

Preface

This single book volume, titled *Food Bioactives: Extraction and Biotechnology Applications*, focuses on the recent cutting edge research advances in the field of food bioactives, particularly their diverse sources, production and downstream processing, emerging delivery technologies, and their therapeutic applications. Contributions from experts in the field provide an overview of current discoveries and trends in food bioactives research. We are grateful to the contributors for their generous and timely reflections on current developments in the discipline.

Food bioactives are physiologically active components in foods such as vegetables, fruits, and whole grains, which may provide desirable health benefits beyond basic nutrition to reduce the risk of chronic disease and the process of carcinogenesis. Bioactives (metabolites synthesised by plants for self-defense) are obtained selectively from plants as speciality chemicals and can be used as nutraceuticals. The addition of bioactives to foods, particularly those foods that are consumed as part of the normal diet of target populations, offers opportunities for improving the health and well-being of consumers. In this book, we focus on a number of bioactive compounds that have been associated with health benefits, in particular in relation to cardiovascular diseases and other chronic diseases. These are flavonoids, isoprenoids, glucosinolates, long chain n-3 polyunsaturated fatty acids (PUFAs) and carotenoids. In the introductory chapter (Chap. 1), Kyriaki and Galanakis discuss the biosynthesis and functionality of glucosinolates from plants. Studies have shown that diets high in these foods are associated with a reduced risk of cancer and improved vascular health. The authors of the chapter focus on emerging technologies (e.g., high pressure processing, ultrasounds and microwaves extraction, pulsed electric field, supercritical fluids extraction) that promise mild treatment and preservation of GLs during processing. Chapter 2 by Sanchez deals with mushroom bioactive compounds such as polysaccharides, proteoglycans, terpenes, phenolic compounds, lectins, peptides, proteins, and their applications. Chapter 3 by Sergio Sanchez and Demain is devoted to bioactives from fungi, especially valuable secondary metabolites, such as antibiotics, anticancer drugs, hypocholesterolemic agents, immunosuppressants, and others.

Bioactive compounds in plants are present in low concentrations; thus, the development of an effective and selective method for their production and extraction is important. Recent advances in “omics” technologies (e.g., genomics, metagenomics, proteomics), and efficient expression systems have been successful in generating more yields. Danquah and his group in Chap. 4 describe in detail the development of a bioprocess for the production of novel bioactive peptides from food proteins by exploiting fermentative and the proteolytic activities of *Lactobacillus delbrueckii* bioactive peptides (BPs). The feasibility of manufacturing BPs on a large scale is also projected by conducting an economic assessment. In Chap. 5, Castillo and co-authors describe in detail two production methods of mussel adhesive proteins (MAPs), natural extraction, and recombinant production. The authors emphasize low-cost approaches with advantages such as engineering additional functions. Chapter 6 by Gupta and co-authors describes the production of natural omega-3 fatty acids and carotenoids through biological (microalgae) pathways. This chapter explains the mechanical, chemical, and biological techniques and the combinations used for the extraction of carotenoids. Chapter 7 by Safarik and co-authors proposes the use of magnetic materials (nanotechnologies) for efficient separation of high-value products (antioxidants, vitamins, fatty acids, oils, polysaccharides, etc.) from algal biomass. Chapter 8 by Singhala and her group offers an overview of the use of enzymes for efficient extraction of bioactives, which is a recent and “green” extraction technique. Enzyme-assisted extraction technique uses specific enzymes to disrupt the cell wall of source material to improve bioactive extraction yield. This technique can be combined with various other techniques to enhance the overall recovery of bioactives from source materials. The authors also provide excellent coverage of the mechanism of enzyme-assisted extraction and structural modifications of biomolecules during extraction.

The delivery of bioactives through food is a major challenge as many bioactives are prone to degradation. There is therefore a need to protect them throughout their shelf life in fortified food products, without compromising the sensory properties of the food. Chapter 9 by Castro and his team discuss the emerging technologies for bioactive application. Micro- and nanoscale devices introduced in foods will facilitate the synthesis of novel enriched foods for special purposes.

In Chap. 10, Riberio provides an overview of the emerging technologies of hydrogels in bioactive compounds delivery with regard to polyphenols. The effectiveness of polyphenols, which depends on preserving their stability, bioactivity, and bioavailability, limits their pharmaceutical application. The chapter covers the encapsulation of polyphenols in hydrogels, as well as the classification, preparation, characterization, and measurements associated with this process. Beneficial effects of polyphenols in prevention or in therapeutics of important pathologies, such as cardiovascular, thrombosis, atherosclerosis, inflammation, cancer, or neurodegenerative diseases, are also outlined in this chapter.

Chapter 11 by Sharma and Puri presents an excellent overview of the use of multifunctional bioactives for cancer therapy. The authors discuss the novel and important directions concerning the application of bioactives from plants through

nanotechnology for the improvement of diagnosis and drug delivery, with a particular focus on cancer therapy. In Chap. 12, Martins and Ferreira describe the role of plant food bioactives in neurocognitive improvement, which can be used to help treat the effects of Alzheimer's disease. The authors provide a systematic overview of the use of plant food-derived bioactive molecules with evident *in vitro* and *in vivo* neuroprotective and neuroregenerative effects.

Representation of facts and their discussions in each chapter are extensive, authoritative, and deeply informative; hence, this book serves as a key reference for recent biotechnological developments of food bioactives and their prospective applications. The broad interdisciplinary approach of this book will surely make the work very interesting to researchers, scientists, and postgraduate students deeply engaged in the research and/or use of food bioactives. We would like to express our sincere thanks to all the contributors for their excellent reviews in this remarkable area. It is their participation that made our effort to organize such a book possible.

I am grateful to Dr. Monica Nijhawan Puri (my wife, an analytical chemist) who assisted in reviewing the contributed chapters. Her chemistry background allowed her to provide further critical validation of the subject content in this book. This endeavor would not have been possible without her motivation and constructive criticism, as well as the cooperation extended by my son Aryan and daughter Arisha. Most importantly, I am indebted to my parents (Retired Prof. K.K. Puri and Ms. Anuradha Puri) for inculcating values that made me an academic.

I would also like to express my deep sense of appreciation to all the editorial and publishing staff members associated with Springer for their keen interest in publishing this book, as well as their all-around help to ensure that the highest standards have been maintained in publishing this book.

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Food Bioactives

Extraction and Biotechnology Applications

Puri, M. (Ed.)

2017, XVI, 326 p. 41 illus., 14 illus. in color., Hardcover

ISBN: 978-3-319-51637-0