
Foreword

Accuse not Nature!
She has done her part;
Do thou but thine!
John Milton, *Paradise Lost*, 1667

Archeology reveals that ancient peoples recognized that certain foods could promote health and treat disease. The use of decoctions, distillates, extracts, and infusions of plant foods, spices and related botanicals in apothecary, Ayurvedic, Chinese, Native American, and other traditional medicines reflects the early application of this knowledge regarding their bioactive constituents. Today, exciting advances in nutrition and medicine, as well as numerous reports in popular books and the media, have stimulated a general interest in phytochemicals and other dietary factors. New recipes emphasizing phytochemical-rich dishes, common foods fortified with these “functional” ingredients, and dietary supplements formulated with a variety of these compounds seem to be appearing every month. However, this profusion of choices is often accompanied by confusion about their efficacy and safety. Thus, the need for ready access to sound, evidence-based science by consumers and health-care professionals is more critical than ever before.

We now appreciate that our evolution in a world of edible plants allowed our bodies not only to forego the energy necessary for synthesizing many critical compounds (that we now call “essential nutrients”) but also to take advantage of other natural constituents in these foods beyond their provision of basic nutritive value. For example, it is interesting to note how our retina employs the carotenoid lutein to filter phototoxic blue light and near-ultraviolet radiation in the same way that lutein protects the plants from which we obtain it. Nutrition scientists are now working to understand the enormous complexity and health implications of thousands of phytochemicals and other dietary factors, including their bioavailability, distribution, metabolism, excretion, mechanisms of ac-

tion, and interactions with one another within individual foods and whole diets. It is worth noting that research indicates that many of these compounds have the potential to influence the expression of mammalian genes, suggesting phytochemicals can influence fundamental aspects of our cellular function, despite their not being “essential” to us. It can appear an overwhelming challenge to document the myriad of fruits, grains, legumes, nuts, seeds, and vegetables and the ways in which they serve to support our physical well being and our mental state. However, the first publication of this book by Dr. Jane Higdon, now updated by Dr. Victoria Drake in this second edition, makes this task much easier by providing a concise synthesis of the basic, observational, and clinical data now available and organizing the material in a practical fashion both by foods and by bioactive constituents and their applications to health promotion and therapy.

The worldwide, demographic imperative of the aging population is readily reflected in the shift during the last century from a situation where most mortality resulted from communicable diseases to one where mortality is more often a result of chronic disease. The promise of the power of nutrition lies in our being able to understand the benefits offered not only by essential macronutrients and micronutrients but by other dietary factors, especially phytochemicals like carotenoids, chlorophylls, glucosinolates, organosulfurs, phytosterols, and polyphenols, as well compounds like α -lipoic acid, L-carnitine, choline, and ubiquinone (coenzyme Q₁₀). All of these compounds, and the foods that contain them, are described in this book. In addition to their own expertise, Drs. Higdon and Drake have ensured the accuracy of this material by having each chapter reviewed by an authority in that field.

The application of this knowledge about phytochemicals and other dietary factors will provide a sound foundation for new dietary guidelines and also the requisite scientific substantiation for the development of new food products,

sometimes called designer foods, functional foods, pharmafoods, or nutraceuticals, as well as for dietary supplements. However, a great deal more research must still be done to demonstrate not only the efficacy but also the safety of these ingredients and how they are formulated into new products that offer to enhance our biological defense mechanisms, promote optimal physiological responses, reduce the risk of specific diseases, and even slow the processes associated with aging. While regulations concerning labeling and claims of benefit made for food products seem often to be controversial, there is no doubt that evaluating the emerging scientific information with sound judgment, as is done in this book, will help health-care providers, especially dietitians, nurses, and physicians, apply it today and allow policymakers and researchers to plan for the future in a rational manner.

Whether counseling patients about their diets or developing more healthful food products, a two-pronged approach is required: reducing ingredients with negative attributes, such as refined sugars, saturated and *trans*-fatty acids, and sodium, and increasing ingredients with positive attributes, including phytochemicals and other dietary factors. However, this is difficult, not only

because issues of convenience, cost, and taste must be considered but also because our knowledge of exactly which healthful ingredients to incorporate is still quite limited, including their effective doses, forms, combinations, and safety. Nonetheless, many elements are now converging to ensure these challenges will be met: the requirement of both the private and public sector to reduce health-care costs, the demands of consumers for “natural” solutions to live longer and better lives, and the drive of food companies and the stores that sell their products to respond to their customers’ needs. Drs. Higdon and Drake have given us a book that is authoritative but easy to read and provides a solid background for those wanting to understand how phytochemicals and other dietary factors may offer some solutions to this problem.

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Preface to the Second Edition

I am honored to revise and update Dr. Jane Higdon's book, *An Evidence-based Approach to Dietary Phytochemicals*. Since the first edition was published in 2007, the literature on the role of plant foods and phytochemicals (literally, plant chemicals) in health and disease has greatly expanded. In this second edition, all 20 chapters of the first edition have incorporated new information from the relevant, more recently published peer-reviewed studies, especially studies with human subjects. Moreover, this edition has been expanded to include new chapters on other dietary factors, including choline, coenzyme Q₁₀, L-carnitine, and lipoic acid. The first part of this book discusses the evidence for the health effects of various plant foods and beverages: fruits and vegetables, cruciferous vegetables, legumes, nuts, whole grains, coffee, and tea. The second section focuses on individual phytochemicals and classes of phytochemicals, and the third section covers key nutrients (essential fatty acids and choline), as well as other dietary factors (coenzyme Q₁₀, L-carnitine, and lipoic acid) that the body synthesizes but that are also found in dietary and supplementary sources.

The importance of a plant-based diet in maintaining optimum health and preventing chronic disease is now well recognized. Plant foods not only provide essential vitamins and minerals but also contain countless phytochemicals, as well as dietary fiber, that benefit health. It is critical that people—health professionals and the general public alike—have access to scientifically accurate and peer-reviewed information regarding how plant foods and their constituents affect health. Additionally, as the availability and popularity of functional foods and dietary supplements increases, it is necessary to consider their

safety profiles, including potential drug and nutrient interactions. This extensively referenced book concisely synthesizes a large amount of experimental, epidemiological, and clinical research on the health effects of plant foods, phytochemicals, and other dietary factors, and also provides the reader with practical information on sources (dietary and supplemental), nutrient and drug interactions, and possible adverse effects.

Acknowledgments

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Preface to the First Edition

Plant foods, including fruits, vegetables, legumes, whole grains, and nuts, are prominent features of healthy dietary patterns. In addition to providing energy and essential micronutrients (vitamins and minerals), plant foods contribute thousands of phytochemicals to the human diet. Although the term “phytochemicals” literally means plant chemicals, it is often used to describe plant-derived compounds that may affect health but are not essential nutrients. Although there is ample evidence to support the health benefits of diets rich in plant foods, evidence that these benefits are due to specific phytochemicals is more limited. Because plant foods are complex packages of biologically active compounds, the health benefits of individual phytochemicals cannot always be separated from those of the foods that contain them. Consequently, the first section of the book discusses the evidence for the health benefits of plant foods and beverages, including fruits and vegetables, legumes, nuts, whole grains, coffee, and tea.

Scientific research on the potential for specific dietary phytochemicals or classes of dietary phytochemicals to prevent and treat chronic diseases has expanded rapidly over the past decade. In some cases, the results of preclinical research have been promising enough to warrant clinical trials designed to examine the bioavailability, safety, and efficacy of high doses of isolated phytochemicals in humans. In the United States and other countries, supplements and extracts containing concentrated doses of isolated phytochemicals are available to the public as dietary supplements without a prescription. The market for functional foods, such as phytosterol-enriched margarines, is also rapidly expanding. As the popularity of these products increases, health and nutrition professionals need accurate information about potential health benefits, risks, and interactions associated with these phytochemicals. The second section of this book reviews the scientific and clinical evidence for the health benefits of individual dietary phytochemicals and classes of phytochemicals. Because high doses of isolated phytochemicals may have unex-

pected effects, the available evidence regarding the safety of these Compounds is also reviewed.

My goal in writing this book was to synthesize and organize the results of thousands of experimental, clinical, and epidemiological studies to provide an overview of current scientific and clinical knowledge regarding the role of plant foods and phytochemicals in human health and disease. An expert in the field covered in each chapter has reviewed the text to ensure its accuracy. The names and affiliations of these scientists are listed in the Editorial Advisory Board. Throughout this book, human research published in peerreviewed journals is emphasized. Where relevant, the results of experimental studies in cell culture or animal models are included. Although randomized controlled trials provide the strongest support for the efficacy of phytochemicals, it is not always ethical or practical to perform a randomized, double-blind, placebo-controlled trial. Observational studies also provide important information about relationships between plant food and phytochemical intakes and human health and disease. In reviewing the epidemiological research, more weight is given to the results of large prospective cohort studies, such as the Nurses' Health Study and Health Professionals Follow-up Study, than retrospective case-control or cross-sectional studies. When available, the results of systematic reviews and meta-analyses, which summarize information on the findings of many similar studies, are also included.

This book could not have been written without the collaboration and support of the scientists and staff of the Linus Pauling Institute at Oregon State University. The Institute was founded in 1973 by Linus Pauling, Ph.D., the only individual ever to win two, unshared Nobel Prizes (Chemistry, 1954; Peace, 1962). In 1996, the Linus Pauling Institute moved to the campus of Oregon State University (Dr. Pauling's undergraduate alma mater) and now operates as one of the University's Research Centers and Institutes. More than 35 years ago, Dr. Pauling proposed that dietary factors, such as vitamin C, could play

a significant role in enhancing human health and preventing chronic disease. The basic premise that an optimum diet is the key to optimum health continues today as the foundation of the Linus Pauling Institute at Oregon State University. Scientists at the Linus Pauling Institute investigate the roles that micronutrients and phytochemicals play in human aging and chronic diseases, particularly cancer, cardiovascular disease, and neurodegenerative disease. The goals of the research at the Linus Pauling Institute are to understand the molecular mechanisms behind the effects of nutrition on health and to determine how micronutrients and phytochemicals can be used in the prevention and treatment of diseases. In particular, scientists at the Linus Pauling Insti-

tute's Cancer Chemoprotection Program are working to understand the mechanisms by which dietary phytochemicals may prevent or treat cancer and to identify novel dietary phytochemicals that may protect against cancer. The Linus Pauling Institute is also dedicated to training and supporting new researchers in the interdisciplinary science of nutrition and optimum health, as well as to educating the public about the science of optimum nutrition.

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