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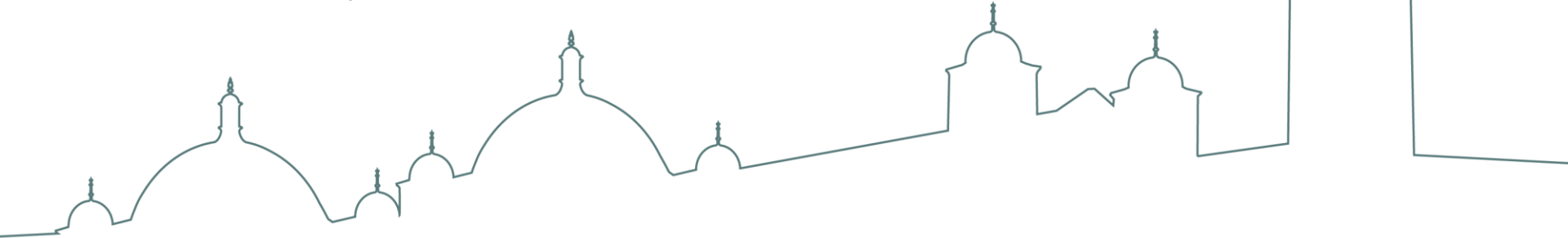
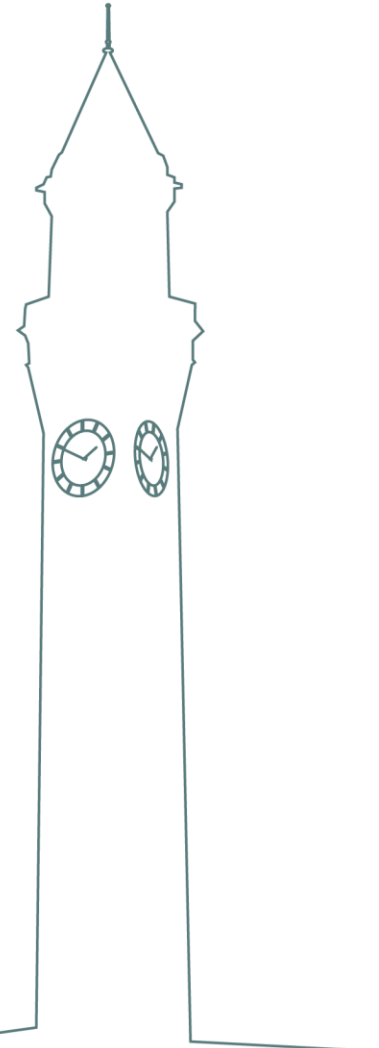
COLLEGE OF LIFE
AND ENVIRONMENTAL
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Development of tools for dissection of oak tree diseases

Dr Graeme Kettles

3rd annual BIFoR Community Meeting

30th January 2019



@GraemeKettles

The challenge of trees (from the perspective of a molecular biologist)



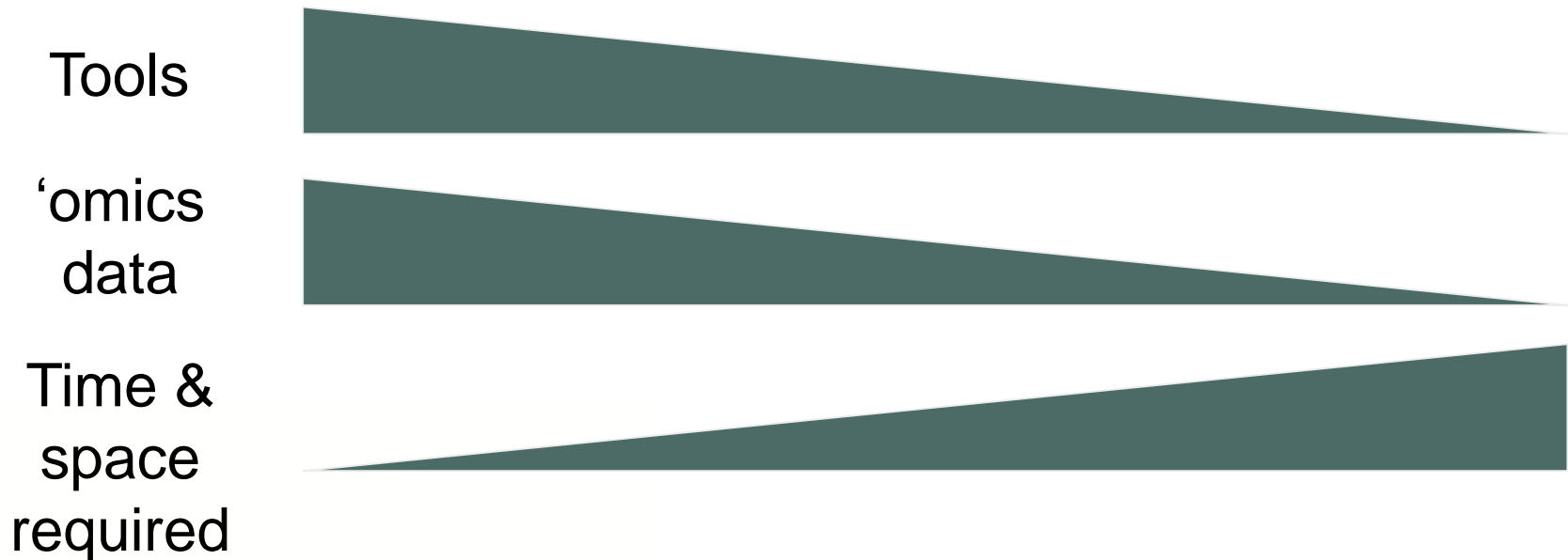
Model plants



Crops



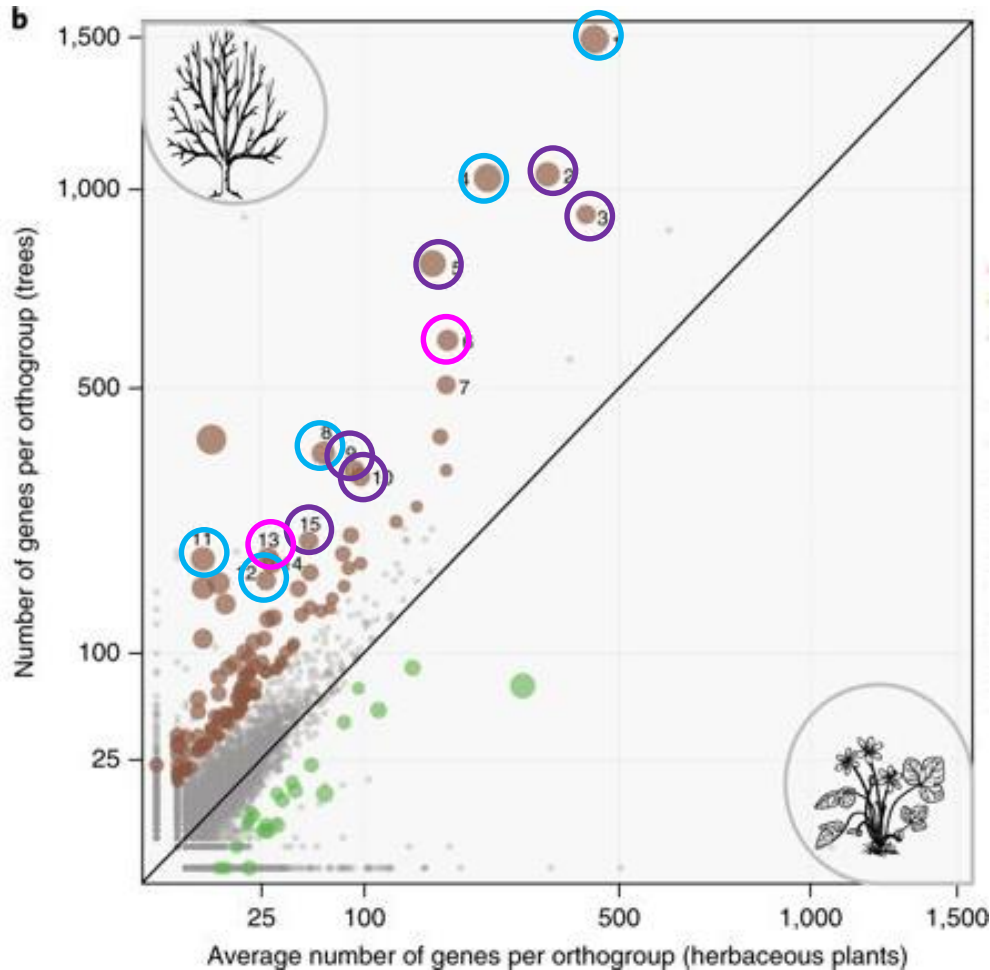
Trees



What tools do we need?

- Genomic data for tree species (leads!)
- A method for reverse genetics
- Markers of immune status
- Expression of transgenes
- Pathogen bioassays

What do tree genomes tell us?



Nucleotide-binding and leucine-rich repeat (NLR) immune sensors

Receptor-like kinase (RLK) immune sensors

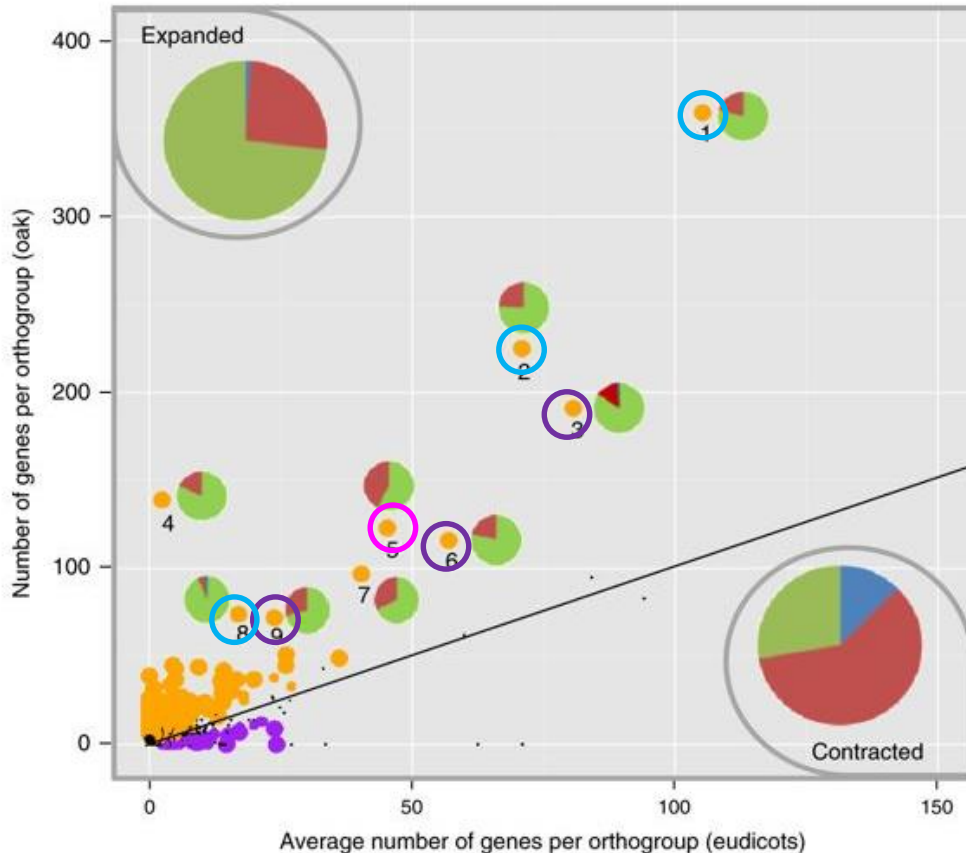
Receptor-like protein (RLP) immune sensors



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The *Quercus robur* genome



Nucleotide-binding and leucine-rich repeat (NLR) immune sensors

Receptor-like kinase (RLK) immune sensors

Receptor-like protein (RLP) immune sensors

How do you chase these leads?

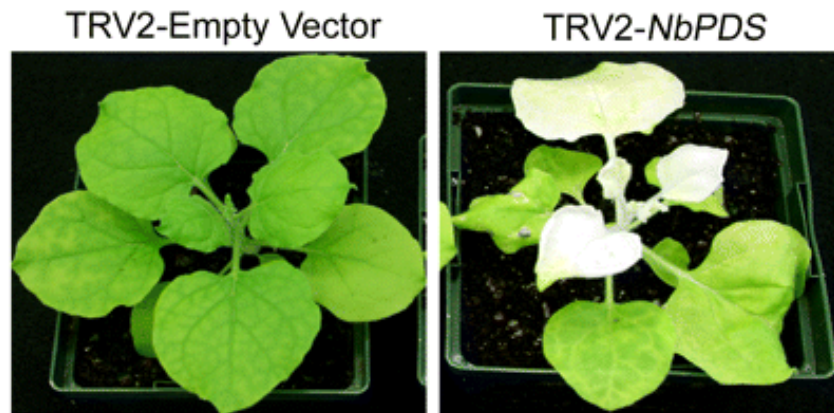


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A method for reverse genetics

- Analysis of gene function often involves targeted mutagenesis
- Stable transformation is difficult in tree species
- Transient methods such as Virus-Induced Gene Silencing (VIGS) are a fast, high-throughput alternative

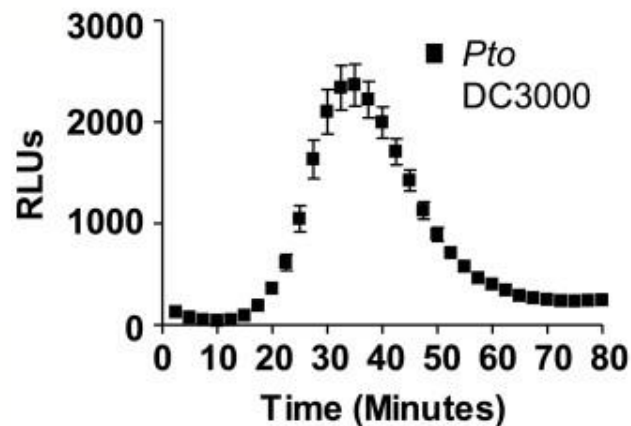


Silencing of the PDS gene induces photobleaching in the tobacco *Nicotiana benthamiana*

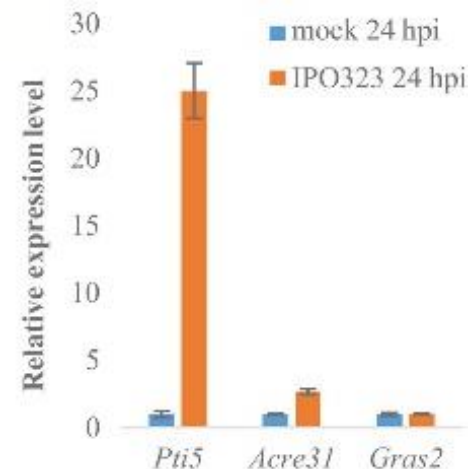
Markers of immune status

- What markers are hallmarks of immune activation?
- How do they differ between resistant and susceptible individuals?

Early (minutes)



Late (days)

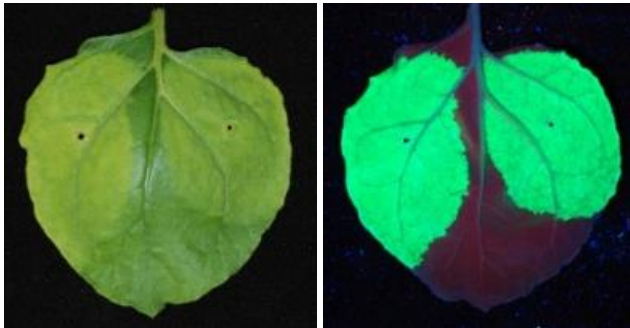


(Smith and Heese, 2014, *Plant Methods*)

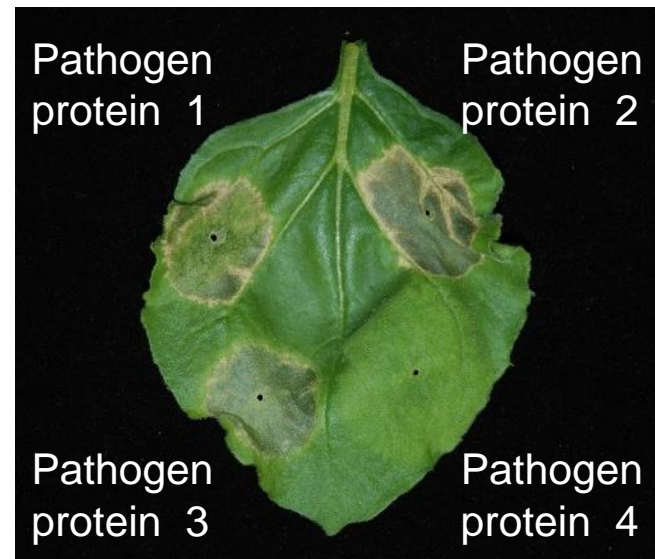
(Kettles et al., 2017, *New Phytologist*)

Expression of transgenes

- Viral and bacterial systems allow expression of foreign proteins in plants
- Proteins can be of plant, animal or pathogen origin

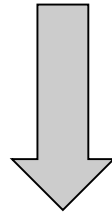


Expression of Green Fluorescent Protein (GFP) in the tobacco *Nicotiana benthamiana*



Glasshouse bioassays

Field symptoms

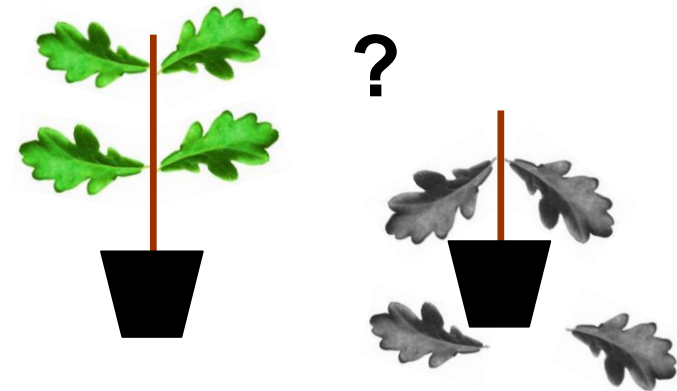


Resistant

Susceptible



Bioassay



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Acknowledgements



@GraemeKettles



Rob MacKenzie

Michael Tausz

David Shorthouse (Norbury Park &
Ranton Estate)

David Gwilliam (Prees Heath Forest Nurseries)



ROTHAMSTED
RESEARCH

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JABBS Foundation

