

velopment, where recent studies have uncovered aspects of cell-division control. Finally, the roles of regulatory factors and hormones in anther dehiscence are discussed.

Takayama and Isogai discuss recent studies on pollen–pistil interactions that drive self-incompatibility (SI) in many species. The SI system represents a collection of divergent mechanisms – those operating in Brassicaceae, Solanaceae and Papaveraceae are best understood. In Brassicaceae, the SRK receptor on the female stigmatic papilla, when bound by incompatible pollen expressing the SP11 male determinant, drives a signalling cascade. Other stigmatic factors act as positive mediators of signalling. The downstream aspects of this cascade are not well characterized, but the current data suggest a role for ubiquitination-triggered degradation. An entirely different mechanism operates in Solanaceae, Rosaceae and Scrophulariaceae, where the female determinant is a S-RNase, similar to the fungal T2 ribonucleases. Pollen specificity is conferred by hyper variable regions. The pollen-borne determinant was recently identified through genomic studies in *Petunia*, tomato and *Antirrhinum*, and was termed SLF/SFB which encodes a F-box factor that is, usually an adaptor for E3-ubiquitin ligases. The mechanistic details of how these RNases trigger haplotype-specific pollen degradation are still not understood. Data from Papaveraceae species show the female determinant to be a secreted protein, whose interactions with an assumed pollen-haplotype-specific receptor trigger a Ca⁺⁺ signalling pathway. The authors bring out the point that all of these different SI systems support the view that SI evolved independently, multiple times, possibly by recruiting genes involved in cell–cell communication in other pathways.

Jurgens and colleagues review recent studies on membrane and cytoskeleton dynamics that occur during somatic cytokinesis. Here the coordinated delivery of membrane vesicles to the centre of the cell division plate generates a transient membrane compartment – cell plate (phragmoplast). They discuss reports indicating that these membrane vesicles arise from Golgi stacks and they also review data that show an endosomal origin for these vesicles. The authors detail studies on mutants like *knolle* (syntaxin), *keule* and *gnom*, the reverse genetic analysis of factors predicted to act in vesicle dynamics,

recent studies using electron tomographic analysis of somatic cell plate formation, role of cytoskeleton in formation and stability of the cell plate. These together give us a better understanding of this essential cellular process.

In a related review Peer and colleagues discuss plasma membrane protein internalization and recycling mechanisms, where they bring out features common to plants and other organisms. They discuss the literature on the identification and characterization of *Arabidopsis* Adaptin, ARFs, dynamins, Rab GTPases, and SNAREs. Their discussion on endocytosis and the role in auxin transport is extensive and increases our current understanding of the functions played by PIN proteins as auxin efflux carrier proteins. Pharmacological studies on factors like the GNOM (ARF-GEF) are well reviewed and enhance our understanding of polarity establishment and dynamics in plant cells. The area of chromatin structure dynamics and its effects on developmental gene expression is reviewed in two related articles.

Wobus and colleagues in their article on legume seed development, elucidate this system as an example for investigations on tissue-specific progression of differentiation. The review focuses on aspects of metabolic and hormonal regulation to highlight new studies that show a network of signalling molecules, ABA, sugars, and SnRK1 kinases to control specific programmes in seed development. The authors discuss data implicating a role for sucrose signalling molecule that affects transcriptional and post-transcriptional processes to affect carbon fluxes.

The current excitement in the area of plant metabolism and signalling is reflected in the articles that review the role of calmodulin-binding proteins (Fromm and colleagues), calcium oxalate and its function (Franceschi and Nakata), starch degradation (Smith and colleagues), and Redox regulation (Buchanan and Balmer). Each one of these extensive reviews provides a wealth of information, which are all up to date and well illustrated. For example, Nambara and Marion-Poll review the biosynthesis and catabolism of abscisic acid. Recent genomic approaches in *Arabidopsis*, identified ABA-8'-hydroxylases as the first commitment step in ABA catabolism, and these are well summarized. Transcriptional regulation of ABA metabolism by external (dehydration, osmotic stress) and endogenous signals (GA and brassinolide) and some emerg-

ing data showing post-transcriptional regulation are presented. The review ends with a perspective on the evolution of these metabolic pathways. Some aspects of plant interaction with the environment are reviewed in articles on evolution of scents and flavours (Gang), carbon dioxide concentrating mechanisms (Raven and colleagues), phytoremediation (Pilon-Smits) and pathogen interactions (Mudgett). The article by Mudgett provides an insight into the functions of Type III effectors from phytopathogenic bacteria that allows the colonization of plant tissues. New studies that dissect the molecular and biochemical action of TTSS effectors are the main focus. The papers discussed highlight how these factors suppress the innate immunity system of plants by interfering with the activation of resistance proteins, MAPK signalling and execution of programmed cell death. In many instances sequenced genomes, protein structure prediction programmes and discovery of catalytic domains in effector proteins proved critical in this field. The review also outlines key outstanding issues – most important of which is how TTSS effectors contribute to co-evolution of bacteria–plant interactions.

The volume is thus a collection of well-written articles on diverse areas of plant biology.

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Himalayan Snow and Glaciers, Associated Environmental Problems, Progress and Prospects. Jagdish Bahadur. Concept Publishing Company, New Delhi. 2004. 164 pp. Price: Rs 300.

The book under review is Series No. 7 on *Discovering Himalayas* and perhaps the first of its kind on Himalayan snow and glaciers in recent times. This short book attempts to provide the reader an introductory overview of Himalayan snow, glaciers, ice ages, process of glaciation, and outlines the status of international efforts for the study of Himalayan glaciers

in historical perspectives. While describing these, the author has also made an attempt to provide information about the extent of snow and glacier fields, their characteristics and the influence exerted by them on the climate, perennial rivers that flow from glacier melts, soil erosion, sediment transport, environmental problems and monitoring the continual timescale changes for protection, arresting degradation and conservation using high-resolution satellite remote sensing, and simulation modeling of snow and glacier fields for estimation of the extent and intensity of snow precipitation, rate of melting and sustained discharge into the rivers.

Within ten short but crisply worded chapters and six annexures, the book covers wide and diverse topics on practically all aspects of Himalayan glaciers, from the history of their formation, characteristics, importance, the flora and fauna they support, the civilizations that exist under their protection to the influence on the weather and climate of the entire Indo-Gangetic and Trans-Gangetic plains of

the northern Indian subcontinent. The author has attempted to provide the most pertinent information about the Himalayas in eighteen tables inserted at appropriate places, describing inter-annual variability of Himalayan snow cover, permanent snow and its distribution, dams erected on various rivers to chronology of the earthquakes incidences in the Garhwal region of the Himalayas. The book and its contents are indeed invaluable for any curious enlightened lay-reader and also to an expert in planning as a help book in conceiving developmental plans, assessing hydroelectric potential, and selection of proper sites in any part of the long mountainous ranges of the Himalayas. It was thoughtful on the part of the author to have inserted informative figures and diagrams and sixteen colour photographs of various sites depicting the amount of flow and range of forces involved in the gushing melts. The glossary of important technological terms in relation to glaciology at the end of the book definitely helps a reader in seeking deeper and finer

insight and meaning between seemingly similar phenomenon. The reviewer agrees with the observations made by the author in his epilogue (chapter 10) that the study of snow and ice is truly an interdisciplinary science. Considering the expanse and amount of snow precipitation that occurs over the Himalayan mountain ranges, the Himalayas needs to be observed carefully for the natural processes occurring there over time for precise measurements and understanding. The Himalayas, by the very nature of its rock system, commanding heights, and geo-physical instability, constitutes a fragile mountain ecosystem and needs considerate, careful, holistic perspective in planning any developmental projects. Little neglect of scientific details can be catastrophic.

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