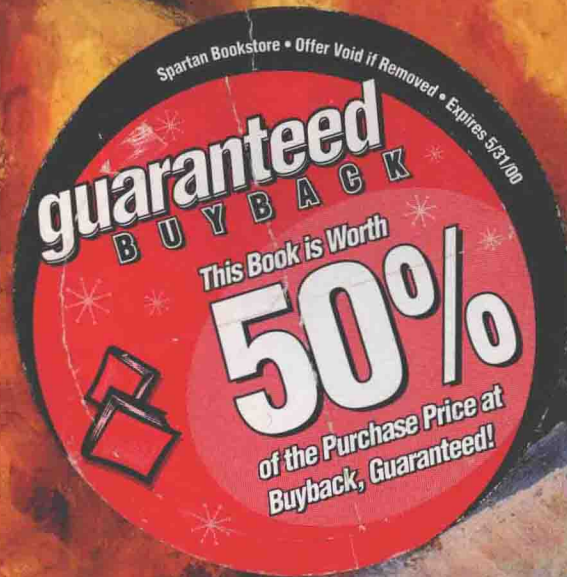


Nutrition

Eighth Edition *Concepts and Controversies*



Frances Sizer
Eleanor Whitney



Nutrition

Eighth Edition

Concepts and Controversies

Frances Sienkiewicz Sizer
Eleanor Noss Whitney

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Publisher: Peter Marshall
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Editorial Assistant: Keynia Johnson
Marketing Manager: Becky Tollerson
Project Editor: Sandra Craig
Print Buyer: Barbara Britton
Permissions Editor: Susan Walters
Production Service: The Book Company
Text and Cover Designer: Baugher Design Inc.
Photo Researcher: Myrna Engler
Copy Editor: Patricia Lewis
Illustrations: Impact Publications, McMahon Medical Art,
EmSpace Artwork, Dorothy Reinhardt
Photographers and Food Stylists: Michael Shay, Steve Cherry, Lucy Radys,
Carol Ladd
Cover Image: SuperStock
Compositor: Parkwood Composition Services
Printer: Von Hoffmann Press

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www.wadsworth.com

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Printed in the United States of America
1 2 3 4 5 6 7 03 02 01 00 99

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Library of Congress Cataloging-in-Publication Data

Sizer, Frances Sienkiewicz.

Nutrition : concepts and controversies / Frances Sienkiewicz Sizer,
Eleanor Noss Whitney. — 8th ed.

p. cm.

Includes bibliographical references and index.

ISBN 0-534-56466-6

1. Nutrition. 2. Food. I. Whitney, Eleanor Noss. II. Title.

QP141.S5365 2000

613.2—dc21

99-36374

Annotated Instructor's Edition ISBN 0-534-56467-4



This book is printed on acid-free recycled paper.

About the Authors

*To my husband Philip Webb
and our four "little fish,"
Caroline, Amanda, David
and Spencer, and the smallest
fry, David Warren.*

Fran

*To all of my grandchildren
and stepgrandchildren: Max,
Zoey, Emily, Rebecca, Sarah,
Will, TootToot, and Jacob.*

Ellie


FRANCES SIENKIEWICZ SIZER, M.S., R.D., F.A.D.A., attended Florida State University where, in 1980, she received her B.S., and in 1982, her M.S. in nutrition. She is certified as a charter Fellow of the American Dietetic Association. She is a founding member and vice president of Nutrition and Health Associates, an information and resource center in Tallahassee, Florida, that maintains an ongoing bibliographic database tracking research in more than 1,000 topic areas of nutrition. Her textbooks include *Life Choices: Health Concepts and Strategies*; *Making Life Choices*; *The Fitness Triad: Motivation, Training, and Nutrition*; and others. She is a primary author of *Nutrition Interactive*, an instructional college-level nutrition CD-ROM. In addition to writing, she lectures at universities and at national and regional conferences, and co-coordinates a local hunger relief effort in her community.

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Preface

FOR MORE than 20 years and in seven previous editions, *Nutrition: Concepts and Controversies* has been serving the needs of students and professors in classrooms across North America. In this, our millennium edition, we apply what we have learned from our past readers, changing the book to meet changing times. As the 21st century is born, the World Health Organization predicts a healthier future for people living in developed nations, with longer life spans, fewer deaths in infancy and childhood, and declining disabilities due to heart and artery disease in old age. Such improvements spring from advances in the science of nutrition, from progress in medical treatment of diseases, and from improved education concerning the effects of daily life choices on people's well being. This book provides the key understandings in the science of nutrition and guides its readers toward making wise choices amidst almost unlimited options.

In this edition, we have explored many of the new frontiers in nutrition, confronting new mysteries while acknowledging their grounding in science. We have heightened our sense of personal connection with instructors and learners alike, writing to them in the informal, clear style that has become our trademark. For both verbal and visual learners, our logical presentation and our clear, colorful figures keep interest high and understanding at a peak. New photos also adorn many of our pages, adding pleasure to reading.

In this edition, you will encounter two new features. The first of these tickles the reader's interest by posing some "Frequently Asked Questions" on the opening page of each chapter. The answers are found sprinkled throughout the chapter text, in sections marked with the FAQ symbol:  The second new feature, called *Fitness for Life*, draws connections among physical activity, nutrition, and health and is intended to motivate readers by addressing fitness topics as they arise in each chapter. The *Fitness for Life* section of Chapter 1 identifies the health benefits that one can expect from regular physical activity, echoing the chapter's emphasis on nutrition and disease risks. That of Chapter 2 provides guidelines for physical activity; those for Chapters 4 through 8, the nutrient chapters, emphasize the roles of the nutrients in supporting physical performance. The remaining sections spell out advantages of physical activity for weight-conscious readers, athletes, healthy adults, pregnant women, and older people.

The practical interactive activities, called *Do It!*, have been retained in this edition to invite students to apply the chapter contents in their everyday encounters with nutrition. The popular *Self Check* features provide review questions at the end of each chapter. The answers to the *Self Check* questions are in Appendix G to provide immediate feedback to the learner.

By popular demand, we have retained our *Snapshots* of vitamins and minerals, but have given them an updated look. These capsules of information depict food sources and reinforce concepts concerning the Food Guide Pyramid and the Daily Values found on food labels. In this edition, the food label format appears often in figures to familiarize readers with the process of comparing the nutrients in foods that bear labels.

We hope that you will enjoy the eighth edition of our text. Chapter 1 begins with a personal challenge to nutrition students. It asks the question so many people ask of nutrition educators: "What kinds of nutritious foods can help to prevent diseases?" We answer with a lesson in diseases on a continuum, from those almost totally preventable by nutrition to those caused by inherited genes. We then introduce the nutrients and explore their roles in the body. Finally, a discussion of the importance of scientific research lends perspective on the context in which study results may be rightly viewed. Chapter 2 brings together the concepts of diet planning through nutrient allowances, such as the new *Dietary Reference Intakes*, and food grouping systems featuring the *Daily Food Guide* with its pyramid of food choices. Chapter 3 presents a thorough, but brief, introduction to the workings of the human body with major emphasis on the digestive system. Chapters 4 through 6 are devoted to the energy-yielding nutrients—carbohydrates, lipids, and proteins. Chapters 7 and 8 present the vitamins, minerals, and water, with special emphasis on the emerging importance of the antioxidant nutrients. Chapter 9 relates energy balance to body composition, obesity, and underweight and presents weight maintenance as a lifelong effort. Chapter 10 presents details about relationships between fitness, physical activity, and nutrition to follow up on concepts introduced in the *Fitness for Life* features of other chapters. Chapter 11 applies the essence of the first ten chapters to two broad and rapidly changing areas within nutrition: immunity and disease prevention. Chapters 12 and 13 point out the importance of nutrition throughout the life span, from gestation through old age. Chapter 14

considers the problems and advantages of food technology, with emphasis on food safety. Chapter 15 touches on the vast problems of the global food supply—world hunger, pollution, overpopulation—and shows how everyday food choices link each person with the meaningful whole.

The *Controversies* of this book's title invite you to explore beyond the safe boundaries of established nutrition knowledge. These optional readings, which appear at the end of each chapter and are printed with colored borders, delve into current scientific topics and emerging controversies. Some are new to this edition and the others have been updated. Controversy 7 sets up a lively competition between food and supplements as vitamin sources, exploring the research to date on the antioxidant vitamins. Controversy 9 tackles some pressing questions surrounding the safety and effectiveness of weight-loss diets, diet profiteers, and attitudes toward overweight people in this country. Controversy 10 presents current thinking about eating disorders. Of special current interest is Controversy 11, which presents the struggle between scientific exploration of the phytochemicals in foods and consumers' need for guidance concerning their consumption of phytochemicals. Controversy 14 evaluates new food technologies and invites the reader to look forward to and evaluate future innovations. Controversy 15 explores ways in which agriculture can ensure a high-quality food supply throughout this century and beyond.

The *Food Feature* sections that appear in most chapters act as bridges between theory and practice; they are practical applications of the chapter concepts that help readers to choose foods according to nutrition principles. *Consumer Corners* present information on olestra and other fat replacers, amino acid supplements, vitamin C and the common cold, bottled water, marketing of infant formula, organic foods, and other nutrition-related marketplace issues to empower students to make informed decisions.

New or major terms in chapters are defined in the margins of the pages where they are introduced and also in the Glossary at the end of the book. Terms in Controversy sections are grouped together and defined in tables within the

sections and in the Glossary. The reader who wishes to locate any term can do so by consulting the index, which lists the page numbers of definitions in boldface type.

The appendixes have been updated. Appendix A now presents the most complete and accurate listings ever of the nutrient contents of more than 2,200 foods. Appendix B, *Canadiana*, supplies the RNI, the Guidelines, the Food Guide, Food Labels, and the Choice System for our Canadian readers. Appendix C demonstrates nutrition calculations, with special emphasis on finding the percentage of calories from fat in a diet and percentages of the Daily Values. Appendix D provides full coverage with applications of the U.S. Exchange System. Appendix E offers an invaluable list of current addresses, telephone numbers, and Internet websites for those interested in additional information. We have collected all chapter and Controversy references in Appendix F. Older source notes have been removed but are easily available by consulting older editions of this book or by contacting the publisher.

As always, our purpose in writing this text is to enhance our readers' understanding of nutrition science and motivation to apply it. We hope the information on this book's pages will reach beyond the classroom into our readers' lives. Take the information you find inside this book home with you. Use it in your life: nourish yourself, educate your loved ones, and nurture others to be a part of our healthy new future. Stay up with the news, too. For despite all the conflicting messages, inflated claims, and even quackery that abound in news reports, true nutrition knowledge progresses with a genuine scientific spirit, and important new truths are constantly unfolding.

Acknowledgments

OUR THANKS to Linda Kelly DeBruyne for the newly updated Chapter 10 and Chapter 12 of this edition. Thanks to Kellie Harder Hatcher for her careful revision of Chapter 14 and her competent and

willing assistance at each stage of this writing. Thanks also to Sharon Rady Rolfes for her helpful ideas throughout this work. Thanks to Sally Lorch Mayo for office tasks and for extra help when time ran short (and congratulations on graduating). Thanks, too, to our associate Lori Turner for much of the *Instructor's Manual*; thanks to Margaret Hedley, University of Guelph, who prepared the Canadian material for the manual and reviewed the Canadian resources listed in the text. For the special Instructor's Edition of the text, we thank Lori Turner, University of Arkansas–Fayetteville (lecture outlines); and Judy Kaufman, Monroe Community College (margin references to overheads, *Nutrition Interactive* CD-ROM, and *NutriLink* CD-ROM). Thanks also to Judy Kaufman who developed the *Self Check* questions for the seventh edition, most of which are still serving students in the current text, and who reviewed the acetate package for the eighth edition. Thank you, Myrna Engler, Dorothy Reinhardt, Polara Studios, David Ruppe and Sandra McMahon and Associates for bringing our figures and photos to their full potential. For his work in creating this edition's lively new design, we thank Norman Baugher.

Special thanks to our publisher, Peter Marshall, and to our editors Laura Graham, Dusty Friedman, and Sandra Craig, and to their staff, for their unflagging efforts to ensure the highest quality of all facets of this book. Our applause and gratitude goes to Becky Tollerson for her efforts in marketing our book. Special thanks to our librarians: Linda Patton, Jackie Hannick, and Lonnie Walsh, for their competent and exacting bibliographic help. Thanks also to Jana Kicklighter of Georgia State University for preparing the *Student Study Guide* and the *Test Bank*. As always, we are grateful to Bob Geltz and Betty Hands and their staff at ESHA research for Appendix A and for the computerized diet analysis program that accompanies this book. To our reviewers, many heartfelt thanks for your many thoughtful ideas and suggestions:

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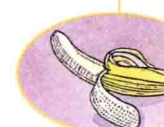
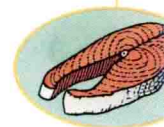
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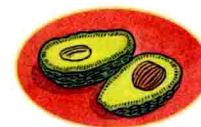
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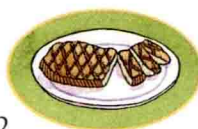
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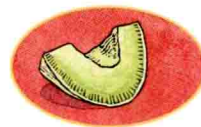
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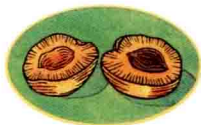
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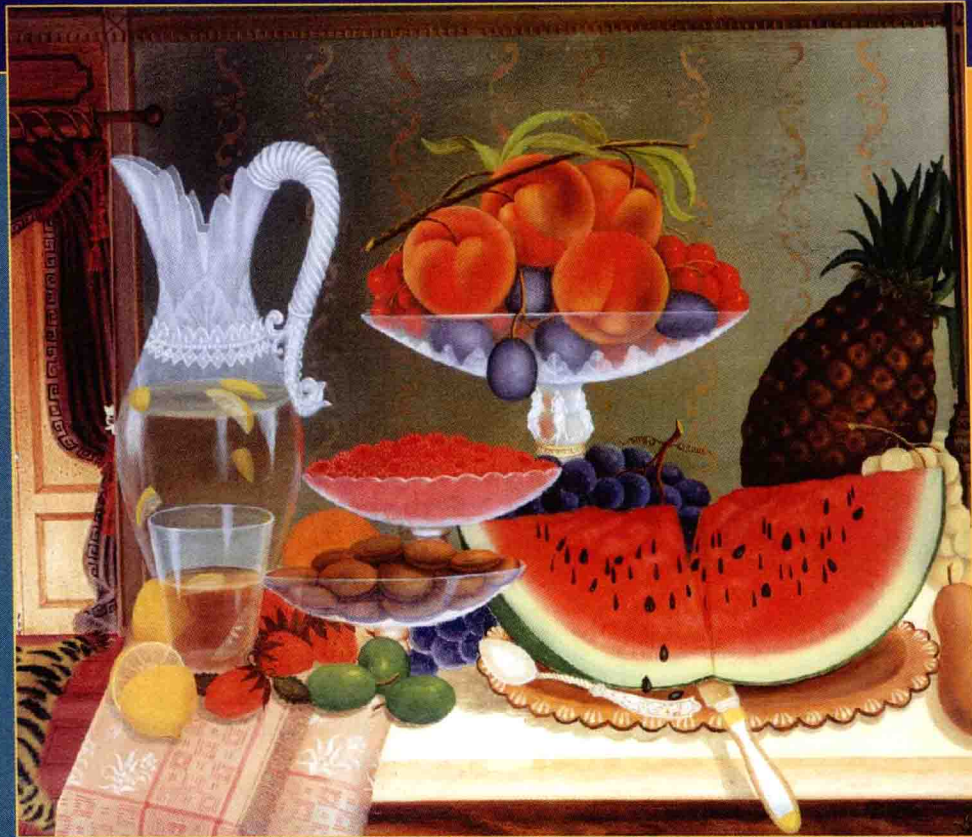
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Food Choices and Human Health

Henry Church, *Still Life*
Date Unknown



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food medically, any substance that the body can take in and assimilate that will enable it to stay alive and to grow; the carrier of nourishment; socially, a more limited number of such substances defined as acceptable by each culture.

nutrition the study of the nutrients in foods and in the body; sometimes also the study of human behaviors related to food.

diet the foods (including beverages) a person usually eats and drinks.

nutrients components of food that are indispensable to the body's functioning. They provide energy, serve as building material, help maintain or repair body parts, and support growth. The nutrients include water, carbohydrate, fat, protein, vitamins, and minerals.

malnutrition any condition caused by excess or deficient food energy or nutrient intake or by an imbalance of nutrients. Nutrient or energy deficiencies are classed as forms of undernutrition; nutrient or energy excesses are classed as forms of overnutrition.

IF YOU CARE about your body, and if you have strong feelings about **food**, then you have much to gain from learning about **nutrition**—the study of how food nourishes the body. Nutrition is a fascinating, much talked-about subject. Everyone wants to know how food affects health—naturally, because we love food and we care about our health. Each day, newspapers, radio, and television present stories of new findings on nutrition and heart health or nutrition and cancer prevention. Magazine advertisements and television commercials constantly bombard us with multicolored pictures of tempting foods—pizza, burgers, cakes, chips, sweet drinks, alcoholic beverages, and many more.¹ Several times a day, you get hungry and turn from your other activities to eat a meal. And if you are like most people, you wonder, “Is this food good for me?” or you berate yourself, “I probably shouldn't be eating this.”

When you study nutrition, you learn which foods serve you best, and you can work out ways of choosing foods, planning meals, and designing your **diet** wisely. Knowing the facts can enhance your health and your enjoyment of eating while relieving you of feeling guilty or worried that you aren't eating well.

This book devotes many chapters to the science of nutrition. This chapter provides a starting point by offering answers to the following questions:

1. What connections exist between the diets people consume and physical health?
2. What does food do for the body and its owner?
3. How can consumers judge whether to believe nutrition news from the media?
4. What constitutes a nutritious diet?

A Lifetime of Nourishment

If you live for 65 years or longer, you will have consumed more than 70,000 meals, and your remarkable body will have disposed of 50 tons of food. The foods you choose have cumulative effects on your body. At 65 years of age, you will see and feel those effects, if you know what to look for.

Your body renews its structures continuously, and each day it builds a little muscle, bone, skin, and blood, replacing old tissues with new. It may also add a little fat, if you consume excess food energy (calories), or subtract a little, should you consume less than you require. In this way some of the food you eat today becomes part of “you” tomorrow. The best food for you, then, is the kind that supports the growth and maintenance of strong muscles, sound bones, healthy skin, and sufficient blood to cleanse and nourish all parts of your body. This means you need food that provides not only energy but also sufficient ‘**nutrients**,’ that is, enough water, carbohydrates, fat, protein, vitamins, and minerals. If the foods you eat provide too little or too much of any nutrient today, your health may suffer just a little. If the foods you eat provide too little or too much of one or more nutrients every day for years, then, by the time you are old, you may well suffer severe disease effects.

The point is that a well-chosen array of foods supplies enough energy and enough of each nutrient to prevent **malnutrition**. Malnutrition includes deficiencies of nutrients, imbalances, and excesses, any of which can take a toll on health over time.



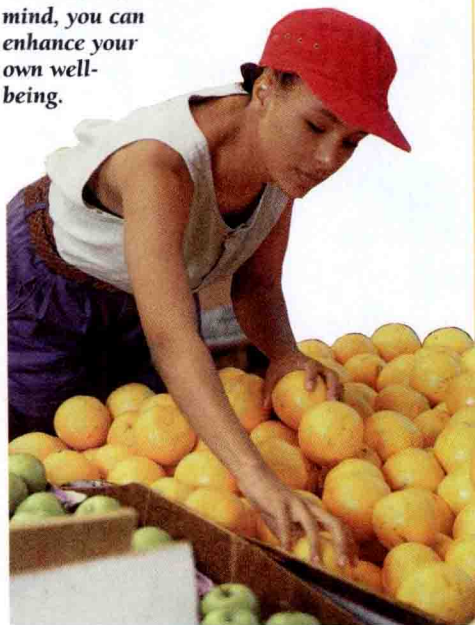
The nutrients in food support growth, maintenance, and repair of the body. Deficiencies, excesses, and imbalances of nutrients bring on the diseases of malnutrition.



How Powerful Is a Nutritious Diet in Preventing Diseases?

Your choice of diet profoundly influences your long-term health prospects. Only two common lifestyle habits are more influential: smoking and other tobacco use, and excessive drinking of alcohol.² Many older people suffer from debilitating conditions that could have been largely prevented had they known the nutrition principles that we know today and applied those principles throughout their lives.

When you choose foods with nutrition in mind, you can enhance your own well-being.



The poor health conveyed by a poor diet involves not only the various forms of malnutrition just described, but also other diseases, especially the **chronic diseases**: heart disease, diabetes, some kinds of cancer, dental disease, adult bone loss, and others. We should hasten to say that although diet can powerfully influence these diseases, they cannot be prevented by a good diet alone; they are to some extent determined by a person's genetic constitution, activities, and lifestyle.³ Within the range set by your inheritance, however, the likelihood that you will develop these diseases is strongly influenced by your food choices.

Some people overestimate and some underestimate the influence of diet in preventing diseases and poor health. Putting diet's exact role in perspective is difficult not only for ordinary people, but also for research scientists who spend their working lives trying to figure out precisely how diet relates to health and various diseases. Some different aspects of the relationship, described next, may help to show the connections.

chronic diseases long-duration degenerative diseases characterized by deterioration of the body organs; examples include heart disease, cancer, and diabetes.

KEY POINT * Nutrition profoundly affects health.

Genetics and Individuality

Consider the role of genetics. Different diseases are differently influenced by genetics and nutrition, as shown in Figure 1-1. The **anemia** caused by sickle cell disease, for example, is purely hereditary. Nothing a person eats affects the person's chances of contracting this anemia, although nutrition therapy may help ease its course. Sickle-cell anemia is shown at the left in the figure as a nutrition-unrelated, genetic disease. In contrast, a condition such as iron-deficiency anemia, listed at the right in the figure, is most often a nutrition-related condition. A person's low iron status can easily result from undernutrition, which can lead to the deficiency form of anemia. Diseases and conditions of poor health appear all along the continuum from purely genetic to purely nutritional; the more nutrition-related a disease or health condition is, the more successfully sound nutrition can prevent it.

Furthermore, some diseases, such as heart disease and cancer, are not one disease but many. Two people may both have heart disease, but not the same form. People differ genetically from each other in thousands of ways. One person's heart disease or cancer may be nutrition-related, but another's may not be. The concept presented in Figure 1-1 is based on the experience of millions of people; in contrast, no simple statement can be made about the extent to which diet can help any one person avoid a disease or slow its progress.

KEY POINT * Choice of diet influences long-term health, within the range set by genetic inheritance. Nutrition has no influence on some diseases but is closely linked to others.

Anemia is a blood condition in which red blood cells are inadequate or impaired, and so cannot meet the oxygen demands of the body. More about the anemia of sickle-cell disease in Chapter 6; iron-deficiency anemia is described in Chapter 8.

Figure 1-1

Nutrition and Disease

Not all diseases are equally influenced by diet. Some are purely genetic, like the anemia of sickle-cell disease. Some may be inherited (or the tendency to develop them may be inherited) but may be influenced by diet, like some forms of diabetes. Some are purely dietary, like the vitamin and mineral deficiency diseases.

