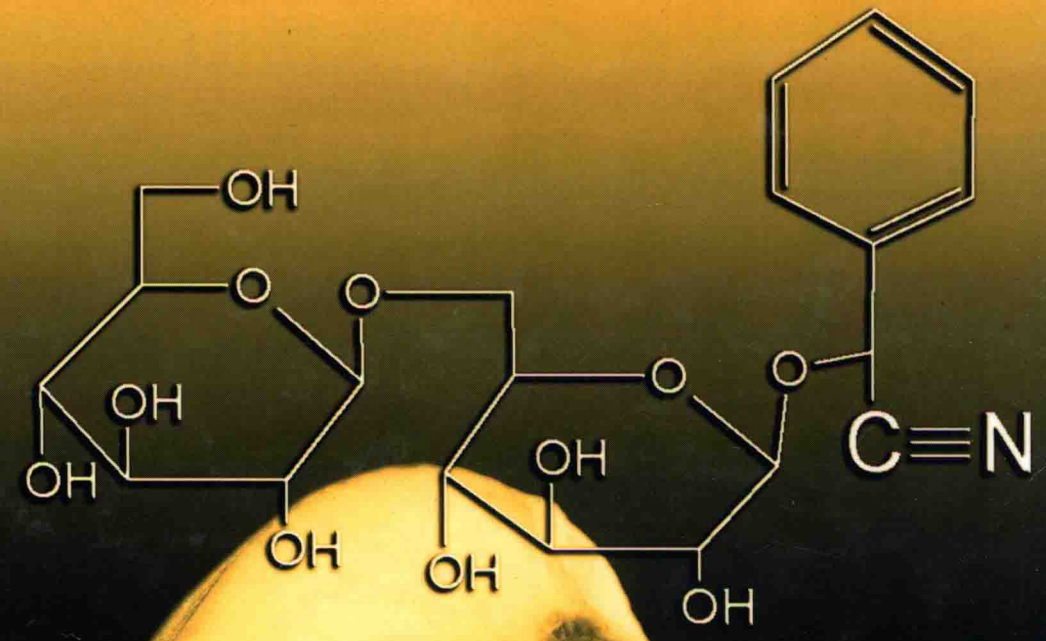
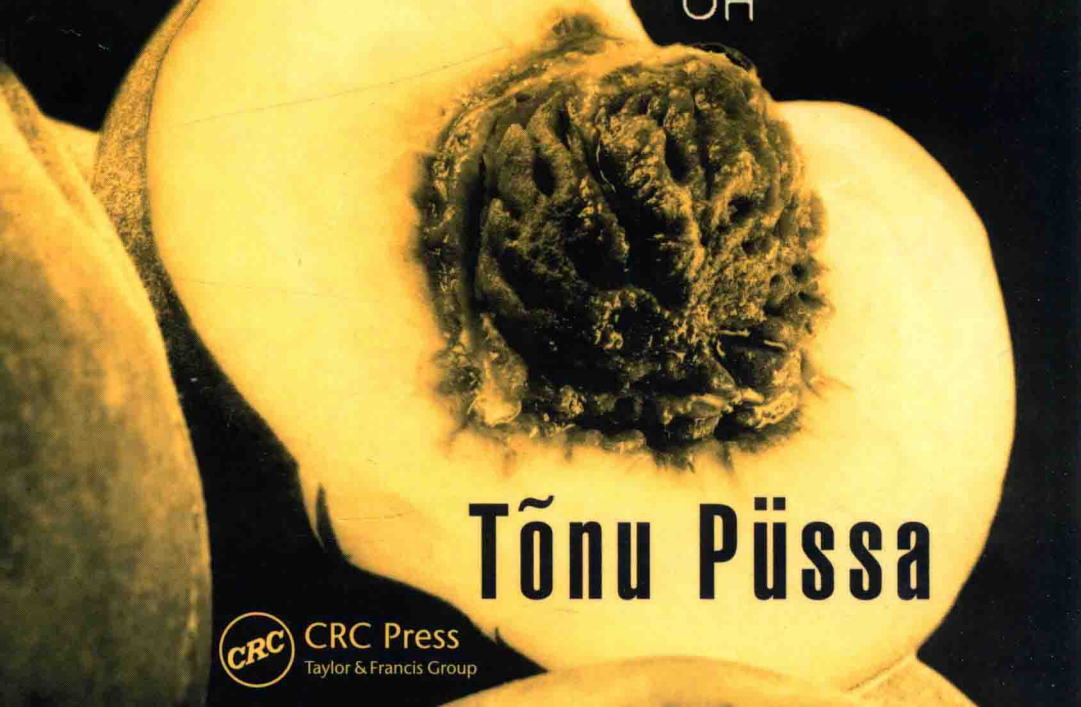
PRINCIPLES OF FOOD TOXICOLOGY





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Dedication

To my wife, Tiia

Preface

Food, as an extremely complex and complicated system, consists of practically an endless number of high- and low-molecular substances, mostly of natural origin. A majority of these compounds are indispensable for the normal functioning of the human organism, either as a source of energy or building material or normal source of pleasure, and their function is to turn eating into a pleasure and to improve digestion. Some of the food components also make food healthier and safer, as well as prolong its storage life.

On the other hand, food also contains substances that are capable of evoking smaller or bigger health disorders, that is, food can sometimes be toxic. Poisonous compounds may not only originate from the raw material of food but may also get into food during its processing, transportation, or storage. Toxic substances may also be the compounds, often synthetic, that are intentionally added to food. Although nowadays these substances called food additives are subjected to 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 synergistically enhance the toxicity of another so far nontoxic food component. Food is never ready; various physical and (bio)chemical processes are continuously going on, which may result in the formation of new and not always harmless substances. The so-called health-promoting functional additives may also elicit toxicological problems.

This textbook is an attempt to put into one pot the 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 (bio)chemical mechanisms of the toxic effects as much as they are known. Knowledge of the mechanisms helps toxicologists perform risk assessment scientifically.

The first part of the book is dedicated to introduction of the principles of toxicology at the molecular, cellular, as well as organism level, related as closely as possible to food. At times, examples from the second part are drawn to illustrate the principles. The second part is a systematic

characterization of the most important foodborne toxicants, closely interconnected with the first part of the book.

This textbook is a thoroughly revised and updated translation of the respective book written in Estonian, which is being used in the author's course of food toxicology at the Estonian University of Life Sciences. It may be of interest for students of food science and technology, for professional food scientists, manufacturers, and regulatory agency personnel.

Acknowledgments

The author would like to express his gratitude to his colleagues who were helping him at the time of writing the Estonian version as well as in translation. Special thanks to associate professor Ain Raal for his reading of the Estonian manuscript and his valuable advice concerning the medicinal side of toxicology and the textbook, to master student Piret Raudsepp for preparation of the figures, and my daughter, Triina, for the linguistic proofreading of the translation.

Author

Tõnu Püssa is an associate professor of food toxicology at the Department of Food Science and Hygiene of the Estonian University of Life Sciences in Tartu, Estonia. After graduating from Tartu University as an organic chemist in 1969, he received his PhD in chemistry at the same university in 1973. During his work at the Department of Organic Chemistry and Laboratory of Chemical Kinetics and Catalysis at Tartu University as a research fellow and associate professor, his research interests were connected with chemical and enzymatic catalysis, algal carbohydrates, and proteins of the endocellular matrix. For a year, he was a guest researcher at the Finnish Red Cross Blood Transfusion Service in Helsinki. During 1996 to 2001, Tõnu Püssa worked at the Estonian University of Life Sciences (former Agricultural University) as the Head of Laboratory of Environmental Chemistry. He has taught student courses of organic chemistry, analytical biochemistry, hydrochemistry, and food toxicology. His present scientific interests are connected with functional foods, particularly with the mechanism of interaction between herbal antioxidant polyphenols and the oxidation system of polyunsaturated fatty acids producing mutagenic epoxyacids. He is married, and has two daughters and two grandsons.

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section one

Basics of toxicology connected to food