**University of Leicester**

**BBSRC MIBTP Studentship Project 2024-5 entry.**

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| **Project Reference** |  |

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| **Additional Supervisor** |  |

**Section 2 – *Project Information***

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| **Project Title** | Investigating the role of SUMOylation in meiotic recombination and chromosome segregation in Arabidopsis |
| **Project Summary** | |
| Post-translational modifications of proteins such as phosphorylation, methylation and acetylation have been extensively studied in eukaryotes and now the Small Ubiquitin modifier (SUMO) is gaining attention for its importance in fundamental biological roles. SUMO is a small protein that can be conjugated to target proteins through a cascade of E1, E2 and E3 ligases. Recently, SUMO has been mapped to yeast meiotic proteins, indicating an essential role in regulating homologous recombination1. We have identified two potential E3 ligases (based on protein structure), that are required for normal recombination to proceed in *Arabidopsis thaliana*. Interestingly, in the mutant of one of the genes, crossover sites are altered in number and position, indicating that SUMOylation is required for crossover patterning. The aim of this project will be to characterise one of the E3 ligase mutants and determine its function during meiosis.    You will analyse chromosomes of the Arabidopsis mutants with structured illumination super-resolution microscopy in conjunction with a panel of antibodies that we have generated in the lab that specifically bind to meiotic proteins that control crossover number and position. This will give you an insight into the mutant phenotype and what is going wrong in the absence of the E3 ligase. You will also perform yeast-2-hybrid experiments to identify which proteins the E3 ligase binds to and which lysine residues are targeted. Once interacting proteins have been identified you will perform an *in vitro* analysis to detect if they are mono- or polySUMOylated. If successful, you will mutate SUMOylated lysine residues and transform the Arabidopsis mutants by complementation to determine the functionality of SUMOylation by phenotypical analysis with cytological and genetic techniques. In addition, you will learn molecular techniques such as cloning, PCR, DNA sequencing and protein analysis.  Techniques that will be undertaken during the project  Super-resolution structured illumination microscopy, immunolocalization, fluorescence in situ hybridisation, PCR, cloning, DNA sequencing. | |
| **References** | |
| Bhagwat NR, Owens SN, Ito M, Boinapalli JV, Poa P, Ditzel A, Kopparapu S, Mahalawat M, Davies OR, Collins SR, Johnson JR, Krogan NJ, Hunter N [SUMO is a pervasive regulator of meiosis.](https://pubmed.ncbi.nlm.nih.gov/33502312/) (2021) Elife. 10:e57720. doi: 10.7554/eLife.57720. | |

**To apply please refer to**

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