Editorial overview: Foodomics technologies

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Classical food analysis approaches directed towards the analysis of a discrete number of target components alone has been rapidly replaced in the last decades by other more comprehensive methodologies, partially thanks to the evolution of modern analytical instruments as well as to meet the requirements of more integrated researches. In this regard, the use of— omics approaches have undoubtedly provided with new analytical capabilities that are being translated into new more in-deep knowledge in all the subfields within Food Science. In the wake of this change, Foodomics was defined almost 10 years ago in an attempt to include researches in food quality, food safety as well as in the food and health field taking advantage of the great capabilities of integrated—omics approaches. The application of these methodologies have permitted, for instance, going from mere bioactivity determinations to gain insight on mechanisms of action of bioactives at a molecular level.

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As can be observed from a fast literature search, the application of these methodologies is continuously increasing, as new reports are published targeting very different aspects but sharing the common approach of applying—omics technologies to those aims. This Special Issue includes some exceptional reviews presented by leading top-scientists in Food Science, providing their expert views on the topics addressed as well as pointing out specially interesting and annotated bibliography to help readers to go deeper into the most important details. The development of Foodomics-related approaches intimately relies on the development of new analytical instruments and methodologies able to collect, analyze and process huge amounts of data from the samples ana-lyzed. As clearly discussed by Ferranti, state-of-the-art high throughput instrumentation is able to provide with a deeper knowledge not only in nutrition and food-related diseases research, but also in food technology addressing important issues linked to food safety and traceability as well as food quality. In this regard, the use of—omics generates vast amounts of data that should be appropriately processed and combined. This aspect implies a clear bottleneck at the moment, as the integration of data coming from different—omics platforms is difficult and is still far from being user-friendly. In the coming years, significant advancements related to this issue are expected. Among the instrumental developments achieved lately, the manufacture of high resolution mass spectrometers with always improved features and capabilities that are available at more affordable prices has significantly contributed to the progression of Foodomics approaches in general, and metabolomics and proteomics in particular. High resolution MS (HRMS) data are a fundamental part of those studies. In spite of the fact that a chromatography-based technique is often-coupled to HRMS, the evolution of this technology also allows the direct analysis of food samples using ambient ionization approaches. The review presented by Klampfl clearly shows some really nice and successful applications of this methodology within Foodomics field using, for instance, direct analysis in real time MS. The strongest point of these approaches is their ease of use and speed of analysis involving almost no sample preparation. The possibility of processing a large number of samples within a short time is already there. However, as emphasized by the author, the complex MS spectra generated without a previous separation could require the use of appropriate chemometric tools for data evaluation. These advanced—omics technologies have found a great interest on food and health-related researches. Nowadays, it has become apparent the importance and influence of diet on the prevention of some chronic non-communicable diseases, such as cancer, cardiovascular, neurodegenerative or metabolic syndrome-related diseases, among others.

Thanks to the use of Foodomics tools, more insight on human physiology and inter-individual metabolic diversity has been obtained, which is critical in the context of personalized nutrition to prevent health problems, as discussed by Mancano, Mora-Ortiz and Claus. To fully understand how diet can (positively) affect health, unravelling the complex relationships during digestion, including metabolism aspects as well as the influence of microbiome is essential. Pimentel, Burton, Vergères and Dupont present an overview summarizing the latest available information regarding the relation- ships between food bioactivity and digestion, also stressing the need to improve data integration as the key to succeed in those researches. Another example is provided by Rochetti, Giuberti and Lucini, who describe the role of HRMS in the context of metabolomics approaches to the study of the complex interactions involving the polyphenols present in gluten-free products. Although food and health topics have clearly benefited from the rise of Foodomics approaches, this discipline has already show good potential to provide strong scientific data when applied to other fields, such as food safety. Related to this field, Carrera, Cañas and Gallardo show how the use of proteomics approaches might be essential to obtain the complete de novo sequencing of new previously unknown food allergens whereas targeted approaches are useful to straightforwardly detect known allergens in foods. What's more, they demonstrate how the use of proteomics-based systems biology researches combined with data mining, interpretation and integration might be key tool to discover the molecular mechanisms beneath food allergy at a physiological level. On the other hand, metabolomics approaches are also interesting in food safety, as demonstrated by González-Salamo, Socas-Rodríguez and Hernandez-Borges. Interestingly, it is not only important the use of proper analytical methods, but also the application of suitable extraction and sample treatment approaches, in order to assess challenging analytical problems, such as the determination of phthalic acid esters in foods, which could pose a risk for human health. Lastly, Sorensen, Aru, Khakimoc, Aunskjaer and Engelsen discuss the relevance of modern food analysis approaches to assess the correct safety of food by-products in the context of circular economy and valorization. As the importance of sustainability grows fostering the development of valorization processes in order to effectively reduce wastes, different hazards could arise related to food wastes. This contribution underlines the potential of detecting biogenic amines as a freshness value of meat-related by-products. In summary, the present Special Issue compiles interesting well-documented contributions providing-specific expert views in diverse fields of research within a Foodomics perspective. As guest editor for this Special Issue devoted to Foodomics Technologies, I would like to sincerely thank all the authors for their excellent contributions which, I am sure, will be of great interest to Current Opinion in Food Science readers. Moreover, I would like to thank the reviewers that kindly collaborated evaluating the manuscripts as well as the Editors-in-chief and the Editorial Board for trusting me to carry out this task. Lastly, I also thank the help and collaboration from Jacky Kennedy from Elsevier, for the preparation of this Special Issue.