

CHAPTER 24

Natural Products (Secondary Metabolites)

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Introduction

Natural products have primary ecological functions.

Plants produce a vast and diverse assortment of organic compounds, the great majority of which do not appear to participate directly in growth and development. These substances, traditionally referred to as **secondary metabolites**, often are differentially distributed among limited taxonomic groups within the plant kingdom. Their functions, many of which remain unknown, are being elucidated with increasing frequency. The **primary metabolites**, in contrast, such as phyto-sterols, acyl lipids, nucleotides, amino acids, and organic acids, are found in all plants and perform metabolic roles that are essential and usually evident.

Although noted for the complexity of their chemical structures and biosynthetic pathways, **natural products** have been widely perceived as biologically insignificant and have historically received little attention from most plant biologists. Organic chemists, however, have long been interested in these novel phytochemicals and have investigated their chemical properties extensively since the 1850s. Studies of natural products stimulated development of the separation techniques, spectroscopic approaches to structure elucidation, and synthetic methodologies that now constitute the foundation of contemporary organic chemistry. Interest in natural products was not purely academic but rather was prompted by their great utility as dyes, polymers, fibers, glues, oils, waxes, flavoring agents, perfumes, and drugs. Recognition of the biological properties of myriad natural products has fueled the current focus of this field, namely, the search for new drugs, antibiotics, insecticides, and herbicides. Importantly, this growing appreciation of the highly diverse biological effects produced by natural products has prompted a reevaluation of the possible roles these compounds play in plants, especially in the context of ecological interactions. As illustrated in this chapter, many of these compounds now have been shown to have important

Natural Products The Secondary Metabolites

James Ralph Hanson



Natural Products The Secondary Metabolites:

Natural Products James Ralph Hanson, 2003 Natural products are compounds that are produced by living systems and the secondary metabolites are those which give particular species their characteristic features These natural products include polyketides terpenoids phenylpropanoids alkaloids and antibiotics The study of these natural products has played a major part in the development of organic and medicinal chemistry and we are now starting to understand the important ecological role that these compounds have The aim of this book is to describe the major features of these compounds and the way in which chemical and physical methods have been used to establish their structures and then to show how these structures can be rationalised in biosynthetic terms The first chapter describes the classes of natural product their biological activity and isolation Subsequent chapters attempt to link chemical and spectroscopic strategies in structure elucidation contrasting the classical chemical strategies that were used in the past with modern spectroscopic methods The final chapter describes the biosynthesis of natural products The elucidation of the structures of natural products brings together many elements taught in courses on functional group chemistry stereochemistry and elementary spectroscopy This book will therefore be welcomed by lecturers and students of second year chemistry courses Ideal for the needs of undergraduate chemistry students Tutorial Chemistry Texts is a major series consisting of short single topic or modular texts concentrating on the fundamental areas of chemistry taught in undergraduate science courses Each book provides a concise account of the basic principles underlying a given subject embodying an independent learning philosophy and including worked examples

Secondary Metabolites Ramasamy Vijayakumar, Suresh Raja, 2022-08-17 This book provides an overview of secondary metabolites in three sections Introduction Secondary Metabolites General Reviews and Biotechnological Interventions and Plant Secondary Metabolites It discusses the antimicrobial anticancer and antioxidant activities of secondary metabolites biotechnological interventions in the production and research of secondary metabolites and the secondary metabolites of plants

Natural Secondary Metabolites Márcio Caroch, Sandra A. Heleno, Lillian Barros, 2023-02-21 This book focuses on the different compounds polyphenols sterols alkaloids terpenes that arise from the secondary metabolism of plants and fungi and their importance for research and industry These compounds have been the backbone and inspiration of various industries like the food pharmaceutical and others to produce synthetic counterparts Furthermore many of these compounds are still widely used to carry out specific functions in all these industries This book offers a compilation of different texts from world leading scientists in the areas of chemistry biochemistry plant science biotechnology which compile information on each group of secondary metabolism compounds and their most important applications in the food pharmaceutical cosmetic and textile industry By showcasing the best uses of these compounds the chemistry behind their production in plants and fungi this book is a valuable resource and a go to artifact for various audiences The new approach this book offers by linking research and the application of these compounds makes it interesting as an inspiration for new

research or as a hallmark of what has been done in the secondary metabolism of plants and fungi in recent years. Although this book may be technical, it is also enjoyable as an integral reading experience due to a structured and integrated flow from the origins of secondary metabolism in organisms to the discovery of their effects, their high intensity research in recent years, and translation into various industries. Beyond learning more on their chemistry, synthesis, metabolic pathway, readers will understand their importance to different research and industry.

Secondary Metabolites Derek J. Chadwick, Julie Whelan, 2008-04-30. A comprehensive review of current thinking on the biosynthesis, function, and evolution of secondary metabolites in animals, plants, and microorganisms. Examines the traditional context of secondary metabolites as natural products having no obvious part to play in the producing organism's life cycle. Covers issues related to genetic and antibiotic applications.

Bioactive Secondary Metabolites from Medicinal Plants of Africa Aman Dekebo, 2025-07-31. This book provides a comprehensive overview of bioactive compounds derived from African traditional medicinal plants, shedding light on their potential applications in modern medicine. It compiles crucial information on compounds with proven *in vitro* and *in vivo* activity against various diseases, providing a foundation for further research in drug discovery. The book also introduces the use of these bioactive secondary metabolites in cosmetics, nutrition, and pest control, with detailed descriptions of medicinal plant species, including their botanical names, ethnomedicinal uses, and pharmacological activities, making it an invaluable resource for researchers and pharmaceutical companies. Key concepts include the exploration of secondary metabolites from plants in Ethiopia, Egypt, Kenya, Uganda, Zimbabwe, Cameroon, Tanzania, Madagascar, and Nigeria, and their industrial applications. The chapters cover ethnobotanical knowledge, bioactivities, and chemical profiling of these plants, including the ethnobotanical and phytochemical studies of Ethiopian flora, the role of rose-scented geranium in the perfume industry, and the use of fruits and vegetables in treating respiratory ailments. Readers will also discover insights into the use of secondary metabolites for pest control, conservation strategies for endangered African plants, and the synthesis of bio-nanoparticles for therapeutic applications. The book presents a detailed analysis of medicinal plants with anti-malarial, anti-leishmanial, improve sexual desire, and antimicrobial properties, highlighting their significance in traditional and modern medicine. This volume is an essential resource for researchers, graduate students, and professionals in the fields of natural products, phytochemistry, and pharmaceuticals. It provides a unique perspective on the integration of traditional African medicine with contemporary scientific research, offering valuable insights into the potential of these bioactive compounds in drug development.

Comprehensive Natural Products II, 2010-03-05. This work presents a definitive interpretation of the current status of and future trends in natural products, a dynamic field at the intersection of chemistry and biology concerned with isolation, identification, structure elucidation, and chemical characteristics of naturally occurring compounds such as pheromones, carbohydrates, nucleic acids, and enzymes. With more than 1,800 color figures, *Comprehensive Natural Products II* features 100% new material and complements rather than replaces the original work, 1999. Reviews the accumulated

efforts of chemical and biological research to understand living organisms and their distinctive effects on health and medicine Stimulates new ideas among the established natural products research community which includes chemists biochemists biologists botanists and pharmacologists Informs and inspires students and newcomers to the field with accessible content in a range of delivery formats Includes 100% new content with more than 6 000 figures 1 3 of these in color and 40 000 references to the primary literature for a thorough examination of the field Highlights new research and innovations concerning living organisms and their distinctive role in our understanding and improvement of human health genomics ecology environment and more Adds to the rich body of work that is the first edition which will be available for the first time in a convenient online format giving researchers complete access to authoritative Natural Products content

Secondary Metabolites and Drug Discovery Umar Ali Dar, Mohd. Shahnawaz, Neha Singh, 2025-08-22 This book explores the promising potential of plant and microbe derived compounds in drug discovery offering insights into safer alternatives to synthetic drugs and highlighting the vital role of natural products in treating diseases with fewer side effects Plants and microbes are a promising source for natural products with the potential to play a major role in drug discovery Due to advances in the fields of science technology engineering and medicine the commercial pharmaceutical industry is growing across the globe Currently allopathy uses synthetic pharmaceutical drugs for the treatment of diseases but this practice also exposes patients to significant side effects Since ancient times other systems of medicine have been developed that utilize plant based extracts and molecules to treat various diseases with fewer side effects While changes in lifestyle including diet have had a significant impact on the increased risks of various diseases there is substantial scientific evidence both epidemiological and experimental that vegetables and fruits are key features of diets associated with lower risks of diseases such as cancers and infections These efforts to identify and create medications from plants are leading to increased manufacturing for larger clinical trials The continuing scientific research of medicinal plants will undoubtedly provide a wealth of novel structurally varied bioactive chemicals This edited volume provides an overview of various medical systems with a special focus on microbial and plant based drug molecules for treating communicable and non communicable diseases making it an invaluable resource for researchers scientists and practitioners interested in the potential of plant and microbe derived secondary metabolites in the ongoing search for innovative effective and safer medicines Readers will find this book Provides an overview of different types of sources and drug molecules used in allopathic homeopathic ayurvedic Chinese and Unani systems of medicine Highlights past and current methods of alternative complementary folklore and integrative medicines Discusses the benefits and side effects of the drug molecules used in different systems of medicine at the global level Explores microbial and plant based drug molecules for treating various communicable and non communicable diseases Audience Researchers academics industry and governmental experts working in the fields of natural science natural products synthetic chemistry pharmacology and medicinal chemistry

Bioactive Natural Products for Pharmaceutical

Applications Dilipkumar Pal,Amit Kumar Nayak,2020-12-14 This book covers the recent innovations relating to various bioactive natural products such as alkaloids glycosides flavonoids anthraquinones steroids polysaccharides tannins and polyphenolic compounds volatile oils fixed oils fats and waxes proteins and peptides vitamins marine products camptothecin piperines carvacrol gedunin GABA ginsenosides and their applications in the pharmaceutical fields related to academic research and industry *In Vitro Production of Plant Secondary Metabolites* M. Anuradha,S. Balasubramanya,2025-03-21

This book addresses the literature gap by providing both theoretical foundations and practical insights into in vitro plant secondary metabolite production It emphasizes the urgency to address the strategies and scientific methods for producing the secondary metabolites in the laboratory conditions This book includes chapters on various in vitro strategies and laboratory methods which are crucial for understanding and implementing techniques in this applied field It equips the readers with the knowledge essential for contributions to pharmaceuticals agriculture and various industries thus filling a critical void currently present in the literature and practical applications in this field This book is structured to cater to a diverse audience including graduate students and researchers It is specifically tailored to address the key aspects of plant cell tissue and organ culture and aligns seamlessly with the curriculum requirements for the courses offered in plant biotechnology The modules on cell cultures secondary metabolite production and metabolic engineering are also integral components for these courses **Fungal Jewels: Secondary Metabolites** Nancy Keller,Jonathan Palmer,Ozgur

Bayram,2017-04-10 Fungal natural products are friends and foes of humans such as deleterious mycotoxins cytotoxic carcinogenic compounds or beneficial compounds such as antibiotics fungicides insecticides antiviral and antitumor metabolites Understanding fungal diversity and estimation of fungal species on our planet poses a great challenge to researchers This complexity is further multiplied by secondary metabolite diversity of fungi which requires interdisciplinary studies It is extremely important to understand the fungal secondary metabolism to stop human animal and plant diseases caused by fungi and harvest their valuable metabolites Furthermore many secondary metabolite gene clusters are silenced under laboratory conditions It is vital to develop effective methods to activate those clusters in order to discover novel potent metabolites This e book is a compilation of original review articles contributed by leading fungal secondary metabolite researchers with a wide range of expertise Important aspects of fungal secondary metabolism including regulation genome mining evolution synthetic biology and novel methods have been discussed This book will be a great source to those people who are interested in understanding overall structure diversity and regulation of production of these tiny but precious chemicals

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