



## Editorial

## Special issue on 10th international conference of predictive modelling in foods: Towards a new paradigm in predictive microbiology



## ARTICLE INFO

## Keywords:

Predictive software  
 Mathematical models  
 Food safety and quality  
 Foodborne pathogens  
 Omics  
 Quantitative microbial risk assessment

This special issue entitled “Special Issue on 10th International Conference of Predictive Modelling in Foods: Towards a new Paradigm in Predictive Microbiology” published in *International Journal of Food Microbiology* includes a number of selected high- quality peer-reviewed papers presented at the 10th International Conference on Predictive Modelling in Foods (ICPMF10) that took place in Cordoba, Spain from 26th to 29th September 2017. The conference attracted more than 150 attendees from different countries all over the world. It included the organization of 3 workshops dealing with new topics in the field of Predictive Modelling in foods (Use of omics data in risk assessment; Advance in the harmonization of Predictive Microbiology, and Meta-analysis applied to microbial risks in foods) and a symposium sponsored by the European Food Safety Authority (EFSA) on Advances in Quantitative Microbial Risk Assessment.

Traditionally, Predictive Microbiology has aimed to study and quantify of the effects of intrinsic, extrinsic and/or factors on the microbial behaviour in food. As such, Predictive Microbiology tools have been largely considered powerful methods to investigate and forecast the effect of varying environmental conditions on the microbial response. Over the last decades, Predictive Microbiology has made relevant achievements, providing useful predictive models for pathogenic and spoilage microorganisms in foods, which have served as valuable instrument for risk managers and assessors.

The Conference included 12 sessions focused on the most relevant advancements in the field of Predictive Modelling and Quantitative Microbial Risk Assessment:

1. Systems biology and whole-cell modelling
2. Individual-based models
3. Modelling approaches using metagenomics (food) data
4. Complex systems modelling approaches for food safety and quality
5. Modelling microbial dynamics in relation to food microstructure
6. Databases, software and decision-support tools in predictive modelling on foods
7. Predictive models for food safety and quality: decontamination,

- food formulation, bacterial transfer, microbial spoilage, etc.
8. Predictive models for food process simulation: dehydrating, mixing, forming, heat transfer, etc.
9. Modelling the impact of microbiological interactions on foods
10. Interdisciplinary approaches and new advances in predictive modelling in foods
11. Quantitative Microbial Risk Assessment and Management
12. Predictive mycology

Predictive Microbiology is a relatively young scientific field, with its major development during the 90's. Nonetheless, the scientific level of the ICPMF 10 denotes that the Predictive Microbiology area has reached maturity. Nowadays, predictive models are considered valid quantitative tools to determine food safety and quality aspects for food producers, Governments and scientists. International Regulation and guidelines are clearly including Predictive Microbiology as a sound scientific approach to accomplish legal requirements for food safety. One of the most relevant achievements over the last few years has been attained in the field of software engineering, by incorporating models in user-friendly software tools, so improving their accessibility to food-chain stakeholders and increasing their range of application. Nevertheless, there are still missing aspects that need attention such as a better harmonization in predictive modelling approaches and a more mechanistic perspective in model development by including a molecular insight. In Cordoba, it was proposed a new paradigm for Predictive Microbiology, that is to enable its integration into other related scientific areas, serving as a transversal tool. This is expected to be mutually beneficial; in one direction, by providing support to other researches in the mathematical prediction field, and in return, to gain an insight into molecular, genetic and metabolic mechanisms involved in microbial kinetics helping us to enhance model accuracy and incorporate biological meaning.

During the conference, it was demonstrated that the potential applicability and reliability of existing predictive models can be reinforced by investigating the underlying mechanisms and incorporating

<https://doi.org/10.1016/j.ijfoodmicro.2018.11.010>

molecular information. The classical individual-based models can be expanded to biological systems through systems biology and whole-cell modelling. As such, it is expected that some approaches may lead to an increasing number of new technologies enabling the study of food-related microorganisms on a hitherto unexplored scale.

Integration of systems biology models together with omics sciences will undoubtedly help to provide a more accurate knowledge for the development of microbial exposure assessments in foods. In the ICPMF10, metagenomics was presented as a useful tool to understand food ecosystems and microbial dynamics. In this sense, it was stressed the use of biomarkers to quantify strain variability and reduce uncertainty in quantitative microbial risk assessment models.

Dedicated sessions to novel complex systems modelling approaches were focused on the study of food microstructure and its influence on microbial dynamics. By introducing some minor compositional and physicochemical factors, complex food model systems can be used to study the isolated effect of certain microstructural aspects on microbial growth, survival and inactivation.

Simulation and databases, together with decision-support tools are interrelated areas also presented at the ICPMF10. The fine-tuning of existing and new food safety software tools facilitates the dissemination of predictive models to food industries to optimize food processes and to aid in decision-making processes in a short-time frame. Further, the ICPMF10 highlighted the importance of having food safety repositories, harmonized formats and rules for model annotation to improve information exchange between resources in the Quantitative Microbial Risk Assessment and Predictive Modelling domain.

Food process simulation models and novel microbial interaction models were also discussed during the Conference. Microbial dynamics during certain food processing operations (i.e. ripening, drying, mixing etc.) was revealed as a promising field where predictive models may be further developed in the next few years.

Other topics widely covered in this special issue of *International Journal of Food Microbiology* include the potential of predictive modelling for analysing the microbial ecology of foods, integrating rapid automated molecular methods validated in foods, and assessing the efficacy of novel processing technologies in relation to microbial behaviour in foods.

In conclusion, the ICPMF10 has greatly contributed to the ICPMF mission to promote the development of predictive models and to

generate new knowledge in the field, that are relevant to food stakeholders, risk assessors and Governmental authorities. We strongly believe and hope that ICPMF will continue to serve as an exchange platform where Predictive Modelling, food safety and quality issues are steadily strengthening.

We would like to express our gratitude to the members of the Scientific Committee of the ICPMF10 who assisted us in selecting the best communications for poster and oral presentations, bringing the ICPMF10 to the highest scientific level possible.

Members of the Organizing Committee of ICPMF10 would like to express their gratefulness to Elsevier for sponsoring the Conference and offering such a prestigious international platform, the IJFM, to disseminate the findings and advances achieved in the Predictive Modelling. We are also thankful to the authors for their valuable participation in this Special Issue, and the reviewers who have taken their time to assess the manuscripts that were submitted for publication.

Sponsors from different organizations which contributed with different provisions, i.e., ICFMH, University of Cordoba, CeiA3, Junta de Andalucía, AECOSAN, EFSA, CIMO, ipb, IRTA, BfR, Unilever, Prolongo, COVAP, Ayuntamiento de Cordoba and Diputación de Córdoba, were also key players to guarantee the success of the ICPMF10. We really appreciate their support in the organization of the Conference.

We do hope that the ICPMF10 Conference has helped to improve knowledge and strengthen the ties between the scientific Risk Assessment, Predictive Modelling and food microbiology community.

We look forward to meeting you all in ICPMF11, in Braganza (Portugal), from 17th to 20th September 2019.

Fernando Pérez-Rodríguez<sup>a,\*</sup>, Elena Carrasco<sup>a</sup>, Abani K. Pradhan<sup>b</sup>, Anderson S. Sant'Ana<sup>c</sup>, Vasilis P. Valdramidis<sup>d</sup>, Antonio Valero<sup>a</sup>  
<sup>a</sup> Department of Food Science and Technology, Faculty of Veterinary, Agrifood Campus of International Excellence (ceiA3), University of Cordoba, 14014 Córdoba, Spain

<sup>b</sup> Department of Nutrition and Food Science, and Center for Food Safety and Security Systems, University of Maryland, College Park, MD 20742, USA

<sup>c</sup> Department of Food Science, School of Food Engineering, University of Campinas, Campinas, SP, Brazil

<sup>d</sup> Department of Food Sciences and Nutrition, Faculty of Health Sciences, University of Malta, Msida MSD 2080, Malta

E-mail address: [b42perof@uco.es](mailto:b42perof@uco.es) (F. Pérez-Rodríguez).

\* Corresponding author at: Department of Food Science and Technology, University of Cordoba, Edif. Darwin-anexo (C1), Campus de Rabanales s/n, Crta, Madrid-Cádiz Km 396A, 14014 Córdoba, Spain.