

FoodBioSystems DTP - PhD Project Advertisement Text

Project Title: FOODBIOSYSTEMS - Evaluating epigenetic and transcriptomic adaptations to climate change in *Brassica napus* (oilseed rape)

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Research Group: FOODBIOSYSTEMS BBSRC DTP

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Application Deadline: 6 March 2020

Project Description:

Background: The recent heat wave events witnessed over the past few years across the UK as a result of change in the global climate, represents a serious threat to agriculture. Significant loss in crop production has been observed worldwide, which is sometimes attributed to the rise of heat coupled with drought (Mittler, 2006). Oilseed rape (*B. napus*) is an economically important crop for the UK, where higher temperature at pre-anthesis period has been proven to reduce pollen fertility (Morrison, 1991) and also can have severe impact on seed moisture at post-anthesis, which in turn deteriorates the quality of oil content and composition. At the other extreme, cold temperatures in December, which may be less common in the future, have recently been positively associated with yield in oilseed rape (Brown *et al.*, 2019).

There is increasing evidence that epigenetic mechanisms, such as DNA methylation and histone modifications, alter the regulation of gene expression as a direct response to heat stress; this may influence plant growth and development. It has been shown that higher temperatures can significantly affect expression of genes related to flowering in *B. napus* (Tang *et al.*, 2019). Currently, the epigenetic mechanism of heat stress response for the UK varieties is not well understood.

Project Aims and objectives: the aim of this project is to provide a systems-level molecular and metabolic understanding of the impact of heat stress on yield and seed development of *B. napus* for UK-specific varieties. Such a systems biology approach will be achieved through monitoring DNA methylation and global transcriptome profiling in tandem with metabolic analysis of oilseed rape as a result of heat stress. The project is a collaboration between Cranfield University and University of Reading. The main objectives of the project include:

1. Investigating the effect of heat stress on two lines on pollination fertility and seed quality at pre- and post-anthesis periods of *B. napus*.
2. Identifying site-specific modification of DNA methylation in the *B. napus* genome susceptible to heat

stress

3. Performing transcriptome profiling using RNA-Seq, to identify key differentially expressed genes as a result of heat stress.

The above objectives will lead to the development of a gene regulatory network in order to assess the epigenetic mediation effect on pollination fertility and seed quality measures. Ultimately, these results will be used to develop a machine learning model to predict the future impact of heat stress on pollination fertility and seed quality.

Funding Notes: This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants. Due to restrictions on the funding, this studentship is only open to UK students and EU students who have lived in the UK for the past three years.

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: The student ideally will be coming from Bioinformatics or related background. Training will be provided training in conducting wet lab experiments under the supervision of experienced academics in Cranfield University and the University of Reading. The project PI is Course Director for the Applied Bioinformatics MSc course and the recruited student will have the opportunity to attend computational and NGS informatics modules of this course according to their background and current skill set. In addition, the student will be able to attend external and internal courses on machine learning as required. The student will also have the opportunity to attend national and international conferences in appropriate subject area.

Student profile: This project would be suitable for students with a BSc in biology and a postgraduate degree in bioinformatics. If the student is trained at undergraduate level in bioinformatics or related computer science field, experience in chemistry, nutrition, agriculture, food science or a closely related science is required.

References:

- Brown, JKM. et al. (2019) Sci.Rep., 9:6953.
- Gao, G. et al.(2014). Bre.Sci, 64:125-133.
- Morrison, MJ. (1991). Can.Jou.Bot., 71:303-308.
- Mittler, R. (2006). Tre.Pla.Sci, 11:15-19
- Tang, X. et al. (2019). BMC Gen., 20:644.
- Yu, X. et al. (2012) Jou.Exp.Bot., 63:1025-1038.