

FoodBioSystems DTP - PhD Project Advertisement

Project title:

FBS2021-40-Rodriguez-Garcia: Fundamental study of the inter-relationships between structure, physicochemical properties and sensory profile of emulsions to evaluate their potential as saturated fat replacers

Lead supervisor:

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Dr Tassos Koidis, School of Biological Sciences, Queen's University Belfast.

Dr Paul Smith, Cargill.

Prof Lisa Methven, School of Chemistry, Food and Pharmacy, University of Reading

Project description:

This project offers an excellent opportunity to work with one of the major ingredient producers worldwide (Cargill) along with two leading department in Food Science and Technology (University of Reading and Queen's University Belfast). The project will focus on the design of novel saturated fat replacers that will have an impact on consumer choice, by providing products that offer better consumer experience; and will have an impact on public health by providing products with healthier nutritional profile.

The cross-disciplinary skills the student will develop will be through the integration of research on **physical properties** (structure and rheology), and **mathematical modelling** (multivariate), **oral processing** (breakdown in mouth), and **sensory perception** (mouthfeel, taste) when designing fat replacers that will be technologically feasible and desirable for the consumer.

During the project the student will explore emulsion composition and formation to design structures that can deliver the required technological properties (firmness, melting point, thermal reversibility). The student will be trained and supported in the use of techniques such as rheology (UoR), interfacial rheology (UoR), spectroscopy (QUB), imaging techniques (small angle x-ray scattering (SAXS) at Diamond Light Source), and microscopy techniques (Confocal Light Scanning Microscopy and Electron Microscopy (UoR)).

The second step will focus on data analysis to map "structure: function" relationships using principles of Design-of-Experiment (DoE), Response Surface Methodology (RSM) and state-of-the-art multivariate analysis algorithms (QUB). This work will enable the screening of potential new emulsion composition with enhanced likelihood of success as saturated fat replacers.

A key part of the project is the evaluation of the oral processing and digestion of emulsions in the oral cavity and the correlation of these processes with how emulsions are perceived during consumption. In-vivo and in-vitro oral digestion (UoR) will be performed to understand how composition and structure define release of components in mouth and how they are perceived (Dynamic Perception Characterisation at UoR).

Finally, these emulsions will be incorporated into model food matrices to evaluate thermodynamic and oxidative stability of the systems.

This project brings the importance of developing ingredients and products for a more sustainable food

industry, a better public health, and more pleased consumers.

The project will be based at the University of Reading in conjunction with Queen's University Belfast and Cargill R&D Centre Europe. At least a 3 months placement will be at Cargill.



Figure 1. First image on the left is a Confocal Raman image of a fat crystal around emulsion droplet; second one is a Light microscopy image of an emulsion; third one is a picture of a solid emulsion; the fourth one shows the application of an emulsion in a food product as a filling.

Training opportunities:

This project will train a doctoral researcher to become an expert in both the measurement and interpretation of food physiochemical properties and how these relate to sensory perception; skills that are much needed in the UK food industry and expertise that is currently underrepresented in UK academia. They will benefit from their access to facilities and expertise at the University of Reading (food physics, microscopy, and sensory science), at Queens University Belfast (oils and fat chemical profiling, oxidative stability, mid infrared Spectroscopy; untargeted data exploration and multivariate classification modelling using linear and non-linear algorithms) and at **Cargill** (food physics, structural imaging, analytical science, applications science). One unique aspect of training will be using the **Diamond** Light Source UK, a centre with imaging and microscopic facilities, which give the student skills currently unique in UK for food scientists. The three-month placement at Cargill will enable the student to undertake applications research and understand how innovation in an international environment at a leading industrial food ingredients R&D centre.

Student profile:

The student should have a background in physical science (soft materials science) ideally coupled with some knowledge of food chemistry and sensory. Graduates of physics, chemistry, chemical engineering, food science and related courses are most likely.

Funding particulars:

This project will be a CASE-Studentship sponsored by Cargill and is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.

The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.

The funding will include a tax free stipend (minimum £15, 285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply

Please go to [FoodBioSystems DTP website](#) for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.