Traditional resources and tools for modern drug discovery: Ethnomedicine and pharmacology – book review

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Book Review

This book provides innovative insights into the combinatorial use of plant-based compounds for drug discovery and development to achieve improved treatment outcomes. It explores the evolution of ethnobotany and traditional medicine as the foundation for modern drug development, employing biotechnological methods that involve the identification, screening, and optimization of natural compounds to enhance affinity, selectivity, bioavailability, and metabolic stability. The book also highlights the crucial role of bioactive compounds in contemporary pharmaceutical research, specifically examining how drugs influence the molecular and physiological regulation of infections and diseases. Written by leading experts and supported by up-to-date literature and illustrations, this volume serves as a valuable academic resource for researchers, industry professionals, and health policymakers.

The book consists of 25 chapters, which are divided into 5 major sections based on themes. Section 1, titled "Foundations of Ethnobotany and Traditional Medicine in Modern Drug Discovery," includes chapters 1, 2, 4, 5, and 14. Section 2, "Tools and Methodologies in Traditional Resource-Based Drug Discovery," covers chapters 3, 8, 9, 10, and 19. Section 3, "Therapeutic Applications of Traditional Resources," comprises chapters 6, 7, 11, 16, 20, and 21. Section 4, "Natural Products and Nutraceuticals in Modern Medicine," includes chapters 12, 13, 22, 23, and 24. Finally, Section 5, "Economic and Industrial Aspects of Traditional Resources in Drug Discovery," encompasses chapters 15, 17, 18, and 25.

Section 1 explains the basics of ethnobotany and traditional medicine in the development of modern medicine. Chapter 1 explains how humans historically explored plants as natural remedies. It also examines the evolution of ethnobotanical methods—from oral traditions and written records to modern scientific approaches—emphasizing the documentation of indigenous knowledge as a means to preserve cultural heritage. Chapter 2 narrates the historical journey of traditional remedies, including the identification of active compounds through cultural studies and their integration into modern pharmaceutical research. Chapter 4 emphasizes the role of traditional knowledge as a valuable guide in identifying bioactive compounds to support safer and more effective therapies, while also addressing the challenges of combining traditional wisdom with modern scientific methods. Chapter 5 highlights the importance of natural resources—including plants, animals, and microorganisms—as integral components of ethnomedicine and discusses the integration of cultural, ethical, and ecological aspects in the development of traditional remedies. Finally, chapter 14 examines the use of traditional herbal medicines in India, illustrating local ethnobotanical practices for treating diseases such as cancer, diabetes,

neurodegenerative disorders, and cardiovascular conditions. It also outlines the limitations and future opportunities for plant-based medicines.

Section 2 illustrates how modern tools enhance the application of traditional resources in drug discovery, combining scientific advancements with ethnobotanical knowledge to develop novel therapeutic agents. Chapter 3 highlights the role of modern software technologies, such as molecular modelling and docking simulations, in optimizing bioactive compound identification and reducing animal testing. Chapter 8 focuses on plant-derived biomarkers, such as alkaloids, flavonoids, and terpenes, emphasizing the importance of techniques like mass spectrometry, nuclear magnetic resonance spectroscopy, and genomics for characterizing these compounds. Genomic tools enhance the understanding of the molecular mechanisms behind plant-based medicines, further supporting their potential in drug development. In chapter 9, the authors discuss metabolomics, emphasizing its importance in uncovering new therapeutic targets from natural products. Metabolomics accelerates drug discovery by enabling high-throughput screening and optimizing lead compounds. Chapter 10 introduces reverse pharmacology, integrating traditional medicine with modern science to identify active compounds and their mechanisms, enhancing drug repurposing and personalized medicine. Finally, chapter 19 explores endophytes as sustainable sources of bioactive compounds, highlighting methods for their isolation and cultivation despite challenges in understanding their interactions with host plants.

Section 3 provides a comprehensive exploration of traditional medicinal plants in addressing various health conditions. Chapter 6 discusses their role in managing metabolic diseases, highlighting numerous plants with anti-diabetic and anti-obesity properties, including *Momordica charantia* (bitter melon), *Syzygium cumini* (black plum), *Carica papaya* (papaya) and *Zingiber officinale* (ginger). Chapter 7 examines ethnic plants as therapeutic agents, particularly in cancer and neurodegenerative disorders. Chapter 11 delves into the role of flavonoids in treating complex neurodegenerative diseases, exploring their potential in combating Alzheimer's, Parkinson's, and Huntington's diseases. Silibinin and epicatechin are noted for their potential anti-Alzheimer's effects, while luteolin and rutin are linked to Parkinson's disease management. Chapter 16 documents the apoptosis-promoting and antimicrobial compounds from the Apocynaceae family, emphasizing their potential in overcoming multidrug resistance in cancer therapy. Chapter 20 underscores the significance of traditional medicines in treating neurological diseases, highlighting various medicinal plants with neuroprotective properties. Finally, chapter 21 further explores the physiological mechanisms through which ethnomedicinal resources regulate metabolic disorders, detailing the multifaceted effects of compounds like resveratrol in combating obesity by reducing caloric expenditure, modulating lipid and carbohydrate metabolism, exhibiting anti-inflammatory properties, and improving insulin sensitivity.

Section 4 highlights the pharmacological potential of bioactive compounds by integrating ethnomedicine with modern science, emphasizing their role in healthcare and drug innovation. Chapter 12 defines nutraceuticals as bioactive food-derived compounds with health benefits beyond nutrition, classifying them into plant-, animal-, and marine-based sources, and discussing their role in managing chronic diseases, though further research on pharmacokinetics and long-term safety is required. Chapter 13 highlights the historical and contemporary significance of natural products in pharmaceuticals, emphasizing key bioactive compounds and modern biotechnological advancements like genomics and proteomics to enhance compound identification. Chapter 22 explores the microbial diversity and health benefits of fermented foods, particularly probiotics, in digestion, nutrient absorption, and immune modulation, while also addressing commercialization challenges. Chapter 23 systematically categorizes bioactive compounds in ethnomedicinal plants, examining their phytochemical composition, pharmacological effects, and applications in medicine. Chapter 24 focuses on the pharmacological significance of medicinal mushrooms, detailing their bioactive compounds and therapeutic potential in immune modulation, oxidative stress reduction, and disease prevention, reinforcing their importance in drug discovery and functional foods. However, challenges such as pharmacokinetic limitations, regulatory barriers, and clinical validation persist. Advancing empirical research and strategic policies is essential for their effective incorporation into evidence-based medicine.

Section 5 explores the intersection of traditional medicine and modern pharmaceuticals. Chapter 15 covers the importance of traditional resources in pharmaceutical industries, highlighting that over 80 percent of allopathic drugs are directly related to medicinal effects found in traditional medicine. It also details various traditional medical systems like Ayurveda, Unani, and Homeopathy, emphasizing their principles and current applications. Chapter 17 provides insights into modern drug research and its impact on pharmaceutical industry, tracing key milestones from the synthesis of aspirin to the Human Genome Project, and discussing advancements like high-throughput screening, omics technologies, and biotechnology. Chapter 18 examines the market value of traditionally used medicinal plants, outlining major markets in the European Union,

China, India, Latin America, and Africa, while also addressing regulatory challenges and potential risks associated with traditional medicine. Chapter 25 focuses on the economic benefits of natural products in modern drug discovery, noting that approximately 35 percent of the global medicine market consists of products derived from natural sources. It also highlights the advantages of natural products in pharmaceuticals, such as their therapeutic efficacy, chemical diversity, and potential for sustainable development.

Overall, the book adeptly navigates the complex landscape of drug discovery, from ethnopharmacological observations to cutting-edge computational methods, while also explaining the potential of ethnomedicine in addressing various health conditions.

The book also underscores the importance of sustainable practices and ethical considerations in harnessing biodiversity for drug development by highlighting the economic and industrial aspects of natural product research. For researchers, students, and industry professionals in the fields of pharmacology, ethnobotany, and drug discovery, this work serves as an invaluable resource. Ultimately, it advocates for a synergistic approach that combines the wisdom of traditional medicine with modern scientific rigor, paving the way for innovative therapeutics that can benefit global health while preserving cultural heritage and biodiversity.

Declarations

Author contributions: M.E.S. conceptualized the study, contributed to drafting sections of the manuscript, revised the entire manuscript, and will be responsible for reading digital proofs. K.A., N.S.L., and S.Y.P. each contributed to writing sections of the manuscript and were actively involved in revising and editing the final version. All authors have reviewed and approved the submitted version of the manuscript.

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