Australian Centre for Evolutionary Biology and Biodiversity

Annual Report 2006
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REPORT FROM THE CHAIR OF THE ADVISORY BOARD

This report covers the sixth full year, 2006, of the Australian Centre for Evolutionary Biology & Biodiversity. This year has been a exciting one for ACEBB, one that has been highly successful in many ways, as well as one that has heralded a number of changes that have significant implications for the future. Importantly, the Centre has been able to capitalise on its previous solid performance and develop a number of new research initiatives that should have long-lasting benefits for all parts of its operation.

At the forefront of changes that have occurred during 2006 is the incorporation of the Australian Centre for Ancient DNA into the Centre, and the expansion of the Management Committee to include Professors Cooper and Lowe. Professor Lowe's involvement on the Management Committee will be particularly important in the future given his joint appointment with the University of Adelaide and the Department for Environment and Heritage SA as Head of Science for the State Herbarium and Biological Survey.

Since its inception in 2000, ACEBB has effectively used its Advisory Board as an external consultative group to help bench-mark its activities and explore future sources of funding and areas of research. In this respect, it is very pleasing to see that Dr Ian Gould has joined the ACEBB Advisory Board. Ian has been influential in the mining industry in Australia over the past two decades and, in particular, has helped the industry develop a strong environmental awareness. He will bring a unique blend of industry experience and involvement with several environmental organisations to the ACEBB Advisory Board, and we look forward to working with him over the next three years.

The major activities of ACEBB are its research programs, and these require a sustainable funding base. It is thus pleasing to see that 2006 has been another year of success in this regard, particularly with the Australian Research Council, but also with off-shore and non-traditional sources such as the National Science Foundation in the US and National Geographic. Concurrent with these programs has been a expansion in the number of postdoctoral fellows and postgraduate students working across a range of projects that cover the strengths of ACEBB. These include fundamental evolutionary biology and biodiversity research, population genetics, phylogeography and the integration of these areas.

I congratulate the Management Committee of ACEBB, Professors Austin, Cooper, Donnellan Hill, Lowe and Associate Professor Whittington for their activities in fostering high-calibre research in evolutionary biology at The University of Adelaide, and their leadership in developing significant research links with other organisations in Australia and overseas.

As the Chair of the Advisory Board, I endorse this report as an accurate and readable account of ACEBB activities in 2006, and commend the Management Committee on their continued enthusiasm in leading this exciting research endeavour.

Dr Steve Morton
Group Executive
Sustainable Energy and Environment
CSIRO
REPORT FROM THE DIRECTOR

The Australian Centre for Evolutionary Biology & Biodiversity (ACEBB) is a University-designated research centre that brings together expertise from three key organisations: The University of Adelaide, the South Australian Museum and the Department for Environment and Heritage’s (DEH) Plant Biodiversity Centre. ACEBB started operating in October 2000 and, with regard to outputs and outcomes, it has expanded every year since then.

The Mission of the ACEBB is to be a leading national and international centre for research and training in evolutionary biology and biodiversity studies, with an emphasis on fauna and flora of Australia. It aims to:

1) Provide a focus for and a recognition of, the high-calibre research already being undertaken by researchers in Adelaide;
2) Provide more secure funding and first-class infrastructure and integrated networking/co-ordination through collaboration among its members and with colleagues externally;
3) Attract postgraduates of excellence;
4) Be a focus for national and international visitors, and
5) Foster communication and ideas among members through seminars, discussion groups, workshops and conferences.

This Report covers the activities of the Centre during 2006, a year which has seen significant development in its operation and activities. Most important of these is the inclusion of the newly formed Australian Centre for Ancient DNA within ACEBB, and a corresponding change of name to the Australian Centre for Evolutionary Biology & Biodiversity. In association with this, and the closer relationship with DEH’s Plant Biodiversity Centre, the Management Committee has been expanded with the addition of Professors Alan Cooper and Andrew Lowe. There have been numerous other developments during the year, as follows:

- A major new international collaborative research grant funded by the National Science Foundation (USA) under its Planetary Biodiversity Inventory Program;
- Arrival of Andrew Lowe as Professor of Plant Conservation Biology, who holds a joint position with the University and DEH;
- Two new Australian Research Council (ARC) projects to study the evolution of the biota of the arid zone artesian Mound Springs, including the award of an Australian Postdoctoral Fellow;
- New ARC and Australian Biological Resources Study (ABRS) grants to continue research on the phylo-geography of stygo-fauna (subterranean aquatic animals) in Western Australia, and to start a new project on the conservation genetics of sugar gliders in fragmented populations;
- A new ARC Infrastructure Grant to further develop and expand the South Australian Regional Facility for Molecular Ecology and Evolution and the Australian Centre for Ancient DNA;
- New ARC grants to examine why some exotic plants become weeds, and to examine long distance dispersal and genomic evolution in plants of the south-west Pacific region;
- New ARC and National Geographic grants to develop a geno-graphics project and study the evolutionary genetics of bovid genomes over the last 60,000 years;
- The successful completion of several PhD’s and the arrival of three new postdoctoral fellows;
- Expansion of the Advisory Board to include Dr Ian Gould.
This report summarises the work and activities undertaken by members and students in the Centre, and provides details on research projects, grants, publications, conference presentations, awards, new staff, and national and international collaborations.

Acknowledgements

On behalf of the members of the Centre, I would like to thank the following people for their help with the successful operation of ACEBB: Professor Bob Hill (Executive Dean, Faculty of Sciences); Dr Sue Carthew (Head, School of Earth & Environmental Sciences); Advisory Board members Professor Steve Hopper (University of Western Australia) and Dr Steve Morton (Group Executive, CSIRO Environment & Natural Resources); Ms Maria Lekis, Trish Catford, Annie Richard and Ramona Dalton for administrative support, and Kate White for her efforts in designing the new ACEBB website.

Professor Andrew Austin
ACEBB Director
e-mail: andy.austin@adelaide.edu.au

Naracoorte World Heritage Caves; a major field site for research by ACEBB staff
RESEARCH NEWS

Planetary Biodiversity Inventory (PBI) – Documenting global diversity of a species-rich group of wasps (Prof Andy Austin & Prof Norman Johnson – Ohio State University)

In 2003 the National Science Foundation in the USA announced the first round of successful grants under its Planetary Biodiversity Inventory Program. The aims of this Program are to:

- Provide a complete taxonomic framework for diverse groups of organisms;
- Describe all of the species within each group on a global basis;
- Develop innovative approaches to taxonomic research;
- Develop a natural classification for each group employing modern phylo-genetic methods;
- Use this information to examine the biogeography, regional diversity and evolution of biological traits for each group.

In 2006, Andy Austin and Norm Johnson were awarded one of only three PBI grants in the second Round of the Program to examine the parasitic wasp super-family Platygastroidea. This group parasitises the eggs and sometimes larvae of a huge array of insects and spiders. The project is an ambitious one in that it will attempt to describe all the known species within a large monophyletic group that comprises well over 1,000 species. It plans to generate a robust phylogeny for the super-family based on a multi-gene study and morphology. Although daunting, the project will enlist the expertise of 15 researchers from nine countries – USA, Australia, New Zealand, Canada, Hungary, UK, Brazil, South Africa and India.

The taxonomic research will be supported by a substantial bio-informatics program based at Ohio State University, and an extensive field program that utilises long-term collecting sites in Peninsula Malaysia, Borneo, southern and western Africa, and Brazil. The first meeting of the PBI participants was held in Columbus, Ohio in February 2007.

Automontage image of a scelionid wasp, the target group for the US National Science Foundation's Planetary Biodiversity Inventory Program on the superfamily Platygastroidea.
Diversity, evolution and conservation of the unique biota associated with artesian (mound) springs in South Australia (Dr Nick Murphy, Prof Andy Austin, Mr Mark Adams & Dr Steve Cooper)

The Mound Springs are the natural discharge sites of the Great Artesian Basin (GAB) (See map below). They represent one of Australia’s most unique and significant environments and are of national biodiversity, cultural and economic significance. The Great Artesian Basin underlies nearly one-quarter of the Australian landmass. For most of this area (including the entire South Australian portion) average annual rainfall is less than 200mm while the evaporation rate exceeds 1,200mm annually, making the underground GAB the most reliable source of water in the region. Utilisation of these Springs by Aboriginal people dates back at least 10,000 years. However, since European colonisation, demands for artesian water for pastoralism, railways, mining and power generation, have increased to the point where localised reduction of aquifer pressure is a considerable threat to the Springs.

Mound Springs (more correctly referred to as GAB Springs) are of considerable biological and conservation interest, containing numerous endemic plant and animal species. The conservation of these unique environments is a national issue following their listing as a ‘threatened ecological community’ by the Federal government in 1999. Despite this listing, there is relatively little known about these communities, which include hydrobiid snails, several crustacean orders, and annelid and flat worms. Knowledge of this aquatic fauna is particularly vital due to the reduction in artesian pressure, which places these communities at direct risk of extinction.

Funding from the ARC’s Linkage and Discovery Programs and the award of an Australian Postdoctoral Fellowship to Dr Nick Murphy, have provided significant resources to examine the aquatic invertebrates of the Springs in South Australia. The Project will use molecular techniques to examine and compare the evolution and diversity of several invertebrate species. By comparing the patterns of genetic diversity...
from co-distributed, biologically diverse groups, the project will identify geographic areas within which whole communities have undergone significant periods of independent evolution. This will identify regions of particular significance for conserving maximum genetic diversity across entire communities and assess the possible consequences of Spring extinctions, aiding plans for the management and conservation of these unique communities.

The unique invertebrate communities of the Great Artesian Basin mound Springs also provide an ideal system to examine the impact of historic aridification and climate change on Australia’s freshwater fauna. By developing robust phylogenies and investigating both ancient and recent lineage divergence for the endemic invertebrates, hypotheses associated with climate history in Australia, origins of the endemic fauna and evolutionary radiations within the Springs, can be examined.

**Why do only some exotics become invasive? Combining ecological and genomic approaches to address alternative hypotheses in a recent Australian weed** (Prof Andy Lowe, Dr Peer Schenk – University of Queensland, Prof Richard Abbott – University of St Andrews & Prof Loren Rieseberg – University of British Columbia)

The genetic processes involved in the post-introduction evolution of invasiveness in exotic plants, are insufficiently understood at a molecular level. Many invading species are suggested to undergo rapid genomic changes after introduction to new environments as a result of hybridization, admixture and strong natural selection. However, the kind of genomic tools and resources required to identify genomic changes associated with invasiveness are not yet fully developed for any invasive plant species. With significant funding from the Australian Research Council, this project aims to be the first to develop the genomic tools (>20 000 ESTs) capable of detecting genetic changes associated with invasiveness by focusing on a model species, *Senecio madagascariensis* (fireweed). Subsequently, new evolutionary methods for detecting positively selected genes in combination with hitch-hiking, mapping and micro-array analyses, will be used to identify specific genetic and gene expression changes associated with invasiveness in this species of fireweed. Outcomes of the project will be enhanced by collaboration with colleagues from Canada, USA, UK and South Africa. This international effort will determine whether certain genes are repeatedly associated with invasiveness. It will also identify the kinds of genetic modifications (in both sequence and expression) that contribute to invasiveness in exotic plant species. Furthermore, this genomic information will help in determining the general mechanisms that lead to invasiveness and if in situ genomic change facilitates plant invasions.
MEMBERS OF THE CENTRE

Membership of the Centre grew significantly in 2006 with the arrival of Andrew Lowe, Professor of Plant Conservation, and several new postdoctoral fellows - Dr Cecile Bacles working with Prof Lowe and based at Queensland University, and Drs Mike Gardner, Marta Kasper, Dean Male and Peter Prentis to work in the School of Earth & Environmental Sciences.

The membership of the Management Committee has also changed with Professor Donnellan taking over as Deputy Director following Professor Bob Hill’s appointment as Executive Dean for the Faculty of Sciences. Also, the Management Committee has been expanded to include two additional members, Professors Alan Cooper and Andrew Lowe.

Unfortunately we have also farewelled three very active members of ACEBB; Prof Tim Flannery departed the SA Museum and University to take up a chair at Macquarie University; Dr Greg Rouse also left the South Australian Museum to take up a professorial research position at Scripps Institute of Oceanography, La Jolla, California, and Dr Brenda Kranz has completed her ARC postdoctoral fellowship and has now taken up a position on the islands of Mauritius.

Key Personnel and Management Committee

**Professor Andrew Austin**, School of Earth & Environmental Sciences (Director)
**Professor Alan Cooper**, School of Earth & Environmental Sciences
**Professor Stephen Donnellan**, South Australian Museum, and Affiliate Professor in Schools of Earth & Environmental Sciences and Molecular & Biomedical Sciences (Deputy Director)
**Professor Robert Hill**, School of Earth & Environmental Sciences, and South Australian Museum
**Professor Andy Lowe**, School of Earth and Environmental Sciences, and State Herbarium and Biological Survey, Department for Environment and Heritage
**Assoc Prof Ian Whittington**, joint appointment, South Australian Museum and School of Earth & Environmental Sciences

Other Staff in the Centre

**Dr Jeremy Austin**, School of Earth & Environmental Sciences
**Dr Bill Barker**, State Herbarium of South Australia, Department of Environment & Heritage
**Associate Professor William Breed**, Anatomical Sciences, Faculty of Health Sciences
**Dr John Conran**, School of Earth & Environmental Sciences
**Professor Alan Cooper**, School of Earth & Environmental Sciences
**Dr Steven Cooper**, South Australian Museum, and Affiliate Senior Lecturer in School of Earth & Environmental Sciences, and School of Molecular & Biomedical Science
**Professor Chris Daniels**, School of Earth & Environmental Sciences
**Dr Jack da Silva**, School of Molecular & Biomedical Science
**Dr Kerrie Davies**, School of Agriculture, Food & Wine
Dr Mark Hutchinson, South Australian Museum, and Affiliate Lecturer in School of Molecular Biosciences

Dr John Jennings, School of Earth & Environmental Sciences

Associate Professor Mike Lee, South Australian Museum, and School of Earth & Environmental Sciences

Associate Professor Sandy Orgeig, School of Molecular Biosciences

Dr Gary Taylor, School of Agriculture, Food & Wine

Postdoctoral Fellows and Research Associates

Dr Cecile Bacles, University of Queensland

Dr Leslie Chisholm, School of Earth & Environmental Sciences

Dr Lachlan Farrington, School of Earth & Environmental Sciences

Dr Mike Gardner, School of Earth & Environmental Sciences

Dr Michelle Guzik, School of Earth & Environmental Sciences

Mr Andrew Hugall, South Australian Museum, and School of Earth & Environmental Sciences

Dr Dean Male, School of Earth & Environmental Sciences

Dr Marta Kasper, School of Earth & Environmental Sciences

Dr Brenda Kranz, School of Earth & Environmental Sciences

Dr Remko Leijs, South Australian Museum, and School of Earth & Environmental Sciences

Dr Nicholas Murphy, School of Earth & Environmental Sciences

Ms Rosemary Paull, South Australian Museum and School of Earth & Environmental Sciences

Dr Peter Prentis, School of Earth & Environmental Sciences
Dr Marta Kasper

Marta has a background in applied ecology, having completed an Honours degree in Science specializing in environmental biology and ecology at Flinders University in 1998. In 2004, she was awarded a PhD at the University of Adelaide for her work on the ecology of European wasps. During that time, she became interested in using simple molecular techniques to answer questions investigating applied ecological issues. While studying for her PhD, she developed a technique to identify insect remains using PCR amplification and subsequent comparison to known databases and phylo-genetic analysis. She was also involved in a project characterising the bacterial communities of wasp larval guts using PCR and denaturing gradient gel electrophoresis, a technique that separates DNA fragments based on sequence composition. After her PhD, she held a post doctoral position at CSIRO Land and Water/Entomology, where she was involved in several projects examining the effects of various above ground treatments on soil microbial biodiversity and activity, using molecular techniques. In that time, she has gained a keen appreciation of the wealth of information contained in soil samples, as well as the difficulties associated with extracting it. Marta joined the ACAD team in June 2006 as a research associate. She is currently working on projects examining the potential of using soil and sediment samples to determine changes in species composition and diversity through time. This information can in turn lead to answering numerous questions about past and possibly present, anthropogenic and climatic changes.

Professor Andrew Lowe

After finishing a degree in Applied Biology at the University of Bath, Andrew Lowe worked for a year as a scientific officer with the Society for Environmental Exploration undertaking biological surveys of the coastal forests of Tanzania. He completed his PhD in plant evolutionary genetics at the University of St Andrews in 1996. Andrew's work used molecular genetic and ecological methods to describe the evolution of Britain's newest plant species, discovered only 30 years ago. Based on this evidence, it was recognised as a new species in 2003, Senecio eboracensis Abbott & Lowe. The origin of a new species within our life time, and its adaptation to man-made habitats (car parks), captured the public imagination. In addition to scientific articles, press releases resulted in international media coverage (e.g. ‘The Times’ front page and ‘Network America’). The proof of evolution of a de novo species also caused raging debate in creationist vs. evolution web chat rooms, and on hearing the story a young British artist, Nich Relph, was inspired to produce an installation for the Finnish National Gallery (Helsinki). Following his PhD studies and this furore, Andrew undertook a series of short postdoctoral positions at the International Livestock Research Institute, Nairobi, Kenya, the Institute of Terrestrial Ecology/Scottish Crop Research Institute, UK, and John Innes/Long Ashton Research Centres, UK, in which he examined the genetic resources of African forage grasses and multi-purpose trees, and developed genomic
makers and mapping database applications for a range of *Brassica* crop species (http://ukcrop.net). In 1998, Andrew was appointed Head of the Ecological Genetics Laboratory at the Centre for Ecology and Hydrology, Edinburgh, UK. He expanded the lab capacity and established a network of collaborative science in plant ecological genetics, attracting more than 6 million Euros of funding for this Group and for leading international projects in plant phylo-geography, population genetics, gene flow analysis and genetic resource management. He also set up an internally incubating company (EcoGeneLabs) to perform plant genetic fingerprinting tests on a commercial basis. In 2003, Andrew moved to Australia to take up a lecturing position at the University of Queensland, and to develop an integrated research project on ecological and evolutionary genetics and genomics. Building on his earlier experiences, he has created an international reputation in intra- and interspecific gene flow of neutral and adaptive genes, and examinations of temporal aspects of species colonisation, predominantly in plants. Andrew was appointed as Professor of Plant Conservation Biology at the University of Adelaide in May 2006, where he holds a joint position within the Department for Environment and Heritage, as Head of Science for the State Herbarium and Biological Survey.

**Dr Dean Male**

Dean gained his PhD at Flinders University in 1998, having investigated human DNA damage, repair and mutation. Awarded a Feinberg Fellowship at the Weizmann Institute of Science, he was involved in large-scale, high-throughput DNA sequencing of human chromosome 21 as part of the Human Genome Project. Subsequent research back in Australia involved bio-informatics, 3D protein molecular modeling and mutagenesis to identify the structure of immune system regulatory genes and protein functional sites. This work stimulated significant interest in genomic segmental duplication and exonic dispersal resulting in gene evolution and functional diversification. As senior research scientist and head of R&D at a major Melbourne-based biotechnical laboratory, Dean established rapid turn-around DNA sequencing-based diagnostic assays for mutations in genes involved in human hereditary breast and colon cancers, aberrant DNA methylation and a variety of SNP and QTL genotyping assays for dogs, cattle, horses and sheep. He joined the ACEBB-affiliated Australian Centre for Ancient DNA in September 2006 as an ARC Senior Research Fellow, using ancient DNA techniques to investigate the environmental impacts of climate change and humans on Southern Hemisphere mega-faunal extinctions.

**Dr Peter Prentis**

Peter recently completed a PhD in population ecology and genetics at the Queensland University of Technology. Since completion, he has worked at the University of Queensland, examining a range-wide biogeography of invasive plants and hybridization between invasive and native plant species. He has a strong interest in population genetics and evolutionary theory, particularly applying genomic techniques to studying adaptive evolution in pest populations. Peter’s research specifically aims to characterize the roles of hybridization, genetic drift and selection in promoting invasiveness in introduced populations of plants. Currently Peter is employed as a
A research associate on a project that will combine genomic techniques with eco-physiological experiments to understand why only a small proportion of introduced plants become significant weeds and why there is often a substantial lag phase before rapid range expansion. This information will allow better management against exotic plants already in Australia and provide genomic tools to screen for potential ‘weediness’ in plants not yet in Australia or only recently discovered.

**Dr Mike Gardner**

Mike Gardner has interests in using genetic techniques to elucidate ecological processes. His research career started at the Queensland University of Technology studying the relationship of shell pattern polymorphisms on inter-tidal snails to their background. Previous studies in Queensland earned him the Entomological Society of Queensland’s Best Student Award for an undergraduate final year project. From here he moved to CSIRO Marine Labs in Hobart to work on stock structure analysis of two shark species commonly caught in the fishery industries. He left Hobart to start a PhD on genetic aspects of sociality in a group-living Australian lizard (*Egernia stokesii*). During this time he developed a micro-satellite isolation method and novel screening procedure which is now being widely used. Following a session developing molecular genetic markers for a parthenogenetic skink at the South Australian Museum, Mike researched co-evolution between a parasitic hoverfly (*Microdon mutabilis*) and its host, a European ant (*Formica lemani*) at the Centre for Ecology and Hydrology in Dorset, UK. This work tapped into an interest of his on the benefits of genetic diversity on organisms/species survival. Mike left Dorset to pursue an Australian research career, taking on a role integrating and teaching Flinders University postgraduate students at the ACEBB in Adelaide. Currently he is also employed in Andrew Lowe’s group. Here he works on micro-satellite development in various species, analysis of gene flow between primary and secondary rainforest plants, and restoration genetics.
ADVISORY BOARD

The Advisory Board forms an important part of the overall management structure of the Centre. It now comprises the six members of the Centre's Management Committee (Professors Austin, Cooper, Donnellan, Hill, Lowe, and Assoc Prof Whittington), the Deputy Vice-Chancellor, Research (Professor Alan Johnson), the Director of the South Australian Museum (currently vacant), and three external members. These are Dr Steve Morton (Group Executive, CSIRO Environment & Natural Resources), Dr Allan Holmes (Chief Executive, Department of Environment and Heritage, South Australia), and Dr Ian Gould, who has replaced Professor Steve Hopper (University of Western Australian) following his move to the Directorship of Royal Botanic Gardens, Kew. The Management Committee has served a crucial role in advising the Director on the day-to-day running of the Centre and has been responsible for much of the activity in the Centre, and particularly in developing new research proposals.

New Member of the Advisory Board

ACEBB is extremely pleased to welcome Dr Ian Gould as a new member of the Advisory Board. Ian has a long standing and high level association with the Australian mining industry, and a strong commitment to environmental research. His experience and expertise at the interface between commercial mining enterprises and environmental science will be a most welcome addition to the Centre’s advisory and bench-marking processes. Ian Gould holds BSc (Hons) and PhD degrees in Geology from the University of Sydney. He is a Fellow and immediate past President of AusIMM.

In 1973 he joined North Broken Hill Ltd's Exploration Division and later took responsibility for North's marketing activities. In 1980, Ian began a 17 year association with the CRA Group as Executive Manager and, in 1982, as Managing Director of AM&S Europe based in Bristol, UK. In 1986 he returned to Australia as Managing Director of Comalco Mineral Products based in Brisbane. In 1989 Ian became a Group Executive of CRA, initially being responsible for CRA Exploration and later for their Asian trading entity, research, development and technology activities and group occupational health, safety and environmental affairs. He became Managing Director of Rio Tinto Australia in 1997. He was appointed Group Managing Director of Normandy Mining Limited later in 1997, based in Adelaide. He retired from the Normandy Group and executive management in general in 2000. In November 2000 he became a Director of Western Metals Ltd (later Chairman), Chairman (now member) of the South Australian Resources Industry Development Board, and more recently a member and currently Chairman of CSIRO's Minerals Sector Advisory Committee. He is a past National President of the Royal Flying Doctor Service and is currently a vice-President of Central Operations of the this Service and Chairman of Saint Andrew’s Hospital. Ian was long-term Chairman of the Minerals Council of Australia's Environment Committee and a Commissioner of the Australian Heritage Commission. He has just finished terms as Chairman of the Advisory Board of the Australian Biological Resources Study (ABRS), and member of the SA Government’s National Parks and Wildlife Council. He is currently Chairman of the AJ Parker Co-operative Research Centre for Hydrometallurgy, and the Australian Centre for Mining Extension and Research. In 2002-03 he became a Director of the Australian Institute of Marine Science (now Chairman), and is Director of Abra Mining Ltd, a listed base metals explorer and Chairman of Toro Energy Ltd, an intending uranium exploration company.
The major research programs in the Centre during 2005 were as follows:

**Evolution and biodiversity of Australian terrestrial arthropods**
*(Prof Andy Austin, Dr John Jennings, Dr Nick Murphy, Dr Kerrie Davies, Dr Gary Taylor)*

This program comprises a series of projects that deal with evolutionary and biodiversity aspects of terrestrial arthropods. These include:

- The taxonomy, phylogenetics and biogeography of the parasitic wasp Family Scelionidae;
- Evolutionary aspects of insect parasitoids, including the evolution of endo-parasitism, polydnavirus associations, and host-parasitoid co-evolution;
- Systematics of the wasp families Pompilidae, Braconidae, Aulacidae and Xiphydriidae;
- Community structure of terrestrial arthropods in sclerophyll forest, semi-arid deserts, and guano cave systems;
- Speciation, molecular phylogeny and co-evolution of *Fergusonina* flies and *Fergusobia* nematodes associated with galls on myrtaceous plants;
- Systematics and co-evolution of insect herbivores of *Casuarina* for development as potential biological control agents in Florida, USA.

These projects have a strong systematics basis that utilizes traditional comparative morphological as well as molecular techniques, and they are underpinned by a comprehensive field program that supports a major insect collection. During 2006, the program had one postdoctoral fellow, one honours and three PhD students.

**Systematics of the Australian flora**
*(Dr WR Barker, Dr HR Toelken, Dr RJ Chinnock, Mr GH Bell; Honorary Associates: Prof HBS Womersley, Dr DE Symon, Ms RM Barker, Ms P Catcheside)*

The State Herbarium coordinates with other Australian herbaria and systematists in advancing the knowledge of the Australian flora through advancing plant classification. Its work includes recognition of new species and resolution of species complexes in South Australia to more intensive revisions of the classification of genera and families in Australia or in the Australian region. The latter involves traditional morphological study and increasingly includes collaboration with molecular researchers in other institutions. Current research projects include:

- Systematics of Australian Solanaceae;
- Systematics of naturalised blackberry (*Rubus* Rosaceae) in Australia;
- A taxonomic monograph of the Myoporaceae;
- Systematics and evolution of Australian Scrophulariaceae;
- Systematics and evolution of Stackhousiaceae;
- A taxonomic revision of *Hibbertia* (Dilleniaceae);
- A taxonomic review of Australian Cactaceae.
Comparative morphology and evolution of mammalian sperm and eggs and their interaction at the time of fertilization

(Assoc Prof Bill Breed)

The successful fusion and incorporation of the spermatozoon into an egg at the time of fertilization is critical for propagation of a species. The work carried out in our group focuses on comparative aspects of sperm and egg morphology and their interaction at the time of fertilisation in the three extant groups of mammals - monotremes, marsupials and eutherians. In marsupials we have recently published our studies on the structural organisation of the egg coat, the zona pellucida, in the koala as well as on the events of sperm-egg interaction \textit{in vitro}. In eutherians most of our work is focused on the 60 or so species of Australian native rodents. We have shown that there are huge inter-specific differences in testis size, and hence numbers of sperm produced that probably relates to the breeding system. We have also found that the structure of the spermatozoa themselves is highly variable and that most of the Old Endemic Australasian rodents have a more complex spermatozoon than that of most other eutherians. Also using this group we have, in collaboration with Dr Steve Cooper, determined the adaptive evolution of the sperm combining region of the egg coat (zona pellucida) protein, and have obtained suggestive evidence that it is under positive selection in a few of the lineages. Co-evolution of the male and female external genitalia is also being investigated and we have found that in one of the Old Endemic lineages a highly divergent structure in both male and female genitalia occurs which is associated with an unusual form of mating behaviour. Our planned future work will build on these observations and, in particular, we hope to gain insight into the selective pressures, and functional differences, in this diversity of form of mammalian gametes, gonads, and external genitalia that we have found over the last few years. Some of these studies will be carried out in collaboration with Prof Brian Setchell, Dr David Taggart and Dr Steve Cooper.

Adaptive evolution of the Australian flora

(Prof John Conran)

The diversity of the Australian flora is generally thought to be a result of adaptive response to environmental change and/or co-evolution with pollinators, dispersers, \textit{etc}. The projects undertaken to examine these hypotheses using morphological and molecular approaches, as well as studies of reproductive biology, are as follows:

- Diversity and biology of carnivorous plants in Australia, particularly \textit{Byblis} (Byblidaceae) and \textit{Drosera} subgen. \textit{Bryastrum} (Droseraceae);
- Ultraviolet floral patterning in Australian flowers in relation to pollination strategies within and between families, genera and species;
- Diversity, biology and the role of hybridisation in \textit{Alyogyne} (Malvaceae);
- Relationships, ecology and biology of the SW-WA endemic family Eremosynaceae;
- Evolution, diversity and biology of Australian petaloid monocots, especially Laxmanniaceae, Boryaceae and Hemerocallidaceae;
- Evolution and ecology of the basal monocot family Hydatellaceae.
Ancient DNA research
(Prof Alan Cooper, Dr Jeremy Austin)

The Australian Centre for Ancient DNA (ACAD) building is almost fully operational and apart from the normal ‘teething’ problems and construction ‘glitches’ we are up and running. Dr Jeremy Austin (ACAD Manager) has done a brilliant job in dealing with the various ‘buck-passing’ manoeuvres that seem integral to any modern construction project. We are also pleased to announce we have obtained AQIS certification and can now move all of our materials out of the various fridges and freezers they have been sequestered in for the past year. The first four PhD students have arrived - Trevor Worthy, Laura Watson, Sarah Bray and Nic Rawlence - and have started their research projects. An honours student is also beginning study through the School of Molecular and Biomedical Sciences Genetics Program with Jack da Silva.

With Steve Donnellan, Alan Cooper obtained an ARC LIEF grant to increase the PCR capacity of the South Australian Regional Facility for Molecular Ecology & Evolution to cope with the rapidly expanding use of these facilities. To date 15 Corbett Palm Cylinders and a Real Time Machine have been ordered and should soon be in use. Alan Cooper and Tim Flannery were awarded an ARC Discovery Grant on using ancient DNA to examine the environmental impacts of climate change and humans over the past 50,000 years.

Diversity, evolution and population dynamics of stygo-fauna from the Yilgarn Region of central Western Australia
(Dr Steve Cooper, Prof Andy Austin, Dr Bill Humphreys - WA Museum, Ms Kathy Saint, Dr Remko Leij, Dr Chris Watts – South Australian Museum, Dr John Bradbury, Dr Michelle Guzik, Mr Adam Allford – University of Adelaide, Dr Stefano Taiti - Italy, Dr Joo-Lae Cho - South Korea)

This project involves a large collaborative team of scientists who are studying the diversity and evolution of a recently discovered subterranean invertebrate fauna (stygo-fauna) found in numerous (>50) isolated calcrete aquifers in the Yilgarn region of central Western Australia. The fauna comprises largely unknown species in diverse invertebrate groups including water beetles (Coleoptera), and crustaceans such as Syncarida, Isopoda, Amphipoda, Copepoda and Ostracoda. Our recent data from diving beetles suggest that stygo-faunas within each aquifer may be highly endemic and we are exploring this possibility further using a combination of molecular genetic and morphological analyses of other components of the stygo-fauna, including amphipods, isopods (Haloniscus) and bathynellids. As part of an ARC Linkage Grant, we are also developing rigorous sampling methods and studying the environmental variability within aquifers, based at a newly established field station at the Sturt Meadows pastoral property. A further aim of this project is to investigate the population structure/dynamics of diving beetle species using micro-satellite DNA markers. These investigations have important implications for the sustainable management of the aquifers and the stygo-fauna within them. Cooper and Humphreys obtained a new ARC Discovery Grant in 2006 to explore modes of speciation in the subterranean water beetles. In particular they aim to investigate the exciting possibility that a number of beetle species may have evolved through a process of sympatric speciation.
Evolution of a physiological system: The pulmonary surfactant system in diving mammals
(Prof Chris Daniels, Assoc Prof Sandra Orgeig)

Pulmonary surfactant lines the alveolar air-water interface. It varies surface tension with lung volume to increase compliance and prevent adhesion of respiratory surfaces. We examined whether the surfactant system of diving mammals exhibits adaptations for more efficient lung function during diving, to complement other respiratory adaptations. Adaptations at the molecular, compositional, functional and cellular levels and during development for animals beginning life on land and progressing to an aquatic environment were investigated. Molecular adaptations to diving were examined in surfactant protein C (SP-C) from terrestrial, semi-aquatic and diving mammals using phylo-genetic analyses. Diving species exhibited sites under positive selection in the polar N-terminal domain. These amino acid substitutions may lead to stronger binding of SP-C to the phospholipid film and increased adsorption in the air-liquid interface. The concentration of shorter chain phospholipid molecular species was greater and SP-B levels were lower in diving mammals when compared to terrestrial mammals. This may lead to a greater fluidity and explain the relatively poor surface activity of diving mammal surfactant. There were no consistent differences in cholesterol between diving and terrestrial mammals. Surfactant from newborn California sea lions was similar to that of terrestrial mammals. Secretory activity of alveolar type II epithelial cells of sea lions demonstrated an insensitivity to pressure relative to sheep cells. The poor surface activity of diving mammal surfactant is consistent with the hypothesis that it has an anti-adhesive function that develops after the first entry into the water, with a surfactant film, that is better suited to repeated collapse and re-spreading.

Environmental control of developmental plasticity of vertebrate cardio-pulmonary systems
(Prof Chris Daniels, Assoc Prof Sandra Orgeig)

It is well established that developmental plasticity (i.e. ability to alter the onset, timing, progression and/or outcome of a structure or process during development) allows an organism to respond to variations in environmental conditions by altering the onset, extent, rate of change and outcome of the development of particular structures and systems, thereby ensuring survival. Hence developmental plasticity must be evident, at least to some extent, for all physiological systems within a species. Environmental variables such as oxygen, temperature and pressure will exploit this plasticity. However, for any given system, the onset and type of plasticity (i.e. the nature of the developmental window), the control mechanisms and the interactions with other developing systems will vary between organisms, and between systems within an organism. More importantly, new species can only appear once developmental programs have changed. It is possible that speciation could occur if environmental variables alter developmental trajectories for one or more systems, and the shifts in developmental windows lead to alterations in the gene frequencies of the controlling systems. Hence, repeated generations of organisms exposed to directional selection from an environmental variable will evolve into new species as a result of shifts in the developmental window. We will test the plasticity patterns in two central systems – the respiratory system (comprised of the pulmonary surfactant system and the process of lung morphogenesis) and the cardiovascular system – against changes in two environmental variables – oxygen and temperature - in a wide range of oviparous and viviparous species. The patterns exposed by examining two systems in widely divergent species will provide a hypothetical framework for how developmental plasticity may lead to the evolution of new species. This study will greatly enhance our understanding of how the environment can influence development of one or more physiological systems in a milieu of different developing structures, organs and systems.
The Process of adaptation at the molecular level: HIV and the immune system

(Prof Steve Donnellan, Assoc Prof Michael Mahony, S Richards & Prof C Moritz)

This program aims to comprehensively revise the species level and higher systematics of the Australo-Papuan hylid frogs with the major concentration on the Australian fauna but we also will examine as far as is practicable the Melanesian elements of this family. cDNA libraries are being used to generate both population and higher systemic level informative molecular markers. Major issues to be examined are:

- Species boundaries in widespread species ‘complexes’ especially where cryptic species may be present;
- Comparative phylo-geography of co-distributed taxa in northern Australia;
- Biogeographic relationships between Australia and New Guinea;
- Higher level relationships within the family as a basis for a revised classification;
- Evolution of morphology and calls and diversification rates in the family.

During 2006, the Program recruited a new PhD student, Luke Price.

Evolution and palaeobiology of the Australian flora

(Prof Bob Hill, Ms Rosemary Paull)

Southern Australia is the best place in the world to study the effects of long-term climate change on vegetation. This is because Australia has moved through approximately 20° of latitude since it separated from Antarctica about 35 million years ago, and during that time this movement has had a profound impact on the global and, more specifically, Australian climate. The study of the effect of this climate change on the vegetation is made possible by the excellent preservation of Cainozoic plant fossils in central and south-eastern Australia. This has been coupled with physiological research on the nearest living relatives of the fossils so that a reconstruction of the reasons behind plant evolution and/or distributional change can be attempted. This program utilises the fossil record and
the living relatives of the fossils to document the impacts of lowering temperatures and reduced water availability on the vegetation of a large region. Such data are vital to our understanding of the potential impact of future, much shorter term, climate change.

**Evolution of reproductive mode in facultative ovoviviparous thrips**
(Dr Brenda Kranz, Dr David Morris, ANU)

Australian idolothripine thrips constitute the only group to contain many species in which the females choose among live birth, egg laying or both. They also choose the sex of each offspring. We are using phylogenetics and experimentation to understand the evolutionary pressures that led to and maintain live birth and the allocation of sex. We are exploiting the natural history of thrips to test the leading hypotheses for the evolutionary transition from egg laying to live birth, by determining:

- How the transition has co-evolved and been maintained with selective pressures also acting on sex allocation;
- The consequences when the selection for reproductive mode (RM) is in conflict with that for sex allocation;
- To what extent the factors of frequency-dependent and sex-specific competition, body size and predation influence the trade-off between RM and sex allocation at a species, population and individual level.

**Evolution and systematics of living and fossil reptiles**
(Assoc Prof Michael Lee, Dr Mark Hutchinson)

Anatomical, palaeontological and molecular approaches are being used to address important questions in reptile evolution, including:

- The tempo and major divergences in squamates (lizards and snakes) based on nuclear genes;
- Diversity of marine reptiles in Australia's Cretaceous inland sea;
- Systematics of Australian agamids (dragons), skinks and diplodactyline geckos;
- Evolutionary mechanisms of limb loss in the diverse scincid lizard *Lerista*;
- Molecular phylogenetics of Australian elapid snakes;
- Phylo-geography of arid zone geckos;
- Fossil record of Australian lizards.

**Spatial, temporal and organismal dynamics of gene flow; considerations for evolution, ecology and conservation**
(Prof Andy Lowe)

*Gene flow – Organismal:* Molecular, morphological and ecological techniques have been applied to examine the impact of hybridisation between species both in terms of promoting evolution and causing extinctions. Hybridisation is a common feature across many plant groups and can lead to speciation and introgression of adaptive genes, both of which can lead to rapid evolutionary pathways. Ongoing work is to quantify and assess the impact of hybridisation between invasive weeds and native flora by considering the genomic composition, gene expression and potential selective sweeps of adaptive genes.
Gene flow – Temporal: Molecular marker and statistical procedures have been used to examine the introduction history of several weed species and the post-glacial colonization dynamics of a range of plant and animal systems. Recently simulation modelling procedures have examined the influence of long distance dispersal/migration on a species’ ability to respond to both past and future climate change scenarios. Ongoing work is examining the contrasting models of long distance dispersal and variance on wide-spread species spanning regions of major geological and climatic change in the SW Pacific, by combining phylogenetic, phylo-geographic, fossil evidence and modelling approaches.

Gene flow – Spatial: Molecular marker and analytical approaches have been developed to describe contemporary gene flow between individuals and populations. Such studies are fundamental to understanding the gene flow dynamics associated with land-use change (e.g. habitat fragmentation) and exploitation, and have lead to changes in extraction rate threshold setting and restoration practice, adopted by government agencies. Recently, simulation modeling has been used to test outcomes of recommended land-use strategies, in terms of genetic diversity and population connectivity, further improving management advice.

Plasticity of surfactant phospholipid molecular composition in mammals
(Assoc Prof Sandra Orgeig, Prof Chris Daniels)

Pulmonary surfactant, a complex mixture of lipids and proteins, lowers the surface tension in terminal air spaces and is crucial for lung function. Within an animal species, surfactant composition can be influenced by development, disease, respiratory rate and/or body temperature. We analyzed the composition of surfactant in three heterothermic mammals (dunnart, bat, and squirrel), displaying different torpor patterns. It was discovered that like bats and dunnarts, surfactant cholesterol increases during torpor in squirrels. However, changes in phospholipid saturation during torpor may not be universal. In addition, we analyzed the phospholipid molecular species composition of a large range of mammals (including placental/marsupial and hetero-/homeothermic contrasts) to determine whether phylogeny or thermal behaviour determines molecular species composition in mammals. We discovered that the ‘major’ surfactant phospholipid dipalmitoylphosphatidylcholine (PC16:0/16:0) is highly variable between mammals and is not the major PL in the wombat, dunnart, shrew or Tasmanian devil. An inverse relationship exists between PC16:0/16:0 and two of the major fluidising components, PC16:0/16:1 and PC16:0/14:0. The PL molsp profile of an animal species is not determined by phylogeny or thermal behaviour. We conclude that there is no single PL molecular species composition that functions optimally in all mammals, rather the surfactant from each animal is unique and tailored to the biology of that particular animal.

Lizard tail regeneration: a model for investigating lymphangiogenesis
(Assoc Prof Sandra Orgeig, Prof Chris Daniels)

This study examines the regeneration of lymphatic and blood vessels in the regenerating tails of lizards. Many species of geckos and some skinks are capable of voluntarily shedding their tail (autotomy). The tail rapidly regenerates, as a fully differentiated structure, including muscle and nervous tissue, cartilage, skin, fat, as well as blood and lymphatic vessels. However, in mammals and humans, lymphatic regeneration (termed lymphangiogenesis) occurs only transiently after surgery or radiotherapy. This inefficient regeneration results in an accumulation of lymphatic fluid in the surrounding tissue, resulting in the debilitating condition known as lymphoedema. We are currently investigating the physiological and molecular mechanisms underlying the successful regeneration of lymphatic vessels in gecko tails after autotomy.
Biology, systematics and evolution of marine parasites
(Assoc Prof Ian Whittington, Dr Leslie Chisholm)

The Monogenean Research Laboratory at The South Australian Museum and The Marine Parasitology Laboratory at The University of Adelaide, continue to focus on helminth parasites of marine fishes. Of particular emphasis is the Monogenea, a class of flatworms (platyhelminths) with a direct life-cycle which chiefly parasitise the ‘skin’, fins and gills of elasmobranch and teleost fishes. Many loci of our research are especially relevant to South Australia because teleost fishes reared in sea cage aquaculture in Spencer Gulf may experience significant problems from parasitic flukes. The feeding activities (ingestion of blood or epidermis) and the mechanisms of attachment (mechanical aggravation of epithelium and dermis) can both weaken and sometimes contribute to fish death. Studies, therefore, by Honours and PhD students continue to investigate features of the biology, epidemiology, ecology and treatment of Monogenea on kingfish, *Seriola lalandi*, in aquaculture. Our research programs continue to embrace several discrete projects investigating parasites of wild and cultivated fish species locally and also overseas. Recent studies also involve identifying flatworm parasites using morphological and molecular genetic methods from fishes in captivity (e.g. public display aquaria and aquarium suppliers) and in fish farms worldwide to determine how widespread and how host-specific some pathogens are on a global scale. Not surprisingly, some parasite species that we thought may have a cosmopolitan and worldwide distribution infecting several closely related host species globally may, in fact, be more local and highly host-specific. As our work continues, we shall shed more light on the fundamentals of parasitism. Our systematic studies continue to demonstrate that even relatively well-known fish species such as *S. lalandi* harbour new internal fluke species that live in, and feed on, blood. Studies include:

- Life cycle parameters of the monogenean parasites *Zeuxapta seriolae* and *Benedenia seriolae* from *Seriola lalandi* in South Australian finfish aquaculture;
- A survey of parasites from wild and farmed carangids (*Seriola lalandi* and *S. hippos*) in southern Australia;
- Efficacy of potential chemotherapeutants against Monogenea of farmed *Seriola* species;
- Stock discrimination of slimy mackerel (*Scomber australasicus*) throughout Australia and New Zealand using parasites, genetics and otoliths;
- The southern fiddler ray, *Trygonorrhina fasciata*, as a model host to investigate parasitism of elasmobranchs;
- Sharing of parasites among the Rhinobatidae (guitarfish; shovelnose rays) in southern and eastern Australian;
- Phylogeny and evolution of the Capsalidae (Monogenea), ecto-parasitic on a diversity of fishes, using morphological characters, molecular genetics and host associations;
- Systematics of Monogenea (Platyhelminthes) from the sharks and rays of Malaysian Borneo;
- Cryptic species complexes among pathogenic Monogenea on wild and cultivated warm water fishes;
- Capsaline Monogenea (Monopisthocotylea) of large, cosmopolitan, migratory pelagic fishes: revisiting species composition, diversity and distribution of the parasites;
- The first monogenean species described may be a species complex: *Entobdella* species (Monogenea: Capsalidae) from teleost flatfishes (Pleuronectiformes);
All our studies dovetail to help build a better indication of the evolution, associations and interactions between marine parasites and their fish hosts. A thorough knowledge of the biology of fish parasites will help expand ideas of how to manage and control pathogen populations on captive fish hosts in public display aquaria and in aquaculture. During 2006, our parasitological activities have involved two Research Associates, one Research Assistant and six PhD students.

*Morelia viridis*, the green python, from Australia and New Guinea is a target species for molecular phylogeographic research by ACEBB staff.
APPOINTMENTS, AWARDS & DISTINCTIONS FOR 2006

Mrs Robyn Barker was made a Life Member of the Australian Systematic Botany Society

Dr Steve Cooper was awarded Australian Academy of Sciences Selby Travelling Fellowship for the distinguished evolutionary biologist Professor Godfrey Hewitt (University of East Anglia, UK) to visit Australia in October

Dr Leslie Chisholm continued (since 2000) her appointment as Editor of the Ichthyoparasitology Newsletter (see: http://www.diplectanum.dsl.pipex.com/newsletter/)

Dr Leslie Chisholm continued her appointment on the Editorial Advisory Committee of the CSIRO journal Invertebrate Systematics

Prof Chris Daniels and Catherine Tait were awarded the Whitley Medal 2006 by the Royal Zoological Society of New South Wales as editors of ‘Adelaide, Nature of a City’ for best book in the zoological sciences

Prof Chris Daniels was a finalist for the Premier’s Science Award in Science Communication and Education

Prof Steve Donnellan was promoted to Affiliate Professor (Level E) in the School of Earth & Environmental Sciences

Professor Bob Hill was appointment as Executive Dean for the Faculty of Sciences

Dr John Jennings was:

- Elected Vice-President of the Royal Society of South Australia
- Reappointed Convenor of the Editorial Board for the Transactions of the Royal Society of South Australia
- Re-elected Chairman of the Council of Heads of Australian Entomological Collections
- Appointed convenor of the Kangaroo Island Long-term Ecological Research site (LTER)
- Appointed South Australian Regional Councillor for the Australian Entomological Society.

Assoc Prof Ian Whittington was:

- Promoted to Reader/Associate Professor (Level D) in the School of Earth & Environmental Sciences
- Remains co-editor of the journal Systematic Parasitology, and is on the Editorial Boards of Folia Parasitologica and Journal of Natural History (since 2001)
- Elected a member of the International Committee of the International Symposium on Fish Parasites (to be held in September 2007, Viterbo, Italy)
- Made Visiting Professor at the Centro de Investigaciones Biológicas del Noroeste (CIBNOR), La Paz, Baja California Sur, México during May and June 2006
- Invited to be Chair of the Localising Organising Committee for the 2008 Australian Society for Parasitology Inc. and ARC / NH&MRC Research Network for Parasitology.
# STUDENTS Enrolled in 2006

The following students undertook research projects in the Centre during 2006.

## Honours Students

<table>
<thead>
<tr>
<th>Name</th>
<th>Project Title</th>
<th>Supervisor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danielle Carey</td>
<td>Molecular phylogeny of baeine wasps (Scelionidae) and the evolution of wing reduction [awarded the Michael Smythe Prize]</td>
<td>AD Austin &amp; N Murphy</td>
</tr>
<tr>
<td>Stephen Griffiths</td>
<td>Influence of homopteran insects and Acacias on the distribution of <em>Iridomyrmex</em> (ant) nests in the Flinders Ranges</td>
<td>AD Austin &amp; J Facelli</td>
</tr>
<tr>
<td>Kimberly Lewis</td>
<td>Male germ cell organisation and production in testicondid testes of the elephant shrew</td>
<td>W Breed</td>
</tr>
<tr>
<td>Craig Michell</td>
<td>Characterising the time dependency of molecular rates in Ancient DNA and viral datasets</td>
<td>A Cooper &amp; J da Silva</td>
</tr>
<tr>
<td>Liberty Olds</td>
<td>Comparative studies on marsupial sperm tail cyto-skeleton and motility in marsupials</td>
<td>W Breed &amp; D Taggart</td>
</tr>
</tbody>
</table>

## MSc Students

<table>
<thead>
<tr>
<th>Name</th>
<th>Project Title</th>
<th>Supervisor(s)</th>
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</thead>
<tbody>
<tr>
<td>Dani Maver</td>
<td>Steroid hormones in peripheral blood and the control of oestrous cycle length in the long-nosed potoroo</td>
<td>W Breed &amp; D Taggart</td>
</tr>
</tbody>
</table>

## PhD Students

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<tr>
<th>Name</th>
<th>Project Title</th>
<th>Supervisor(s)</th>
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<tbody>
<tr>
<td>Mark Adams</td>
<td>Evaluation of biodiversity in Australia’s freshwater fish fauna</td>
<td>K Walker &amp; S Donnelllan</td>
</tr>
<tr>
<td>Adam Allford</td>
<td>Biology and ecology of stygo-fauna in the Yilgan region of Western Australia</td>
<td>AD Austin, S Cooper &amp; M Guzik</td>
</tr>
<tr>
<td>Melissa Bauer</td>
<td>Sperm pleomorphism in Australian native rodents</td>
<td>W Breed</td>
</tr>
<tr>
<td>Helen Blacker</td>
<td>Regenerating lizard tails: a model for understanding the process of lymphangiogenesis</td>
<td>S Orgeig &amp; C Daniels</td>
</tr>
<tr>
<td>Deborah Bower, University of Canberra</td>
<td>Ecology of the broad-shelled turtle in the Murray-Darling Basin</td>
<td>A Georges (Univ Canberra), M Hutchinson &amp; S Donnellan</td>
</tr>
<tr>
<td>Tessa Bradford</td>
<td>Modes of speciation in subterranean water beetles</td>
<td>S Cooper &amp; AD Austin</td>
</tr>
<tr>
<td>Sarah Bray</td>
<td>The evolution and genetic diversity of ancient bears</td>
<td>J Austin &amp; A Cooper</td>
</tr>
<tr>
<td>Andrew Breed, University of Queensland</td>
<td>Are black flying foxes a possible vector of <em>Nipa</em> virus?</td>
<td>J Meers (Univ. of Qld), H Field, (Qld DPI) &amp; S Donnellan</td>
</tr>
<tr>
<td>Wetjens Dimmlich</td>
<td>Spawning in anchovies</td>
<td>W Breed, T Ward (SARDI Aquatic Sc) &amp; M Geddes</td>
</tr>
</tbody>
</table>

### Note

The above content is a table listing students who undertook research projects in 2006, detailing their names, project titles, and supervisors. The content is presented in a clear and structured manner, facilitating easy reading and understanding.
### PhD Students

<table>
<thead>
<tr>
<th>Name</th>
<th>Project Title</th>
<th>Supervisor(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matthew Donnan</td>
<td>Molecular evolution and adaptive radiation of <em>Lomandra</em> and related genera (Laxmanniaceae)</td>
<td>J G Conran &amp; TD Macfarlane</td>
</tr>
<tr>
<td>Alison Fitch, Flinders University</td>
<td>Molecular systematics and phylo-geography of Australian goannas</td>
<td>A Goodman (Flinders Univ) &amp; S Donnellan</td>
</tr>
<tr>
<td>Wendy Foster</td>
<td>Reproductive biology and mating system of the red-tailed phascogale</td>
<td>D Taggart &amp; S Donnellan</td>
</tr>
<tr>
<td>Vanessa Glennon</td>
<td>Monogenean parasites of the southern fiddler ray, <em>Trygonorrhina fasciata</em>: an exceptional model to investigate parasite biology, ecology, infection dynamics, micro-habitat selection and speciation</td>
<td>ID Whittington &amp; L Chisholm</td>
</tr>
<tr>
<td>Travis Gotch</td>
<td>Population and conservation biology of mound springs spiders in South Australia</td>
<td>AD Austin &amp; M Keller</td>
</tr>
<tr>
<td>Nilanaga Gunawardane</td>
<td>Impact of DNA degradation on the reliability of DNA fingerprinting</td>
<td>M Henneberg &amp; S Donnellan</td>
</tr>
<tr>
<td>Jaro Guzinski, Flinders University</td>
<td>Genetic population structure in parapatric ticks</td>
<td>M Bull (Flinders University) &amp; S Donnellan</td>
</tr>
<tr>
<td>Julie Hagen, Flinders University</td>
<td>Behavioural ecology and population structure in the Solomons Islands prehensile-tailed skink</td>
<td>M Bull (Flinders University) &amp; S Donnellan</td>
</tr>
<tr>
<td>Magda Halt</td>
<td>Phylogeny of Cirratuliformia (Polychaeta) and assessment of the Barcode of Life program</td>
<td>G Rouse &amp; S Cooper</td>
</tr>
<tr>
<td>Elise Head</td>
<td>Biology of gall-forming <em>Fergusonolina-Fergusobia</em> (Diptera, Nematoda) on eucalypt trees</td>
<td>I Riley, K Davies, G Taylor &amp; AD Austin</td>
</tr>
<tr>
<td>Margaret Heselwood</td>
<td>Biogeography of the Cunoniaceae in Australasia and the Southwest Pacific; interactions of dispersal, geology and climate change</td>
<td>A Lowe</td>
</tr>
<tr>
<td>Kate Hodges</td>
<td>Comparative population structure of turtles in the Murray-Darling Basin</td>
<td>S Donnellan, M Hutchinson &amp; A Georges (Univ of Canberra)</td>
</tr>
<tr>
<td>Andrew Hugall</td>
<td>Tempo and mode of evolution in Australian land snails</td>
<td>J Austin &amp; M Lee</td>
</tr>
<tr>
<td>Kate Hutson</td>
<td>Parasite interactions of wild and farmed kingfish (<em>Seriola lalandi</em>) in Spencer Gulf, South Australia</td>
<td>ID Whittington &amp; I Ernst</td>
</tr>
<tr>
<td>Christopher Izzo</td>
<td>An assessment of telomere length change for aging sharks and rays</td>
<td>B Gillanders &amp; S Donnellan</td>
</tr>
<tr>
<td>Takeshi Kawakami, University of NSW</td>
<td>Systematics, phylo-geography and speciation of chromosomally diverse Australian morabine grasshoppers</td>
<td>D Paull (Univ of NSW), S Cooper, R Butlin</td>
</tr>
<tr>
<td>Le Cao Luong</td>
<td>Investigation into the taxonomy and biology of tubular black thrips, <em>Haplothrips victoriensis</em> Bagnall</td>
<td>JT Jennings &amp; G Baker</td>
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<tr>
<td>Mansoureh Malekian</td>
<td>Conservation biology of the sugar glider, <em>Petaurus breviceps</em></td>
<td>S Carthew &amp; S Cooper</td>
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<tr>
<td>Allan Mooney</td>
<td>Biology of <em>Zeuxapta seriolae</em> from the gills of <em>Seriola lalandi</em> (Carangidae)</td>
<td>ID Whittington &amp; I Ernst</td>
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<tr>
<td>Kate Muirhead</td>
<td>Biosystematics and biology of the <em>Cotesia flavipes</em> complex of wasps</td>
<td>AD Austin &amp; S Donnellan</td>
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<td>Paul Oliver</td>
<td>Evolution in the <em>Diplodactylus vittatus</em> complex</td>
<td>M Lee &amp; S Cooper</td>
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<tr>
<td>Kym Ottewell</td>
<td>Pollen mediated gene flow in woodland eucalypts</td>
<td>D Paton &amp; SC Donnellan</td>
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<tr>
<td>Cate Paull</td>
<td>Beneficial arthropods in Coonawarra vineyards</td>
<td>AD Austin &amp; N Schellhorn</td>
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<tr>
<td>Rosemary Paull</td>
<td>The plant macrofossils from the Miocene of Kiandra, NSW</td>
<td>R Hill &amp; J Watling</td>
</tr>
<tr>
<td>Grant Pelton</td>
<td>The effects of vegetation rolling in the Ngarkat Conservation Park in relation to fire management</td>
<td>JG Conran</td>
</tr>
<tr>
<td>Name</td>
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<td>Supervisor(s)</td>
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<tr>
<td>Elizabeth Perkins</td>
<td>Molecular systematics, phylogeny and radiation of the Capsalidae (Monogenea)</td>
<td>ID Whittington &amp; SC Donnellan</td>
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<tr>
<td>Luke Price</td>
<td>Systematics of the Australo-Papuan tree frogs</td>
<td>S Donnellan &amp; M Mahony (Univ of Newcastle)</td>
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<tr>
<td>Nguyen Huu Quang</td>
<td>Investigation of Nabis kinbergii and its suitability as a bio-control agent</td>
<td>M Keller &amp; JT Jennings</td>
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<tr>
<td>Nicolas Rawlence</td>
<td>Population genetic demographics of moa during the Pleistocene and Holocene in New Zealand</td>
<td>A Cooper &amp; J Austin</td>
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<tr>
<td>Terry Reardon</td>
<td>Systematics and biogeography of Mormopterus (Chiroptera:Molossidae)</td>
<td>S Carthew &amp; S Cooper</td>
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<tr>
<td>David Schmarr</td>
<td>Stock assessment of slimy mackerel (Scomber australasicus) in southern Australia using parasites, genetics and otoliths</td>
<td>ID Whittington &amp; T Ward (SARDI Aquatic Sc.)</td>
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<tr>
<td>Udani Sirisena</td>
<td>Evolution and relationships of Thysanotus (Laxmanniaceae)</td>
<td>JGConran, TD Macfarlane &amp; D Yakanawara</td>
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<tr>
<td>Adam Skinner</td>
<td>Systematics and evolution of Lerista (Scincidae, Squamata)</td>
<td>M Lee and M Hutchinson</td>
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<tr>
<td>Elisa Sparrow</td>
<td>Reproductive biology and genetical relationships in wombats</td>
<td>W Breed, D Taggart &amp; S Cooper</td>
</tr>
<tr>
<td>Nicholas Stevens</td>
<td>Systematics of Australian agathidine wasps (Insecta: Hymenoptera: Braconidae); solitary endo-parasitoids of lepidopteran leaf-rolling larvae</td>
<td>AD Austin &amp; JT Jennings</td>
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<tr>
<td>Christine Swann</td>
<td>The evolution and function of the zona pellucida in Australian rodents</td>
<td>W Breed &amp; S Cooper</td>
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<td>Nuttawat Tithipramote</td>
<td>Seasonal changes in germ cell production in bandicoot rats</td>
<td>W Breed &amp; J Suwanjarat (Prince Songkla University, Thailand)</td>
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<tr>
<td>Karleah Trengove</td>
<td>Determination of dispersal and mating system of the Bilby</td>
<td>W Breed &amp; S Carthew</td>
</tr>
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<td>Fraser Vickery</td>
<td>The effect of fire on narrow leaf mallee (Eucalyptus cneorifolia) ecosystems on Kangaroo Island using ants as bio-indicators</td>
<td>JT Jennings &amp; AD Austin</td>
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<tr>
<td>Carlos Villacorta</td>
<td>Population structure and phyl-geoography of Canary Island amphipods</td>
<td>S Cooper &amp; C Juan (Universidad de Islas Baleares, Spain)</td>
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<td>Rissa Williams</td>
<td>Novel treatments for Monogenea infecting commercially important finfish species in aquaculture</td>
<td>I Ernst &amp; ID Whittington</td>
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<td>Zheng Qi Zhao</td>
<td>Taxonomy, biology and pathogenicity of nematodes associated with pine trees and other conifers in Australia</td>
<td>K Davies, I Riley, J Nobbs (SARDI) &amp; Smith (Forestry Victoria)</td>
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### Student Completions

<table>
<thead>
<tr>
<th>Name</th>
<th>Ph.D. Thesis</th>
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<tr>
<td>Meredeth Brown</td>
<td>Socio-ecology and Phylo-geography of the yellow-bellied glider (<em>Petaurus australis</em>)</td>
<td>S Carthew &amp; S Cooper</td>
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<td>Lyda Castro, University of Wollongong</td>
<td>Mitochondrial genome organisation in the insect Order Hymenoptera</td>
<td>M Dowton (Univ. of Wollongong) &amp; AD Austin</td>
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<td>Sylvia Clarke</td>
<td>Impact of management practices on invertebrate biodiversity in the Flinders Ranges, South Australia</td>
<td>AD Austin, J Facelli &amp; A Andersen (CSIRO)</td>
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<tr>
<td>Kris Helgen</td>
<td>Rodent systematics in southeast Asia</td>
<td>T Flannery &amp; R Hill</td>
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<tr>
<td>Tim Moulds</td>
<td>Ecology and conservation of a unique guanophiliic invertebrate community</td>
<td>AD Austin &amp; JT Jennings</td>
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<tr>
<td>Claire Stephens</td>
<td>The impact of weeds invasions on insect diversity and associated community structure and processes</td>
<td>AD Austin &amp; J Facelli</td>
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<td>Pakawadee Worawittayawong</td>
<td>Dynamics of sperm production and morphogenesis of sperm form in the SE Asian rodent <em>Bandicota indica</em>.</td>
<td>W Breed &amp; P Sretagusa (Mahidol Univ Thailand)</td>
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Nick Stevens, a final year PhD student, undertaking a project on the systematics and evolution of parasitic wasps
Communications

Website

The ACEBB website has been completely redesigned and rebuilt with the assistance of Kate White from the University’s Marketing & Strategic Communications section. The website is at http://www.ees.adelaide.edu.au/ACEBB/ and provides a portal into all of the activities of the Centre. It includes information on staff, students, research programs, funding, and seminars.

ACEBB Seminar Series

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker, Title</th>
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<tr>
<td>9 March 2006</td>
<td><strong>Prof Jim Whitfield</strong>, University of Illinois “Parasitic wasps and their immune-suppressing polydnaviruses”</td>
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<tr>
<td>28 April 2006</td>
<td><strong>Dr Kris Helgen</strong>, School of Earth &amp; Environmental Sciences, The University of Adelaide “Reassessment of taxonomic diversity and geographic patterning in the Melanesian mammal fauna”</td>
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<tr>
<td>21 June 2006</td>
<td><strong>Assoc Prof Gerry Mullins</strong>, Adelaide Graduate Centre “Factors that influence honours students’ intentions to proceed to postgraduate study”</td>
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<tr>
<td>25 October 2006</td>
<td><strong>Prof Godfrey Hewitt</strong>, University of East Anglia “Genetic consequences of the ice-ages and the construction of biota”</td>
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<tr>
<td>28 November 2006</td>
<td><strong>Dr Jessica Worthington-Wilmer</strong>, Queensland Museum “Aquatic islands in an arid sea: population dynamics of an endangered mound spring snail in Central Australia”</td>
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<tr>
<td>13 December 2006</td>
<td><strong>Assoc Prof Mike Lee</strong>, School of Earth &amp; Environmental Sciences, and the South Australian Museum “The uses of paleontology in the molecular age”</td>
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</table>
CONFERENCE PRESENTATIONS 2006

Barker WR, Potentially useful synapomorphies in the traditional Scrophulariaceae. *Australian Systematic Botany Society Annual Conference*, James Cook University, Cairns.


Cooper A, The time dependency of evolutionary rates and issues with dating recent evolutionary events. *Geogenes II*, Wellington, New Zealand.


Cooper S, Relevance of DNA technology to invertebrate taxonomy. *Workshop on Mining and Groundwater Dependent Ecosystems*, Australian Centre for Minerals Extension and Research, Adelaide.


Jennings JT & Schiff, NM, Systematics of Australian wood-wasps (Xiphydriidae). 6th International Society of Hymenopterists Conference, Sun City, South Africa.

Kasper M, Austin AD & Mackay D, Biology, ecology and pest status of Vespula germanica (Hymenoptera: Vespidae) in Mediterranean Australia. Australian and New Zealand Entomological Societies Conference, University of Adelaide.

Kranz BD, Morris DC & Neville TN, The trade-off between reproductive mode and sex allocation in facultatively ovoviviparous thrips. 11th International Behavioural Ecology Congress, Tours, France.


Leys RC, Watts CHS, Cooper S & Humphreys W, Multiple body size classes of subterranean diving beetle species (Coleoptera: Dytiscidae: Biedessini, Hydroporini) repeated in numerous aquifers in arid Australia. 18th International Symposium of Biospeleology Cluj-Napoca, Romania.

Lowrie A & Conran JG, Utricularia simmonsi (Lentibulariaceae), a new species in the new section Minuta, from northern Queensland, Australia. ASBS Conference, James Cook University, Cairns.

Lowrie A & Conran JG, Byblis guehoi (Byblidaceae), a new species from the Kimberley, Western Australia. ASBS Conference, James Cook University, Cairns.

Malekian M, Cooper SJB & Carthew SM, Phylogeographic analyses of the sugar glider (Petaurus breviceps): new cryptic species are present in Australia and Papua New Guinea. 52nd Australian Mammal Society Conference, Melbourne.

Mooney AJ, Ernst I & Whittington ID, Time to sexual maturity at different water temperatures in Zeuxapta seriola, a gill parasite of kingfish, Seriola lalandi. Annual Scientific Meeting of the Australian Society for Parasitology Inc. and the Australian National Network for Parasitology, Surfers Paradise, Queensland.

Muirhead KA, Murphy ANP, Donnellan SC, Sallam MN & Austin AD, Cophylogeny of the Cotesia flavipes complex and their polydnavirus symbionts: towards the effective biological control of stemborer pests in Australia. International Society of Hymenopterists Conference, Sun City, South Africa.

Muirhead KA, Murphy ANP, Donnellan SC, Sallam MN & Austin AD, Cophylogeny of the Cotesia flavipes complex and their polydnavirus symbionts: towards the effective biological control of stemborer pests in Australia. SSB/SSE/ASN Joint Conference, Stony Brook, New York.

Murphy ND, Carey D & Austin AD, Phylogeny of the platygastroid wasps based on multiple genes: implications for classification and evolution of the ovipositor system. International Society of Hymenopterists Conference, Sun City, South Africa.


Ruykys L D, Taggart DA, Breed B & Schultz D, Investigations of sarcoptic mange in southern hairy-nosed wombats (Lasiorhinus latifrons) in the Murraylands of South Australia. 52nd Scientific Meeting of the Australian Mammal Society, Melbourne.
Stevens NB, Austin AD & Jennings JT, An investigation of the little known agathidine (Hymenoptera: Braconidae) fauna of Australia. 6th International Society of Hymenopterists Conference, Sun City, South Africa.


Taggart DA, Fletcher T, Schultz D, Temple-Smith PD & Breed WG, Cross-fostering and pouch isolation studies in Kangaroos, Wallabies, and Rat Kangaroos: implications for conservation and species management. 52nd Scientific Meeting of the Australian Mammal Society, Melbourne.

Taylor GS, Davies KA, Martin N & Crosby T, First record of Fergusonina flies and associated nematodes from New Zealand. Australian and New Zealand Entomological Societies Conference, University of Adelaide.

Thitipramote NJ, Suwajarat, & Breed WG, Are there seasonal differences in quality of sperm production in Great Bandicoot rats (Bandicota indica)? Microscopical Society of Thailand.

Whittington ID, Perkins EM, Chisholm LA & Donnellan SC, Neobenedenia ‘melleni’ (Monogenea: Capsalidae): is this enigmatic infamous pest of fishes worldwide a cryptic species complex? 11th International Congress of Parasitology (ICOPA XI), Glasgow, UK.


Kangaroo Island is a Long-term Ecological Research site (LTER) and is the location of several ACEBB research projects.
NATIONAL & INTERNATIONAL COLLABORATIONS

Members of the Centre have very strong links with research groups around Australia and internationally. These have resulted in several initiatives, as well as numerous joint grant applications and co-authored publications during 2006. Some of the major linkages with members of the Centre over this period are:

**Dr Jeremy Austin**

- Jim Groombridge, Durrell Institute of Conservation & Ecology, University of Kent, Project: *Phylogeny of extinct Indian Ocean birds*.
- Jane Melville, Museum Victoria, Project: *Phylogeography of arid-zone reptiles*.
- Paul Doughty, West Australian Museum, Project: *Systematics of Australian reptiles*.
- Nick Arnold, British Museum, Natural History, Project: *Phylogeny of Indian Ocean island reptiles*.
- Juan Sanchez, Institute of Forensic Medicine, University of Copenhagen, Project: *Ancient human DNA*.
- Melanie Lancaster, Department of Genetics, La Trobe University, Project: *Ancient DNA from Macquarie Island to identify pre-European species*.
- Gillian Gibb, Allan Wilson Centre, Massey University, Project: *Mitochondrial genome sequencing of extinct birds*.
- Ken Aplin, CSIRO - Sustainable Ecosystems, Project: *Phylogeny of Australasian rodents*.

**Professor Andy Austin**

- Dr Mark Dowton, University of Wollongong, Project: *The molecular evolution and phylogeny of the parasitic Hymenoptera*.
- Dr Mark Harvey, Western Australian Museum, Project: *The systematics and phylogeny of Australian lycosid spiders*.
- Dr Bill Humphreys, Western Australian Museum, Project: *The evolution and diversity of stygofauna associated with calcretes in the Yulgan region of Western Australia*.
- Dr Norman Johnson, Ohio State University, Project: *Phylogeny and higher-level classification of platygastroid wasps*.
- Dr John La Salle, CSIRO, Entomology, Project: *Development of an interactive platform for the identification of Australasian Hymenopteran families*.
- Dr Jim Whitfield, University of Illinois, Project: *Phylogeny of microgastroid braconid wasps*.

**Dr W.R. (Bill) Barker**

- Dr P Beardsley, Idaho State University, USA, Project: *Molecular studies in the sub-tribe Mimulineae (Scrophulariaceae)*.
- Mr Dwayne Estes, Dept of Ecology & Evolutionary Biology, Knoxville, USA, Project: *A world-wide taxonomic revision of Gratiola (Scrophulariaceae)*.
- Prof Michael Kiehn, Department of Biogeography and Botanical Garden, Vienna, Project: *Chromosomal evolution of Stackhousiaceae*. 
Dr William Breed

- Prof M Eddy - NIH, Research Triangle, North Carolina, Project: Marsupial sperm tail cytoskeletal proteins.
- Dr Larry Heaney - Field Museum of Natural History, Chicago, Project: Evolution of sperm morphology of murine rodents.
- Prof Tim Birkhead - Dept of Plant and Animal Sciences, University of Sheffield, Project: Sperm cooperation and sperm motility in rodents.
- Prof Richard Oko - Queens University, Kingston, Ontario Canada, Project: Cytoskeletal proteins in the sperm head of murine rodents.
- Dr Jamie Chapman - Discipline of Anatomy and Physiology, University of Tasmania, Project: Glycoproteins of the marsupial egg coat.

Dr John Conran

- Ms Jennifer Bannister and Dr Daphne Lee, University of Otago, New Zealand, Project: Fossil monocots from New Zealand.
- Prof Mark Chase, RBG Kew, Project: The molecular systematics and phylogeny of Australian monocots.
- Mr Paul Forster, Qld Herbarium, Project: Systematics of Romnalda (Laxmanniaceae).
- Dr Jie Li Xishuangbanna, Tropical Botanical Garden, Kunming, P.R. China, Project: The molecular evolution and phylogeny of the Laureae (Lauraceae).
- Dr Terry Macfarlane, DEC WA, Project: Systematics of Australian Laxmannianceae.
- Dr Paula Rudall, RBG Kew, Project: The morphological evolution and diversity of Australian monocots.
- Prof Hiroshi Tobe, Kyoto University, Japan, Project: Evolution in the Smilacaceae.
- Mr Phillip Simpson, New Zealand, Project: Fossil palms in Miocene New Zealand.

Dr Steve Cooper

- Professor Roger Butlin, University of Leeds, UK, Project: Population genetics and evolution of morabine grasshoppers, genus Vandiemenella.
- Dr Bill Humphreys, Western Australian Museum, Project: The evolution and diversity of stygofauna associated with calcrites in the Yilgarn region of Western Australia.
- Assoc Prof Mike Schwarz, Flinders University, Project: Social evolution and molecular systematics of allodapine bees.
- Dr Stefano Taiti, Istituto per lo studio degli ecosistemi, Florence, Italy, Project: Systematics of Haloniscus isopods from calcrite aquifers of the Yilgarn region of WA.
- Dr Mark Harvey, Western Australian Museum, Project: Systematics of moggridgea spiders from Western Australia.
- Dr David Paull, University of NSW, Project: Population genetics and evolution of morabine grasshoppers, genus Vandiemenella.
- Dr Joo-Lae Cho, International Drinking Water Centre, South Korea, Project: Systematics of bathynellid stygofauna from the Yilgarn region of Western Australia.
**Dr Jack da Silva**

- Drs Kyle Summer and Tom McConnell, East Carolina University, Project: *Evolutionary Dynamics of the DAB and DXB MHC II loci in Xiphophorus fishes.*

**Dr Kerrie Davies**

- Assoc Prof Robin Giblin-Davis and Dr Weimin Ye, University of Florida; and Dr Kelley Thomas, University of New Hampshire, Project: *Speciation, molecular phylogeny and co-evolution of Fergusonina flies, Fergusobia nematodes and their myrtaceous hosts.*
- Assoc Prof Robin Giblin-Davis and Dr Weimin Ye, University of Florida; and Dr Kelley Thomas, University of New Hampshire, Project: *Morphological and molecular investigation of nematodes from Ficus sycones in Australia.*

**Professor Steve Donnellan**

- Dr Chris Austin, Louisiana State University, Baton Rouge, Project: *The phylogeography of New Guinean reptiles and frogs.*
- Dr Don Driscoll, Flinders University, Project: *The impact on genetic diversity of drying of the palaeo-Lake Bungunnia – implications for conservation genetics.*
- Dr Paul Doughty, Western Australian Museum, Project: *Systematics of the brood frogs.*
- Dr Joe Benshemesh, Monash University, Project: *Systematics and population biology of marsupial moles.*
- Dr Ken Aplin, Australian National Wildlife Collection, Project: *Systematics of the Australian and New Guinean vertebrates.*
- Professor Arthur Georges, Canberra University, Project: *Conservation biology of the broad-shelled turtle*
- Professor Craig Moritz, University of California, Project: *Molecular systematics of the Australo-Papuan treefrogs (Hylidae).*
- Associate Professor Michael Mahony, University of Newcastle, Project: *Molecular systematics of the Australo-Papuan treefrogs (Hylidae).*
- Professor Mike Bull, Flinders University, Project: *Biology of Egernia group skinks lizards.*

**Professor Bob Hill**

- Dr Sung Soo Whang, Chonbuk National University, South Korea, Project: *Conifer morphology.*
- Dr Tim Brodribb, Harvard University, Project: *Conifer eco-physiology.*
- Assoc. Prof. Andrew Drinnan, University of Melbourne, Project: *Plant macrofossil evidence for evolution of the Australian vegetation.*
Dr Mark Hutchinson

- Arthur Georges, Canberra University, Project: Conservation Biology of the broad-shelled turtle.
- Mike Bull, Flinders University, Project: Conservation biology of endangered lizards (Tiliqua and Egernia).

Dr John Jennings

- Dr Nathan Schiff, USDA Forest Service, Center for Bottomland Hardwoods Research, Stoneville, Project: Revision of the Australasian wood-boring sawflies (Hymenoptera: Xiphydriidae).
- Dr Andy Deans, Department of Entomology, University of Illinois, Urbana, Project: Revision of Australian hatchet wasps (Hymenoptera: Evanilidae).
- Dr Alexandre Aguiar, Museu de Zoologica da Universidade de Sào Paulo, Brazil, Project: New Caledonian Stephanidae.

Dr Brenda Kranz

- Dr David Morris, ANU, Project: The evolution of egg retention and sex allocation in facultative ovoviviparous thrips.
- Prof Laurence Mound, ANIC, CSIRO Entomology, Project: The evolution of egg retention and sex allocation in facultative ovoviviparous thrips.
- Prof Koji Tsuchida, Gifu University Japan, Project: The evolution of egg retention and sex allocation in facultative ovoviviparous thrips.
- Dr Arturo Goldarazena, NEIKER, Research Institute, SPAIN, Project: The evolution of egg retention and sex allocation in facultative ovoviviparous thrips.

Associate Professor Mike Lee

- John Scanlon, University of NSW and Outback at Isa, Project: Early snake evolution.
- Mike Caldwell, University of Alberta, Edmonton, Project: Marine reptiles.
- Tod Reeder, San Diego State University, San Diego, Project: The deep scaley project (NSF Tree of Life grant).

Dr Remko Leijs

- Dr Bill Humphries, Western Australian Museum, Project: The evolution of subterranean water-beetles.
- Dr Lindell Bromham, University of Sussex, Project: The effect of eusociality and population size on the rate of molecular evolution.
- Dr James Wallman, University of Wollongong, Project: Molecular Phylogeny of Australian carrion-breeding blowflies.
- Stefan Eberhard, CALM, WA, Project: Conservation of cave-dwelling amphipods in south-western Western Australia.
- Dr Michael Batley, Australian Museum, Project: Taxonomic revision of the Australian bee species belonging to the genus Amegilla.
- Dr Jim Mitchell, Flinders University, Project: Development and implementation of biodiversity information for sustainable management of South Australian groundwater.

**Professor Andy Lowe**

- Dr Maurizio Rosetto and Dr Darren Crayn, Sydney Botanic Gardens and Dr Pete Hollingsworth, Royal Botanic Gardens Edinburgh, UK, Project: Plant biogeography and population genetics.
- Dr Susanne Schmidt and Peer Schenk, University of Queensland, Project: Plant genomics and polyploid evolution.
- Prof Richard Abbott, University of St Andrews, UK and Prof Loren Rieseberg, University of British Columbia, Canada, Project: Weed genetics and speciation.
- Dr Stephen Cavers, Centre for Ecology and Hydrology, UK and Dr Carlos Navarro and Dr Bryan Finegan, Central American Tropical Research Centre, Costa Rica, Project: Tropical tree population genetics.
- Prof Antroine Kremer and Dr Remy Petit, National Agronomic Research Institute, France, and Dr Giovanni Vendramin, National Research Centre, Italy, Project: Temperate and tropical tree population genetics.
- Hugh Possingham and Yvonne Buckley, University of Queensland, Project: Ecology, biogeography, dispersal and weed population dynamics.

**Associate Professor Sandra Orgeig & Professor Chris Daniels**

- Dr Steven Stacker and Dr Marc Achen, Ludwig Institute for Cancer Research, Melbourne, Project: The role of vascular endothelial growth factors C & D (VEGF-C &D) in lymphangiogenesis in regenerating gecko tails.
- Dr Chris Tsopelas and Dr Barry Chatterton, Department of Nuclear Medicine, Royal Adelaide Hospital, Project: The functional development of the lymphatic system in regenerating gecko tails.
- Assoc Prof Jesus Perez-Gil, Universidad Complutense, Madrid, Spain, Prof. Sam Schürch, University of Calgary, Prof. Fred Possmayer, University of Western Ontario, Dr Kaushik Nag, Memorial University, Newfoundland, Canada, Dr Amiya Panda, Behala College, W.B. India, Project: Effects of temperature on the biophysical function of pulmonary surfactant.
- Dr Tony Postle, University of Southampton, UK, Project: Analysis of the molecular composition of surfactant samples of model species, to determine the effect of temperature on surfactant composition.

**Dr Gary Taylor**

- Assoc Prof Robin Giblin-Davis and Dr Weimin Ye, University of Florida; Dr Kelley Thomas, University of New Hampshire; Dr Sonja Scheffer, Systematic Entomology Lab, USDA, Beltsville, MD, Project: Speciation, molecular phylogeny and co-evolution of Fergusonina flies, Fergusobia nematodes and their myrtaceous hosts.
- Matthew Purcell, Australian Biological Control Laboratory, CSIRO Entomology, Brisbane; Dr Greg Wheeler, USDA—ARS, Invasive Plant Research Laboratory, Ft. Lauderdale, FL USA, Project: Systematics and co-evolution of insect herbivores of Casuarina for development as potential biological control agents in Florida, USA.
Associate Professor Ian Whittington and Dr Leslie Chisholm

- Professor Janine Caira, University of Connecticut, Dr Kirsten Jensen, University of Kansas, Dr Gavin Naylor, Florida State University, Drs Peter Last and John Stevens, CSIRO Marine Research, Hobart, Project: *Collections of parasites from sharks and rays from Sarawak and Sabah, Malaysian Borneo.*
- Dr Kevin Christison, University of the Western Cape, South Africa, Project: *Monogenea of elasmobranchs and teleosts in public aquaria.*
- Roxana Inohuye Rivera and Juan Carlos Pérez Urbiola, Centro de Investigaciones Biológicas del Noroeste (CIBNOR), La Paz, Baja California Sur, México, Project: *Complexities in the systematics of Neobenedenia 'species' known to occur on marine fishes in the region.*
- Federico José Rotman, Kona Blue, Holuoloa, Hawaii, USA, Project: *Pathogenic Monogenea in finfish aquaculture.*
- Dr Graham Kearn, University of East Anglia, Norwich, U.K., Project: *Biology and systematics of capsalid Monogenea from stingrays and teleost flatfishes.*
- Dr Simonetta Mattiucci, Department of Public Health Sciences, Section of Parasitology, University of Rome “La Sapienza”, Italy, Project: *Identity of capsalid parasites from istiophorids in the Mediterranean Sea and Atlantic Ocean.*
- David Vaughan, Two Oceans Aquarium, Cape Town, South Africa, Project: *Monogenea of elasmobranchs and teleosts in public aquaria.*
- Dr Olivier Verneau, Parasitologie Fonctionnelle et Evolutive, Université de Perpignan, France, Project: *Use of parasitic platyhelminths to study the early evolution of neobatrachian frogs.*

An underground nest of the invasive European wasp *Vespula germanica* in an Adelaide city garden
The Centre continues to fund its core functions from its original set-up grant in 2000 and profits from a conference held in 2001. It has received no further funding from the University since then. Major expenses incurred by ACEBB in 2006 were for travel and living expenses for invited speakers and members of the external Advisory Board, office expenses, and for communication. The annual cost of running ACEBB in 2006 was $2,602, less than in previous years but this was at the expense of restricting some activities.

### ACEBB 2006 Financial Summary

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ACEBB 2006 Annual Report
**PUBLICATIONS 2006**

**Refereed Papers 2006**


### Books and Symposia Chapters


### Other Publications


## RESEARCH GRANT FUNDING 2006

<table>
<thead>
<tr>
<th>Years</th>
<th>Investigators</th>
<th>Agency</th>
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<tr>
<td>05-08</td>
<td>Austin AD</td>
<td>ABRS</td>
<td>110,000</td>
<td>Systematics of the Australian spider-hunting wasps</td>
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<td>03-06</td>
<td>Austin AD, Cooper SJ &amp; W.F. Humphreys</td>
<td>ARC Linkage</td>
<td>228,000</td>
<td>Assessment of the diversity, distribution and uniqueness of subterranean animals from calcrete aquifers in central western Australia</td>
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<td>03-06</td>
<td>Austin AD &amp; Donnellan S</td>
<td>ARC Linkage APAI</td>
<td>71,000</td>
<td>Genetic variation in the <em>Cotesia flavipes</em> complex of parasitic wasps: towards the effective biological control of stem-borer pests</td>
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<td>04-06</td>
<td>Austin AD, Whitfield JB &amp; Maeto K</td>
<td>ARC Discovery</td>
<td>210,000</td>
<td>Evolution of micro-gastroid parasitic wasps and their symbiotic viruses - a major group of biological control agents</td>
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<td>05-08</td>
<td>Austin CC, Allison A &amp; Donnellan S</td>
<td>NSF</td>
<td>501,000</td>
<td>Evolutionary biogeography in the lowland reptile and amphibian fauna from New Guinea</td>
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<td>04-07</td>
<td>Barker RM</td>
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<td>53,700</td>
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<td>06-07</td>
<td>Barker RM</td>
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<td>05-08</td>
<td>Bull M, Hutchinson M &amp; Donnellan S</td>
<td>ARC Linkage</td>
<td>105,000</td>
<td>Conservation management of the endangered Pygmy Bluetongue lizard</td>
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<td>06</td>
<td>Carthew S, Cooper S &amp; Malekian M</td>
<td>Sir Mark Mitchell Foundation</td>
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<td>Conservation genetics of Sugar Gliders (<em>Petaurus breviceps</em>) in fragmented populations of south-eastern South Australia and western Victoria</td>
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<td>06-08</td>
<td>S. Carthew S, Taylor A &amp; Cooper S</td>
<td>ARC Linkage Project</td>
<td>293,000</td>
<td>Conservation genetics and socio-ecology of marsupials in fragmented populations of south-eastern South Australia: towards a regional biodiversity management plan</td>
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<td>05-08</td>
<td>Cooper A &amp; Flannery T</td>
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<td>Using ancient DNA to investigate the environmental impacts of climate change and humans through time</td>
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<tr>
<td>05-09</td>
<td>Cooper A</td>
<td>ARC Federation Fellowship</td>
<td>1,572,630</td>
<td>Using ancient DNA to understand Australian past and manage its future</td>
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<td>06-10</td>
<td>Cooper A</td>
<td>National Geographic Society</td>
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<td>06</td>
<td>Cooper A, Donnellan S &amp; Schwarz M</td>
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<td>Expansion and enhancement of the South Australian Regional Facility for Molecular Ecology and Evolution and the Australian Centre Ancient DNA</td>
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<td>06-09</td>
<td>Cooper A &amp; Taylor G</td>
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<td>06-08</td>
<td>Cooper S &amp; Humphreys W</td>
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<td>Modes of speciation in subterranean diving beetles from</td>
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<td>Cooper S &amp; Kawakami T</td>
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<td>Systematics, phylogeography and speciation of chromosomally diverse Australian morabine grasshoppers (Orthoptera: Eumastacidae: Morabinae: Vandiemenella)</td>
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<td>06-08</td>
<td>Daniels CB, Torday J, Burggren W &amp; Whitsett J</td>
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<td>Environmental Control of developmental plasticity of vertebrate cardio-pulmonary systems</td>
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<td>05-06</td>
<td>K.A. Davies</td>
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<td>Systematics of new nematode species from endemic Australian Ficus</td>
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<td>05-08</td>
<td>Donnellan SC, Mahony M &amp; Richards SJ</td>
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<td>Systematics of the Australo-papuan tree frogs</td>
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<td>Dowton M &amp; Austin AD</td>
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<td>Structural reorganization of the hymenopteran mitochondrial genome</td>
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<td>05-07</td>
<td>Drinnan AN, Hill R &amp; McLoughlin S</td>
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<td>Fossil evidence for the evolution of Australia’s modern vegetation</td>
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<td>Facelli JM, A.D. Austin AD &amp; Donnellan SC</td>
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<td>Population genetics and dynamics of orchids and their pollinators in fragmented landscapes of South Australia</td>
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<td>Georges A, Hutchinson M &amp; Donnellan S</td>
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<td>Conservation biology of the largest Australian freshwater tortoise, the broad-shelled tortoise, <em>Chelodina expansa</em> – rare and endangered or cryptic and secure?</td>
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<td>Gillanders B &amp; Donnellan SC</td>
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<td>Population structure in the giant Australian Cuttlefish: implications for management of a unique eco-tourism and fishery resource in regional Australia</td>
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<td>04-08</td>
<td>Hill R, Austin AD, Donnellan SC et al.</td>
<td>ARC Network</td>
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<td>Understanding the Australian ecosystem: integrating contemporary and historical perspectives on the evolution, ecology and management of Australia’s living resources</td>
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<td>Hill R, Brodribb T &amp; Jordan G</td>
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<td>Hutchinson M &amp; Cooper SJ, Adams M &amp; Oliver P</td>
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<td>Biodiversity of stone geckos in southern Australia arid zone and their response to Plio-Pleistocene climatic fluctuations</td>
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<td>Hutchinson M &amp; Cooper SJ</td>
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<td>Speciation in the gekkonid lizards of the <em>Diplodactylus vittatus</em> group</td>
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<td>Hutchinson M &amp; Lee M</td>
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<td>Jennings JT</td>
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<td>Jennings JT &amp; Schiff N</td>
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<td>Taxonomy of Australian xiphydrid woodwasps (Hymenoptera: Xiphydriidae)</td>
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<td>Jennings JT &amp; Stevens N</td>
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<td>Systematics of Australian agathidine wasps (Insecta: Hymenoptera: Braconidae); solitary endoparasitoids of</td>
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<td>Johnston C, Ernst I, <strong>Whittington ID</strong>, Gillanders BM, <strong>Hutson K</strong> &amp; Chambers CB</td>
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<td>Wild kingfish populations in Spencer Gulf: potential for parasite interactions with farmed fish, discrimination of farmed and wild fish and assessment of migratory behaviour</td>
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<td>Kear B &amp; Lee M</td>
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<td>Kemper C &amp; Cooper S</td>
<td>Field Naturalists Society of South Australia, Lirabenda Endowment Fund</td>
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<td>The conservation status of the grey-bellied dunnart (<em>Sminthopsis griseoventer</em>) in South Australia: where is it distributed and how can it be distinguished in the field?</td>
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<td>04-06</td>
<td>Kranz B &amp; Morris D</td>
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<td>The evolution of egg retention and sex allocation: a phylogenetic contrasts study using ovoviviparous thrips</td>
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<td>05-08</td>
<td>Kremer A, Koelewijn HP, Berenyi M, Degen B, Vendramin GG, Boerjan W, Bradshaw R, <strong>Bacles C</strong> &amp; Lowe AJ</td>
<td>ADaPtE. European Union Marie Currie Outgoing Fellowship</td>
<td>580,000</td>
<td>Ecological Genomics of Sub-tropical Eucalypt Woodlands: Comparing the Structure and Dynamics of Neutral and Adaptive Genes across a Sharp Environmental Cline in Eucalyptus</td>
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<td>Lee M &amp; Hutchinson M</td>
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<td>Major evolutionary events in reptiles</td>
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<td>Lowe AJ</td>
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<td>Phylogeography and genetic identity of cats claw in its native and introduced ranges</td>
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<td>Lowe AJ</td>
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<td>Phylogeographic connectivity assessment of Wet Tropic montane vegetation</td>
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<td>Phylogeography and genetic identity of bellyache bush in its native and introduced ranges</td>
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<td>Lowe AJ, Clarke AR, Schenk PM, Rieseberg LH &amp; Abbott RJ</td>
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<td>Why do some exotics become invasive? Using ecological and genomic approaches to test alternative hypotheses in an Australian weed, fireweed.</td>
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<td>06-09</td>
<td>Lowe AJ, Rossetto M, Crayne D, Pole M, Lambert D &amp; Hollingsworth P</td>
<td>ARC Discovery</td>
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<td>Quantifying rates of long distance dispersal and genomic evolution in divergent plant lineages of the SW Pacific region.</td>
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<td>06</td>
<td><strong>M. Malekian</strong>, Cartewh S &amp; Cooper S</td>
<td>Holsworth Wildlife</td>
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<td>Conservation genetics of Sugar Gliders (<em>Petaurus breviceps</em>)</td>
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<td>Morgan-Richards M, Robertson A &amp; <strong>Lowe AJ</strong></td>
<td>Royal Society of New Zealand, Marsden Grant</td>
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<td>Does gene flow limit species’ ranges?</td>
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<td>04-06</td>
<td><strong>Orgeig S</strong>, Koblar S, Tsojelas C, Chatterton B &amp; Cooter RD</td>
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<td>Regenerating lizard tails: A model for understanding the process of lymphangiogenesis</td>
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<td>06</td>
<td>Paull D, <strong>Cooper S</strong>, Butlin R &amp; Kawakami T</td>
<td>University of NSW Faculty Research Grants Program</td>
<td>19,900</td>
<td>Speciation, phylogeography and systematics of chromosomally diverse Australian morabine grasshoppers (Orthoptera: Eumastacidae: Morabinae: <em>Vandiemenella</em>).</td>
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<td><strong>Rouse GW</strong> &amp; Jermiin L</td>
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<td>Retracing the early evolution of Metazoa using novel methods and strategies</td>
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<td><strong>Rouse GW</strong> &amp; Messing G</td>
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<td>Crinoidea (Echinodermata) of Australia: Taxonomy, ‘species’ and illustrated guides</td>
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<td><strong>Rouse GW</strong> &amp; Messing G</td>
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<td>The puzzle of metazoan evolution: are feeding larvae always primitive?</td>
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<td>Schmidt S &amp; <strong>Lowe AJ</strong></td>
<td>Spontaneous Evolution Technologies</td>
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<td>Assessing the ecophysiological and genomic stability of synthetic polyploid trees.</td>
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<td>04-09</td>
<td>Smith NC <em>et al</em>. including <strong>Whittington ID</strong></td>
<td>ARC and NH&amp;MRC Network</td>
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<td>ARC/NH&amp;MRC Network for Parasitology</td>
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<td><strong>Whittington ID</strong> &amp; Donnellan SC</td>
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<td>Phylogeny and radiation of flatworm ecto-parasites from marine fish using morphology and genetics, with novel approaches to identify pathogenic species</td>
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<td>Marine flatworm parasites of elasmobranchs: a unique model for experiments exploring invasion strategies, biology and specificity to help understand parasitism</td>
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<td><em>Neobenedenia</em> (Platyhelminthes: Monogenea: Capsalidae), a genus of ectoparasitic flatworms of wild and cultivated fishes with special diversity in México: identification, systematics &amp; biology</td>
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<td>06-07</td>
<td>Zalucki M, Hoffman A &amp; <strong>Lowe AJ</strong></td>
<td>National Integrated Pest Initiative/CSIRO</td>
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<td>Estimating the risk of null alleles in moth population genetic studies</td>
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