



# BIOACTIVES IN FRUIT

**HEALTH BENEFITS AND FUNCTIONAL FOODS**

EDITED BY

**Margot Skinner and Denise Hunter**

**WILEY** Blackwell

# **Bioactives in Fruit**

## ***Health Benefits and Functional Foods***

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# Preface

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For centuries we have known that fruit is important for health but we are only just beginning to fully understand why. This book aims to summarize some of our current knowledge on the bioactive compounds that are associated with the health benefits of specific fruits with a strong emphasis on the validation of health benefits by human intervention trials. Because of the present interest in food and health, the book includes strategies to retain and enhance the bioactives in fruit through growing conditions, fruit storage, processing into ingredients and production of functional foods. To accomplish this task authors with expertise in biology, chemistry, pharmacology, food science, nutrition, medicine and horticulture have contributed. They come from universities, government and industry-funded research institutes and from biotechnology and food companies in Europe, the United States, Asia and New Zealand to give the book a broad perspective.

A brief introduction on the major classes of bioactives present in fruit is followed by a chapter on fruit fibre, exploring the many different chemical compositions that fibre from different sources, including commercial preparations, may contain. This is an important aspect to consider when attempting to attribute health benefits to fibre and when developing new fibre containing foods. The focus of the next chapter is the bioavailability of antioxidant compounds from fruit and includes vitamins C and E, as well as carotenoids and polyphenolic phytochemicals. It incorporates a discussion of the reasons why plasma antioxidant levels are maintained at low concentrations even when consumed at quite high levels, an important consideration as recommendations for fruit and vegetable consumption increase and supplements containing high amounts of these compounds are promoted by their manufacturers. Bioavailability and bioactivity of both foods and pharmaceuticals are related to their absorption, metabolism, distribution, excretion and transport across cell membranes, together with their ability to bind to specific receptors. The potential for functional food bioactives to interact with pharmaceuticals is considerable due to the large number of constituents that they contain. Some examples of the way in which selected functional foods and nutraceuticals influence the pharmacokinetics and pharmacodynamics of drugs are the subject of the next chapter, emphasizing the need to understand whether interactions of foods with medicines are clinically harmful or beneficial to drug therapy.

There then follow a number of chapters on the bioactives and health benefits of common and not-so-common fruits, which include apple and pear, citrus, pomegranate and stone fruit, grapes, blackcurrants, blueberry, cranberry and kiwifruit, feijoa and tamarillo. 'Vegetable' fruits, olives, avocado and cocoa, plant foods not commonly consumed as 'fruit', are not left out. The chapters are written from different perspectives depending on the interests and research focus of the authors. For example, the chapter on apples and pears includes an update on the biosynthesis and genetic regulation of bioactives within apples. The chapter on citrus includes attributes of citrus that have raised health concerns and again discusses the

grapefruit–drug interactions alluded to in an earlier chapter, including ways that this may be overcome now and in the future. The chapter on blueberries includes a detailed examination of mechanistic and pre-clinical studies in models that range from longevity in fruit flies to myocardial ischemia in rats.

The health areas covered in the book span a wide range. These include basic antioxidant activity and all it may be associated with, immune modulation including positive effects associated with asthma, antibacterial properties and reduction of symptoms of infections such as cold and influenza, cardiovascular health, bone health, obesity, metabolic syndrome and diabetes, eye health and vision, oral and gastrointestinal health, urinary tract health, cognition and anxiety and, associated with a number of these areas, longevity. Supporting data, including results from mechanistic, *in vitro* and *in vivo* animal studies, are discussed together with validation from human intervention trials, and tentative or firm conclusions drawn, depending on the evidence available. It should be mentioned that epigenetic and nutrigenomic factors that may influence how individuals respond to the bioactive components in fruit is beyond the scope of this book. Once intervention trials are designed and conducted to provide more personalized outcomes, we may find that some of the equivocal results that are often obtained in intervention trials will be clarified and health benefits of functional foods be more commonly assigned to particular groups or genotypes.

The next two chapters are on the subject of horticulture. Using anthocyanins as an example, a chapter on breeding for enhanced levels of these bioactive compounds in blackcurrant and blueberry outlines gains that may be achieved through conventional breeding techniques, as well as the potential for using genetic transformation in strawberries as a proof of concept. As many of the bioactives in fruit are secondary metabolites, whose levels increase in plant cells after exposure to environmental stress, the potential of stress priming to enhance the bioactive contents of fresh fruit or produce new fruit-based products is considered in the chapter following.

The book finishes with two chapters that highlight different aspects of functional foods. In a chapter on recovery of bioactive compounds from entities such as peel and seeds, where they are present in high amounts, innovative process technologies are described that can be applied to purify, enrich and selectively fractionate the compounds from crude extracts recovered from food processing byproducts. The recovery of such components for use as bioactive compounds in functional or enriched foods, as well as dietary supplements, is presented as a promising strategy to produce ingredients and products from waste streams to help achieve sustainable agricultural food production. The last chapter discusses many of the interactions that may occur between fruit bioactives and other food components when they are incorporated into finished processed foods. It goes on to point out that it is the complexity of finished foods, coupled with the processing conditions, that influence the stability, bioaccessability and, ultimately, the bioavailability of the fruit bioactive compounds in a finished processed functional food product.

The information gathered in this book, describing fruit bioactives, their health benefits when consumed as a food and related topics regarding their development into fresh or processed functional foods, will be of use to postgraduate students, researchers, functional food product developers, food regulators and anyone who has curiosity about why ‘fruit is good for you’. The information contained within may provide plant breeders with new targets for the development of value-added horticultural products. It may also provide nutritionists and dieticians with a useful resource for developing strategies to assist in preventing or slowing disease onset or severity. In many instances, the regular consumption of specific

fruits in a quantity that is pleasurable and achievable within the context of the diet is all that may be required.

We extend our sincere thanks to the many individuals who have contributed so generously in accomplishing this project.

Margot Skinner  
Denise Hunter

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