

TABLE OF CONTENTS – Molecular Techniques in Food Biology: Safety, Biotechnology, Authenticity and Traceability

List of Contributors

Preface

Acknowledgments

Section I General Topics 1

1 How to Determine the Geographical Origin of Food by Molecular Techniques 3

Aly Farag El Sheikha

1.1 Linkage Between Food and Its Geographical Origin: Historical View 3

1.2 Scope and Approach 4

1.3 Definitions Related to Tracking of Food Origins 4

1.4 Driving Forces for Determining the Geo•]origin of Food 8

1.5 Geo•] origin Determination ... Evolution of Molecular Techniques 13

1.6 Pros and Cons of Molecular Techniques Used as Geo•]Discriminative Tools of Food 16

1.7 Conclusions 17

References 18

2 Unraveling Pathogenic Behavior of Phytopathogens through Advanced Molecular Techniques 27

Avantina S. Bhandari and Neeta Sharma

2.1 Introduction 27

2.2 Plant Pathogens: A Menace to Agricultural Productivity 28

2.3 Future Directions 38

References 39

3 Molecular Characterization of Ochratoxigenic Fungal Flora as an Innovative Tool to Certify Coffee Origin 47

Aly Farag El Sheikha and Nadege Donkeng Nganou

3.1 Introduction: Coffee Factsheet 47

3.2 The Microflora of Coffee 50

3.3 Detection of Ochratoxigenic Fungi in Coffee by Molecular Techniques 55

3.4 Using Molecular Detection of OTA•]producing Fungi to Certify Coffee Origin: Is it Possible? 57

3.5 Conclusions and Future Perspectives 63

References 63

4 Molecular and “Omics” Techniques for Studying Gut Microbiota Relevant to Food Animal Production 71

Joshua Gong, Chengbo Yang, and Ehsan Khafipour

4.1 Introduction 71

4.2 Methods for Studying Gut Microbiota Composition 72

4.3 Culture•] independent Techniques 72

4.4 Tools for Functional Studies of Gut Microbiota 75

4.5 “Omics” 76

4.6 Animal Models 78

4.7 Bioinformatics 79

4.8 Application in Poultry and Swine Research 80

4.9 Integrated Approaches for Studying Gut Microbiome 83

4.10 Conclusions and Future Directions 84

Acknowledgments 85

References 85

5 Molecular Techniques for Making Recombinant Enzymes Used in Food Processing 95

Wenjing Hua, Aly Farag El Sheikha, and Jianping Xu

5.1 Introduction 95

5.2 Molecular Strategies to Produce Recombinant Enzymes Used in the Food Industry 96

5.3 Applications and Safety Issues of Enzymes in the Food Industry 106

5.4 Conclusions and Future Perspectives 109

References 110

Section II Fruits and Vegetables 115

6 Molecular Identification and Distribution of Yeasts in Fruits 117

Justine Ting, Rui Xu, and Jianping Xu

6.1 Introduction 117

6.2 Molecular Methods for Distinguishing Yeast Species and Strains 118

6.3 Yeast Diversity in Wild/fresh Fruits 120

6.4 Yeast Diversity in Processed Fruits 134

6.5 Conclusions and Future Perspectives 141

Acknowledgments 142

References 142

7 Current and New Insights on Molecular Methods to Identify Microbial Growth in Fruit Juices 145

Elena Rosello• JSoto, Sonia Barba• JOrellana, Mohamed Koubaa, Shahin Roohinejad, Francisco Quilez, and Francisco J. Barba

7.1 Introduction 145

7.2 Microorganisms in Fruit Juices 146

7.3 Conventional Identification Techniques 148

7.4 Non•] conventional Identification Techniques 150

7.5 Molecular Techniques 151

7.6 Conclusions and Future Perspectives 154

References 154

Section III Fish and Meat Products (Non-Fermented) 161

8 Molecular Techniques Related to the Identification of the Bacterial Flora of Seafood 163

Robert E. Levin

8.1 Introduction 163

8.2 Major Seafood Spoilage Bacteria 164

8.3 Seafood-borne Bacterial Pathogens 183

8.4 Conclusions and Future Perspectives 201

References 201

9 Assessment of the Microbial Ecology of Meat and Meat Products at the Molecular Level: Current Status and Future Perspectives 215

Spiros Paramithiotis, Agni Hadjilouka, and Eleftherios H. Drosinos

9.1 Introduction 215

9.2 Extraction of Nucleic Acids 216

9.3 Microbial Communities Assessment 216

9.4 Detection of Selected Bacterial Target 220

9.5 Biodiversity Assessment 225

9.6 Conclusion and Future Perspectives 226

References 227

Section IV Fermented Foods and Beverages 239

10 Revolution in Fermented Foods: From Artisan Household Technology to the Era of Biotechnology 241

Aly Farag El Sheikha

10.1 Introduction 241

10.2 Historical View: Where and When Did Fermentation Start? 242

10.3 Fermented Foods: From the Past to the Current Era 243

10.4 Fermented Foods and Health Effects 246

10.5 Is it Possible to Trace the Geographical Origin of Fermented Foods? 249

10.6 Conclusions and Future Perspectives 252

References 254

11 Molecular Techniques for the Identification of LAB in Fermented Cereal and Meat Products 261

Malik Altaf Hussain

11.1 Introduction 261

11.2 Fermented Food Products 262

11.3 Lactic Acid Bacteria and Fermented Foods 265

11.4 Molecular Approaches Used to Study Fermenting Microflora 268

11.5 Identification of Lab in Fermented Cereal and Meat Products 269

11.6 Advantages of Molecular Techniques 275

11.7 Concluding Remarks 275

Acknowledgment 277

References 277

12 Molecular Techniques and Lactic Acid•]Fermented Fruits and Vegetables 285

Aly Farag El Sheikha

12.1 Introduction 285

12.2 Fermented Fruits and Vegetables: Between the Past and the Present 286

12.3 Benefits of Fermented Fruits and Vegetables 286

12.4 Techniques of Lab Analysis Used in Fermented Fruits and Vegetables 288

12.5 Future Applications 300

12.6 Conclusions 300

References 300

13 New Trends in Molecular Techniques to Identify Microorganisms in Dairy Products 309

Elena Rosello•]Soto, Sonia Barba•]Orellana, Francisco J. Barba, Francisco Quilez, Shahin Roohinejad, and Mohamed Koubaa

13.1 Introduction 309

13.2 Polymerase Chain Reaction (PCR)•]based Methods 310

13.3 Fluorescent *In Situ* Hybridization 316

13.4 Immuno•]based Methodologies, Biochips, and Nanosensors 317

13.5 Benefits and Limitations of Molecular Techniques 318

13.6 Conclusions and Future Perspectives 318

References 318

14 Molecular Techniques for the Detection and Identification of Yeasts in Wine 323

Cecilia Diaz, Grigori Badalyan, and Mark Bucking

14.1 Introduction 323

14.2 Methods of Identification and Detection of Biodiversity 327

14.3 Enumeration of Wine Yeasts 330

14.4 Diversity of Wine Yeasts 332

14.5 Conclusions and Future Perspectives 334

References 334

Section V Foodborne Pathogens and Food Safety 341

15 Rapid Detection of Food Pathogens Using Molecular Methods 343

R.M.U.S.K. Rathnayaka, Rakshit K. Devappa, and Sudip Kumar Rakshit

15.1 Introduction 343

15.2 Methods Used to Detect Foodborne Pathogens 344

15.3 Conclusions 355

References 355

16 Biosensor•]Based Techniques: A Reliable and Primary Tool for Detection of Foodborne Pathogens 361

Moni Gupta, Baby Summuna, Sachin Gupta, and Deepika Sharma

16.1 Introduction 361

16.2 Ideal Requirements for Biosensor•]Based Microbial Detection Assay 366

16.3 Need for Rapid Method 367

16.4 Classification of Biosensors 367

16.5 Conclusions and Future Perspectives 378

References 379

17 Molecular Identification and Detection of Foodborne and Feedborne Mycotoxigenic Fungi 385

Glaucia E.O. Midorikawa, Robert N.G. Miller, and Daniela M. de C. Bittencourt

17.1 Mycotoxigenic Fungi 385

17.2 Polymerase Chain Reaction• Jbased Characterization of Mycotoxigenic Fungi 386

17.3 Genomics of Mycotoxigenic Fungi 394

17.4 Functional Genomics of Mycotoxigenic Fungi 396

17.5 Conclusions and Future Perspectives 398

References 398

18 Molecular Identification of Enteric Viruses in Fresh Produce 409

Martin D'Agostino and Nigel Cook

18.1 Introduction 409

18.2 Sample Treatment 410

18.3 Sample Receipt 410

18.4 Removal of Viruses from the Food Surfaces 410

18.5 Removal of Food Substances 411

18.6 Concentration of Viruses 411

18.7 Nucleic Acid Extraction 411

18.8 Detection Assay 412

18.9 ISO 15216• J1/2:2013: The Future “Gold Standard” 413

18.10 Quantitation 415

18.11 What is a Positive? 415

18.12 Future Developments and Requirements 416

18.13 Conclusions and Future Perspectives 416

References 417

Section VI Future Perspectives 421

**19 Molecular Techniques and Foodstuffs: Innovative Fingerprints, Then What?
423**

Aly Farag El Sheikha and Jianping Xu

19.1 Introduction 423

19.2 Emerging Fingerprinting Technologies 424

19.3 DNA Fingerprints 426

19.4 Conclusions and Future Perspectives 428

References 431

Index 435.