Handbook of New Bacterial Systematics

Edited by

M. GOODFELLOW
Department of Microbiology, The Medical School, Framlington Place, Newcastle upon Tyne, UK

and

A. G. O’DONNELL
Department of Agricultural and Environmental Science, The University, Newcastle upon Tyne, UK

ACADEMIC PRESS
Harcourt Brace & Company, Publishers
London San Diego New York Boston Sydney Tokyo Toronto
Contents

Preface ix
Contributors xi

I. INTRODUCTION

1 Roots of Bacterial Systematics
   M. Goodfellow and A. G. O'Donnell
   1. Introduction 3
   2. Guiding concepts 6
   3. An historical perspective 17
   4. Towards a modern taxonomy 20
   5. Integration of genotypic and phenotypic data 39
      References 41

II. CLASSIFICATION

2 Structure of the Bacterial Genome
   N. J. Palleroni
   1. Introduction 57
   2. Genome organization 58
   3. Genome replication 75
   4. Gene expression 78
   5. Genome evolution 91
   6. Epilogue: genome structure and systematics 95
      References 98

3 Plasmids, Transposons and Gene Flux
   C. R. Harwood
   1. Introduction 116
2. General properties of plasmids 110
3. General properties of transposons 128
4. Barriers to the maintenance of non-homologous DNA 138
5. Impact of plasmids and transposons on systematics and bacterial evolution 147
6. Concluding remarks 149
References 149

4 Nucleic Acids and Classification
E. Stackebrandt and W. Liesack
1. Introduction 157
2. Basic procedures 158
3. General characterization of the genome 158
4. Nucleic acid hybridization 161
5. Determination of relationships by sequence comparison of ribosomal RNA 166
6. Determination of relationships by sequence comparison of DNA 170
7. Application of phylogenetic parameters in bacterial systematics 182
8. Conclusions and future developments 183
References 185

5 Cell Envelopes and Classification
K. Suzuki, M. Goodfellow and A. G. O'Donnell
1. Introduction 195
2. Lipids 196
3. Peptidoglycans 232
4. Conclusions 237
References 238

6 Protein Electrophoresis and Classification
L. Vauterin, J. Swings and K. Kersters
1. Introduction 251
2. Electrophoresis of cellular proteins 253
3. Electrophoresis of ribosomal proteins 266
4. Electrophoresis of cell envelope proteins 267
5. Enzyme electrophoresis 268
6. Conclusions 271
References 272

7 Computer-assisted Classification
M. J. Sackin and D. Jones
1. Introduction 282
2. Planning a computer-assisted classification 283
3. Computer-methods: general 284
4. Hierarchical methods 287
5. Non-hierarchical methods 301
6. Pros and cons of hierarchical and non-hierarchical methods 306
CONTENTS

7. Choosing a program 306
8. Impact on bacterial taxonomy 307
9. Conclusions 309
   References 309

III. NOMENCLATURE

8 Bacterial Nomenclature and its Role in Systematics
   I. J. Bousfield
   1. Introduction 318
   2. The Bacteriological Code 318
   3. Taxonomic categories 319
   4. Function of names 320
   5. Formation of names 320
   6. The type concept 322
   7. Publication of names 324
   8. Approved lists of bacterial names 328
   9. Changes of names 329
  10. Citation of names 333
  11. Proposing a new name 334
      References 336

9 Nomenclatural Literacy
   T. O. MacAdoo
   1. The binomial system 339
   2. The importance of accuracy 341
   3. Tools of the trade 341
   4. Latin and Greek 343
   5. The Latin declensions 344
   6. The Greek alphabet and its Latin equivalents 345
   7. The Greek declensions and their Latin equivalents 346
   8. Adjectives and participles 347
   9. Compounding in Latin and Greek 349
  10. The latinizing of modern proper names 350
  11. The forming of names and epithets 353
  12. How to help a classicist help you 355
      References 357

IV. IDENTIFICATION

10 Computer-assisted Identification
   F. G. Priest and S. T. Williams
   1. Introduction 361
   2. Preparation of the database 363
   3. Approaches to identification 368
   4. Evaluation and application of identification systems 375
5. Concluding remarks
References

11 Whole-organism Fingerprinting

J. Magee
1. Introduction
2. Pyrolysis-based techniques
3. Laser microprobe analysis
4. Infrared and Raman spectrometry
5. Summary and conclusions
References

12 Serological Identification

G. H. W. Bowden
1. Introduction
2. Serological methods in identification and analysis
3. Methods used to demonstrate a reaction between antigen and antibody
4. Antibodies in bacterial serology
5. Specificity of antisera and monoclonal antibodies
6. Conclusions and future trends
References

13 Nucleic Acid Probes

K. H. Schleifer, W. Ludwig and R. Amann
1. Introduction
2. Design of a nucleic acid probe
3. Labelling of nucleic acid probes
4. Preparation of target nucleic acid
5. Hybridization methods and detection
6. Increasing the sensitivity
7. Identification of infrasubspecific taxa
8. Applications
9. Conclusions and future developments
References

V. CONCLUSIONS

14 Future of Bacterial Systematics

A. G. O’Donnell, T. M. Embley and M. Goodfellow

Glossary of Taxonomic Terms

Subject Index