**University of Nottingham - University of Adelaide Joint Doctoral Training Partnership**

We are delighted to invite applications for the University of Nottingham (UK) - University of Adelaide (Australia) Joint Doctoral Training Partnership. The jointly awarded PhD scheme has been working successfully for several years, and there are currently 10 PhD students on the scheme, and 13 additional students due to start in 2018-2019. The new PhDs will join an active cohort of research students (click here to read about current projects). The student cohort will be co-supervised by staff at both universities and will study at the University of Nottingham in year one, move to Adelaide for years two and three and then return to Nottingham for the final year of the degree. The offered Nottingham-Adelaide Doctoral Scholarships, will be primarily based on the Waite Campus in Adelaide or on the Sutton Bonington campus in Nottingham. Both campuses are renowned for their world-leading research in agricultural, food and beverage sciences, and their outstanding facilities for research and teaching.

PhD graduates will obtain jointly awarded degrees from the University of Adelaide and the University of Nottingham. The studentships will cover PhD tuition fees, plus a stipend corresponding to the standard research council rates of both countries (contributions will also be made towards travel between the UK and Australia during the project). There are four fully funded 4-year PhD studentships on offer, expected to start on **1st October 2018**, for the following projects:

1. **Maternal diet and the composition of breast milk: impact of reducing sugar and fat consumption.**
   Supervision by Professor Simon Langley-Evans (UoN; simon.langley-evans@nottingham.ac.uk), Dr Matt Elmes (UoN) and Dr Beverly Muhlhausler (UoA)

2. **Vetch as a new protein source for the human diet.**
   Professor Ian Fisk (UoN; ian.fisk@nottingham.ac.uk), Dr Iain Searle (UoA) and Dr Kerry Wilkinson (UoA)

3. **A novel population phenotypic and genetics-based approach to understanding sensory preferences of the "global consumer".**
   Dr Rebecca Ford (UoN; r.ford@nottingham.ac.uk, Dr Qian Yang (UoN), Professor Ian Fisk (UoN), Dr Susan Bastian (UoA) and Professor David Adelson (UoA).

4. **Genomic analysis of S-haplotypes in almond and biophysical aspects of S-proteins.**
   Dr Tim Robbins (UoN; tim.robbins@nottingham.ac.uk), Dr David Scott (UoN), Dr Michelle Wirthensohn (UoA) and Professor Diane Mather (UoA).

Informal enquiries may be addressed to the individual project lead supervisor or to SB-Research@exmail.nottingham.ac.uk.

**Eligibility:** The studentship is open to UK/EU students. All students should have, or expect to obtain, a first-class or good 2:1/2A honours degree and/or a high distinction, distinction or high merit at the Masters level in a biologically related subject area.

**To apply:** Please select the specific project that you wish to apply for, then apply online by sending your CV, unofficial transcripts (details of University grades/predicted grades) together with the names and contact details of two referees and a covering letter indicating your interests and why you are applying to the "Joint Nottingham-Adelaide Programme" to the principal project supervisor (see project for contact details).

**Closing date for applications:** 8th June 2018, 5pm.

More information on studentship projects:

1. **Maternal diet and the composition of breast milk: impact of reducing sugar and fat consumption.**
   *Background:* Nutrition in early life is known to influence future metabolic and cardiovascular disease risk. Interventions to alter maternal diet in pregnancy are not generally advocated, so there is interest in the potential for interventions in the first 4 months of life, which target infant feeding. We have published a number of animal studies that demonstrate that maternal diet during lactation has consequences for offspring weight gain, body composition, lipid and glucose metabolism, eating and learning behaviours. These studies are of relevance to humans as maternal overweight and obesity are known to impact on breastmilk quality and metabolic hormone content.
   *Hypothesis*: The macronutrient and fatty acid composition of human milk is responsive to short-term interventions to improve the quality of the maternal diet.
   *Plan of Investigation:*
   *Systematic review of the literature:* A systematic review and meta-analysis will address the questions of whether reducing fat and/or sugar intake during lactation has beneficial effects on a) breast milk composition; b) hormonal exposures of breastfed infants and; c) the growth trajectories of breastfed infants. We aim to publish this systematic review at the end of the first year of the studentship.
   *Experimental studies*: Breastfeeding women will be recruited through community groups, social media and lactation clinics both in the UK and Australia. The samples will be stratified by maternal weight status and will follow diets that are designed to contain sufficient energy, protein and micronutrients to support lactation. Women will complete 7-day periods on their normal diet, following a standardised diet and following a low-sugar, low-fat diet. Diet diaries will be collected for each period, along with samples of maternal blood and breast milk for analysis. Analyses will include total protein, lactose, total fat content and fatty acid composition (gas chromatography-FID analysis). We will determine concentrations of metabolic hormones (leptin, insulin, ghrelin and adiponectin) and obtain measures of infant growth in each period.
   By the end of the project we will have uniquely characterised the effects of dietary interventions on breastmilk composition and will know how this varies between women of normal weight, overweight or obesity. This will add to current public health debates on how early life nutrition may be targeted as an intervention to support healthier ageing.

   Supervision by Professor Simon Langley-Evans (UoN; simon.langley-evans@nottingham.ac.uk), Dr Matt Elmes (UoN) and Dr Beverly Muhlhausler (UoA)

2. **Vetch as a new protein source for the human diet.**

The PhD student will spend years 1 and 4 with the Food Chemistry Group (Professor Ian Fisk) at the University of Nottingham's Sutton Bonington Campus, UK and years 2 and 3 at the University of Adelaide (Australia) under the supervision of Dr Iain Searle (Director of Science, Australia-China Joint Research Centre) and Dr Kerry Wilkinson (Associate Professor of Oenology).
Common vetch (Vicia sativa) is a leguminous, annual crop plant that provides valuable soil nitrogen to farming systems and is a palatable, cheap, high protein feed source with high potential as feed for livestock and humans. In comparison to other legumes, vetch requires lower amounts of soil nutrients, grows on more diverse soil types and is drought tolerant and the production cost is around 50% of other similar yielding legumes, like lentils. One significant reason for vetch's limited agricultural use is that anti-nutritional compounds exist in seeds, especially β-cyano-alanine and γ-glutamyl-β-cyano-alanine (GBA), which have high toxicity to monogastric animals, like poultry, pigs, and humans.
In this project, the student, whilst at Adelaide will test whether the anti-nutritional compounds can be reduced to optimise food acceptability and to include Vetch as a viable protein source for the human diet. The mRNA profiles of anti-nutritional compound genes with specific functions will be identified across a number of vetch accessions using established RNA-sequencing and a diagnostic set of genes defined using machine learning approaches so that they can be used as screenable markers to select legume crops with improved nutritional profiles.
Whilst the student is at Nottingham, vetch will be evaluated for its value as a food ingredient for humans and processability evaluated using established food processing technologies. Food materials will be generated and taste tested, resultant aroma and flavour of the final products will be evaluated and linked back to flavour precursor concentration and mRNA profiles in the raw materials.
Extensive genomic, genetic and bioinformatics resources have recently been established at UoA that include; a draft genome sequence of common vetch, >1,000 wild accessions and advanced breeding lines, bioinformatic software for analysis of transcriptome-wide RNA-sequencing and epigenetic datasets, and high-performance computing. Furthermore, we have recently established a transformation and regeneration system and CRISPR genome-editing. The UoN is a leading international centre for flavour chemistry and the flavour chemistry group is led by Professor Ian Fisk.
Through this exciting joint international PhD, the successful student will learn a combination of skills not possible at one University campus and includes; bioinformatics, genomics, food and flavour chemistry.
Year 1: University of Nottingham: Literature review; flavour and sensory science training; source a number of common vetch varieties with defined heritage; initial food processing trials and flavour screening of varieties using SPME-GC-MS/MS
Year 2-3: University of Adelaide: Profile genes involved in synthesis and degradation of anti-nutritional compounds in legume seeds by using established RNA-seq techniques and bioinformatics; use genome CRISPR-Cpf1 genome editing to modify target genes; demonstrate reduced anti-nutritional effects.
Year 4: University of Nottingham: Evaluate the impact of standard food processing technologies (drying, heating, acid treatment) on vetch; thesis preparation and submission.

Professor Ian Fisk (UoN; ian.fisk@nottingham.ac.uk), Dr Iain Searle (UoA) and Dr Kerry Wilkinson (UoA)

3. **A novel population phenotypic and genetics-based approach to understanding sensory preferences of the "global consumer".**

Applicants are invited for this exciting PhD studentship studying the impact of phenotypic and genetic variations in sensory response on food preferences in both the UK and Australia.
Phenotypic and genetic variations in the population have been shown to have an impact on sensory response and consumer preference. For example, previous research has shown vegetable intake is related to variations in sensory response to a specific bitter compound (PROP) which can be explained by genetic variation on the TAS2R38 gene. However, little is known about the impact of other phenotypes and genotypes on sensory preferences of sweet foods and diet choices.

This PhD will take a scientifically controlled approach to investigate the phenotypic and genotypic variations across different global population groups. Resulting data will be mined to generate understanding of the "global consumer" to facilitate calorie reduction for food manufacturers. A background in statistics or bioinformatics is essential and some knowledge of sensory and consumer science, genetics or food science would be beneficial.

Dr Rebecca Ford (UoN; r.ford@nottingham.ac.uk, Dr Qian Yang (UoN), Professor Ian Fisk (UoN), Dr Susan Bastian (UoA) and Dr David Adelson (UoA).

4. **Genomic analysis of S-haplotypes in almond and biophysical aspects of S-proteins.**
Self-incompatibility (SI) is common in many orchard crops including almond. This results in the rejection of self-pollen with no fruit produced. This natural trait requires the use of pollinator trees if the main crop is self-incompatible. The molecular genetics of SI have been studied for many years and two genes at the S-locus (S-RNase and SFB) with allelic variants known as S-haplotypes are known to be involved in controlling the pistil and pollen specificity respectively. One of the fundamental questions in self-incompatibility research is the specificity of recognition between the S-RNase and SFB. In this project the PhD student would work with several almond S-RNase and SFB sequences identified by researchers in Adelaide. These genes will be cloned into expression systems that will allow protein purification. The project will allow access to the protein structure facilities at Harwell. Expression studies in yeast will allow protein-protein interactions to be examined. The project will involve molecular breeding studies at the University of Adelaide. This will include bioinformatic analysis of next generation sequencing data for 15 S-haplotypes in almond. These data will be studied to build up a better understanding of the organisation of repeat sequences at the S-locus. This has implications for the evolution of S-haplotypes which comprise a co-adapted gene complex.

Dr Tim Robbins (UoN; tim.robbins@nottingham.ac.uk), Dr David Scott (UoN), Dr Michelle Wirthensohn (UoA) and Professor Diane Mather (UoA).