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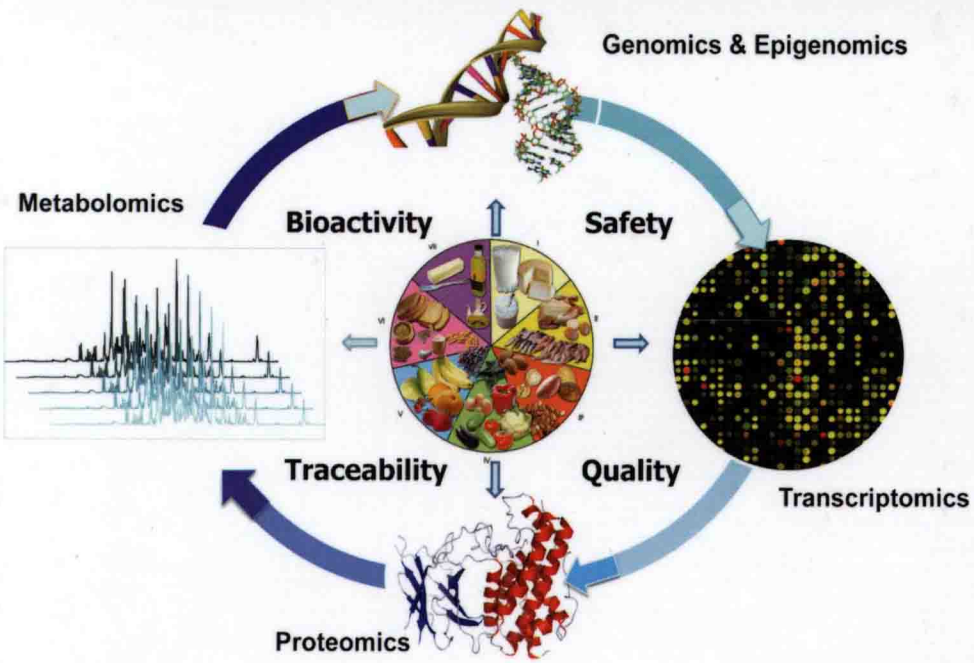
Foodomics

Advanced Mass Spectrometry in Modern Food Science and Nutrition

EDITED BY **Alejandro Cifuentes**



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FOODOMICS

Advanced Mass Spectrometry in Modern Food Science and Nutrition

Edited by

ALEJANDRO CIFUENTES
Laboratory of Foodomics (CIAL)
National Research Council (CSIC)
Madrid, Spain

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FOODOMICS

WILEY SERIES ON MASS SPECTROMETRY

Series Editors

Dominic M. Desiderio
Departments of Neurology and Biochemistry
University of Tennessee Health Science Center

Nico M. M. Nibbering
Vrije Universiteit Amsterdam, The Netherlands

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To the three women in my life, Susana, Claudia and Fernanda, every day they make of this world a better place to be.

A las tres mujeres de mi vida, Susana, Claudia y Fernanda, porque cada día ellas hacen de este mundo un lugar mejor donde vivir.

PREFACE

The impressive analytical developments achieved at the end of the twentieth century have made possible the sequencing of nearly the whole human genome at the beginning of the twenty-first century, opening the so-called *postgenomic era*. These advances have made feasible analytical instruments and methodological developments that were unthinkable a few decades ago. These impressive developments have traditionally found their first application in the biotechnological or biochemical field many times linked to pharmaceutical, medical, or clinical needs. The huge amount of money allocated to these fields of research is logically an additional push to be considered when selecting the area in which a new analytical method can be probed, a good way to compensate the efforts behind any innovative analytical development. As a result, biotech, pharmaceutical, and clinical related industries have usually been the first targets for analytical chemists and instrumentation companies. This has left food analysis overshadowed and connected to the use of more traditional analytical approaches. Nowadays, boundaries among the different research fields are becoming more and more diffuse giving rise to impressive possibilities in the emerging interdisciplinary areas, for example, health and food. As a result, researchers in food science and nutrition are being pushed to move from classical methodologies to more advanced strategies usually borrowing methods well established in medical, pharmacological, and/or biotechnology research. This trend has generated the emergence of new areas of research for which a new terminology is required. In this context, our group defined a few years ago *Foodomics, as a discipline that studies the food and nutrition domains through the application of advanced omics technologies to improve consumer's well-being, health, and confidence*. The main idea behind the use of this new term has been not only to use it as a flag of the new times for food analysis but also to highlight that the investigation into traditional and new problems in food analysis

in the postgenomic era can find exciting opportunities and new answers through the use of genomics, transcriptomics, epigenetics, proteomics, and metabolomics tools. Indeed, *Foodomics* is opening a new and unexpected land still wild, still unexplored, to a new generation of researchers who, using the everyday more powerful omics technologies, can find original search possibilities and innovative answers to crucial questions not only related to food science but also related to its complex links with our health.

The interest of the scientific community in modern food analysis and *Foodomics*, and the different trends in this hot area of research are well documented in the 20 chapters that compose this volume on "*Foodomics: Advanced Mass Spectrometry in Modern Food Science and Nutrition*", the first book devoted to this new discipline in which the authors present their advanced perspective of the topic. Namely, in the first chapter the principles of Foodomics are presented, the next five chapters (chapter 2 to 6) are devoted to proteomics applications in Foodomics, including a description of modern instruments and methods for proteomics, proteomic-based techniques for food science and food allergens characterization, examination of antioxidant food supplements using advanced proteomics methods and proteomics in nutritional systems biology. The next two chapters (chapters 7 and 8) are devoted to the description of advanced MS-based methodologies to study transgenic foods development and characterization and the microbial metabolome. The following nine chapters (chapters 9 to 17) are devoted to metabolomics developments in Foodomics with special emphasis on the possibilities of MS-based metabolomics in nutrition and health research, for food safety, quality, and traceability, the investigations on future personalized nutrition, the study of the effect of the diet on acute and endurance exercise, the investigation on diet-related diseases, and the study on how Foodomics impact optimal nutrition or can provide crucial information on micronutrients (the case of folates), phenolic compounds as functional ingredients, and lipids (lipidomics). The following two chapters (chapters 18 and 19) present the main principles of Green Foodomics and the use of chemometrics in mass spectrometry and Foodomics. The last chapter of the book is devoted to the description of the possibilities of systems biology in food and nutrition research.

As editor of this book devoted to "*Foodomics: Advanced Mass Spectrometry in Modern Food Science and Nutrition*", I would like to thank all the authors for their suitable contributions, Dom Desiderio for inviting me to prepare this piece of work, Michael Leventhal for his help and support, and to those in the John Wiley & Sons team who contributed their effort to the preparation of this volume.

ALEJANDRO CIFUENTES

CONTRIBUTORS

Francesco Addeo, Dipartimento di Scienza degli Alimenti, University of Naples Federico II, Naples, Italy

Juan Pablo Albar, Functional Proteomics Group, Centro Nacional de Biotecnología–CSIC, Madrid, Spain

Lluís Arola, Centre Tecnològic de Nutrició i Salut (CTNS), TECNIO, Reus, Spain; Departament de Bioquímica i Biotecnologia, Nutrigenomics Research Group, Universitat Rovira i Virgili, Tarragona, Spain

Anna Arola-Arnal, Departament de Bioquímica i Biotecnologia, Nutrigenomics Research Group, Universitat Rovira i Virgili, Tarragona, Spain

Coral Barbas, Center for Metabolomics and Bioanalysis (CEMBIO), Facultad de Farmacia, Universidad CEU San Pablo, Boadilla del Monte, Madrid, Spain

Isabel Bondia-Pons, Quantitative Biology and Bioinformatics, VTT Technical Research Centre of Finland, Espoo, Finland

Antoni Caimari, Centre Tecnològic de Nutrició i Salut (CTNS), TECNIO, Reus, Spain

Mónica Carrera, Institute of Molecular Systems Biology, ETH Zürich, Zürich, Switzerland

María Castro-Puyana, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

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Juan Pablo Albar, Functional Proteomics Group, Centro Nacional de Biotecnología–CSIC, Madrid, Spain

Lluís Arola, Centre Tecnològic de Nutrició i Salut (CTNS), TECNIO, Reus, Spain; Departament de Bioquímica i Biotecnologia, Nutrigenomics Research Group, Universitat Rovira i Virgili, Tarragona, Spain

Anna Arola-Arnal, Departament de Bioquímica i Biotecnologia, Nutrigenomics Research Group, Universitat Rovira i Virgili, Tarragona, Spain

Coral Barbas, Center for Metabolomics and Bioanalysis (CEMBIO), Facultad de Farmacia, Universidad CEU San Pablo, Boadilla del Monte, Madrid, Spain

Isabel Bondia-Pons, Quantitative Biology and Bioinformatics, VTT Technical Research Centre of Finland, Espoo, Finland

Antoni Caimari, Centre Tecnològic de Nutrició i Salut (CTNS), TECNIO, Reus, Spain

Mónica Carrera, Institute of Molecular Systems Biology, ETH Zürich, Zürich, Switzerland

María Castro-Puyana, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

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Alejandro Cifuentes, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Sebastiano Collino, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Anna Crescenti, Centre Tecnològic de Nutrició i Salut (CTNS), TECNIO, Reus, Spain

Josep M. del Bas, Centre Tecnològic de Nutrició i Salut (CTNS), TECNIO, Reus, Spain

Sylvia H. Duncan, Rowett Institute of Nutrition and Health, University of Aberdeen, Aberdeen, UK

Susan J. Duthie, Natural Products Group, Division of Lifelong Health, Rowett Institute of Nutrition and Health, University of Aberdeen, Aberdeen, UK

Søren B. Engelsen, Faculty of Science, University of Copenhagen, Copenhagen, Denmark

Marcela A. Erazo, Center for Metabolomics and Bioanalysis (CEMBIO), Facultad de Farmacia, Universidad CEU San Pablo, Boadilla del Monte, Madrid, Spain

Laurent Fay, R&D Infant Formulae, Nestlé Nutrition, Vevey, Switzerland

Pasquale Ferranti, Istituto di Scienze dell'Alimentazione, CNR, Avellino, Italy; Dipartimento di Scienza degli Alimenti, University of Naples Federico II, Naples, Italy

Federico Ferreres, Department of Food Science and Technology, CEBAS-CSIC, Murcia, Spain

Jose M. Gallardo, Marine Research Institute, CSIC, Vigo, Pontevedra, Spain

Antonia García, Center for Metabolomics and Bioanalysis (CEMBIO), Facultad de Farmacia, Universidad CEU San Pablo, Boadilla del Monte, Madrid, Spain

Virginia García-Cañas, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Cristina García-Viguera, Department of Food Science and Technology, CEBAS-CSIC, Murcia, Spain

José Ignacio Gil, Service of Radiodiagnostic, Mammary Pathology Department, Hospital José María Morales Meseguer, Murcia, Spain

Angel Gil-Izquierdo, Department of Food Science and Technology, CEBAS-CSIC, Murcia, Spain

Jean-Philippe Godin, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Miguel Herrero, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Tuulia Hyötyläinen, Quantitative Biology and Bioinformatics, VTT Technical Research Centre of Finland, Espoo, Finland

Clara Ibáñez, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Elena Ibáñez, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Elsa M. Janle, Department of Foods and Nutrition, Purdue University, West Lafayette, Indiana, USA

Peter Kastenmayer, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Martin Kussmann, Proteomics/Metabonomics Core, Nestlé Institute of Health Sciences, Lausanne, Switzerland; Faculty of Science, Aarhus University, Aarhus, Denmark

Ashraf G. Madian, Department of Chemistry, Purdue University, West Lafayette, Indiana, USA

Gianfranco Mamone, Istituto di Scienze dell'Alimentazione, CNR, Avellino, Italy

François-Pierre Martin, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Sonia Medina, Department of Food Science and Technology, CEBAS-CSIC, Murcia, Spain

María del Carmen Mena, Functional Proteomics Group, Centro Nacional de Biotecnología–CSIC, Madrid, Spain

José A. Mendiola, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Sofia Moco, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Chiara Nitride, Dipartimento di Scienza degli Alimenti, University of Naples Federico II, Naples, Italy

Matej Orešič, Systems Biology and Bioinformatics, VTT Technical Research Centre of Finland, Espoo, Finland

Ignacio Ortea, Health Research Institute of Santiago de Compostela, A Coruña, Spain

Gianluca Picariello, Istituto di Scienze dell'Alimentazione, CNR, Avellino, Italy

Francesc Puiggròs, Centre Tecnològic de Nutrició i Salut (CTNS), TECNIO, Reus, Spain

Fred E. Regnier, Department of Chemistry, Purdue University, West Lafayette, Indiana, USA

Serge Rezzi, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Alastair Ross, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Francisco J. Rupérez, Center for Metabolomics and Bioanalysis (CEMBIO), Facultad de Farmacia, Universidad CEU San Pablo, Boadilla del Monte, Madrid, Spain

Wendy R. Russell, Rowett Institute of Nutrition and Health, University of Aberdeen, Aberdeen, UK

Max Scherer, BioAnalytical Science, Nestle Research Center, Lausanne, Switzerland

Thomas Skov, Faculty of Science, University of Copenhagen, Copenhagen, Denmark

Carolina Simó, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Manuel Suárez, Departament de Bioquímica i Biotecnologia, Nutrigenomics Research Group, Universitat Rovira i Virgili, Tarragona, Spain

Francisco A. Tomás-Barberán, Department of Food Science and Technology, CEBAS-CSIC, Murcia, Spain

Alberto Valdés, Laboratory of Foodomics, Institute of Food Science Research (CIAL), National Research Council (CSIC), Madrid, Spain

Débora Villaño, Department of Food Science and Technology, CEBAS-CSIC, Murcia, Spain

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