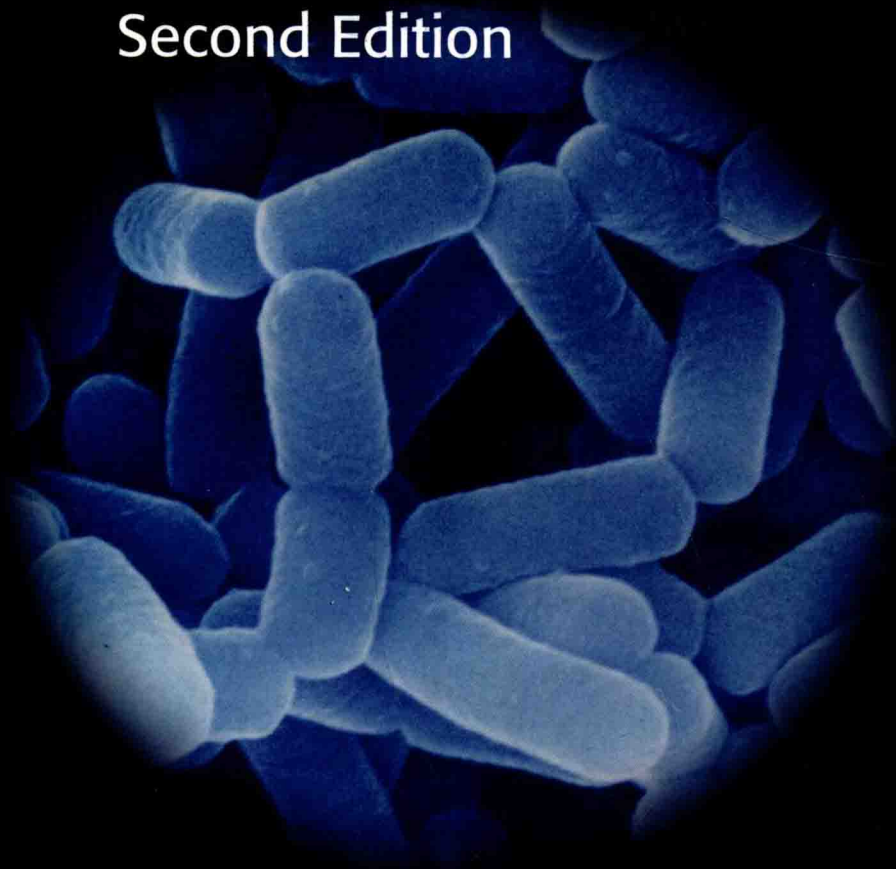


# *The* Microbiology *of* Safe Food

Second Edition



Stephen J. Forsythe

 WILEY-BLACKWELL



# The Microbiology of Safe Food

**Second edition**

**Stephen J. Forsythe**

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 **WILEY-BLACKWELL**

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# **The Microbiology of Safe Food**

## Preface to second edition

Although I was pleased with the first edition of this book (MoSF), I nevertheless felt that it was not complete. This new edition tries to address this by including new sections on bioinformatics, biothreats and personnel, as well as updating many other sections. Since 2000, the topic of microbiological risk assessment has increased, and subsequently, I have incorporated parts of my other Blackwell's book *Microbiological Risk Assessment of Food* (2002) into Chapter 10 as it was a substantial improvement on the first MoSF edition's few pages. My appreciation is due to Simon Illingworth (LabM, Bury, UK) for reviewing Chapter 5 on detection methods for me.

A major change is the complementing websites at <http://www.wiley.com/go/forsythe>. This was available with the first edition, but was an afterthought and so unfortunately was not fully utilised. In fact, it was one of the first web-based supported books by Blackwells, and the listing of URL in the Appendix was considered a 'novelty'! How much has changed since 2000. I am using the web for two main purposes. Firstly to keep some chapters up-to-date, and secondly to offer various data exercises which are not in keeping with the book format. One aspect which I have been wanting to expand and encourage 'younger' readers to explore is the application of genomics, post-genomics and bioinformatics to food microbiology. Again, the first edition included microarrays but not the tools for one to investigate microbial genomes for oneself. In fact, 2000, the year MoSF was published, was also the year when the first version of the *Campylobacter jejuni* genome was released, and since the MoSF text was written in 1999, the whole topic of microbial genomics was not even on the radar. The fact that genomes are sequenced faster than they can be fully annotated means that one can quickly discover something which no one else has even known before, and I hope the bioinformatics aspects will enable and encourage readers to try *in silico* research. One topic which was gaining increasing public attention in 1999–2000 was BSE-vCJD. It appears in the intervening years that we have possibly passed the peak incidence, fortunately. However, over the same period, the spectre of bioterrorism has arisen and so this issue is addressed in a new section of this edition.

One thing which has not changed between these two editions is the unacceptable high incidence of foodborne disease. Even more alarming is that we still are only aware of the 'tip of the iceberg' with regard to its true incidence. When one considers that it has been estimated that in the United States, 3400 deaths are due to unknown foodborne agents (Frenzen *et al.* 2005), then there is evidently a considerable amount of research and investment still to be undertaken.

Confession time, it was my full intention to complete this new edition for publication in 2005. However, our intensive research into *Cronobacter* spp. (*Enterobacter sakazakii*) and related organisms have taken up more of my time than the hours in the day can permit. This emergent pathogen, sadly, can infect neonates causing severe illness, and even death. In order not to unbalance this book by excessive reference to this organism of my own personal interest,

readers should consult the 2008 ASM Press book *Enterobacter sakazakii*, edited by myself and Jeff Farber (Health Canada) as well as my homepage (see <http://www.wiley.com/go/forsythe>).

As always, my thanks and appreciation go to Nigel Balmforth, David McDade and especially Katy Loftus at Wiley-Blackwell for their patience as the deadlines made a whooshing sound as they went by (frequently). Finally, a special thanks to my forever supportive wife Debbie, my children James and Rachel, and my parents – without whom none of this would have been possible.

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Nottingham Trent University

## Preface to first edition

Throughout the world, food production has become more complex. Frequently, raw materials are sourced globally and the food is processed through an increasing variety of techniques. No longer does the local farm serve the local community through a local shop; nowadays, there are international corporations adhering to national and international regimes. Therefore, approaches to safe food production are being assessed on an expanding platform from national, European, trans-Atlantic and beyond. Against this backdrop, there have been numerous highly publicised food safety issues such as BSE and *E. coli* O157:H7 which have caused the general public to become more cautious of vociferous concerning food issues. The controversy in Europe over genetically modified foods is perceived by the general public within the context of 'food poisoning'.

This book aims to review the production of food and the level of micro-organisms which humans ingest. Certain circumstances require zero tolerances for pathogens, whereas more frequently, there are acceptable limits set, albeit with statistical accuracy or inaccuracy depending upon whether you subsequently suffer from food poisoning. Microbes are traditionally ingested in fermented foods and this has developed into the subject of pre- and probiotics with refuted health benefits. Whether engineered 'functional foods' will be able to attain consumer acceptance remains to be seen.

Food microbiology covers both food pathogens and food spoilage organisms. This book aims to cover the wide range of micro-organisms occurring in food, both as contaminants and deliberate inoculation. Due to the heightened public awareness over food poisoning, it is important that all companies in the food chain maintain high hygienic standards and assure the public of the safety of the produce. Obviously, over time, there are technological changes in production methods and methods of microbiological analysis. Therefore, the food microbiologist needs to know the effect of processing changes (pH, temperature, etc.) on the microbial load. To this end, this book reviews the dominant foodborne micro-organisms, the means of their detection, microbiological criteria as the numerical means of interpreting end-product testing, predictive microbiology as a tool to understand the consequences of processing changes, the role of 'Hazard Analysis Critical Control Point' (HACCP) and the objectives of Microbial Risk Assessment (MRA) and the setting of Food Safety Objectives which have recently become a focus of attention. In recent years, the web has become an invaluable source of information and to reflect this a range of useful food safety resource sites are given in the back to encourage the reader to boldly go and surf. Although primarily aimed for undergraduate and postgraduate courses, I hope the book will also be of use to those working in industry.

The majority of this book was written during the last months of 1999, a time when France was being taken to the European Court over its refusal to sell British beef due to BSE/nvCJD and there had been riots in Seattle concerning the World Trade Organisation. Whilst large organisations

were wondering about the impact of the millennium bug, in the United Kingdom, the public were waiting to see the impact of the BSE 'bug' (a few hundred or a few thousand cases?).

As usual, no book can be achieved without assistance, and special thanks are due to Phil Vosey concerning MRA, Ming Lo for considerable help with the computer packages, Alison at Oxoid Ltd for the invaluable information on microbiological testing procedures around the world, Pete Silley and Andrew Pridmore at Don Whitley Scientific Ltd for the RABIT diagrams, and Garth Lang at Biotrace Ltd for the ATP bioluminescence data. Not forgetting of course Debbie and Cathy for reading through the draft copy, nevertheless all mistakes are the author's fault.

This book is especially dedicated to Debbie, James and Rachel, Mum and Dad for their patience whilst I have been burning the midnight oil.

Dr Steve Forsythe on 6 January, 2000



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