Faculty of Science and Technology

PhD programme in FOOD ENGINEERING AND BIOTECHNOLOGY

Website: https://www.unibz.it/en/faculties/sciencetechnology/

Duration: 3 years
Academic year: 2020/2021
Start date: 01/11/2021
Official language: English

Programme contents

The Ph.D. in Food Engineering and Biotechnology is a full-time programme held in English. The Ph.D. thesis has to be written in English and accompanied by German and Italian abstracts. Ph.D. students should benefit from the special multilingual opportunities offered by the University, which include activities/events in Italian, German or other languages (e.g., seminars, optional courses, social events). The Ph.D. programme comprises lectures and research activities that can be completed both at the Free University of Bozen/Bolzano and at universities abroad. The time spent abroad can be at one of the foreign universities where foreign members of the Ph.D. Course Committee are coming from or at other universities or research centres, including prestigious Italian institutions.

The Ph.D. programme is based on the following milestones:

- students develop and organize their research plan, including the state-of-the-art of their research topic, in the first six months of the course together with their supervisor or co-supervisors. At the latest after six months, students must defend their research plan in front of the Ph.D. Course Committee;
- students have to take part in at least one international conference where they are expected to present a paper or a poster;
- students must spend at least 3 months abroad or at prestigious Italian institutions conducting research;
- students must attend specific compulsory courses, focused on the analysis of literature and writing scientific articles and on advanced statistics as well as other courses or summer schools courses approved by the PhD Course Committee, and pass the relevant exam. The minimum requirement for the admission to the PhD programme with regard to English language proficiency is level B2, which will be tested in conjunction with the oral exam; at the end of the three-year programme each PhD student must have achieved the C1 level. Therefore students should attend English courses offered by the language Center of unibz focused on the preparation and achievement of this final level of English language. In order to be admitted to the final exam, students must have published or submitted for publication in international peer-reviewed journal at least three articles
where they figure as first, second or last author. Exceptions to this rule, if adequately motivated, will be evaluated and eventually approved by the Scientific Committee.

**Stages of the PhD**

The research activities are spread over five stages, respectively, after 2, 6, 12, 24 and 36 months. At the end of each stage, students have to meet the Ph.D. Course Committee to present their project and the updating of the results. The Ph.D. Course Committee assesses students’ work and provides suggestions if needed.

*First stage (first 2 months):* the Ph.D. Committee meets the students, appointing the supervisor. Students and their supervisors decide on their research topic within the areas listed in this admission bulletin. Students also work on a study plan that has to be approved by the Ph.D. C Committee.

*Second stage (2nd -6th month):* students, after an exhaustive review of the literature concerning their subject area, have to prepare their research programme that has to be approved by the Ph.D. Course Committee. Students will follow courses that are relevant to their individual study plan. Students prepare their public seminar that will take place at the Free University of Bozen/Bolzano, where they discuss the state-of-the-art of their research topic.

*Third stage (6th -12th month):* students begin their research in the lab and/or field, and can also attend courses and summer schools. During this stage they will also present to the Ph.D. Committee their research programme that they want to conduct abroad or at prestigious Italian institutions in the following years. In addition, they propose a co-supervisor at the university or research centre for approval and prepare a report about the first-year activities.

*Fourth stage (12th -24th month):* students continue their research and finish any courses that they have been following. At this stage, it is likely that some of this time will be spent abroad or at prestigious Italian institutions. At this stage or in the next one, students are also expected to attend international conferences to present their results, also starting the preparation of the manuscript(s) for publication in peer-reviewed journals. The student presents to the Ph.D. Course Committee a report about the second-year activities.

*Fifth stage (24th-36th month):* students finish their research and any experiences abroad or at prestigious Italian institutions; they finish writing the manuscript(s) that are to be published and finish their thesis. To be admitted to the final exam the student has to present to the Ph.D. Course Committee a report about the third-year activities and about his final thesis.

**Research areas**

The following research areas, including sub-headings, are considered in the Ph.D. on Food Engineering and Biotechnology.

*Primary food production*

This issue mainly concerns those foods that are not subjected to technology processing, and their relationships with the agriculture and environmental features. The main goal is to focus on natural, sustainable and high performing processes and products. Non-restrictive examples of related research areas are as follows.
Renewable technologies and sensors in agriculture engineering; precision agriculture; identification of microbial and plant metabolic markers in response environmental stresses and nutritional supply; thermo-conversion of agriculture and food by-products for the production of chemical compounds.

**Set-up, management and validation of food processes**
This issue mainly concerns food processing, with particular emphasis to the set up, and consequent management and validation, of novel processes for the manufacture of products with very high quality sensory, rheology, hygiene and nutritional attributes. Non-restrictive examples of related research areas are as follows.
Optimization of structure, aroma and hygiene food attributes; point-of-care diagnostic for food traceability, quality assessment and smart packaging; application of non-thermal technologies and rapid methods (e.g., electrochemical biosensors); sensors and management tools for predictive maintenance applications in agrifood industries; food microstructure engineering; biotechnology production of natural foods through the gene and enzyme conditioning; conditioning of the chemical changes of food compounds with high nutritional value; design and evaluation of on-farm drying processes for delicate vegetable products.

**Application of the omics techniques**
This issue mainly concerns the application of food omics platforms (meta-genomics, proteomics and/or metabolomics) for conditioning and characterizing food processing and products, with particular emphasis towards fermented foods. Omics platforms will deserve an interest also to characterize the food-human axis, aiming at strengthening the role of the gut microbiome. Non-restrictive examples of related research areas are as follows.
Functional characterization of foods and related microbiota for the manufacture of fermented foods; set-up of microbial food processes for improving the nutritional and functional attributes; characterization and use of chemical nutrients that affect the response by the human gastrointestinal microbiome; exploitation of the potential of food by-products.

**Admission requirements - Evaluation criteria for examinations/qualifications**

Degrees from the old Italian system: all
Master (laurea specialistica/magistrale): all

**Foreign degrees**
Applicants who have done their degrees abroad must have university education of at least five years and hold the prerequisites listed below.

**Other**
The prerequisites for admission to doctoral programmes are related to having achieved an appropriate educational, and/or cultural background, and/or have worked in the Ph.D. course areas of research.
Qualifications in food science, agriculture, biotechnology and food engineering are preferable.

Admission to the programme is based on the assessment of applicants through:
- CV and academic qualifications;
- the cover letter, mainly based on the motivation for applying to this Ph.D. programme;
- interview.
To apply for the PhD programme, applicants must include the following documents:

- personal statement written in English (max. 1 page).
- Curriculum vitae (CV) (in English and possibly following the EU format that can be downloaded here [https://europass.cedefop.europa.eu/en/documents/curriculum-vitae](https://europass.cedefop.europa.eu/en/documents/curriculum-vitae)
- Master degree certificate/exam transcript. For admission, the (exams) average grade of master's degree (or equivalent) must be greater than or equal to 24/30. For foreign degrees, if the marking system is different, the mark will be transformed. In case of Italian university titles the certification MUST be substituted by a self-declaration or by the Diploma Supplement.

If the certificates or diplomas were awarded by Italian public bodies, the relevant self-certifications must be completed in the portal.

If the certificates or diplomas were awarded by foreign bodies, the certificates or diplomas must be uploaded to the portal.

**Other documents to be included in the application if available:**

- reference letters, written in Italian, German or English from a university lecturer or a researcher from a research institute;
- List of publications (published, being published or submitted for publication), with related links, if possible.

Only the applicants with the above mentioned pre-requisite will be taken into account. The Evaluation Committee will first evaluate the CV, the personal statement letter and the applicant’s qualifications - including publications (if any) - taking also into account the appropriateness of the candidates’ profiles with the PhD programme research areas, and will then draw up a list of applicants admitted to the next stage of the selection process. This will consist of an interview, in which their basic knowledge in one or more research areas of the Ph.D. programme will be assessed. The interview can make use of media such as video-conferencing, telephone and the like. The Committee will select the best applicants on the basis of a comparative assessment.

The following points will be awarded:

- up to 10 points for: the applicant’s CV, cover letter and qualifications;
- up to 10 points for the appropriateness of the CV regarding the research areas of interest for the PhD programme;
- up to 20 points for the interview.

The final score is the sum of the previous scores. The maximum score is 40. The lowest score to be admitted to the rank list is 20/40. The final score is used for the ranking of applicants and to establish access to the PhD programme and who will receive grants.

A lot will be drawn to decide on the allocation of places. The ranks list will be published on the website of unibz ([www.unibz.it/phd](http://www.unibz.it/phd)).
Examination dates

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<tr>
<th>Description</th>
<th>Date</th>
<th>Place</th>
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<tbody>
<tr>
<td>Interview</td>
<td>12 - 16 July 2021</td>
<td>Videoconference - Microsoft TEAMS, if not otherwise communicated</td>
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Positions and scholarships

Total positions: 16
Positions with scholarships from the University: 8,5
Positions with external co-funding: 5,5
Positions without scholarship: 2

PhD scholarships bound to specific research topics/areas:

<table>
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<tr>
<th>Topics/areas</th>
<th>Positions</th>
<th>Founder</th>
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<tbody>
<tr>
<td>Sustainable bio-degradable sensors for food and environmental monitoring</td>
<td>0,5*</td>
<td>Istituto Italiano di Tecnologia</td>
</tr>
<tr>
<td>see text below**</td>
<td>2</td>
<td>Research Center &quot;Laimburg&quot;</td>
</tr>
<tr>
<td>Development of innovative approaches for the valorization of apple by-products</td>
<td>1</td>
<td>VOG Products</td>
</tr>
<tr>
<td>Development and preclinical testing of a functional beverage to boost immune defenses in elderly people</td>
<td>0,5*</td>
<td>Edmund Mach Foundation</td>
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<tr>
<td>Development of alternative plant-based protein-rich food and beverages and assessing of digestibility at human gut level</td>
<td>1</td>
<td>&quot;Smart Protein&quot; research project</td>
</tr>
<tr>
<td>Development of novel food with targeted human functional activities</td>
<td>0,5*</td>
<td>Bonomelli - Montenegro</td>
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*integrated by unibz funds

**1st scholarship Laimburg FEB

Metabolic profiling of alpine food products using NMR

Consumers have been increasingly interested in on food quality and safety, demanding authentic foods and beverages that deliver healthy nutrients and bioactive compounds, as well as foods with improved sensory characteristics, such as taste and aroma. Therefore, robust and nondestructive analytical methods are needed that are able to analyze the composition of food matrices at the molecular level. Nuclear magnetic resonance (NMR) spectroscopy is a noninvasive and nondestructive technique that enables the detection and identification, in vivo and in vitro, of a variety of chemical species in a range of biological systems. NMR spectroscopy has been combined with chemometric tools to study quality parameters and to trace the origin of food.

The aim of this PhD project is to apply these methods to South Tyrolean food products. Molecular details of quality parameters, sensory characteristics and origin will be investigated, and the NMR data will be compared to results obtained with other chromatographic and/or spectroscopic methods.
Chlorophyll breakdown and phyllobilins in fruit crops beyond senescence.

Chlorophyll plays an fundamental role in plants and fruits, and its disappearence is typically associated with senescence due the autumnal leaf coloring. Chlorophyll breakdown, however is not limited to senescence: Fruits change color during ripening and early leaf yellowing or chlorosis is a well-studied symptom of biotic and abiotic stress. Recent work has shown that chlorophyll is broken down to the same class of metabolites (phyllobilins, PBs) via a common metabolic pathway in all three cases: senescence, ripening and stress. The aim of this PhD project is to determine the whole spectrum of chlorophyll breakdown products during chlorosis as well as ripening and storage of fruits and to test their potential as biomarkers for ripening and plant health. State-of-the-art metabolomics tools, like liquid chromatography coupled to high resolution mass spectrometry and magnetic resonance spectroscopy will be employed for the analysis.