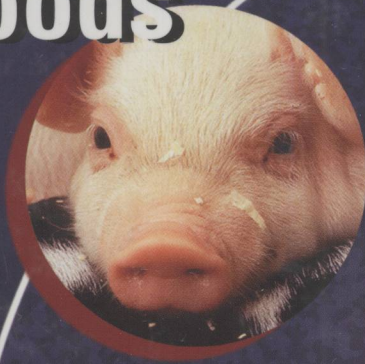


Microbiologically Safe Foods



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MICROBIOLOGICALLY SAFE FOODS

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To our families

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FOREWORD

Food safety has become a worldwide concern that affects international trade and relations due to its impact on human health and economics, especially in recent years when the number and complexity of food safety issues has increased substantially. This is evidenced by the large number of new, emerging, reemerging, or evolving pathogenic microorganisms (e.g., *Escherichia coli* O157:H7 and other Shiga toxin-producing *E. coli* serotypes, *Salmonella* serotypes Enteritidis and Typhimurium DT 104, *Campylobacter jejuni/coli*, *Yersinia enterocolitica*, *Listeria monocytogenes*, and *Enterobacter sakazakii*, parasitic agents such a *Cryptosporidium* and *Cyclospora*, Noroviruses) which have become food safety concerns after the 1970s, 1980s, and even 1990s. Another alarming development is the increasing number of types of foods being involved in outbreaks, including products not usually associated with confirmed foodborne illness episodes in the past (e.g., fruit juices, lettuce, spinach, other produce, mayonnaise, various berries, sautéed onions, clam chowder, ice cream). Simultaneously, controlling bacterial pathogens, which are the most important food safety concern relative to number of deaths and economic losses, has become more complicated as accumulating evidence indicates development of resistance to antibiotics and potential adaptation and cross-resistance or cross-protection to traditional food preservation barriers, such as acidity, thermal processing, cold temperature storage, dry or low-water-activity environments, and chemical additives. In addition, evidence indicates the existence of pathogenic strains with enhanced ability for survival in their hosts, lower infectious doses, and increased virulence.

Modern food safety issues and concerns appear to multiply and become more significant when considered in association with societal changes and our transformation as consumers. Our societies have become more urbanized, populations continue to increase dramatically, human life expectancy increases, and as lifestyles are changing,

consumer food preferences and expectations related to food characteristics are different than they were just a few decades ago. As aging populations increase, they include more immunosuppressed and chronically ill persons who are more sensitive to foodborne illnesses and their consequences. Modern advances in medical treatments improve human survival rates from various illnesses but are also associated with increasing numbers of people with reduced immunity to infection. As a consequence, it is logical that food safety risks become even greater and more acute for consumers who are more sensitive to microbial infection. Thus, ongoing microbial evolution, coupled with societal changes including consumer food preferences, lack of adequate food-handling education, increases in at-risk human populations, complex food distribution patterns, increased international trade, and better methods of testing for microbial detection, bring microbial food safety to the forefront of our societal concerns. These developments have certainly increased interest in food safety among scientists, regulatory officials, industry, and public health agencies at the national and international level, especially as they become of more interest to news-reporting media and public-interest groups. This increased publicity leads to public awareness, concern, and more interest in food safety issues worldwide. The result is increased pressure on the private and public sectors to accelerate efforts that may lead to enhanced microbial food safety.

Initiatives undertaken by regulatory and public health agencies, industry, and research organizations in recent years have targeted microbial food safety as a worldwide public health issue. Important developments include establishment of new regulations, based on the concept and principles of hazard analysis of critical control points (HACCP) for the inspection of meat, poultry, seafood, and fruit juice—processing operations in the United States, as well as similar efforts undertaken by countries in various parts of the world. Furthermore, efforts are undertaken to improve international collaboration, coordination, and harmonization of food safety assurance programs. Parallel efforts and accomplishments include scientific research and development for better control of pathogens in order to reduce risks. The knowledge base generated by research is necessary for regulatory decision making, development of industry approaches for solutions to food safety problems, worker training, and public education in food safety. These scientific efforts have contributed not only significant new knowledge in pathogen ecology, detection, and control, but have also generated new approaches for development of novel control strategies based on microbial predictive modeling and risk assessments. These new avenues of thinking and addressing food safety issues should facilitate adoption of evolving concepts such as food safety objectives and associated process and product criteria needed for assurance of desired levels of food protection.

In light of these concerns and related developments, a book providing comprehensive coverage to all microbial food safety issues is very timely and needed. *Microbiologically Safe Foods* is a comprehensive book of worldwide interest written by an impressive group of international experts. It addresses all aspects of microbial food safety that are of interest to scientists, regulators, public health officials, and industry worldwide. The strength of this book is its comprehensive nature and the excellent expertise of the authors. It is a book that I have always considered as needed

because it deals with all aspects of microbial food safety: bacterial, fungal, parasitic, and viral, including various emerging concerns. It is comprehensive because it covers all known foodborne pathogens, including those that usually receive little or no coverage in most available books on food microbiology because they may not be of major concern in certain developed countries. The other unique feature that makes this book extremely valuable is that in addition to covering a long list of pathogens and other modern food safety issues, it includes specific chapters on food safety problems associated with all types of food commodities or groups of food products. Additional topics of current interest covered by the book include microbiological risk assessment, various programs for pathogen control, HACCP, novel pathogen control technologies, traditional and modern microbial detection approaches, laboratory accreditation, bioterrorism, genetically modified organisms, and predictive microbiology. Overall, this book should be extremely valuable to all those interested in food safety, as a single comprehensive source covering modern microbial food safety concerns of international interest.

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JOHN N. SOFOS

PREFACE

The seed for this book was planted, germinated, and nurtured in Monterrey, Mexico, during the International Conference of Food Safety hosted in this city. The goal was to compile a “mini” encyclopedia of microbial food safety to span the proverbial farm-to-fork continuum. With the advent of NAFTA and the global commerce of food, it was only natural that the book would acquire an international flavor. This publication surveys foodborne pathogens and food safety issues, including those that usually receive little or no coverage in most books because they may be of local concern. However, with the global exchange of commodities, these are now of interest worldwide.

The book addresses the contamination of foods in the production chain and presents approaches and state-of-the-art technologies to harvest microbiologically safe foods for our global dinner table. Each chapter summarizes and updates scientific advances of importance to professionals involved in all aspects of food science, especially pre- and post-harvest food safety, processing, quality control, and regulatory matters.

Production processes of a variety of foods, including dairy, eggs, beef, and poultry, and the recognition of fruits and vegetables as major vehicles of the transmission of human foodborne diseases are surveyed. The growing market in processed foods, as well as interventions, including innovative food packaging and high technologies to inhibit spoilage organisms and prolong shelf life, is addressed. Recent foodborne outbreaks and recalls involving a particular product and incriminated microbial hazards are summarized.

Other current issues that broaden readership are the role of genetically modified organisms in food safety, predictive microbiology, emerging foodborne pathogens, and good manufacturing practices. The emergence of bioterrorism is tracked. Novel

approaches to pre-harvest food safety, such as the potential of competitive exclusion cultures in livestock and poultry, are examined. The impact of HACCP strategies on enhancing the microbial quality of foods is chronicled. The critical issue of microbiological laboratory accreditation to assure compliance with performance standards is described. The applications of molecular biology, encompassing rapid methods to detect, characterize, and enumerate pathogens, abound throughout.

Authors were selected on the basis of their scientific stature, their presentations at international conferences, and the recommendations of commodity groups. Some were active participants in the Monterrey conferences, shared our dream of compiling this book, and urged us on to publication. The coeditors added, revised topics, and updated chapters in response to the prevailing trends in the food safety community. Hence, we included a chapter on avian influenza because of its potential implications for food safety. It was during the final editing of the 31 chapters that we realized the enormity (and significance!) of the undertaking.

Although the task of selecting topics and authors was daunting, we are indebted to the participants of the international conferences held in Mexico, whose interest was a catalyst in the final selection of authors and chapter topics. We thank Wiley for their encouragement along the way and for realizing the publication of this book.

We encourage the reader to suggest topics and offer improvements for future editions of this international collaboration.

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