitochondrial transport, signalling pathways, transcription factors and epigenetic regulation specific to the process. Hammond *et al.* review crucial roles that microglia play in brain development and disease conditions. Microglia in disease is covered extensively. Protein aggregates in neurodegenerative diseases have been the subject of intense research by biochemists, cell biologists and neurobi-

ologists, with a view to understand the process and develop therapies, which is still a far cry, but a necessity. Davis *et al.* apart from introduction to the area, dwell at length on how proteins, native and misfolded, exit a cell and natively misfolded protein seeds enter recipient cells. The authors are of the view that addressing challenges in this area would aid in developing therapies for some neurological diseases.

A striking feature in all the reviews is the excellent illustrations and tables that effectively summarize the contents of the reviews. Another aspect that is normally not found in reviews is supplementary information. The perspectives of the authors and questions that remain to be answered in several areas would be of immense use to researchers: established and newcomers as well as postdocs who would be setting up their own laboratories. Finally, a notable feature in almost all the reviews is the relevance of the topic to diseases in humans and therapies, though tenuous in some cases. This aspect highlights the importance of in-depth basic research while attempting translation. Hence, these reviews would be particularly useful to scientists working in the area of translational research.

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