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Book review

Biotechnology: Secondary Metabolites
KG Ramawat and JM Mérillon (eds.) Science Publishers, Enfield, NH, USA, 1999, 393 pp.

This book covers plant secondary metabolites and in particular their production in plant cell and organ cultures. Of its 19 chapters, 11 are authored or co-authored by the senior editor, K.G. Ramawat.

The first chapter presents a fairly upbeat Introduction that outlines the historical and contemporary importance of plant secondary products and research in the field. This is then followed by a survey of the main classes of secondary products. The organisation of this material is less than ideal; e.g. phenylpropanoids and phenolics are separated by a section on polyisoprenes that is itself divorced from the section on isoprenoids. Very few references are provided. The third chapter surveys tools and techniques for the analysis of phytochemicals. There are unfortunately significant deficiencies in this compilation; a number of modern techniques are not addressed, for instance capillary electrophoresis, there is no coverage of phytochemical structure elucidation and principles for devising strategies of natural product isolation from complex mixtures, for example on the basis of biological activity, are not mentioned.

The next three chapters survey the production of three different functional classes of compounds: antitumour agents, food additives and insecticides. There is useful if often empirical information in each of these, though the reader tends to be left in some doubt where current research priorities lie, particularly since few of the references are to work published within the last 5 years and very many are more than 10 years old.

Chapters 7–10 cover general aspects of the behaviour and treatment of cell cultures: optimisation of cultures, selection, hormonal autonomy and the effects of stress. These chapters again survey a great deal of empirical information, largely from the older literature, but they would benefit greatly by being interfaced more effectively with current mainstream plant physiology and cell biology. It would have been valuable to have summarised succinctly our present understanding of the major physical and chemical factors important in plant growth (e.g. light, temperature, osmotic potential, nutrition, plant growth factors, elicitors), including receptors, cell-signalling pathways and the control of gene expression, and to have related this to the cell-culture context and the relevant secondary-product literature. Some attempt to do this has been made in Chapter 11 in the discussion of elicitors, but overall the reader is left with insufficient perception of the current and emerging knowledge base of plant responses to environmental conditions. There is, for example, scant reference to the induction and regulation of enzymes of the phenylpropanoid pathway and its branch pathways.

Chapters 11 and 12 return to the theme of Chapters 4–6 in dealing with groups of secondary products, though in this case chemical classes, alkaloids and steroidal saponins respectively. Both of these are useful surveys, though again short on recent literature.

Chapter 13 is entitled "Mechanism and Control" and deserves to be much longer, since it begins to address some of the concepts not covered in Chapters 7–10. There is some treatment of genetic engineering of metabolic pathways, but this could be more comprehensive and more critical. In particular, the concept of rate-limiting enzymes as targets for genetic manipulation needs to be placed in the context of theories of metabolic control analysis. There is also no mention of altering pathway expression by the use of transcription factors. Chapter 14 presents a short and concise account devoted mainly to the sequestration of toxic compounds as glycosides in plant vacuoles.

Chapter 15 covers the bioconversion of secondary metabolites (biotransformations) and is undoubtedly one of the best chapters in this book. It is an informative and well-balanced account covering all the most important examples and presenting a personal view of the present status and future prospects in this field.

The final four chapters address a range of different topics. Chapter 16 is entitled "Genetic Transformation for Production of Secondary Metabolites" and in practice deals with transformed root and shoot cultures established by transformation with *Agrobacterium*. This is a useful survey and well-referenced, though rather lacking in recent references. Chapter 17 is a good treatment of the principles and practice of bioreactor scale-up and includes very clear diagrams. Chapter 18, as the authors admit, is a compendium of information on

selected medicinal plants (23 in all) not presented specifically elsewhere in the book, with an emphasis on species from the Indian subcontinent. The tissue-culture information is reasonably well-referenced, but the pharmacological information is not, making it very difficult to assess its status. Finally, Chapter 19 presents a short series of practical demonstrations in cell culture and secondary-product analysis suitable for classroom use. There are also useful tables of the constituents of growth media.

Although this book has its good points, it is difficult overall to recommend it. It has four notable drawbacks. Perhaps the least serious is its organisation; the book as a whole is not very well structured. Secondly, there are many errors, mostly typographical. These are often factually unimportant, but in other cases — e.g. in Fig. 4.1 — compounds are misspelt. Occasional errors of this kind are almost inevitable in a book of this type and size, but there are far more in this book than is usual. Thirdly, much of the value of a book of this type to the reader lies in the references cited. No consistent policy has been adopted here; some chapters end with a list of reviews for further reading and others have a list of references to the primary literature; some have both. In many cases, there is a serious shortage of references to the recent literature. Finally, much of the content is not "leading edge". There is nothing wrong with a classical approach or a historical context, but modern knowledge and emerging perspectives must not be neglected and unfortunately many of the chapters in this book do fall appreciably short in this respect.

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