



Editorial

Editorial: Lactic Acid Fermentation and the Colours of Biotechnology 2.0

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Lactic acid bacteria (LAB) belong to an assorted cluster of bacteria that are protagonists of fermentative processes and bio-based solutions of interest in the different fields of biotechnological sciences, from the agri-food sector (green) up to the industrial (white), throughout the pharmaceutical (red). Even though LAB's main metabolic action is the synthesis of lactic acid as a result of the fermentation of carbohydrates, they have a great number of applications in the food and pharmaceutical industries [1–6]. In fact, LAB have a safe history of use by humans, and they are responsible for the production of many valuable molecules such as organic acids, exopolysaccharides, polyols and antimicrobial compounds. The continuous progress in the knowledge of LAB physiology and biochemistry and the availability of a great number of their complete genomic sequence have encouraged the characterization and production of an assortment of commercial starter cultures. These strains, denoted with probiotic, bio-protective and pro-technological properties, testify the biotechnological relevance of this heterogeneous bacteria class [1–6].

The Special Issue “Lactic Acid Fermentation and the Colours of Biotechnology 2.0” covers nine contributes: six original research papers and three reviews. As Guest Editors, we briefly report an overview of these contributions that included multiple aspects of LAB-based innovations concerning biotechnological development, such as innovative strategies for lactic acid production, D-lactate, functional or typical fermented foods.

Indeed, three of the original research papers focused on the description of novel approaches for the biotechnological production of lactic acid/lactate. Lin et al. [7] have demonstrated lactic acid production by LAB-mediated fermentation of seaweed hydrolysates, thus confirming this substrate as a promising carbon source for microbial fermentation. Krull and coworkers [8] have studied the use of low-cost agricultural hydrolysates to produce L-lactic acid with *Lacticaseibacillus casei*, showing that the industrial costs were likely to be reduced by up to 23%. Concerning the D-lactate production, Wada et al. [9] evaluate the heterologous expression of a *Lactobacillus bulgaricus* DLDH-encoding gene under the control of a T7-driven expression system. The obtained results demonstrate the utility of the PYR strain to develop fermentation processes of pyruvate-based chemicals production.

Two original research papers deal with the development of new products enriched with nutrients and probiotics. Hyrslova and collaborators [10] have determined the species-specific influence of bovine colostrum and several milk bioactive compounds on the growth of ten selected strains from genera *Lactobacillus*, *Lacticaseibacillus*, *Bifidobacterium* and *Enterococcus*. Krausova et al. [11] developed and characterized new Se-enriched *Streptococcus thermophilus* and *Enterococcus faecium* strains, representing an effective selenium source essential for human health. Both tested strains demonstrated good potential for Se-enrichment and improved antioxidant properties.

Closing the primary sources, Murgia and coworkers [12] have carried out the characterization of *Fruhe* cheese, a typical goat and sheep cheese from Sardinia (Italy). The authors



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described the first study on the microbiological and physico-chemical characteristics of this product cheese, emphasizing its microbiological quality and the potential nutritional value.

Concerning the review papers, the contributors focused on specific bio-productions or on the significance as starter cultures. Mora-Villalobos and collaborators [4] provided a review on the industrial value of co-products of LAB-promoted lactic acid fermentations, with special attention on bacteriocins, lipoteichoic acid, and probiotics. Moreover, the authors proposed a novel multi-product process involving lactic acid and the other compounds of interest. Guerin et al. [13] reviewed the chemical composition, biosynthetic pathways and regulation mode of exopolysaccharide (EPS) produced by lactic acid bacteria, examining the impact of EPS on food quality and human health benefits since their prebiotic, antioxidant, anti-inflammatory and cholesterol-lowering activities. Capozzi et al. [14] summarized the available knowledge on LAB's oenological properties with a specific focus on their positive or negative impacts on wine quality. In particular, the characteristics of several LAB species of oenological interest were described, thus being a tool to orient the selection of new strains, to design tailored microbial starter cultures, also for traditional/typical products.

This collection contributed to improve the knowledge on the heterogeneous class of lactic acid bacteria (LAB) and recent innovative applications for lactic acid fermentation in the different biotechnological fields.

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