Australia & New Zealand

http://www.arabidopsis.org/portals/masc/countries/Australia.jsp
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Australia has a strong tradition in plant scientific research with most institutions across all states of Australia having some research involving *Arabidopsis* as a model system. Major areas of *Arabidopsis* research and functional genomics are Canberra, Melbourne and Perth. Major sites of plant science with foci on crops such as grains, grapes and legumes include Queensland, Tasmania, South Australia and NSW.

Increasing numbers of New Zealand plant scientists are incorporating *Arabidopsis thaliana* into their research, and several are using functional genomics approaches. Funding is principally available through the Royal Society of New Zealand's Marsden Fund and the New Zealand Foundation for Research, Science and Technology. In addition to the projects being conducted at the universities, research programs are carried out at the Government-owned Crown Research Institutes, including Horticulture and Food Research Institute of New Zealand (HortResearch), and the New Zealand Institute for Crop & Food Research Limited (Crop & Food Research).

The number of peer reviewed publications in 2006 utilizing Arabidopsis that listed Australia or New Zealand was 189.

Key new development during 2006

Establishment of the Australian Plant Phenomics Facility

The Australian Government has recently awarded funding for the Australian Plant Phenomics Facility (APPF) to be established as a bi-nodal Facility between the University of Adelaide in Adelaide and CSIRO Plant Industry and The Australian National University in Canberra. The APPF will aim to be a state-of-the-art plant phenotyping facility with sophisticated plant growth facilities and cutting edge technologies for plant performance and function monitoring. It will have the following broad scientific targets and objectives:

- The high throughput phenotypic analysis of agricultural species, particularly cereals (>100,000 plants screened per year).
- Analysis of model species such as *Arabidopsis* and rice for gene function discovery (>50,000 plants screened per year)
- Application of the phenotyping data for the more rapid discovery of molecular markers and faster germplasm development, aimed at improving the tolerance of major crops and other agriculturally important plants to biotic and abiotic stresses, including drought, salinity and a broad spectrum of plant diseases
- Deployment of emerging technologies in plant phenotyping

The University of Adelaide Waite Campus will develop a suite of glasshouse facilities with robotic monitoring of plant growth and performance with particular emphasis on application to agricultural species. The Canberra node will specifically establish a model species screening facility which will include a focus on Arabidopsis analysis. The technologies used for screening will include various imaging approaches including morphological growth and colour analysis, chlorophyll fluorescence and hyperspectral reflectance. These will be coupled to robotic systems which will allow medium throughput screening of plant material grown under controlled environment conditions.

The APPF will be available on a fee for service basis in 2008 for research projects from national and international researchers. Contact Murray Badger (murray.badger@anu.edu.au) or Mark Tester (mark.tester@acpfg.com.au) for any inquiries.

Major Research Institutions involved in Functional Genomics of Arabidopsis

• Australian Research Council (ARC) Centre of Excellence in Plant Energy Biology (www.plantenergy.uwa.edu.au/). The focus of the Centre is *Arabidopsis* functional genomics as it pertains to the roles of the chloroplast, mitochondria and peroxisome in energy metabolisms and plant development. This new knowledge will aid improvement of plants by

enabling better management of: (1) the timing and rate of plant growth and development; (2) biomass and yield; (3) efficient use of water and mineral nutrients; (4) tolerance of plants to environmental stresses such as excess light and drought; and (5) synthesis of plant metabolites important for human nutrition. Investigators are: Ian Small , Murray Badger , David Day , Barry Pogson , Harvey Millar , Jim Whelan and Steven Smith .

• CSIRO Plant Industry (www.pi.csiro.au). Major Programs on Genomics, microRNAs and Plant Development. This program investigates several aspects of plant function and, importantly, is developing major facilities for *Arabidopsis* functional genomics work. Work on microRNAs, funded as a CSIRO emerging science initiatives, involves a number of researchers (including Peter Waterhouse, Iain Wilson, Frank Gubler). Other Projects include activation tagging and CHP on Chip (Chris Helliwell), reproductive development (Abed Chaudhury) , floral initiation and epigenetic regulation (Jean Finnegan), genetic engineering for plant improvement (Jeff Ellis) and fruit initiation (Anna Koltunow).

Examples of Australian and New Zealand Universities and Institutions with substantial research on Arabidopsis

- University of Auckland: (www.auckland.ac.nz/)
- Association of Crown Research Institutes, including AgResearch and HortResearch: (www.acri.cri.nz/)
- University of Otago: (www.otago.ac.nz/)
- Monash University (www.biolsci.monash.edu.au/)
- University of Melbourne (www.unimelb.edu.au/)
- The Australian National University (www.anu.edu.au/bambi/ ; www.rsbs.anu.edu.au/)
- The University of Queensland (www.uq.edu.au/)
- The University of Adelaide (www.adelaide.edu.au/)

Genomics Companies

- CAMBIA (www.cambia.org)
- Diversity Arrays Technology Pty Ltd (www.diversityarrays.com).

Examples of Research Projects Using Functional Genomics Approaches

• Aluminum and manganese stress tolerance- Peter Ryan, CSIRO
• Arabinogalactan proteins - Carolyn Schultz and Tony Bacic, U. Adelaide
• Boron tolerance- Robert Reid, U. Adelaide
• CesA- related genes and cellulose synthesis- Richard Williamson, ANU
• Chloroplast development and function, oxidative stress and photoprotection - Barry Pogson, ANU
• Dehydrin genes and Myb gene function - Roger W. Parish, La Trobe U.
• Defense gene expression - Karam Singh, CSIRO
• Defining microRNA function – Tony Millar, ANU
• Fimbrin gene family - David McCurdy, U. Newcastle
• Flowering - Alan Neale, John Hamill, John Bowman, David Smyth, Monash
• Heterotrimeric G-proteins - Jimmy Botello, U. Qld
• Mechanical impedance in roots - Josette Masle, ANU
• Mitochondria - Jim Whelan, David Day, Harvey Millar, UWA and U. Syd.
• Nodulation related control mechanisms - Peter Gresshoff, U. Qld
• Peroxisomes and Metabolomics – Steve Smith, UWA
• Phosphorus-use efficiency - Peter Ryan, CSIRO
• Photosynthetic capacity regulation - Murray Badger, ANU
• Plant Development, John Golz, U. Melb
• Plant Natriuretic Peptide immunoanalogues (PNPs) - Helen R. Irving and David Cahill, Deakin U
• Plasmodesmata functional proteomics - Robyn Overall, U. Syd
• PPR proteins – Ian Small, UWA
• Respiration: non-phosphorylating pathways associated with the mitochondrial electron transport chain - Kathleen Soole, Flinders U.
• Sodium efflux systems in the plasma membrane - Ian A. Newman, U. Tas

Major funding sources for Arabidopsis functional genomics in Australia

Funding is mainly available through the Australian Research Council's (ARC's) Discovery and Linkage Grant Schemes and its Centre of Excellence Scheme (www.arc.gov.au).

- Discovery Grants and Fellowships - supporting fundamental research

- Linkage Grants - supporting projects between academic institutions and industry
- Linkage-International - In the context of the International *Arabidopsis* Research Community, the Linkage-International Scheme is particularly relevant. It provides funding for movement of researchers at both senior and junior levels between Australian research institutions and centers of research excellence overseas. Two types of awards include (1) Fellowships, under international agreements for the reciprocal exchange of postdoctoral researchers, (2) Awards, to build links between research centres of excellence in Australia and overseas by funding extended collaborations.
- Other major sources of funding for Plant Science are the Research Development Councils. The funding for these organizations is based to a substantial degree on Industry levies and therefore the research is targeted to particular industries. The largest is the Grains Research and Development Corporation of Australia (GRDC). A list of the RDCs is given at www.grdc.com.au/sites/rdcorp.htm .

Major funding sources for Arabidopsis functional genomics in New Zealand

- Royal Society of New Zealand Marsden Fund: (www.rsnz.org/funding/marsden_fund/)
- New Zealand Foundation for Research, Science and Technology: (www.frst.govt.nz/)