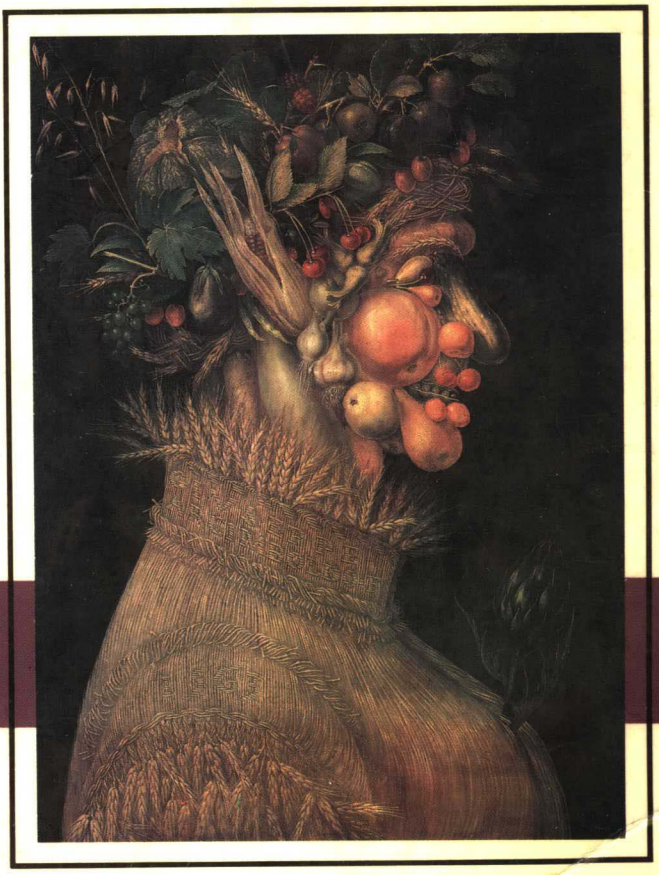
Food Science and Nutritional Health:

An Introduction

Theodore P. Labuza
John W. Erdman Jr.



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In memory of
Dr. Howard Appledorf
who stimulated the ideas
for the first edition
of this book.

Preface

This book represents the cumulative changes that have occurred in the fields of food science and nutrition in the seven years since T.P. Labuza first published *Food and Your Well-Being.* And like *Food and Your Well-Being,* the purpose of this book remains the same: to provide a reliable source of information on the connection between food and health.

This connection is often steeped in controversy and exaggerated claims and, if anything, these controversies and exaggerations have become even more intense since *Food and Your Well-Being* was published. As this book goes to press, EDB is making news as a contaminant and many grain products are being recalled from supermarket shelves. In the recent past, there have been newspaper headlines on the partial banning of saccharin; news articles on sulfite as a cause of instant death; and an alleged connection between the new sweetener, Aspartame®, and brain dysfunction. These controversies will continue and new ones will appear; rarely will these controversies be completely resolved. This places the consumer in an awkward position: whom and what to believe, what to eat and what not to eat, and, above all, how to make the best choices for personal and family health.

These choices can best be made by being informed, by understanding the basic concepts of food science and nutrition. It is our goal to present these basic concepts in a clear and straightforward manner so that the reader can make a better connection between food and food processing, nutrition and health. The hope is that this book will be an invaluable tool in the home as well as in the classroom. Toward this end, and beginning with *Food and Your Well-Being,* John Erdman has extensively revised and expanded the coverage of nutrition in the first half of the book and Ted Labuza has revised and expanded the second half of the book on the technology and preservation of food.

Acknowledgements

No book is written alone, and we owe much to others.

Ted Labuza would like to thank his students for continually asking penetrating questions during and after class, the many consumers who call for help on food problems, the media in the Twin Cities area who call seeking a resource and, collectively, the FDA, the Food Drug Law Institute, and Peter Barton Hutt for instilling the legal sense which helped put the complex food/nutrition issue into a proper perspective. Finally, a large measure of thanks to those who endured the grueling two years of "working on the book," especially Mary Schmidl.

John Erdman would like to recognize the editorial assistance of Edith Erdman and Donald Thompson, the suggestions of Mary Grummer, and the typing of Rita Craighead. A special thanks is due his family and graduate students for their considerable patience during the preparation of this book.

Together, we would like to thank Gary Woodruff and Marge Johnson of West and the reviewers whose comments and suggestions materially helped shape the book into what it now is: Michael E. Mangino, Ohio State University, Clarice Schlickling, Orange Coast College, James Acton, Clemson University, Stan Biede, Louisiana State University. Michael E. Mangino deserves a special mention for his authorship of the accompanying Instructor's Manual.

TPL

JWE

Biographical sketches

Dr. Theodore P. Labuza

Dr. Theodore P. Labuza is a professor of food science and technology in the Department of Food Science and Nutrition at the University of Minnesota. Dr. Labuza is a native of New Jersey. He received a B.S. in Food Science at MIT and a Ph.D. in Food Science and Nutrition at MIT in 1965. After receiving his degree, Dr. Labuza taught at MIT in the Department of Nutrition and Food Science until July of 1971. At that time he joined the University of Minnesota. Dr. Labuza is the author of over 110 scientific articles as well as articles for the popular press concerning food technology and nutrition. He has written three other nutrition books: *Food For Thought* (AVI Publishing Company 1974), *The Nutrition Crisis: A Reader* (West Publishing Company 1975) and *Contemporary Nutrition Controversies* (West Publishing Company 1975). He is a member of many professional organizations. In 1975 he was the National Program Chairman for the Institute of Food Technologists and was responsible for its annual meeting. Dr. Labuza received the IFT award for outstanding research in 1972 and the IFT teaching award in 1978. Besides his regular course in food technology, he also teaches an introductory food processing course and a food law course. Over the last ten years, Dr. Labuza's major research has been in the properties of water in foods as related to nutrient losses and microbiological activity during processing and storage of dehydrated and intermediate moisture foods as well as developing methods for shelf life testing of foods and drugs.

Dr. John W. Erdman, Jr.

Dr. John W. Erdman, Jr., is an associate professor of food science in the Department of Food Science at the University of Illinois. Dr. Erdman received a B.S. degree in food science at Rutgers University. He worked for six months as a flavor chemist for Pepsico and served for two years in the United States Army before returning to Rutgers for graduate

school. Dr. Erdman received his Ph.D in 1975. He joined the University of Illinois in 1975. Dr. Erdman is the author of over 50 scientific articles, many dealing with the effects of food processing upon the bioavailability of minerals from foods and others dealing with vitamin A metabolism in man and animals. He has co-authored seven book chapters, and since 1980 has written a monthly column for the magazine *Cereal Foods World.*

Dr. Erdman is a member of many professional organizations including the American Institute of Nutrition, Institute of Food Technologists (IFT), and the Society of Nutrition Education. He is a member of the Subcommittee on the Uses of the RDA, National Research Council, National Academy of Science. He has served on a number of national committees for IFT and is currently chairman-elect of the Nutrition Division of IFT. In 1980 Dr. Erdman received the Samuel Cate Prescott Award for Research from IFT. He has been recognized on numerous occasions by his students at the University of Illinois for his excellence in teaching. In 1983 the University of Illinois presented Dr. Erdman with the Excellence in Off-campus Teaching Award. Dr. Erdman is married and has two children aged three and seven.

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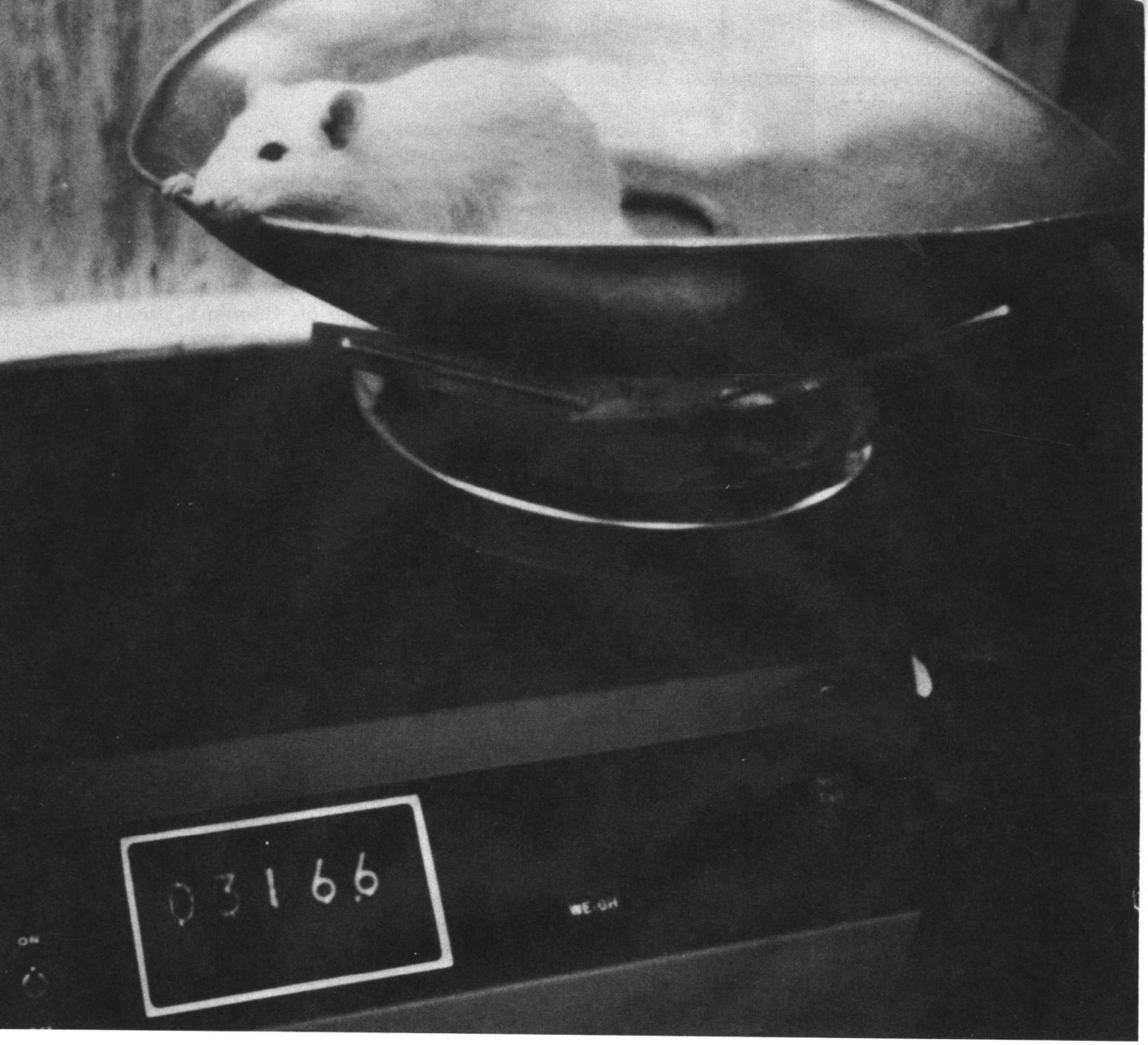

1 NUTRITIONAL ADEQUACY AND THE STATE OF THE BODY

The science of nutrition is a very young science. Prior to 1900 there were few scientific investigators working on nutritional studies. Then the explosion came. New laboratory analytical techniques and a better understanding of biochemical processes resulted in a wide interest in nutritional research. In addition, the ability to synthesize organic compounds increased the study of the effects of various chemicals on health. No vitamins were discovered until 1910. By 1970 there were over 1,300 papers published on vitamin B_{12} alone, and in 1982 just one scientific meeting had almost 1,000 papers presented on various nutrition topics.

Unfortunately, much of this information has not been communicated to the public. This problem is due, in part, to our schools, which require neither an adequate science education nor an integrated food and nutrition education. Moreover, the scientific jargon of nutrition is often too difficult for most people to understand. Consequently, a person's ability to apply findings of nutritional research is limited.

So that we ourselves may begin to better understand how to keep healthy through a good diet, we will first define nutritional adequacy in the most simple terms. We should remember here that nutrition is the sum total of all the processes that occur in the body to break down foods into their various components. The body then uses these substances for growth, repair, and maintenance of all the systems that contribute to health. Food is the input to nutrition. Thus an adequate food intake is a prerequisite to nutritional adequacy, whereas an inadequate food intake can lead to poor health.

CHARACTERISTICS OF NUTRITIONAL ADEQUACY

What are some of the characteristics commonly attributed to nutritional adequacy (or inadequacy)? What state of mind or state of the body makes us feel healthy and gives us vitality? Factors such as body size, weight, longevity, ability to withstand stress, and ability to reproduce can be used as indicators of good health and thus nutritional adequacy. Biochemical and clinical analyses are also extremely helpful in determining nutritional status. Nutrition is not an exact science, however.

Each of us, due to our genetic makeup, differs in our needs for certain nutrients in our diets. Genetically, we all differ in our predisposition to chronic disease. Scientists often speak of the biochemical individuality of people. Just as each of us has different fingerprints, each of us is made up differently. Therefore, we must always think in terms of ranges of nutrient needs or average nutrient needs, not in terms of an absolute need for every person. One person may require 30 milligrams (mg.) of vitamin C daily and his or her neighbor only 15 mg.

Some of the measures we commonly use to define nutritional adequacy are discussed on the following page.