

# **NUTRITION**

**BASIC CONCEPTS AND APPLICATIONS**

William L. Scheider

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William L. Scheider

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# NUTRITION

BASIC CONCEPTS AND APPLICATIONS

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## PREFACE

One of the most important tasks of a college education in today's complex world is to train students to make intelligent decisions about issues that affect them and their society. One area of particular concern is nutrition, and an introductory course provides an ideal opportunity to instill and emphasize sound nutritional principles. It can help students select a nutritious diet at a time when they are assuming greater responsibility for their food choices, as well as guide those who want to lose weight, engage in athletic competition, or experiment with vegetarianism. An introductory nutrition course also provides students with information useful when raising families or caring for their parents. In addition, it may influence their thinking on social and political issues, such as hunger in America or malnutrition in developing nations, and inspire some to become involved in solving these problems.

This text, designed for introductory courses, provides nutrition information students can apply to their lives. It can also serve as a good foundation for further studies in nutrition and related fields. Previous coursework in biology and chemistry is not required, although the first chapter includes an optional section for those who wish to examine or review some basic concepts useful in the study of nutrition. The major intent of the first chapter is to present an overview of nutrition that introduces concepts used throughout the book, such as the Recommended Dietary Allowances, the Basic Four Food Group Plan, the U.S. Dietary Goals, and the Dietary Guidelines for Americans.

Parts One, Two, and Three of the book describe the nutrients, including functions, requirements, sources, and the results of deficiency and excess. The vitamins and minerals chapters are organized by topic (functions, requirements, sources, and so on), rather than vitamin by vitamin and mineral by mineral. This approach shows the similarities and relationships among nutrients. For example, the role of the B vitamins as coenzymes is emphasized in the functions section, while the interplay of biological, economic, and cultural factors that has led to beriberi, pellagra, scurvy, and rickets is discussed in the deficiency section. A summary table has been included within these chapters to organize the

material in the traditional manner. Part Four, which contains the life cycle chapters, begins with the principles and practice of choosing an adequate adult diet. The rest of the section shows how and why nutrient needs vary during other stages of the life cycle, and the means by which these different requirements can best be met. The book concludes by looking at some of the challenges facing nutritionists in the next decade and placing nutrition in a national and global, as well as personal, context.

Topics of current interest, controversies, and myths are highlighted in the Issue and Focus sections of each chapter. Some, such as lactose intolerance and pica, are designed to provide up-to-date information on specific areas of nutritional interest. When the topic is a genuine controversy, such as the role of cholesterol in causing heart disease, both sides are presented and students are encouraged to draw their own conclusions. Myths relating to the topic are given in a "Fact or Fantasy?" list in each chapter. The myths are evaluated by showing the faulty logic involved and presenting experimental data that refute them. Important statements about a variety of topics are emphasized by setting them off as callouts.

To reinforce the material and encourage application, a Study Guide has been incorporated into the book at the end of each chapter. The summary is a concise, point-by-point outline of important concepts in the chapter. A vocabulary list, study questions, and a self-test provide a comprehensive examination of the material. Students can reinforce their understanding of important terms by defining the vocabulary in their own words and comparing their definitions with those in the glossary. The study questions emphasize concepts of a general nature. The self-test deals with specific points not covered by the vocabulary or study questions; the correct answers are given at the end of the book. Suggested activities are intended to encourage application of information presented in the chapter. For those who wish to pursue topics in more detail, a complete reference list is provided at the end of the book. Some of the more readable and informative references are described in a "For Further Reading" section in the Study Guide.

The text is supplemented with many illustrations and tables. In addition, a "Ready Reference" section is included at the end of the book. It contains the Recommended Dietary Allowances, American Dietetic Association Exchange Lists, several tables of food composition, and other useful data. The book should serve as a valuable reference source long after the course has ended.

An instructor's manual and separate test bank have been prepared for use with this text. The instructor's manual briefly outlines the objectives for each chapter and how the chapter can be used to meet those objectives. Included are a list of concerns my students have expressed about nutrition, as well as suggestions for stimulating discussion in the classroom. Sources of supplementary materials are provided at the end of the manual. Questions in the test bank are drawn from examinations I have given to my own students.

A book of this nature is the collective effort of many people. I would like to thank Elizabeth Raleigh and Karen Fleischer for some timely encouragement in getting the project started, and my editors, Rhona Robbin and Jeannine Ciliotta, for their invaluable advice, editorial efforts, and support throughout its development. I am also grateful to Sharon Antonelli, Carol Bishop, Jan Christian, Lois Farone, Amy Ireson, Naomi A. Peel, Valerie Reid, and Judith Roepke for their comments and criticisms and would particularly like to thank Dr. Jean Bowering, Syracuse University, and Dr. John M. Hill, Brigham Young University, for reviewing the entire manuscript. I am also indebted to Donna Brooks for typing the manuscript. Finally, I would like to thank my family and friends for their support during this lengthy project.

**William L. Scheider**

UTRITION  
s Nutrition?  
g Nutrition Information  
and Biology  
Summary  
Vocabulary  
Study Questions  
Further Reading

Interest in nutrition has grown tremendously during the last decade, and, as our knowledge has increased, we have become more and more conscious of the connection between diet and health. We ask more and more questions about what we should eat. Can our foods provide all the nutrients we need? Are food additives dangerous? Will vitamin and mineral supplements give us more energy and prevent disease? How can we lose weight safely and effectively? Is a vegetarian diet better than a conventional one? In 1968 a Citizen's Board of Inquiry into Hunger and Malnutrition in the United States published *Hunger U.S.A.*, which documented an alarming prevalence of nutritional deprivation in this country. In the early 1970s, the Senate Select Committee on Nutrition and Human Needs began to hear testimony linking food-consumption patterns in the United States, and other affluent nations with the relatively high incidence of obesity, heart disease, diabetes mellitus, and certain types of cancer in these countries. As a result, in 1977 the committee issued a set of dietary recommendations called the U.S. Dietary Goals. The Dietary Goals were subsequently used by the United States Department of Agriculture (USDA) and the Department of Health and Human Services (HHS) as the basis for their *Dietary Guidelines for Americans* (1). These Dietary Guidelines are a significant step toward a national nutrition policy.

In the industrialized countries, our problem seems to be one of food choices. People in the developing world, however, are concerned with just getting enough to eat. Much has been said and written about the "protein



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# THE SCIENCE OF NUTRITION

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Further Reading

Interest in nutrition has grown tremendously during the last decade, and, as our knowledge has increased, we have become more and more conscious of the connection between diet and health. We ask more and more questions about what we should eat. Can our foods provide all the nutrients we need? Are food additives dangerous? Will vitamin and mineral supplements give us more energy and prevent disease? How can we lose weight safely and effectively? Is a vegetarian diet better than a conventional one? In 1968 a Citizen's Board of Inquiry into Hunger and Malnutrition in the United States published *Hunger U.S.A.*, which documented an alarming prevalence of nutritional deprivation in this country. In the early 1970s, the Senate Select Committee on Nutrition and Human Needs began to hear testimony linking food-consumption patterns in the United States and other affluent nations with the relatively high incidence of obesity, heart disease, diabetes mellitus, and certain types of cancer in those countries. As a result, in 1977 the committee issued a set of dietary recommendations called the U.S. Dietary Goals. The Dietary Goals were subsequently used by the United States Department of Agriculture (USDA) and the Department of Health and Human Services (HHS) as the basis for their Dietary Guidelines for Americans (1). These Dietary Guidelines are a significant step toward a national nutrition policy.

In the industrialized countries, our problem seems to be one of food choices. People in the developing world, however, are concerned with just getting enough to eat. Much has been said and written about the "protein

FIGURE 1-1  
Factors Influencing Food Choices. The choices we make about the composition of different foods available for human consumption depend on a variety of factors.

gap" and the "energy gap," as well as the need to increase food supplies and distribute them better. Drought, crop failures, the increased cost of energy, and political factors resulted in a famine in many parts of the world during the mid-1970s. Although the crisis eases periodically, the problems have not been solved, so we need good nutrition information to protect our health and to be well-informed voters, taxpayers, and members of the world community. First, however, we need to know what nutrition is. We need to know how new information is generated and tested, and we need some reliable sources of this information.

## What Is Nutrition?

**Nutrition** is the science that studies the means by which we obtain, assimilate, and utilize food. It is a discipline with many facets; it draws on many other sciences, including chemistry, biochemistry, physiology, medicine, sociology, economics, geography, agriculture, politics, and food science. Determining the role of a nutrient, such as protein in the body, requires the expertise of biochemists and physiologists. To establish programs to meet the nutritional needs of a developing nation, however, a nutritionist might work with agricultural scientists, economists, and politicians. Treating obesity sometimes requires the help of a psychologist. Nutrition tells us why each nutrient is necessary in the diet, how much of each is required, which foods provide them, the factors that influence food availability and food choices, and the results of deficiency and excess.

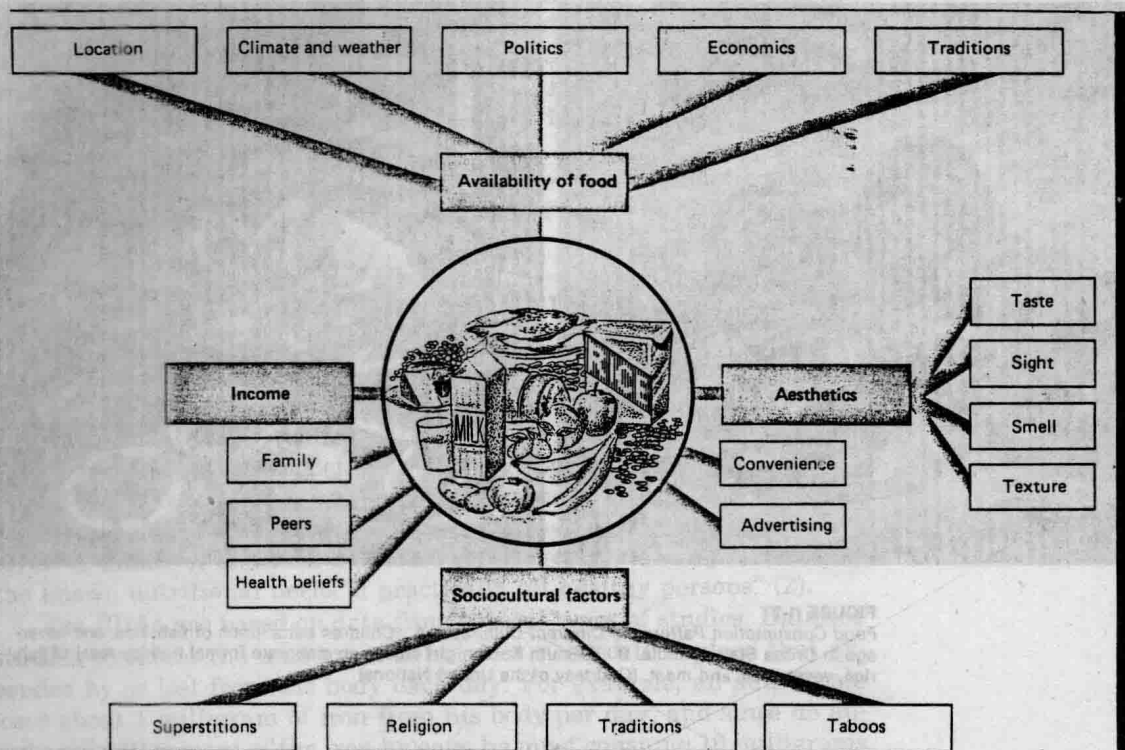
## WHY WE NEED NUTRIENTS

**Nutrients** are substances required in the diet for growth, maintenance, and reproduction. Protein, carbohydrate, and fat, for example, provide energy. Proteins perform a variety of other functions, including catalyzing chemical reactions, transporting substances in the blood, muscle contraction, and maintaining fluid and acid-base balances. Vitamins and minerals help other substances do their jobs. Water is also a nutrient; it provides the medium in which all the other nutrients function. Water bathes each cell, transports substances to and from the cells and into and out of the body, regulates body temperature, and participates in chemical reactions.

The relationships between the nutrients and other body substances are very complex. Deficiency of a single nutrient can impair several processes simultaneously, and prolonged deficiency can lead to death. Nutrients also interact with each other in a variety of ways. For example, copper and vitamin C promote the proper functioning of iron, while zinc interferes with copper absorption and utilization. An important part of our study of nutrition will be to look at these relationships, as well as the basic functions of each nutrient.

## INFLUENCES ON FOOD CHOICES

Of the thousands of foods known to people throughout the world, each individual selects particular ones to eat. Another important part of nutri-



**FIGURE 1-1**  
*Factors Influencing Food Choices.* The choices we make from the thousands of different foods suitable for human consumption depend on a variety of factors.

tion is the study of the factors that influence these choices (Figure 1-1). A major factor is the availability of different types of food, which in turn is influenced by geographic location, climate and weather, economic policies, political decisions, and cultural traditions. For instance, the climate and geography of southeast Asia are conducive to growing rice rather than other grains, and a cultural pattern has evolved around rice as a staple. In much of the United States, wheat is the major staple. Another factor influencing food choices is income. In the developing nations, meat, dairy products, and eggs are often too expensive to purchase in significant amounts, and many people must do without them. In the United States, rising meat prices have led consumers to buy the less-expensive cuts or to resort to alternatives, such as legumes and grain-based dishes.

Family, peers, health beliefs, convenience, advertising, and sociocultural factors, such as religion, superstition, and taboos, also help determine food choices. Parents shape food preferences by continually exposing their children to particular types of foods at a time when they are forming their likes and dislikes. Forcing a child to eat or using food as a reward or punishment may result in a fondness for or an aversion to certain foods. Peers influence food choices by introducing new foods; many people, especially children, tend to imitate peers they particularly like or respect (see Chapter 12).

The effect of health beliefs on food choices is of great concern to nutri-