

VACANCIES

The **Research Group of Industrial Microbiology and Food Biotechnology (IMDO)** of the **Department of Bioengineering Sciences (DBIT)** of the **Vrije Universiteit Brussel (VUB, Brussels, Belgium)** wants to acquire

six PhD students to perform doctoral studies

Each of these collaborators will contribute to an internally or externally financed research project. It concerns the following subjects and projects:

1) Interaction of lactic acid bacteria and yeasts during sourdough fermentation

Sourdough is a mixture of flour and water that is fermented by lactic acid bacteria (LAB) and yeasts, either spontaneously or after addition of a starter culture. Initially, the focus of IMDO's sourdough research was on the species diversity, community dynamics, and metabolite kinetics of wheat, rye, and spelt sourdough fermentations. Subsequently, alternative cereals, such as barley, oat, and teff were studied. Recently, focus is on the expression of sleeping genes of pathways relevant for enhanced aroma formation by the addition of specific ingredients. Also, a metagenomic approach for both taxonomic and functionality analyses of spontaneous and starter culture-initiated sourdough fermentations is started. To study these fermentation processes, both laboratory fermentations with flour as the sole non-sterile component and fermentations carried out under bakery conditions, *i.e.*, firm doughs with a low dough yield, are carried out. This PhD research proposal aims at getting an insight into the aroma and taste formation of liquid, active sourdoughs within a reasonable processing time. Indeed, the aroma and taste of the bread crumb is mainly determined by the yeast fermentation. However, the latter is limited in time with currently applied baking practices. Active, liquid sourdoughs, based on the activity of both LAB and yeasts, may offer an interesting alternative for the bakery practices. Yet, sourdough preparation is also time-consuming. Therefore, it is challenging to examine how flavour formation can be steered during wheat sourdough fermentation through interactions between LAB and/or yeasts by means of co-cultures, to ultimately improve the bread crumb flavour. This research will be financed through a university project.

2) Inter-relationships between the quality of the flour, sourdough and bread produced thereof

The use of sourdough in bakery products is increasing strongly. Not only because of the natural and traditional character of this cereal fermentation product but also because of its impact on the aroma, taste, shelf-life and health-related aspects of the final bakery product. This impact may be accentuated by the use of starter cultures (industrial sourdoughs) to replace spontaneous fermentation processes (artisan sourdoughs). However, the impact of the quality of the flour, regarding both its nutritional and microbial composition, on the sourdoughs produced is not known yet. Moreover, the impact of the sourdough used on the final bakery product may vary greatly. This indicates that the process parameters applied have an important influence on the use of sourdough. Hence, the impact of diverse process parameters has to be known. Only in this case the right process conditions may be implemented to optimally use sourdoughs in the production of bakery goods. This research will be financed by the Flemish authorities and the bakery sector.

3) Field-cereal-flour-sourdough-bread axis regarding microbial species diversity

Artisan bakery sourdoughs are often characterized by a typical microbiota, often determined by the house microbiota, the flour and/or ingredients used, and the process conditions applied. Moreover, it has been shown that organic cereal production influences the development of the sourdough microbiota. Evidently, the flour regarding nutrient availability and physico-chemical parameters is fundamental for the establishment of stable microbial consortia within a short period, so that only those species and/or strains that are very well adapted to the sourdough ecosystem will thrive. Competitiveness may thus, at least partially, explain the association of certain LAB species and/or strains with specific sourdough fermentation processes. However, other factors may play a role as well, such as the agricultural practices and flour production. The PhD research project proposal will examine the field-cereal-flour-sourdough-bread axis. The research will be financed partly by an artisan bakery company.

4) Cocoa bean fermentations initiated with selected starter cultures

Cocoa bean fermentation is the first step in the curing process of the raw cocoa beans before the fermented dry cocoa beans can be used for chocolate production. The fermentation process is still a spontaneous process that facilitates the drying of non-germinating cocoa beans by pulp removal as well as to stimulate colour and flavour development of fermented dry cocoa beans. As it is carried out on-farm, cocoa bean fermentation is subjected to various agricultural and operational practices and hence fermented dry cocoa beans of variable quality are obtained. Spontaneous cocoa bean fermentations carried out with care for approximately four days are characterised by a succession of particular microbial activities of three groups of microorganisms, namely yeasts, LAB, and acetic acid bacteria (AAB), which results in well-fermented cocoa beans. The PhD research project aims at performing starter culture-initiated cocoa bean fermentations in cocoa-producing countries using various combinations of interesting strains of species of yeasts, LAB, and AAB to compose functional starter cultures not only for an improved cocoa bean fermentation process but also to carry out steered

fermentations regarding flavour and health-related compounds. This research will be financed by the Flemish authorities.

5) Interdisciplinary research project (IRP): tradition and naturalness in fermented meats

The research groups IMDO, FOST (Social and Cultural Studies), HOST (Historical Research into Urban Transformation Processes), and BUSI/MARK (Research Cluster of Marketing and Consumer Behaviour) of the Vrije Universiteit Brussel acquired an IRP project entitled “Tradition and naturalness of animal products within a societal context of change”. This unique project consortium combines four research teams, embedded in three different faculties. Besides engaging in interdisciplinary research between the different teams to address the historical mechanisms, cultural dimensions, and consumer aspects involved, IMDO will focus on the role of food (bio)technology in both the shaping of and responding to market demands for tradition/naturalness, for instance via the use of processing based on artisan set-ups (e.g., the use of spontaneous fermentation) or clean-label approaches (i.e., avoidance of food additives that are perceived as chemical and, thus, unnatural). As such, effects of processing cues that refer to tradition and naturalness in the context of meat fermentation will be investigated. This investigation will be carried out in meat simulation media (in bioreactors), meat models (on laboratory scale), and during actual production of fermented meats (pilot-scale experiments). The set-up will include the use of meat other than conventional pork/beef (e.g., wild boar, horse, or duck), spontaneous fermentation, absence of additives, artisan-type mild acidification, use of traditional compounds (e.g., figs, nuts), etc. Challenge tests will be performed under traditional conditions and using artisan-type recipes with cocktails of both beneficial microbial starter cultures [LAB and coagulase-negative staphylococci (CNS)] and problematic microorganisms (pathogens and spoilers). The output will objectify the impact of processing steps, as to confirm or reject prevailing perceptions related to product quality, in particular food safety, diversity of the fermentative microbiota, and generation of tangible sensory benefits. The PhD research project will be financed by the university.

6) Combatting *Clostridium botulinum* in fermented meats without nitrate/nitrite

Fermented meats are under scrutiny because of the potential association with the risk of colon cancer. As a result, a persistent market demand for process modifications has been created, including for instance a search for clean-label products prepared without nitrate- and nitrite-containing curing salts. However, curing is not only essential for proper colour and flavour development but also for food safety purposes. In such framework, a need for improved pathogen control is of paramount importance. Indeed, removing nitrate and nitrite may for instance augment the incidence of the deadly pathogen *Clostridium botulinum*. The objective of the PhD research project will be to make use of bacteriocinogenic LAB and CNS to sufficiently control some key pathogens that may arise in modified process technologies, in particular with respect to the effect of nitrite/nitrate lowering or removal. To facilitate the assays, use will be made of atoxigenic knock-out mutants of *C. botulinum* in collaboration with an external partner. The strategies will be explored in liquid meat simulation models in bioreactors and in meat batter models, and ultimately validated on pilot-scale level within a

broader project set-up that will involve different academic partners as well as members of the industry. This research will be financed by the Flemish authorities and the meat sector.

Profile:

He/she has a university degree of MSc in Bioengineering Sciences (Chemistry or Cell and Gene Biotechnology) or equivalent, with a vast knowledge of and interest in (food) microbiology, biochemistry, bioinformatics, fermentation technology, and/or food technology. Important additional qualifications are: sense of initiative, team spirit, sense of responsibility, motivation and dynamism, persistence, and good communication and reporting skills. Good knowledge of the English language is required.

We offer:

A young, creative, dynamic, pluralistic, and international working atmosphere. Possibilities for national and international cooperation with renowned laboratories and companies. Interesting work field with many perspectives for a future career. Salary as PhD student.

All vacancies mentioned above can be filled in immediately. If you are interested, please take contact with and send your curriculum vitae to:

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