

## BOOK REVIEWS

**The Biosynthesis of Secondary Metabolites:** by R B HERBERT Chapman & Hall, London and New York, 1981 ix + 178 pp Paperback £6 50

R B Herbert has attempted the impossible to produce a concise but comprehensive account of the biosynthesis of secondary metabolites, suitable for both undergraduate and postgraduate students of chemistry and biochemistry, all within the space of 178 pages. In this endeavour he has been surprisingly successful, and the book's shortcomings are primarily the result of squeezing so much information and so many structural formulae into such a slim volume. There are seven chapters of which the first two are of an introductory nature, and the rest encompass all of the usual biosynthetic pathways. Chapter one contains a brief introduction to primary and secondary metabolism including a rather superficial discussion of fatty acid biosynthesis, polyacetylenes and prostaglandins, all within the space of four pages, a section on stereochemistry in biosynthesis which contains a useful account of the utility of compounds containing chiral methyl groups, and finally the essential chemistry of oxidative phenolic coupling, aromatic hydroxylation and methylation merits three and a half pages. The second chapter is concerned with the techniques used in biosynthetic studies, and 11 pages are devoted to the use of radioisotopes and stable isotopes. Overall this is a useful section, though there is a rather complex example to illustrate the use of  $^{13}\text{C}$ - $^2\text{H}$  double labelling for NMR analysis. On the final page of the chapter there is a mention of the isolation of biosynthetic enzymes and the use of mutants.

The next four chapters provide a conventional but comprehensive account of polyketides, isoprenoids, the shikimic acid pathway and alkaloids. There are examples of polyketide metabolites derived from four  $\text{C}_2$  units through to those derived from ten  $\text{C}_2$  units, but some of the complex pathways will be hard to follow for the uninitiated because they are illustrated with great economy. Steroid biosynthesis is discussed in great detail,

but monoterpenes merit only one page. Sesquiterpenes fare rather better, though the complex route to the trichothecane skeleton is poorly illustrated. The biosynthesis of shikimic acid and aromatic amino acids is covered in some detail, then quinones, coumarins, flavonoids and odd compounds like helicobasidin and the furanocoumarins are given an abbreviated treatment. Chapter six is probably the best in the book with a very comprehensive account of all of the main classes of alkaloids and their biosynthetic pathways. This chapter also contains the best illustrations. Finally, a concluding chapter contains a diverse collection of odd microbial metabolites containing nitrogen. This miscellany includes the ergot alkaloids, diketopiperazines, benzodiazepines, ansamycins, cytochalasins and  $\beta$ -lactam antibiotics, amongst others. In addition there are 584 references, and an eight page index, but no problems for the student to tackle.

This is a useful book, with few apparent errors or serious omissions (though the cannabis metabolites are not mentioned), but the major disappointment is the size of the structural formulae. Many are very small and the complex pathways are often unclear because the mechanistic arrows are so tiny. I imagine that the publisher desired a cheap book, and the paperback version is certainly within the right price range for undergraduates, but the cramped appearance of the figures lessens the appeal of the book. Finally, although this is a book 'about experiments and the results of experiments', there is no mention whatsoever of the pharmacological, toxicological, or ecological significance of the secondary metabolites—and it is usually these biological properties that provide the *raison d'être* for the experiments. We are left instead, with tantalizing phrases like 'biologically interesting' or 'important plant hormone', but such comments are very rare indeed.

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**Phytoalexins,** edited by J A BAILEY and J W MANSFIELD Blackie, Glasgow, 1982 334 pp £28

Considering that the phytoalexin concept was not comprehensively formulated until 1940 and that the first phytoalexin was not fully characterized until 1962, the progress that has been made in studying these natural defence agents has been truly remarkable. Of course, the idea that plants might be able to produce toxins in response to pathogen attack has a respectable history in plant pathology and early experiments by Bernard on orchid bulbs soon after the turn of the century can in retrospect be interpreted as being phytoalexin based. Nevertheless, it was not until the pioneering experiments of Cruickshank and Perrin with pisatin from pea pods

during the 1960's that the phytoalexin concept caught on. Since then, many notable advances have been made and we now have a very extensive knowledge of these fascinating biologically active phytochemicals. The phytoalexin response, for example, has now been recorded in at least 20 higher plant families and over 100 phytoalexins have been characterized in the Leguminosae alone.

Although it is always dangerous to prophesy about future scientific developments, it does appear at present that most of the major experiments with phytoalexins have been carried out. It is time to take stock and look at the considerable body of data that has accumulated. What better way to do this than to produce the first monograph dealing exclusively with these compounds?

This must surely have been in the minds of Drs Bailey and Mansfield when they set out to prepare the book under review, simply entitled *Phytoalexins*. Indeed, the present data on phytoalexins are put into perspective here by a historical introductory chapter by B J Deverall and a forward-looking valedictory chapter by the editors entitled Current Problems and Future Prospects.

In between, there are eight chapters detailing our present knowledge of phytoalexin production throughout the plant kingdom. An authoritative account by J L Ingham on the phytoalexins of legumes is followed a second chapter on solanaceous phytoalexins by J Kuc, while a third by D T Coxon reviews the phytoalexins formed in all other families. Biosynthesis is discussed comprehensively by A Stoessl and metabolism by H D Van Etten and coworkers. A wide ranging contribution on phytoalexin toxicity by D A Smith covers antibacterial and animal toxicity as well as the more familiar fungitoxicity of these antimicrobial substances. There remain to mention the two key chapters of the book on the pathological role of phytoalexins—their contribution to plant disease resistance (J W Mansfield) and the

mechanism of their accumulation, as well as of their elicitation (J A Bailey). The editors here take a well balanced but properly critical view of the many experiments that have set out to establish a role for phytoalexins in plant-pathogen interactions. It is here that our present knowledge is particularly incomplete and where future experiments might be most profitably directed.

In this excellent monograph, the authors and editors have provided a most valuable survey of the phytoalexin field, which is both remarkably comprehensive and very up-to-date. The whole is amply illustrated with tables, figures, electron micrographs and formulae and there is a very adequate subject index. The references (with titles) appear at the end of each chapter in alphabetical order and although there is no author index, cross reference is not too difficult. In all, this is a really first class addition to the literature of both phytochemistry and plant pathology and this will remain an essential reference point for many years to come.

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**The Biochemistry of Alkaloids:** by T ROBINSON. Second edition, Springer, Berlin, 1981. 225 pp. DM 88.

I remember when the first edition of this very welcome text came out being disappointed that the author chose such a narrow definition of the word 'biochemistry' that he mainly discussed biosynthesis at the expense of natural distribution, further metabolism, function and biological properties. In this second edition, the scope has been widened with a more extensive treatment of metabolism and a chapter on the biochemical effects of alkaloids which deals in the main with their pharmacological effects on mammalian systems. These are certainly useful additions but it is sad that little is included on chemotaxonomy or on ecological aspects. The remarkable utilization of plant pyrrolizidine alkaloids by danaid butterflies as sex pheromones surely deserves at least a paragraph or two.

The main thrust of the book, therefore, remains the pathways of biosynthesis and here it is excellent. In view of the considerable progress made since 1970, there has been considerable updating of the original text and this is reflected in the fact that *ca* 40 % of the literature references are taken from the researches of the last decade. The discoveries of certain of the enzymes of biosynthesis are recorded and biosynthetic studies in tissue culture are mentioned, though perhaps without the emphasis they deserve. Dr Robinson has a very attractive, lucid and informative style of writing and this second edition is probably the best introductory text available on the general biochemistry and biosynthesis of these plant bases. It can be warmly recommended to the student reader.

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