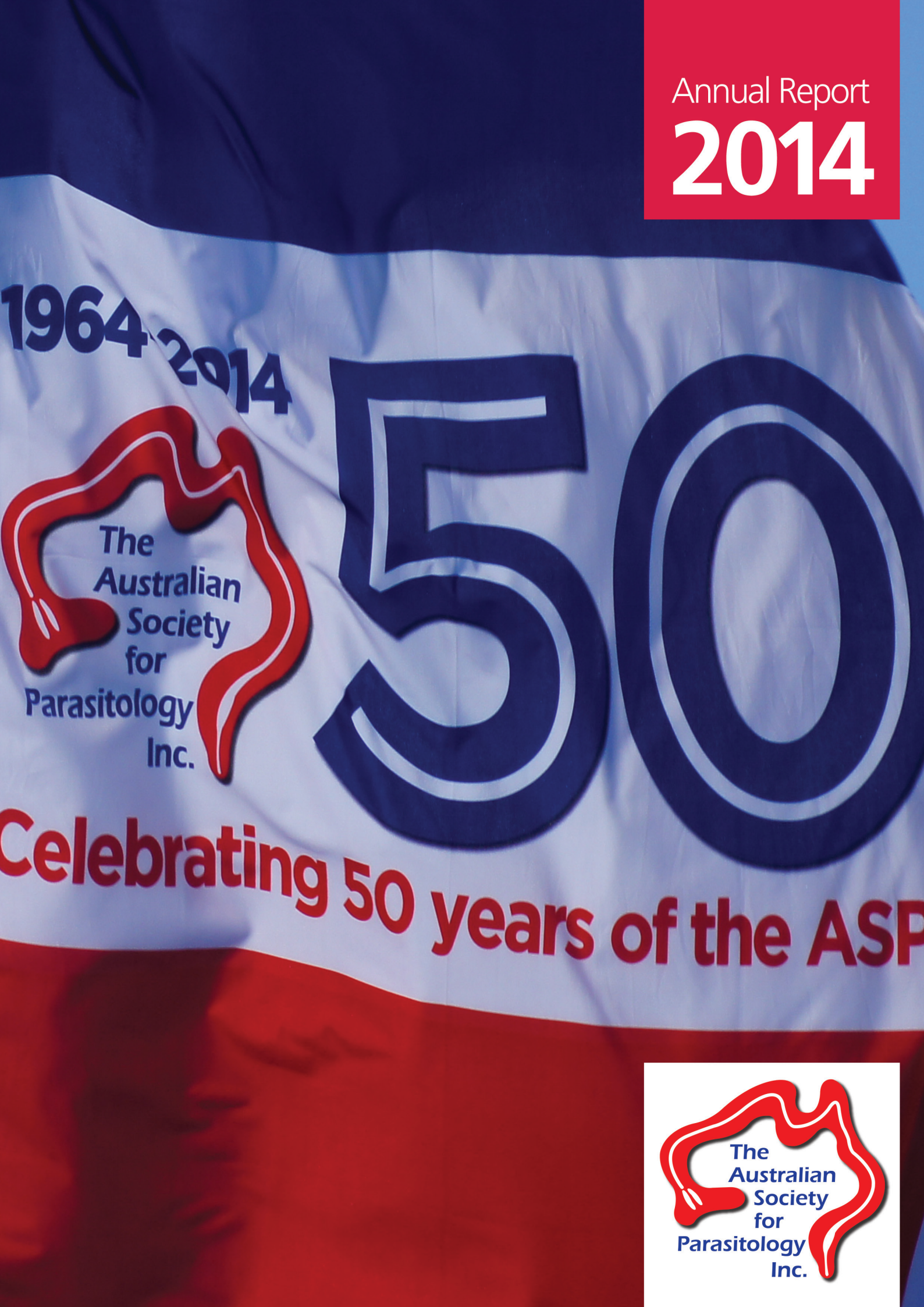
Annual Report 2014



The Australian Society for Parasitology Inc.

Introduction

I AM DELIGHTED TO PRESENT TO YOU THE 2014 ANNUAL REPORT FOR THE AUSTRALIAN SOCIETY FOR PARASITOLOGY INC., WHICH HAS BEEN PREPARED BY OUR ASP NETWORK TEAM, LISA JONES, IAN HARRIS AND NICK SMITH.

Parasitology research in Australia continues to flourish, with over 490 research papers published in 2014 and various, well-deserved honours bestowed on ASP Members, including the induction of three new Fellows of the ASP: Geoff McFadden; Tom Cribb; and Rob Adlard. However, funding for our research reached a low point for the last decade, with only 37 research grants or fellowships (worth $17 million) awarded to ASP members, versus 10-year averages of 60 grants (range: 37-87) and $34 million (range, $17-54 million). This reduced funding is being experienced across diverse disciplines and is, by no means, a reflection of any decline in quality or intensity of parasitological research in this country. Unfortunately, though, at this point there is no sign of a reversal of this disturbing trend in research funding patterns in Australia, which seems to buck many international trends. Thus, international linkages forged by schemes like our own Researcher Exchange, Training and Travel Awards, will become increasingly important and critical.

The success of the ASP is due to the energy, time and commitment of every Member, but some deserve special thanks for their efforts in 2014.

First, the Members of Council of the Society, all of who work enthusiastically on behalf of all Society Members. My thanks to Aaron Jex (Treasurers), David Piedrafita (Executive Secretaries), Denise Doolan (Vice-President), David Emery (President-Elect), Richard Allen and Giel van Dooren (ACT reps), Lesley Warner and

ASP President, Robin Gasser

Ryan O'Handley (SA Reps), Colin Stack (NSW rep.), Melanie Leef (Tasmania rep.), Jutta Marfurt and Benedikt Ley (NT reps), Abdul Jabbar (Victorian rep.), Mark Pearson (QLD rep.), Alan Lymbery and Stephanie Godfrey (WA reps), Chris Peatey and Tina Skinner-Adams (Incorporation Secretary), Peter O'Donoghue (Bancroft-Mackerras Medal Convenor), Jason Mulvenna (Webmaster), Alex Loukas (IJP Editor), Kevin Saliba and Andrew Kotze (IJP:DDR Editors), Andy Thompson (IJP:PAW Editor), Haylee Weaver (Archivist), Nick Smith (Network Convenor) and Lisa Jones (Newsletter Editor and Network Communcations Coordinator).

Second, the Researcher Exchange, Training and Travel Assessment Committee, who had an exceptionally hard job in 2014, with a huge number of quality applications to consider and limited funding to dispense. Thanks to Una Ryan (Chair), Geoff McFadden,

Introduction cont.

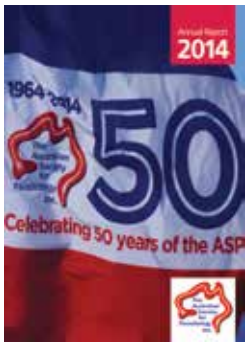
Rowena Martin, Kate Hutson, Brendan McMorran, Deb Holt, Nick Smith and Lisa Jones. We also thank the OzeMalaR Researcher Exchange Assessment Committee: Geoff McFadden, Denise Doolan, Ric Price, Chris Engwerda, Dominique Soldati-Favre, Andy Waters, Kevin Saliba, Klaus Lingelbach, Nick Smith and Lisa Jones.

The 2014 ASP Conference was our 50th Anniversary Conference and, therefore, was held in Canberra, at The Australian National University, where it all began in 1964. The meeting was a major highlight, not just of 2014, but also of the Society's rich history. It was attended by almost 300 delegates from 12 countries, but more than 280 delegates were from Australia. The ASP is extremely grateful to the conference organising committee: Kiaran Kirk, Kevin Saliba, Rowena Martin, Carol Behm, Alex Maier, Melanie Rug, Eva Bennet-Jenkins, Giel van Dooren, Richard Allen, Ian Cockburn, Adele Lehane, Haylee Weaver, Chris Bryant, Nick Smith and Lisa Jones. The Society is also extremely thankful to the ever-willing, Maria Meuleman and the "army" of student volunteers who helped keep the meeting running so smoothly: Esther Rajendren, Renate Zelger, Edwin Thjin, Adelaide Dennis, Sarah Shafik, Sashika Richars, Suzanne Campbell, Nick D'Arcy, Sanduni Hapuarachchi, Kathryn Parker, Erick Thjin, Caitlyn Flint, Melanie Ridgway, Vanessa Howieson, Phuong Tran, Meng Zhang, Tilo Forbes, Robert Summers and Melani Vial. The conference was sponsored generously by Meat & Livestock Australia, Bayer, the International Journal for Parasitology, Elsevier Parasitology, Virbac Animal Health, Elanco, Compounds Australia and New England Biolabs.

The Inspiring Australia initiative grant, secured from the Commonwealth Government (back in 2011) by Lisa Jones and Nick Smith, reached its conclusion in 2014, financing several hugely successful public events to help celebrate the ASP's 50th Anniversary. Meanwhile, the Society's own Outreach Fund ensured that interactions between Parasitologists and the public occurred throughout the year; the ASP's members are truly remarkable for their willingness and enthusiasm to embrace community engagement as a core activity of the Society, an attitude that will no doubt stand us in good stead for many years to come.

Two other major projects came to fruition in 2014: our Veterinary Parasitology e-Text, "Australian Parasites: Inside and Out" became publicly available on our website, and the Society is indebted to David Emery, Ian Beveridge and their team of co-authors for producing this long-awaited resource; and the year closed with our inaugural Advanced Parasitology Course – Concepts in Parasitology, held at ANU's field station at Kioloa, on the NSW south coast, bringing to reality a decade's worth of discussion, affirmation at the Society's 2010 Strategic Planning Workshop and two years of planning, spearheaded by Alex Maier, assisted by Giel van Dooren and a host of enthusiastic ASP members – may it be the first of many courses that we run to ensure the future strength of our beloved discipline and Society!

Robin Gasser
President of the ASP



Cover: An ASP flag flying over Canberra, July 2014, marking the Society's 50th anniversary.
[Photo by Lisa Jones]

Contents

ASP Network

THE MISSION OF THE ASP NETWORK FOR PARASITOLOGY IS TO:

- FOCUS AND ENHANCE AUSTRALIA'S FUNDAMENTAL, STRATEGIC AND APPLIED PARASITOLOGY RESEARCH CAPABILITIES TO UNDERSTAND PARASITISM, PARASITE BIOLOGY AND PARASITIC DISEASE; AND
- TO USE THAT UNDERSTANDING TO DISCOVER AND DEVELOP SUSTAINABLE CONTROL STRATEGIES TO IMPROVE AND MAINTAIN THE HEALTH AND WELL-BEING OF HUMANS AND ANIMALS.

The ASP, through its Network aims to:

- organise and fund conferences, workshops and meetings for scientists, industry representatives, end-users (e.g. farmers, veterinarians, wildlife experts), government representatives and community groups, including participation by international experts;
- foster and finance exchange of staff between national and international research institutions to maximise access to key infrastructure, equipment, expertise and supervision and to encourage the growth of new collaborative relationships;
- provide mentoring, training and grant writing support for young investigators.

Contribution to the National Research Priorities

Australia's National Research Priorities were rewritten in 2013 (see http://www.innovation.gov.au/Research/pages/StrategicresearchPriorities.aspx). ASP Members contribute

This page and next: Images from the 2014 ASP Conference in Canberra

ASP Network cont.

significantly to three of Australia's stated research priorities (see the publication lists in Appendix 1 of this annual report):

[1] Living in a changing environment

By assessing the susceptibility to, and monitoring the prevalence of, parasitic disease in wildlife, ASP researchers generate new information that will assist in the management of terrestrial and marine ecosystems.

[2] Managing our food and water assets

ASP researchers work hard to: better understand the epidemiology and transmission dynamics of parasites; discover and develop better surveillance systems for parasites on land and in water; and find new ways to control parasites in our livestock and fisheries.

[3] Promoting population health and wellbeing.

ASP researchers carry out fundamental, strategic and translational research to: better understand host-parasite relationships; and discover and develop sustainable parasite control strategies. In so doing, they make a major contribution to the longterm, sustained discovery and development of strategies, drugs and vaccines to control, treat and prevent parasitic disease.

Governance

The Network Convenor and Communications and Strategic Planning Coordinator report directly to the ASP Council and are responsible for implementing the strategies and initiatives agreed with Council. The Network has a specific committee for assessing Researcher Exchange, Training and Travel Awards:

Prof. Una Ryan (Chair; Murdoch University); Lisa Jones (Communications and Strategic Planning Coordinator; Executive Officer); Prof. Nick Smith (Convenor, James Cook University); Prof. Geoff McFadden (University of Melbourne); Dr Rowena Martin (Australian National University); Dr Brendan McMorran (Menzies Institute, University of Tasmania); Dr Kate Hutson (James Cook University); and Dr Deb Holt (Menzies School, Darwin).

Progress on Initiatives

Website and Newsletter

The ASP website is administered by Dr Jason Mulvenna and Lisa Jones and the address is www.parasite.org.au. In combination with the ASP Newsletter, which was published three times in 2014, the website keeps ASP Members informed about developments and opportunities provided by the ASP, the ASP Network. It also highlights achievements of ASP members. Newsletters can be downloaded from the ASP website.

Scientific Conferences and Workshops: ASP Annual Conference

The 2014 annual meeting of the Australian Society for Parasitology Inc. was the Society's 50th and, in tribute to the first meeting, was held at the Australian National University (ANU Commons). It attracted almost 300 delegates.

The program was multidisciplinary and included the following themes and invited speakers:

Elsevier Lectures

Raffi Aroian (University of California, San Diego, USA), IJP Lecturer – *Bacillus thuringiensis Cry5B protein as a cure for intestinal roundworms*

David Horn (University of Dundee, UK), IJP:DDR Lecturer – *High-throughput decoding of drug targets and drug resistance mechanisms in African trypanosomes*

Vanessa Ezenwa (University of Georgia, USA), IJP:PAW Lecturer – *From host immunity to pathogen invasion: linking helminth co-infection to microparasite dynamics*

ASP Invited Lecturers

Boris Striepen (University of Georgia, USA), Function and biogenesis of the apicoplast

Margaret Mackinnon (KEMRI-Wellcome Trust Research Programme, Kenya, and University of Oxford, UK), *Malaria parasites*

Mike Ferdig (University of Notre Dame, USA), *Rethinking of antimalarial drug targets and drug resistance through co-expression network analysis*

Plenary Lecturer

Tim Geary (McGill University, Canada), *Anthelmintic discovery at the crossroads: phenotypic vs mechanism-based approaches*

Symposium Lecturers

Audrey Odom (Washington University School of Medicine, USA), *A sugar phosphatase regulates the MEP pathway in malaria parasites*

Mal Jones (The University of Queensland), *Getting under the skin: the body walls of hosts and their parasites in parasitic interactions*

Alyssa Barry (Walter and Eliza Hall Institute of Medical Research), *The importance of population genetics in malaria control and elimination*

Marshall Lightowlers (The University of Melbourne), *Anti-parasite vaccines – how far have we come?*

Archie Clements (The Australian National University), *Epidemiological tools for the sustainable control of soil transmitted helminth infections*

Wai-Hong Tham (Walter and Eliza Hall Institute of Medical Research), *Cytoplasmic domains of malaria parasite adhesins are important for invasion into human erythrocytes*

Vicky Avery (Griffith University), *Protozoan drug discovery from the academic's perspective*

Progress on Initiatives cont.

Images from the 2014 ASP Conference in Canberra

Jan Slapeta (The University of Sydney), *How parasites add new perspectives to our knowledge of host ecology: a hookworm/se lion model*

Christian Doerig (Monash University), F*unctional kinomics of Plasmodium-infected erythrocytes*

Tom Cribb (The University of Queensland), *Trematodes of the Great Barrier Reef: a moving target*

Ian Cockburn (The Australian National University), *Imaging the CD8+ T cell response to Plasmodium in the lymph nodes and liver*

The conference also featured two special sessions:

A Celebration of Australian Parasitology, Chaired by **Graham Mitchell** and featuring ASP Fellows, **Ian Beveridge**, **Mike Rickard**, **Chris Bryant**, **Brendan Crabb**, **Emanuela Handman** and **Peter O'Donoghue**; and

The Future of Parasitology, Chaired by **Graham Mitchell** and featuring Bancroft Mackerras Medallists, **Alan Johnson**, **Marshall Lightowlers**, **Alex Loukas, Leann Tilley** and **Malcolm McConville.**

For the fourth time, ASP Workshops were held for students and early career researchers (ECRs). This year, the theme was "Engaging with the Public" with presentations by Geoff Crane (from Questacon, The National Science Centre), Lisa Jones, Mic Smout and Nick Smith, demonstrating different formats for different type of public audiences including open lecture, Pecha Kucha, Fame Lab and TedX presentations.

Researcher Exchange, Training and Travel Awards

In 2014, 44 Network or OzeMalaR Researcher Exchange, Training and Travel Awards were provided, most going to students or ECRs for visits to overseas laboratories and training courses:

JD Smyth Travel Award winners

Sarah Charnaud, PhD student, Burnet Institute for a researcher Exchange to Sanger Institute, Hinxton, Cambridge, UK for 6 weeks

Progress on Initiatives cont.

and attending EviMalaR Conference, EMBL Heidelberg.

Amanda Worth, PhD Candidate, Murdoch University, Researcher Exchange to The Florey Institute of Neuroscience and Mental Health, Melbourne.

Andrea Lawrence, PhD Candidate, The University of Sydney, for a QIIME workshop, Seoul, Korea and a Researcher Exchange to Museum of Natural History, London to visit Theresa Howard, and to attend the III Parasitology Summer Course (IIIParSCo) in Parco Regionale di Gallipoli Cognato, Basilicata.

Rebecca Stewart, PhD candidate, The Walter and Eliza Hall Institute, Researcher Exchange to the Hunter lab, University of Pennsylvania in Philadelphia for hands on training of 2-Photon Microscopy to analyse Toxoplasma in the brain in vivo and to attend Parasitology Conference, Philadelphia and Woods Hole, Massachusetts, USA

Brendan Ansell, PhD Candidate, The University of Melbourne, for a Researcher Exchange to visit Prof. Staffan Svard at Uppsala University, Sweden for expertise in the laboratory manipulation of Giardia.

ASP Network Travel Award winners

Adebayo Molehin, PhD Student, QIMR Berghofer Medical Research Institute, for Researcher Exchange to visit Prof Paul Brindley, George Washington University, Washington, USA, 9-19 November 2013.

Victoria Morin-Adeline, PhD Student, The University of Sydney, for Researcher Exchange to visit Genomics of Gene Expression Lab of the Bioinformatics Department at the Centro de Investigacion Principe Felipe (CIPF), Dr. Ana Conesa's laboratory, October – December 2013.

Elizabeth Zuccala, PhD Student, WEHI, for Researcher Exchange Research placement in the lab of Dr Ashley Toye, University of Bristol, UK, 1 February – 1 April 2014.

Patrick Lelliott, PhD candidate, Macquarie University to visit several research facilities located in the USA and Canada.

Samantha Emery, PhD Student Macquarie University for a Researcher Exchange to 3 week researcher exchange to Professor Steve Gygi's lab at Harvard Medical School in Boston, June 2014.

Melissa Martin, Ph.D Candidate, National Center for Marine Conservation and Resource Sustainability, Australian Maritime College, UTas for a Researcher Exchange to RMIT, Melbourne to the laboratory of Dr Nathan Bott, Jan – April 2014.

Leah Cronin, PhD candidate, University of Western Sydney for a Researcher Exchange to Professor John Dalton in the School of Biological Sciences at Queen's University, Belfast, Northern Ireland. May – July 2014.

Fiona Angrisano, PhD Student, WEHI, for Researcher Exchange to Imperial College London Professor Robert Sinden's laboratory 11th May 2014 – 11th August 2014.

Victoria Morin-Adeline, PhD Student, The University of Sydney, Researcher Exchange to visit Genomics of Gene Expression Lab of the Bioinformatics Department at the Centro de Investigacion Principe Felipe (CIPF), Dr. Ana Conesa's laboratory.

Andrew Teo, PhD student, The University of Melbourne, Researcher Exchange to European Molecular Biology Laboratory, Heidelberg, Germany and to University of Copenhagen, Copenhagen Denmark.

Terry Spithill, La Trobe, Researcher Exchange to Prof Maule's lab, Queen's University, Belfast, UK, and Prof Matt Berriman's lab, Sanger Institute, Cambridge, UK.

Susann Herrmann, The University of Melbourne, TEM training at The University of Adelaide.

Christie Foster, PhD candidate, The University of Sydney, Researcher Exchange to Laboratory of Photosynthesis, Institute

Progress on Initiatives cont.

of Microbiology, Academy of Sciences of the Czech Republic and Institute of Parasitology, Biology Centre, Academy of Sciences of the Czech Republic.

Rebecca Stewart, PhD Candidate, The Walter and Eliza Hall Institute, EMBL Advanced Course in Fluorescent Imaging, Heidelberg Germany.

Chris Hosking, Ph.D Candidate, Monash University, Researcher Exchange to to McManus laboratory, QIMR Berghofer.

Giana Bastos Gomes, PhD candidate, Centre for Sustainable Tropical Fisheries and Aquaculture, School of Marine and Tropical Biology, James Cook University, visit the Microbial Diversity Laboratory at UMass-Amherst, Amherst, MA, USA (Program in Organism and Evolutionary Biology) led by Professor Laura A. Katz to develop new in in vitro culture techniques for aquatic protozoan parasites (Chilodonella spp.) and use denaturant gradient gel electrophoresis (DGGE) to aid morphological and genetic identification15th September 2014- 3th October 2014

Catarina dos Santos, PhD Candidate, The University of Tasmania, for a Researcher Exchange with a leading fish immunologist in New Zealand, Dr. Steve Bird, The University of Waikato to learn molecular techniques to significantly increase the understanding of amoebic gill disease – Atlantic Salmon interaction.

Stephanie Hing, PhD Student, Murdoch University, for Researcher Exchange to Charles Sturt University.

OzEMalaR Travel Award winners

Andrew Teo, PhD student, University of Melbourne, Department of Medicine, Rogerson Laboratory, for a Research Exchange to Professor Ali Salanti, Professor Thor Theander and Professor Lars Hviid at the Department of International Health, Immunology and Microbiology, CMP University of Copenhagen, Denmark 9 May 2014 - 27 June 2014

Sarah Charnaud, PhD student, Brendan Crabb and Paul Gilson laboratory, Burnet Institute, Melbourne, for a Research Exchange to Sanger Institute, Hinxton, Cambridge, UK 6 weeks in May, to coincide with the EviMalaR Conference, EMBL Heidelberg 12-14 May (co-funded with ASP Network for Parasitology Travel Award scheme

Fiona Angrisano, PhD student, Walter & Eliza Hall Institute – Baum Laboratory, for a Research Exchange to Laboratory of Dr Oliver Billker, Welcome Trust Sanger Institute, Hinxton, Cambridgeshire, UK, 19th May - 19th August 2014

Clara Lin, PhD Candidate, Walter and Eliza Hall Institute of Medical Research, Infection and Immunity, Cowman Lab, for a Research Exchange to University of Heidelberg, Department of Parasitology, Friedrich Frischknecht 5 May to 3 September 2014 with BioMalPar Conference from 12 May –14 May and visit to EMBL Hamburg for 1 week in between for research exchange with Svergun group.

Professor James McCarthy, QIMR Berghofer Medical Research Institute, for EviMalaR-funded workshop: "Plasmodium falciparum hostparasite interplay in the Human Bone Marrow" and Research Visit Location: Harvard School of Public Health, Boston, June 23 – 27, 2014

Professor Leann Tilley, Department of Biochemistry and Molecular Biology, The University of Melbourne, for EviMalaR-funded workshop: "Plasmodium falciparum host-parasite interplay in the Human Bone Marrow and Research Visit Location: Harvard School of Public Health, Boston, June 23 – 28, 2014

Matthew Dixon, NHMRC Research Fellow, Department of Biochemistry and Molecular Biology, The University of Melbourne, for EviMalaRfunded workshop: "Plasmodium falciparum host-parasite interplay in the Human Bone Marrow and Research Visit Location: Harvard School of Public Health, Boston, June 23 – 30,

This page and previous:
A panorama of the 2014 AGM by Lisa Jones

Progress on Initiatives cont.

2014

Kylie Renee James, QIMR Berghofer Medical Research Institute, to visit Laboratories of Dr Oliver Billker and Dr Sarah Teichmann at the Genome Campus, Hinxton, UK

Grennady Wirjanata, Menzies School of Health Research, to visit Lanzer lab, University of Heidelberg, Germany

Dr Johanna Dups, The John Curtin School of Medical Research, ANU, for collaborative field and laboratory work with Drs Francis Ndungu and Kevin Marsh at The Kenya Medical Research Institute (KEMRI)

Dr Philippe Boeuf, The University of Melbourne, to visit Prof Artur Scherf and Prof Chetan Chitnis at the Pasteur Institute, Paris, France

Dr Gaoqian Feng, The Burnet Institute to visit Centre for Geographic Medicine Research of the Kenya Medical Research Institute in Kilifi, Kenya (Dr Francis Ndungu and Dr Faith Osier)

Steven Kho, Menzies School of Health Research, Darwin to visit Professor Hernando del Portillo, Barcelona Centre for International Health Research (CRESIB), Hospital Clinic - Universitat de Barcelona, Barcelona, Spain & Dr Pierre Buffet, Parasitology and Mycology Unit, and French National Center for Metropolitan Malaria, de l'Hôpital Pitié-Salpêtrière, Paris, France

Danushka Marapana PhD student, WEHI, Cowman laboratory for a Researcher Exchange to University of Heidelberg/ Friedrich Frischknecht

Sofonias Tessema, PhD student, WEHI, Barry laboratory for a Researcher Exchange to the Lavstsen laboratory at the University of Copenhagen.

ASP Student Conference Travel Grant

The following ASP students were awarded 2013 ASP Student Conference Travel Grants: Rebecca Abraham (Adelaide), Adeshina Adekunle (UNSW), Mahdis Aghazadeh (QIMR Berghofer), Brendan Ansell (Melbourne), Clare Anstead (Melbourne), MD. Shakif-Ul Azam (Monash), Luke Barron (JCU), Giana Bastos Gomes (JCU), Adriana Botero Gomez (Murdoch), Julie Burel (QIMR Berghofer), Alice Butterworth (QIMR Berghofer), Timothy Cameron (La Trobe), Brittney Caruana (La Trobe), Tara Cassidy (CSU), Sarah Catalano (Adelaide), Scott Chisholm (Deakin), Soranot Chotnipat (JCU), Lindsay Christian (QIMR Berghofer), Oliver Creagh (QIMR Berghofer), Danielle Davenport (UTAS, AMC), Karina Pires De Sousa (QIMR Berghofer), Michelle Dever (UNE), Pablo Elias Diaz (UQ), Shannon Donahoe (Sydney), Catarina do Carmo Norte dos Santos (UTAS), Timothy Elliott (La Trobe), Brendan Elsworth (Burnet Institute), Samantha Emery (Macquarie), Jessica Engel (Griffith), Deepani Darshika Fernando (QIMR Berghofer), Nancy Gomes (La Trobe), Laura Gonzalez Poblete (UTAS), Catherine Gordon (QIMR Berghofer), Harshanie Abeywardena Habarakadage (Melbourne), Katherine Harvey (Burnet Institute), Thomas Hill (AMC), Alison Hillman (Murdoch), Stephanie Hing (Murdoch), Jennifer Que Phuong Hoang (QIMR Berghofer), Chris Hosking (Monash),Hong Ming Huang (Macquarie), Tim Jenkins (JCU), Francesca Jones (Murdoch), Krista Jones (Murdoch), Alex Kennedy (WEHI), David Khoury (UNSW), Pasi Kalevi Korhonen (Melbourne), Andrea Lawrence (Sydney), Patrick Lelliott (Macquarie), Shijie Li (UTAS), Linda Ly (UQ), Phoebe Makepeace (CSU), Md Abdullah Al Mamun (Monash), Danushka Marapana (WEHI), Melissa Martin (UTAS/ AMC), David Mitchell (UNE), Adebayo Molehin (QIMR Berghofer), Victoria Morin-Adeline (Sydney), Lukas Neumann (UTAS), Hanh Hong Thi Nguyen (Melbourne), Amy Northover (Murdoch), Ylenia Pennacchi (UTAS), Piyumali Kanchana Perera (Melbourne), Catherine Perez (Murdoch), Sarah Preston (Monash), Shiwanthi Lakmali Ranasinghe (QIMR Berghofer), Vignesh Rathinasamy (LaTrobe), Ali Raza (UQ), Victoria Ryg-Cornejo (WEHI), Dhanasekaran Sakthivel (Monash), Cilly Schnider (Macquarie), Mary Shuttleworth (Melbourne), Saba Sinai-Mameghany (UQ), Leah Stroud (UWS), Melissa Sykes (Griffith), Marie Tan (JCU), Yen Thon Teoh (Melbourne), Napatsorn Torchareon (UTAS), Alejandro Trujillo (JCU), Victoria Valdenegro (UTAS), Clare Van Dorssen (QIMR Berghofer), Elke Vermeulen (Macquarie), Rebecca Waddell (QIMR Berghofer), Liana Wait (Adelaide), Jessica Wilkie (La Trobe), Amanda Worth (Murdoch), Jerald Yam (UQ)

RESEARCHER EXCHANGE TRAVEL REPORTS

GIANA BASTOS GOMES FROM JAMES COOK UNIVERSITY REPORTS ON A FRUITFUL VISIT TO SMITH COLLEGE IN MASSACHUSETTS, FUNDED BY AN ASP NETWORK RESEARCHER EXCHANGE, TRAINING AND TRAVEL AWARD .

I am very grateful to the Australian Society for Parasitology (ASP) for the financial support awarded to me for my research exchange experience to visit the Microbial Diversity Laboratory (Centre for Genetics, Genomics and Evolution) led by Professor Laura A. Katz at Smith College, Northampton, MA, US. The objective of this visit (from 15th September to 3rd October 2014) was to learn how to culture parasitic ciliate protozoans, and apply different molecular techniques to identify cryptic species. Professor Katz's group has been growing "in vitro" Chilodonella uncinata (a free-living species extensively used as a genetic model) over the last six years.

This research exchange was crucial for my PhD project on parasitic Chilodonella species that cause diseases and economic loss in freshwater barramundi farms in north QLD and Murray cod fish farms from southern Australia. The freshwater finfish aquaculture industry requires more knowledge about this ciliate protozoan in order to integrate the most appropriate control strategies. Identification of parasitic species can be challenging, as some Chilodonella spp. can alternate between parasitic and free-living stages. Furthermore, there are limited distinguishing morphological characters within closely related species' groups.

My research project involves investigating the ecology and transmission dynamics of Chilodonella spp. infections in Australian fishes. I have been collecting water samples from freshwater aquaculture ponds from north QLD with a history of Chilodonella spp. infections, as well as samples from infected fish (gills and skin) collected during epizootic events. I have successfully detected Chilodonella spp. using novel environmental DNA (eDNA) diagnostic techniques developed during my project. Although I have sequenced more than 100 samples, identifying the species assemblage present in the region is challenging, as there is a lack of knowledge of morphological and genetic differentiation among Australian Chilodonella species.

Chilodonella species responsible for epizootics in freshwater farmed fish in Australia are poorly known. Based on my preliminary results there is evidence of multiple Chilodonella species present in single farms. Successful in vitro culture of ciliates is crucial for morphological and genetic analyses. Artificial culture of parasitic Chilodonella spp. is considerably challenging and is the single largest problem for identification of multiple and/or potential new species. Chilodonella spp. have been traditionally classified as morphospecies (species described and identified by morphological characters), but more recent genetic studies based on mtSSU-rDNA gene revealed multiple genetic variance among single Chilodonella cells. Chilodonella spp. has been classified

Giana Bastos Gomes - "Success! I have grown Chilodonella spp. from farmed barramundi in vitro at James Cook University following my researcher exchange in the US."

Progress on Initiatives cont.

recently as a cryptic complex of species (similar morphology but genetic variance). Additionally, some studies show considerable dynamics in the distribution of cryptic species of Chilodonella uncinata.

While working with Professor Laura Katz (pictured on the left) we discussed the use of traditional molecular techniques such

as denaturing gradient gel electrophoresis (DGGE) which may provide a cheap and quick insight into the spatial (i.e. between different ponds) and temporal (i.e. different months of the year) community changes of the parasitic Chilodonella species affecting barramundi in tropical QLD. DGGE could help us to understand the different genetic types of parasitic Chilodonella species present in farmed barramundi. Understanding the genetic relationship among Chilodonella species affecting fish in tropical QLD can help to determine which species are more likely to cause outbreaks and potential treatment methods.

Professor Katz's work focuses on principles of eukaryotic evolution through phylogenetic reconstruction, community sampling and analyses of genome evolution. In the last 18 years she has published over 90 research articles with focus on molecular biology and ciliates. She has used different species of ciliates for her molecular research but the species Chilodonella uncinata has become an important model organism as part of her projects.

During my visit to Professor Laura A. Katz's lab I learnt how to culture in vitro Chilodonella spp. observing how the technique has been applied to growing Chilodonella uncinata. I learnt how to identify single Chilodonella cells by a simple fluorescent in situ hybridization (FISH) protocol. This technique is another interesting tool with great potential to be used in my project to identify parasitic Chilodonella from farmed fish in Australia.

The skills learned from Professor Katz and her group will be useful not only for my PhD but for all my future work as a researcher. More importantly, this research exchange opened up opportunities for future collaborative research with Professor Katz's team. This opportunity provided unique and critical educational experiences to my research development and greatly improved my scientific skills and my knowledge on Chilodonella spp. Since my return to Australia I have been able to practise the skills learned for in vitro Chilodonella sp. culture collected from a barramundi farm from North Queensland. The culture has been growing very well and I have been enjoying every minute of this important step for my project.

Activities/skills learned were:

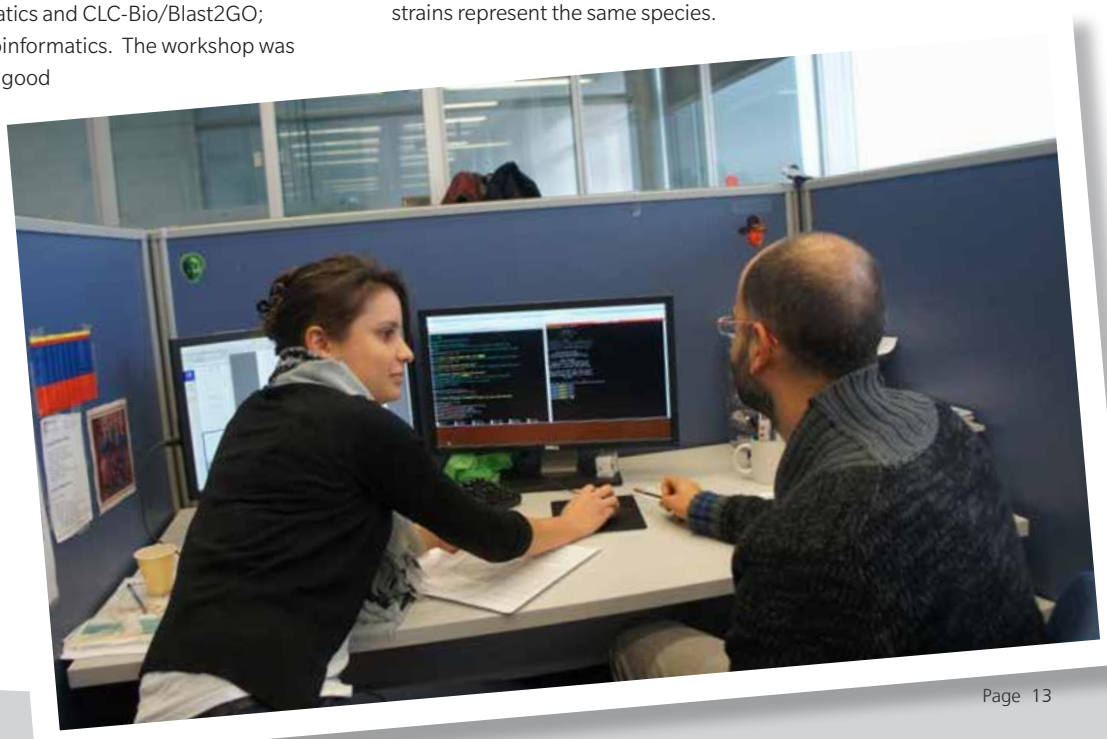
- In vitro growth of free-living Chilodonella uncinata
- Manipulation and collection of single cells of Chilodonella uncinata
- Direct PCR using a single cell of Chilodonella uncinata (without DNA extraction)
- Preparation and observation of fluorescent in situ hybridization (FISH) slides for identification of Chilodonella species
- Denaturant gradient gel electrophoresis (DGGE) to assess community diversity of ciliates present in environmental samples (water, soil, etc)
- Cloning of other ciliates and Chilodonella uncinata (for different genes).

VICTORIA MORIN-ADELINE OF THE UNIVERSITY OF SYDNEY REPORTS ON HER RESEARCHER EXCHANGE TO THE GENOMICS OF GENE EXPRESSION LAB, CIPF, VALENCIA, SPAIN

My story with the Genomics of Gene Expression Lab at the Príncipe Felipe Research Centre (CIPF) in Valencia, Spain started at the beginning of 2013. As part of my PhD project, I prepared and sent RNA samples from the bovine and feline strain of Tritrichomonas foetus for sequencing. My aim is to extract the UTR regions and to use them in transfection trials to improve the current transfection system in these agriculturally and veterinary important parasites. Additionally, with the raw sequence data set of both T. foetus strains, I will gain a unique opportunity to further explore the expressed genome of these parasites, delivering new insights into expressed differences between the two stains. So RNAseq was to be my world for the next few months of my PhD; a prospect that frankly alarmed me as I had very limited computer skills and no experience handling sequencing data.

At the beginning of 2013, I received an ASP network travel grant to attend a 3-day international course; automated functional annotation and data mining: - From raw sequencing data to a functional annotated genome, in Brisbane. The course was organized by the QFAB Bioinfomatics and CLC-Bio/Blast2GO; both widely used programs in bioinformatics. The workshop was a major success. While I gained a good understanding of de novo transcriptome assembly and annotation, gene expression analysis and experimental design for bioinfomatic studies, I had the pleasure of meeting the course organizer, Dr. Ana Conesa, also the head of the Genomics of Gene Expression Lab at CIPF in Spain. We discussed the main aspects of my transcriptomics analysis, and she extended an invitation for me join her lab to analyse my sequencing data. I was co-funded by the ASP network travel grant to travel to Valencia, Spain for two months.

Working at CIPF turned out one of the steepest learning curves I've been on, but undoubtedly an excellent opportunity for my personal exposure into the field of computational biology. I worked closely with Dr. Conesa and Dr. Rodrigo Lomas (postdoc) to grasp command line and bash scripting, a thought that was initially very daunting. I worked extensively with a variety of common bioinfomatic tools including Trinity, TopHat, Bowtie, Blast2GO, Qualimap and worked in close contact with the authors of the Full-lengthernext and UTRscan algorithms to adapt them for non-model organisms such as T. foetus parasites. Over the two month period, I was able to assemble the two T. foetus transcriptomes and accomplish my initial goals, that is, to extract UTRs from several subsets of the T. foetus bovine and feline transcriptomes for transfection comparisons. Equally as exciting is a new line of enquiry which we've developed in the Genomics of Gene Expression Lab regarding the annotation of motifs within the UTRs regions, more interestingly, the 5' UTRs. These motifs are known to add to a layer of gene expression regulation. Additionally, I am currently in the process of preparing a manuscript for publication to present a cell-wide comparison of expressed genes between the bovine and feline T. foetus strains. This will address the controversial dilemma of whether the bovine and feline T. foetus strains represent the same species.



Right: Victoria with with Dr. Rodrigo Lomas

Progress on Initiatives cont.

While in Valencia, Dr. Conesa was extremely generous to provide financial support for me to attend an Emerging Technology (EmTech) conference. EmTech is organized by the Massachusetts Institute of Technology's (MIT) Technology Review magazine and gathers together the most innovative scientist, technology leaders and business gurus to discuss innovative ideas shaping our world today. Coincidently, one of the pressing themes at the conference was 'big data', such as sequencing data, its potential/limitations and its future. The conference was for me the 'icing on the cake' as I am very enthusiastic about the combination of new technology, science and innovation. It was a pleasure to listen to and network with so many people who are passionate to improve the world we live in.

Overall, the experience I've received from my trip in Valencia has been very rewarding. I was hosted with amazing hospitality from colleagues at CIPF made and several potential collaborative connections. As the work I started at CIPF is still not completely finished, I am thankful to for the continued access I have been given to their computer servers and work on my Valencian computer remotely while here in Sydney. In all, I discovered that I enjoyed the 'dry lab' experience and all of its unique optimization challenges just as much as I enjoyed working in a 'wet lab'.

Images from top:

Researchers at CIPF
Evening out with colleagues
With Dr Ana Conesa

THREE COUNTRIES IN THREE WEEKS – A WHIRLWIND ADVENTURE IN PARASITOLOGY IN SOUTH KOREA AND EUROPE. REPORT BY ANDREA LAWRENCE, THE UNIVERSITY OF SYDNEY.

It isn't always the case that PhD students get to travel to exotic and exciting places for the betterment of their PhD, particularly in their first year. In September this year, I became one of the lucky ones, the envy of other first year students. This 'luck' was largely in the form of funding received from ASP (JD Smyth Postgraduate Student Travel Award) and further supplemented by The University of Sydney Grants-in-Aid (constituted by the G.H.S and I.R. Lightoller Scholarship and the Bailieu Research Scholarship) and the Australian Biological Resources Study (National Taxonomy Research Grant Program – Student Travel Grant). Without this financial support, this wonderful opportunity would have slipped through my fingers.

My work is centred on fleas, in particular the common cat flea (Ctenocephalides felis), which is the most common ectoparasite found on cats and dogs globally. The ubiquitous nature of these fleas in family households represents a significant disease risk from zoonotic flea-borne pathogens. It is the flea vectors themselves and the dynamics of the pathogens they carry that I am interested in. The opportunity to expand this interest came about in around March in the form of my stumbling across an advertisement on the ASP website for IIIParSCo: the third instalment of a summer parasitology course on vectors and their transmitted pathogens in southern Italy. The course was run by Prof. Dr. Domenico Otranto (University of Bari, Italy) and Dr Filipe Dantas-Torres (Aggeu Magalhães Research Institute, Recife-Brazil) – two of the editors of the journal Medical and Veterinary Entomology where, earlier this year I published the paper entitled: 'High phylogenetic diversity of the cat flea (Ctenocephalides felis) at two mitochondrial DNA markers'. Consequently, I was very keen meet the two researchers especially given their reputation as prolific and talented scientists. The main aim of the course was to give us updated information and practical skills on vectors and vector-borne disease in the Mediterranean region. They were to select only 12 applicants globally with preference given to local Italian students. As it turns out, there ended up being 13 attendees representing 9 different nationalities including myself as the only Australian, the only non-veterinarian and the youngest by at least 3 years.

Above: Andrea as human 'bait' for collecting eyeworm vector Phortica variegata

Around the time I applied for IIIParSCo I was also struggling to 'learn bioinformatics'. As a part of my project I aim to validate the flea microbiome as a pathogen detection tool, which will enable analysis of whole microbial community data - instead of single pathogen detection as in regular PCR – allowing the detection of known and new pathogens. I was just brushing the surface of how to use and understand the command processor Bash when one of my supervisors A/Prof. Jan Šlapeta forwarded me an email for a 1 day bioinformatics workshop in Seoul, Korea. The workshop focussed on a software package called QIIME, used to organise

Progress on Initiatives cont.

and analyse microbiome data by the people behind the human microbiome project. The workshop was run by the creators of QIIME: Jose C. Clemente (Hess Centre for Science and Medicine, Icahn School of Medicine, NYC), Greg Caporaso (Centre for Microbial Genetics and Genomics, Northern Arizona University), Daniel McDonald (ANU College of Engineering and Computer Science, Canberra) and Antonio Gonzalez and Rob Knight (Knight Lab, University of Colorado, Boulder). I had exactly 4 hours before the deadline for application submission and I was luckily accepted

and spent 3 days in Seoul to attend the workshop on the 30st August. The workshop was too brief to be able to work with my own data, however it was an enlightening day for consolidating my existing bioinformatics knowledge and expanding to new concepts and features of QIIME. As it was run by the creators, I also became privy to the limitations of the software, which tools I should use for my individual project and the progress of new or improved features. Despite being such a short workshop, the enthusiasm and relatability of the presenters meant that the trip to Seoul was well worth it. I am still currently working with this software in the analysis of my flea microbiome.

Between Seoul and Italy I visited the London School of Hygiene and Tropical Medicine to visit the lab of James Logan, head of the Department for Disease Control and gave a seminar which was very well received. The questions afterwards lead to a discussion regarding the difficulty of flea taxonomy, particularly in the Ctenocephalides genus and prompted me to consider morphometrics after it was suggested by a postdoc who used this technique with butterflies during his PhD. I visited the Natural History Museum in London, to view the famous Rothschild Collection of Fleas containing the type specimens used to describe several species. I took with me four specimens representing two native flea species both collected from echidnas in NSW to donate to the museum. During my two day visit to the museum I was able to create an image reference library of the type specimens that I can now refer to when identifying fleas and that will be invaluable to me for the entirety of my PhD and beyond. Working with these type specimens also confirmed and strengthened my own taxonomic knowledge of the Ctenocephalides genus, meaning I am now equipped to make confident taxonomic decisions and to challenge existing dogmas in flea taxonomy.

After London, I flew into Bari on the south-east coast of Italy where the first day of my week long Mediterranean parasitology adventure began. The course location was Parco Regionale di Gallipoli Cognato Piccole Dolomite Lucane, Basilicata. This beautiful region contains many of the sites of collection for the parasites and vectors included publications by Domenico and his team.

My main current aim for my PhD is to collect fleas from as many countries as possible to compare global population dynamics of Ctenocephalides spp. and relate this to their vector capability using microbiome analysis. I felt what better way to collect fleas from new countries than an international parasitology workshop. As such I emailed all the attendees prior to the trip imploring them to bring fleas from their respective countries. I was happy

when on arrival to the course I was greeted by many with "You're Andrea? The flea girl?" and was then handed vials and vials of fleas. I received a large cohort of fleas from Paraguay courtesy of Jorge Miret and we are currently collaborating on a small project together describing the genetic profile of cat fleas throughout Paraguay. I also received fleas from Belgium, Portugal and several parts of Italy and Greece given to me by Domenico and others. Prior to the course I had collected fleas from 20 different countries over the course of 1 ½ years. Arriving home after the trip I had boosted that number to 25 over just three weeks.

The course was based heavily on practical activities with Domenico, Filipe and a number of affiliated veterinarians, parasitologists and molecular biologists imparting their skills in the field. These skills included collecting, identifying, dissecting and preserving endemic vectors such as sandflies, ticks, Phortica variegata – a fruitfly that transmits eyeworm – from both the environment and from their respective hosts. The collection of Phortica variegata included using us students as human 'bait' for the attraction of the zoophilic flies. We also learnt techniques for isolating and identifying the pathogens these vectors transmit such as Leishmania spp., various tick-borne pathogens, Thelazia callipaeda (eyeworm), and metastrongyloides (lungworms).

We gained experience mist netting migratory birds, tagging and collecting ticks from them, collecting ticks from cattle and deer, collecting Thelazia eyeworms from dogs, and skin snip samples from dogs for diagnosis of Certopithifilaria and other filaroid microfilariae and collecting blood, mucosal and bone marrow samples for Leishmania spp. isolation.

On top of all this we also got lectures on these topics every day. and one evening we were gifted with a surprise 'meeting' via skype with Emeritus Prof. Chris Arme, editor-in-chief the journal of Parasites and Vectors and we were able pick his brain for an hour with our questions regarding the future of the parasitology field and current challenges.

Attending IIIParSco was an incredible experience for many reasons. Firstly the skills and knowledge I gained from the course gave me an international perspective of vectors and pathogens particularly of a region where vector diversity is rich. Although the course emphasized European vectors and diseases, these same species are also common problems in other regions or are expanding their ranges as a result of climatic changes. Secondly, I have gained samples for my project that will inevitably be incorporated into at least one publication. But the most significant aspect I have taken away is the professional collaborations and long-lasting personal friendships I now have with the talented

group of parasitologists who attended and organised the course. I wholeheartedly recommend this course to any young parasitologist who is lucky enough to come across the opportunity to attend. For these experiences, I have ASP to thank along with the University of Sydney and the Australian Biological Resources Study for the provision of essential funding, without which the trip would not have been possible.

Above: Andrea with Charlotte Sarre from the Department of Virology, Parasitology and Immunology at Ghent University, Belgium.
Previous page: cioleagues in South Korea

Significant Contibutions and Highlights for 2014

New Fellows of the Society

In 2014, the ASP recognised the lifetime achievements of three outstanding parasitologists, **Geoff McFadden** of The University of Melbourne; **Tom Cribb** of The University of Queensland, and **Rob Adlard** of the Queensland Museum, by making them Fellows of the Society. (See the features on each of the new ASP Fellows)

Bancroft Mackerras Medal and the JFA Sprent Prize

The ASP also acknowledged the outstanding quality of research of two of its members: **Una Ryan** (Murdoch University) was awarded the Bancroft Mackerras Medal for research excellence for her work on the molecular epidemiology of waterborne parasites, most particularly, Cryptosporidium; and **Rina Wong** (The University of Western Australia) was awarded the JFA Sprent Prize for her PhD entitled, "Resistance of Plasmodium falciparum to anti-malarial in Papua New Guinea: associations between in vitro drug sensitivity, genetic mutations and clinical outcome".

Other ASP awards and prizes

The ASP recognised four of its young rising-stars by awarding them a JD Smyth Award: **Sarah Chanaud** (Burnet Institute); **Andrea Lawrence** (The University of Sydney); **Rebecca Stewart** (Walter and Eliza Hall Institute of Medical Research); and **Brendan Ansell** (The University of Melbourne).

The Society also recognised the research achievements of several outstanding students and early career researchers at its 2014 conference including the:

- Best Student Poster Prize, won by **Adriana Botero Gomez** (Murdoch University)
- Best Student 2 Minute Research Presentation Prize,won by **Alejandro Trujillo** (James Cook University)
- Best Student Oral Presentation Prize, won by **Esther Rajendren** (the Australian National University)
- Best Presentation by an Early Career Researcher, won by **Neil Young** (The University of Melbourne)

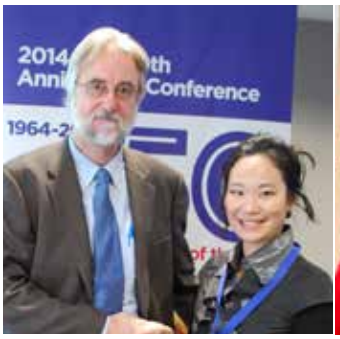
The ASP recognised three excellent international colleagues with ASP 2014 International Invited Lectureships:

- **Boris Striepen** (University of Georgia, USA)
- **Margaret Mackinnon** (KEMRI-Wellcome Research Programme, Kilifi, Kenya and University of Oxford, UK)
- **Mike Ferdig (**University of Notre Dame, USA).

Awards from other bodies

Other ASP Members honoured in 2014 included:

- **Ian Beveridge** (The University of Melbourne), awarded the World Federation of Parasitologists Distinguished



Significant Contributions cont.

Achievement Award

- **Shokoofeh Shamsi** (Charles Sturt University) was awarded the Recognition Medal by the University of Allahabad, India, at the Global Biodiversity Meeting on Parasites and Aquatic Ecosystem Health

- **Terry Speed** (Walter and Eliza Hall Institute of Medical Research) won the 2014 CSIRO Eureka Prize for Leadership in Science "For his superb leadership of the bioinformatics team at the Walter and Eliza Hall Institute of Medical Research, and his other contributions to the science of bioinformatics" (See more at: http://australianmuseum.net.au/media/2014-eureka-leadership#sthash.eFqjBZgR.dpuf)

- **The Magic Glasses Team** (QIMR Berghofer Medical Research Institute and University of Queensland), were finalists for the 2014 Australian Infectious Diseases Research Centre Eureka Prize for Infectious Diseases Research (See more at: http://australianmuseum.net.au/2014-finalists-eureka#sthash.dn9K8w7s.dpuf)

- **Alan Cowman** (Walter and Eliza Hall Institute of Medical Research) was awarded the Sornchai Looareesuwan Medal, which is awarded by the Faculty of Tropical Medicine at Mahidol University, Thailand, and "recognises a researcher who has focused their efforts on malaria and made a significant contribution to the field". (See the feature "Awards for WEHI Researchers")

- **Justin Boddey** (Walter and Eliza Hall Institute of Medical Research) received WEHI's top research award, The Burnet Prize, which "recognises early career scientists for their pioneering research" and was established in 1987 through a bequest of former director, Sir Frank Macfarlane Burnet. (See the feature "Awards for WEHI Researchers")

Publications

With over 490 publications involving Australian parasitologists in 2014 (see Appendix 1), there were innumerable highlights. However, at least a few deserve special mention.

First, as noted in last year's annual report, Australia has taken a leadership role in the discovery and application of new drugs against parasites and in understanding how anti-parasitics work

Above: Ian Beveridge awarded the World Federation of Parasitologists Distinguished Achievement Award by Robin Gasser and David Perdrafita

Previous page and this page: medal, awards and prizes at the 2014 ASP Conference in Canberra. Pictured L-R with ASP President Robin Gassser are:
Una Ryan, Rina Wong, Adriana Botero Gomez, Alejandro Trujillo, Robert Summers, Esther Rajendren and Neil Young.

Significant Contributions cont.

and how parasites develop resistance to them – this continued in 2014, with a diverse series of outstanding publications including, perhaps most notably, a remarkable series of papers on drugs against malaria:

Vaidya AB, Morrisey JM, Zhang Z, Das S, Daly TM, Otto TD, Spillman NJ, Wyvratt M, Siegl P, Marfurt J, Wirjanata G, Sebayang BF, Price RN, Chatterjee A, Nagle A, Stasiak M, Charman SA, Angulo-Barturen I, Ferrer S, Belén Jiménez-Díaz M, Martínez MS, Gamo FJ, Avery VM, Ruecker A, Delves M, Kirk K, Berriman M, Kortagere S, Burrows J, Fan E, Bergman LW. **Pyrazoleamide compounds are potent antimalarials that target Na+ homeostasis in intraerythrocytic *Plasmodium falciparum***. *Nat Commun*. 2014 Nov 25;5:5521. doi: 10.1038/ncomms6521.

Tran PN, Brown SH, Mitchell TW, Matuschewski K, McMillan PJ, Kirk K, Dixon MW, Maier AG. **A female gametocyte-specific ABC transporter plays a role in lipid metabolism in the malaria parasite.** *Nat Commun.* 2014 Sep 8;5:4773. doi: 10.1038/ncomms5773

Summers RL, Dave A, Dolstra TJ, Bellanca S, Marchetti RV, Nash MN, Richards SN, Goh V, Schenk RL, Stein WD, Kirk K, Sanchez CP, Lanzer M, Martin RE. **Diverse mutational pathways converge on saturable chloroquine transport via the malaria parasite's chloroquine resistance transporter.** *Proc Natl Acad Sci* U S A. 2014 Apr 29;111(17):E1759-67. doi: 10.1073/pnas.1322965111. Epub 2014 Apr 11

Jiménez-Díaz MB, Ebert D, Salinas Y, Pradhan A, Lehane AM, Myrand-Lapierre ME, O'Loughlin KG, Shackleford DM, Justino de Almeida M, Carrillo AK, Clark JA, Dennis AS, Diep J, Deng X, Duffy S, Endsley AN, Fedewa G, Guiguemde WA, Gómez MG, Holbrook G, Horst J, Kim CC, Liu J, Lee MC, Matheny A, Martínez MS, Miller G, Rodríguez-Alejandre A, Sanz L, Sigal M, Spillman NJ, Stein PD, Wang Z, Zhu F, Waterson D, Knapp S, Shelat A, Avery VM, Fidock DA, Gamo FJ, Charman SA, Mirsalis JC, Ma H, Ferrer S, Kirk K, Angulo-Barturen I, Kyle DE, DeRisi JL, Floyd DM, Guy RK. **(+)-SJ733, a clinical candidate for malaria that acts through ATP4 to induce rapid host-mediated clearance of *Plasmodium***. *Proc Natl Acad Sci* U S A. 2014 Dec 16;111(50):E5455-62. doi: 10.1073/pnas.1414221111. Epub 2014 Dec 1.

Lehane AM, Ridgway MC, Baker E, Kirk K. **Diverse chemotypes disrupt ion homeostasis in the malaria parasite**. *Mol Microbiol.* 2014 Oct;94(2):327-39. doi: 10.1111/mmi.12765. Epub 2014 Sep 15

Also continuing a trend from 2013, Australian parasitologists remained at the forefront of teams that analysed the genomes and transcriptomes of veterinary and medically significant parasites throughout 2014:

Reid AJ, Blake DP, Ansari HR, Billington K, Browne HP, Bryant J, Dunn M, Hung SS, Kawahara F, Miranda-Saavedra D, Malas TB, Mourier T, Naghra H, Nair M, Otto TD, Rawlings ND, Rivailler P, Sanchez-Flores A, Sanders M, Subramaniam C, Tay YL, Woo Y, Wu X, Barrell B, Dear PH, Doerig C, Gruber A, Ivens AC, Parkinson J, Rajandream MA, Shirley MW, Wan KL, Berriman M, Tomley. **Genomic analysis of the causative agents of coccidiosis in domestic chickens**. *Genome Res.* 2014 Oct;24(10):1676-85. doi: 10.1101/gr.168955.113. Epub 2014 Jul 11

This page and next page:
ASP 2014 International Invited Lectureships
Dr Margaret Mackinnon,
KEMRI-Wellcome Research Programme, Kilifi, Kenya
Professor Boris Striepen,
GRA Distinguished Investigator, University of Georgia
Associate Professor Mike Ferdig,
Biological Sciences, University of Notre Dame

Significant Contributions cont.

Jex AR, Nejsum P, Schwarz EM, Hu L, Young ND, Hall RS, Korhonen PK, Liao S, Thamsborg S, Xia J, Xu P, Wang S, Scheerlinck JP, Hofmann A, Sternberg PW, Wang J, Gasser RB. **Genome and transcriptome of the porcine whipworm *Trichuris suis*.** *Nat Genet.* 2014 Jul;46(7):701-6. doi: 10.1038/ng.3012. Epub 2014 Jun 15

Tang YT, Gao X, Rosa BA, Abubucker S, Hallsworth-Pepin K, Martin J, Tyagi R, Heizer E, Zhang X, Bhonagiri-Palsikar V, Minx P, Warren WC, Wang Q, Zhan B, Hotez PJ, Sternberg PW, Dougall A, Gaze ST, Mulvenna J, Sotillo J, Ranganathan S, Rabelo EM, Wilson RK, Felgner PL, Bethony J, Hawdon JM, Gasser RB, Loukas A, Mitreva M. **Genome of the human hookworm *Necator americanus*.** *Nat Genet.* 2014 Mar;46(3):261-9. doi: 10.1038/ng.2875. Epub 2014 Jan 19

Young ND, Nagarajan N, Lin SJ, Korhonen PK, Jex AR, Hall RS, Safavi-Hemami H, Kaewkong W, Bertrand D, Gao S, Seet Q, Wongkham S, Teh BT, Wongkham C, Intapan PM, Maleewong W, Yang X, Hu M, Wang Z, Hofmann A, Sternberg PW, Tan P, Wang J, Gasser RB. **The *Opisthorchis viverrini* genome provides insights into life in the bile duct.** *Nat Commun.* 2014 Jul 9;5:4378. doi: 10.1038/ncomms5378

Gaze S, Driguez P, Pearson MS, Mendes T, Doolan DL, Trieu A, McManus DP, Gobert GN, Periago MV, Correa Oliveira R, Cardoso FC, Oliveira G, Nakajima R, Jasinskas A, Hung C, Liang L, Pablo J, Bethony JM, Felgner PL, Loukas A. **An immunomics approach to schistosome antigen discovery: antibody signatures of naturally resistant and chronically infected individuals from endemic areas.** *PLoS Pathog.* 2014 Mar 27;10(3):e1004033. doi: 10.1371/journal.ppat.1004033. eCollection 2014 Mar

Clinical trials and a new vaccine

In other, very practical, developments:

James McCarthy (QIMR Berghofer Medical Research Institute) registered three clinical trials in 2014:

- Trial Id ACTRN12614000680662.
  A cluster randomised controlled trial comparing the impact of a water, sanitation and hygiene (WASH) intervention integrated with albendazole distribution versus albendazole distribution alone, on reinfection with intestinal parasites in rural communities in Timor-Leste. Date registered: 27/06/2014

- Trial Id ACTRN12614000781640.
  A proof-of-concept study to assess the effect of ACT-451840 against early Plasmodium falciparum blood stage infection in healthy subjects. Date registered: 21/07/2014

- Trial Id ACTRN12614000930684.
  Blood stage challenge pilot study to assess the safety and the infectivity of Plasmodium vivax isolate HMPBS02-Pv in healthy volunteers. Date registered: 29/08/2014

Brown Besier (Department of Agriculture and Food Western Australia, Albany WA), David Smith (Moredun Research Institute, Edinburgh, UK), **Robert Dobson** (Murdoch University, WA) and **Lewis Kahn** (University of New England, Armidale NSW) released Barbervax, a new approach to *Hemonchus contortus* control, in October 2014. (See the feature "Barbevax: a new vaccine")

And, finally:

Alex Maier, **Giel van Dooren** and a team of very dedicated parasitologists successfully staged the first ever ASP Advanced Parasitology Course: Concepts in Parasitology;

David Emery, **Ian Beveridge** and others launched the e-publication of "Australian Parasites: inside and out".

GEOFFREY I. MCFADDEN FASP

PROFESSOR GEOFFREY I. MCFADDEN IS ELECTED TO FELLOW OF THE AUSTRALIAN SOCIETY FOR PARASITOLOGY.

Geoff McFadden, a 1984 PhD graduate in Botany from The University of Melbourne, identified the relict chloroplast in apicomplexan parasites – a discovery that has revolutionised our understanding of one of the world's major pathogens and opened up new strategies to battle the deadly disease, malaria. Geoff has focused his research on the biology and evolution of protists, the kingdom of life that includes algae as well as many other unicellular organisms. His research has shown, quite unexpectedly, that Plasmodium, the parasite responsible for malaria, is related to algae and contains a plastid – the chloroplast organelle that is responsible for photosynthesis in algae and higher plants. In apicomplexans, this organelle, now known as the "apicoplast", no longer contains chlorophyll but has a circular DNA genome similar to all other plastids. This fundamental scientific discovery opened up novel approaches for studying and combating malaria.

Geoff's team has identified many new drug targets in the plastid of malaria parasites, vastly increasing the number of strategies for the development of much needed new anti-malarial drugs.

In recognition of the importance of his work, Geoff has been elected as a Fellow of the Australian Academy of Science and as an overseas associate to the Canadian Institute of Advanced Research. He has received two Howard Hughes Medical Institute International Scholar Awards, the Australian Academy of Science's Frederick White Prize, The David Syme Prize, the Friedrich-Mieschner Prize for endosymbiosis research, the Julian Wells Medal for genome research, the Royal Society of Victoria Research Medal and the Ramaciotti Research Medal. Geoff has been the recipient of three consecutive major National Health and Medical Research Council (NHMRC) 5 year Program Grants in collaboration with some of Australia's finest parasitologists, and has been an Australian Research Council (ARC) Professorial Fellow, and a Federation Fellow.

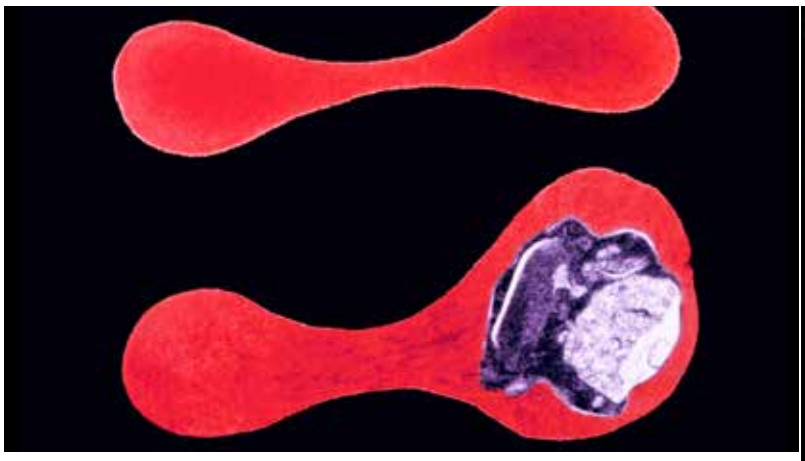
Geoff has published over 200 papers, many in high impact journals such as Nature, Science, PNAS, The EMBO Journal, Current Biology and The Journal of Cell Biology. His publications have attracted 14,000 citations, and he has an h-factor of 60. Thirty-eight of his papers have been cited more than 100 times, including six with

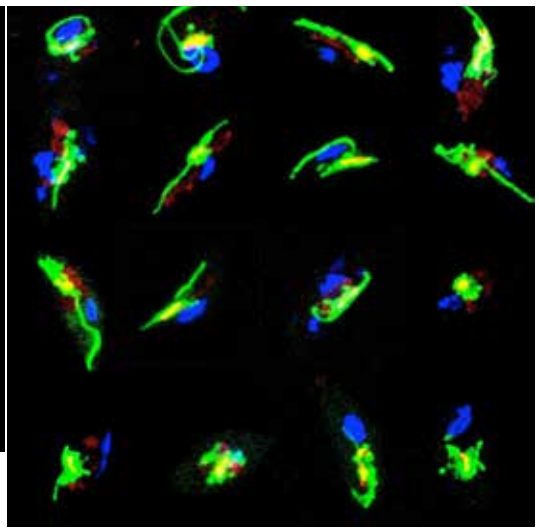
Significant Contributions cont.

more than 200 citations, three more with over 300 citations, three with more than 400 cites, one with more than 600 citations and one cited more than 3,000 times. Journal covers have featured images from his laboratory 20 times.

Geoff's contributions to unraveling the evolutionary relationships of microscopic plankton and the origin of chloroplasts by endosymbiosis, placed him in the perfect situation for identifying a relict chloroplast in human parasites. He is the only botanist working on malaria and the only botanist to be a Principal Investigator in National Health and Medical Research Council (NHMRC) Program Grants. Similarly, he is the only botanist to secure grants from the Howard Hughes Medical Institute for Medical Research. He has crossed discipline boundaries, requiring a determination and flexibility to adapt to a difficult and demanding research subject. His success in obtaining funding support, and his wide-ranging collaborations with parasitologists, evolutionary biologists and botanists in universities, medical research institutions, hospitals, the military and non-government organisations, attest to the significance of his research success.

But over and above this, Geoff has been an outstanding mentor to young scientists and a loyal servant to the Australian Society for Parasitology. His graduate students and postdoctoral fellows have made outstanding contributions to parasitology, received competitive research fellowships and many have gone on to become strong, independent researchers now leading their own teams at prestigious national research institutions including The Walter and Eliza Hall Institute of Medical Research, the Burnet Institute, the Royal Botanic Gardens of Melbourne, the Bio21 Institute, The University of Melbourne, the Australian National University, plus renowned international institutions such as Nanyang University, the University of British Columbia, Université de Limoges, the University of Otago, the Pasteur Institute, the Sanger Institute, the University of Cambridge and Merck Pty Ltd. Geoff was one of the driving forces behind the establishment and the success of the ARC/NHMRC Research Network for Parasitology, and served on its the management committee from 2004-2010, then becoming the inaugural director of the Australian/European Malaria Research Network. He has helped to revitalise the discipline of parasitology in Australia over the last decade. Geoff has also been the President of the International Society of Evolutionary Protistology. He is a more than worthy recipient of the title, Fellow of the Australian Society for Parasitology.





Left: a healthy red blood cell & a malaria-infected red blood cell (image courtesy McFadden)
Right: Plasmodium falciparum gametocytes (image courtesy Okamoto)

ROBERT ADLARD, FASP

DR ROBERT ADLARD IS ELECTED TO FELLOW OF THE AUSTRALIAN SOCIETY FOR PARASITOLOGY.

Robert Adlard received a BSc (Honours) from the University of Queensland in 1983 and a PhD from the same university with a thesis entitled, "The effects of the parasitic isopod Anilocra pomacentri Bruce (Cymothoidae) on the population dynamics of the reef fish Chromis nitida Whitley (Pomacentridae)". He then held positions as Postdoctoral Fellow in the Department of Parasitology, University of Queensland, and Assistant Curator of the Queensland Museum. Rob has also served as consultant to industry in marine sciences, specializing in the control of parasitic infections of commercial species. Rob has carved out a role as an international leader in the field of parasite biodiversity. Rob was the inaugural curator of the globally significant International Research Centre for Avian Haematozoa (IRCAH).

Rob is now Head of Marine Environments (while retaining the title of Senior Curator of Parasitology) at the Queensland Museum, and has responsibility for the significant collections of parasitological specimens at the Museum, estimated as around the fifth-largest collection of such material anywhere in the world and representing a major resource for the members of the Australian Society for Parasitology.

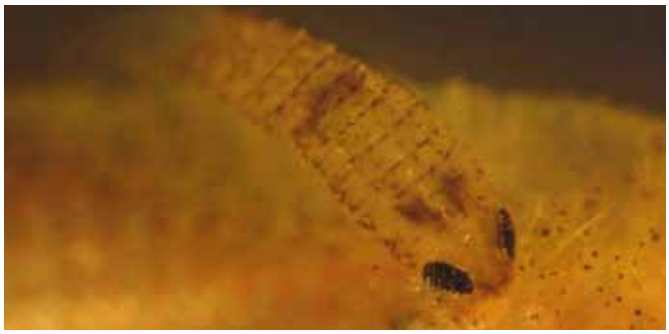
Rob's career has focused almost exclusively on understanding the biology and diversity of parasites of marine organisms and wildlife. His work has had a strong whole organism and ecological focus, with a view to solving major economic problems of significance to Australian and international fisheries. Among his research achievements are: the first empirical demonstration undertaken in an open marine system (Great Barrier Reef), proving that parasites regulate host fish populations; demonstration that polychaetes are involved in the lifecycle of QX disease (Marteilia sydneyi), a significant pathogen of commercial oysters; determination of the oyster cycle of this parasite using molecular probes, epidemiology and causal webs for the disease agent and devising a scientific evidence-based management plan; demonstration that the wide host range and wide geographic distribution of marine White Spot Disease (Cryptocaryon irritans, a devastating pathogen of aquarium fish and fish in aquaculture), was the result of the presence of a species complex;

This page and next page:
images courtesy of Rob Adlard, QLD Museum

Anilocra pomacentri manca stage (ectoparasitic isopod) initial feeding scar on juvenile Chromis nitida – Heron Island

Marine leech from the leopard shark – Flinders Reef Moreton Bay

Anterior of trypanorhynch metacestode from a serranid fish.



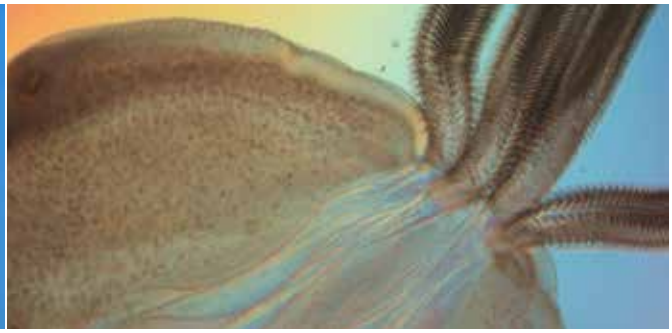
Significant Contributions cont.

determining the life cycle of a significant pathogen of Southern Bluefin Tuna – provided enabling information for management by industry; rationalised the systematics of myxozoan parasites and assessed biological correlates to provide a benchmark for study and diagnosis of these fish pathogens. Rob has discovered and described a total of 140 new species of parasites from fish and wildlife, providing substantial enhancement of knowledge of the diversity of parasites in Australia.

Rob has been an outstanding mentor in parasitology. He has supervised 14 PhD and 10 Honours students to successful completion of their studies. He has funded and mentored 4 post-doctoral fellows. Dr Adlard has been an excellent advocate for the discipline of Parasitology in television and radio interviews on issues in parasitology, in television shows for children, public lectures, Museum National Science Week activities, parasite exhibitions and Meet-the-Curator programs at the Queensland Museum. He has strong input into the ASP's Parasites in Focus exhibition. In keeping with his broad interests in biology, Rob has contributed chapters and images to local popular publications, including Wildlife of Greater Brisbane, Wild Guide to Moreton Bay, Discovery Guide to the Great Barrier Reef, and led the development of a Field Guide to Queensland Fauna smart phone app launched in May 2014.

An international advocate for Australian parasitology, Dr Adlard is currently a member of the Steering Committee for the MalariaRCN, a research co-ordination network funded by the National Science Foundation (USA) to promote research on Malaria and Related Haemosporidian Parasites of Wildlife. He has published 100 peer-reviewed scientific research papers and is recognised as a world expert in myxozoan parasites of fishes, presenting an invited Keynote Lecture on the subject at the International Symposium of Fish Parasites in 2011 in Chile. He has presented almost 100 conference papers on his work both nationally and internationally and won over $3.4 million in competitive grant funding. He is a currently a Regional Resource Expert for the Network of Aquaculture Centres of the Asia-Pacific (centred in Bangkok) and Chair of the National Reference Group for the Neptune project, the Australian aquatic animal health web-platform.

Rob has been one of the most loyal and hardworking servants of the Australian Society for Parasitology. He has been executive secretary of the ASP Council on two occasions, and Queensland State representative for three years. He has served on the organizing committee of 1999 Conference in Yeppoon and the 2006 conference on the Gold Coast. He is now a member of the curriculum committee for the ASP Kioloa Intensive Parasitology Course to be run for the first time in late 2014. Dr Adlard was a participant and steering committee member of the ARC/NHMRC Research Network for Parasitology bid in 2004, and a member of the Managerial and Advisory committee for the Network from 2007 to 2009. He has served on the Specialist Editorial Board of the International Journal for Parasitology for two terms. Through his endeavours, Rob has promoted the advance of parasitology and has rendered conspicuous service to the cause of Parasitology and the Society. Dr Robert Adlard is a very worthy recipient of the Fellowship of the Australian Society for Parasitology.



THOMAS H. CRIBB, FASP

PROFESSOR THOMAS H. CRIBB IS ELECTED TO FELLOW OF THE AUSTRALIAN SOCIETY FOR PARASITOLOGY.

Tom received his PhD in Parasitology from the University of Queensland in 1986 for work focusing on elucidating the taxonomy and life-cycles of trematodes of Australian freshwater fishes. He then took up a CSIRO postdoctoral Fellowship in London and Canberra to work on trematodes of Australian terrestrial mammals. A QEII Fellowship followed, during which he commenced work on trematodes of marine fishes, principally of the tropical Indo-Pacific.

The theme of his research for more than 30 years has been the biodiversity of trematodes – their taxonomy, evolution, host-specificity, geographical distribution and life cycles. Using a combination of morphological and molecular approaches, Tom has gone on to become one of the most significant contributors to the understanding of trematodes, and has made major contributions to knowledge of the evolution and ecology of helminths in both aquatic and terrestrial systems. Evidence of the significance of these contributions is provided in his receipt of the Bancroft-Makerras Medal for research excellence in 2007. Since receiving his PhD, Tom has published 259 manuscripts in high-quality, peer-reviewed scientific journals describing more than 300 new species and 65 genera of helminths, as well as expanding knowledge of the distribution and biology of countless other species. A feature of his work has been the elucidation of many complex novel trematode life-cycles. Tom's research shows his clear passion for fundamental research in zoology, ecology, parasitology and the world's natural history. He has also made significant applied contributions to his field, including characterizing the life-cycles of Brachylaima cribbi, a parasite that infects humans, and, with colleagues, that of Cardicola forsteri, a significant pathogen of ranched southern bluefin tuna.

Beyond his direct scientific contributions, Tom Cribb has made substantial contributions to the discipline of Parasitology. He has supervised to completion 77 post-graduate students, including 22 PhD candidates and 54 Honours students and continues to provide strong mentorship and guidance for many of his former students as they have gone on to develop their careers in Parasitology as post-doctoral research scientists and senior researchers within industry, the departments of primary industries, CSIRO, or as faculty members of universities within Australia and around the world. Tom has been a strong supporter, mentor and teacher in undergraduate education at all levels, and has run numerous specialist field courses on Marine Parasitology on Heron Island, North Stradbroke Island and, through the Australian Society for Parasitology outreach program, Kenya. Currently, he serves on the editorial boards of Acta Parasitologica, Folia Parasitologica, Parasite, Parasitology International and Systematic Parasitology.

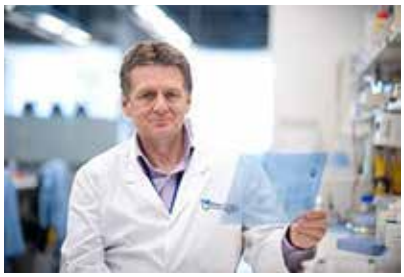
Tom also has a strong history of substantial contributions to the Australian Society for Parasitology. He is a former member of the editorial board of the International Journal for Parasitology, served as Councilor from 1995-1997 and as President-Elect, President and Vice-President from 2001-2003. Tom has also been a stalwart supporter of the Society through his research group, with students under his supervision having presented their research at every meeting of the ASP since he commenced his Lectureship position at the University of Queensland in 1992. Many of these students have since gone on to make their own contributions to the Society through service to the Council and through their own research groups.

For his major contributions to Parasitology through his scientific research and tireless mentorship of his current and former students and for his significant contributions to the Society, Thomas H. Cribb is elected Fellow of the Australian Society for Parasitology.

AWARDS FOR WEHI RESEARCHERS

ALAN COWMAN WAS AWARDED THE SORNCHAI LOOAREESUWAN MEDAL BY THE FACULTY OF TROPICAL MEDICINE AT MAHIDOL UNIVERSITY, THAILAND. THE MEDAL "RECOGNISES A RESEARCHER WHO HAS FOCUSED THEIR EFFORTS ON MALARIA AND MADE A SIGNIFICANT CONTRIBUTION TO THE FIELD."

Alan, Head of the Infection and Immunity Division at the Walter and Eliza Hall Institute, and his team have spent decades probing the inner workings of Plasmodium falciparum. His work has led to the creation of two potential malaria vaccines, one in clinical trials and another in preclinical development. He has also made important discoveries about the biology of the malaria parasite, including how it evades the immune system, infiltrates and remodels red blood cells to replicate and spread, and how it communicates with other parasites to trigger the next stage of infection.



Alan said the work had the potential to aid the quest to eradicate malaria. "We can use our understanding of how the parasite survives within a human host to identify weaknesses to target with new drugs," he said. "In addition, our work on malaria transmission and resistance informs eradication and control programs, providing knowledge to devise the best strategies for minimising malaria spread."

Alan said he was deeply honoured to receive the Sornchai Looareesuwan Medal. "Professor Sornchai Looareesuwan was an outstanding scientist who made a significant contribution to malaria research and I am humbled to receive the medal named in his honour," he said. "Our team has worked hard for many years to find new ways to tackle this disease and this award also recognises their outstanding efforts."

JUSTIN BODDEY RECEIVED WEHI'S TOP RESEARCH AWARD, THE BURNET PRIZE FOR HIS WORK ON THE PLASMODIUM PARASITE.

Justin said his work focused on discovering potential weaknesses in the parasite responsible for malaria. "The Plasmodium parasite invades red blood cells to hide from the immune system," he said. "To survive, malaria needs to renovate the blood cell it invades so that it can take up nutrients, multiply and evade removal by the immune system. With colleagues from the ACRF Chemical Biology Division, Justin discovered the mechanism the Plasmodium parasite uses to export proteins. "We developed a small molecule that blocks Plasmepsin V, a protein essential for protein export," Justin said. "This small molecule demonstrated that Plasmepsin V is essential for parasite survival, and also provided a potential new class of antimalarial drugs for treating malaria."

The Burnet Prize "recognises early career scientists for their pioneering research" and was established in 1987 through a bequest of former director, Sir Frank Macfarlane Burnet. It includes a cash prize of $2000 and a bronze plaque created by acclaimed Melbourne sculptor Michael Meszaros.

Text from Alan Gill, Science Communications Officer, WEHI

BARBEVAX: A NEW VACCINE

IN OCTOBER 2014, BROWN BESIER (DEPARTMENT OF AGRICULTURE AND FOOD WESTERN AUSTRALIA, ALBANY WA), DAVID SMITH (MOREDUN RESEARCH INSTITUTE, EDINBURGH, UK), ROBERT DOBSON (MURDOCH UNIVERSITY, WA) AND LEWIS KAHN (UNIVERSITY OF NEW ENGLAND, ARMIDALE NSW) RELEASED BARBERVAX, A NEW APPROACH TO HAEMONCHUS CONTORTUS CONTROL.

After many years of research in Scotland by the Moredun Research Institute, and recent collaboration with the Department of Agriculture and Food in Western Australia, the world's first sheep worm vaccine, and the first gut worm vaccine of any kind, has been produced.

Barbevax gives the sheep industries a new weapon in the fight against an old foe. It provides a major alternative to drench-based control, and will help manage drench resistance. Barbervax will be of particular benefit in the major Haemonchus-endemic regions, where frequent drenching is usually necessary to prevent sheep deaths, and where anthelmintic resistance has severely reduced drench options. The vaccine was launched in Armidale in the NSW Northern Tablelands, where resistance to the majority of drench classes occurs on most properties, and long-acting drench types often no longer provide prolonged protection. Barbervax is now registered for use in lambs.

Extensive trial work funded by Meat and Livestock Australia shows that the vaccine provides between 75 and 95% protection. In trials in NSW and WA, vaccinated sheep maintained low H. contortus worm egg counts over summer and autumn, when worm egg counts in unvaccinated control sheep reached many thousands of eggs per gram, and many controls would have died of anaemia without a salvage drench. Because the number of H. contortus worm larvae on the pasture remains low due to the reduced worm egg output, even the small percentage of sheep that do not respond to vaccination (as occurs with all vaccines) are not faced with significant worm larval intake.

Vaccines against livestock worms have been a major research subject for many decades, and the only other anti-worm vaccine available is against the lungworm of cattle, developed in the 1950s. It was the collaboration between the researchers from the Moredun Institute and the researchers from Western Australia that made Barbevax a reality.

Barbervax production will be increased in coming years from the first 300,000 doses, for use in Australia. Eventually, the vaccine will be marketed overseas for situations where H. contortus cannot be easily or sustainably controlled without the excessive use of drenches. Registration to use the vaccine in yearling and adult sheep will also be sought. Trials are proceeding in goats to confirm previous encouraging results. The vaccine will not be a "silver bullet", but used in a monitored control program it is expected to provide a significant new approach – at a competitive cost - to control of a very significant parasite.

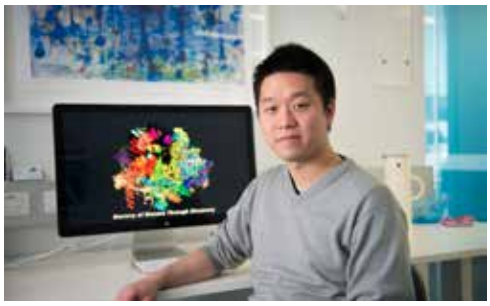
Source of text and image:
http://www.wormboss.com.au/news/articles/nonchemical-management/barbervaxa-new-approach-to-barbers-pole-worm-control.php

EMETINE, AN ANTIBIOTIC TO FIGHT MALARIA

RESEARCHERS AT WEHI ARE MAKING PROGRESS TOWARDS NEW ANTIMALARIAL DRUGS, AFTER REVEALING HOW AN ANTIBIOTIC CALLED EMETINE BLOCKS THE MOLECULAR MACHINERY THAT PRODUCES THE PROTEINS REQUIRED FOR MALARIA PARASITE SURVIVAL.

Although emetine is effective against malaria it is not used as a preventive drug due to its significant side effects. However, the work of Walter and Eliza Hall Institute researchers Dr Wilson Wong (pictured) , Dr Jake Baum and colleagues in showing how emetine attaches to and blocks the molecular machinery that makes the proteins required for malaria parasite survival has revealed new approaches for antimalarial drug development.

Their study, involving collaborators led by Dr Sjors Scheres from the MRC Laboratory of Molecular Biology in Cambridge, UK and the Bio21 Institute in Melbourne was published in the journal eLife.



Dr Wong said the study examined the parasite cell's protein-making machinery, called the ribosome, visualising for the first time the structure of this 'protein complex' in the malaria parasite. "The ribosome is responsible for constructing all proteins inside the cell, based on the DNA 'blueprint'," he said. "Antibiotics such as emetine kill the malaria parasite by binding to its ribosome and preventing the parasite from building the proteins it needs to produce energy, grow, reproduce and evade the immune system."

Dr Wong said knowledge of emetine and related antibiotics such as pactamycin could be used as the basis for developing new antimalarial drugs. "Our structure is an exciting discovery as it gives a clear path forward in developing new drugs to tackle this deadly disease. We have found features of the parasitic ribosome that are not found in the human form. Drug makers could exploit these features in order to specifically target the production of proteins within the malaria parasite," Dr Wong said.

"We are now working with our colleagues from the institute's ACRF Chemical Biology division to develop new molecules based on emetine and pactamycin. Knowing exactly how these antibiotics work will enable development of new antimalarial drugs that replicate the active component of these antibiotics while changing the parts that make it toxic to patients," Dr Wong said.

Dr Jake Baum, now at the Imperial College of London, UK, said the study used a new imaging technique called cryo-electron microscopy (cryo-EM) to create the structure of the malaria parasite's ribosome. "Cryo-EM is an exciting technique that allows us to visualise the structure of protein complexes directly from cellular material, instead of having to crystallise them which is often difficult to do and requires huge amounts of material," Dr Baum said.

The research was funded by the NHMRC, ARC, Wellcome Trust (UK), UK Medical Research Council, Australia–Europe Malaria Research Cooperation (OzEMalaR), Human Frontier Science Program and the Victorian Government.

Cryo-EM structure of the Plasmodium falciparum 80S ribosome bound to the anti-protozoan drug emetine", Wilson Wong, Xiao-chen Bai, Alan Brown, Israel S Fernandez, Eric Hanssen, Melanie Condron, Yan Hong Tan, Jake Baum, eLife 2014;3:e03080

Outreach

AS WE CELEBRATED THE 50TH ANNIVERARY OF THE ASP AND AUSTRALIAN PARASITOLOGY RESEARCH, OUR ASP-INSPIRING AUSTRALIA EVENTS AND SOME EXCELLENT MEMBER-RUN OUTREACH EVENTS WERE A HIGHLIGHT OF THE YEAR.

Our wonderful colourful parasite flags adorned the flagpoles leading up to Parliament House in Canberra and brightened up a Canberra winter from June - August 2014.

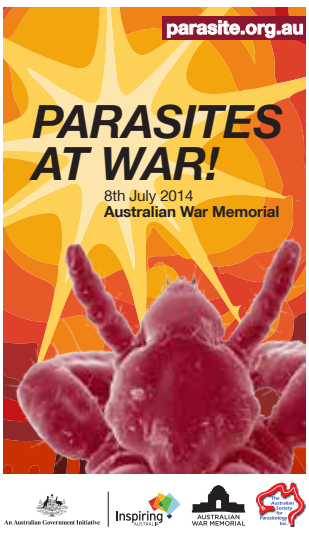
Parasites in Focus was on display at the CSIRO Discovery Centre 9 June –3 August 2014, before moving on to WEHI for use during their public events.

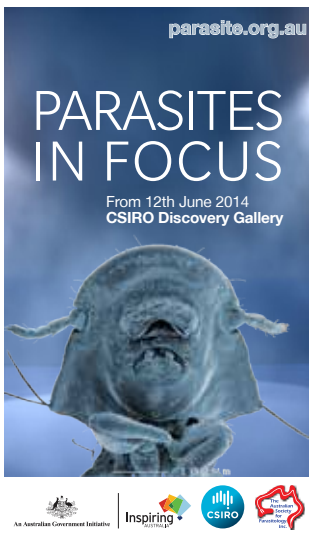
At the Australian War Memorial (AWM) in Canberra we ran a two-part public lecture series "Parasites: the war years" in June and August which was well attended and very well received by the audiences who included many AWM members and staff. Parasites have been affecting soldiers for centuries in times of both war and peace. In "War on Parasites", Sunday 29th June, Professor Alex Loukas from the Australian Society for Parasitology gave an insight on parasitic helminths and Dr Graham Mitchell gave a wonderful introduction to parasites and war.

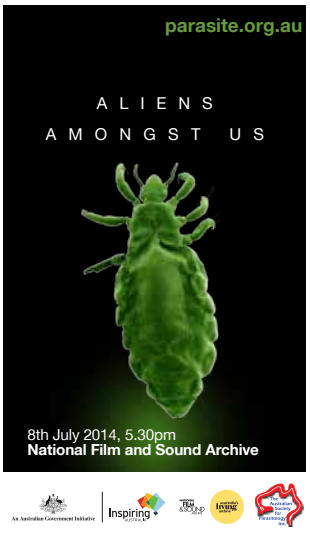
Professor Nick Smith and Lisa Jones ran a War Worms interactive workshop for children aged 5+ at the Australian War Memorial on Tuesday 8th July. Nick also gave a parasitological insight into the 1979 cult American science-fiction horror movie Alien directed by Ridley Scott, at our "Aliens amongst us" event, Tuesday 8th July at the National Film and Sound Archive (NFSA).

"Malaria in wartime" lecture on Sunday 17th August, from 2pm at the Australian War Memorial Lecture Theatre featured Dr Rowena Martin from the Australian Society for Parasitology who gave an excellent insight into malaria in wartime and discussed the latest malaria research and control strategies. Prof Nick Smith gave a wonderful introduction about parasites in wartime.

The final event in our ASP-Inspiring Australia grant funded program was parasites at PechaKucha night Cairns - an entertaining evening covering a range of topics – 20 images x 20 seconds – at the Tanks Arts Centre and two of the presenters were Michael Smout and Lisa Jones from the Australian Society for Parasitology Inc. with their parasite stories.







Outreach cont.

Left: flag designs Above: ASP-Inspiring Australia events 2014

ASP MEMBER OUTREACH: GTAC

A "PARASITES IN FOCUS" STUDENT PROGRAM TOOK PLACE AT GTAC ON FRIDAY 15TH AUGUST 2014 DR AARON JEX AND BRENDAN ANSELL (VETERINARY SCIENCES, UNIVERSITY OF MELBOURNE) ALONG WITH GTAC'S TONY CHIOVITTI AND HIS TEAM DELIVERED THE PROGRAM.

The program was attended by 106 students of Years 10 & 11 and 11 teachers. The program was co-ordinated by Tony Chiovitti and Rachael Rutkowski of GTAC and comprised the following elements.

An opening address by Dr Aaron Jex (Faculty of Veterinary Sciences, University of Melbourne). Aaron introduced students to the field of parasitology, discussing parasite biology and the global impact of parasites on humans. At the conclusion of the presentation, many students asked Aaron probing questions about parasites, how they are studied, and how the conditions they cause are managed.





The students then participated in three rotating 1-hour laboratory workshops where students worked in small groups of ~7 students each mentored by practising scientists. The three workshops were:

- **Hooked on Parasites**. Students used microscopy to explore how endoparasites locate, attach, feed and reproduce in their hosts. Particular case studies included equine bot fly larvae and tape worms, plus chemotaxis experiments with live nematodes.
- **A Case of Cross-Border Detection.** An exploration in the application of biotechnology to medical parasitology, students used PCR and gel electrophoresis to diagnose which Plasmodium species was infecting a patient recently returned from an adventure holiday.
- **Parasites Getting it Under Control** Using the NetLogo simulation software, students modelled the impacts of the parastoid wasp, Trichogramma carverae to assess it as a potential biological control for the agricultural pest, the light brown apple moth.

Morning tea and lunch were intended to create a conference-style ambience enabling students, teachers, and scientists to interact informally. GTAC thanks the Australian Society for Parasitology for its generous grant of $1,000 to support the program. In addition, GTAC thanks Dr Aaron Jex and Brendan Ansell (Veterinary Sciences, University of Melbourne) for their contribution to the program's delivery and Christine Andersen (Veterinary Sciences, University of Melbourne) for providing resources for the Hooked on Parasites workshop.

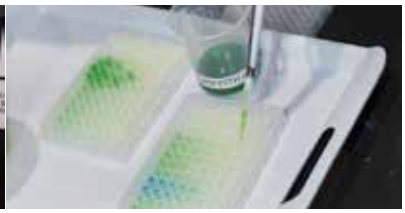
Report prepared for the Australian Society for Parasitology by Tony Chiovitti, GTAC.. Photos courtesy Tony Chiovitti, GTAC.

ASP MEMBER OUTREACH: EKKA

PARASITES FEATURED AT THE BRISBANE EKKA ON THE 8TH AUGUST 2014 WHEN ASP MEMBERS KATHY ANDREWS AND TINA SKINNER-ADAMS FROM GRIFFITH UNIVERSITY ESKITIS INSTITUTE FOR DRUG DISCOVERY RAN A HANDS-ON DISPLAY ENTITLED "HOW CAN TREES HELP CURE DISEASE?"

The stall was manned by 16 volunteers from the Eskitis Institute, including ASP members Kathy Andrews, Tina Skinner-Adams, Jessica Engel, and Sabine Fletcher. The ~6m long display was visually stunning with Eskitis, ASP, and Street Science rs, posters and a canvas photo art piece on display. The display targeted children aged 4-12 with the following activities:





- A drug discovery timeline puzzle comprising flasks containing bark, bark extract, assay tubes, pills etc. Visitors were invited to put the flasks in the correct order with a small description card explaining each step. Examples of drugs that were discussed included the antimalarial drug artemisinin.
- A workstation where children could make a simple molecule (H20) out of plasticine and straws using simple instructions.
- Two workstations where children were able to perform a "drug" dilution series with a micro pipette and coloured water – this was extremely popular! Children were told that this is the kind of process that is used in the lab when looking for new drugs, including antimalarial agents.
- A microscope displaying a Giemsa-stained thin blood film of P. falciparum infected erythrocytes (100x oil immersion). Children were shown pictures of malaria parasites and given a simple description of the disease and health problem malaria causes. This was also very popular.

Throughout the day we gave away prizes to inspire children: 220 ASP-sponsored pens (with highlighter on one end) with a stylized image of a rupturing Plasmodium schizont and the simple educational message "Plasmodium parasites cause malaria"; and hundreds of colouring-in, crossword and find-a-word activities.

Over 3,000 school groups were booked into the EKKA, and several hundred directly viewed or actively participated in our display. There was a constant stream of school groups at the display.

Our display was visited by Mr Jeffrey L Bleich (former US Ambassador and Special Counsel to the President of the US) and Mr Mario Pennisi from Life Sciences Queensland. Kathy Andrews discussed the malaria situation with Mr Bleich, who in his former role had been involved with US decisions around malaria and other health matters.

Report and images courtesy Kathy Andrews and Tina Skinner-Adams

ASP MEMBER OUTREACH: SCIENCE IN ACTION

THE ACT BRANCH OF THE ASP, ALONGSIDE ~20 OTHER SCIENCE SOCIETIES PARTICIPATED IN 'SCIENCE IN ACTION', A NATIONAL SCIENCE WEEK EVENT SUPPORTED BY THE ACT GOVERNMENT AND THE ANU.

Melanie Ridgway, Caitlyn Flint, Edwin Tjhin, Erick Tjhin, Johanna Dups, Jonathan Fu, Keith Emerson, Margaret McKinnon, Markus Winterberg, Meng Zhang, Renate Zelger, Sanduni Hapuarachchi, Sashika Richards, Sarah Shafik, Vanessa Howieson, 'Vincent' Yi Aw, and Richard Allen were all part of the ASP and ANU team who participated in 'Science in ACTion', and the 'ANU Science Carnival', 15 & 16 August 2014 at ANU in Canberra. This well organised event allowed us to highlight the world of parasites, their relevance to humans, work carried out by ASP members at the ANU, to local high school and university students, and to the general public.




On Friday, several hundred students from ACT high schools and ANU visited on Saturday we welcomed large numbers of the general public. We ran several activities: The 'What Parasite is that?' game (where 10 images of parasites were to be matched with 10 hosts), enjoyed by more than 300 individuals over the 2 days. We estimate that more than double that number strolled past our booth at the Saturday event alone. At one point, we had students standing 6 deep in front of the images completing the quiz, then lining up to have their answers vetted, and receive the high-calorie reward promised for all quiz participants. In addition to chocolate, we had a number of small items to give away, among them Head Lice combs, more popular than we had expected. A duplicate version of the game ran simultaneously on the Friday for the ANU's Science Carnival held in the Student Union Court. Support for this function was received from the ANU's Science Communication Department.

Posters, designed by ANU parasitology students and ASP members, explained to the lay person the interesting and unusual lives of a number of human and animal parasites, were displayed at the booth. We set up a large screen to show a variety of entertaining video's exhibiting a range of parasites and their life cycles. Microscopes were set up at the booth enabling visitors to look at slides of different stages of malaria and multi-celled parasites. Badges were made using a variety of parasite images and worn by ASP members who took turns at running the booth. Parasite masks were made by members and students for children who visited the booth.

Many of the Science in ACTion events and booths were featured in an article on ABConline (http://www.abc.net.au/news/2014-08-17/science-in-action-draws-crowds-in-canberra/5676414).

Although confident of having designed an entertaining and interesting display and range of activities, we were pleasantly surprised at the high degree of enthusiasm the ASP booth generated among high school and university students, and in the general public. The organisers of 'Science in ACTion' were impressed with the way that the display, and those who manned the booth, engaged the visitors to the event. Our many thanks to the many ASP members and students who gave up their experimental time and/or their weekend to contribute to the event's success.

By Richard Allen and Melanie Ridgway,

ASP MEMBER OUTREACH: BURWOOD

CHRISTIE FOSTER AND VICTORIA MORIN-ADELINE, PHD CANDIDATES FROM THE UNIVERSITY OF SYDNEY, RECENTLY TAUGHT THREE GRADE 5 CLASSES AT BURWOOD PUBLIC SCHOOL (NSW) ABOUT ALL PARASITES GREAT AND SMALL.

"Woahhh, they look so different!" – These were the words that echoed throughout the class upon seeing us enter the room.

On the 24th of March we conducted an ASP outreach event at Burwood Public School, NSW, where over the course of the day we ran three classes for a total of approximately 100 eager and inquisitive grade 5 children (aged 9-11 years old). Our self-designed lesson aimed to teach the kids all about parasitology. Starting with the basic concept of the parasitic lifestyle, we then moved on to the different categories of parasites, with a special focus on those relevant to primary school-aged children, such as tapeworm and head lice.

To emphasise the importance of hygiene in preventing transmission, our first fun and interactive activity involved the "GlitterBug" kit – a UV-fluorescent hand lotion which simulates germs. Using this kit, some props and several student volunteers, we showed the classes: A) how thoroughly hands need to be washed; and B) that germs can be transmitted by handshaking, unwashed fruits, and playing with pets.

During each session we passed around laminated colour posters that we printed from the ASP's "Parasites in Focus" collection, as well as some inflatable ticks and fleas and an anatomical model heart containing heartworms which were all kindly donated by Merial. Jars of "gross" worms and ticks were also on display, and each student took turns looking at fleas under the light microscopes that we brought with us to the school.

We had LOTS of questions from genuinely interested kids, both about parasites and ourselves. And it turns out we were certainly NOT what they were expecting when they were told that scientists would be visiting the school; hence their reaction described at the start of this report! Prior to our arrival, the general consensus was that scientists are "nerdy" and are males with white lab coats, glasses, crazy hair and who mix colourful solutions (see accompanying photo!!). We have now changed their perception of scientists, and through our educational sessions have hopefully inspired some up-and-coming parasitologists of the future!

Overall, we had a great day and received lots of positive feedback from the students and their teachers. We would like to say a big thank you to the ASP for supporting our outreach initiative, and thanks to Mr Mike Taylor from Burwood Public School for his help in planning and coordinating our visit.

Written by Christie Foster and Victoria Morin-Adeline,
The University of Sydney

Outreach cont.

Member-reported outreach and media

Rob Adlard

Radio live 4BC Mornings with Patrick Congren 17th July 2014 – ASP Fellowship, cost of parasites to Australia and QM role in research and collections.

Radio live ABC Regional with Rebecca McLaren 22nd July 2014 – ASP Fellowship, cost of parasites to Australia and QM role in research and collections.

Radio live 4BC Mornings with Patrick Congren 2nd May 2014 – interview advertising the release of QM's first Smart Phone App Field Guide to Queensland Fauna.

Kathy Andrews and Tina Skinner-Adams

Organized a major outreach event on the 8th August for a hands on display entitled "How can trees help cure disease?" on the opening day of the 2014 EKKA. Highlights: 6m long display; 15 Eskitis volunteers, distributed ~200 Eskitis Institute/Nature Bank bookmarks with scanner codes linking back to the Eskitis website, 200 ASP-sponsored pens with a stylized image of a rupturing Plasmodium schizont and the simple educational message "Plasmodium parasites cause malaria", and hundreds of colouring-in, crossword and find-a-word activity sheets. Several hundred school children visited display. Display was visited by Mr Jeffrey L Bleich (former US Ambassador and Special Counsel to the President of the US) and Mr Mario Pennisi from Life Sciences Queensland. Full report was circulated to ASP.

Karina De Sousa
(PhD student at QIMR Berghofer Molecular Vaccinology Laboratory)

Judged at the Kelvin Grove State College 17th Annual Science Fair. Brisbane, Australia.

Performed as a volunteer Science Ambassador for QIMR Berghofer, Brisbane, Australia.

Performed outreach activity in the form of an interactive Science demonstration at Ulladulla High School, Ulladulla, NSW, Australia.

Volunteered as a Welcoming Comittee member at QIMR Berghofer Medical Research Institute's 2nd Open Day

Robin Gasser

News items for:

Tang YT, Gao X, Rosa BA, Abubucker S, Hallsworth-Pepin K, Martin J, Tyagi R, Heizer E, Zhang X, Bhonagiri-Palsikar V, Minx P, Warren WC, Wang Q, Zhan B, Hotez PJ, Sternberg PW, Dougall A, Gaze ST, Mulvenna J, Sotillo J, Ranganathan S, Rabelo EM, Wilson RK, Felgner PL, Bethony J, Hawdon JM, Gasser RB, Loukas A, Mitreva M (2014) Genome of the human hookworm Necator americanus. Nature Genetics 46, 261-269. doi: 10.1038/ng.2875

- http://www.abc.net.au/science/articles/2014/01/20/3928649.htm
- http://www.natureasia.com/en/research/highlight/9021/
- http://www.skynews.com.au/health/article.aspx?id=943437&vId
- http://www.voanews.com/content/researchers-map-genetic-sequence-of-parasitic-worm/1833388.html
- http://www.digitaljournal.com/life/health/hookworm-genome-reveals-potential-treatment-targets/article/366606
- http://www.business-standard.com/article/news-ani/researchers-decode-dna-of-blood-sucking-worms-114012000211_1.html
- http://www.theaustralian.com.au/higher-education/hookworm-genome-helps-potential-treatment/story-e6frgcjx-122680612519
- http://phys.org/news/2014-01-hookworm-genome-sequenced.html
- http://www.sbs.com.au/news/article/2014/01/20/hookworm-genome-helps-potential-treatment
- http://www.livescience.com/42707-hookworm-genome-decoded.html

Outreach cont.

- http://www.huffingtonpost.com/2014/01/20/hookworm-genome-sequenced-new-treatments-infection_n_4632113.htm
- http://www.redorbit.com/news/science/1113050344/researchers-decode-genome-of-blood-sucking-worm-that-infects-worlds-poor-012014/
- http://www.ibtimes.co.uk/scientists-decode-dna-bloodsucking-hookworm-parasite-1432997
- http://www.laboratoryequipment.com/news/2014/01/researchers-decode-hookworm-dna
- http://www.science20.com/news_articles/bloodsucking_worms_poor_minorities_impacted_most-128025
- http://zeenews.india.com/news/science/researchers-decode-dna-of-blood-sucking-worms_90541
- http://www.scienceworldreport.com/articles/12280/20140120/scientists-decode-dna-blood-sucking-hookworm.htm
- http://www.ad-hoc-news.de/scientists-said-sunday-they-had-unravelled-the-genome-of-the--/de/News/33965612
- http://www.huffingtonpost.com/2014/01/20/hookworm-genome-sequenced-new-treatments-infection_n_4632113.html?ir=Science
- http://www.globalpost.com/dispatch/news/afp/140119/hookworm-genome-reveals-potential-treatment-targets
- http://www.biosciencetechnology.com/news/2014/01/dna-infectious-blood-sucking-worm-decoded#.Ut7pdYVxWfU
- http://www.parentherald.com/articles/3650/20140120/decoded-dna-of-blood-sucking-worm-that-infects-worlds-poor.htm
- http://www.genomeweb.com/sequencing/hookworm-genome-protein-analysis-offers-possible-therapeutic-targets?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+genomeweb+%28GenomeWeb+%C3%9Cberfeed%29
- http://articles.timesofindia.indiatimes.com/2014-01-20/science/46373549_1_worm-genome-anemia
- http://www.business-standard.com/article/news-ians/hookworm-that-infects-world-s-poor-decoded-114012000400_1.html
- http://www.japantimes.co.jp/news/2014/01/20/world/genome-paves-way-to-parasite-remedy/
- http://www.health24.com/Lifestyle/Environmental-health/News/Scientists-find-new-ways-to-beat-hookworm-20140120
- http://lifescientist.com.au/content/molecular-biology/news/hookworm-genome-sequenced-26085156
- http://www.scidev.net/global/genomics/news/hookworm-genome-sequence-helps-identify-drug-candidates.html
- http://www.health24.com/News/Unravelling-hookworm-genome-may-lead-to-vaccine-20140119
- http://www.canindia.com/2014/01/hookworm-that-infects-worlds-poor-decoded/

News items for:

Young ND, Nagarajan N, Lin SJ, Korhonen PK, Jex AR, Hall RS, Safavi-Hemami H, Hofmann A, Kaewkong W, Bertrand D, Gao S, Seet Q, Wongkham S, The BT, Wongkham C, Intapan PM, Maleewong W, Yang X, Hu M, Wang Z, Sternberg PW, Tan P, Wang J, Gasser RB (2014) The Opisthorchis viverrini genome provides insights into life in the bile duct. Nature Communications 5, 4378. doi: 10.1038/ncomms5378.

- http://www.medicalnewstoday.com/articles/279658.php
- http://phys.org/news/2014-07-scientists-code-cancer-causing-parasite.html
- http://mdhs.unimelb.edu.au/news/scientists-crack-code-cancer-causing-parasite
- http://www.labonline.com.au/news/68683-Scientists-sequence-genome-of-cancer-causing-parasite
- http://newsroom.melbourne.edu/news/scientists-crack-code-cancer-causing-parasite
- http://southernpaws.org/2014/07/cancer-causing-liver-flukes-genome-is-fully-sequenced/
- http://www.healthcanal.com/cancers/53026-scientists-crack-the-code-of-a-cancer-causing-parasite.html

Outreach cont.

- http://www.technology.org/2014/07/16/scientists-crack-code-cancer-causing-parasite/
- http://www.news-medical.net/news/20140716/Scientists-sequence-genome-of-Asian-liver-fluke-a-cancer-causing-parasite.aspx
- http://www.medicalnewstoday.com/articles/279658.php?tw
- http://www.news-medical.net/news/20140921/Sequencing-the-Asian-liver-fluke-genome-an-interview-with-Dr-Neil-Young.aspx
- http://www.news-medical.net/news/20140911/Scientists-crack-genetic-code-of-liver-fluke-parasite.aspx

News items for:

Jex AR, Nejsum P, Schwarz EM, Hu L, Young ND, Hall RS, Korhonen PK, Liao S, Thamsborg S, Xia J, Xu P, Wang S, Harris TW, Scheerlinck J-P, Hofmann A, Sternberg PW, Wang J, Gasser RB (2014) Genome and transcriptome of the porcine whipworm Trichuris suis. Nature Genetics 46, 701-706. doi: 10.1038/ng.3012.

- http://phys.org/news/2014-06-pig-whipworm-genome-aid-autoimmune.html
- http://www.medicaldaily.com/genome-pig-whipworm-offers-insight-how-they-can-help-treat-immune-disorders-288316
- http://www.asianscientist.com/in-the-lab/trichuris-suis-genome-autoimmunity-2014/
- http://www.news-medical.net/news/20140618/Pig-whipworm-genome-could-lead-to-new-treatment-options-for-human-diseases.aspx
- http://www.healthcanal.com/immune-system/51996-researchers-map-parasite-with-promising-effect-on-autoimmune-diseases.html
- http://www.topix.com/forum/science/genetics/T5P5AOTP5G8PRAKAR
- http://www.medindia.net/news/pig-whipworm-genome-may-be-modified-to-help-treat-autoimmune-diseases-137781-1.htm
- http://www.natureasia.com/en/research/highlight/9318
- http://www.sciencedaily.com/releases/2014/06/140620103205.htm
- http://esciencenews.com/articles/2014/06/20/the.pig.whipworm.genome.may.aid.treat.autoimmune.diseases
- http://news.ku.dk/all_news/2014/06/researchers-map-parasite-with-promising-effect-on-autoimmune-diseases/
- www.thehealthsite.com/news/genes-in-pig-worm-to-treat-autoimmune-diseases/
- http://www.eurekalert.org/pub_releases/2014-06/bs-tpw062014.php
- https://app.griffith.edu.au/news/2014/06/17/parasite-study-may-improve-global-health/
- http://www.genomics.cn/en/news/show_news?nid=100030
- http://healthsciences.ku.dk/news/news2014/researchers-map-parasite-with-promising-effect-on-autoimmune-diseases/
- http://www.biocompare.com/Life-Science-News/163943-The-Pig-Whipworm-Genome-May-Aid-To-Treat-Autoimmune-Diseases/
- http://brisbaneglobalcafe.com/Stories/Whipworm-turns-showing-parasite-benefits

Radio and television: 16/06/2014 Herald Sun article; ABC Radio 774 Red Symonds (live to air); 3AW 8 am news report; 3AW Neil Mitchell (live to air); ABC Radio PM; Channel 9 6 pm news report.

Paul Giacomin

I presented a public lecture "Worms: A cure for Inflammatory Diseases?" as part of the Australian Society for Immunology "Day of Immunology" event in Townsville QLD in 2014.

Our publication relating to the therapeutic efficacy of hookworms in treating coeliac disease in the Journal of Allergy and Clinical Immunology had substantial mainstream local and international media impact, including features on National TV, radio interviews,

Outreach cont.

domestic and international newspaper Articles and has an Altmetrics score of 155, ranking #2 all-time for the Journal (of 2864 total articles) and in the top 1% of all published articles.

Tommy Leung

Parasitology-related public outreach in 2014 includes:

Articles on The Conversation (which together have racked up roughly 293K views as of 31/12/2014):

- https://theconversation.com/good-parasite-bad-parasite-nature-has-a-job-for-everyone-23279
- https://theconversation.com/theres-just-one-thing-stopping-killer-shrimp-from-wreaking-even-more-havoc-24711
- https://theconversation.com/the-crab-castrating-parasite-that-zombifies-its-prey-27200
- https://theconversation.com/how-some-parasites-can-end-up-in-your-eye-and-turn-you-blind-2929

I am still doing a regular radio segments for the local ABC New England radio station and there were a few episodes (available online as podcasts) last year where I talk about parasites and parasitoids:

- https://soundcloud.com/abcnsw/creepy-but-curious-hairworm
- https://soundcloud.com/abcnsw/creepy-but-curious-the-emerald
- https://soundcloud.com/abcnsw/creepy-but-curious-the-silence-of-the-crickets

And as usual, I am still regularly writing the Parasite of the Day blog, http://dailyparasite.blogspot.com And speaking of the blog, it got a recommendation from Ed Yong (writer of "Not Exactly Rocket Science") when he gave a TED talk last year:

- http://www.ted.com/talks/ed_yong_suicidal_wasps_zombie_roaches_and_other_tales_of_parasites/recommendations

Rowena Martin

Presentations to the general public:

40-min public lecture and afternoon tea discussion at the Australian War Memorial, Canberra.

Television and radio

Radical action needed to prevent drug-resistant malaria spread, ABC The World.

New research may help overcome malaria drug resistance, WIN TV Evening News.

New role for chloroquine in fight against malaria, Radio Australia.

Scientists find new way to fight Malaria drug resistance, ABC 666 Radio.

Print and web articles

The key to evolution: Multiple mutational pathways in sequence, Forbes.

Connection between war and parasites helps researchers in quest for malaria treatment, The Canberra Times.

Researcher warns radical action needed to prevent spread of drug-resistant malaria parasite, ABC Online News.

Researchers hope for new role for chloroquine in fight against malaria, ABC Online News.

ANU scientists find new way to fight malaria drug resistance: Australian Life Scientist, Shanghai Daily, Delhi Daily News, The Financial Express, etc.

Outreach cont.

New strategy emerges for fighting drug-resistant malaria: Science Daily, News Medicinal, Yahoo News India etc.

James McCarthy

24 July 2014. "Bubonic plague hits China" – 621 ABC Brisbane. Radio interview regarding the bubonic plague epidemic in China.

1 December 2014. "Best and Brightest" – QWeekend. High Achiever recognition in the Courier Mail.

16 December 2014. "Don't forget Malaria" - MJA Insights. Interview on malaria diagnosis and treatment in Australia.

Michelle Power

Media

Research on Giardia in seals (Delport et al, IJP:PAW) was covered by news reports (mainly Science internet sites). PhD student Tiffany Delport determined that Giardia species and strains present in sea lions were the same as those strains typically observed in humans and other terrestrial vertebrates. The outcomes suggest that the presence of G. duodenalis in the endangered Australian sea lion is likely the result of dispersal from human or domestic animal sources. Sea lions are endangered and threats of disease maybe of further detriment to dwindling populations. Tiffany's data will be used to consider how seal lion habitat can be managed, particularly in areas near wastewater outlets, risks of tourist visitations and also how captive management can be improved.

Outreach

Australian Museum Science Festival (12-21 August 2014) – Volunteer on display desk

Endeavor Hills Primary School Victoria – interactive 'parasites in Antarctica session' in relation to Year 5/6 Curriculum on Antarctica

Tina Skinner-Adams

Scientists in School Program – Several Visits to Ferny Grove High School to discuss parasitology, general biology and careers in science (Rat dissection (Year 9), Infectious diseases using malaria as an example (Year 12) and career opportunities in science (Year 10).

Presentation – Hillbrook Anglican School – Brief science and research presentation to the entire school.

Contribution to the National Benefit

The contribution of ASP Network for Parasitology to Australia's fundamental, strategic and applied research effort is evident in the quantity and quality of publications listed in Appendix 1 for Australia's National Research Priorities. With regard the Network more directly, 2014 has been a year where national and international collaboration has been strongly fostered by the Network through its, and OzeMalaR's, Researcher Exchange, Training and Travel Funds. Additionally, the Network has created substantial training and networking opportunities for research students and early career researchers, again through these Researcher Exchange, Training and Travel Funds. Young researchers are publishing their research undertaken on Network funding and winning grants and fellowships, either as spin-offs of research undertaken under the Network Researcher Exchange, Training and Travel Award scheme or as a result of linkages forged at Network-sponsored events. Fostering the exposure, profile and opportunities of young researchers is seen as key to the future of parasitology research in Australia and is, therefore, a high priority for the ASP Network.

Statistical Snapshot 2014

Number of (active) members;

Australian Society for Parasitology Incorporated (ASP) had 607 financial members in 2014

Number of ECRs funded to do various activities;

88 ASP Student Members were given funding assistance to attend the 2014 ASP Annual Conference via the ASP Student Member Conference Grant scheme.

37 students and ECRs were awarded ASP Network or OzeMalaR Researcher Exchange, Training and Travel, out of a total of 44 awards made in 2014.

Conferences supported;

2014 ASP Annual Conference and WAAVP attended by nearly 300 parasitologists from 12 countries, including over 280 Australians.

Number of international visits;

The ASP, including its journals, funded eight international visitors to Australia (as invited lecturers to the 2014 Annual Conference);

The ASP funded 39 researchers to travel to, and work in, overseas laboratories in 2014.

Number of publications produced;

493 printed publications.

Research funding received;

In 2014, Australia's parasitologists received 37 research grants securing more than $17 million in new research grant funding.

Websites

ASP web site | http://www.parasite.org.au

ASP Facebook page | http://www.facebook.com/ASParasitology

ASP Twitter account |https://twitter.com/#!/AS_Para

ASP YouTube channel | http://www.youtube.com/user/ASPParasiteNetwork

The ASP's Google Plus account | https://plus.google.com/100938254649203422506#100938254649203422506/posts

OzEMalar website | www.ozemalar.org.au

OzEMalaR Facebook page | http://www.facebook.com/ozemalar

OzEMalaR Twitter account | https://twitter.com/#!/OzEMalaR

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Appendix 1: Publications by ASP Members in 2014

WHERE APPLICABLE, LINKS TO ABSTRACTS IN PUBMED HAVE BEEN PROVIDED FOR 2014 PUBLICATIONS.

A Changing Environment

Adlard RD, Miller TL, Smit NJ. The butterfly effect: parasite diversity, environment, and emerging disease in aquatic wildlife. Trends Parasitol. 2014 Dec 2. pii: S1471-4922(14)00184-6.

Alanazi AD, Said AE, Morin-Adeline V, Alyousif MS, Slapeta J Quantitative PCR detection of Theileria equi using laboratory workflows to detect asymptomatic persistently infected horses Vet Parasitol. 2014 Dec 15;206(3-4):138-45.

Andres MJ, Pulis EE, Cribb TH, Overstreet RM Erection of the haploporid genus Litosaccus n. g. and its phylogenetic relationship within the Haploporidae Nicoll, 1914 Syst Parasitol. 2014 Nov;89(3):185-94.

Barker SC, Walker AR, Campelo D A list of the 70 species of Australian ticks; diagnostic guides to and species accounts of Ixodes holocyclus (paralysis tick), Ixodes cornuatus (southern paralysis tick) and Rhipicephalus australis (Australian cattle tick); and consideration of the place of Australia in the evolution of ticks with comments on four controversial ideas. Int J Parasitol. 2014 Oct 15;44(12):941-53

Barnett LJ, Miller TL, Cribb TH A review of the currently recognised opecoelid cercariae, including the identification and emergence ecology of Cercaria capricornia XII (Digenea: Opecoelidae) from Nassarius olivaceus (Gastropoda: Nassariidae) in Central Queensland, Australia Parasitol Int. 2014 Oct;63(5):670-82.

Barnett LJ, Miller TL, Cribb TH A review of the currently recognised zoogonid cercariae, including the identification and emergence ecology of Cercaria capricornia XI (Digenea: Zoogonidae) from Nassarius olivaceus (Gastropoda: Nassariidae) in Central Queensland, Australia. Folia Parasitol (Praha). 2014 Aug;61(4):322-30

Berkhout BW, Lloyd MM, Poulin R, Studer A Variation among genotypes in responses to increasing temperature in a marine parasite: evolutionary potential in the face of global warming Int J Parasitol. 2014 Nov;44(13):1019-27

Beveridge, I New species of parasitic nematodes of the genus Cloacina (Nematoda: Strongyloidea) from the banded hare wallaby, Lagostrophus fasciatus (Marsupialia: Macropodidae) Transactions of the Royal Society of South Australia 2014 138: 249-256

Beveridge I A review of the genus Paramoniezia Maplestone et Southwell, 1923 (Cestoda: Anoplocephalidae), with a new genus, Phascolocestus, from wombats (Marsupialia) and redescriptions of Moniezia mettami Baylis, 1934 and Moniezia phacochoeri (Baylis, 1927) comb. n. from African warthogs (Artiodactyla) Folia Parasitol (Praha). 2014 Feb;61(1):21-33

Beveridge I, Bray RA, Cribb TH, Justine JL Diversity of trypanorhynch metacestodes in teleost fishes from coral reefs off eastern Australia and New Caledonia Parasite. 2014;21:60.

Beveridge I, Gasser RB Diversity in parasitic helminths of Australasian marsupials and monotremes: a molecular perspective Int J Parasitol. 2014 Oct 15;44(12):859-64.

Beveridge, I., Jabbar, A. & Shuttleworth, M. New species of Cloacina Linstow, 1898 (Nematoda: Strongylida) from the swamp wallaby, Wallabia bicolor (Desmarest, 1804) (Marsupialia). Transactions of the Royal Society of South Australia 138: 237-248.

Beveridge I, Nguyen H, Nyein S, Cheng C, Koehler A, Shuttleworth ME, Gasser RB, Jabbar Aription of Cloacina atthis sp. nov. from the stomach of the euro (Macropus robustus) (Marsupialia: Macropodidae) from Western Australia based on morphological and molecular criteria Parasitol Res. 2014 Sep;113(9):3485-93

Beveridge I, Spratt DM Biodiversity and parasites of wildlife:

Appendix 1 cont.

Helminths of Australasian marsupials Trends Parasitol. 2014 Nov 26. pii: S1471-4922(14)00182-2.

Born-Torrijos A, Poulin R, Raga JA, Holzer AS Estimating trematode prevalence in snail hosts using a single-step duplex PCR: how badly does cercarial shedding underestimate infection rates? Parasit Vectors. 2014 May 27;7:243

Bray RA, Cribb TH, Waeschenbach A, Littlewood DT Molecular evidence that the genus Cadenatella Dollfus, 1946 (Digenea: Plagiorchiida) belongs in the superfamily Haploporoidea Nicoll, 1914 Syst Parasitol. 2014 Sep;89(1):15-21

Catalano SR, Whittington ID, Donnellan SC, Gillanders BM Dicyemid fauna composition and infection patterns in relation to cephalopod host biology and ecology Folia Parasitol (Praha). 2014 Aug;61(4):301-10

Clark N.J., Adlard R.D. & Clegg S.M. First evidence of avian malaria in Capricorn silvereyes (Zosterops lateralis chlorocephalus) on Heron Island Sunbird 2014 44:1-11

Cribb TH, Adlard RD, Bray RA, Sasal P, Cutmore SC Biogeography of tropical Indo-West Pacific parasites: a cryptic species of Transversotrema and evidence for rarity of Transversotrematidae (Trematoda) in French Polynesia Parasitol Int. 2014 Apr;63(2):285-94

Cribb TH, Bott NJ, Bray RA, McNamara MK, Miller TL, Nolan MJ, Cutmore SC Trematodes of the Great Barrier Reef, Australia: emerging patterns of diversity and richness in coral reef fishes Int J Parasitol. 2014 Oct 15;44(12):929-39

Cribb TH, Miller TL, Bray RA, Cutmore SC The sexual adult of Cercaria praecox Walker, 1971 (Digenea: Fellodistomidae), with the proposal of Oceroma n. g Syst Parasitol. 2014 May;88(1):1-10

Cripps J, Beveridge I, Ploeg R, Coulson G Experimental manipulation reveals few subclinical impacts of a parasite community in juvenile kangaroos Int J Parasitol Parasites Wildl. 2014 Apr 13;3(2):88-94

Cutmore SC, Miller TL, Bray RA, Cribb TH A new species of Plectognathotrema Layman, 1930 (Trematoda: Zoogonidae) from an Australian monacanthid, with a molecular assessment of the phylogenetic position of the genus Syst Parasitol. 2014 Nov;89(3):237-46

Cuttell L, Gómez-Morales MA, Cookson B, Adams PJ, Reid SA, Vanderlinde PB, Jackson LA, Gray C, Traub RJ

Evaluation of ELISA coupled with Western blot as a surveillance tool for Trichinella infection in wild boar (Sus scrofa) Vet Parasitol. 2014 Jan 31;199(3-4):179-90.

Debrincat, S., Taggart, D., Rich, B., Beveridge, I., Boardman, W. & Dibben, R Effects of overnight captivity on antioxidant capacity and clinical chemistry of wild southern hairy-nosed wombats (Lasiorhinus latifrons) Journal of Zoo and Wild Animal Medicine 2014 45: 469-475

Dembo E, Ogboi J, Abay S, Lupidi G, Dahiya N, Habluetzel A, Lucantoni L A user friendly method to assess Anopheles stephensi (Diptera: Culicidae) vector fitness: fecundity J Med Entomol. 2014 Jul;51(4):831-6

Dinh Hoai T, Hutson KS Reproductive strategies of the insidious fish ectoparasite, Neobenedenia sp. (Capsalidae: Monogenea) PLoS One. 2014 Sep 29;9(9):e108801

Donahoe SL, Rose K, Slapeta J Multisystemic toxoplasmosis associated with a type II-like Toxoplasma gondii strain in a New Zealand fur seal (Arctocephalus forsteri) from New South Wales, Australia Vet Parasitol. 2014 Sep 15;205(1-2):347-53

Estrada-Peña A, Ostfeld RS, Peterson AT, Poulin R, de la Fuente J Effects of environmental change on zoonotic disease risk: an ecological primer Trends Parasitol. 2014 Apr;30(4):205-14

Gabrielli S, Giannelli A, Brianti E, Dantas-Torres F, Bufalini M, Fraulo M, La Torre F, Ramos RA, Cantacessi C, Latrofa MS, Cancrini G, Otranto D. Chronic polyarthritis associated to Cercopithifilaria bainae infection in a dog Vet Parasitol. 2014 Sep 15;205(1-2):401-4

Appendix 1 cont.

Gao Z, Wang M, Blair D, Zheng Y, Dou Y Phylogenetic analysis of the endoribonuclease Dicer family PLoS One. 2014 Apr 18;9(4):e95350

Giannelli A, Cantacessi C, Graves P, Becker L, Campbell BE, Dantas-Torres F, Otranto D A preliminary investigation of serological tools for the detection of Onchocerca lupi infection in dogs Parasitol Res. 2014 May;113(5):1989-91

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Appendix 2: Research grants awarded to ASP Members in 2014

IN 2014, ASP MEMBERS SECURED OVER $17 MILLION IN NEW RESEARCH GRANTS AND FELLOWSHIPS.

INSTITUTION NAMES IN THE LIST BELOW REFER TO THE AUSTRALIAN ADMINISTERING INSTITUTION, NOT NECESSARILY THE HOME INSTITUTION OF INDIVIDUAL RESEARCHERS)

ARC and NHMRC Fellowships and Grants

NHMRC Research Fellowships

Professor James Beeson, Macfarlane Burnet Institute for Medical Research and Public Health, for Malaria immunity and vaccines

Professor Michael Good, Griffith University, for Translating novel vaccine strategies to early phase clinical trials

Professor Terry Speed, Walter and Elisa Hall Institute of Medical Research, for Statistics and v bioinformatics for medical omics

Professor Miles Davenport, The University of NSW, for Control of chronic infectious diseases.

NHMRC Grants and Fellowships, Awarded in 2014 to Commence in 2015

Dr Bridget Barber, Early Career Fellowship, Comparative pathophysiology and clinical epidemiology of knowlesi malaria, Menzies School of Health Research

Dr Phurpa Wangchuk, Early Career Fellowship, Isolation and pre-clinical evaluation of small molecule antiinflammatory compounds from hookworms, James Cook University

Dr Darren Gray, Career Development Fellowship, Sustainable Control and Elimination of Neglected Tropical Diseases in the Asia-Pacific, Australian National University

Professor Leann Tilley, Project Grant, Breaking malaria's lethal grip: Targeting the assembly of an adhesive complex on infected red blood cells, University of Melbourne

Doctor Geoffrey Gobert, Project Grant, Targeting Schistosome Calcium Signalling to Improve and Broaden Praziquantel Efficacy, The Council of the Queensland Institute of Medical Research

Doctor Nigel Beebe, Project Grant, Release the sterile males: a new direction for mosquito population control technologies, Commonwealth Scientific and Industrial Research Organisation, CSIRO

Associate Professor Tania de Koning- Ward, Project Grant, Functional dissection of the malaria RhopH complex and its contribution to new permeation pathways, Deakin University

Professor Christian Doerig, Project Grant, Why is the hijacking of a human erythrocyte signalling pathway essential for malaria infection?, Monash University;

Professor Alexander Loukas, Project Grant, Secreted exosome-like vesicles from the carcinogenic liver fluke, James Cook University

Doctor Sheila Donnelly, Project Grant, A helminth-derived peptide is a novel prophylactic and therapeutic treatment for autoimmune disease, University of Technology Sydney

Professor Miles Davenport, Project Grant, Dissecting the dynamics of malaria infection, University of New South Wales

Appendix 2 cont.

Doctor Michaela Petter, Project Grant, Chromatin dynamics during sexual differentiation in the malaria parasite P. falciparum, University of Melbourne.

Doctor Sasha Lanyon, Early Career Fellowship for Fetal immune response to vertical transmission of Toxoplasma gondii, University of Adelaide

Asoociate Professor Kathy Andrews (Griffith University) and **Professor David Fairlie** (The University of Queensland), NHMRC-EU Partnership Grant for Epigenetic inhibitors for parasitic diseases

ARC Future Fellowship

Dr Timothy Dempster, The University of Melbourne, for research into host behaviour and parasite outbreaks in fish.

ARC Discovery Grant

Prof Kiaran Kirk; **Dr Giel G van Dooren**; **Prof Stefan Broer**; **A/ Prof Ian A Cockburn** A novel family of amino acid transporters in Apicomplexan parasites, 2015-18 The Australian National University | Apicomplexan parasites are single celled organisms that are the causative agents of major diseases in livestock and humans. However, the basic biochemistry of these intracellular parasites is poorly understood, and there are limited treatments available for the diseases these parasites cause. The project hypothesis is that a novel family of proteins that are unique to apicomplexan parasites play a key role in the uptake of essential nutrients (amino acids) into these organisms. This project aims to use a combination of genetic, biochemical and physiological methods to understand the function of these proteins, the role(s) that they play in apicomplexan biology, and their importance for parasite survival.

ARC Lief Grants

Prof Katharina Gaus; Prof John J Gooding; Dr Till Boecking; Dr Lawrence Lee; Prof James C Whisstock; Prof Jamie Rossjohn; Prof Paul J Hertzog; Prof William R Heath; Prof Dale I Godfrey; Dr Daniel Hatters; A/Prof Harry M Quiney; Dr Brian Abbey; A/Prof Filip C Braet; Prof Nicholas J King; **Prof Georges E Grau**; Prof Antoine M van Oijen; Prof Ewa M Goldys; Prof Johnson Mak; Prof Frederic A Meunier; Prof Alpha S Yap; Dr Nicholas S Eyre; Prof Sarah M Russell, The University of New South Wales, The University of Adelaide, Swinburne University of Technology, Monash University, The University of Melbourne, La Trobe University, The University of Sydney, University of Wollongong, Macquarie University, Deakin University, The University of Queensland | Single molecule imaging laboratory: The goal of the project is to establish a single molecule imaging laboratory to close the gap between structural imaging and cellular imaging. Utilising the expertise of the ARC Centre of Excellence in Advanced Molecular Imaging, the aim of the project is to design, build and apply three microscopes that go beyond the current commercial solutions for single molecule localisation microscopy such as Photo- Activation Localisation Microscopy (PALM) and Stochastic Optical Reconstruction Microscopy (STORM) and perform single molecule imaging: deep inside cells and tissue.The facility will have a fast acquisition rate to monitor highly dynamic molecular events, and improved precision to image molecules and complexes in intact cells with less than or equal to one nanometre resolution. There is currently no comparable imaging facility in the world.

Prof Trevor J Lithgow; Dr Georg Ramm; Prof Richard A Strugnell; Prof Elizabeth L Hartland; **Dr Eric Hanssen**; Prof David A Jans; Prof John Carroll; Prof Paul J Hertzog; Prof Paul A Gleeson, Monash University, The University of Melbourne | A video-rate nanoscopy facility for super-resolution imaging: Super-Resolution Microscopy (SRM) is a major frontier technology and is revolutionising our understanding of the structure and dynamics of cellular organisation. A video-rate SRM imaging facility will be established and is expected to bridge the gap between the functional dynamics and structure of living systems at the level of the single molecule. In leading international centres, breakthroughs are being made in understanding molecular mechanisms in cancer, infectious diseases and neuropathologies. Beyond purely biomedical considerations, SRM is redefining our knowledge of cellular architecture and will impact on our understanding of the fundamental biology of all plants, animals and micro organisms.

Dr Eric Hanssen; Prof Tony Bacic; **Prof Geoffrey I McFadden**;

Appendix 2 cont.

Prof Malcolm J McConville; Prof John B Furness; Prof Dougal G McCulloch; A/Prof Vipul Bansal; Prof Kathryn N North, The University of Melbourne, RMIT University, Murdoch Childrens Research Institute, The Florey Institute of Neuroscience and Mental Health | An automated 3D electron microscopy facility: The aim of this project is to establish the next generation of electron microscopy facility, with a fully automated tool enabling 3D imaging. The automated serial section system incorporated in a scanning electron microscope circumvents the limitation of transmission electron microscopy, which provides unique insights into molecular structures and cell components at high resolution, however, the area and volume are limited in size to a few microns. This new type of microscope can image whole organisms and be used by non-electron microscopists. It will be housed in an open access facility and will meet a growing demand for 3D electron microscopy.

Prof Staffan Persson; **Prof Leann Tilley**; Dr Paul J McMillan; Prof Tony Bacic; Prof John L Bowman; A/Prof Rachel A Burton; Prof Marilyn A Anderson; Dr Bernhard Dichtl; Prof Geoffrey B Fincher; Prof James M Whelan; **Prof Geoffrey I McFadden**; A/Prof Roslyn M Gleadow, The University of Melbourne, Monash University, La Trobe University, Deakin University, The University of Adelaide | Spinning disk confocal microscope with dual stages: This custom-built spinning disk confocal microscope with rotational stages will constitute an internationally unique platform. The system has the capability of rapidly monitoring cells in growing biological specimens under changing environments. It offers an integrated platform for multiple imaging strategies, including confocal and Total Internal Reflection Fluorescence (TIRF) microscopy. The system will reside in core facilities with open access to a broad research community. The system may be used to monitor a wide variety of cells and molecules, and will offer capabilities that are of importance to understand cell trafficking, disease and signalling, plant biomass production, and climate change.

A/Prof Timothy P Stinear; Dr Torsten Seemann; A/Prof Alex Andrianopoulos; Dr Kathryn E Holt; **Prof Christian D Doerig**; Prof Julian I Rood; Prof Stephen J Turner; **Prof Robin B Gasser**; A/Prof Sureshkumar Balasubramanian; Dr Paul J Sunnucks, The University of Melbourne, Monash University | A single molecule real-time DNA sequencing facility: A PacBio SMRT sequencing facility will be established and used to accelerate ten specific research programs across a breadth of biological disciplines at two institutions. A specialised high throughput DNA sequencing technology called Single Molecule Real-Time (SMRT) sequencing developed by Pacific Biosciences (PacBio) is revolutionising biological research. SMRT sequencing allows researchers to discover important information in DNA and RNA molecules that are missed by other modern DNA sequencing approaches. It is expected that this facility will also be a key infrastructure resource for the wider scientific community, helping to address fundamental questions in biology.

Prof Andrew H Millar; A/Prof Peta L Clode; A/Prof Gavin R Flematti; Prof Peter J Leedman; Prof Dongke Zhang; Prof Kliti Grice; Prof Michael Bunce; Prof Richard P Oliver; Dr Kar-Chun Tan; A/Prof Robert D Trengove;, Dr Garth L Maker; **Prof Richard C Thompson**; Prof Stephen D Wilton; Prof Ralph N Martins;, Dr Chris R Abbiss; Dr Mary C Boyce The University of Western Australia, Curtin University of Technology, Murdoch University, Edith Cowan University | High resolution mass spectrometry for metabolomics and proteomics research: Ultra-high resolution mass spectrometry and capillary electrophoresis are expected to greatly enhance separation and mass analysis for multi-disciplinary research. Biological processes, and the metabolites and proteins that control them, will be analysed at rates, sensitivities and resolutions which are expected to significantly advance molecular and cell biology research. Multiple levels and types of fragmentation will allow complex experiments to be conducted and provide new mechanisms to aid plant and crop science, sports science, energy and resource science, and chemical toxicology. Comparative and systems biology, where analysis of rare or complex samples is a key requirement, will be strongly supported by these new facilities.

Prof David D Sampson; Prof Shaun P Collin; Prof Martin T Hill; Prof Yinong Liu; Prof Martin Saunders; Prof Steven M Reddy; Dr Gretchen Benedix; Prof Craig E Buckley; Dr Katy A Evans; Prof Birger Rasmussen; A/Prof Lai Chang Zhang; A/Prof Zongwen Liu; Dr Ravinder Anand; Dr Stephen J Barnes; **Prof Richard C Thompson**; A/Prof Gamini Senanayake | The University of Western Australia, Curtin University of Technology, The University of Sydney,

Appendix 2 cont.

Murdoch University, Edith Cowan University, Commonwealth Scientific and Industrial Research Organisation | Ultra-high resolution focussed ion beam facility: An ultra-high resolution dual beam facility (incorporating ion and electron beams) will provide 3D imaging, site-specific analysis and nano-machining to a wide range of internationally recognised Australian researchers across a broad spectrum of disciplines in the geosciences, engineering, biological and physical sciences. Providing critically needed access to this world-class infrastructure is expected to advance international competitiveness, leading to high-impact outcomes in smart materials, nanotechnology, bioscience, and geoscience, including support for the Australian resources sector.

Prof David D Sampson; Prof Shaun P Collin; Prof Andrew S Whiteley; Prof David A Mackey; A/Prof Matthew D Linden; Prof Michael C Berndt; Prof Philip Newsholme; A/Prof Giuseppe Verdile; Dr Janina E Tirnitz-Parker; Dr Delia J Nelson; Prof Simon A Mallal; **Prof Una M Ryan**; Dr Philip A Stumbles; Dr Garth L Maker; Prof Ralph N Martins; A/Prof Mel Ziman; Dr Elin S Gray; Dr Deborah H Strickland; Dr Jason Waithman; Dr Meegan Howlett; Dr Bree A Foley The University of Western Australia, Curtin University of Technology, Murdoch University, Edith Cowan University, Telethon Kids Institute | Mass cytometry - a breakthrough in multidimensional systems biology: Mass Cytometry by Time of Flight marries the resolution, specificity and sensitivity of atomic stable isotope mass spectrometry to the high-throughput, single-cell analytical advantages of flow cytometry. Using molecular probes conjugated with stable isotope tags, a large increase is possible in the number of simultaneous quantitative measurements in complex samples. These parameters, denoting cell type, function and signalling status, will make possible future advances in the understanding of the diversity of cell phenotype and function with a systems biology approach.

Other research grants

Denise Doolan, QIMR Berghofer Institute of Medical Research, Bill and Melinda Gates Foundation Grant for Identification of T-cell target antigens after immunization by Chemo-Prophylaxis and Sporozoites (CPS) regime

Denise Doolan and **Carla Priotti**, QIMR Berghofer Medical Research Institute, QIMR Berghofer MRI Seed Grant for Epigenetics and ost Immunity to Malaria

Denise Doolan (QIMR Berghofer Medical Research Institute) and **Ivo Mueller** (Walter and Eliza Hall Institute of Medical Research), Foundation for Innovative New Diagnostics (FIND) for Discovery & Validation of Serological markers of recent exposure to P. vivax in (pre)elimination settings

Ala Lew, Meat & Livestock Australia for Cattle vaccination studies using novel anti-cattle tick antigens

Rowena Martin, Australian National University, NHMRC Small Equipment Grant

James McCarthy, QIMR Berghofer Medical research Institute, Bill and Melinda Gates Foundation Grant for Identification of Individuals with Glucose-6-Phosphate Dehydrogenase Deficiency

Robert Walker, James Cook University, Swiss Government Excellence Fellowship for Blocking oocyst formation in Toxoplasma gondii

Alex Loukas, James Cook University, Bellberry Foundation for A hookworm protein to suppress asthma

Alex Loukas, James Cook University, Janssen Cilag Pty Ltd Research and Development Grant for Treatment of asthma with the recombinant hookworm protein Ac-AIP-2

Nick Smith (James Cook University), Adrian Hehl and Peter Deplazes (University of Zurich), Bellberry Foundation for The path to a transmission-blocking vaccine for Toxoplasma gondii

Joel Barratt, University of Technology, Sydney, UTS Chancellors Postdoctoral Research Fellowship