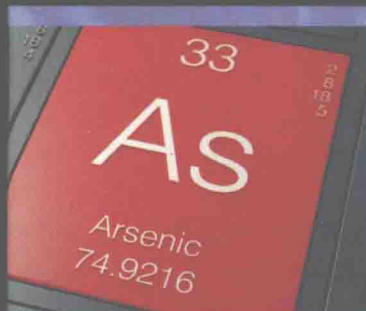


SECOND EDITION

PRINCIPLES OF FOOD
TOXICOLOGY

Tõnu Püssa

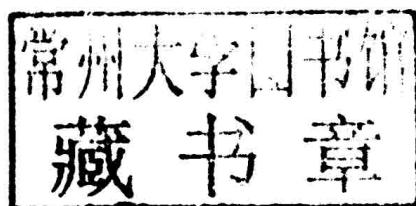


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SECOND EDITION

PRINCIPLES OF FOOD
TOXICOLOGY

To my wife, Tiia

Preface to the Second Edition

Several years have passed since the publication of the first edition of this book. The developing food technology has adopted new processing techniques that may generate totally new food constituents calling for a special toxicological evaluation. For example, *trans* fatty acids resulting from the chemical hydrogenation of unsaturated fats, or 3-monochloropropanediol arising from the chemical hydrolysis of proteins have recently been identified as toxic substances in processed food. On the other hand, toxicology, hand in hand with other natural sciences and largely owing to the developments in chemical analysis, is ever more ready for these new challenges, including re-examination of the former data and even theories. For example, it turned out that the hitherto infamous nitrite ions are perhaps not so bad at all, but in fact possess beneficial physiological properties as well. Also, the customary NOAEL (no-observed adverse effect level) values have started to shake. The risk–benefit analysis has become a constituent part of toxicological evaluation for any substance or mixture.

There is a widespread view that the safety of traditional foods has already been fully proven by their long-term nonproblematic consumption. Nevertheless, thanks to progress in chemical analysis techniques, it has been discovered that foodstuffs consumed for centuries may still contain remarkable amounts of toxicants and/or antinutritional substances. One of the recently reported examples of process-derived chemical hazards in food is the formation of acrylamide in baked products. Although a similar process had been used for centuries for baking bread, potatoes, and other starch-based foods, this drawback went unnoticed until 2002. An increased knowledge of long-term and chronic toxic effects enables us to be aware of the health hazards that were earlier either unknown or underestimated. Even very small quantities of toxic substances in prepared food can, as a result of continuous long-term consumption and accumulation in the organism, become hazardous for humans.

Moreover, life standards, expectations, and conceptions of life and health have also substantially changed over the past few decades. Diets have changed, and there has been an upsurge in vegetarianism and the consumption of exotic, minimally prepared, and fast foods. An emerging area of further concern that has

recently become a more serious issue for food packaging material manufacturers is the migration of hazardous chemicals from packaging materials into foods. Against this background, new conceptions of food safety are emerging. Acute food intoxications are nowadays relatively rare; considerably more frequent and more significant issues are represented by the long-term and often hard-to-diagnose effects of plant and animal toxicants that have already developed extensively by the time of discovery.

In comparison with the first edition, the material presented here has been revised and updated. A completely new chapter “Food Adulterants” and new sections, such as “Reproductive and Developmental Toxicity” and “Risk–Benefit Analysis,” have been included. The list of literary sources, mainly referring to recent scientific, in particular, reviewing articles, has been sufficiently expanded to facilitate deeper immersion of the reader into the exciting details of food chemical safety.

Preface to the First Edition

Food is an extremely complex and complicated system that consists of a practically endless number of high- and low-molecular substances, mostly of natural origin. A majority of these compounds are indispensable for the normal functioning of a human, either as a source of energy or body building material or as a normal source of taste—the main function of which is to turn eating into a pleasure and to improve digestion. Some of the food components also perform the task of turning foods healthier and safer and prolonging the storage time or “shelf life” (“best before”).

On the other hand, food always contains substances that are capable of evoking smaller or bigger health disorders, that is, that are toxic. Poisonous compounds may originate from the raw materials of food, but they may get into food during its processing, transportation, or storage. Compounds, often synthetic, that are intentionally added to food may also be toxic. Although these substances, called food additives, undergo, nowadays, an exhaustive toxicological examination, one can never be absolutely sure that a long-known food constituent can be regarded as safe in a new environment, where it can turn toxic by itself or synergetically enhance the toxicity of another which was thought to be a nontoxic food component. Food is never ready to be consumed; various physical and biochemical processes occur continuously in it that may provide new and not always harmless substances. The so-called health-promoting functional additives may also elicit toxicological problems.

This book is an attempt to put into one pot principles of general- and food toxicology and to spice them up with the most important and vivid examples of food-related poisons and poisonings from all over the world. Owing to the rapid development of food toxicology, it is not usually possible to present the ultimate truth about toxic effects and their mechanisms. And this is good because it makes the reader think with us. Special attention is paid to the biochemical mechanisms of the toxic effects as much as they are known. Knowledge of the mechanisms helps toxicologists to scientifically perform the risk assessment.

The first part of the book is dedicated to the introduction of principles of toxicology at the molecular, cellular, and organism level, as much as possible in

relation with food. At times, examples taken from the second part are used to illustrate the principles. The second part is a systematic characterization of the most important food-borne toxicants, closely connected with the first part of the book.

This book is a thoroughly revised and updated translation of a book written in Estonian that is being used in the author's course on Food Toxicology at the Estonian University of Life Sciences. It will be of interest to students of food science and technology and to professional food scientists, manufacturers, and regulatory agency personnel.

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Author

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