

3rd Edition

Edited by Janet E L Corry, Gordon D W Curtis and Rosamund M Baird

Handbook of Culture Media for Food and Water Microbiology



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Microbiology
3rd Edition

Acknowledgements

This book is the result of the work of many microbiologists who have taken part in the meetings of the Working Party on Culture Media since its inception in 1978. The International Committee on Food Microbiology and Hygiene of the International Union of Microbiological Societies thanks all those who participated in the meetings and in particular those who prepared monographs for discussion: R.M. Baird, V. Bartl, L.R. Beuchat, R.M. Blood, E. de Boer, F.J. Bolton, R.E. Brackett, G.D.W. Curtis, A.R. Datta, L. Dominguez Rodriguez, E. Elliot, J.M. Farber, G.A. Gardner, W.H. Holzapfel, R. Holbrook, G. Klein, R.V. Lachica, J.V. Lee, W.H. Lee, S.J. Lewis, B.M. Mackey, G.C. Mead, S.C. Morgan Jones, the late D.A.A. Mossel, P. van Netten, J.D. Oliver, I. Perales, T. Petersen, D.J. Pusch, B. Ralovich, G. Reuter, D.P. Sartory, M. van Schothorst, the late D.A.L. Seiler, N. P. Skovgaard, B. Swaminathan, H. Veenendaal, S. in't Veld, J. Watkins, G. Wauters, G. Weenk and P. Zangerl. The various Editors-in-Chief of the International Journal of Food Microbiology, have been unfailingly helpful and patient in the publication of proceedings in that journal.

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Introduction to the Third Edition

In the eight years since the second edition of this book was published we have held three meetings of the ICFMH Working Party on Culture Media. The first was held in 2003 in Ljubliana during a FEMS Microbiology symposium, the second in Bologna during the IUMS ICFMH Food Micro 2006 symposium, and the final meeting of the authors of the chapters in the third edition was held at Bath University in 2008.

Apart from the change of publisher, this edition, with the exception of Chapter 2, has been completely revised, and differs from those that preceded it in a number of respects:

- 1 We have extended our remit to include media used by water microbiologists as well as food microbiologists in all chapters, and, in particular, we have added two chapters dealing specifically with the detection of microbes of importance with respect to water. One discusses the different methods used by water and food microbiologists to look for similar microbes, while the other deals with a particularly important water-borne pathogen, *Legionella*. As a result, we have also changed the title of our book to reflect the broader scope. We are grateful to Dr Sue Passmore for her assistance in editing these chapters.
- 2 For some media we have included coloured illustrations, many of which have been provided by commercial medium manufacturers.
- 3 We have included extra monographs – some for water media as well as extra media used in food microbiology – in addition we have inserted CAS numbers for the ingredients in the monographs, for which we are grateful to Dr Patrick Druggan.

Outside the WPCM, Gordon Curtis has taken an active part in on the revision of ISO 11133. This standard has incorporated many features first proposed by WPCM for performance testing of culture media. It has also led to

a noteworthy cooperation between two constituent parts of the IUMS, the WPCM and the World Federation of Culture Collections, to produce a list of Universal Strain Identifiers by collation of the catalogue numbers of test strains in various national culture collections. A database containing this information has been prepared by the World Data Centre for Microorganisms and is available at <<http://refs.wdcm.org/home.htm>>

We are all now retired, but would like to encourage a further edition of this book edited by some younger colleagues.

Finally, and most important, we would like to dedicate this edition to the memory of Professor David Mossel, (1919–2004) from whose idea this book was developed.

Janet E.L. Corry, Gordon D.W. Curtis
and Rosamund M. Baird

Introduction to the Second Edition

The reception given to the first edition of this book, including citation in a draft standard (CEN, 2000) and in the manuals of medium manufacturers, led us to believe that a revision would be of value.

Since the publication of the book in 1995 there have been three meetings of the ICFMH Working Party on Culture Media. A number of papers delivered at the Workshop in Budapest in 1996 were published (Corry, 1998). These included consideration of development of standard microbiological methods, validation systems for new methods and the use of reference materials. The second Workshop was held during the Food Micro '99 meeting in Veldhoven, The Netherlands and the most recent, generously funded by Becton Dickinson, at Temse, Belgium in 2000. Topics considered included updates on media and methods for the various microbe groups covered in the first edition of this book; consideration of the effect of sublethal damage on recovery of microbes from foods using traditional methods, and the development of new medium monographs. This new edition of *Culture Media for Food Microbiology* includes some revised, some completely rewritten and some new chapters, mostly derived from these two meetings. There are completely new chapters on stressed organisms, *Shigella* spp., *Alicyclobacillus acidoterrestris*, flavobacteria and bifidobacteria, while the chapters on Enterobacteriaceae, non-sporulating Gram positive spoilage bacteria and the *Aeromonas/Pseudomonas/Plesiomonas shigelloides* groups have been divided to reflect the growing specialised interest in some of these organisms. In particular, the pathogenic Enterobacteriaceae (pathogenic *Escherichia coli*, *Shigella* spp. and salmonellas) are dealt with separately from the indicator organisms – 'coliforms' and Enterobacteriaceae. New medium monographs include two for *Aeromonas* spp., two for *E. coli* O157:H7, two for *Streptococcus thermophilus*, as well as iron sulphite agar for thermophilic sporeforming spoilage bacteria. A few monographs on media for *Listeria* spp., that are rarely used, have been omitted, and 'half Fraser broth' has been added.

A number of monographs exist in draft form, awaiting evaluation before publication. After discussion by members of the Working Party these will be

categorised as 'Proposed' or 'Approved' and published in the International Journal of Food Microbiology from time to time. A list of monographs in draft or Proposed form can be obtained by application to gdwcurtis@hcs.oxford.fsnet.co.uk. We rely upon readers to assist us in evaluating new monographs, to use the methods and test organisms suggested in this volume, and to inform the editors of any errors or ambiguities found in published or draft monographs or methods. Please send us any comments or suggestions you may have concerning improvements, deletions or additions that can be made in future editions.

Janet E.L. Corry, G.D.W. Curtis
and Rosamund M. Baird

Introduction to the First Edition

The roots of this book are an idea of the past president of the International Committee for Food Microbiology and Hygiene (ICFMH), Professor David Mossel, who formed the Working Party on Quality Assurance of Culture Media in 1978. This group convened its first meeting in Mallorca, Spain in 1979. In those days little attention was paid by many food microbiologists to the possibility that the media they used might not always function optimally. This applied especially to selective media used to isolate pathogens. The Mallorca meeting, funded by the Merck Society for Arts and Science, brought together 35 microbiologists from 13 countries. Topics covered included quality assurance tests used for raw materials for media, microbiological methods of monitoring complete media and particular problems encountered with media developed for specific groups of micro-organisms. Areas identified as requiring particular investigation were: standard methods and choice of reference strains for use in media monitoring; guidance concerning the effect of substrate (*e.g.* type of food examined); the effects of sublethal damage and competitive flora; information concerning the shelf-life of dehydrated media, rehydrated media and poured plates.

Inhibitors such as bile salts and brilliant green were identified as unsatisfactory because they were poorly defined and methods were needed for monitoring them. The proceedings were published in a book (Corry, 1982).

The sequel to the Mallorca meeting was held in Dallas, USA, in 1981, funded by Oxoid Ltd. Most contributions were concerned with selective media developed for specific groups of food-related pathogens but it was at this time that the possibility of producing a 'pharmacopoeia' of culture media was first discussed in depth following a paper presented by Dr Vladimir Bartl from Prague. The proceedings were published in a special issue of the *Archiv für Lebensmittelhygiene* (Corry and Baird, 1982).

The third meeting of the Working Party held in London in January 1984 and funded by Difco Inc., was the first at which all three editors of this pharmacopoeia were present. The proceedings appeared in a special issue of the new ICFMH journal, the *International Journal of Food Microbiology* (Baird *et al.*, 1988) which set the scene for (i) the format of the information to be included

in the monographs for each medium (supplied, appropriately, by Rosamund Baird, whose first degree is in pharmacy): (ii) the protocol for microbiological testing of culture media, devised by a committee of the Working Party chaired by Gordon Curtis and (iii) the media for which monographs were to be written.

There followed two years of hard work editing the pharmacopoeia and organising the fourth meeting of the Working Party. This was held in association with the IUMS 14th International Congress of Microbiology in Manchester, England in 1986 and funded by a consortium of manufacturers and Elsevier Science B.V. It was a highly productive meeting lasting two very full days and considered draft monographs for 42 different media. As a result of this meeting a complete issue of the International Journal of Food Microbiology was published containing all the monographs as well as standard methods of testing the selectivity and productivity of solid and liquid media and a list of standard strains to be used for testing media performance (Baird *et al.*, 1987).

A subsequent meeting in Budapest in 1988 added more monographs, many of which were for *Listeria monocytogenes* media (Baird *et al.*, 1989). This bacterium was by then attracting widespread attention as a 'new' food-borne pathogen.

There followed a period of consolidation while food microbiologists from all parts of the world were requested to monitor their media using the test strains and methods prescribed. In 1992 a four day meeting was held in Heidelberg, funded by Becton Dickinson, at which all the monographs were reviewed, some were added and some deleted. The results of media monitoring using standard strains as well as 'in house' strains of test organisms were presented and analysed by approximately 30 participants and as a result, the numbers of test organisms recommended for monitoring each medium were reduced and the total number of strains recommended for use were rationalised. The new monographs as well as a series of reviews of media for different groups of food micro-organisms were published in the International Journal of Food Microbiology. All current monographs together with these reviews are collected in this new volume.

We hope that microbiologists specialising in food and related areas, particularly those who are members of or who aspire to join a laboratory accreditation scheme, will find this book useful.

We have tried to include all the media most commonly used in food microbiology. Inclusion of a medium, however, implies no endorsement of its superiority over other media, and likewise, there will be good media that are absent from our book. Topics that still need to be addressed include the standardisation of undefined ingredients such as blood, plasma, bile and brilliant green, procedures for resuscitation of sublethally-damaged organisms and the effect of the type of food on the optimal method of examination.

We rely upon readers to use the methods and test organisms suggested and to inform the editors of any errors or ambiguities found. Please send us any

comments or suggestions you may have concerning improvements, deletions or additions that can be made in future editions.

Janet E.L. Corry, G.D.W. Curtis
and Rosamund M. Baird

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