2018 Meeting Preview: Make Lactic Acid Bacteria Great Again—Malting and Brewing

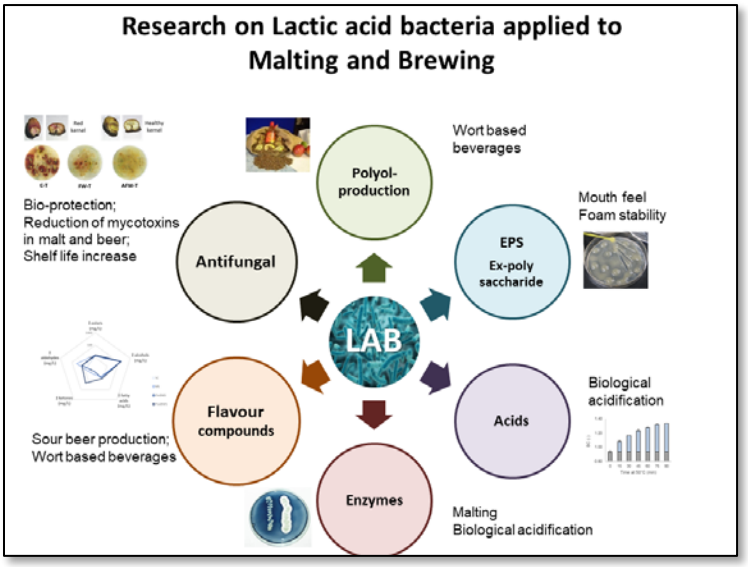
By Elke K. Arendt, University College Cork

ASBC is proud to announce that the Keynote Speaker for the 2018 ASBC Meeting in San Diego will be Professor Elke Arendt, School of Food and Nutritional Sciences and APC Microbiome Institute, University College, Cork, Ireland.

She will be speaking on lactic acid bacteria in malting and brewing. She's giving us a sneak peak at her upcoming keynote presentation.

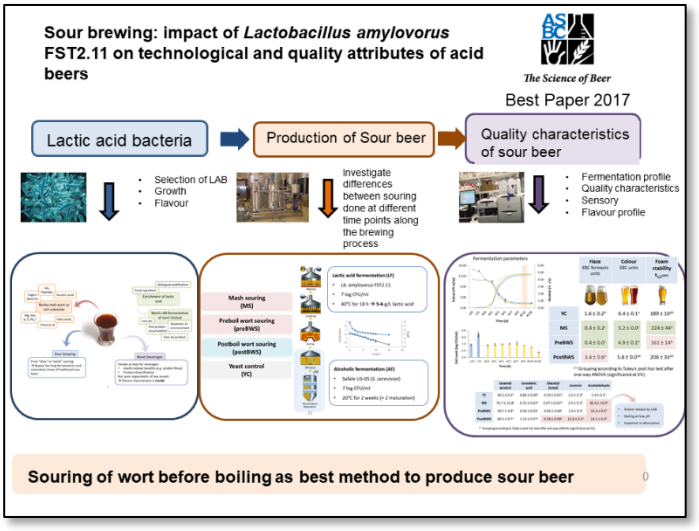
Make Lactic Acid Bacteria Great Again—Malting and Brewing

Lactic acid bacteria (LAB) constitute a diverse group of microorganisms that have been used throughout human history as fermentative agents in food preparation and conservation. They contribute to the organoleptic and nutritional improvement of fermented products as well as to the inhibition of spoilage microorganisms. The inability of LAB to synthesize several growth factors restricts their occurrence to nutrient-rich substrates, such as milk, meat, and cereals. The capacity of LAB to dominate and acidify cereal substrates opens new possibilities for maltsters and brewers to enrich metabolites with functional application. In this regard, wort is a versatile and highly nutritious medium that can well sustain LAB growth and their metabolic output.



Malting, or the controlled germination of cereal grains, is a complex biological and biochemical process, and the microbial communities that naturally colonize the grain surface can influence the performance in terms of processability and safety of the final malt. The favorable processing conditions found during steeping and germination can encourage the growth of spoilage microorganisms. Problems arise when toxigenic fungi such as *Fusarium* spp.

proliferate to levels that cause cereal deterioration, while also posing potentially serious health hazards. The high thermostability of *Fusarium* mycotoxins explains their survival along the production chain from grain to malt and finally beer. The increasing interest in replacing traditional preservation methods with natural, clean-label technologies has encouraged the search for biological alternatives as antifungal agents. The application of LAB starter cultures during the early stages of malting has been found to significantly antagonise spoilage contaminants and reduce mycotoxin levels, e.g., DON and ZEA. Wort can be used as a readily available, food-grade, and cheap substrate by maltsters for the enrichment of LAB and the antifungal compounds that they produce. A complex, synergistic mechanism between these metabolites has been suggested to be at the core of the overall antifungal effect of LAB. In addition, organic acids and other unidentified compounds exert a phytotoxic effect on germinating barley, allowing the maltster to control the extent of malting losses.



Lactic acid (LA) is a versatile acidulant, flavor enhancer, and preservative in the food industry. Acidified wort has been used to control pH during brewing operations, and recently, the growing popularity of sour beers in the craft brewing sector calls for a more in-depth knowledge on bacterial acidification of wort. During batch fermentation, LAB growth and metabolism are increasingly self-inhibited by the low pH, which limits the extent to which LA can be accumulated. Different strategies could be adopted to extend the time of LA production, such as acid neutralization, improvement of buffering capacity, or nutrient addition. Ultimately, the technology chosen should be easy to operate and cost-efficient and comply with the legislative framework to which the brewery adheres. Traditional sour beer styles, e.g., *Lambics*, are the result of a widely diverse inoculum that plays a role in fermentation and maturation, which can last between 1 to 3 years. Even though the long ageing process is crucial in delivering the distinctive flavor profile of these beers, brewers have also looked into simpler and faster ways to produce acidic beers. The prevailing alternative consists in applying lactic acid cultures to acidify a batch of mash and/or wort for 1 to 3 days, followed by an alcoholic fermentation by yeasts. Depending on the bacterial inoculum, the substrate and/or other fermentation control variables (e.g., duration, temperature, etc.), the brewer could expect significant differences in the processability and in the overall quality of the final beers.

In the last few decades, the growing awareness of the impact of nutrition-related health problems on quality of life has led to increasing interest in added-value products. Cereal-based beverages fermented by LAB have the potential to fill this market gap. They can be promoted thanks to the intrinsic content of health-related metabolites in wort, e.g., minerals, vitamins, and phytochemicals. Moreover, lactic fermentation can enrich the substrate with functional

metabolites, reduce anti-nutritive factors, and improve the organoleptic profile. LAB are already familiar to the consumer as probiotic cultures in dairy products, which would favor their introduction and bodes well for the acceptance of such wort-based products. Regarding the flavor profile, this can be improved by conducting a targeted selection of the starter culture according to the organoleptic profile that they impart. Different metabolic capacities give rise to an array of flavour and aroma profiles which are species-, substrate-, and process-dependent. Common flavor-active metabolites from LAB are lactic and acetic acid, diacetyl, acetoin, and acetaldehyde..

To learn more, join us at the 2018 ASBC Meeting in San Diego!

Professor Elke K. Arendt, M.Sc., Ph.D., D.Sc.

Professor Arendt is a native of Stuttgart, Germany. She graduated as an engineer of food technology at Hohenheim University in 1988 (M.Sc.) and received her Ph.D. degree from the same institute in 1991. The same year, she moved to University College Cork (Ireland) as a postdoctoral scientist funded by a Marie Curie fellowship. In 1993, she was appointed as a faculty member at UCC where she established an externally-funded research group, which was consistently supported by grants from national, EUn and industry sources. In 2007, she was awarded a D.Sc. degree from the National University of Ireland for her published work in the area of fermented foods. In 2016, she was appointed as principal investigator at the APC Microbiome Institute. In her research field, she was listed as one of the most highly cited researchers in world in 2017 (Clarivate Analytics) and has a H-Index of 63 (Google Scholar). She lectures and carries out research in the areas of malting, brewing, and cereal science. Specific research topics include: lactic acid bacteria and their application in malting and brewing as well as cereal products, gluten-free malting and brewing, and functional cereal-based foods and beverages. Professor Arendt is currently the head of a group of 25 research staff and Ph.D. students.