

FUNCTIONAL FOODS

Biochemical & Processing Aspects

Edited by

G. Mazza, Ph.D.

Agriculture and Agri-Food Canada



LANCASTER • BASEL

Functional Foods

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*To my wife Rachel, my daughter Victoria, and my sons Michael and Joseph
who received less of my
attention while this book was being written/edited.*

Foreword

FUNCTIONAL foods, designer foods and nutraceuticals—terms used interchangeably to refer to foods or isolated food ingredients that deliver specific nonnutritive physiological benefits that may enhance health—have clearly emerged as major food industry buzzwords of the late 1990s. Initially viewed as a passing fad, the concept of formulating foods for their ancillary health benefits is a trend that is quickly moving into the corporate mainstream [1,2]. The topic of functional foods has been the focus of numerous international meetings [3] and one of the leading topics of interest within the field of food technology in 1997 [4]. With a current (1997) U.S. market value estimated at \$86 billion and a growth rate of +7.5% [5], the functional food/nutraceutical trend is clearly one that will continue to grow as we enter the next millennium.

A significant driving force in the functional foods marketplace is consumer demand—the quest by consumers to optimize their health through food. The “health race for health-promoting ingredients” was identified as the fourth most important trend in the food industry in 1996 [6], while the most recently released HealthFocus Trend Report [7] found that the percentage of today’s shoppers who believe that certain foods can help to reduce their reliance on drugs and medical therapies increased significantly in just 2 years—from 42% to 52%. Finally, in a recent R&D Magazine survey (in *Food Processing*) of the top 100 food companies, functional foods/nutraceuticals were identified as the single most important consumer trend impacting new food product development [8]. Increasing consumer demand for healthier foods or food ingredients is not likely to dwindle as baby boomers attempt to stave off the chronic health problems associated with aging and realize that dietary intervention can be a safe and cost-effective alternative to drugs or other more traditional therapies.

Research and development activity in the functional foods arena is no longer relegated to companies "on the fringe," since a number of industry conglomerates have recently made substantial commitments of resources to the development of such products. Having broken new ground in 1984 by utilizing an unapproved health claim on its All Bran® cereal to raise consumer awareness about the importance of fiber in colon cancer prevention, Kellogg's has once again established itself as an innovator by being the first major food conglomerate to formally establish a Functional Foods Division [9]. In April of 1997, Kellogg's petitioned the U.S. Food and Drug Administration under the Nutrition Labeling and Education Act (NLEA) of 1990 for a health claim on the role of dietary fiber from wheat bran in reducing the risk of colon cancer [10]. This petition follows on the success of the first food-specific health claim, awarded in January of 1997 to the Quaker Oats Company, for the association between the consumption of soluble fiber from whole oat products and a reduced risk of coronary heart disease [11]. Another large company that has made a commitment to the development of functional foods is the Campbell Soup Company, which introduced its Intelligent Quisine home-delivered meal program in 1996 [12]. Developed in consultation with the American Heart Association and the American Diabetes Association, Intelligent Quisine is specifically formulated for individuals with elevated blood cholesterol, diabetes, and high blood pressure. Five clinical trials conducted at eight universities (involving 1,200 subjects) have demonstrated that, after following this meal plan for 10 weeks, 73% of the participants reduced their blood cholesterol, 75% reduced their blood pressure, and 62% reduced their blood sugar. Clearly, food companies are beginning to respond to leading consumer health concerns.

Nonfood companies are also venturing into the functional food/nutraceutical arena. For example, Johnson & Johnson's McNeil Consumer Products division recently announced that it has acquired the U.S. marketing rights for the cholesterol-lowering margarine Benecol [13], a functional food whose sales have reached \$17 million annually in Finland, a country with a population of only 3 million adults. DuPont has recently acquired Protein Technologies International [14], the leading manufacturer of soy protein isolate, a functional ingredient that has been the focus of intense research efforts because of its ability to lower cholesterol [15] and possibly reduce the risk of cancer [16], osteoporosis [17], and symptoms associated with menopausal transition [18].

Market activity for functional foods increases significantly in response to a more flexible regulatory environment. For example, in Japan, which is the first and only country to have established a specific approval process for functional foods—Foods for Specified Health Use (FOSHU)—80 approved FOSHU products have been developed in less than 5 years [19].

A critical issue in the regulation of functional foods, particularly if any

claims are to be made in the labeling of these products, is the identification of the active component responsible for the purported health benefits. As Dr. Alison Stephen astutely points out in Chapter 14, *Regulatory Aspects of Functional Products*, "It is unacceptable anywhere to be told that a product of any kind has a particular action if it is uncertain whether or not it contains the right components to bring about that action." Thus, companies that wish to utilize the oat/coronary heart disease health claim on a product, for example, must be able to demonstrate that the product bearing the claim contains 0.75 grams of β -glucan—the physiological component responsible for the cholesterol-lowering effect—per reference amount customarily consumed (RACC). This level is based on a total daily intake of 3 grams (the effective dose) of β -glucan per day, consumed over four eating occasions.

Although several recent books have emerged on the topic of functional or designer foods [20–22], none has addressed the issue of processing, which can profoundly affect the health-enhancing potential of a functional food. Processing of a functional food may have profound effects on the specific health benefits it claims to deliver. If, for example, the physiological effect of β -glucan were altered significantly during processing, it is conceivable that the lipid-lowering properties associated with it could be lost, a result that is obviously undesirable. Conversely, certain processing techniques may *enhance* the health benefits of a functional food. A good example of this can be seen with flax, an oilseed that, because of its significant α -linolenic acid content, is highly susceptible to oxidation. As illustrated in Chapter 4 by Oomah and Mazza, microencapsulation of flaxseed oil produces a product with very high oxidative stability, which has many applications for new, health-enhancing products.

Foods are composed of a myriad biologically active constituents that may contribute to health enhancement [23]. *Functional Foods: Biochemical and Processing Aspects*, in addition to providing a comprehensive overview of an array of these biologically active compounds from both plant and animal sources, is unique in its ability to shed light on how the processing of these phytochemicals and zoochemicals may impact the health benefits of functional foods. The information in this book will thus be of value to anyone interested in this tremendously exciting and rapidly growing area in the food and nutrition sciences, and I am grateful to G. (Joe) Mazza for giving me the opportunity to review the information herein and provide these comments.

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Preface

THIS book provides a comprehensive treatment of the physiological effects of foods and food components capable of promoting good health and preventing or alleviating diseases. Our objective was to assemble in one volume the large amount of information that has been published in recent years on the nature and physiological effects of biologically active components of major plant foods (cereals, oilseeds, fruits, and vegetables), dairy and fish products. Opportunities for the application of existing and novel food processing methods to the manufacturing of food products with health-enhancing effects are also discussed in various chapters.

Entire chapters are devoted to functional food products from oats, wheat, rice, flaxseed, mustard, fruits, vegetables, fish and dairy products. The chapter on designer vegetable oils covers all the recent developments in vegetable oils, including genetically modified oils and engineering and production of structured lipids. Functional products from quinoa, amaranth, beans, ginseng, echinacea, and other botanicals are covered in separate chapters. The book ends with an authoritative chapter on the present regulatory status of functional foods in the United States, Japan, Canada, and the European Union. This chapter also discusses assessment of natural products for use in promoting human health and as medicinal agents. The issue of where the burden of proof to show an effect of a food product on a physiological or biochemical process lies and costs of making health claims are also considered.

With over 1,800 literature references, this book is expected to benefit food scientists and technologists, food process engineers, biochemists, nutritionists, public health professionals, as well as entrepreneurs, who are designing, processing, and marketing new functional food products. Everyone who be-

lieves in the need for foods that combine nutritional and medical benefits, and believe that such foods can be produced, will find this book invaluable.

As editor, I wish to express my sincere appreciation to the 26 contributors who, by giving freely of their expertise, have made the book possible. Many thanks are also due to Paul Ferguson and Linda Kerr, who helped with the preparation of portions of the book. My gratitude is also extended to several of my colleagues at Agriculture and Agri-Food Canada and elsewhere who read and commented on the drafts of various chapters; in particular, I thank Clare Hasler, Carrie Thomson, Robert Ackman, and the staff and management of Technomic Publishing Co., Inc., especially Eleanor Riemer.

I shall be very obliged to readers who would call my attention to aspects that have been neglected and to errors or omissions that might appear in this book.

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