PhD Project Advertisement

Project No/title: FBS2026 25 Girija ar / *AI-Guided Understanding of Nutrient and Microbe Changes in Sprouted Grains for Sustainable and Nutritious Foods*

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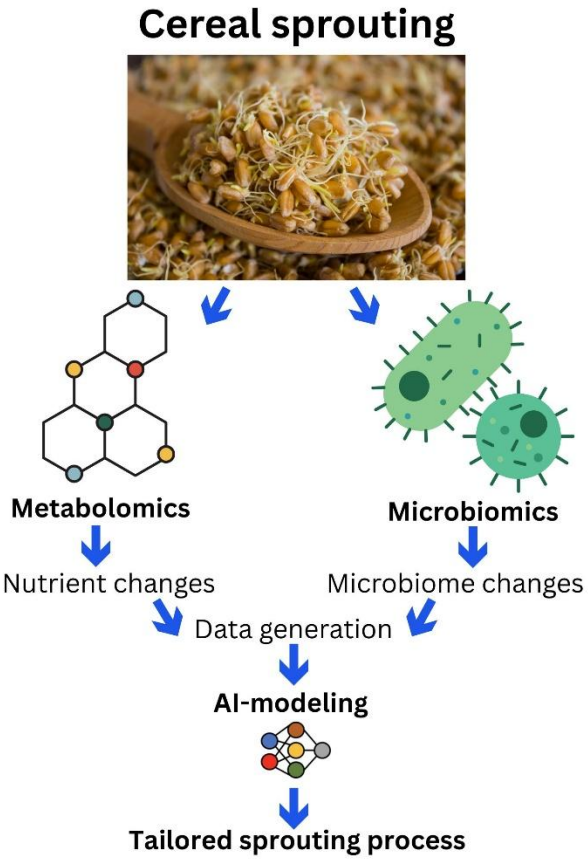
Project Details

Cereal grains like wheat, oats and tef are an important part of diets around the world, but many of their nutrients cannot be fully used by the body. Sprouting, which involves germinating grains, is a simple and low-energy method that can naturally improve their nutritional value. During sprouting, vitamins and minerals can increase, and anti-nutrients that limit digestion will decrease. At the same time, a community of helpful microbes grows on the grains. These microbes may play an important role in releasing nutrients or creating beneficial compounds, but their activity is still not well understood.

Because many changes happen at once during sprouting, it is difficult to predict the best conditions for nutrition and sustainability. This project uses artificial intelligence (AI) to bring together information on nutrients, microbes and sprouting conditions, helping us understand these changes and design healthier, more sustainable cereal-based foods.



Research aims: To understand how nutrients and microbes change during the sprouting of wheat, oats and tef, and how these changes relate to sprouting conditions. By combining experimental data with AI modelling, it will identify and test optimal sprouting methods that improve nutrition and support sustainable cereal processing.

What you will do: This project combines traditional cereal sprouting with a data-driven approach to improve nutrition. The student will carry out controlled sprouting experiments with wheat, oats and tef under different environmental conditions. Samples will be collected at set times to measure changes in nutrients, including protein quality, vitamins, minerals, and compounds that limit digestion. Microbial communities will be analysed using DNA sequencing to determine their composition and activity, while metabolomics will reveal biochemical changes linked to microbes and enzymes. All nutritional, microbial and metabolite data will be integrated using machine-learning. These AI models will identify key factors influencing nutrient improvement and microbial balance, and predict optimal sprouting conditions. The student will test and refine these AI-guided methods, producing a predictive tool to help create more nutritious and sustainable sprouted cereal foods.

References:

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2. Girija A, Jifar H, Jones C, Yadav R, Doonan J, Mur LAJ. Tef: a tiny grain with enormous potential. Trends Plant Sci. 2022 Mar;27(3):220-223. doi: 10.1016/j.tplants.2021.11.011. Epub 2021 Dec 2. PMID: 34865980.
3. Ikram A, Saeed F, Afzaal M, Imran A, Niaz B, Tufail T, Hussain M, Anjum FM. Nutritional and end-use perspectives of sprouted grains: A comprehensive review. Food Sci Nutr. 2021 Jun 23;9(8):4617-4628. doi: 10.1002/fsn3.2408. PMID: 34401108; PMCID: PMC8358358.
4. Tiozon RJN, Sreenivasulu N, Alseekh S, et al. Metabolomics and machine learning technique revealed that germination enhances the multi-nutritional properties of pigmented rice. Commun Biol. 2023;6:1000. https://doi.org/10.1038/s42003-023-05379-9
5. Tiozon RJN, Sartagoda KJD, Serrano LMN, Fernie AR, Sreenivasulu N. Metabolomics based inferences to unravel phenolic compound diversity in cereals and its implications for human gut health. Trends Food Sci Technol. 2022 Sep;127:14-25. doi: 10.1016/j.tifs.2022.06.011. PMID: 36090468; PMCID: PMC9449372.

Student profile

Essential for project: A background in one or more of the following: food science, nutrition, agriculture, biochemistry, plant biology, microbiology, or related subjects, with an interest in sustainable food systems and data-driven research.

Desirable for project: Experience in molecular biology, microbiome analysis, metabolomics, biostatistics, and coding in Python or R or equivalent computational analysis. Training will be provided to develop these skills for candidates without prior experience.

Minimum requirements for all FoodBioSystems applicants: An upper 2nd class degree (or equivalent) in a subject relevant to the project. Candidates with a lower class of Bachelors degree, but merit or above at Masters level will also be considered**.** Demonstrable skills in problem-solving, team-working, communication and time management.

Training

Project specific training opportunities: This project offers multi-disciplinary training in food biochemistry, microbiomics, and AI. The student will gain hands-on experience in cereal sprouting, biochemical assays, and microbiome profiling, including DNA extraction and sequencing, supported by facilities at Aberystwyth University. Training in metabolomics, including advanced mass spectrometry, will provide skills in both targeted and non-targeted analysis of metabolites. The student will learn to integrate large-scale nutritional, microbial, and metabolomic datasets using machine learning, bioinformatics, high performance computing, and statistical tools. At the University of Reading, they will receive practical training in food processing and product development, including texture analysis, 3D scanning, and colour measurement, translating lab findings into functional foods. Experience with industrial partners will provide insight into sprouting processes and nutritional enhancement in cereal-based products. Students will benefit from expert supervision, access to cutting-edge facilities, and opportunities to present work at national and international conferences. This training equips students with technical, analytical, and professional skills for careers in food science, biotechnology, or related fields.

FoodBioSystems training opportunities: Throughout their studentship, all FoodBioSystems doctoral researchers participate in cohort training that covers four key themes: food systems, big data (data analytics and modelling), business, and research fundamentals. All doctoral researchers complete a placement: either project-related with a non-academic (CASE) partner, or unrelated to the project and outside the academic environment (PIPS). Details of training are available on the DTP website: https://research.reading.ac.uk/foodbiosystems/training/.

Project supervision style

The supervision plan will ensure regular, structured support throughout the project. The student will have weekly one-to-one meetings with Dr. Girija (Lead) to discuss progress and troubleshoot challenges. Fortnightly meetings with the co-supervisory team (Dr. Atefeh, Dr. Lloyd, and Dr. Swain) will provide a holistic review of the project. These meetings will allow the team to provide input on experimental design, data analysis and training needs. The supervisory team will maintain an open communication policy, using shared digital platforms to monitor progress and provide continuous mentoring.The lead will provide initial feedback within seven days of receiving reports and data sets. The wider team will provide feedback within ten days to ensure timely progress and that the student can meet project milestones. The student will also participate in monthly lab meetings to receive feedback and engage in discussions. Formal progress reviews will occur every six months, aligned with institutional milestones.

Stipend (Salary)

FoodBioSystems DTP students receive an annual tax-free stipend (salary) that is paid in instalments throughout the year. For 2025/26 this is £20,780 and it will increase slightly each year at rate set by UKRI.

Equity Diversity and Inclusion

The FoodBioSystems DTP is committed to equity, diversity and inclusion (EDI), to building a doctoral researcher (DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- Guaranteed interview and applicant mentoring schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups who also meet academic eligibility criteria and the student profile essential for the project.

These are opt-in processes**.**

Our studentships can be offered to home students on a part-time basis, and studentship end date and stipend payments will be amended to reflect the part-time registration. The minimum registration for DTP funded part-time students is 0.5 FTE (studying an average of 20 hours per week over 8 years). We regret that part time registration is not available to international students due to complexities of visa restrictions.

Funding note

We welcome applications from candidates with Home/ROI fees and international fees status. This studentship is funded by UKRI and covers stipend, fees at Home/ROI rate, and research costs. The host university will not charge UKRI funded international students the difference between Home/ROI fees and international fees.
Costs that must be found from other sources or met by the individual student include: visa fees, healthcare surcharge, relocation costs and guarantor services.

For up to date information on funding eligibility, studentship rates and part-time registration, please visit the FoodBioSystems website.