



Plant cell wall composition
First steps in manipulating plant cell wall synthesis

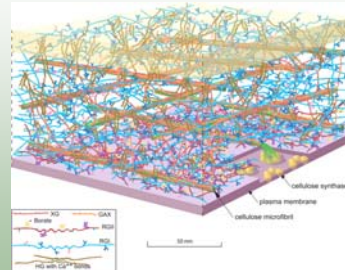
Paul Dupree

Jenny Mortimer, Florence Goubet, Godfrey Miles,
 Thilo Weimar, Dora Tryfona, Marcelo Segura, Hui Chung Liang,
 Nick Hartman, Patricia Mathabe, Zhinong Zhang, Xiaolan Yu

Kathryn Lilley CCP Proteomics Group Leader
 Pawel Sadowski, Svenja Hester

Elaine Stephens, Chemistry

The first step towards optimising biomass:
understanding plant cell walls
 – both structure and function of components.

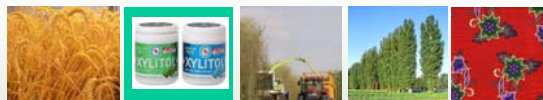


Approx. content
 Cellulose (40%),
 Hemicelluloses (20-30%)
 Pectins (10-20%)
 Proteins (<10%)
 Lignin (0-20%)

Hemicelluloses constitute
 a high proportion of biomass

Somerville et al, based on McCann and Carpita

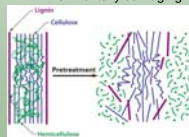
Uses of plant cell wall polymers



Dietary fibre Sugar substitute Energy - combustion or ethanol Timber, paper, pulp Materials

Insufficient in diet
 Too much in animal feed

Hemicellulose and lignin extraction from cellulose:
 Harsh chemical treatments
 Energy intensive
 Environmentally damaging

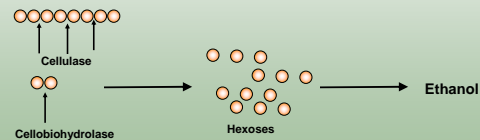


'2nd generation' biofuels.

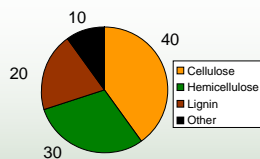


•Bioenergy crops or by-products of food production e.g. *Miscanthus*, sugar cane bagasse, wheat straw, willow.

•Cellulose is the current focus, with hemicelluloses often considered waste.



Efficient biofuel production will need to use hemicelluloses.



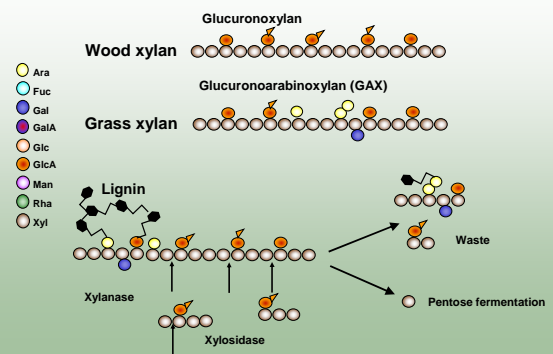
Hemicellulose:
 90% Xylans, 5% Mannan

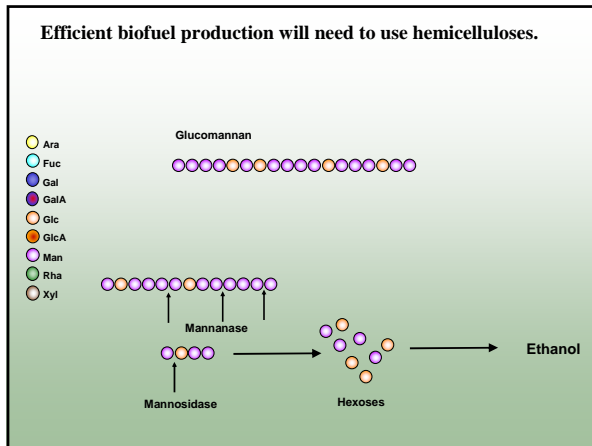


Hemicellulose:
 5% Xylan 90% Mannan



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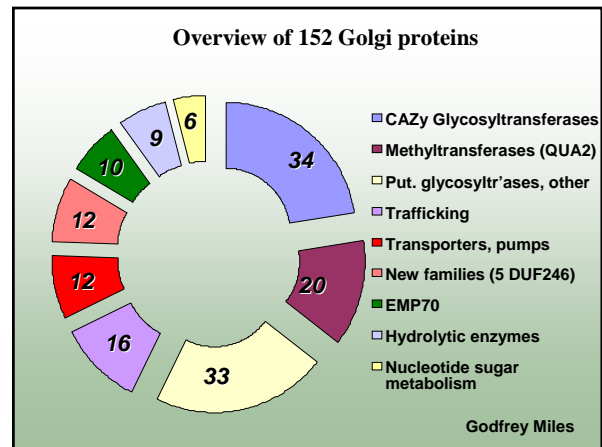
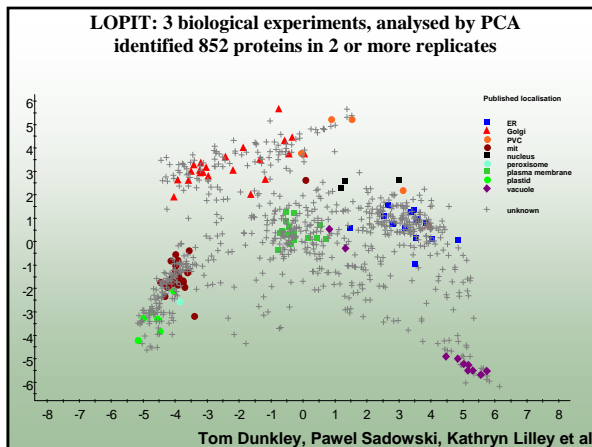
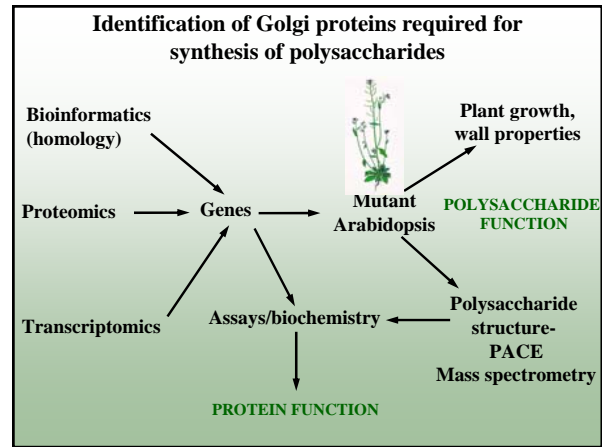
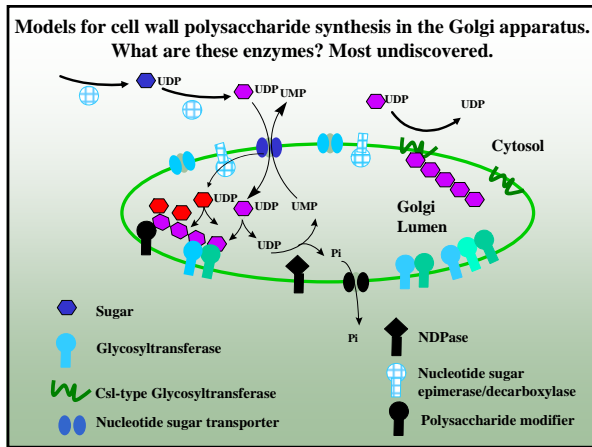
Efficient biofuel production will need to use hemicelluloses.

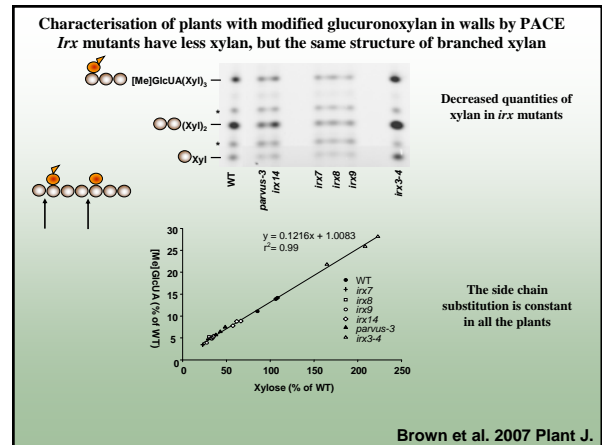
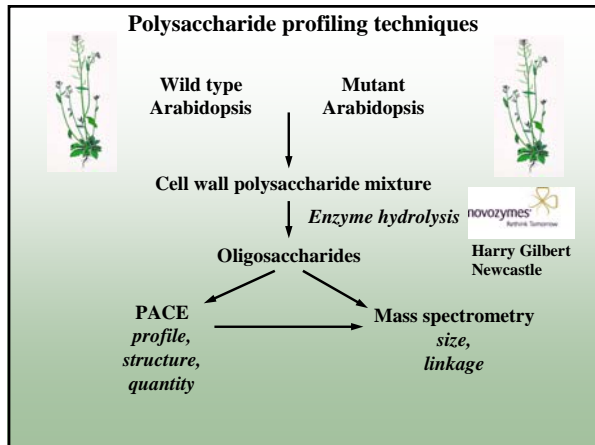
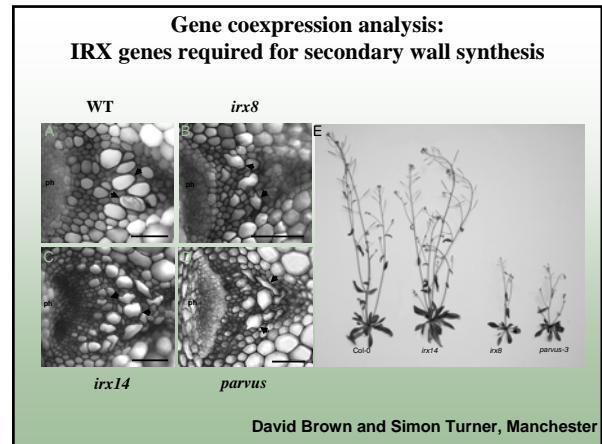
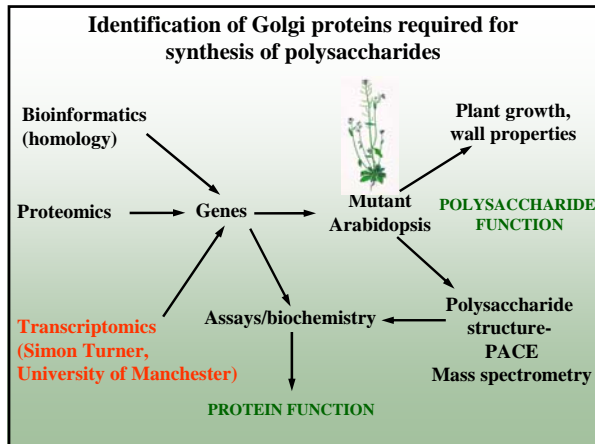
Issues:

- Linkages of xylan and lignin inhibit access of cellulases to the cellulose
- Fermentation of hexose is more effective than of pentose

Solution:

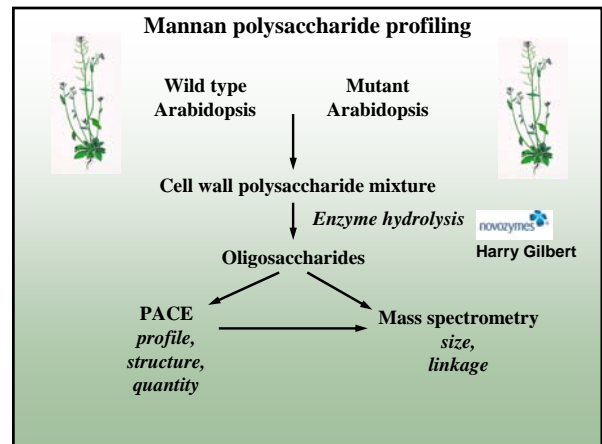
- Understand the synthesis of polysaccharides
- Understand their function
- Optimise their synthesis and structure to minimise pretreatment, maximise useful yield

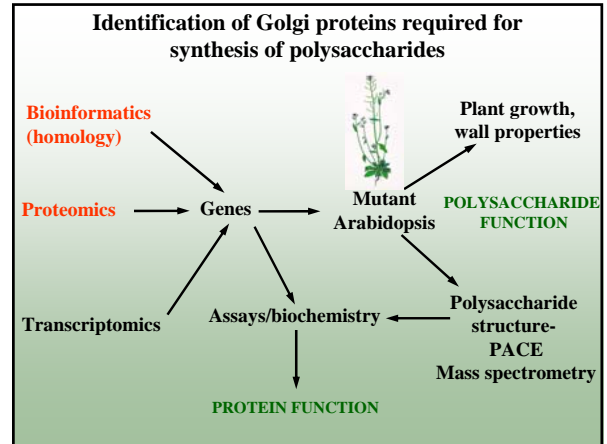
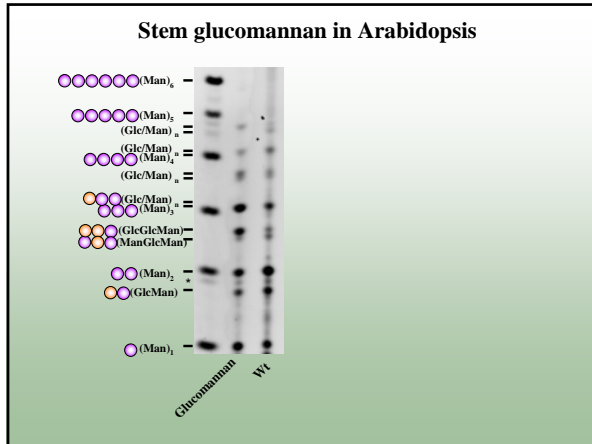








Xylan synthesis conclusions

- Reduction of xylan content below 60% of normal leads to collapsed xylem and dwarfing
- Branching seems constant in all mutants
- Discovery of branching enzymes and links to lignin are an important target





 <p>UNIVERSITY OF CAMBRIDGE</p> <p>Golgi enzymes and PACE, glycan analysis</p> <p>Bioinformatics</p> <p>Proteomics Protein complexes Membrane trafficking Golgi proteins</p>   	<p>Department of Biochemistry Paul Dupree</p> <p>Jenny Mortimer, Hui Chung Liang, Dora Tryfona, Xiaolan Yu, Zhinong Zhang, Godfrey Miles, Florence Goubet, Chris Barton, Vicky Wong, Peter Richardson Postdoc vacancies</p> <p>Marcelo Segura, Xiaofei Li</p> <p>Patricia Mathabe, Nick Hartman Thilo Weimar Godfrey Miles</p> <p>Kathryn Lilley CCP Group Leader Pawel Sadowski, Tom Dunkley</p> <p>Elaine Stephens, Chemistry Keith Seffen, Engineering</p> <p>Chris Hawes, Oxford Brookes Dave Twell, Leicester Harry Gilbert, Newcastle</p>
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