



Designing Future Wheat

The Coordinated UK Wheat (ISP) Programme

<https://designingfuturewheat.org.uk>

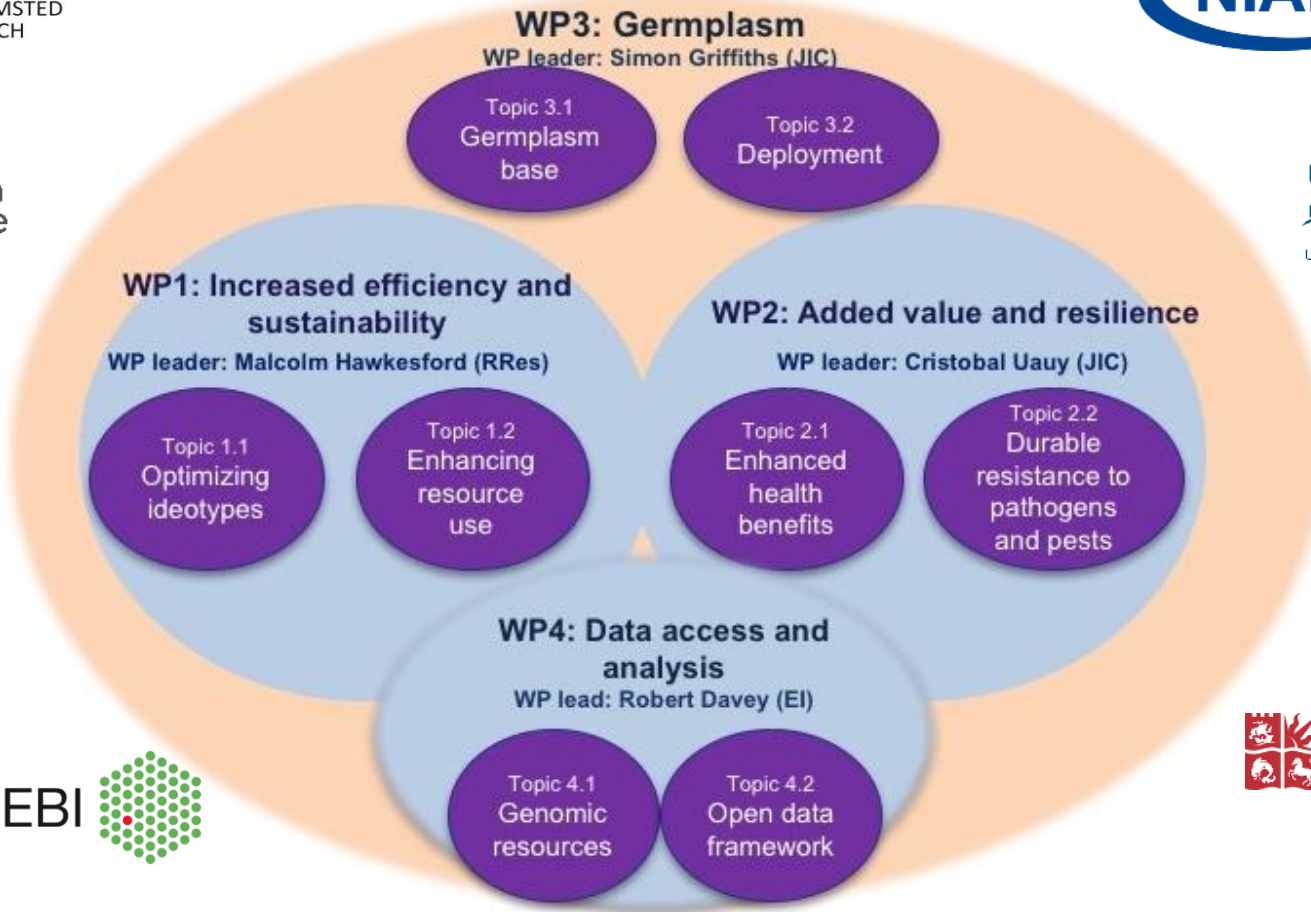
Formed in response to a recommendation made in 2015
by a BBSRC Council Wheat Sub-group, subsequently
endorsed by Council



Designing Future Wheat

Structure

Eight institutions-36 Project leaders





Designing Future Wheat

Research Strategy

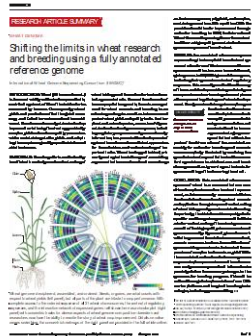
- ISPGs support long term research programmes or pre-competitive (underpinning) activities not suitable for small grant funding
- DFW strategy centres on development of key community resources and germplasm with field-based experimentation
- DFW researchers have been at the forefront of a series of resource developments, together creating a major 'Step Change' in wheat research
- This 'Step Change' is propelling wheat research into the mainstream of the international plant research community





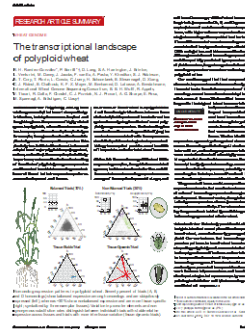
The 'Step Change'

Wheat genome sequence-Science-2018



Know gene order of every gene

Wheat gene expression-Science-2018



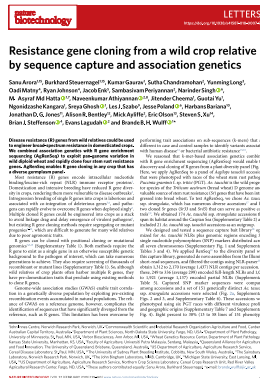
Know expression pattern of every gene

Targeted gene mutagenesis



mutations of every gene
-so can know their function

Disease resistance-Nature biotech-2019



Rapid identification of wheat resistance genes

Speed breeding-Nature Plants-2018



Reduce generation times by 40%

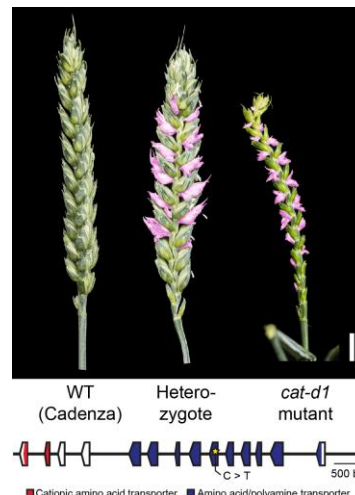
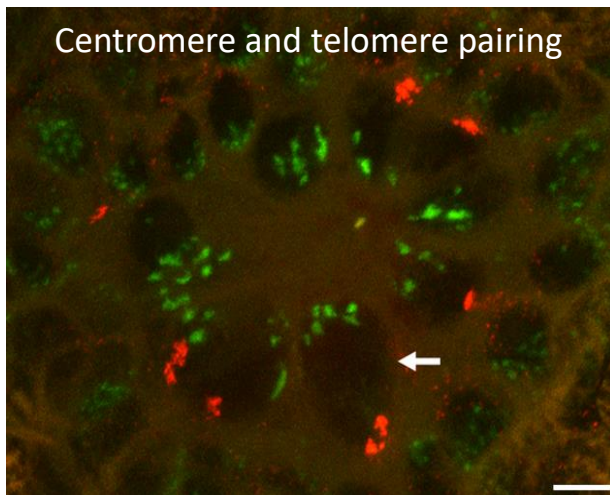


The 'Step Change' (cont)

Impact on Biology Targets

First examples

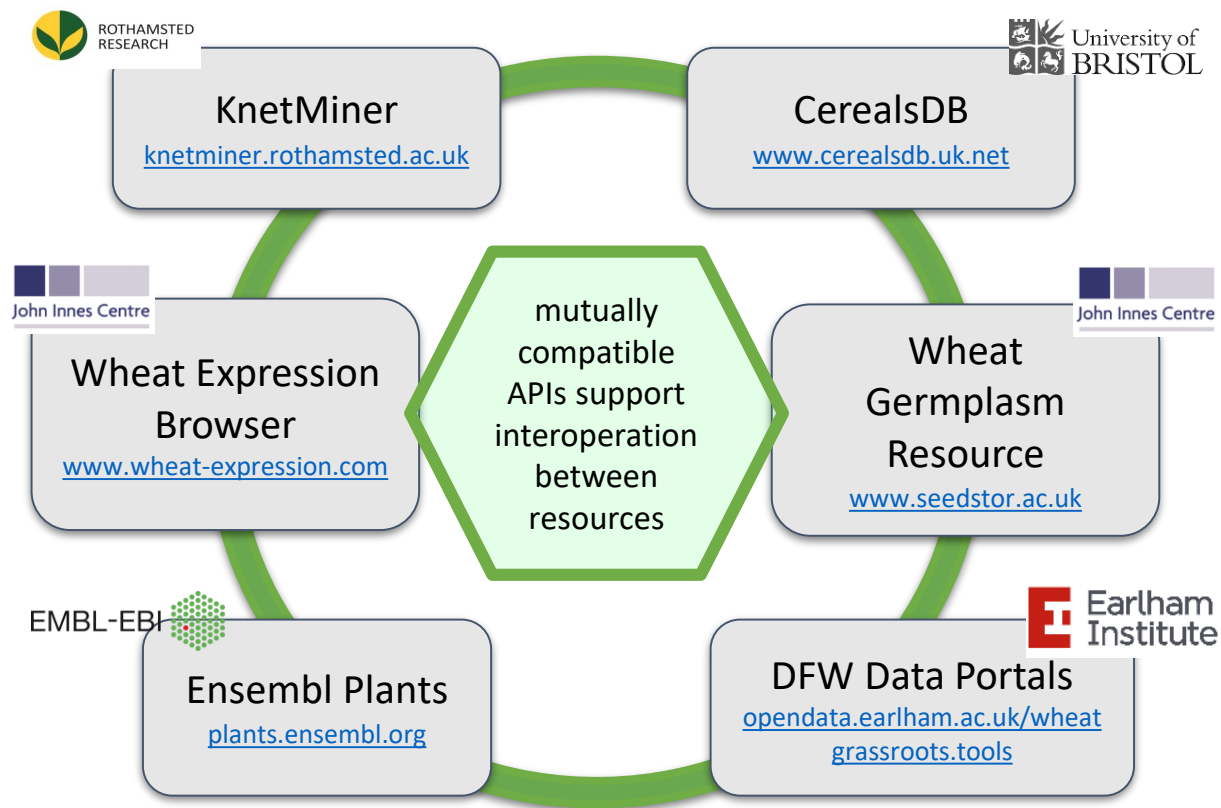
- 60 year old *Ph1* story on meiosis and polyploidy brought to a close
- Identification of genes (*TB1* and *CAT1*) regulating inflorescence architecture in hexaploid wheat
- *Stb6* Septoria resistance gene cloned and characterised in an analysis of resistance/susceptibility genes to pathogens and pests





The 'Step Change' (cont)-Data Resources

Partner Data Resources contributing to virtual data infrastructure



Data in open public repositories

Web Statistics (Apr17-Oct19)

DFW Data Portals: **6164** unique users
(22TB data hosted, 14TB downloaded)
 Wheat Expression: **9739** unique users
 Knetminer: **7199** unique users
 CerealsDB: **11126** unique users
 SeedStor: **13202**
 Ensembl Plants (Wheat): **34488** unique users

81918 total

Earlham Institute

DFW Publication Repository
ckan.grassroots.tools

255 DFW papers and associated datasets

The screenshot shows a search interface with the following details:

- Page title: Designing Future Wheat
- Navigation: Datasets, Organizations, Groups, About, Search
- Search results: 255 datasets found
- Organization list: Rothamsted Research (18), John Innes Centre (2), Earlham Institute (2), National Institute (1), University of Bristol (1), University of Nottingham (1), European Bioinformatics Institute (1)
- Group list: DFW Publications (18)
- Featured dataset: **Triforce Genomics for Sustainable Agriculture** (Version 1.1 assemblies of *Triticum aestivum* (Cadizca, Paragon, Robigus, Claire) and *Triticum turgidum* (Kronos). Version 1.1 assemblies were generated from filtering v1.0...)
- Another dataset: **Aegilops tauschii diversity panel** (This is the raw data from whole genome shotgun sequencing of 150 accessions of *Aegilops tauschii*, a wild relative of wheat.)

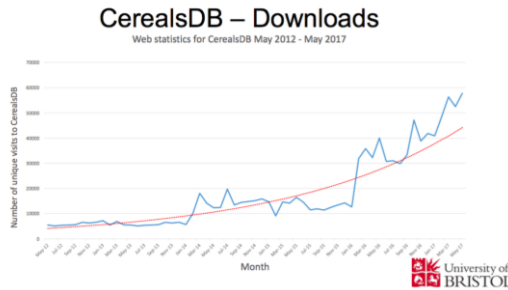


The 'Step Change' (cont)

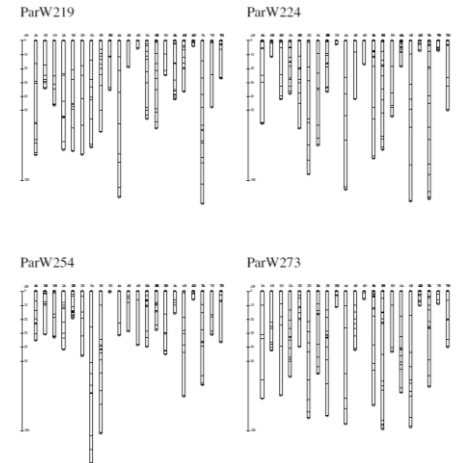
Germplasm Development

'Academic toolkit'

26,000 DFW pre-breeding lines, many mapped for yield, nitrogen-use efficiency, and disease resistance



Molecular markers associated with traits



>100 F₆ "off-the shelf" mapping populations (many phenotyped)

Germplasm publicly available through
Germplasm Resource Unit



<https://www.seedstor.ac.uk>



Designing Future Wheat Pathways to Impact - Breeders Toolkit

Breeder Tool Kit Selection Committee

Chair
Simon Griffiths

Breeding Companies

- KWS Jacob Lage
- RAGT Chris Burt
- LSPB David Schafer
- Limagrain Phil Talby
- Syngenta David Feureuhelm
- BASF Michael Schmolke
- DSV Matt Kerton
- Elsoms Milika Buurman

Work Package Leaders

- Malcom Hawkesford
- Cristobal Uauy
- Rob Davey

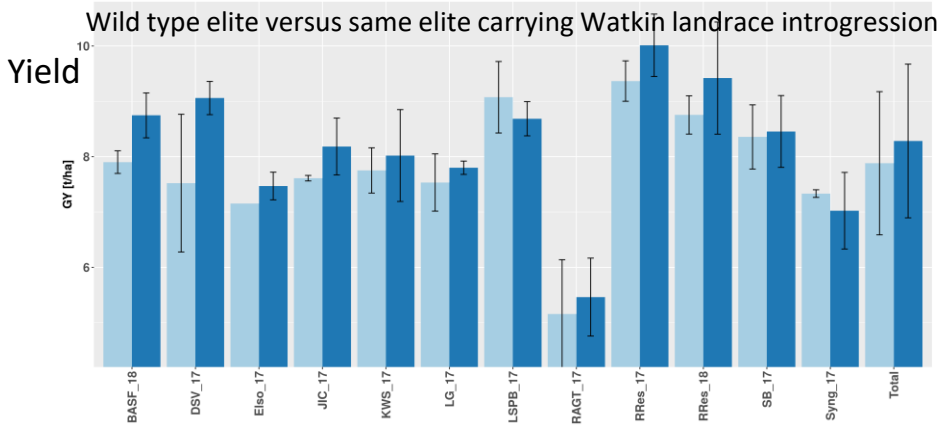
Work Package 3 Institute Representatives

- Bristol Keith Edwards
- NIAB Alison Bentley
- Nottingham Julie King

GRU Representative and Coordinator Simon Orford

DFW Programme Manager Julie Ellwood

DFW Programme Lead Graham Moore



Germplasm Resources Unit

..... a national capability supported by the BBSRC at the John Innes Centre



Designing Future Wheat

Final Two Years

- Two further years of field experimentation
- Clear that even highly heritable traits such as flowering time do not behave the same in the field and glasshouse
- Field experimentation becoming more important – an extension of the lab
- Refine phenotyping tools and data management and integrate with genomics and field experimentation

