FoodBioSystems DTP - PhD Project Advertisement Text

Project Title: FOODBIOSYSTEMS - A machine learning approach to the metabolic profiling of a diverse heritage collection of apples and pears

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Research Group: FOODBIOSYSTEMS BBSRC DTP
Project ID: FBS2020-35

Application Deadline: 6 March 2020

Project Description: The project will provide an excellent opportunity for a bio-sciences graduate to develop highly transferrable skills in computational biology using big data analytics. There are 26,000 definable biochemicals in our food, many with documented but unquantified effects: the so-called nutritional dark matter that may hold the key to human nutritional health (Barabási et al., Nature Foods, 2019). Apples and pears are a rich source of metabolites, particularly phenolics, which are not only responsible for imparting taste and other sensory attributes on the fruit but may also be responsible for a wide range of health benefits.

The project seeks to expand on the preliminary metabolite profiling research that was made on a large collection of modern and heritage apple cultivars that showed that key metabolites, with enhanced health promoting properties, have gradually been bred out from modern cultivars (Anastasiadi et al., 2017). The focus will be on discovery in unique Welsh apple and pear cultivars primarily used for cider and perry that are conserved in museum orchards planted at various locations in Wales (Thorogood, 2018). Specialist cider apples and perry pears are known to have diverse and complex secondary metabolite profiles and they typically possess levels of health-promoting phenolics at higher levels than commercial culinary and dessert cultivars.

An extensive range of liquid chromatographic and mass spectrometric methodologies will be used. The project will use a data-driven, machine learning approach to metabolite discovery and quantification by characterising changes in the metabolic fingerprints of a range of dessert, culinary and cider/perry apple/pear cultivars using the methodology developed at Cranfield University. Cultivar differences and changes in metabolites focusing on soluble sugars, organic acids and phenolics (e.g. flavan-3-ols and procyanidins, dihydrochalcones, quercetin glycosides) will be evaluated through fruit storage, juicing and juice fermentation processes. At the same time, sensory characteristics (taste, flavour, and physical/rheological characters) of fruit and processed juice and pomace will be assessed. As well as potentially identifying and quantifying nutritionally valuable metabolites, the findings will enable the establishment of links between key metabolite biomarkers and superior fruit quality and storage properties, and juice, fermented juice and pomace qualities. The data will also provide the evidence base for selection of Welsh heritage cultivars with value that can be further developed and promoted.

"Frongoch James Nicholson" a newly discovered bitter-sweet cider apple variety from Aberystwyth University
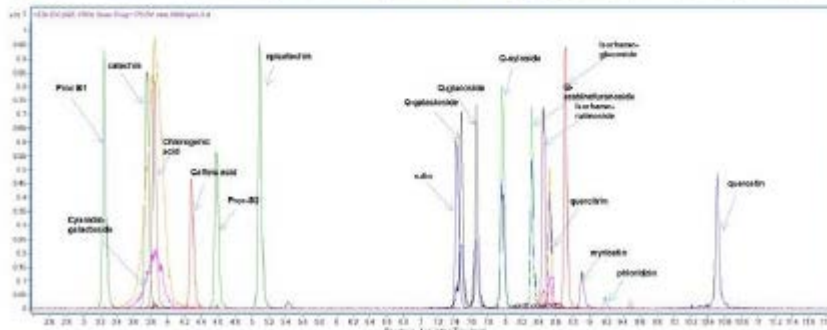
Liquid chromatography – mass spectrometry instrumentation and a typical apple phenolics output

The FoodBioSystems DTP is a collaboration between the University of Reading, Cranfield University, Queen's University Belfast, Aberystwyth University, Surrey University and Brunel University London. Our vision is to develop the next generation of highly skilled UK Agri-Food bioscientists with expertise spanning the entire food value chain. We have over 60 Associate and Affiliate partners. To find out more about us and the training programme we offer all our postgraduate researchers please visit
https://research.reading.ac.uk/foodbiosystems/.

Training opportunities: Apart from the in-house training on metabolite profiling and bioinformatics, the appointed student will have opportunities to interact with organisations such as the National Trust and the Welsh Perry and Cider Society and their commercial grower and producer members. There is also an

opportunity for an up to three month PIP (Professional Internships for PhD students) placement with the newly opened Future Foods and Bio-Refining Centres of the Aberystwyth Innovation and Enterprise Campus (AIEC) located on site at Gogerddan.

Student profile: We seek to recruit a scientist with a biochemistry background wishing to enhance their computational biology skills. The student will have a desire to embrace the data driven biology paradigm through the critical application of new computational technologies, methodologies and resources. Although not essential, a background and interest in plant science, food processing and/or fermentation biology would be an advantage.

References:
Anastasiadi M, Mohareb F, Redfern SP, Berry M, Simmonds MSJ, Terry LA. 2017. Biochemical profile of heritage and modern apple cultivars and application of machine learning methods to predict usage, age, and harvest season. Journal of Agricultural and Food Chemistry, **65**: 5339-5356.
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