**University of Leicester**

**BBSRC MIBTP Studentship Project 2025-6 entry.**

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**Section 2 – *Project Information***

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| **Project Title** | Engineering meiotic resilience to climate change in plants |
| **Project Summary** | |
| **Background**  Climate change is associated with a global rise in temperatures and unpredictable weather patterns. This has a direct impact on plants that are adapted to pre-industrial conditions and therefore susceptible to new abiotic stresses. The majority of calories consumed by humans arise from plant reproductive tissues (e.g. corn, rice, fruit and various vegetables), so any damaging effects arising during development have a direct impact.  Meiosis is a specialised cell division during sexual reproduction that is required to halve the numbers of chromosomes so normal ploidy is restored by fertilisation. Meiosis is particularly sensitive to changes in seasonal and global temperatures and can lead to fertility defects as chromosomes are more likely to mis-segregate under these conditions1,2. We have recently identified new proteins in Arabidopsis that are involved in a particularly sensitive stage of meiosis. These proteins require molecular and cytogenetic characterization, but more importantly, they can be tested for functionality at high temperatures and provide a potential route for future-proofing crop plants. The project will involve use of cutting-edge technology including super-resolution fluorescence microscopy in conjunction with a panel of antibodies to meiotic proteins and mutant lines that we have previously characterised. Cloning and gene editing with CRISPR/Cas are likely to be employed to modify alleles to test the role of specific amino acids in the target proteins as well as yeast-2-hybrid for interaction analysis.  **Aim**  The ultimate aim of this work is to identify susceptible parts of the meiotic system to heat stress (e.g. specific protein folding, protein-protein interactions or gene expression) and then engineer resilience through modified alleles or gene expression. This work will be performed in the model plant Arabidopsis that can be translated into crop plants.  **Objectives**   1. Identify which meiotic stages are most susceptible to heat stress temperatures (28-34oC) 2. Identify and compare Arabidopsis ecotypes sensitive and resilient to high temperature stress (e.g. from North Sweden and Cape Verdi Islands) 3. Investigate gene dosage effects on heat stress tolerance 4. Utilise super-resolution microscopy to dissect which proteins do not function normally at high temperatures 5. Test for interactions of proteins with yeast-2-hybrid and potentially engineered variants   Techniques that will be undertaken during the project  Super-resolution fluorescence microscopy  Yeast-2-hybrid  DNA extraction  Cloning  Immunolocalisation  Cytology | |
| **References** | |
| **References**   1. De Jaeger-Braet J, Schnittger A (2024) [Heating up meiosis - Chromosome recombination and segregation under high temperatures.](https://pubmed.ncbi.nlm.nih.gov/38749207/) *Curr Opin Plant Biol*. 80:102548. doi: 10.1016/j.pbi.2024.102548. 2. Bomblies K, Higgins JD, Yant (L 2015) [Meiosis evolves: adaptation to external and internal environments.](https://pubmed.ncbi.nlm.nih.gov/26075313/) *New Phytol*.;208(2):306-23. doi: 10.1111/nph.13499 | |