Annual Review of Genetics, 2006. Allan Campbell, Wyatt Anderson and Elizabeth Jones (eds). Annual Reviews, 4139, El Camino Way, P.O. Box 10139, Palo Alto, California, USA. Vol. 40. 509 pp. Price: $80 individual and $188 institutional price.

This volume of the *Annual Review of Genetics* comprises 19 invited reviews on some of the most important topics in molecular biology and genetics, written by pioneers in the field. All reviews are short, well written and cover the latest developments (up to 2006) in the field. Most reviews provide summary points and future directions at the end, which would help readers take home a message from each review.

In 'Soil to genomics: The *Streptomyces* chromosomes', David Hopwood has discussed peculiar aspects related to the *Streptomyces* genome organization, its replication and DNA transfer/spread during mating or in growing mycelium. *Streptomyces* has a linear genome with terminal inverted repeats at ends, which join noncovalently. The sequencing of its genome has revealed that the single *Streptomyces* chromosome consists of a core containing housekeeping genes and arms rich in conditionally adaptive genes.

The peculiar aspect of *Streptomyces* replication is that although it is a linear genome, replication occurs in a bidirectional mode from a centrally placed oriC and not from one end as in other linear genomes. Since it is a linear genome, this mode of replication results in a 3′ gap that is later filled in by DNA synthesis by terminal proteins (TP).

In 'Discovering DNA encodes heredity and prions are infectious', McCarty and Prusiner draw certain remarkable parallels in these major discoveries of the 20th century – most important being improved bioassays and the challenging task of convincing skeptics! It is a fascinating story that is sure to stimulate young researchers.

'Origin and evolution of spliceosomal introns' by Ayala *et al.*, presents recent ideas on the origin of introns. They discuss the hotly debated introns-early and introns-late theories as well as the new introns-first theory that proposes that introns have evolved during the RNA world when protein and DNA did not exist and RNA was the sole carrier of genetic information.

The next review on 'Cell cycle regulation in plant development' by Inzé and Veylder describes the unique features of plant cell division, its regulation by developmental and environmental cues, and ends with a discussion on a modified mode of cell cycle called endoreduplication that some of the plant cells undergo to generate cells with higher ploidy.

The review 'Chromatin insulators' brings out common themes in the mode of action of insulators from different organisms. The authors, Valenzuela and Kamakaka, address important questions related to formation of boundary elements and the commonality in the mechanism of insulation of gene expression domains at different boundary elements in different organisms. Chromatin looping via tethering of boundary element to nuclear periphery to prevent interaction between enhancer and promoter has been discussed in greater detail.

Two of the reviews cover interplay between signal transduction pathways such as EGFR and Notch pathways during development, and the genetic and molecular pathways that link circadian and metabolic rhythms. The former by Vivekanand and Rebay describes the emerging principles in regulation of signalling cascades taking epidermal growth factor tyrosine kinase signalling cascade as a paradigm. The view now is that signalling cascades are not linear steps; they are rather an integration of feedback mechanisms, alternate signalling routes, regulation by microRNAs and crosstalk with other pathways.

The review on biological rhythms is one of the highlights of this volume. The authors, Wijnen and Young, discuss this field in depth, covering almost all model organisms employed to study circadian and metabolic rhythms. They also bring out the importance of these rhythms in cell-cycle regulation. They propose that, while the circadian clock is influenced by certain environmental factors, by and large it is the primary time-keeping mechanism in all living systems. While the circadian clock is linked to metabolic and cell-cycle rhythms by gene regulation (transcriptional and post-translational), certain metabolic rhythms (for example, photosynthesis in cyanobacteria) could reset its phase. This review also highlights the importance of regulation of cell cycle by circadian clock. For example, in unicellular organisms or during cleavage of vertebrate embryos, the circadian clock may restrict cell divisions during the light phase to protect the dividing cells from UV-induced DNA damage.

Liu and Butow have reviewed mitochondrial retrograde signalling. Under situations of mitochondrial dysfunction, signalling from mitochondria causes changes in nuclear gene expression that in turn causes metabolic reconfiguration (for example, activation of β-oxidation pathway and proliferation of peroxisomes) to help them meet the biosynthetic demands of the cells. The review describes the components, regulators and targets of mitochondrial retrograde signalling pathway and its connection to TOR signalling, ageing and nutrient sensing.

A major feature of this particular volume is a host of reviews on DNA damage repair and related fields. As many as five reviews cover cellular responses to DNA damage, to how DNA helicases help in repair of damaged replication forks. In a fascinating review Riba *et al.* have reviewed the studies that implicate DNA break–repair pathway in telomere maintenance. Cellular responses to DNA damage include activation of checkpoints that arrest/modify cell cycle, activation of P53-dependent and independent DNA repair mechanisms and, in extreme cases, activation of apoptosis. Data on the mechanism by which each of these mechanisms function are voluminous. However, what causes a cell to decide between these three options (i.e. cell-cycle arrest, repair and apoptosis) is still not well understood.

There are a couple of reviews which focus on advances made in our understanding of a biological phenomenon using specific model organisms. Hariharan and Bilder review all genetic studies to identify tumour-suppressor genes in *Drosophila* and have tried to come out with a interaction network map of those genes during growth control. The last review by Schafer addresses the progress made in identifying the molecular basis of egg-laying behaviour in the nematode worm, *Caenorhabditis elegans*. Important candidates such as serotonin receptors that did not turn up in previous forward genetics screens due to redundancy were shown to be important by approaches that target multiple paralogs in the post-genomic era.

Pheromone signalling is one of the widely used paradigms to understand the mechanism of behavioural responses. Dulac and Wagner review neurological basis of pheromone signalling and discuss how

olfactory and vomeronasal systems in mammals modulate behavioural responses.

Genetics of adaptation in bacteria, mechanism of cyclin-di-GMP signalling in bacteria and host genetic factors that determine susceptibility to infectious diseases are also featured in this volume.

As it has always been, this volume of the *Annual Review of Genetics* too is a compendium of latest information on topics of interests to both researchers and students of genetics.

KALPANA MAKHIJANI
L. S. SHASHIDHARA*

Centre for Cellular and Molecular Biology,
Hyderabad 500 007, India
**e-mail: shashi@ccmb.res.in*

Annual Review of Plant Biology, 2006. S. Merchant, W. R. Briggs and V. R. Chandler (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California, USA. Vol. 57. 914 pp. Price not stated.

There are many welcome changes in this volume of *Annual Review of the Plant Biology* (*ARPB*), though these extend to several other *Annual Reviews* series too. Many illustrations in colour (long overdue), key references in boldface and critical notes in the margin, all greatly enhance the readability and value of the reviews.

One also notices that the *ARPB* is getting weightier each year (this volume comprises > 900 pages); natural perhaps to accommodate the greatly expanded research activity. Also, the editors cover not only the more conceptual advances such as relating to the photosynthetic apparatus or phytochrome action, but provide space and thus encourage somewhat less glamorous or more mundane topics such as chlorophyll degradation or vitamin synthesis, which is perhaps necessary since ultimately the idea is to understand a plant in its entirety – and many future biotechnological exploits may involve manipulating genes which, even as they may seem quite ordinary biochemically, could have important implications in agriculture or human welfare. The added weight of the *ARPB* also derives from the survey of many technical advances such as DNA microarrays. As always, each chapter is written by a world expert, though often involving younger collaborators as 'senior' authors.

The *ARPB* continues the fine tradition of the Prefatory chapters (these should be read by all young and aspiring researchers). This time an admirable and highly readable chapter has been written by Sarah Gibbs on 'Looking at life: from binoculars to the electron microscope'. Gibbs started research with the late Kenneth Thimann, a doyen of American Plant Physiology and Biochemistry, and a grand-guru of many of us. But as luck would have it, Thimann then had to leave for India on a visit sponsored by the US Government. He spent much time in Delhi, where my father, the late Panchanan Maheshwari (who had known Thimann since his own Harvard visit in the 1940s), organized the first national symposium in Plant Physiology at Delhi University and in which Thimann was a key guest speaker and a close advisor. But the visit became longer as Thimann' wife contracted jaundice, necessitating admission in a local hospital. And it is probably this unexpected long stay in India, which altered Sarah Gibb's career. Not having much success with the slow-growing *Acetabularia*, she was a bit distraught and on Thimann's suggestion (on his return), she sought another advisor and changed her research area to electron microscopy investigating the pyrenoid of *Chlamydomonas*. Eventually, she moved to McGill (Montreal), where she became a distinguished member of the faculty. Her autobiographical sketch is one among the most inspiring and frank ones that I have ever read and shows how despite the difficulties that a woman faces in pursuing a career (despite a debilitating affliction of multiple sclerosis); by sheer hard work, determination and grit, she became an outstanding specialist of chloroplast ultrastructure.

Turning now to the various reviews, a timely one is on the 'Structure and function of photosystems I and II' (several titles have been abbreviated by me to conserve space) by Nelson and Yocum, who have themselves done pioneering work on these systems. They bring together the work of many other key laboratories, such as of Barber, Fromme, Saenger, Witt and others (it is a particular pleasure to note here that among the world leaders in this research are Yachandra and Chitnis who have past links with India). Although the general organization of the two photosystems is now fairly clear, the most fundamental question – of how exactly molecules of water split to release electrons, protons and oxygen – is still a mystery.

Addressing now the other core chapters, as a student of developmental plant biology, I find among those most interesting, the first one is on 'Micro RNAs' by Jones-Rhodes in collaboration with David and Bonnie Bartel, with pioneers in this area. The new RNAs in recent years have emerged as powerful regulators of development. It is clear now that the removal of old mRNAs is as important as synthesis of new ones, which is accomplished by various micro RNAs, appearing at critical points (by cleavage of larger precursors while these primary transcripts are still in the nucleus), then moving out into the cytoplasm and getting incorporated in a silencing complex which has ribonuclease activity. Typically, pairing of the micro RNA with a mRNA having a complementary sequence targets the latter for cleavage and total destruction. Research in several laboratories has shown that many of the target mRNAs code for transcription factors and their degradation is obviously as important as the synthesis of new ones for the onset of a new developmental programme.

From the viewpoint of growth and morphogenesis, a chapter of great interest is by Hussey *et al.*, which touches an area of great mystery, i.e. how cell shape is determined and how, for example, root hairs or trichomes arise. It appears that the actin skeleton is fundamental, whose overall size is itself dependent on ARP (AR for Actin Related) and a number of other proteins, among them formins, gelsolins and prolifins. Another review of related interest is by Eherhardt and Shaw on 'Microtubule dynamics and organization in plant cortical arrays', which too is a topic central to growth and morphogenesis. Microtubule organization undergoes dynamic changes with growth. Although there is considerable progress in understanding the various components of the cytoskeleton, little is yet understood as to how decisions such as directional growth or orientation of the spindle during cell division are made. The relative role of actin and ARP vs microtubule proteins is yet to be delineated since microtubules appear to be involved in a variety of other roles such as cell-wall biosynthesis (cellulose microfibril alignment), spiral cell growth or stomatal movement. The great benefit deriving from use of *Arabidopsis* is in generation