How does whole genome duplication alter phenotypes? Lessons from Arabidopsis about crops and cancer.

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Submit applications for this project to the University of Bath

Project description:

Polyploidy, when organisms have more than two copies of one chromosome, is a common occurrence in plants, and many major food crops are polyploid (e.g. potato, wheat, oilseed rape). In addition, genome instability, including polyploidy and aneuploidy, is among the major drivers of cancer in humans. Thus, understanding how polyploidy affects genetic programmes is of central importance to diverse areas of biology, ranging from crop development to human health.

Polyploid plants are often more tolerant to abiotic stresses such as cold and drought, but it remains unclear why polyploidy causes changes in plant phenotypes. It is easier to explain phenotypic changes in allopolyploids which arise through the combination of two distinct genotypes, due to the introduction of new genetic combinations. However, changes in phenotypes are also seen in recently created autopolyploids, which arise through genome duplication and theoretically contain the same genetic information as their diploid ancestors, except in higher dosage.

In this project, we will use existing autopolyploid lines (4n, 8n) of the diploid (2n) plant Arabidopsis thaliana, to investigate how genome doubling affects molecular and whole-plant phenotypes. The specific aims of the project are to investigate the role of genomic rearrangements on the initial generations after WGD, to investigate the impact of WGD on tolerance to abiotic stress, to determine how WGD influences RNA and protein expression using RNA-seq and quantitative proteomics, and to integrate these data sets to deduce the influence of the (epi)genome on protein expression and ultimately whole plant phenotype.

The project, based at Rothamsted Research and Bath University, will provide excellent opportunities for the student to learn a broad range of molecular skills and to develop quantitative and bioinformatics skills within an evolutionary plant science context.