



CENTRE FOR EVOLUTIONARY  
BIOLOGY AND BIODIVERSITY



# ANNUAL REPORT 2004



South Australian Museum



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## REPORT FROM THE CHAIR OF THE ADVISORY BOARD

During the period 2004, the Centre for Evolutionary Biology & Biodiversity has made significant advances in developing its research into cutting-edge, cognate programs. In every respect, it can now be considered the national leader in evolutionary biology, and one of the key groups internationally. A number of formidable strategic initiatives are at the heart of CEBB's success in 2004. These initiatives have been planned and developed over the last few years, and it is very pleasing to see them come to fruition.

Most important to CEBB's current and future operation is the success of Professor Alan Cooper's Federation Fellowship. Alan is a scientist of international distinction in the area of ancient DNA studies, and he will undoubtedly make a fantastic contribution to the Centre and Australian science in general.

The key staff in CEBB, Professors Austin, Donnellan and Hill, are to be commended for their efforts in putting together a successful bid for an Australian Research Council (ARC) Research Network to link together researchers across the country in the areas of evolutionary biology, palaeobiology, climate change, biodiversity and aboriginal history. Although the scope of the Network goes well beyond the core activities on CEBB, it will greatly expand and enhance the current and future research capacity of the Centre.

Professor Donnellan and Austin's successful bid for an ARC Linkage Infrastructure grant two years ago, has now resulted in the develop of the *South Australian Regional Facility for Molecular Evolution and Ecology*, a collaborative molecular genetics facility serving biologists at The University of Adelaide, Flinders University, and the South Australia Museum. This has provided first-rate facilities for more than 60 researchers and postgraduate students, and there is currently a follow up application with the ARC to further expand these laboratories, and enhance their capabilities.

Of major importance to the Centre and The University of Adelaide is the development by CEBB staff of a named undergraduate degree in evolutionary biology. This degree, although not likely to attract large numbers, will cater for high-calibre students who have interests in molecular evolution, systematics and palaeobiology, and are keen to pursue a research career in one of these areas.

Finally, it is pleasing to see that CEBB has attracted a number of excellent early career postdoctoral fellows to Adelaide on ARC funds. These people are the future of science in Australia; they will make a fantastic contribution to the Centre, and I wish them well with their research over the coming years.

As the Chair of the Advisory Board, I commend CEBB on it programs in 2004 and look forward to seeing its future success and development in the years to come.



Professor Steve Hopper  
Foundation Professor of Plant Conservation Biology  
School of Plant Biology  
The University of Western Australia

## REPORT FROM THE DIRECTOR

The Centre for Evolutionary Biology & Biodiversity (CEBB) is a University designated research centre that brings together expertise in these areas from two key organisations: The University of Adelaide and the South Australian Museum. In addition, a number of other groups are involved in CEBB, including the Plant Biodiversity Centre in the South Australian Department for Environment & Heritage. The Centre started operation in October 2000 and is now in its fifth year.

The **mission** of the CEBB is to be a leading national and international centre for research and training in evolutionary biology and biodiversity studies, with an emphasis on the fauna and flora of Australia. As such it aims to **1)** provide a focus and recognition for the high-calibre research already being undertaken by researchers in Adelaide, **2)** provide more secure funding and first-class infrastructure through collaboration among its members and with colleagues externally, **3)** to attract high-quality postgraduates, **4)** to attract national and international visitors, and **5)** to foster communication and ideas among members through seminars, discussion groups, workshops and conferences.

This report covers the activities of the Centre during 2004, a year in which CEBB was able to capitalise on much of the work undertaken in previous years in developing and solidifying our research operations. Without doubt, 2004 has been the Centre's most successful year ever in terms of developing major new research areas and strengthening its existing programs. In many respects, the Centre is now the pre-eminent location in Australia for research in evolutionary biology, a claim that is supported by numerous successes, including the award of a Federation Fellowship to Professor Alan Cooper; the successful bid for the ARC-funded *Environmental Futures Network*; the arrival of three new postdoctoral fellows; the development of *South Australian Regional Facility for Molecular Evolution and Ecology* through the Australian Research Council LIEF program; the launch of Australia's first degree in Evolutionary Biology, and Dr Greg Rouse's paper in *Science* describing the biology *Osedax*, a polychaete worm that consumes the bone of whale carcasses in waters more than two kilometres deep. These and the Centre's other activities for 2004 are described in more detail below.

### 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 CEBB: Professor Tim Flannery (Director, South Australian Museum), Professor Peter Rathjen (Executive Dean, Faculty of Sciences), Ms Janet Dibb-Smith (Director, Research, Policy & Support), the members of the Advisory Board, Professor Steve Hopper (University of Western Australia) and Dr Steve Morton (Group Executive, CSIRO Environment & Natural Resources), and Ms Maria Lekis, Gail Edwards, Anne Richards and Mary Odum for administrative support.



**Professor Andrew D Austin**

September, 2005

NEWS FROM AROUND CEBB

**Professor Alan Cooper and the Australia Centre for Ancient DNA**

The arrival of Alan Cooper in Adelaide on a prestigious Federation Fellowship heralds a new direction in Australian evolutionary biology. Previously at Oxford University, Professor Cooper is the world expert in the technically demanding analysis of highly degraded and fragmented DNA\* that remains in trace amounts in some fossils, in the environment, and in long-term preserved museum specimens. With financial assistance from The University of Adelaide, the South Australian Department of Environment & Heritage, and the Australian Research Council, Professor Cooper is currently developing Australia's first ancient DNA (aDNA) facility at a site within the Adelaide Botanic Gardens precinct, remote from contaminating sources of DNA on the University campus and adjacent hospital laboratories. Scheduled for completion in late 2005, the facility will become one of a series of international reference laboratories with those already constructed in Oxford and Copenhagen. Once the Adelaide aDNA laboratory is operational, it will become the focus of a large number of collaborative research projects that span archaeology, palaeontology, climate change research, evolutionary biology, molecular ecology, forensic sciences and environmental reconstruction and monitoring, and bring together more than 30 researchers from across Australia and overseas.

\*Cooper, A., C. Lalueza-Fox, S. Anderson, A. Rambaut, J. Austin & R. Ward (2002) Complete mitochondrial genome sequences of two extinct moas clarify ratite evolution. *Science* 289: 1139.



Ancient DNA Laboratory (right), Department for Environment & Heritage

**Here to unlock ancient secrets**



**DNA DETECTIVE:** Professor Alan Cooper has several DNA investigations in mind, including periodic outbreaks of Murray River encephalitis.

**By BEN ENGLISH**  
in London

ALAN COOPER will soon be delving into Australia's distant past, but in the process he will help establish a promising - and potentially lucrative - future for Adelaide's scientific community.

Professor Cooper, the world's foremost expert on ancient DNA, has been plucked from his home at Oxford University to establish a specialist research laboratory at the University of Adelaide.

By unlocking secrets hidden in fossils, Professor Cooper hopes to help solve some of Australia's environmental, medical and agricultural challenges.

"DNA is like a time capsule," he told *The Advertiser*.

"It enables us to see how plants and animals have responded to events in the past that may be repeating themselves.

"If we can see how they changed and adapted, we can apply those lessons today."

The Dunedin-born chief of

Oxford's prestigious ancient DNA unit said he already had several DNA investigations in mind, including the mysterious bleaching "disease" devastating the Great Barrier Reef, rising salinity levels, aridity and the periodic outbreaks of the deadly Murray River encephalitis.

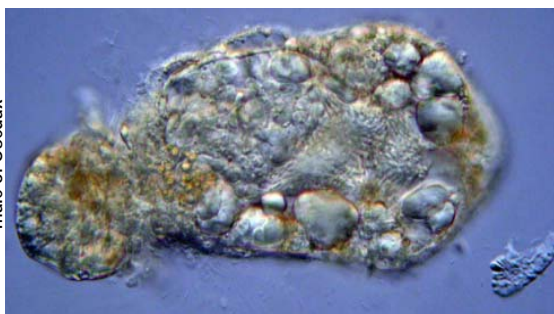
He said Australia's benign geological history would enable him to sample areas rich in ancient DNA. "Australia has got a tonne of opportunities for ancient DNA projects - a lot of the really interesting ecology that has been geologically stable for a very long time because Australia never had glaciers ripping the ground away or other major forms of erosion," he said.

"It means you get records of how the climate and environment has been situated for a long time. There are old lake beds that go back hundreds of thousands of years."

Professor Cooper's five-year tenure begins on January 1.

## The Bizarre Whale-Bone Eating Worm

Figure 1. The minute paedomorphic male of *Osedax*



In 2002, Californian researchers using a submarine came across a whale skeleton at the bottom of Monterey Canyon in nearly three kilometres of water. Many of the bone surfaces were covered with bright red plumes connected to worm-like trunks up to 7 cm long. Each worm had four plumes connected to its trunk that was encased in a transparent jelly-like tube. Specimens of the worms and bone were sent to Dr Greg Rouse at the South Australian Museum for further study. All the worms were females with

the bulk of the body being an ovisac in the bone. From this ovisac branched off numerous roots of green tissue that ramified out into the bone marrow. The roots were full of symbiotic bacteria that were breaking down the lipid-rich bone. Close examination of the female tubes showed that they often contained numerous tiny males that were filled with developing sperm and yolk droplets. The males retain morphological traits typical of worm larvae and the presence of yolk also strongly suggested that they were in fact paedomorphic, or dwarf males.

The tubes of larger females contained more than 100 males each, with a male:female sex ratio of about 17:1. In a paper published in *Science* in 2004\*, Rouse and his coworkers described two species of the bone-eating worm and placed them in the new genus, *Osedax*, meaning 'bone-eater'. They showed that *Osedax* is a polychaete annelid whose closest relatives include hydrothermal vent annelids such as *Riftia*, that also have symbiotic bacteria. Molecular clock estimates suggest that *Osedax* appears to have been exploiting the bones of marine mammals for million of years. They have solved a problem of accessing the lipids locked away in the bone and have a reproductive strategy that allows them to produce large numbers of offspring, some of which will be lucky enough to land on another whale-fall.

\*Rouse, G.W., S.K. Goffredi & R.C. Vrijenhoek (2004) *Osedax*: Bone-eating marine worms with dwarf males. *Science* 305: 668-671.

## Australia's First Degree in Evolution Biology

In 2004, Professors Andy Austin and Bob Hill proposed a new degree program within the Faculty of Sciences in the area of evolution biology. After significant discussion, the program was fully developed and approved in late 2004, with the first enrolment of students coming into the University for the 2005 academic year. This is a named degree within the Bachelor of Science and it is titled *BSc (Evolutionary Biology)*. The program runs for three years with an additional fourth honours year, and incorporates a number of unique and innovative features. There are two majors within the degree – one in *Palaeontology* and the other in *Molecular Systematics and Evolution*. Students start specialising in the second year, and can take a number of elective courses that are drawn from currently available offerings in botany, zoology, geology and molecular biosciences. To complement these, a number of new courses have been introduced in the second and third years that focus on more contemporary issues in evolutionary biology, systematics, and molecular evolution. A major component of the course in third year requires students to undertake an individual research project supervised by a staff member in the South Australian Museum or University.

The new degree was launched by Professor Tim Flannery, Director of the South Australian Museum at a reception in August 2005 and was attended, among others, by the initial group of students in the degree who are now approaching the end of their first year of study. With a high TER score required to gain entrance to this program, it is expected that the majority of students will continue on into the honours program and possibly postgraduate study in the evolution research laboratories of the University and Museum.

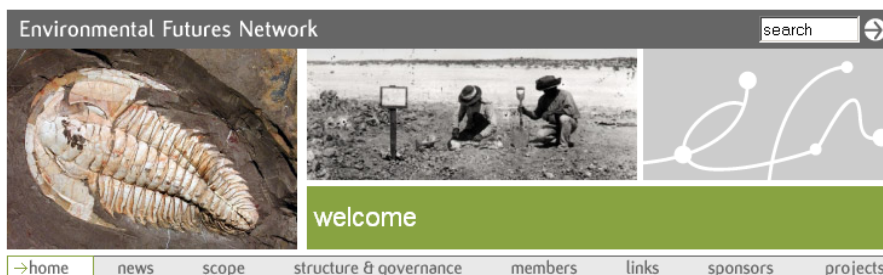
## The ARC-Funded Environmental Futures Network

Adelaide is now the home of one of the new ARC-funded research Networks. Key staff in CEBB, Professors Hill, Austin and Donnellan developed the proposal which brings together some 70 researchers across Australia and overseas to begin examining some of the big-picture questions in environmental and evolutionary biology as it applies to Australia. Originally, titled *Discovering the past and present to shape the future*, this Network aims to unite specialists with a wide range of research interests, and to pool their ideas and expertise to improve and develop new approaches to describing Australia's current biodiversity and the biological and environmental history leading up to the present. The Network will be based around three interrelated themes: the impact on biodiversity caused by 1) Global climate change, past and future, 2) Geo-historical (non-climatic) processes, and 3) The arrival and spread of humans

Although the Network will allow researchers to come together physically for meetings and conferences, a major part of the Network will be based on effective electronic communication among its members. The Network website is now active and provides a hub for contact both within the Network and with other researchers, managers and the general public. Maria Lekis has been seconded from the University to act as Network Administrator and she is the point of contact for the new Network website at <http://nesuab.ees.adelaide.edu.au>

Fundamental to *Environmental Futures Network* is an essential focus on a time scale that ultimately reaches back tens of millions of years, to a time when Australia was still part of Gondwana during the Cenozoic, when the living biota had its genesis. It is widely acknowledged that many critical events in the Cenozoic shaped the fate of the Australian biota, and this is an area where there is significant expertise within the CEBB.

For more information visit the Environmental Futures Network  
at: <http://nesuab.ees.adelaide.edu.au>



## MEMBERS OF THE CENTRE

Membership of the Centre was strengthened significantly in 2004 with the arrival of Dr Jack da Silva as a new lecturer in the School of Molecular Biosciences, and three new postdoctoral fellows, Drs Michelle Guzik, Brenda Kranz and Nick Murphy into the School of Earth & Environmental Sciences (see profiles below).

### **The Key Personnel and Management Committee for the Centre**

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**Professor Andrew Austin**, School of Earth & Environmental Sciences (Director)

**Professor Stephen Donnellan**, South Australian Museum, and Affiliate Professor in Schools of Earth & Environmental Sciences and Molecular & Biomedical Sciences

**Professor Robert Hill**, School of Earth & Environmental Sciences, and South Australian Museum (Deputy Director)

**Dr Ian Whittington**, joint appointment, South Australian Museum, and School of Earth & Environmental Sciences

### **Other Staff in the Centre During 2004**

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**Dr Bill Barker**, Plant Biodiversity Centre, South Australian Department of Environment & Heritage

**Assoc. Prof. William Breed**, Anatomical Sciences, Faculty of Medicine

**Dr John Conran**, School of Earth & Environmental Sciences

**Dr Steven Cooper**, South Australian Museum, and Affiliate Senior Lecturer School of Earth & Environmental Sciences

**Assoc. Prof. Chris Daniels**, School of Earth & Environmental Sciences

**Dr Jack da Silva**, School of Molecular & Biomedical Sciences

**Dr Kerrie Davies**, School of Agriculture & Wine

**Professor Tim Flannery**, South Australian Museum, and the University of Adelaide

**Dr Rory Hope**, School of Molecular & Biomedical Science

**Dr Mark Hutchinson**, South Australian Museum, and Affiliate Lecturer School of Earth & Environmental Sciences

**Dr John Jennings**, School of Agriculture & Wine

**Assoc. Prof. Mike Lee**, South Australian Museum, and School of Earth & Environmental Sciences

**Assoc. Prof. Sandy Orgeig**, School of Earth & Environmental Sciences

**Dr Greg Rouse**, South Australian Museum, and School of Earth & Environmental Sciences

**Dr Gary Taylor**, School of Agriculture & Wine

**Dr Ian Whittington**, South Australian Museum, and School of Earth & Environmental Sciences

### **Postdoctoral Fellows and Research Associates**

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**Dr Leslie Chisholm**, School of Earth & Environmental Sciences

**Dr Micelle Guzik**, School of Earth & Environmental Sciences

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

**Dr Brenda Kranz**, School of Earth & Environmental Sciences

**Dr Remko Leijs (Leys)**, 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



## PROFILES - NEW STAFF AND POSTDOCTORAL FELLOWS IN CEBB

### Dr Jack da Silva



Jack was appointed as a lecturer in Genetics in the School of Molecular and Biomedical Science in late 2003. He did his PhD at the University of Oxford, where he studied behavioural ecology. He then went on to do postdoctoral work in evolutionary genetics at McGill University in Canada and Pennsylvania State University in the USA. At McGill, he conducted selection experiments to test ideas on the nature of trade-offs between components of fitness and on the evolutionary maintenance of sex. At Penn State, he began his work on molecular adaptation in HIV. At Adelaide University Jack teaches introductory population genetics in the second-year Genetics and Evolutionary Biology course, and molecular evolution in the third-year Genetics course. His research focuses on the process of adaptive evolution at the molecular genetic level. He uses a combination of comparative sequence analysis and individual-based, Monte Carlo simulation modelling to investigate the factors affecting the rate and limit of adaptation. His preferred model system is HIV because of the depth of knowledge of viral-host interactions at the molecular level, the availability of well-established population genetic parameter values, and the wealth of sequence data.

### Dr Michelle Guzik



Michelle has a strong interest in molecular evolutionary biology and genetics. She is interested in the application of molecular markers to investigate the evolutionary processes that underlie present day species diversity, patterns of distribution and population structuring. Understanding the mechanisms of speciation is at the core of her broader research interests. Her PhD research was carried out at James Cook University and completed in 2004. Her thesis was entitled "Phylogenetics and evolutionary history of reproductive life history traits in benthic shallow-water octopuses (Cephalopoda: Octopodinae)". This research was a molecular phylogenetics study that investigated the evolutionary relationships among species from the poorly known genus *Octopus*. In the context of this molecular phylogeny the evolutionary history and adaptability of reproductive strategies amongst species was also examined.

Michelle is presently a research associate funded on an ARC Linkage Grant, and is investigating the population genetic structure of stygobitic dytiscid species that live in calcrete aquifers of the Yilgarn region, Western Australia. The aim of this research is to determine whether individual calcretes contain panmictic populations of dytiscids or show genetic substructuring strong enough to indicate isolating processes that could lead to allopatric speciation of dytiscids within calcretes.

### Dr Brenda Kranz

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Brenda is an evolutionary/behavioural ecologist. She completed her BSc at Flinders University in 1993, majoring in environmental biology, and then did Honours in Soil Science at Adelaide University, where she studied the interactions of soil amoebae and nematodes with soil fungi under the supervision of Sally Smith, Eileen Scott and Kerry Davies. Brenda then went back to Flinders to do a PhD with Mike Schwarz, with co-supervision from Bernie Crespi at Simon Fraser University in Vancouver, to study the evolution of social behaviour in gall-inducing thrips on Australian *Acacia*. During her candidature, she was awarded a Commonwealth Canadian Scholarship and went to Bernie's laboratory to develop microsatellite DNA markers to investigate relatedness and kin selection in some of these thrips. In 2000, Brenda went to Japan with a Japan Society for the Promotion of Science Postdoctoral Fellowship, where she studied the life history and behaviour of a genus of facultatively ovoviviparous thrips. Her work from this postdoc formed the basis for her current ARC Discovery Grant and APD Fellowship, entitled 'The evolution of egg retention and sex allocation: a phylogenetic contrasts study using facultatively ovoviviparous thrips', which was awarded through ANU in collaboration with David Morris. Brenda transferred the grant to Adelaide University in June of 2004.

Her current interests are in the selective mechanisms involved in the evolution and maintenance of mate choice, reproductive behaviours and sex allocation, using the idolothripine subfamily as a model system. Brenda is also interested in *Homo sapiens*. Between her postdocs she worked for 18 months with the South Australian State Government researching routes of lead exposure in 0-4 month old children living in Port Pirie. Her broad ecological approach to human behaviour contributed to the work being published in the Nature Publishing journal, *Journal of Exposure Analysis and Environmental Epidemiology*. On completion of her current postdoc, Brenda hopes to continue her research into human behaviour. Brenda's 13 peer-reviewed research papers are in well respected international journals, including PNAS, *Journal of Evolutional Biology*, *Behavioural Ecology*, *Evolutionary Ecology Research* and *Naturwissenschaften*.

### Dr Nick Murphy

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Nick has an avid interest in all areas of evolutionary and systematic research, in particular using molecular data to address questions relating to phylogenetic relationships, character evolution, and biogeography. His main focus is on arthropod relationships at all levels from populations to deeper phylogeny, having worked on a number of crustacean species, lycosid wolf spiders and parasitic Hymenoptera. Nick's PhD entitled "Molecular Systematic Studies of Freshwater Prawns of the Genus *Macrobrachium*," was completed in late 2003. Throughout this research he examined the relationships amongst a number of freshwater prawn species and completed the first phylogenetic analysis of this economically important group, which resulted in a number of publications.

He has been a member of CEBB since late 2003 and has completed a comprehensive phylogenetic analysis of lycosid wolf spiders, which has recently been accepted for publication in the journal *Molecular Phylogenetics and Evolution*. Currently he is undertaking an extensive phylogenetic analysis of scelionid and platygastriid wasps, and is about to commence a study of the coevolution of microgastrine wasps and polydnaviruses. He is also supervising Danielle Carey's honours project, which is examining wing reduction and phylogenetic relationships in baeine wasps and assisting a number of postgraduates in the Insect Evolution and Ecology Laboratory with their molecular techniques and data analysis.

## ADVISORY BOARD & ADMINISTRATION

The Advisory Board forms an important part of the overall management structure of the Centre. It comprises the four members of the Centre's Management Committee (Professors Austin, Donnellan and Hill, and Dr Whittington), the Deputy Vice-Chancellor, Research (Professor Neville Marsh), the Director of the South Australian Museum (Professor Tim Flannery), and three external members, Professor Steve Hopper (University of Western Australia), Dr Steve Morton (Group Executive, CSIRO Environment & Natural Resources), and Dr Allan Holmes (Chief Executive, Department of Environment and Heritage, South Australia).

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, particularly in developing the successful research proposal for an Australian Research Council Infrastructure grant, the ARC Network, and other competitive funding sources. Administrative support for the Centre is provided through the School of Earth & Environmental Sciences. Ms Gail Edwards acted as the administration officer in 2004, with this role being taken over by Ms Maria Lekis in 2005, while Ms Mary Odlum acted as finance officer for the Centre.



**Figure 2: An automontage image of a member of the wasp family Pteromalidae. This imaging technology is being used to develop an interactive identification key to Australian wasps by staff in Professor Austin's research group.**

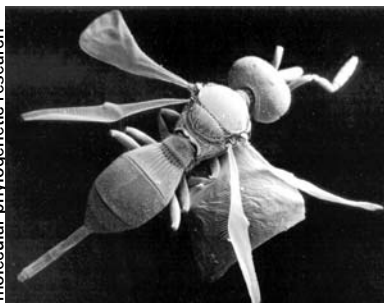
## RESEARCH PROGRAMS

The major research programs in the Centre during 2004 were as follows:

### Evolution and biodiversity of Australian terrestrial arthropods

(Professor A.D. Austin, Dr J.T. Jennings, Dr M. Dowton, Dr M. Iqbal, Dr K.A. Davies, Dr N. Murphy, Dr G.S. Taylor)

Figure 3. A scelionid parasitic wasp - a target group for molecular phylogenetic research



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

- Evolutionary aspects of insect parasitoids, including the evolution of endoparasitism, polydnavirus associations, and host-parasitoid co-evolution
- Molecular phylogeny of the major groups of parasitic Hymenoptera using both sequence data and mitochondrial genome organisation
- Systematics of specific groups of parasitoids, including the Braconidae, Scelionidae, Gasteruptionidae and Aulacidae
- Evolution and systematics of the Australian lycosid spider fauna
- 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.

These projects have a strong systematics basis that utilise traditional comparative morphological and molecular techniques, and are underpinned by a comprehensive field program that supports a major insect collection, the Waite Insect and Nematode Collection. During 2004, the program had three postdoctoral fellows, six PhD and two honours students, and a research assistant.

### The Process of adaptation at the molecular level: HIV and the immune system

(Dr J. da Silva)

Progress in understanding the process of adaptation at the molecular level has been impeded by the lack of a mature population genetic theory of adaptation and by a poor understanding of the sources and targets of selection. One way forward is to model a system that is well understood at the molecular level and then use 'simulation experiments' to test hypotheses about which factors affect the rate and limit of adaptation. This approach has two main advantages: it allows manipulations that would be impossible, too costly, or unethical with real experimental systems, and it allows a reductionist approach to modelling that does not require the unrealistic or untested simplifying assumptions often required of more tractable (analytical) mathematical models. However, a major obstacle to this approach, when applied to the protein level, is that it requires knowledge of the fitness effects of all amino acids at all sequence sites. I solve this problem by using site-specific amino acid frequencies as correlates of fitness effects, and apply this approach to model the adaptive evolution of human immunodeficiency virus type 1 (HIV-1). Simulations with this model are being used to investigate the effects of mutation rate, mutation bias, epistasis, pleiotropy, cell superinfection, and viral recombination on the rates and limits of adaptation at the molecular level.

### Asexually reproducing reptiles are diverse in the Australian deserts

(Dr S. Donnellan)

Although, asexual reproduction is rare among vertebrates, arid Australia has a growing list of species that have exploited this rare form of reproduction including the skinks of the *Menetia greyii* complex. We have discovered as many as five species that are asexual reproducers in southern Australian deserts and that they are all closely related to sexually reproducing species, many of which have been also recently discovered. Each asexual species was produced by hybridisation between separate sets of sexual species. Each asexual species has a wide geographic distribution and contains much genetic diversity, i.e. clones, contradicting predictions that asexual species should be ephemeral due to the impact of constrained genetic diversity of adaptability in the face of environmental change over evolutionary time scales.

### DNA fingerprinting and wildlife management

(Prof. S. Donnellan, Prof A. Goodman, Prof M. Henneberg)

Figure 4. The green python, a species involved in the illegal wildlife trade



This program aims to develop a range of DNA fingerprinting “tools” that will assist wildlife managers to more efficiently monitor and protect wild populations of Australian and Melanesian reptiles, in particular the pythons and goannas which are much sought after by the pet trade. The research has utilised a range of genetic markers and revealed little appreciated aspects of the evolutionary dynamics of DNA fingerprinting “genes”. The results have also provided detailed insights into the systematics of the pythons and goannas, in the case of pythons rejecting and in the case of goannas confirming previous notions of their origins. We are also investigating the reliability of DNA fingerprint profiles obtained from decayed carcasses and soil as part of establishing the markers for use in a wide range of forensic and archaeological settings. During 2004, the program had three PhD students.

### The impact of climate change on the evolution of the Australian Flora

(Professor R.S. Hill, Ms R. Paull)

Figure 5. The fossil plant Fitzroya



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.

### **Biology, systematics and evolution of marine parasites**

(Dr Ian Whittington, Dr Leslie Chisholm)

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The Marine Parasitology Laboratory of The University of Adelaide focuses specifically on parasites of marine fishes. Of particular focus is the Monogenea, wholly parasitic flatworms that principally infect skin, fins and gills of elasmobranch and teleost fishes. Elements of our research have special relevance to South Australia because finfish in some local aquaculture ventures in sea cages have experienced some parasite problems. Accordingly, the activities of some PhD and Honours students continue to investigate features of the biology, epidemiology and treatment of Monogenea on kingfish, *Seriola lalandi*, in aquaculture. Currently, the research program of the Marine Parasitology Laboratory embraces several discrete projects investigating parasites of local and more distant fish species.

- Life cycle parameters of the monogenean parasites *Zeuxapta seriolae* and *Benedenia seriolae* from *Seriola lalandi* in South Australian aquaculture
- A survey of parasites from wild and farmed kingfish (*Seriola lalandi*) in southern Australia
- Efficacy of potential chemotherapeutants against Monogenea of farmed *Seriola* species
- Stock discrimination of slimy mackerel (*Scomber australasicus*) in Australia and New Zealand using parasites, molecular genetics and otoliths
- The southern fiddler ray, *Trygonorrhina fasciata*, as a model to investigate parasitism of elasmobranchs
- Phylogeny and evolution of the Capsalidae (Monogenea), ectoparasites of a diversity of fishes, using morphological characters, molecular genetics and host associations
- Systematics of Monogenea (Platyhelminthes) from the sharks and rays of Malaysian Borneo
- Ultrastructure of adhesive secretions of monopisthocotylean Monogenea

All these studies are integrated to build a more complete picture about the evolution, associations and interactions between marine parasites and their fish hosts. One project completed in 2004 studied terrestrial parasites: tapeworms of emus! Throughout 2004, our parasite activities included 1 postdoctoral fellow, 2 research associates, 5 PhD students and 1 Honours student.

### **Systematics and evolution of marine invertebrates**

(Dr Greg Rouse)

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This program focuses on the systematics and reproduction in polychaetes annelids, which this year was investigated from both morphological and molecular perspectives at several scales. This year's highlights were the publication of a broad study on the placement of the bizarre hydrothermal vent worms Siboglinidae and the description of the bone devouring siboglinids *Osedax* (see story under News from around CEBC). The latter was published in *Science* and received wide media coverage around the world. Two reviews on annelids and polychaetes were published in 2004 as well as papers on sharks, molluscs and fossil polychaetes. Collecting trips for the NSF collaborative proposal on Assembling the Tree of Life: Protostomes, were undertaken in Europe during June/July 2004.

## Diversity and evolution of stygofauna from the Yilgarn Region of central Western Australia

(Dr Steve Cooper, Prof. Andy Austin, Dr Bill Humphreys - WA Museum, Dr Remko Leijds, Ms. Kathy Saint, Dr Chris Watts - SA Museum, Dr John Bradbury, Dr Michelle Guzik, Dr Stefano Taiti - Italy)

Figure 6. The stygo beetle *Nirripiriti cooperi* from the Yilgarn region of Western Australia



This program aims to investigate the species diversity and evolutionary history of a recently discovered subterranean invertebrate fauna (stygofauna) in calcrete aquifers of central Western Australia. The fauna comprises largely unknown species in diverse invertebrate groups including dytiscid diving beetles and crustaceans (Amphipoda, Isopoda, Copepoda, Syncarida and Ostracoda).

The program has a strong systematics component, combining both morphological and molecular genetic analyses to study taxonomy, phylogenetic relationships and evolutionary history of the major lineages, with a current focus on dytiscids, amphipods and isopods. We also have recently commenced population genetic and ecological studies of the stygofauna ecosystem. The program is funded from grants by the ARC

(Linkage to Austin, Cooper & Humphreys, APD to Leijds) and ABRS (Cooper, Humphreys, Watts, Bradbury).

Highlights of the program in 2004 included:

- the appointment of Dr Michelle Guzik as a research associate, who will study the population dynamics of diving beetles within calcrete aquifers, utilizing microsatellite DNA markers.
- discovery of two calcretes (one at Sturt Meadows and a second at Laverton Downs), each containing an extensive array of exploration bore holes in the calcrete, allowing us to establish a field station for testing sampling strategies and carrying out ecological and population genetic studies of the stygofauna ecosystem.
- new taxonomic (Watts) and molecular data (Leijds) from diving beetles showing the existence of more than 80 distinct species, each unique to a single calcrete aquifer
- new taxonomic and molecular data (Saint) from crangonyctoid amphipods (Bradbury) and *Haloniscus* isopods (Taiti) showing the existence of multiple new species, each confined to single calcrete aquifers. These data provide support for our hypothesis that individual calcretes have been isolated like "islands in the desert" for circa 10-5 million years, since the onset of aridification during the Pliocene.
- simulation analyses by Leijds, showing that numerous diving beetle species, each in distinct size classes within a calcrete aquifer, may have evolved by a process of sympatric speciation
- molecular analyses of the cinnabar eye pigment gene (Leijds and Cooper) show evidence for relaxed selection and the presence of pseudogenes in independently evolved blind beetles, supporting the theory that the subterranean environment leads to a loss of purifying selection on genes involved in eye development.

## Evolution of mammalian sperm and eggs

(Assoc. Prof W G Breed)

Our research program mainly consists of a variety of studies on the evolution and diversity of mammalian gamete form and function. Present investigations include:

- Evolution of the sperm combining region on the glycoprotein egg coat, the zona pellucida, in marsupials and rodents
- Evolution of sperm form of muroid rodents especially that of species from the Australasian and southeast Asian regions
- Factors underlying the divergence of male gonad size and sperm numbers produced in muroid rodents
- Evolution of form, function, and molecular organisation of the sperm head cytoskeleton of Australasian rodents
- Molecular organisation and function of the marsupial sperm tail cytoskeleton.

## **Evolution of the regulation of pulmonary surfactant development**

(Assoc. Prof. Chris Daniels & Assoc. Prof. Sandra Orgeig)

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Pulmonary surfactant is a mixture of lipids and proteins that is secreted by alveolar type II cells. It reduces alveolar surface tension and hence the work of breathing. Despite the tremendous diversity of lung structures amongst the vertebrates, the composition of surfactant is highly conserved. Conserved elements of the surfactant system amongst distantly related species are likely to be crucial factors for successful lung development. Understanding the mechanisms by which the surfactant system becomes operational in animals with dramatically different birthing strategies and in distantly related species will provide important information about the role of the surfactant system in the commencement of air breathing and the processes regulating surfactant maturation and secretion.

Using a range of vertebrate species, both oviparous and viviparous, we have examined the hypothesis that the control of surfactant production is dependent on glucocorticoids, thyroid hormones and autonomic neurotransmitters. We have also examined whether the overall intrinsic pattern of the control of surfactant maturation is conserved throughout the vertebrate radiation.

Although there are some differences between groups in the absolute amounts of surfactant present in the lung, the rates of cellular secretion of surfactant, the function of acetylcholine and the degree of agonist response, these variations are not dependent on phylogeny. It is likely that the differences in control of surfactant development are likely to be primarily related to metabolic activity and the duration of incubation (i.e. the "speed" of development). Moreover, the hormones examined appear important in promoting development, and therefore appear conserved within the amniotes. However, the autonomic neurotransmitters induced different responses in different species. Hence, some factors are crucial for the proper maturation of the surfactant system whereas others vary throughout evolution without being detrimental to the overall function of the system.



## APPOINTMENTS, AWARDS & DISTINCTIONS

**Andy Austin** was made an Honorary Research Fellow of the South Australian Museum

**Andy Austin** was reappointed to a second three-year term on the Advisory Board of the Australian Biological Resources Study

**Steve Cooper** was appointed an Affiliate Senior Lecturer of The University of Adelaide

**Jack da Silva** was appointed as South Australian Representative for the Genetics Society of Australasia.

**Jack da Silva** became a member of the Board of the Australian Genomics Information Centre.

**Steve Donnellan** was appointed an Affiliate Professor of The University of Adelaide

**Steve Donnellan** was promoted to Senior Principal Research Scientist at the South Australian Museum

**Vanessa Glennon** won the prize for Best Student Oral Presentation at the Australian Society for Parasitology Annual Conference in Fremantle in September.

**John Jennings** was re-elected as the Chairman of the Council of Heads of Australian Entomological Collections

**John Jennings** was appointed Head of the Editorial Board of the Transactions of the Royal Society of South Australia

**John Jennings** was re-elected treasurer of the Royal Society of South Australia

**John Jennings** became the inaugural convenor of the Management Committee of the Kangaroo Island LTER (Long-Term Ecological Research site)

**John Jennings** was reappointed to the Steering Committee of the Australian Plant Pest Database – Plant Health Australia

**Mike Lee** was appointed as an associate editor of the international journal *Systematic Biology*

**Gary Taylor** was awarded status as a Visiting Research Scientist, CSIRO Entomology at Indooroopilly, Brisbane for 2004-05

**Dr Ian Whittington** served as a member of the Extended Executive of the South Australian Museum

**Dr Ian Whittington** served as a member of the International Committee of the International Symposium on Fish Parasites

**Dr Ian Whittington** served as a member of the International Committee of the Fifth International Symposium on Monogenea held in Guangzhou Province, China in August 2005

**Dr Ian Whittington** served as Councillor (State Representative) for the Australian Society for Parasitology Inc.

**Dr Ian Whittington** served as a member of the Editorial Advisory Boards for the following parasitological and natural history journals: *Systematic Parasitology* (Kluwer Academic Publishers, Netherlands); *Folia Parasitologica* (Academy of Sciences of the Czech Republic); *Journal of Natural History* (Taylor & Francis, U.K.)

## STUDENTS

The following students undertook research projects in the Centre during 2004.

Honours Students		
Name	Project Title	Supervisor(s)
Amy Campain	City bats: The ecology of bats in the Adelaide parklands	C. Daniels & G. Johnston
Wendy Foster	An investigation of multiple paternity in the red-tailed Phascogale ( <i>Phascogale calura</i> )	W.G. Breed & D.A. Taggart
Stephen Griffiths	Influence of homopteran insects and acacias on the distribution of <i>Iridomyrmex</i> (ant) nests in the Flinders Ranges	A.D. Austin & J. Facelli
Jodie Haig	Population ecology and larval development of <i>Aporometra</i> (Crinoidea)	G.W. Rouse
Virginia Holt	Effect of bridle creeper litter on soil micro-invertebrates at Mt Billy Conservation Park	A.D. Austin
Julia Lackenby	Effects of environmental parameters on development and fecundity of <i>Benedenia seriolae</i> (Monogenea: Capsalidae) parasitic on yellowtail kingfish, <i>Seriola lalandi</i>	I. Ernst & I. Whittington
Amber Liaw	The impact on genetic diversity of drying of the palaeo-Lake Bungunna	D. Driscoll & S. Donnellan
Caroline McDonald	The effect of gonadotrophins on ovarian follicular development and oocyte maturation in wombats	W. Breed & D. Taggart
Penny McLachlan	Survey of antennal sensilla in the Evanioidea (Hymenoptera)	J.T. Jennings & R. Leijs
Rebecca Morgan	Antibody production of the zona pellucida proteins in the marsupial <i>Trichosurus vulpecula</i>	W.G. Breed
Paul Oliver	Systematics and evolution of stone geckos, <i>Diplodactylus vittatus</i> complex (Squamata: Diplodactylinae)	M. Hutchinson & S. Cooper
Elsa Reuter	Phylogeography of echidnas	S. Donnellan
Elisa Sparrow	Sperm variability and inbreeding in wombats	W.G. Breed & D.A. Taggart
Peter Stokes	Systematic implications of male colour variation in painted dragons	M. Hutchinson, M. Adams & S. Donnellan
Danae Taylor	Habitat utilisation of geckos in the Southeast parklands	C. Daniels
Caroline Wilson	Population and reproduction of <i>Patiriella parvivipara</i> (Asteroidea, Echinodermata)	G.W. Rouse
Karen Young	How birds use street trees	C. Daniels & G. Johnston

Postgraduate Students		
Name	Project Title	Supervisor(s)
Jenny Barker	Identifying the wood used in Aboriginal artifacts	R. Hill & P. Clarke
Melissa Bauer	Sperm pleiomorphism in Australian native rodents	W.G. Breed, M. Ricci & E. Peirce
Helen Blacker	Regenerating lizard tails: A model for understanding the process of lymphangiogenesis	S. Orgeig & C. Daniels
Andrew Breed	CRC Biosecurity, University of Queensland, Project Title: Are black flying foxes a possible vector of Nipa virus?	J. Meers, University of Queensland, H. Field, Queensland DPI & S. Donnellan
Meredith Brown	The mating system, reproductive ecology and conservation status of the yellow-bellied glider ( <i>Petaurus australis</i> ).	S. Carthew & S. Cooper
Lyda Castro, University of Wollongong	Mitochondrial genome organisation in the insect order Hymenoptera	M. Dowton & A.D. Austin
Sylvia Clarke	Impact of management practices on invertebrate biodiversity in the Flinders Ranges, South Australia	A.D. Austin & J. Facelli
Wetjens Dimmlich	Spawning in pilchards	W.G. Breed, T. Ward, SARDA-Aquatic Sciences & M. Geddes
Alison Fitch, Biological Sciences, Flinders University	Molecular systematics and phylogeography of Australian goannas	A. Goodman & S. Donnellan
Ana Glavinic, Flinders University	Systematics and phylogeography of <i>Neotrigonia</i> (Bivalvia)	G.W. Rouse
Vanessa Glennon	Monogenean parasites of the southern fiddler ray, <i>Trygonorrhina fasciata</i> : an exceptional model to investigate parasite biology, ecology, infection dynamics, microhabitat selection and speciation	I. Whittington & L. Chisholm
Travis Gotch	Population and conservation biology of Mound Springs spiders in South Australia	A.D. Austin & M. Keller
Greg Guerin	Revision of the <i>Hemigenia/Microcorys</i> group (Labiatae)	R. Hill & W. Barker
Nilanaga Gunawardana	Impact of DNA degradation on the reliability of DNA fingerprinting	M. Henneberg & S. Donnellan
Jaro Guzinski, Biological Sciences, Flinders University	Genetic population structure in parapatric ticks	M. Bull, Flinders University & S. Donnellan
Elise Head	Biology of gall-forming <i>Fergusonina-Fergusobia</i> (Diptera, Nematoda) on eucalypt trees	I. Riley, K. Davies, G. Taylor & A.D. Austin
Kris Helgen	Rodent systematics in southeast Asia	T. Flannery & R. Hill
Magda Halt	Phylogeny of Cirratuliformia (Polychaeta) and assessment of the Barcode of Life program	G. Rouse
Kate Hutson	Parasite interactions of wild and farmed kingfish ( <i>Seriola lalandi</i> ) in Spencer Gulf, South Australia	I. Ernst & I. Whittington

Postgraduate Students		
Mansoureh Malekian	Conservation Biology of the sugar glider, <i>Petaurus breviceps</i>	S. Carthew & S. Cooper
Dani Maver	Steroid hormones in peripheral blood and the control of oestrous cycle length in the long-nosed potaroo	W.G. Breed & D.A. Taggart
Radika Michniewicz, Biological Sciences, Flinders University	Long term monogamy in the sleepy lizard <i>Tiliqua rugosa</i> .	M. Bull & S. Cooper
Natalie Miller	Project Title: Evolution of a physiological system: The effect of pressure on the pulmonary surfactant system of diving mammals	C. Daniels & S. Orgeig
Mansour Mohamadian	Stomatal wax plugs and desiccation avoidance	J. Watling & R. Hill
Allan Mooney	Biology of <i>Zeuxapta seriolae</i> from gills of <i>Seriola lalandi</i> (Carangidae)	I. Ernst & I. Whittington
Ben Moretti	Bioinformatic and software architecture design for the databasing of biological collections	A.D. Austin & R. Hill
Tim Moulds	Ecology and conservation of a unique guanophilic invertebrate community	A.D. Austin & J.T. Jennings
Kate Muirhead	Biosystematics and biology of the <i>Cotesia flavipes</i> complex of wasps	A.D. Austin & S. Donnellan
Kym Ottewell	Pollen mediated gene flow in woodland eucalypts	D. Paton & S.C. Donnellan
Cate Paull	Beneficial arthropods in Coonawarra vineyards	A.D. Austin & N. Schellhorn
Rosemary Paull	The plant macrofossils from the Miocene of Kiandra, N.S.W	R. Hill & J. Watling
Mario Ricci	The structure and function of the sperm cytoskeleton in marsupial mammals	W.G. Breed
David Schmarr	Stock assessment of slimy mackerel ( <i>Scomber australasicus</i> ) in southern Australia using parasites, genetics and otoliths	I. Whittington & T. Ward, SARDI
Claire Stephens	The impact of weeds invasions on insect diversity and associated community structure and processes	A.D. Austin & J. Facelli
Nicholas Stevens	Systematics of Australian agathidine wasps (Insecta: Hymenoptera: Braconidae); solitary endo-parasitoids of lepidopteran leaf-rolling larvae	A.D. Austin & J.T. Jennings
Christine Swann	The evolution and function of the zona pellucida in Australian rodents	W.G. Breed, S. Cooper & R. Hope
Duncan Taylor, Biological Sciences, Flinders University	Population structure and molecular evolution in pythons	A. Goodman & S. Donnellan
Nuttawat Tithipramote	Seasonal changes in germ cell production in bandicoot rats	W. G. Breed & J. Suwanjarat, Prince Songkla University, Hat Yai, Thailand
Fraser Vickery	The effect of fire on narrow leaf mallee ( <i>Eucalyptus cneorifolia</i> ) ecosystems on Kangaroo Island using ants as bio-indicators	S. Taylor & J.T. Jennings
Elaine Vytopil	Phylogeography of kelp	S.C. Donnellan & S. L. Connell
Rissa Williams	Novel treatments for Monogenea infecting commercially important finfish species in aquaculture	I. Ernst & I. Whittington

<b>Postgraduate Students</b>		
Pakawadee Worawittayawong	Spermatogenesis and sperm form in the Asian bandicoot rat ( <i>Bandicota indica</i> )	W.G. Breed & P. Sretarugsa - Mahidol University, Thailand
Zheng Qi Zhao	Taxonomy, biology and pathogenicity of nematodes associated with pine trees and other conifers in Australia	K. Davies, I. Riley, J. Nobbs (SARDI) & I. Smith - Forestry, Victoria

<b>Student Completions</b>		
<b>Name</b>	<b>Ph.D. Thesis</b>	<b>Supervisor(s)</b>
Marta Kasper	The ecology of European wasp in South Australia	A.D. Austin, D.A. Mackay & S. Cooper
Michael O'Callaghan	Studies on the systematics of the cestodes infecting the emu, <i>Dromaius novaehollandiae</i> (Latham, 1790)	I. Whittington & M. Davies

## COMMUNICATION

### Website

The CEBB website is at <http://www.ees.adelaide.edu.au/research/cebb/> and provides an excellent portal into the activities of the Centre. It includes information on staff, students, research programs, funding, conferences and useful links to other sites. The School of Earth & Environmental Sciences is currently redeveloping its website and we are taking this opportunity to completely redesign and further expand the CEBB site. We expect this to be completed by the end of 2005.

### CEBB Seminar Series 2004

Date	Speaker, Title
27 January	<b>Dr Jim Whitfield</b> , Department of Entomology, University of Illinois "Co-phylogeny between bracoviruses and microgastrid parasitic wasps"
7 June	<b>Dr Greg Rouse</b> , South Australian Museum, and School of Earth & Environmental Sciences "Osedax: whalebone-eating worms with green roots and dwarf males"
12 August	<b>Dr Stephen Williams</b> , CRC for Tropical Rainforest Ecology, James Cook University " Macroecology of Australian tropical rainforests: predicting the impacts of climate change"
28 August	<b>Prof. Paul Brakefield</b> , Leiden University, The Netherlands "Exploring constraints with the evolution and developmental genetics of butterfly wings"
4 November	<b>Prof. Nico Michiels</b> , University Muenster, Germany "The evolution of gender expression in animals"

### Conference Presentations

- Austin, A.D., J. La Salle & J.T. Jennings. Endemic radiations within the megadiverse fauna of Australian Hymenoptera. *XXII International Congress of Entomology*, Brisbane.
- Austin, A.D., J.T. Jennings & N.B. Stevens. What wasp is that? An interactive key to the identification of Australian & New Zealand ants, bees, sawflies and wasps. *XXII International Congress of Entomology*, Brisbane.
- Breed, W.G. & C. Swann. Rats and mice of Australasia. *50th Easter Conference. of the Mammal Society* (invited presentation)
- Breed, W.G. & C. Swann. Rats and mice of Australia. *50th Anniversary Conference of The Mammal Society of Great Britain* (invited presentation).
- Brown M., S. Carthew & S.J.B. Cooper (2004) Home Range analysis and mating system of yellow-bellied gliders (*Petaurus australis*) in south-western Victoria. *50<sup>th</sup> Australian Mammal Society Meeting*, Tanunda SA.
- Chisholm, L.A. (2004) Monogeneans on elasmobranchs in public aquaria. Sustainable Control of Fish Diseases in Aquaculture (SCOFDA), November 3-4, *Royal Veterinary & Agricultural University*, Frederiksberg, Denmark.
- Clarke, S.C., A.D. Austin, J.M. Facelli & A.N. Andersen. Ant functional group response to perennial shrub loss and recovery in a xeric environment. *International Congress of Entomology*, Brisbane.

- Clarke, S.C., J.M. Facelli, A.D. Austin & A.N. Andersen. The impact of perennial shrub loss on arthropod diversity and community structure in chenopod shrublands in the Flinders Ranges: ants as indicators. *13th Biennial Conference of the Australian Rangeland Society*, Alice Springs.
- Cooper S.J.B., R. Leys, C.H.S. Watts & W.F. Humphreys (2004) Is extinction always catastrophic? Surface extinction of water beetle (Dytiscidae) populations in the arid zone of Western Australia coincides with groundwater radiations. *1<sup>st</sup> Okazaki Conference in Biology, January 26-30, Okazaki, Japan.*
- Cooper S.J.B., R. Leys, J. Bradbury, K. Saint, C.H.S. Watts & W.F. Humphreys (2004) Subterranean islands in the desert: evolutionary history of stygofauna from calcrete aquifers of central Western Australia, *Genetics Society of Australia, July 11-14, Melbourne.*
- da Silva, J. (2004) The strange case of the recurrent laryngeal nerve: pleiotropy and developmental constraints. *Joint Meeting of the Australasian Society for the Study of Animal Behaviour and Australasian Evolution Society, Adelaide.*
- da Silva, J. (2004) Computer simulation of HIV-1 evolution in response to antibody selection. *Australian Centre for Hepatitis Virology and HIV Virology Interest Group Inaugural Workshop, Barossa Valley.*
- da Silva, J. (2004) Predicting adaptive molecular evolution: Simulation of HIV-1 adaptation to antibody surveillance. *51<sup>st</sup> Annual Meeting of the Genetics Society of Australia, Melbourne.*
- Framenau, V.W., N. Murphy, A.D. Austin, S. Donnellan & M.S. Harvey. How many times did the wolves loose their webs? A molecular phylogeny of the Lycosidae (Araneae). *16<sup>th</sup> International Congress of Arachnological, Denver, Gent, Belgium.*
- Glennon V., L. Chisholm & I. Whittington (2004) House-hunting monogenean style: infection of the southern fiddler ray, *Trygonorrhina fasciata*, off Adelaide. *Annual Scientific Meeting of the Australian Society for Parasitology Inc., September 26-30 2004, Fremantle, Western Australia, Australia.*
- Hogendoorn, K. & R. Leys. Phylogenetic and experimental approaches to understand incipient sociality. *International Congress of Entomology, Brisbane.*
- Humphreys W.F., C.H.S. Watts, R. Leys & S.J.B. Cooper (2004) Subterranean wetlands of arid Australia: remipedes, spelaeogriphaceans and diving beetles. *IGCP 448-Global Karst Correlation, and the First International Workshop on RAMSAR Subterranean Wetlands. Naracoorte, SA*
- Hutson K.S., I. Ernst & Whittington, I.D. (2004) Parasite interactions between wild and farmed kingfish (*Seriola lalandi*). *Annual Scientific Meeting of the Australian Society for Parasitology Inc., September 26-30, Fremantle, Western Australia, Australia.*
- Jennings, J.T., A.D. Austin & N.B. Stevens. Australasian Aulacidae (Hymenoptera: Evanioidea), endoparasitoids of wood-boring beetles and wasps. *XXII International Congress of Entomology, Brisbane.*
- Kasper, M.L., D.A. Mackay & A.D. Austin. Is South Australia too hot for the European wasp (*Vespula germanica*, Hymenoptera: Vespidae) to handle? *International Congress of Entomology, Brisbane.*
- Kemper C., S. Cooper S & G. Medlin (2004) *Sminthopsis cf. griseoventer*, a new species for South Australia. *50<sup>th</sup> Australian Mammal Society Meeting, Tanunda.*
- Leys, R., S.J.B. Cooper, C.H.S. Watts & W.F. Humphreys (2004) Speciation in natural test-tubes. *XXII International Congress of Entomology, Brisbane.*
- Leys, R., S.J.B. Cooper, C.H.S. Watts & W.F. Humphreys (2004) Islands in the desert: evolution of subterranean diving beetles (Coleoptera: Dytiscidae: Bidessini, Hydroporini) in arid Australia. *XXII International Congress of Entomology, Brisbane.*
- Leys, R. Genetic assessment of groundwater dependent fauna in South Australia. *First International Workshop on RAMSAR Subterranean Wetlands, Naracoorte.*

- Moulds, T.A., A.D. Austin & J.T. Jennings. Guanophilic arthropod ecology & seasonal spatial distribution in a bat maternity cave. *XXII International Congress of Entomology*, Brisbane.
- Muirhead, K.A., A.D. Austin, M.N. Sallam & S.C. Donnellan. Genetic variation in the *Cotesia flavipes* complex of parasitic wasps: towards the effect biological control of stemborer pests in Australia. *International Congress of Entomology*, Brisbane.
- Paull, C., A.D. Austin & N. Schellhorn. Key arthropods for the control of *Epiphyas postvittana* (Walker) (Lepidoptera: Tortricidae) in Coonawarra vineyards, South Australia. *International Congress of Entomology*, Brisbane.
- Stephens, C.J., A.D. Austin & J.M. Facelli. Weeds and wasps: the effect of bridal creeper on parasitic wasp assemblages. *International Congress of Entomology*, Brisbane.
- Stevens, N.B., A.D. Austin & J.T. Jennings. The Agathidinae (Hymenoptera: Braconidae) of Australia; parasitoids of lepidopteran larvae. *XXII International Congress of Entomology*, Brisbane.
- Taiti S, W.F. Humphreys, S.J.B. Cooper, K. Saint & R. Leys (2004) The Oniscidea (Crustacea: Isopoda) from groundwater calcretes of Australian arid zones. *XXII International Congress of Entomology*, Brisbane.
- Taiti S, W.F. Humphreys, S.J.B. Cooper, K. Saint & R. Leys (2004) Islands under the desert: biogeography and evolution of stygobitic Oniscidea (Crustacea, Isopoda) from arid Australia. *XVII International Symposium on Biospeleology*, Raipur, India.
- Taylor, G.S., K.A. Davies, J. La Salle & A.D. Austin. Biogeography of gall flies (Diptera: Fergusoninidae) and associated parasitoids. *XXII International Congress of Entomology*, Brisbane.
- Taylor, G.S., S.J. Scheffer, W. Ye, K.A. Davies & R.M. Giblin-Davis. Gall flies, nematodes and the Myrtaceae: phylogenetic congruence in a tritrophic system. *XXII International Congress of Entomology*, Brisbane.
- Thomas, W.K., W.M. Ye, R.M. Giblin-Davis, K.A. Davies, M.F. Purcell, S.J. Scheffer, G.S. Taylor, T.D. Center & K. Morris. Molecular phylogeny of *Fergusobia* species (Tylenchida: Fergusobiinae) inferred from nuclear ribosomal and mitochondrial DNA sequence data. *Society of Nematologists 2004 Annual Meeting*, Estes Park, Colorado.
- Wallman, J., M. Dowton, R. Leys & L. Nelson. Identification of Australian carrion-breeding blowflies using multiple gene regions. *International Congress of Entomology*, Brisbane.
- Whittington, I.D. (2004) The monogenean life-cycle in detail and how Monogenea diversity 'down under' can confront fish culture. Sustainable Control of Fish Diseases in Aquaculture (SCOFDA), November 3-4, *Royal Veterinary & Agricultural University*, Frederiksberg, Denmark.
- Williams R., I. Ernst, C. Chambers & I. Whittington (2004) Efficacy of orally-administered praziquantel against monogenean parasites *Zeuxapta seriolae* and *Benedenia seriolae* infecting sea-caged yellowtail kingfish, *Seriola lalandi*. *Annual Scientific Meeting of the Australian Society for Parasitology Inc.*, September 26-30 2004, Fremantle, Western Australia, Australia



## NATIONAL & INTERNATIONAL COLLABORATIONS

Members of the Centre have very strong links with research groups around Australia and internationally. These have resulted in several new initiatives, as well as numerous joint grant applications and co-authored publications during 2004. Some of the major linkages with members of the Centre over this period are:

### Professor Andy Austin

- Dr Mark Dowton, University of Wollongong, Project: *The molecular evolution and phylogeny of the parasitoid Hymenoptera.*
- Dr Mark Harvey, Western Australian Museum, Project: *The systematics and phylogeny of Australian lycosid spiders.*
- Dr Bill Humphries, 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 Bob Wharton, Texas A & M University, College Station, Project: *Systematics of gall-forming mesostoinine wasps endemic to Australia.*
- Dr Jim Whitfield, University of Illinois, Project: *Phylogeny of microgastroid braconid wasps.*

### Associate Professor Bill Breed

- Prof. J.M. Bedford, Cornell University Medical College, New York, Project: *Sperm form of Madagascan rodents.*
- Prof. T. Berger, University of California at Davis, Project: *Sperm surface proteins involved in sperm-egg binding and interaction.*
- Prof. R. Oko, Queen's University, Kingston, Ontario, Project: *Cytoskeletal proteins in the sperm head of murid rodents.*
- Prof M Eddy, NIH, Research Triangle, North Carolina, Project. *Marsupial sperm tail cytoskeletal proteins*
- Dr. Lilian Soon, University of Sydney, Sydney, Project: *Sperm chemotaxis in marsupials*
- Dr. J. Chapman, University of Tasmania, Hobart, Project: *Glycoproteins of the marsupial egg coat, the zona pellucida.*

### Dr Steve Cooper

- Professor Roger Butlin, University of Leeds, Project: *Chromosome evolution, speciation and phylogeography of the viatica group of morabine grasshoppers.*
- Prof. Horst Wilkens and Dr Ulrike Strecker, Universität Hamburg, Project: *The molecular evolution of eye development genes in subterranean diving beetles of the Yilgarn region of central WA.*
- Dr Bill Humphries, Western Australian Museum, Project: *The evolution and diversity of stygofauna associated with calcretes in the Yulgan region of Western Australia.*
- Dr Stefano Taiti, Istituto per lo Studio Degli Ecosistemi, Florence, Italy, Project: *The Oniscidea (Crustacea, Isopoda) from groundwater calcretes of the Australian arid zone*
- Assoc. Prof. Michael Schwarz, Flinders University, Project: *Co-evolution of sociality and sex allocation: phylogenetic comparative approaches using insects*
- Assoc. Prof. Robert Holland (University of NSW) and Dr A. Gooley, Proteome Systems Ltd. and Macquarie University, Project: *The molecular evolution of globin genes in mammals.*
- Dr Mark Harvey, Western Australian Museum, Project: *Species boundaries in Moggridgea spiders (Migidae) of WA.*

### Dr Kerrie Davies

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- 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, Fergusonia nematodes and their myrtaceous hosts*. This project also contributes to the Nematode Tree of Life through a project with Dr Thomas.
- 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

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- Dr Darrel Frost, American Museum of Natural History, New York: *The molecular phylogeny of the Amphibia*.
- Dr Chris Austin, Louisiana State University, Baton Rouge: *The phylogeography of New Guinean reptiles and frogs*.
- Dr Don Driscoll, Flinders University: *The impact on genetic diversity of drying of the palaeo-Lake Bungunna – implications for conservation genetics*.
- Dr Paul Doughty, Western Australian Museum: *Systematics of the brood frogs*.
- Dr Joe Benshemesh, Monash University: *Systematics and population biology of marsupial moles*.
- Dr Ken Aplin, Australian National Wildlife Collection: *Systematics of the Australian and New Guinean rodents*.

### Professor Bob Hill

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

### Dr John Jennings

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- Dr David Smith, Systematic Entomology Laboratory, National Museum of Natural History, Smithsonian Institution, Washington, D.C., Project: *Revision of miscellaneous Pseudofoenus spp. and Gasteruption spp. (Hymenoptera: Gasteruptionidae)*.
- 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, Projects: *Revision of Australian hatchet wasps (Hymenoptera: Evaniidae)*, and *Assembling the Tree of Life*.
- Dr Alexandre Aguiar, Museu de Zoologia da Universidade de São Paulo, Brazil, Project: *New Caledonian Stephanidae*.

### Associate Professor Mike Lee

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- Mieczyslaw Wolsan, Polish Academy of Sciences, Warsaw, Project: *Species concepts*.
- Mike Caldwell, University of Alberta, Edmonton, Project: *Early snake evolution*.
- Lindell Bromham, University of Sussex, Brighton, Project: *Molecular clocks*.
- Garth Underwood, British Museum of Natural History, London, Project: *Snake systematics*.
- Tod Reeder, San Diego State University, San Diego, Project: *Lizard evolution and molecular genetics*.

### Dr Remko Leys

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- Dr Bill Humphries, Western Australian Museum, Project: *The evolution of subterranean waterbeetles.*
- 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 southwestern Western Australia.*
- Dr Michael Batley, Australian Museum, Project: *Taxonomic revision of the Australian bee species belonging to the genus Amegilla.*

### Dr Sandra Orgeig & Dr Chris Daniels

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- 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.*
- Prof. Sam Schürch, University of Calgary, Prof. Fred Possmayer, University of Western Ontario, Dr Kaushik Nag, Memorial University, Newfoundland, Canada, 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.*
- Prof. John Torday, Harbor-UCLA Medical Center, California, USA, Project: *The role of PTHrP in the evolution of lung development.*

### Dr Greg Rouse

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- Igor Eeckhaut, Laboratory of Marine Biology University of Mons, Project: *Systematics of Myzostomida.*
- Gonzalo Giribet, Museum of Comparative Zoology, Harvard University, Project: *Phylogeny of Metazoa.*
- Shana Goffredi, Monterey Bay Aquarium Research Institute, Project: *Taxonomy of whalefall organisms.*
- Fredrik Pleijel, Muséum national d'Histoire naturelle, Project: *Polychaete phylogeny.*
- Mark Siddall, American Museum of Natural History, Project: *Polychaete phylogeny.*
- Bob Vrijenhoek, Monterey Bay Aquarium Research Institute, Project: *Taxonomy of whalefall organisms.*

### Dr Gary Taylor

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- Assoc. Prof. Robin Giblin-Davis, University of Florida, Dr Sonya Scheffer, Systematic Entomology Laboratory, USDA, Beltsville Agricultural Research Service, Washington, D.C., Project: *Speciation and co-evolution of Fergusonina flies, Fergusobia nematodes and their myrtaceous hosts.*
- Dr John Goolsby and Mr Matthew Purcell, USDA, Australian Biological Control Laboratory, Brisbane, Project: *Insect fauna associated with Casuarinaceae in Australia.*
- Dr Andrew Beattie, University of Western Sydney, Dr Paul De Barro, CSIRO Entomology, Brisbane, Dr Paul Holford, University of Western Sydney and Dr John La Salle, CSIRO Entomology, Canberra, Project: *Pre-emptive responses to managing an incursion of citrus greening and its vector citrus psyllid.*
- Dr Diana Percy, Leverhulme Trust Fund, and CSIRO Entomology, Canberra, Project: *Sound production and mate recognition in relation to diversification of Australian trioizid psyllids (Hemiptera; Psylloidea).*
- Dr Anna Maryanska-Nadachowska, Department of Experimental Zoology, Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Krakow, and Dr Valentina Kuznetsova, Russian Academy of Sciences, St Petersburg, Project: *Karyotypes of Australian Psylloidea.*

### Dr Ian Whittington

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- Dr Bronwen Cribb, Centre for Microscopy & Microanalysis and School of Life Sciences, The University of Queensland, Project: *Adhesives of Platyhelminthes*.
- Dr Emma Fajer-Avila, Centro de Investigación en Alimentación y Desarrollo (CIAD), Unidad de Investigación en Acuicultura y Manejo Ambiental de CIAD, Mazatlán, Mexico, Project: *Neobenedenia 'melleni' on cultured pufferfish, Sphoeroides annulatus*.
- Roxana Inohuye Rivera and Juan Calos Pérez Urbiola, Centro de Investigaciones Biológicas del Noroeste (CIBNOR), La Paz, Mexico, Project: *Complexities in the systematics of Neobenedenia 'species' that are known to occur on other marine fishes in the region*.
- Dr Graham Kearns, University of East Anglia, Norwich, U.K., Project: *Systematics of capsalid Monogenea from stingrays*.

### Dr Ian Whittington and Dr Leslie Chisholm

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- Dr Robert Adlard, Queensland Museum, Dr Jess Morgan University of California Berkeley, USA, Project: *Preliminary phylogeny of the Capsalidae (Monogenea)*.
- Professor Kurt Buchmann, Royal Veterinary & Agricultural University, Frederiksberg, Denmark, Project: *Problematic parasites in aquaria and aquaculture*.
- 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*.
- Andreas Fischer, Underwater World-Sunshine Coast, Mooloolaba, Queensland, Project: *Monogenea on stingrays in public aquaria*.
- Dr Kevin Christison, University of the Western Cape, South Africa, Project: *Monogenea of elasmobranchs in public aquaria*.

## BUDGET

Following an initial set-up grant in 2000 from the University of Adelaide through the participating Faculties and Departments, and from the South Australian Museum, CEBB has maintained an adequate budget to cover its core functions. It has received no further funding from the University and its only income was from profits of the *Invertebrate Biodiversity & Conservation Conference* held in 2001 (\$11,123). Major expenses incurred by CEBB in 2004 were for travel and living expenses for invited speakers, and a once-off grant to the successful bid for an *ARC Research Network*.

The annual cost of running CEBB in 2004 was \$3,607 and this was without an Advisory Board meeting in that year and any new initiatives.

### CEBB 2004 Financial Summary

<b>Opening Balance 2004</b>		<b>\$17,291.31</b>
<b>Income</b>		<b>0.00</b>
<b>Expenditure</b>		
3202	Contribution to ARC Network	1,000.00
2545	Consumables	3.86
2745	Stationery	11.46
2774	Freight	22.77
2781	Accommodation and meals	931.91
2783	Airfares	1,488.35
2786	Meal FBT employees	22.83
2787	Meal non-FBT clients	125.59
<b>Total Expenditure</b>		<b>3,606.77</b>
<b>Closing Balance</b>		<b>\$13,684.54</b>

## PUBLICATIONS

## Refereed Papers

- Austin, A.D., D.K. Yeates, G. Cassis, M.J. Fletcher, J. La Salle, *et al.* (2004) Insects 'Down Under' - Diversity, endemism and evolution of the Australian insect fauna: examples from select orders. *Australian Journal of Entomology* 43: 216-234.
- Balke M., C.H.S.Watts, S.J.B. Cooper, W.F. Humphreys & A.P. Vogler (2004) A highly modified stygobitic diving beetle of the genus *Copelatus* (Coleoptera, Dytiscidae): Taxonomy and cladistic analysis based on mtDNA sequences. *Systematic Entomology* 29: 59-67.
- Belokobylskij, S.A., Iqbal, M. & A.D. Austin (2004) Systematics, distribution and diversity of the Australasian doryctine wasps (Hymenoptera, Braconidae, Doryctinae). *Records of the South Australian Museum Monograph Series* 8: 1-150.
- Breed, W.G. (2004) The spermatozoon of Eurasian murine rodents: its morphological diversity and evolution. *Journal of Morphology* 261: 52-69.
- Brown M., T.A. Kendal, H. Cooksley, K.M.Saint, A.C. Taylor, S.M. Carthew & S.J.B. Cooper (2004) Polymorphic microsatellite markers for the gliding marsupials *Petaurus australis* and *Petaurus breviceps*. *Molecular Ecology Notes* 4: 704-706.
- Caldwell, M. W. & Lee, M. S. Y. 2004. Reevaluation of the Cretaceous marine lizard *Acteosaurus crassicostatus*. *Journal of Paleontology* 78: 617-619.
- Caprette C.C., Lee M.S.Y., Shine R., Mokaney A., Downhower J.F. 2004. The origin of snakes as seen through eye anatomy. *Biological Journal of the Linnean Society* (London) 81: 469-482.
- Carpenter, R.J., R.S. Hill, D.R. Greenwood, A.D. Partridge & M.A. Banks (2004) No snow in the mountains: Early Eocene plant fossils from Hotham Heights, Victoria, Australia. *Australian Journal of Botany* 52: 685-718.
- Chisholm, L.A. & I.D. Whittington (2004) Two new species of Myliocotyle (Monogenea: Monocotylidae) from the gills of *Aetomylaeus maculatus* and *A. nichofii* (Elasmobranchii: Myliobatidae) from Sarawak, Borneo, Malaysia. *Folia Parasitologica* 51: 304-310.
- Chisholm, L.A. & I.D. Whittington (2004) Two new species of *Dendromonocotyle* Hargis, 1955 (Monogenea: Monocotylidae) from the skin of *Taeniura meyeri* (Dasyatidae) and *Aetobatus narinari* (Myliobatidae) from aquaria in Queensland, Australia. *Systematic Parasitology* 57: 221-228.
- Chisholm, L.A., I.D. Whittington & A.B.P. Fischer (2004) A review of *Dendromonocotyle* (Monogenea: Monocotylidae) from the skin of stingrays and their control in public aquaria. *Folia Parasitologica* 51: 123-130.
- Cribb, B., W. Armstrong & I.D. Whittington (2004) Simultaneous fixation using glutaraldehyde and osmium tetroxide or potassium ferricyanide-reduced osmium for the preservation of monogenean flatworms: an assessment for *Merizocotyle icopae*. *Microscopy Research & Technique* 63: 102-110.
- Cribb, B.W. & I.D. Whittington (2004) Anterior adhesive areas and adjacent secretions in the parasitic flatworms *Decacotyle lymmae* and *D. tetrakordyle* (Monogenea: Monocotylidae) from the gills of stingrays. *Invertebrate Biology* 123: 68-77.
- Cribb, B.W., W.D. Armstrong & I.D. Whittington (2004) Mechanism of adhesion and detachment at the anterior end of *Merizocotyle icopae* (Monogenea: Monocotylidae) including ultrastructure of the anterior adhesive matrix. *Parasitology* 129: 181-190.
- Daniels, C.B., S. Orgeig, L.C. Sullivan, N. Ling, M.B. Bennett, S. Schürch, A.L. Val & C.J. Brauner (2004) The origin and evolution of the pulmonary surfactant system in fish: Insights into the evolution of lungs and swim bladders. *Physiological & Biochemical Zoology* 77:732-49

- Davies, K.A. & R.M. Giblin-Davis (2004) The biology and associations of *Fergusobia* (Nematoda) from the *Melaleuca leucadendra* complex in Queensland and New South Wales, with descriptions of new species. *Invertebrate Systematics* 18: 291-319.
- Dimmlich, W.F., W.G. Breed, M. Geddes, & T.M. Ward (2004) Relative importance of gulf and shelf waters for spawning and recruitment of Australian anchovy, *Engraulis australis*, in South Australia. *Fisheries Oceanography* 13: 310-323
- Donnellan, S.C. & M.J. Mahony (2004) Allozyme, chromosomal and morphological variability in the *Litoria lesueuri* species group (Anura: Hylidae), including a description of a new species. *Australian Journal of Zoology* 52: 1-28.
- Giblin-Davis, R.M., B.J. Center, K.A. Davies, M.F. Purcell, S.J. Scheffer, G.S. Taylor, M.L. Lewis, J. Goolsby & T.D. Center (2004) Histological comparisons of *Fergusobia/Fergusonina* induced galls on different myrtaceous hosts. *Journal of Nematology* 36: 249-262.
- Giblin-Davis, R.M., S.J. Scheffer, K.A. Davies, G.S. Taylor, J. Curole, T.D. Center, J. Goolsby & W.K. Thomas (2004) Coevolution between *Fergusobia* and *Fergusonina* mutualists. *Nematology Monographs and Perspectives* 2: 407-417.
- Hill, R.S. (2004) The macrofossil record of the conifer family Cupressaceae in Australia. *Australian Biologist* 17: 23-27.
- Hill, R.S. (2004) Origins of the southeastern Australian vegetation. *Philosophical Transactions of the Royal Society of London B* 359: 1537-1549.
- Hugall, A. E. & Lee, M.S.Y. 2004. Molecular claims of Gondwanan age of Australian agamids are untenable. *Molecular Biology and Evolution* 21: 2102-2110.
- Hyman, I.T., W.F. Ponder & G.W. Rouse (2004) *Ophicardelus* (Mollusca, Pulmonata) in eastern Australia: how many taxa? *Journal of Natural History* 38: 2377-2401.
- Jennings, J.T., A.D. Austin & N.B. Stevens (2004) First record of Aulacidae (Hymenoptera: Evanioidea) from New Caledonia with descriptions of three new species of *Aulacus* Jurine. *Australian Journal of Entomology* 43: 346-352.
- Jennings, J.T., A.D. Austin & N.B. Stevens (2004) *Hyptiogastrites electrinus* Cockerell, 1917, from Burmese amber: redescription and its placement within the Evanioidea (Hymenoptera). *Journal of Systematic Palaeontology* 2: 127-132.
- Jennings, J.T., A.D. Austin & N.B. Stevens (2004) Species of the wasp genus *Aulacus* Jurine (Hymenoptera: Aulacidae) endemic to South Australia. *Transactions of the Royal Society of South Australia* 128: 13-21.
- Jennings, J.T., A.D. Austin & N.B. Stevens (2004) The aulacid wasp fauna of Western Australia with descriptions of six new species. *Records of the Western Australian Museum* 22: 115-128.
- Kasper, M.L., A.F. Reeson, S.J.B. Cooper, K.D. Perry & A.D. Austin (2004) Assessment of prey overlap between a native (*Polistes humilis*) and an introduced (*Vespula germanica*) social wasp using morphology and phylogenetic analyses of 16S rDNA. *Molecular Ecology* 13: 2037-2048.
- Knowles, R., M. Mahony, J. Armstrong & S.C. Donnellan (2004) Systematics of sphagnum frogs of the genus *Phylloria* (Anura: Myobatrachidae) in eastern Australia. *Records of the Australian Museum* 56: 57-74.
- Lee, M. S. Y. (2004) The molecularisation of taxonomy. *Invertebrate Systematics* 18:1-6.
- Lee, M.S.Y. (2004) Molecular and morphological data sets have similar numbers of relevant characters. *Taxon* 53: 1019-1022.
- Miller, N.J., C.B. Daniels, D.P. Costa & S. Orgeig (2004) Control of pulmonary surfactant secretion in adult California sea lions. *Biochemical & Biophysical Research Communications* 313: 737-742.

- Paull, R. & R.S. Hill (2004) Why were the leaves of Tertiary *Nothofagus* subgenus *Brassospora* species serrate margined? *Australian Biologist* 17: 34-54.
- Peach, M.B. & G.W. Rouse (2004) Phylogenetic trends in the abundance and distribution of pit organs on elasmobranchs. *Acta Zoologica* 85: 233-244.
- Pleijel, F. & G.W. Rouse (2004) Carboniferous fireworms (Amphinomida, Annelida), with a discussion of species taxa in palaeontology. *Invertebrate Systematics* 18: 693-700.
- Rabosky, D.L., K.P. Aplin, S.C. Donnellan & S.B. Hedges (2004) Molecular phylogeny of blindsnakes (*Ramphotyphlops*) from Western Australia and resurrection of *Ramphotyphlops bicolor* (Peters, 1857). *Australian Journal of Zoology* 52: 531-548.
- Rawlings, L.H., D. Barker & S.C. Donnellan (2004) Phylogenetic relationships of the Australo-Papuan region pythons, *Liasis* (Reptilia: Macrostromata) based on mitochondrial DNA. *Australian Journal of Zoology* 52: 215-227.
- Rouse, G.W., S.K. Goffredi & R.C. Vrijenhoek (2004). *Osedax*: Bone-eating marine worms with dwarf males. *Science* 305: 668-671.
- Rousset, V., G.W. Rouse, M.E. Siddall, A. Tillier & F. Pleijel (2004) The phylogenetic position of Siboglinidae (Annelida), inferred from 18S rRNA, 28S rRNA, and morphological data. *Zoologica Scripta* 20: 518-533.
- Scanlon, J.D. & Lee, M.S.Y.(2004) The phylogeny of Australasian venomous snakes (Elapidae, Hydrophiidae) based on phenotypic and molecular evidence. *Zoologica Scripta* 33: 335-366.
- Scheffer, S.J., R.M. Giblin-Davis, G.S. Taylor, K.A. Davies, M. Purcell, M.L. Lewis, J. Goolsby & T.D. Center (2004) Phylogenetic relationships, species limits, and host specificity of gall-forming *Fergusonina* flies (Diptera: Fergusoninidae) feeding on *Melaleuca* (Myrtaceae). *Annals of Entomological Society of America* 97: 1216-1221.
- Schwarz M.P., S.M.Tierney, S.J.B. Cooper & N.J. Bull (2004) Molecular phylogenetics of the allodapine bee genus *Braunsapis*: A-T bias and heterogeneous substitution parameters. *Molecular Phylogenetics and Evolution* 32: 110-122.
- Taylor, G.S. (2004) Revision of *Fergusonina* Malloch gall flies (Diptera: Fergusoninidae) from *Melaleuca* (Myrtaceae). *Invertebrate Systematics* 18: 251-290.
- van Camp, L., A.R. Dyer, S.C. Donnellan, J.N. Havenhand & P.G. Fairweather (2004) Multiple paternity in field- and captive-laid egg strands of *Sepioteuthis australis* (Cephalopoda: Loliginidae). *Marine and Freshwater Research* 55: 819-823.
- Wheeler D., R.M. Hope, S.J.B. Cooper, A.A.Gooley & R.A.B. Holland (2004) Linkage of the  $\beta$ -like  $\omega$ -globin gene to  $\alpha$ -like globin genes in an Australian marsupial supports the chromosome duplication model for separation of globin gene clusters. *Journal of Molecular Evolution* 58: 642-652.
- Whittington, I.D. (2004) The Capsalidae (Monogenea: Monopisthocotylea): a review of diversity, classification and phylogeny with a note about species complexes. *Folia Parasitologica* 51: 109-122.
- Whittington, I.D., M.R. Deveney, J.A.T. Morgan, L.A. Chisholm & R.D. Adlard (2004) A preliminary phylogenetic analysis of the Capsalidae (Platyhelminthes: Monogenea: Monopisthocotylea) inferred from large subunit rDNA sequences. *Parasitology* 128: 511-519.
- Whittington, I.D., W. Armstrong & B.W. Cribb (2004) Mechanism of adhesion and detachment at the anterior end of *Neoheterocotyle rhinobatidis* and *Troglocephalus rhinobatidis* (Monogenea: Monopisthocotylea: Monocotylidae). *Parasitology Research* 94: 91-95.
- Whittington, I.D., W. Armstrong, L.A. Chisholm & B.W. Cribb (2004) A comparison of the anterior adhesive system in the oncomiracidium and adult of the monogenean parasite *Merizocotyle icopae* (Monocotylidae). *Parasitology Research* 93: 223-229.



## Books and Symposia Chapters

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- Chapman J. & W.G. Breed (2004) The egg coats of the brushtail possum (*Trichosurus vulpecula*) following ovulation and artificial activation with particular reference to the origin of the perivitelline space matrix. Pp 426-433. In R. Goldingay & S.M. Jackson (Ed.), *The Biology of Possums and Gliders*. Surrey Beatty & Sons, NSW.
- Clarke, S.C., J.M. Facelli, A.D. Austin & A N. Andersen (2004). The impact of perennial shrub loss on arthropod diversity and community structure in chenopod shrublands in the Flinders Ranges: ants as indicators. Pp. 189-194. In *Proceedings of the 13th Biennial Conference of the Australian Rangeland Society*, 5-8 July 2004, Alice Springs.
- Giblin-Davis, R.M., Davies, K.A., Taylor, G.S. & Thomas, K.W. (2004). Entomophilic nematode models for studying biodiversity and cospeciation. Pp. 493-540. In Z.X. Chen, S.Y. Chen & D.W. Dickson (Eds), *Nematology, Advances and Perspectives*. Tsing-hua University Press/CABI, New York.
- Jennings, J.T. & A.D. Austin (2004) Biology and host relationships of aulacid and gasteruptionid wasps (Hymenoptera: Evanoidea); a review. Pp. 187-215. In K. Rajmohana, K. Sudheer, P. Girish Kumur & S. Santhosh (Eds), *Perspectives on Biosystematics and Biodiversity*. SERSA, University of Calicut, Kerala, India.
- Orgeig, S., C.B. Daniels & L.C. Sullivan (2004) Development of the pulmonary surfactant system. Chapter 10, pp150-167. In R. Harding, K. Pinkerton & C. Plopper (Eds), *The Lung: Development, Aging and the Environment*. Academic Press, London.
- Orgeig, S. & C.B. Daniels (2004) The effect of aging, disease and the environment on the pulmonary surfactant system. Chapter 27, pp 363-375. In R. Harding, K. Pinkerton & C. Plopper (Eds), *The Lung: Development, Aging and the Environment*. Academic Press, London.
- Rouse, G.W. (2004) Class Polychaeta. Pp. 194-206. In C.M. Yule & H.S. Yong (Ed.), *Freshwater Invertebrates of the Malaysian Region*. Academy of Sciences Malaysia.
- Siddall, M.E., E. Borda & G.W. Rouse (2004) Towards a Tree of Life for Annelida. Pp. 237-251. In J. Cracraft & M.J. Donoghue (Ed.), *Assembling the Tree of Life*. Oxford University Press, New York.

## Other Publications

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- Bauer, M.K., C.M. Leigh, M. Ricci, E.J. Peirce & W.G. Breed (2004). Evidence for continued maturation of spermatozoa after entry into the vas deferens of the hopping mouse, *Notomys alexis*. Abstract O22 in *Reproduction Abstracts Series* No. 31.
- Ernst, I., C. Chambers & I. Whittington (2004) *Yellowtail & Kingfish Parasite Management Project Progress Report 2003*. Unpublished and confidential research report from ARC Linkage project to industry partners Yamaha Nutreco Aquatech, Skretting Australia, Nutreco and South Australian Marine Finfish Farmers Association, 85pp.
- Pleijel, F. & G.W. Rouse (2004) Hesionidae. The Tree of Life Web Project. <http://tolweb.org/tree?group=Hesionidae&contgroup=Phyllococida>.
- Pleijel, F. & G.W. Rouse (2004) Phyllococida. The Tree of Life Web Project. <http://tolweb.org/tree?group=Phyllococida&contgroup=Annelida>.
- Pleijel, F. & G.W. Rouse (2004) Capricornia. The Tree of Life Web Project. <http://tolweb.org/tree?group=capricornia&contgroup=Hesionidae>.
- Rouse, G.W. (2004) Book Review: *Systema Porifera: Guide to the Classification of Sponges*. J.N.A. Hooper & R.W.M. Van Soest (Eds). *Invertebrate Systematics* 18: 233-234.
- Swann, C.A., S. Cooper, R.M. Hope & W.G. Breed (2004) Evolution of the putative sperm adhesion region of zona pellucida C glycoprotein in murid rodents: is there evidence for species specificity? Abstract P14 in *Reproduction Abstracts Series* No. 31.
- Swann, C.M., C.M. Leigh & W.G. Breed (2004) Glycoconjugates of the zona pellucida of murid rodents-is there evidence for species-specificity? Abstract O31 in *Reproduction Abstracts Series* No. 31.
- Whang, S.S., K. Kim & R.S. Hill (2004) Cuticle micromorphology of leaves of *Pinus* (Pinaceae) from North America. *Botanical Journal of the Linnean Society* 144: 303-320.
- Worawittayawong, P., C.M. Leigh, P. Sretarugsa & W.G. Breed (2004) A possible cause for the presence of vacuoles in the nucleus of spermatids and spermatozoa of the bandicoot rat (*Bandicota indica*). RGJ-PhD Congress V. The Thailand Research Fund.

## RESEARCH GRANT FUNDING

2004

(members of CEBC in bold)

Date	Investigators	Sponsor	Amount	Project Title
02-04	<b>A.D. Austin, J.T. Jennings &amp; N.B. Stevens</b>	ABRS	28,000	Development of an interactive identification key to Australian Hymenoptera (wasps, ants, bees and sawflies)
02-05	<b>A.D. Austin</b> & N.A. Schellhorn	ARC Linkage APAI	71,000	Beneficial arthropods in Coonawarra vineyards and sustainable grape production
02-05	<b>A.D. Austin &amp; J.T. Jennings</b>	ARC Linkage APAI	71,000	Ecology and conservation of a unique threatened guanophilic invertebrate community
02-05	M.S. Harvey & <b>A.D. Austin</b>	ABRS	150,000	Systematics of Australian wolf spiders (Araneae: Lycosidae)
03-06	<b>A.D. Austin &amp; S. Donnellan</b>	ARC Linkage APAI	71,000	Genetic variation in the <i>Cotesia flavipes</i> complex of parasitic wasps: towards the effective biological control of stem-borer pests
03-06	<b>A.D. Austin, S.J. Cooper</b> & W.F. Humphreys (WA Museum)	ARC Linkage	228,000	Assessment of the diversity, distribution and uniqueness of subterranean animals from calcrete aquifers in central Western Australia
04-06	<b>A.D. Austin</b> , J.B. Whitfield & K. Maeto	ARC Discovery	210,000	Evolution of microgastroid parasitic wasps and their symbiotic viruses - a major group of biological control agents
03-05	D. Mackay, <b>A.D. Austin</b> & S. Carthew	ARC Linkage APAI	71,000	Conservation biology of butterflies in South Australia
03-04	<b>W. G. Breed</b> , R.M. Hope & O. Wiebkin	Faculty of Health Sciences, Small Grant	10,000	The structural organisation of egg coat glycoproteins
02-04	D. A. Taggart & <b>W.G. Breed</b>	ARC-SPIRT	45000	Development and Application of cross-fostering model for the conservation of Australia's rare and endangered marsupials
04	M. Brown, <b>S. Carthew &amp; S. Cooper</b>	Australian Geographic	4,500	The conservation and taxonomic status of fragmented populations of yellow-bellied gliders ( <i>Petaurus australis</i> ).
03-05	M. Schwarz (Flinders Univ.) <b>S. Cooper</b> , B. J. Crespi (Simon Fraser Univ.) & T. Chapman (Flinders Univ.)	ARC Discovery	360,000	Co-evolution of sociality and sex allocation: phylogenetic comparative approaches using insects
02-05	<b>S. Cooper</b> , W. Humphries (WA Museum) & J. Bradbury	ABRS	150,000	Taxonomy and distribution of subterranean amphipods from calcrete aquifers in central Western Australia
03-05	<b>C. Daniels, S. Orgeig</b> , S. Schürch, S. Hooper	ARC Discovery	300,000	Environmental control of genetic/phenotypic interactions in lung development: An evolutionary perspective
03-05	<b>C. Daniels</b>	Adelaide City Council	300,000	BioCity - Centre for Urban Ecology

Date	Investigators	Sponsor	Amount	Project Title
5	M. Bull & <b>S. Donnellan</b>	ARC Discovery	126,000	Lizard social behaviour and the influence of parasites.
03-04	<b>S. Donnellan</b>	Seaworld Research & Rescue Foundation	20,000	Database for the fishes – a molecular tool for fish identification.
04	<b>S. Donnellan</b>	Sir Mark Mitchell Foundation	4,000	Is the echidna, Australia's most widely distributed mammal, a single species?
04	<b>S. Donnellan</b>	Wildlife Conservation Fund SA	6,000	Distribution and species status of toadlets ( <i>Pseudophryne</i> ) in South Australia
04-05	<b>S. Donnellan</b>	National Geographic Society	24,000	Blind leading the blind – molecular ecology of marsupial moles
02-04	A. Goodman & <b>S. Donnellan</b>	Australia & Pacific Science Foundation	25,000	DNA fingerprinting for management of trade in reptiles.
04-08	<b>R. Hill, A.D. Austin, S.C. Donnellan et al.</b>	ARC Network Funding	150,000	Understanding the Australian ecosystem: integrating contemporary and historical perspectives on the evolution, ecology and management of Australia's living resources.
03-04	<b>R. Hill, J.R. Watling, G.D. Farquhar, G.J. Jordan, J.G. Conran, T.F. Flannery &amp; P.J. Franks</b>	ARC Discovery	125,356	Why our biota is unique: ecophysiological response, adaptive radiation and changing.
03-07	M. Lee & <b>M. Hutchinson</b>	ARC Professorial Fellowship	625,000	Major evolutionary events in reptiles.
03-05	<b>J.T. Jennings</b>	APPD Contract	33,700	Databasing the WINC collection
04-07	<b>J.T. Jennings &amp; N. Stevens</b>	ABRS	34,000	Systematics of Australian agathidine wasps (Insecta: Hymenoptera: Braconidae); solitary endoparasitoids of lepidopteran larvae
03-04	<b>J.T. Jennings &amp; F. Vickery</b>	Native Vegetation Research Fund	2,500	The effect of fire on <i>Eucalyptus cneorifolia</i> communities on Kangaroo Island (using ants as bio-indicators).
03-05	<b>R. Leys</b>	ARC Discovery	246,000	Regressive evolution of eyelessness in subterranean diving beetles.
02-05	<b>S. Orgeig, R. Cooter, C. Daniels, C. Tsopelas, &amp; B. Chatterton</b>	Breast Cancer Research Association.	97,790	Testing novel growth factors for lymphangiogenic activity to aid in the treatment of lymphoedema
04-06	<b>S. Orgeig, S. Koblar, C. Tsopelas, B. Chatterton &amp; R.D. Cooter</b>	ARC Discovery	240,000	Regenerating lizard tails: A model for understanding the process of lymphangiogenesis
04-05	G. Giribet, <b>G.W. Rouse et al.</b>	NSF	49,480	Assembling the Tree of Life: An integrated approach to the origin and diversification of Protostomes

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04-05	J. Blake, J. Williams, <b>G.W. Rouse</b> , et al.	NSF	15,000	PEET: Systematic and Phylogenetic Analysis of the Polychaeta: The Families Cirratulidae, Orbiniidae, Oweniidae, Paraonidae, Scalibregmatidae, and Spionidae.
04-06	<b>G.W. Rouse</b> & L. Jermiin	ARC Discovery	210,00	Retracing the early evolution of Metazoa using novel methods and strategies.
04-06	<b>G.W. Rouse</b> & G. Messing	ABRS	57,000	Crinoidea (Echinodermata) of Australia: Taxonomy, 'species' and illustrated guides.
04	<b>G.S.Taylor</b>	USDA Agricultural Research Service	25,000	Insect fauna associated with Casuarinaceae in Australia.
04-05	<b>G.S.Taylor &amp; K.A.Davies</b>	ABRS	8,000	Tritrophic radiations: taxonomy, distribution, and host and nematode associations of Australian Fergusoninidae (Diptera)
02-05	<b>I.D. Whittington</b> & I. Ernst	ARC Linkage	474,559	Integrated management of pathogenic monogenean (flatworm) parasite infections in warm water finfish aquaculture
03-05	I. Ernst, C.B. Chambers, B.M. Gillanders & <b>I.D. Whittington</b>	PIRSA	70,000	Wild kingfish populations in Spencer Gulf: seasonal migration and potential for parasite interactions with farmed fish.
03-06	I. Ernst, <b>I.D. Whittington</b> , B.M. Gillanders, K. Hutson & C.B. Chambers	FRDC	136,650	Wild kingfish populations in Spencer Gulf: potential for parasite interactions with farmed fish, discrimination of farmed and wild fish and assessment of migratory behaviour.
04	<b>I.D. Whittington, S.C. Donnellan &amp; L.A. Chisholm</b>	University of Adelaide, Faculty of Sciences, Strategic Research Scheme	8,000	Identity and phylogeny of flatworm parasites from marine fish using morphology and genetics, with novel approaches to identify pathogenic species