About the Author

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Bernd Markus Lange is currently an Associate Professor at the Institute of Biological Chemistry and a Co-Director of the MJ Murdock Metabolomics Laboratory at Washington State University (USA). He received his BSc and MSc in chemistry from the University of Bonn, and a PhD in botany (1995) from the University of München (both in Germany). Upon graduation, he held postdoctoral positions with Lutz Heide at the University of Tübingen (Germany) and Rodney Croteau at Washington State University (USA). Subsequently, he led research groups in the biotechnology industry in San Diego (Novartis Agricultural Research Institute [CA, USA], Torrey Mesa Research Institute and Diversa [CA, USA]), before joining Washington State University as a faculty member in 2004. His research interests center on using integrative approaches to characterize the regulation of metabolic pathways. His laboratory has a particular interest in plant cell types specialized for the biosynthesis of terpenoids, the largest class of natural products. These studies are enabled by continuing developments in single cell transcriptomics and metabolomics. He has (co-)authored more than 55 journal articles, including 12 highly cited papers with over 100 citations each.

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Foreword

Metabolomics in food and nutrition

Bernd Markus Lange

Modern-day consumers expect high standards when it comes to the availability, safety and quality of food products. To ensure these standards are met, food testing laboratories employ an array of ever more sophisticated analytical assays. While some metabolites relevant for food safety and quality are known and can be quantified reliably with standard assays (e.g., vitamins A and C), other characteristics are the result of complex mixtures of metabolites (e.g., taste and aroma). Metabolomics is an emerging technology aimed at providing comprehensive profiles of small-molecule metabolites accumulated in microbes, plants and animals, or in food products derived from these organisms. In this book, a group of experts in the field have contributed chapters to review the current status of the use of metabolomics in the food and nutritional sciences.

Conceptually, the topics of these articles can be divided into three areas of research. The first area encompasses the integration of metabolomics into crop improvement programs based upon classical breeding (Daygon and Fitzgerald; [Chapter 1](#)) or genetic engineering (Frank and Engel; [Chapter 2](#)). The second area concerns the role of metabolomics in food quality control, including authentication (Catharino and colleagues; [Chapter 3](#)), safety (Aberg; [Chapter 4](#)), predictive modeling of sensory and nutritional attributes (Putri, Bamba and Fukusaki [\[Chapter 5\]](#); and Lange [\[Chapter 6\]](#)) and the analysis of processed foods (Beleggia, Ficco and Fragasso; [Chapter 7](#)). The utility of metabolomics for assessing the correlation of dietary composition and human health (German; [Chapter 8](#)) constitutes a third area of experimental inquiry covered in this book.

The greatest technological challenges for a broader implementation of metabolomics are currently to increase the dynamic range to reliably quantify metabolites of extremely low to very high abundance, improve the coverage of the metabolome to include metabolites of vastly different chemical properties, and further develop bioinformatic resources for inferring biological relevance from complex metabolomics data sets. These issues are briefly discussed here. The focus of this book is more on highlighting recent advances in applications and charting out future opportunities for the use of metabolomics in the food and nutritional sciences. Perhaps the most important conclusion is that metabolomics efforts at various levels of the food supply chain have the potential to inform each other. For example, an improved understanding of the relevance of the metabolic composition (metabolome) of our diet for disease prevention can be used as the basis for selection in crop breeding. The introduction of novel, nutritionally enhanced cultivars will require adjustments to quality control assessments, and metabolomics can again play an important role in these analyses. The nutritional value of these newly developed cultivars will then have to be evaluated and, once again, metabolomics will be the technology of choice for this purpose.

In summary, while technological advances are continually increasing the utility of metabolomics, the food and nutritional enterprise has much to gain from integrating this technology across the different sectors. Hopefully, readers will find this book to be an informative source of food for thought.

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