

Chapters 4–6 are devoted to the area of metabolic engineering of alkaloid biosynthetic pathways. Chapter 4 describes recent advances in the study of nicotine, terpenoid and tropane alkaloid pathways. The authors discuss the importance of functional genomics approaches to identify genes involved in alkaloid biosynthetic pathways. The role of transporter genes for accumulation and secretion of alkaloids is highlighted. The combinatorial biochemistry approach to engineer tropane alkaloid pathways in various plants using well-established concepts is covered. Chapter 5 highlights the prospects of engineering polyamine biosynthesis for enhanced alkaloid content. It illustrates how polyamine biosynthesis has been engineered for enhanced alkaloid content by over-expression of ornithine decarboxylase and arginine decarboxylase genes. The chapter gives good coverage of polyamine-derived pyrrolizidine, tropane, quinolizidine and other polyamine-derived alkaloids. Chapter 6 presents case studies on metabolic engineering of tyrosine-derived isoquinoline and putrescine-derived tropane and nicotine alkaloids. The review covers details of enzymes and genes in biosynthesis of alkaloids as well as potential of and pitfalls in metabolic engineering for alkaloid production. A general strategy for metabolic engineering is discussed as well.

There are four chapters related to metabolic engineering involving aroma, flavour and nutritive value of the crops. Chapter 7 gives a detailed account of vanillin biosynthetic pathway in *Vanilla planifolia*, along with the potential applications of metabolic engineering to the vanilla industry. The focus here is more on the biosynthetic enzymes of vanillin. Chapter 8 presents a detailed summary of pathway engineering of plant vitamin C metabolic network. It summarizes different independent pathways such as D-mannose/L-galactose pathway, L-glucose pathway, D-galacturonic acid pathway and myo-inositol pathway for vitamin C (L-ascorbic acid) formation in plants and provides the most comprehensive discussion on strategies to enhance vitamin C levels in plants. The authors also discuss the chemistry of ascorbic acid and its role in human health and plant metabolism. Metabolic engineering of terpenoid biosynthesis in plants is described in Chapter 9. The authors review the recent progress in terpenoid metabolic engineering in plants using several well-

characterized examples and discuss some future opportunities in the existing field. This comprehensive review provides much detailed information on terpenoid biosynthesis and functional implications of engineering terpenoids. Chapter 10 describes the metabolic engineering of seed oil biosynthetic pathways to produce omega-3 long chain polyunsaturated fatty acids (LCPUFAs), such as eicosapentaenoic acid and docosahexaenoic acid for human health. The reconstitution of microbial LCPUFAs pathways in plants and beneficial value of a plant-based fish oil substitute are discussed. Chapter 11 summarizes the progress, potential and limitations in metabolic engineering of sugarcane for enhanced yield of sucrose, high-value novel sugars and sugar derivatives, sugar-derived polymers, bioplastics, aromatic compounds and waxes. In the backdrop of high biomass production and useful precursor flux in sugarcane, this chapter highlights the role of metabolic engineering in the production of renewable materials in this well-studied plant.

Chapter 12 describes the expression of anti-solamargine (As)-*scFv* gene in *Escherichia coli* and its characterization. It describes antibody-based metabolic engineering in plants with respect to As *scFv*-enhanced production of solamargine glycosides in transgenic hairy root cultures of *S. khasianum*. Chapter 13 describes the results of experiments on the over-expression of cysteine synthase and serine acetyltransferase genes for metabolic engineering of sulphur assimilation in plants. A brief review of sulphur and sulphur-containing products under various scenarios in plant cells, such as detoxification of environmental pollutants and heavy metals is provided. The last chapter deals with plant-based medicine and describes general rules and problems associated with this area. This chapter also covers *Hypericum perforatum* (St. John's wort) products as an example of chemical profiling. It summarizes the chemical contents of St. John's wort preparations and addresses the benefits of controlled environment production of plants to obtain uniform chemical profile.

This book will prove useful for researchers and professionals alike who are into the field of plant metabolic engineering. It must be emphasized that each chapter in the book is well referenced with current literature, which highlights the task of editing a book in this ever-

expanding field, while still adhering to the basic requirement to give background information and concepts for understanding. The authors have done a commendable job.

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Geology of Haryana and Delhi. J. L. Thussu. Geological Society of India, P.B. No. 1922, Gavipuram, Bangalore 560 019. 2006. 191 pp. Price: Rs 250.

The Geological Society of India (GSI) has been publishing state-wise geology textbooks. The book under review deals with the geology of Haryana and Delhi. This is a commendable effort on part of the GSI. These books provide up-to-date knowledge and help planners in developmental activities in the respective states. Understanding of the physical features and geology of a state plays an important role in its overall development and also that of mankind in the future. State-of-the-art books on the geology of most states are now available because of the consented efforts of the GSI.

This book is divided in two parts. Part I provides a comprehensive account on geomorphology, geology, palaeontology, mineral and geothermal resources and geoenvironmental aspects of the Haryana. Part II deals in concise manner with the geology, mineral resources and geoenvironment of Delhi.

I read the book with interest, as it is one of its kind attempting at providing data on geological history, mineral and geothermal resources, abiotic and biotic hazards, and most interesting, on the drainage migration in the Indo-Gangetic Plains of Punjab and Haryana. The geological data are well synthesized and provide a good compendium. The initial pages in both parts provide a physiographic set-up and summary of geological history. The section dealing with the geology synthesizes up-to-date status of knowledge on Proterozoic Aravalli and Delhi Supergroup, followed by Neoproterozoic of the Himalayan foothills and

Tertiary and Quaternary sequences. The description on Quaternary sequences, which cover a large part of Haryana, comprises of the author's previous published work, which he connects in a coherent manner. The book also addresses groundwater conditions and the causes of salinity in Haryana. The section on drainage migration and geomorphic evolution of the Punjab–Haryana plains condenses the work of experts into readable syntheses. The book is written in a lucid

manner and is organized under various headings supported by excellent illustrations, good photographs and tables. The overall presentation of the book is good. It will serve as a good reference book for researchers and students interested in the geology of these two states. However, I feel that the portion of the book dealing with palaeontology, mineral and geothermal resources and geophysical surveys could have been synthesized in a better way. The reference list given at the end

is quite exhaustive. The author has done a commendable job in writing this book. Anyone interested in the geology of Haryana and Delhi would like to procure a copy of this book.

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