

## Dr Ben Trevaskis

CSIRO Agriculture and Food

Group Leader - Crop Genomics for Yield and Adaptation (RP1G2)

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## QUALIFICATIONS

PhD, Plant Sciences, Australian National University, 1998.

BSc, Honours (first class), Melbourne University, 1993.

## RESEARCH AREA – GENETIC CONTROL OF FLOWERING IN CEREALS

Flowering and grain production must coincide with optimal conditions to achieve the highest yield and optimal grain quality. I am investigating how cereal breeders have utilised variation in seasonal flowering behaviour to adapt crops to different climates. This research includes highly focussed molecular characterisation of the genetic pathways that control flowering in cereals and diversity surveys of genetic variation in wheat and barley breeding programs.

## PROFESSIONAL HISTORY

- Jun. 2014-now, Group Leader, “Crop genomics for yield and adaptation”, leading 5 teams with ~ 25 staff in total.
- 2006–2014, Research Scientist at the CSIRO Division of Plant Industry, Canberra, Australia. Research area: genetic control of flowering an grain production in cereals.
- 2002–2006, Post-doctoral fellow CSIRO Division of Plant Industry, Black Mountain, with Dr Liz Dennis and Dr Jim Peacock. Research area: genetic control of flowering an grain production in cereals (see following sections for details of achievements)
- 1999–2002, Postdoctoral fellow at the Max Planck Institute for Molecular Plant Physiology, Golm, Germany. Research area: Legume-rhizobia nitrogen–fixing symbiosis. (see publication list for details of achievements)
- 1998–1999 Postdoctoral Fellow in Biochemistry and Molecular Biology Department, Australian National University, Canberra. Research area: Legume-rhizobia nitrogen–fixing symbiosis. (see publication list for details of achievements)
- 1994–1998, PhD, Australian National University, Canberra. Thesis topic: The characterisation of hemoglobins from *Arabidopsis thaliana*. (see publication list for details of achievements)
- 1990–1993, BSc, with major in Genetics. University of Melbourne, Melbourne, Australia.

## **MEMBERSHIP OF PROFESSIONAL ORGANISATIONS**

- Australian Society of Plant Scientists

## **PRIZES AND ACADEMIC AWARDS**

- 2009 Goldacre Award, Australian Society of Plant Scientists (early career research).
- 2006 Julius Career Award (early career research, CSIRO award).
- 1999 Alexander von Humboldt Fellowship.
- 1993 Howitt (Major) Scholarship. (high achievement in biology, Melb. University).
- 1993 Dwight Prize (top 3<sup>rd</sup> year Genetics student, Melb. University).
- 1992 Dame Margaret Blackwood Prize (top 2<sup>nd</sup> year Genetics student, Melb. University).

## **GRANTS AND FELLOWSHIPS**

- ARC Discovery Grant “Clocks in crops: exploring the role of circadian rhythms in crop adaptation” with principal investigator Jim Weller, University of Tasmania.
- 4 year project to investigate genetic variation controlling flowering behaviour of wheat. (Grains Research and Development Corporation - GRDC, 2014)
- 3 year project to determine the relationship between frost tolerance and flowering in wheat and barley (GRDC, 2014).
- OCE Postdoctoral position, Genetics networks controlling flowering in cereals
- 2 year extension to research project - Frost tolerance and flowering (GRDC).
- CSIRO Julius Career Award
- An OCE/Transformational biology funded Postdoctoral position.
- An OCE/ANU funded PhD student position.
- Grains Research and Development Corporation E-concept - Frost tolerance and flowering (3 year project)
- CSIRO Postdoctoral Fellowship
- Max Planck Society Fellowship
- Alexander von Humboldt Fellowship

## **INVITATIONS ACCEPTED**

- Flowering Time Control – from Natural Variation to Crop improvement, Kiel, Germany 2018 (fully sponsored).
- International Symposium on Plant Breeding, Genomics and Biology, Shandong Agricultural University, Tai'an, China, 2017 (fully sponsored).
- 5th International Symposium on Plant Reproductive Development (5th ISPRD), Shanghai, China, 2017 (fully sponsored).
- University Vermont, adaptation of grasses workshop, 2016, (fully sponsored)
- Donald Danforth Centre for Plant Genomics Fall Conference, 2016 (fully sponsored)

- Plant Genomics China XV, Keynote speaker, 2014, (fully sponsored)
- Queenstown Plant Molecular Biology, NZ, 2014 (sponsored).
- Norwegian Plant Biology Meeting, Oslo, Norway 2012 (fully sponsored).
- North American Barley Researchers Workshop, Corvallis, Oregon, USA 2011 (partly sponsored).
- Nordic Grass Adaptation Workshop, Helsinki 2011 (fully sponsored).
- Congress of the Federation of European Societies for Plant Biology (FESBP) (2008), Tampere, Finland (fully sponsored).
- International Wheat Genetics Symposium (2008), Brisbane, Australia.
- Visiting Fellow at Oregon State University, Department of Crop and Soil Sciences. Sept. – Dec. 2008.

## TEACHING

- Supervising PhD student Jess Hyles, with Professor Richard Trethowan University of Sydney (2017-now)
- Co-supervised PhD student Julian Greenwood, with Professor's Steve Swain and Jim Weller, University of Tasmania (2013-2017)
- Co-supervised PhD student Darren Cullerne, with Dr's Craig Wood and Andy Eamans, University of Newcastle (2013-2017)
- Co-supervised PhD student, Ursula Steinfurt, with Dr Fernanda Dreccer, 2012-2015.
- Supervised PhD student, Aaron Greenup, with Dr Tony Millar, Australian National University (2008-2011)
- Six lectures per year BIOL2161, Australian National University (2004-2006)

## GERMPLASM DEVELOPED

- Near-isogenic wheat lines with different alleles of *VRN1* and *PPD1*.
- Near-isogenic barley lines with different alleles of *VRN1*, *VRN2* and *PPD1*.
- Wheat mutant collections (cv. Sunstate, Axe, Wedgetail, Suntop, Mace)

## OTHER RESEARCH CONTRIBUTIONS

- 2016-2018, Steering Committee CIMMYT "International Wheat Yield Consortium, Phenology project"
- 2016-2018, Management Committee, GRDC National Frost Initiative.
- Organising committee for the Australian Barley Technical Symposium, Sydney 2015 and Hobart 2017
- Organiser "Developing Crops of the Future" meeting, Kiama 2016.

## Publication List

Summary: 50 papers, 2454 citations, H-Index 26 (*Citation analysis from Web of Science*)

1. Flohr BM, Hunt JR, Kirkegaard JA, Evans JR, **Trevaskis B**, Zwart A, Swan A, Fletcher AL, Rheinheimer B. (2018) Fast winter wheat phenology can stabilise flowering date and maximise grain yield in semi-arid Mediterranean and temperate environments. *Field Crops Research*, 223, 12-25.
2. Finnegan EF, Ford B, Wallace X, Pettolino F, Griffith P, Schmitz RJ, Zhang P, Barrero JM, Boden SA, Hayden MJ, Cavanagh CA, Swain S, **Trevaskis B** (2018) Zebularine treatment is associated with deletion of FT-B1 leading to an increase in spikelet number in bread wheat. *Plant Cell Environment*, in press.
3. Voss-Fels KP, Robinson H, Mudge SR, Richard C, Newman S, Wittkop B, Stahl A, Friedt W, Frisch M, Gabur I, Miller-Cooper A, Campbell BC, Kelly A, Fox G, Christopher J, Christopher M, Chenu K, Franckowiak J, Mace ES, Borrell AK, Eagles H, Jordan DR, Botella JR, Hammer G, Godwin ID, **Trevaskis B**, Snowdon RJ, Hickey LT. (2017) *VERNALIZATION1* Modulates root system architecture in wheat and barley. *Molecular Plant*, 11: 226-229.
4. Greenwood JR, Finnegan EJ, Watanabe N, **Trevaskis B**, Swain SM (2017) New alleles of the wheat domestication gene *Q* reveal multiple roles in growth and reproductive development. *Development*, 144: 1959-1965.
5. Steinfort U, Fukai S, **Trevaskis B**, Glassop D, Chan A, Dreccer FM (2017) Vernalisation and photoperiod sensitivity in wheat: the response of floret fertility and grain number is affected by vernalisation status. *Field Crops Research*, 203:243-255.
6. Steinfort U, **Trevaskis B**, Fukai S, Kerry L, Dreccer FM (2017) Vernalisation and photoperiod sensitivity in wheat: impact on canopy development and yield components. *Field Crops Research*, 201:108-121.
7. Ford B, Deng W, Clausen J, Oliver S, Boden S, Hemming M, **Trevaskis B** (2016) Barley (*Hordeum vulgare*) circadian clock genes can respond rapidly to temperature in an *EARLY FLOWERING 3*-dependent manner. *Journal of Experimental Botany* 67(18):5517-5528.
8. Eagles HA, Wilson J, Cane K, Vallance N, Eastwood R, Kuchel H, Martin PJ, **Trevaskis B** (2016) Frost-tolerance genes *Fr-A2* and *Fr-B2* in Australian wheat and their effects on days to heading and grain yield in lower rainfall environments in southern Australia. *Crop and Pasture Science*, 67(2):119-127.
9. **Trevaskis B** (2015) Wheat gene for all seasons. *Proc. Natl. Acad. Sci. USA*, 112:11991-11992. (*commentary*)

10. Cuesta-Marcos A, Munoz-Amatriain M, Filichkin T, Karsai I, **Trevaskis B**, Yasuda S, Hayes P, Sato K (2015) The relationships between development and low temperature tolerance in barley near isogenic lines differing for flowering behavior. *Plant Cell Physiol*, 56: 2312-2324.
11. Deng W, Clausen J, Boden S, Oliver SN, Casao MC, Ford B, Anderssen RS, **Trevaskis B** (2015) Dawn and dusk set states of the circadian oscillator in sprouting barley (*Hordeum vulgare*) seedlings. *PLoS ONE* 10(6), DOI: 10.1371/journal.pone.0129781
12. Boden S, Cavanagh C, Cullis B, Ramm K, Greenwood J, Finnegan EJ, **Trevaskis B**, Swain S (2015) Ppd-1 is a key regulator of inflorescence architecture and paired spikelet development in wheat. *Nature Plant* 1(2)14016
13. Deng W, Casao MC, Wang P, Sato K, Hayes PM, Finnegan EJ, **Trevaskis B** (2015) Direct links between the vernalization response and other key traits of cereal crops. *Nature Communications* 6:5882
14. Jokelal V, Trevaskis B, Seppanen, M.M (2015) Genetic variation in the flowering and yield formation of timothy (*Phleum pratense* L.) accessions after different photoperiod and vernalization treatments. *Frontiers in Plant Science* 6:465
15. Sanchez-Garcia M, Alvaro F, Peremarti A, **Trevaskis B**, Martin-Sanchez JA, Royo C (2015) Breeding effects on dry matter accumulation and partitioning in Spanish bread wheat during the 20th century. *Euphytica* 203(2): 321-326
16. Fjellheim S, Boden S, **Trevaskis B** (2014) The role of seasonal flowering responses in adaptation of grasses to temperate climates. *Front Plant Sci.* 14:508
17. Boden SA, Weiss D, Ross JJ, Davies NW, **Trevaskis B**, Chandler, PM, et al. (2014). *EARLY FLOWERING3* regulates flowering in spring barley by mediating gibberellin production and *FLOWERING LOCUS T* expression. *Plant Cell* 26, 1557-1569. doi: 10.1105/tpc.114.123794
18. Eagles HA, Cane K, **Trevaskis B**, Vallance N, Eastwood RF, Gororo NN, et al. (2014). *Ppd1*, *Vrn1*, *ALMT1* and *Rht* genes and their effects on grain yield in lower rainfall environments in southern Australia. *Crop Pasture Sci.* 65, 159-170. doi: 10.1071/CP13374
19. Oliver SN, Deng W, Casao MC, **Trevaskis B** (2013) Low temperatures induce rapid changes in chromatin state and transcript levels of the cereal *VERNALIZATION1* gene. *Journal of Experimental Botany*, **64**: 2413-2422.
20. Kane C, Eagles H, **Trevaskis B** (2013). *Ppd-B1* and *Ppd-D1* and their effects in southern Australian wheat. *Crop and Pasture Science*, 64:100-114.
21. Hemming MN, Walford SA, Fieg S, Dennis ES, **Trevaskis B** (2012) Identification of high-temperature-responsive genes in cereals. *Plant Physiology* **158**: 1239-1450

22. Alonso-Peral MM, Oliver SN, Casao MC, Greenup AA, **Trevaskis B. (2011)** The promoter of the cereal *VERNALIZATION1* gene is sufficient for transcriptional induction by prolonged cold. *PLoS ONE* 6:e29456
23. Hemming MN, **Trevaskis B (2011)** Make hay when the sun shines: The role of MADS-box genes in temperature-dependant seasonal flowering responses. *Plant Science*, 180: 447-453.
24. Greenup AG, Sasani S, Oliver SN, Walford SA, Miller AA, **Trevaskis B (2011)** Transcriptome analysis of the vernalization response in barley (*Hordeum vulgare*) seedlings. *PLoS ONE* 6:3
25. Eagles HA, Cane K, **Trevaskis B (2011)** Veery wheats carry an allele of *Vrn-A1* that has implications for freezing tolerance in winter wheats. *Plant Breeding* 130: 413-418.
26. Greenup AG, Sasani S, Oliver SN, Talbot MJ, Dennis ES, Hemming MN, **Trevaskis B (2010)** *ODDSOC2* is a MADS box floral repressor that is down-regulated by vernalization in temperate cereals. *Plant Physiology*, 153: 1062-1073.
27. **Trevaskis, B (2010)** The central role of the *VERNALIZATION1* gene in the vernalization response of cereals. *Functional Plant Biology*, 37: 479-487.
28. Hemming MN, Fieg S, Peacock WJ, Dennis ES and **Trevaskis B (2009)**. Regions associated with repression of the barley (*Hordeum vulgare*) *VERNALIZATION1* gene are not required for cold induction. *Molecular Genetics and Genomics* **282**: 107-117.
29. Oliver SN, Finnegan EJ, Dennis ES, Peacock WJ, **Trevaskis B (2009)** Vernalization-induced flowering in cereals is associated with changes in histone methylation at the *VERNALIZATION1* gene. *Proc. Natl. Acad. Sci. USA.*, 20, 8386-8391.
30. Sasani S, Hemming MN, Oliver SN, Greenup A, Tavakkol-Afshari R, Mahfoozi S, Postini K, Sharifi H, Dennis E.S, Peacock WJ, **Trevaskis B (2009)** The influence of vernalization and daylength on expression of flowering-time genes in the leaves and shoot apex of barley (*Hordeum vulgare*). *Journal of Experimental Botany*, 7, 2169-2178.
31. Greenup A, Peacock WJ, Dennis ES, **Trevaskis B (2009)** The molecular biology of seasonal flowering-responses in Arabidopsis and the cereals. *Ann Bot (Lond)*, 103, 1165-1172.
32. Hemming MN, Peacock WJ, Dennis ES, **Trevaskis B (2008)** Integration of seasonal flowering time responses in temperate cereals. *Plant Signalling and Behaviour*, 3: 601–602.
33. Hemming MN, Peacock WJ, Dennis ES, **Trevaskis B (2008)** Low temperature and daylength cues are integrated to regulate *FLOWERING LOCUS T* in barley. *Plant Physiology*, 147(1):355-66.

34. **Trevaskis B**, Tadege M, Hemming MN, Peacock WJ, Dennis ES, Sheldon CC (2007) *SHORT VEGETATIVE PHASE*-like MADS-box genes inhibit floral meristem identity in barley. *Plant Physiology*, 143:225-235.
35. **Trevaskis B**, Hemming MN, Dennis ES, Peacock WJ (2007) The molecular basis of vernalization-induced flowering in cereals. *Trends in Plant Science*, 12:352-357.
36. **Trevaskis B**, Hemming MN, Peacock WJ, Dennis ES (2006) *HvVRN2* responds to daylength, whereas *HvVRN1* is regulated by vernalization and developmental status. *Plant Physiology*, 140:1397-13405.
37. Wandrey M, **Trevaskis B**, Brewin N, Udvardi MK (2004) Molecular and cell biology of a family of voltage-dependent anion channel porins in *Lotus japonicus*. *Plant Physiology*, 134:182-193.
38. **Trevaskis B**, Bagnall DJ, Ellis MH, Peacock WJ, Dennis ES (2003) MADS box genes control vernalization-induced flowering in cereals. *Proc. Natl. Acad. Sci. USA*. 100:13099-13104.
39. **Trevaskis B**, Wandrey M, Colebatch G, Udvardi M (2002) The soybean *NODULIN6*-like gene encodes a late nodulin expressed in the infected cells of nitrogen-fixing nodules. *Mol. Plant Microbe Interact.*, 15:630-636.
40. **Trevaskis B**, Colebatch G, Desbrosses G, Wandrey M, Wienkoop S, Saalbach G, Udvardi M (2002) Differentiation of plant cells during symbiotic nitrogen fixation. *Comparative and Functional Genomics*, 3:151-157.
41. Hunt PW, Klok EJ, **Trevaskis B**, Watts RA, Ellis MH, Peacock WJ, Dennis ES (2002) Increased level of *hemoglobin 1* enhances survival of hypoxic stress and promotes early growth in *Arabidopsis thaliana*. *Proc. Natl. Acad. Sci. USA*, 99:17197-202.
42. Colebatch, G, **Trevaskis B**, Udvardi M (2002) Symbiotic nitrogen fixation research in the post-genomics era. *New Phytologist*, 153:37-42.
43. Colebatch G, Kloska S, **Trevaskis B**, Freund S, Altmann T, Udvardi MK (2002) Novel aspects of symbiotic nitrogen fixation uncovered by transcript profiling with cDNA arrays. *Mol. Plant Microbe Interact.*, 15:411-20.
44. Moreau S, Thomson RM, Kaiser B.N, **Trevaskis B**, Guerinot ML, Udvardi M, Puppo A and Day DA (2002) *GmZIP1* encodes a symbiosis specific zinc transporter in soybean. *Journal of Biological Chemistry*, 277:4738-4746.
45. Colebatch G, **Trevaskis B**, Udvardi M. (2002) Functional Genomics: tools of the trade. *New Phytologist*, 153:27.

46. Hunt P.W, Watts R.A, **Trevaskis B**, Llewellyn D.J, Burnell J, Peacock W.J, Dennis E.S. (2001) Expression and evolution of functionally distinct hemoglobin genes in plants. *Plant Molecular Biology*. 47:677-692.
47. Shelden M, Dong B, de Bruxelles G, **Trevaskis B**, Whelan B, Ryan P, Howit S, Udvardi M (2001). Arabidopsis ammonium transporters, *AtAMT1;1* and *AtAMT1;2*, have different biochemical properties and functional roles. *Plant and Soil*, 231:151-160.
48. Panter S, Thomson R, de Bruxelles G, Laver D, **Trevaskis B** and Udvardi M. (2000). Identification with proteomics of novel proteins associated with the peribacteroid membrane of soybean root nodules. *Mol. Plant Microbe Interact.* 13:325-333.
49. Dolferus R, Ellis M, de Bruxelles G, **Trevaskis B**, Hoeren F, Dennis ES, Peacock WJ. (1997) Strategies of gene action in *Arabidopsis* during hypoxia. *Annals of Botany* 79:21-31.
50. **Trevaskis B**, Watts RA, Andersson CR, Llewellyn DJ, Hargrove MS, Olson JS, Dennis ES, Peacock WJ (1997) Two hemoglobin genes in *Arabidopsis thaliana*: the evolutionary origins of leghemoglobins. *Proc. Natl. Acad. Sci. USA* 94:12230-12234.