

**Essentials of Botanical Extraction: Principles and Applications.** Subhash C. Mandal, Vivekananda Mandal and Anup Kumar Das. Academic Press, An Imprint of Elsevier, 32 Jamestown Road, London NW1 7BY, UK. 2015. xvi + 207 pages. Price: US\$ 99.95.

The book under review consists of ten well-written chapters, which cover all the aspects of profiling crude botanical extracts for rapid identification of bioactive compounds. Historically, throughout our evolution, the importance of plant-derived bioactive phytochemicals for health and procuring medicinal agents has been enormous. Due to diverse medicinal potential and biochemical activities of natural products, nearly every civilization from different time periods and ethnic groups have accumulated experience and knowledge about their uses.

This book integrates insights regarding several conventional and modern extraction methods pertinent to extraction of botanicals, and demonstrates the importance of the choice of appropriate extraction method for drug discovery and development from botanical sources. It also covers various mathematical models and chemometric aspects in relation to extraction. It also describes several practical examples, provides suitable diagrams and figures, and is easy to follow.

In the beginning, the history and current state of natural product drug discovery and development are described highlighting the successes and current issues. Subsequently, the role of plants in terms of the secondary metabolites as potent anti-inflammatory, analgesic, cardiotoxic, anti-hypertensive, anti-diabetic, anti-obesity, anti-malarial, anti-leishmanial and anti-cancer leads for pharmaco-

logically active compounds which are currently under clinical trials are described. More importantly, the factors thought to be the reason for declining interest in botanicals such as difficulties in obtaining authenticated plant materials, problems associated with the measurement of biological activities of extracts, time constraints, lack of reproducibility of bioactivity are well discussed. To overcome some of these bottlenecks, the strategies to improve the status of drug discovery from botanicals such as amalgamation of *in silico* screening approach, and towards the selection of medicinal plants, ethnopharmacology approach, chemotaxonomic approach, field observations and zoopharmacognosy approach are described in simple terms.

As one proceeds with further reading, the authors take the reader through the steps of classical approach for the extraction of analytes from both solid and liquid samples. Following this, various non-conventional, modern extraction techniques including microwave-assisted extraction, supercritical fluid extraction, accelerated solvent extraction, pulse electric field-assisted extraction along with the principles, instrumentation details and the advantages of each technique are explained in detail. It is evident from this chapter that the continuous progress in the area of separation technology has increased the variety and variability of the extraction methods that can be successfully utilized in the extraction of potent bioactives. For any natural product researcher, it is therefore essential to become familiar with the newer approaches in the field of extraction technology.

The next chapter covers a newly emerging structured approach for the process development of solvent-based botanical extraction techniques. While developing a new methodology involving any type of extraction technique, two types of situations arise where the intervention of experimental design is necessary. The first is to screen out the few vital factors anticipated to have a significant effect on the final experimental outcome or response. The second is to find the value of the selected factor which will optimize the response, namely, the optimization phase. Through this chapter, an overview covering various approaches in combination with statistical techniques and chemometrics encompassing botanical background are dis-

cussed. The discussion gives an in-depth process understanding for an improved process economy.

The next important aspect in extraction of bioactives is their identification. This has systematically been offered as strategies for identification of known volatile and non-volatile compounds with or without reference standards followed by the identification of compounds with unknown structures, together with the stages in elucidation of the structure. Towards qualitative phytochemical screening, one step chemical test procedures including the preparation of reagents required for the chemical test are provided for detection of alkaloids, glycosides, flavonoids, tannins, steroids and other phenolic compounds. In addition, procedures for preparation of spray reagents and the suitable solvent systems for detection of the above phytochemicals by thin layer chromatography are described. Suggested outcome is also indicated.

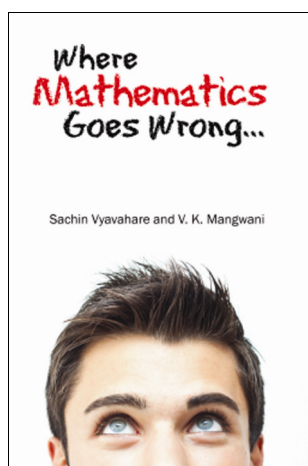
During the natural drug discovery process, emergence of undesirable components with no pharmacological interest becomes inevitable. In this regard, dereplication process, which is a procedure for identifying known compounds responsible for the activity of an extract prior to final isolation, will help in concluding the extraction process efficiently. This process involves the separation of a single metabolite by chromatographic methods, identification of compounds by spectroscopic methods, bioassays for evaluation of the biological activity, and database search for verification of the novelty of compounds. Stages where dereplication is applied during traditional and modern approaches of drug discovery are well demonstrated. Finally, the strategies for profiling crude extracts for the rapid identification of bioactive compounds through construction of crude extract library and purified natural product library are explained.

In spite of the massive arsenal of clinical candidates developed by the pharmaceutical industries, worldwide, many members of modern society are increasingly turning to plants as a source of novel drug entities through research at both the academic and industrial levels, thus making herbal remedies as a popular alternative for treatment and prevention of diseases. In view of this, to all those who are pursuing active research in the field of phytomedicines and to the new

entrants or aspirants alike, this book will be very useful as a protocol book and an excellent resource material for the essentials of botanical extraction.

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**Where Mathematics Goes Wrong...: Mathematical Fallacies, Howlers & Number Tricks....** Sachin Vyavahare and V. K. Mangwani. Notion Press, 5 Muthu Kalathy Street, Triplicane, Chennai 600 005. 2014. xii + 84 pages. Price: Rs 130. Soft, ISBN: 9789383808991.

Beyond all doubt, all will invariably agree with the statement that the sum of angles in a triangle is equal to 180 degrees. But the aforesaid statement is true only in Euclidean Geometry. As one progresses to hyperbolic geometry and elliptic geometry, axioms, definitions, theorems and laws start changing. It has been proved by a few experts that the sum of angles in a triangle will always be less than  $180^\circ$  in hyperbolic geometry and it has also been proved by a few experts that in elliptic geometry the sum of angles in a triangle will always be

greater than  $180^\circ$ . Interestingly, all the three assertions (sum of angles of a triangle =  $180^\circ$ , sum of angles of a triangle  $> 180^\circ$ , sum of angles of a triangle  $< 180^\circ$ ) are correct! Thanks to mathematicians and scientists such as Bernhard Riemann and Gauss–Bolyai–Lobacheskvy. New knowledge (which might challenge existing knowledge so far believed to be correct) is being added only because of the painstaking efforts of people of their ilk.

Can 1 and 2 be equal to each other? Can 3 and 5 be equal to each other? Many books dwell on an algebraic proof to prove that 1 and 2 (or 3 and 5) are equal to each other. But in the work under review the authors have not only provided an algebraic viewpoint, but also examined the aforesaid fallacy using derivatives, the concepts of commutative and associative laws of addition, inequality, limits, integration, theory of complex numbers, trigonometry, matrices, binomial theorem, simple arithmetic and induction. The famous missing square puzzle (created by noted American neuropsychiatrist L. Vosburgh Lions based on a phenomenon observed by a world-famous magician by the name of Paul Curry), Tangram paradox (based on the work of the mathematician named Henry Ernest Dudeney), TrollPi (or  $\pi = 4$ ) have been beautifully explained via means of intricate drawings and easy-to-understand text.

The book under review is a mesmerizing odyssey of fallacies, howlers and novel number tricks coupled with well-labelled diagrams and hilarious pictures which are bound to keep the reader engaged and stimulate thinking and reasoning on similar or dissimilar patterns. The book has been effectively divided into three parts. The first part is devoted to fallacies (including multivalve functions fallacies, calculus fallacies, power and root fallacies, dissection fallacies), the second part dwells on howlers and the third part lays bare useful and interesting number tricks. The book performs a minute dissection of the differences between a *simple mistake* and a *mathematical fallacy*. The authors have explained

the significance, meaning and uses of fallacies and howlers in great detail by unfolding them in a layer-by-layer manner which will help the reader in stretching his/her imagination. The book is a kaleidoscope of logic, patterns, and will help in developing a positive approach to mathematics.

Life is a game of mathematics. It may not be an exaggeration to say that Mathematics is as vast as the firmament or as unfathomable as the universe (or shall we say multiverses) and no amount of exploration will help in comprehending the entire firmament or the universe. Nonetheless, exploration is imperative and it certainly enriches us in several ways. The work under review touches on interesting and confounding concepts in mathematics which have been simplified by the authors because of their superlative presentation skills. The book will definitely help the reader in developing a deeper understanding of mathematics and provide meaningful insights into the subject. It will be of special interest to the aficionados of Mathematics. The book under review is a landmark effort. It is charming, exciting and will be of great help to exegetes, polemicists and all those who are seeking intellectual challenges. It offers much for further verification and exploration. The reader might perhaps have two misgivings after reading and comprehending the work under review. The first might be with the caption of the book *Where Mathematics Goes Wrong* because Mathematics does not go wrong, it is human thinking which might be wrong! Second, the reader might feel that more paradoxes, fallacies and howlers should have been provided because the book whets the reader's appetite for similar mathematical fallacies and paradoxes. Even so, the book is indeed a collector's item.

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