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NUTRITIONAL AND TOXICOLOGICAL CONSEQUENCES OF FOOD PROCESSING

Edited by
Mendel Friedman
U.S. Department of Agriculture
Albany, California

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No part of this book may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording, or otherwise, without written permission from the Publisher
I dedicate this book to my wife Dora for foregoing the pleasure of my company during many a weekend that went into this effort.

Mendel Friedman
Moraga, California
December, 1990

The earth is full of the fruit of Thy works.
Thou causest grass to spring up for cattle,
And herbs for the service of man.
Thou bringest forth bread out of the earth
To sustain man’s life,
And wine to gladden his heart.

Psalm 104: 28 -33

The eyes of all look to you expectantly,
and you give them their food when it is due,
You give it openhandedly, feeding every creature to its heart’s content.

Psalm 145: 15 -16

Eat nothing that will prevent you from eating.

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PREFACE

A variety of processing methods are used to make foods edible; to permit storage; to alter texture and flavor; to sterilize and pasteurize food; and to destroy microorganisms and other toxins. These methods include baking, broiling, cooking, freezing, frying, and roasting. Many such efforts have both beneficial and harmful effects. It is a paradox of nature that the processing of foods can improve nutrition, quality, safety, and taste, and yet occasionally lead to the formation of anti-nutritional and toxic compounds. These multifaceted consequences of food processing arise from molecular interactions among nutrients with each other and with other food ingredients.

Since beneficial and adverse effects of food processing are of increasing importance to food science, nutrition, and human health, and since many of the compounds formed have been shown to be potent carcinogens and growth inhibitors in animals, I organized a symposium broadly concerned with the nutritional and toxicological consequences of food processing. The symposium was sponsored by the American Institute of Nutrition (AIN) - Federation of American Societies for Experimental Biology (FASEB) for its annual meeting in Washington, D.C., April 1-5, 1990. Invited speakers were asked to develop at least one of the following topics:

1. Nutrient-nonnutrient interactions between amino acids, proteins, carbohydrates, lipids, minerals, vitamins, tannins, fiber, natural toxicants, etc.

2. Effects of radiation.

3. Thermally induced formation of dietary mutagens, antimutagens, carcinogens, anticarcinogens, antioxidants, and growth inhibitors.

4. Effects of pH on nutritional value and safety.

5. Effects of oxidizing agents on food quality and safety.

6. Effects of processing on food allergenicities.

7. Metabolic detoxification pathways.


The most important function of a symposium, I believe, is dissemination of insights and exchange of ideas so as to catalyze progress by permitting synergistic interaction among related disciplines. I hope that the reports presented at the symposium fulfilled this purpose. In addition, a number of scientists who could not participate in the symposium accepted invitations to contribute manuscripts to this volume on the theme of the symposium. This book is, therefore, a hybrid between symposium proceedings and a collection of invited papers.

Brought together here are outstanding international authors from twelve countries who discuss the multidisciplinary aspects of nutritional and toxicological significance of the processing of foods. The major theme of this book is that a better understanding of the molecular changes during food processing is needed to optimize beneficial effects such as bioavailability, food quality and food safety, and to minimize the formation and facilitate inactivation and removal of deleterious mutagens, carcinogens, and other toxicants.

The described multidisciplinary studies reveal a complex interplay between chemistry, biochemistry, nutrition, physiology, pharmacology, and toxicology of food ingredients.

I am particularly grateful to all contributors for excellent cooperation, to Dr. R. G. Allison of the American Institute of Nutrition for helpful correspondence on the theme of the symposium, and to Lillie Davis for excellent secretarial assistance.

Plenum Press is publishing the papers under the title *Nutritional and Toxicological Consequences of Food Processing*, as a volume in the series Advances in Experimental Medicine and Biology. This book is intended to complement the following published volumes which I edited for the same series: *Protein - Metal Interactions* (1974) - Vol. 40; *Protein Crosslinking: Biochemical and Molecular Aspects* (1977) - Vol. 86A; *Protein Crosslinking: Nutritional and Medical Consequences* (1977) - Vol. 86B; *Nutritional Improvement of Food and Feed Proteins* (1978) - Vol. 109; *Nutritional and Toxicological Aspects of Food Safety* (1984) - Vol. 177; and *Nutritional and Toxicological Significance of Enzyme Inhibitors in Foods* (1986) - Vol. 199.

I very much hope that these and related monographs which I edited (*Protein Nutritional Quality of Foods and Feeds*, Marcel Dekker, 1975 and *Absorption and Utilization of Amino Acids*, CRC Press, 1989) will be a valuable resource for further progress in agriculture, food chemistry, food safety, animal and human nutrition, physiology, pharmacology, toxicology, and medicine; all areas in which there is an urgent world-wide need to better the human condition. If so, the effort will be most worthwhile.

Mendel Friedman.
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