

plants. The chapter considers the flow of nitrogen from ammonia to the diverse range of nitrogenous compounds found in plants, including developmental and environmental conditions of nitrogen flow. Despite the complexity of the scheme it is clear now, that nitrogen is constantly being recycled as ammonia and is re-assimilated by the action of glutamine synthetase and glutamate synthase.

The second part deals with enzymology of synthesis and degradation, molecular genetics and regulation of amino acid metabolism as well as amino acid uptake and transport. The first chapter of this part, written by R. J. Ireland and P. J. Lea, is of fundamental importance. It describes the basic roles of glutamine, glutamate, asparagine, and aspartate in a model of the major pathways of amide amino acid metabolism. J. Bourguignon, F. Rébeillé and R. Douce wrote a most interesting chapter on serine and glycine metabolism, covering the parallel chloroplastic and cytosolic “glycolytic” pathways or the glyoxylate pathway as well as the catabolism of serine and glycine in the photosynthetic (photorespiratory cycle) and nonphotosynthetic tissues. These amino acids are integrated into a complex metabolic network, tuned up to the metabolism of various cellular compartments. The chapter makes clear that there are still many problems to be solved, especially on regulation. Recent progress in research on amino acid long-distance transport and membrane-located transporters will help in understanding resource allocation across the plant (D. R. Bush). In research on compartmentation of the shikimate pathway, leading to tryptophan, tyrosine, and phenylalanine, the long-standing debate on whether or not there is a cytosolic as well as a chloroplastic location obviously came to an end (J. Schmid and N. Amrhein; D. L. Siehl). All evidence points to an exclusive chloroplastic location, except for the myseric cytosolic chorismate mutase isoenzyme.

The third part discusses applied aspects, such as design of herbicidal inhibitors and examination of herbicide-resistant crops (D. L. Shaner) as well as molecular

approaches to enhance the nutritional value of plant products, e.g. by enhancing the content of essential amino acids (G. Galili and B. A. Larkins; S. S. M. Sun) or by reducing amino acid-derived secondary products, such as glucosinolates (R. M. Wallsgrove, K. Doughty and R. N. Bennett) or cyanogenic compounds (B. L. Møller and D. S. Seigler). And there might be a fruitful connection between academic and applied aspects. Excellent examples of progress in finding novel herbicides that increases our knowledge on the particular enzymes is found in the chapter on inhibitors of histidine biosynthesis (J. Dancer, S. Lindell and M. J. Ford). Such enzymes, e.g. the histidinol dehydrogenase, are the subject of patent applications relating to their role as potential herbicide targets.

Future work on amino acid metabolism will definitely concentrate on biotechnological approaches (raising mutants and transgenic plants) to elucidate the regulatory signals which are integrated into the control of crucial steps of nitrogen metabolism (R. J. Ireland and P. J. Lea). This might also hold true for the sulfur metabolism in plants. A detailed understanding of cysteine biosynthesis at the molecular level has recently been achieved and might open the window to molecular engineering of sulfur metabolism (K. Saito).

The book is absolutely essential for scientists working on amino acids. It can equally be recommended to any scientific worker interested in plant metabolism, phytochemists, physiologists, biochemists, and molecular biologists as well as agricultural engineers and biotechnologists. It will also attract undergraduate and graduate students in plant biology and will be of great help for those starting their scientific work in the various fields of plant amino acid metabolism.

Dieter Strack

*Institut für Pflanzenbiochemie, Abt.
Sekundärstoffwechsel, Weinberg 3, D-06120, Halle
(Saale), Germany*

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***Naturally Occurring Glycosides*; edited by Raphael Ikan. John Wiley and Sons, Chichester, 1999, ISBN 0-471-98602-X, 444 pp. £120**

The twelve chapters in “Naturally Occurring Glycosides” focus on structural, biochemical and bio-

logical aspects of plant glycosides. Topics include metabolites from a variety of plant biosynthetic pathways, i.e. aminoglycoside antibiotics, anthocyanins, cardiac glycosides, cyanogenic glucosides, glucosinolates, glycoalkaloids, glycosidically bound volatiles, saponins and terpenoid glycosides.

Each chapter is written independently by leading experts in the respective field. Therefore content and focus of each chapter varies with the expertise of its author. Several chapters, e.g. aminoglycoside antibiotics or steroidal glycosides from marine organisms, read like an up to date dictionary of chemical structures of the respective compounds. Others comprise the current knowledge of glycoside chemistry combined with additional information on biosynthesis and molecular biology of individual compounds. This is achieved in the chapters on cyanogenic glycosides and glucosinolates. The chapter on anthocyanins is concerned with intra- and intermolecular stacking and aggregation of these highly conjugated structures as well as pH dependent stability and color of the pigments. On the other hand the chapter is disappointing if the reader is interested in biological data, such as the current problems on transport of flavonoid conjugates or molecular regulation of anthocyanin biosynthesis. However this might be beyond the scope of this chapter.

A detailed example on current glycoside research is presented on limonoids. These triterpenoid aglycones are one of two bitter principles in *Citrus* fruits (the other one is related to the presence of the flavanone

glycoside naringenin). The reader is confronted with an exciting summary of structures, biochemistry, molecular biology of the respective glycosyltransferases involved in the debittering process and the possible industrial application of *Citrus* species with enhanced glycosylation potential.

In summary the book is worth reading not only to the scientist interested in plant glycosides, but also to any advanced student with a general interest in natural product biochemistry. It is never boring, because it is not a dictionary and each chapter features the different point of view of the respective author. In addition, the book manages to cover not only the diversity of glycoside structures but also summarizes the variety of methods applied. The list of references is up to date until 1997 and is a storehouse for each researcher working in the field. The editor and the contributing authors have successfully covered many aspects of glycoside research.

Thomas Vogt
*Institut für Pflanzenbiochemie, Abt.
Sekundärstoffwechsel, Weinberg 3, D-06120, Halle
(Saale), Germany*