BBSRC Research Experience Placement Studentship

Title of Project	Safeguarding our daily bread from wheat rust diseases
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Wheat rusts are destructive diseases of wheat, which throughout recorded history have caused devastating epidemics almost wherever wheat is grown. The wild ancestors of domesticated wheat represent a rich source of genetic variation with huge potential for improving disease resistance. Deploying this genetic diversity into elite, cultivated wheat by traditional breeding takes many years for just a single resistance gene. However, the molecular identification (cloning) of resistance genes opens up new possibilities for accelerated breeding by marker-assisted selection and genetic engineering[1]. The Wulff lab has established a suite of molecular plant breeding technologies that significantly reduce costs and accelerate **plant growth**[2,3], **gene discovery**[4,5,6] and **gene cloning**[6,7,8] (**Fig. 1**).

The project addresses the BBSRC priority area of Food Security. You will work closely with a Postdoc in the lab, Dr Sanu Arora, to engineer binary vector constructs containing candidate wheat stripe rust resistance genes, which we have previously identified in *Aegilops tauschii*, for transformation into bread wheat. This will involve a blend of bioinformatics and wet lab molecular biology from determining exon-intron gene structure by RNAseq analysis to long range PCR, subcloning and sequence verification by Sanger sequencing. You will also have the opportunity to receive training in our bespoke association genetics pipelines for rapid gene identification[6].

You will join a team of postdocs and PhD students with expertise in bioinformatics, mathematics, scripting, genetics, plant pathogen interactions, and wheat husbandry and crossing. JIC is a vibrant place to discuss and plan science. You will become part of the larger JIC community and alumni, which we hope will have lasting positive impacts on your future career.

References

[**1**] Dhugga & Wulff (2018). *Science* 361:451-452. [**2**] Watson *et al* (2017) *Nature Plants* 4:23-29. [**3**] Ghosh *et al* (2018) *Nature Protocols* 13(12):2944-2963. [**4**] Steuernagel *et al* (2015) *Bioinformatics* 31:1665-7. [**5**] Steuernagel *et al* (2018) BioRxiv: doi.org/10.1101/339424 [**6**] Arora *et al* (2019). *Nature Biotechnology* 37:139-143. [**7**] Steuernagel *et al* (2016). *Nature Biotechnology* 34:652-5. [**8**] Sánchez-Martín *et al* (2016). *Genome Biology* 17:221.

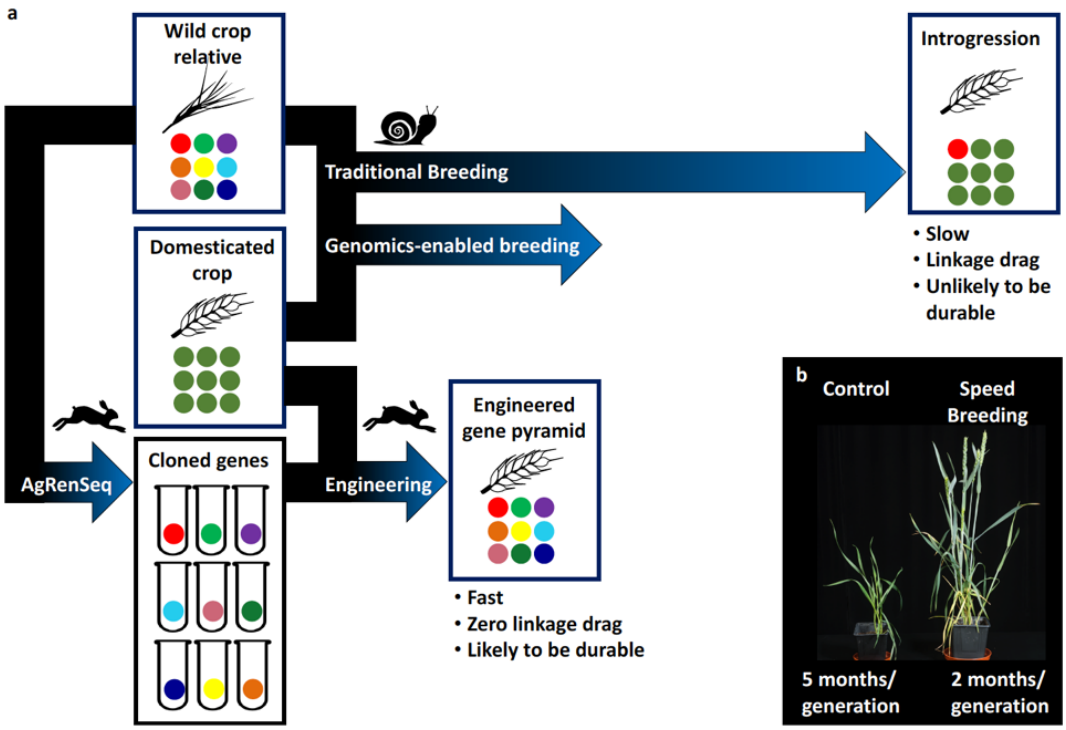

Figure 1. Incorporation of resistance genes from crop wild relatives into elite cultivars. Speed breeding halves the generation time. Insert (**b**) shows plants grown under glasshouse conditions (left) or speed breeding (right).