ANICdotes

The official newsletter of the Australian National Insect Collection

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Welcome to our second issue for 2015

David Yeates, Director, ANIC

This issue of ANICdotes contains articles on a wide variety of activities from all parts of the collection. In July Ted Edwards learned that he had been selected as the Karl Jordan medallist for 2015. This is a very prestigous honour, with past ANIC staff Dr Ian Common , Dr Ebbe Nielsen and Dr Elwood Zimmerman having previously received this award. The medal is international recognition for Ted's lifelong contribution to the study of Lepidoptera.

CSIRO CEO Larry Marshall being shown examples from the ANIC collection by David Yeates [Photo: A. Landford]

In August CSIRO's new CEO, Larry Marshall, paid a visit to ANIC as one of the jewels of Australia's biodiversity infrastructure. Larry has a background in physics and a successful career in silicon valley, and he showed great interest in the collection and our research activities.

We also highlight various outreach activities including Nicole Fisher's involvement with science week, and Bryan Lessard's workshop and talks in Canberra and Raleigh North Carolina. Robyn Meier has been very busy over the past months testing and trialling CollectiveAccess a new database management system for ANIC. We know that if anybody can put a database management system through its paces, Robyn can. Also in the list of awards received over the past few months we are very pleased to acknowledge Natalie Bank's success in receiving the "outstanding emerging researcher award for 2015" from the Plant Biosecurity CRC.

In May a group of ANIC staff headed north to Cape York, collecting material to add to our research program in phylogenomics, with specimens carefully preserved for analysis using the most modern DNA sequencing techniques.

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BANNER: *Graphium macleayanus* image: Biodiversity Heritage Library.

The group focussed collecting in the Wet Tropics, Iron Range, and further north around Bamaga. Shortly after David Yeates and Bryan Lessard travelled to the USA for more field work, and also to discuss the ABRS-funded Stratiomyidae (soldier fly) work with US collaborators in California, Washington and North Carolina.

In this issue our staff focus is on Karen Meusemann, our Schlinger Trust funded Postdoc who has been working with us for the past two years. Karen did her PhD with Bernie Misof in Bonn, Germany, and has expertise in the analysis of phylogenomic datasets. She is heavily involved in the 1KITE consortium, and is an author on two papers in *Science* in the past year produced by the group. Karen has been very busy transferring her knowledge to other groups in ANIC, CSIRO, and elsewhere in Australia. She is currently working on a number of phylogenomic datasets on fly relationships with David Yeates and collaborators.

In the past few months we have been actively recruiting, with Alan Landford being permanently appointed as a technical officer, and the recruitment process for a new Collection Manager almost complete. We hope to bring news of the successful applicant in the next issue. Applications have just closed for our new Research Scientist position in ANIC as well.

In July we said farewell to Hermes Escalona who has taken up a prestigious Humboldt Fellowship in Bonn, Germany.

Farewell lunch for Hermes at Ruchi Indian Resturant in Belconnen

Award for ANIC student

Mike Hodda

Natalie and her supervisors celebrate her achievement

At the Plant Biosecurity CRC Science meeting in August, Natalie Banks, a PhD student in ANIC, received an official award as the "outstanding emerging biosecurity researcher". Natalie was selected for the award from all researchers financially supported by the CRC for her groundbreaking work on movement of pathogenic species via trade networks. These studies have shown that there is the potential for considerable mixing of nematode populations from different regions and countries, with important implications for the systematics of the species involved. These are pest species of great economic and biosecurity significance, many of which are actively evolving under the strong selective pressures of agriculture. Knowing the connectivity of different populations, the variation within species, the ways that the different species interact, and the ways that new species or subspecific groups evolve, are all basic to the systematics underpinning trade and biosecurity. It is has very important and immediate practical implications.

Natalie has worked at the ANIC for many years, and was a member of technical staff before embarking on her PhD, supervised by Mike Hodda from ANIC, Kirsty Bayliss from Murdoch University in Perth, and Dean Paini from CSIRO's Health & Biosecurity Business Unit.

Natalie was presented with the award by Martin Barlass, the Chairman of the CRC board before several hundred biosecurity researchers at a special function at Maroochydore on Queensland's Sunshine Coast. Congratulations on well-deserved recognition.

Collecting from Cairns to Cape York, QLD

Bryan Lessard and Andreas Zwick

The ANIC was recently awarded funds to sequence 600 insect transcriptomes (all "active" genes of a specimen), which requires fresh or RNAlater preserved specimens as starting material. To obtain samples from a broad range of the Australian insect fauna, we (Karen Meusemann, Bryan Lessard, You Ning Su, Andreas Zwick, Glenn Cocking, Ted Edwards and David Yeates) embarked on a field trip to Kutini-Payamu (Iron Range) National Park in May 2015. This was the ANIC's largest collecting trip in a decade, with over 1,600 km travelled, not including the extra 5,000 km journey made by the two CSIRO vehicles freighted from Canberra. The entomologists arrived in Cairns and eagerly collected in the Atherton tablelands, Daintree National Park, the quaint town of Coen, and eventually arrived in Iron Range.

Kutini-Payamu (Iron Range) National Park is the largest remaining area of low lying rainforest in Australia, extending from the Pacific Ocean and rising 543 m above sea level. The park has a unique mix of coastal heath, dry sclerophyll forest, and rainforest refugia at its heart. It also shares many species of flora and fauna with New Guinea, including the eclectus parrot and rifle bird. For those who are interested in staying in the park, Greenhoose Cabins run by Stu Layton offered comfortable accommodation and cooking facilities which were conveniently located at the edge of the park.

The researchers spent one week collecting in Kutini-Payamu (Iron Range) National Park itself, erecting malaise traps, collecting with hand nets during the day and at night at brightly lit sheets powered by generators. Specimens were preserved dry on pins, in alcohol or in RNAlater for transcriptome sequencing. Scaly highlights of the night collecting were numerous, but amongst the most impressive was an unnamed red lecithocerid moth (*Crocanthes* sp.) that "danced" with elegant moves of its wings. Mount Tozer Lookout hosted a

Glenn, Andreas and Ted at Cape York.

range of interesting Diptera species, including the flesh fly species *Sarcophaga* (*Sarcosolomonia*) *papuensis* whose larvae are adapted to live inside the digestive fluids of pitcher plants. Other productive sites included Cooks Hut campground, Gordon Creek, Old Coen Track and Chilli Beach, providing a suite of insects, including bee flies, soldier flies and horse flies which are the focus of phylogenetic work on Diptera currently being conducted by the ANIC.

We left Kutini-Payamu after a week of very successful collecting for different habitats and species further north. Backtracking on Portland Road, we headed on an exceptionally well maintained Peninsula Developmental Road for Jardine River National Park. We caught the last ferry of the day across the beautiful, clear Jardine River and settled near its banks for a night of light collecting in the dry heathland of the park. The species composition resembled what we collected at Mount Tozer a few nights earlier, then we moved on to Bamaga. The friendly rangers at Bamaga helped us to get in touch with local Elders, who kindly permitted us to collect insects on Injinoo land. The forest along the road to Pajinka, the tip of Cape York, was much taller than the forest we could readily reach in Kutini-Payamu, and collecting along the road and near Somerset proved very interesting. While multiple specimens of the giant moth *Coscinocera hercules* flapped around our lights each night, the real entomological treasures are among the smaller moths, many of which we hadn't seen before on this trip – the proximity to Papua New Guinea seemed very real. On our way back to Cairns we also had a good night of collecting at Captain Billy Landing, before we completed our trip with the coolest and moistest night on Mt. Lewis, famous with entomologists and nature lovers alike.

Although the entomologists did not see any crocodiles (the crocodiles no doubt saw them), the field work on Cape York Peninsula was a success. It will open the doors to future remote field work undertaken by the team in Australia, in addition to the continued collection of fresh material building upon the ANICs holdings of Australia's unique biodiversity.

A good result!

Entomologists abroad – visiting US Diptera collections

Bryan Lessard

Fresh from their return from Iron Range, David Yeates and Bryan Lessard flew to the United States to visit collaborators and museum collections. The first stop was the California Department of Food and Agriculture in Sacramento, California, to meet collaborators Martin Hauser and Shaun Winterton. After shaking off the jetlag at a welcoming BBQ hosted by Shaun, the group was quick to discuss current projects involving the reconstruction of phylogenetic relationships of soldier and bee flies using contemporary Next Generation Sequencing (NGS) data. This was also a fantastic opportunity to acquire material for genetic analysis and even conduct some local field work with PhD student Keith Bayless from the North Carolina State University. The three dipterists spent three days driving from Sacramento to Chester hoping to collect the fly family Hilarimorphidae whose genetic relationship within the Diptera remains unclear. Despite their hard work and persistence, the crew was unsuccessful in collecting the trepid fly family; however, the team did collect a range of interesting Nearctic flies and primitive beetles.

Bryan Lessard, David Yeates and Karen Meusemann in San Francisco

The next stop was visiting Michelle Trautwein at the California Academy of Science in San Francisco, California. After drinking good coffee and admiring the polished concrete offices in the new building, Bryan organised a loan of pinned soldier fly material for his revisionary work, while David and Michelle discussed bee fly phylogeny and identified specimens collected from a suite of worldwide malaise residues. Karen Meusemann also joined the Diptera festivities to discuss higher level phylogenetic relationships of the flies with Michelle. In fact, Michelle was kind enough to host David, Bryan, Keith, Karen and Shaun in her home all at the same time, forming a mini Diptera symposium.

After saying goodbye to Michelle, Keith and the Golden Gate Bridge, David and Bryan flew to meet Norm Woodley at the Smithsonian Institution in Washington DC. This was the first time all three members of the ABRS project to revise the taxonomy of the Australian soldier flies had met to discuss the progress of the grant and examine the world's largest collection of soldier flies. Norm and Bryan also discussed collaborative papers to describe new species from the genera Antisella, Australoactina, Damaromyia, Eumecacis, and Octarthria. The team spent some time planning an expedition to Chile early next year to collect soldier flies, for a project assessing the Gondwanan origins of the group. Torsten Dikow was also kind enough to show David and Bryan around the Smithsonian's updated molecular laboratory and discuss future research on the systematics of Australian robber flies. Bryan was also reunited with fellow tabanid-PEET worker Mauren Turcatel who is a postdoctoral fellow at the USNM working on robber fly phylogeny.

Last but not least was the visit to the North Carolina State University to visit Brian Wiegmann, Brian Cassel and Keith in his home surroundings. Once the confusion settled as to which Brian/Bryan was which, the researchers happily updated one another on their collaborative projects, grants and publications. Bryan also took this opportunity to learn the latest techniques from Brian Cassel in the wet laboratory protocols of NGS data acquisition, as well as giving a public outreach seminar on species discovery to members of the general public at the North Carolina State Museum of Natural Sciences. Overall this whirlwind one month tour of the US museums was a success in forging new collaborative relationships, in addition to collecting new material for future revisionary and genetic research to be conducted by the ANIC.

Karen Meusemann, A Schlinger PostDoc at ANIC

David Yeates

[Photo: A. Landford]

Karen arrived at the ANIC more than two years ago. She obtained her PhD in Evolutionary Biology in 2012 at the University of Bonn, Germany, at the Center for Molecular Biodiversity Research, ZMB, Bonn, in Bernhard Misof's group. She was working mainly on the phylogeny of apterygote hexapods (primarily wingless insects). This was also the first time she had worked with molecular sequence data trying to resolve evolutionary relationships using Next Generation Sequencing data (transcriptomics).

Four years ago, Karen became heavily involved in the 1KITE project (1 K Transcriptome Insect Evolution). This project was started by 12 enthusiastic and daring scientists and now includes over 80 scientists from various fields of research. This project provided and still provides Karen with many opportunities to meet other researchers from all around the world.

Karen and I met in 2012 at the International Entomology Meeting in Korea where she was giving presentations on her work with 1KITE. Adam Slipinski and I had become involved in the 1KITE project ourselves and after listening to Karen talk and getting to know her I realised that she would be able to make a very valuable contribution to the work we are doing in the ANIC. Six months after this meeting I was in a position to offer her a Schlinger Postdoc here in Australia. I was delighted that she accepted the challenge. On arrival she immediately began work on the insect tree of life and is currently working on relationships of flies with transcriptome data involving the several thousand genes available for analyses. This is expanding our knowledge on the evolution of this mega-diverse insect group.

Karen has thrown herself into life in Australia, participating in field trips and learning a lot about the Australian way of life and the Australian way of research. For the future, Karen would be keen to learn more about genomics, working with complete gemomes that would enable a deeper look into the evolutionary mechanisms that allow us to understand the development of certain character traites or behaviours in insects increase our understanding of their evolutionary biology. Karen is enjoying working with scientists from various fields including systematists, taxonomists, morphologists, bioinformatics specialists, paleontologists and theoretical biologists and making good contacts for the future.

David and Karen in the field getting up close and personal with some local wildlife [Photo: C. Manchester]

She is now attempting to resolve phylogenetic relationships among different groups of insects using sequence data from protein-encoding DNA. Recent advances in sequencing technology have produced massive amounts of data, and the challenge is to develop and improve analytical methods to extract information that can be used for phylogenetic inference. One of the objectives of the analysis is to identify and exclude biased or misleading phylogenetic signals. The results of these molecular analyses are compared with results from other types of data, including morphology, to improve our understanding of insect evolution. Karen is currently focusing her attention on the higher level phylogeny of early derivative families of Brachycera (Diptera), and on the relationships among fleas, flies and scorpion flies.

The Karl Jordan Medal

You Ning Su and Glenn Cocking

In late July Ted Edwards travelled to Purdue University, Indiana, to receive the Karl Jordan Medal from the Lepidopterists' Society at their annual meeting.

Ted Edwards proudly holding the Karl Jordan medal [Photo: A. Landford]

The Karl Jordan Medal is awarded every two years if a suitable nomination is received. It is given when a nominee has made a major contribution in recent years to our knowledge in a specific area of traditional taxonomy of the Lepidoptera. In this case the major contribution was to knowledge of the moths of the Australian Region. It is not awarded if no suitable nomination is received. As the only international award in Lepidopterology, it carries great prestige. The meeting at Purdue, organised by Dr Jennifer Zaspel, was a great success and the medal oration by Ted received a standing ovation. The medal was received from Dr Todd Gilligan the retiring president of the society and Dr Jackie Miller, the last recipient of the medal and widow of Dr Lee Miller who instituted the medal in 1973. ANIC has been well represented as winners of the award by three past recipients Dr Elwood Zimmerman, Dr Ian Common and Dr Ebbe Nielsen.

Dr Karl Jordan (1861-1959) was an outstanding Lepidopterist who worked for Lord Walter Rothschild in his museum at Tring, UK. He was an advocate for trinomial nomenclature and its use in clarifying the status of many butterfly and moth populations as either species or subspecies. In this he advised the collection of long series and the detailed study of populations and geographical variation. These ideas were effective for a century but now molecular studies are adding further refinement. He also played a key role in the inception of the International Congresses of Entomology. His most important work, where his ideas were fully tested, was his revision with Rothschild of the world Sphingidae (hawk moths) in 1903, a work so thorough it is still widely useful.

Papers presented at the meeting covered a wide range from proboscis function, sequestered plant poisons and regional fauna studies, conservation of prairie butterflies to taxonomic studies and phylogenies. Several talks indicated that the NHM and Maguire Centre in Florida were only digitising very well-known groups; British and Irish butterflies and North American silk moths respectively. An interesting molecular study on *Heliconius* butterflies indicated that muellerian mimicry is greatly facilitated by rare hybridising events, and the different species maintain their integrity even though 98% of the genome may be exchanged. Surprisingly, there were few presentations on Lepidoptera ecology or behaviour.

At the concurrent ANIC's biennial moth weekend in Canberra Michael Braby, who nominated Ted, gave a detailed talk on why Ted was absent from Canberra and Michael's reasons for nominating him.

From Purdue, Ted and his family travelled on to visit his son at the University of Rochester, NY.

Detail of the medal and Ted's remarkable butterfly tie
[Photo: A. Landford]

New collection management system (CMS)

Robyn Meier and Rob Van Heuzen

Technician Robyn Meier has been re-deployed into a major project to test and develop a new software system for management of the Collection. The project team includes specialists from CSIRO Information Management and Technology, the Manager of Digital Collections from National Research Collections Australia, the Collection Manager from the National Herbarium, the Database Manager from the Australian National Wildlife Collection, and technical and management specialists from private industry. The overall program aims to implement improvements to collection management processes and systems to enable sustainable support and custodianship for the important collections that CSIRO maintains. The pilot project will initially evaluate a potential software system called CollectiveAccess (CA), using the Australian National Insect Collection as the test case.

The main objectives of the pilot project are:

- A functioning version of CollectiveAccess that meets ANIC's needs
- A report on the technical suitability of CollectiveAccess to support the CMS
- A detailed progress report on the status of the system

So far the group has built a functioning pilot version of CollectiveAccess which is now being tested by ANIC staff. The test module uses a subset of real data that was imported from the existing BioLink database.

The project is now expanding to incorporate other biological collections to ensure that CA meets their particular needs. Data fields from the National Herbarium collection and the National Botanic Gardens databases have been matched to fields in CA with encouraging results.

The two Robs putting CollectiveAcccess through its paces [Photo: A. Landford]

Performance testing is well under way and will continue to be a major focus of the project until the end of the pilot period. The system has successfully demonstrated that it can process loans and labels, support data entry and maintenance, and import records from other databases. The system has demonstrated it is extremely flexible and can be easily adapted to our needs. Staff are providing valuable feedback during the development process and the project team is extremely grateful for their support.

Outreach in the ANIC

Bryan Lessard and Nicole Fisher

Scientists and mathematicians in schools for National Science Week

On the 14th of August 2015 CSIRO invited Scientists and Mathematicians in Schools (SMiS) to join them in a science activity to celebrate National Science Week. SMiS is a national volunteer program that brings real science, maths and information and communications technology (ICT) into primary and high school classes by combining the skills of teachers and professional scientists.

Nicole answering questions from the children about the insects while Senator Zed Seselja and their teacher look on

As part of this initiative Senator Zed Seselja along with Andrea Wild, Roger Nicoll (communication staff at CSIRO) and Nicole Fisher from the ANIC visited the O'Connor Cooperative School. Nicole brought along some spectacular display drawers full of insects from the collection, aimed at inspiring and nurturing the natural scientific curiosity of the children to learn more about the these amazing creatures.

Student bootcamp

On the 16th of April 2015 CSIRO Education and Outreach held a science bootcamp for high school students at CSIRO Discovery in Canberra.

About 30 high school students came to meet and talk to CSIRO scientists. As part of the program Dr Bryan Lessard, a Postdoctoral Fellow in the ANIC, gave a 15 min talk on how scientists find and describe new species of insects. He used the Beyonce fly to illustrate his point.

The talk was well received with good feedback suggesting that perhaps some future entomologists had been inspired.

Science inquiry workshop

On the 3rd of September 2015 a school group from Our Lady of Mercy College in Victoria attended the Science Inquiry Workshop in the Discovery Centre at CSIRO.

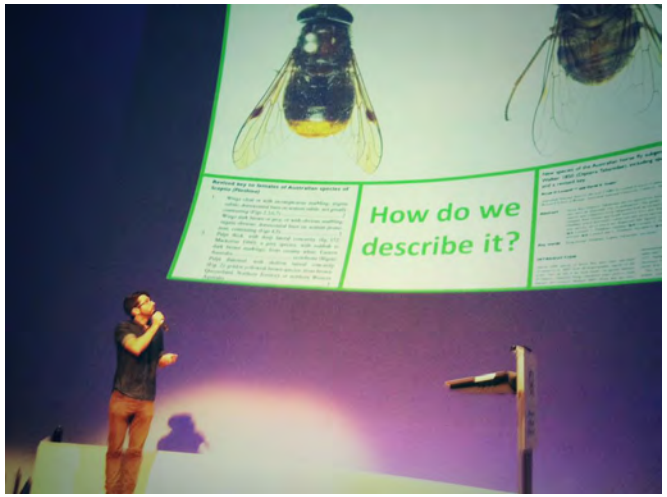
Two CSIRO scientists were asked to speak about their work , Dr Andrew Bissett, Senior Research Scientist in Agriculture and Dr Bryan Lessard, from the ANIC. As well as talking about their work they provided the students with a practical workshop challenge. They asked the students to work in groups and fill out a grant proposal! The students and teachers acted as the funding body. A selection of the students were then asked to pitch their proposals to this 'body'.

The challenge was: Native dung beetles are not well adapted to dealing with the large quantities of dung produced by introduced livestock. This has led to decreased pasture productivity and a huge increase in fly populations which are a major nuisance for people and livestock.

It proved to be a great way of demonstrating the scientific process, including applying for grants, conducting pilot studies, background research and considering ethics. The feedback was incredibly positive and the students expressed a wish that they could have spent a lot more time with the scientists.

Public outreach in the USA

On the 18th of June 2015 at the North Carolina State Museum of Natural Sciences Dr Bryan Lessard gave a 15 min talk to the general public on the scientific processes of entomological research conducted in the Australian National Insect Collection. The topics included collecting, curating, describing new species of insects and the methods used to study their evolutionary development using DNA. Families and children in the audience found the methods of naming new species entertaining and revealing.



Bryan impressing the audience with his presentation

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