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Book Review

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Modern alkaloids – structure, isolation, synthesis and biology

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Alkaloids are probably the most diverse group of natural products. Indeed, the diversity in their chemical structures, their physiological role in the plant, their therapeutic and pharmacological activities, is so great that no clear definition of the term 'alkaloid' can be given that would include all the alkaloids. The presence of a basic nitrogen atom seems to be the only unifying factor for the various classes of alkaloids (but then again, not all organic compounds with a basic nitrogen are alkaloids).

The editors of *Modern Alkaloids* admit in their introduction that their handbook cannot be regarded as a comprehensive presentation of alkaloid research. This is not meant as a criticism; even the excellent series 'The Alkaloids' which currently counts 66 volumes cannot be regarded as a fully comprehensive presentation. Fattorusso and Tagialatela-Scafati have attempted to make a careful selection of the relevant modern developments in alkaloid research and approached an international range of alkaloid specialists to write contributions for this book.

The result is essentially a collection of 20 review papers on different aspects of alkaloid chemistry and pharmacology. The book is divided into three sections: Structure and Biology, New Trends in Alkaloid Isolation and Analysis, and New Trends in Alkaloid Synthesis and Biosynthesis.

The section on structure and biology gives a good overview of the diversity of alkaloids and, no less interesting, of the diversity of the natural sources of alkaloids. Most readers will be aware of various terrestrial plant species as sources of medicinal alkaloids. The book starts with a thought-provoking, though perhaps rather speculative, overview of the possible ecological roles of alkaloids. After this introduction, a selection is made of various alkaloids grouped according to their pharmacological effects, i.e. antitumour activity, bitter taste, capsaicin–TRV1 interaction, glycosidase inhibition and neurotoxicity. The next five chapters betray the editors' own interests: both are organic chemists working on the chemistry of secondary metabolites from marine invertebrates. The chapters on marine organisms as alkaloid sources highlight an area of research that has remained relatively under-explored. Marine natural products only add to the rich diversity of alkaloids that may act as lead compounds for drug development. The potential of these novel products is currently

being tested in a range of rapid high-throughput assay systems, and a number of compounds have progressed to phase II or phase III clinical trials, notably as anticancer drugs.

The section on new trends in alkaloid extraction and analysis is in fact a general overview of modern methods in natural products extraction and analysis. Whereas it is essential to be aware of modern extraction techniques (i.e. supercritical fluid extraction, microwave-assisted extraction, pressurised solvent extraction and solid-phase micro extraction) and modern analytical techniques that allow analysis of small biological samples (notably GC-MS and HPLC-MS), application of these techniques is not specific for alkaloids. The applications given here for some alkaloids are of limited general value, due to the sheer diversity of possible alkaloid structures; each separate alkaloid subgroup will require development of a different protocol for optimal separation and analysis. The next chapter presents a fervent plea for ^{15}N NMR as an analytical tool. This is of particular interest to alkaloid research since the possession of a nitrogen atom in its chemical structure is the one feature that is shared by all alkaloids. Recent developments in NMR hardware and software have greatly facilitated the utilization of ^{15}N chemical shift and long-range coupling pathway information in the determination of the structure of alkaloids.

The final section of the book, on new trends in alkaloid synthesis and biosynthesis, contains six chapters, each of which are well worth reading in their own right, but as a whole perhaps lack the coherence one would expect in a handbook. The chapters deal with an eclectic mix comprising of the use of transition metals in oxidative cyclization, synthesis of camptothecin analogues, combinatorial synthesis and drug development, biosynthesis and biomimetic synthesis of *Daphniphyllum* alkaloids, biosynthesis of halogenated alkaloids (mainly of marine origin), and genetic engineering of the indolocarbazole alkaloid biosynthetic pathway in actinobacteria.

Alkaloid research is too broad a topic to sufficiently discuss in a single volume, but the editors of *Modern Alkaloids* have made an interesting and original choice of topics within this wider area. Overall, the book should not be seen as an introductory handbook to alkaloid research, for this would require it to have an overview of the more mundane, commonly used extraction and analytical methods, and a discussion of the most commonly used medicinal alkaloids. However, the book provides a wealth of detailed information for students and researchers who want to 'cleanse the doors of perception' and explore new developments in alkaloid chemistry.

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