Intercepting CLAVATA receptor-like kinase function to engineer ear size in wheat

Supervisory team:
Main supervisor: Dr Jill Harrison (University of Bristol)
Second supervisor: Prof Keith Edwards (University of Bristol)
Non-academic (CASE) supervisor: Dr Chris Burt (RAGT seeds)

Host institution: University of Bristol
CASE partner: RAGT seeds

Project description:

Summary: Ensuring continuous global food security will be a major challenge of the 21st century, and wheat contributes approximately 20% of the total calories consumed by humans (FAO, 2017). In cereals like wheat, inflorescence (ear) size determines the number of flowers (florets) and grains produced, and this aspect of plant architecture is regulated by the activity of stem cells in the growing shoot tips. The CLAVATA peptide/ receptor-like kinase signalling pathway maintains the size of the stem cell pool during plant development, and mutants in maize and tomato have increased yields, arising due to an increase in size of the stem cell pool. This project aims to intercept wheat CLAVATA signalling to engineer ears with more fertile grain sites and increase yield. The project will involve: (1) Identification of wheat CLAVATA pathway components (2) Expression analyses of wheat CLAVATA pathway components (3) Generation phenotypic analysis of wheat CLAVATA pathway mutants. Dr Harrison's group has recently published gene trees for CLAVATA pathway components from a range of land plants (Whitewoods et al. (2018)), and she has experience of analysing gene expression patterns and function in a wide range of plant species. Professor Edwards and colleagues from the Bristol Centre for Agricultural Innovation have extensive experience with wheat having sequenced the genome (Brenchley et al. (2012)), identified many mutants from the exome sequenced Cadenza TILLING mutant population (Krasileva et al. (2017)) and established engineering procedures using CRISPR/Cas9. The CASE partnership with RAGT seeds will bring an opportunity for the student to directly experience wheat breeding and exchange knowledge and findings with wheat growers.
Training: By combining computational and wet lab approaches, your project work will provide training at the cutting edge of the plant development field. You will benefit from further formal teaching and internships included in the SWBioDTP programme. The skills and techniques you learn will be broadly applicable in the academic biology and biotech sectors and widely transferable amongst areas such as science policy, publishing and computing.

Reading: Brenchley et al. (2012). Analysis of the bread wheat genome using whole-genome shotgun sequencing. Nature 491: 705-710. Food and Agriculture Organization of the United Nations, FAOSTAT statistics database, Food balance sheets (2017); www.fao.org/faostat/en/#data/FBS. Krasileva et al. (2017). Uncovering hidden variation in polyploid wheat. PNAS 114: E913-E921. Whitewoods et al. 2018. CLAVATA was a genetic novelty for the morphological innovation of 3D growth in land plants. Current Biology 28: 2365-2376.