RESEARCH REPORT
2010 - 2012
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In Australia, our region and the world beyond, we face our greatest challenge yet—sustaining quality life and ecosystems, with a projected population of 9 billion. These challenges demand veterinary and animal research solutions. We must double food production by 2050, halt the loss of terrestrial and aquatic natural resources and stem the threat of new pathogen emergence. In the past 2 decades the sheer pace of human development has escalated the pressures on sustainability of our natural environment, reducing scope for agricultural expansion and driving emergence of dangerous new diseases, transmitted through the increasingly close contact of wildlife, domestic animals and man. Little wonder there is rising alarm about the safety, quality and adequate supply of our food. Our Faculty’s research leaders are tackling these issues, through international, multidisciplinary programs in farm animal health, animal and human biosecurity, poultry and dairy production, animal genomics, advanced reproduction, animal welfare science and ecosystems health. Through application of the explosive potential of the "omics", (genetics, genomics, metabolomics, proteomics) our research will improve animal protein production and our understanding of the fundamental mechanisms of disease. Important research advances in this report include; understanding the role of weather in spread of equine influenza; quantification of the comparative stresses in poultry in conventional, barn and free range systems; application of remote-sensing and robotic technology for more efficient milking; identification of new parasites of Australian frogs; description of serious fungal pathogens in cats with respiratory disease; dissection of the impact of Johne’s disease on host-pathogen defenses; remarkable and insightful research recognized by Australia’s top scientific prizes, three Eureka awards, Kestevan and Clunies Ross awards.

We are completing a review of the research achievements of our Faculty’s first century, capturing the remarkable stories of our staff and graduates part in national improvements in livestock productivity, the identification and management of animal disease, protection of human health from zoonotic disease, and advancement in the quality and diversity of veterinary clinical services. Our advances are in tissue repair, veterinary education, companion animal disease and clinical service, to name a few areas of emerging strength. The 2012 global accreditation site visit commended Faculty for making research an outstanding feature of the quality of our veterinary program.

Our progress is possible thanks to the vision and generosity of donors, including Loxton, Whitehead, Beveridge, Holt and Valentine Charleton bequests, to name a few. We invite you to be part of our passion for research, and make a difference to the well being of animals, and our planet, by being a donor, supporter, student or collaborator. We would love to hear from you!

Best regards,

Rosanne Taylor
I am pleased to present the Faculty of Veterinary Science Research Report for the period 2010-2012. Our research has seen changes over the past two years with some tremendous and exciting new areas of research finding their way into our diverse and multi-disciplinary collection of projects. We continue to strengthen in our traditional research themes across animal health, animal production and wildlife research. Growth in our international program has been a feature, and we are beginning to see our colleagues from other disciplines engaging with the One Health concepts. We are also now in the era of the Excellence in Research for Australia federal government scheme and it was really very pleasing to see a maximum score of 5 awarded to our research in the field of Veterinary Sciences, and in the general category of Agricultural and Veterinary Sciences, an outstanding achievement and appropriate recognition for the dedication and hard work from all of our researchers.

Approximately 70% of our research income is directed towards the health and performance of production animals. This has stabilized in recent years and provides the base for total research income of approximately $8M. Wildlife research has become an area of intense interest and activity with a fantastic diversity of species now being studied. We also have a strong core of biomedical research and this has been reflected in the way that our research student graduates have been valued by leading medical research institutes, both in Australia and overseas. With the development of major research initiatives across the University, the Faculty is involved more than ever in multidisciplinary research that holds very exciting prospects for the future.

Our campus at Camperdown has witnessed the incredible construction phase of the Charles Perkins Centre between our Faculty and the medical faculty precinct. We will engage with the academic program in a substantial way in 2013 with the appointment of the Professor of Nutritional Ecology. Professor David Raubenheimer will arrive in early 2013 to take up this appointment as a joint position with the Faculty of Science, and he will lead the major theme of nutrition in the Charles Perkins Centre. This continues our alignment with the University strategy for cross-faculty research collaboration. Another notable area of growth has been our international program. Firmly rooted in our Farm Animal and Veterinary Public Health research program lead by Professors Richard Whittington, Michael Ward and Peter Windsor. We have seen continued activities throughout South-East Asia and the establishment of research program in Africa, led by an alumnus Dr Robyn Alders, who has recently returned to the Faculty as a Principal Research Fellow, Robyn, and another recruit, Dr Siobhan Mor, Lecturer in Food Security, have extensive experience in animal health and poverty alleviation programs in Africa.

Our interests in emerging infectious diseases and veterinary public health have also continued to grow, and our participation in the newly formed Sydney Institute of Emerging Infectious Diseases and Biosecurity continues to strengthen our interactions and collaborations with the Faculty of Medicine and School of Public Health. Meanwhile our Research Foundations have had wonderful success in engaging with stakeholders through the annual symposia and in attracting research funds. The appointment of Dr Aaron Cowieson as Director of the Poultry Research Foundation after some years of recruiting efforts has been most welcome. The poultry science research team has responded with a rapid period of growth in activity and funding. Our collaborations have also brought new and interesting research projects into the faculty in animal-human interactions through Professor Paul McGreevy, and his expertise in animal behavior has been recognized by the working dogs project funded with Professor Claire Wade. Wildlife research continues to expand and the Tasmanian Devil facial tumour project of Professor Kathy Belov and her team continues to attract a great deal of public interest.

Last but not least we have had a major focus this year on our early career researchers. The Faculty has a relatively large cohort of young researchers who have also thrown themselves into their research with great enthusiasm. This enthusiasm has been rewarded in a number of ways, notably for Dr Kate Bosward along with Associate Professor Jacqui Norris who with collaborators from the Children’s Hospital, Westmead, were rewarded with an NHMRC grant to study Q-fever in the veterinary community. Congratulations to all of the ECRs and to the other researchers in the Faculty for their outstanding efforts.
Paul McGreevy’s most significant contributions to research are in the fields of behaviour and welfare in domestic animals, especially dogs and horses. He is one of only three veterinarians recognised worldwide by the Royal College of Veterinary Surgeons as Specialists in Veterinary Behavioural Medicine. His contribution to the field of animal welfare has been acknowledged with several national and international awards.

The results of Paul’s research findings have been published in 6 books, 30 book chapters, 100 conference abstracts and over 120 peer-reviewed journal articles. He has been awarded over $1M in research grant income.

Among various topics, Paul’s group has been investigating motor laterality in quadrupeds. In dogs, this can be studied through paw use.

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**Behaviour & Welfare - Dogs**

Paul’s work with dogs established an intriguing relationship between the distribution of retinal ganglion cells and nose length in the dog. This demonstrates that many different breeds of dog have different visual fields. It has profound implications for dog trainers, handlers and keepers since all dogs cannot be expected to perceive the same visual stimuli or respond to the world in the same way. This work may help to explain some of the behavioural differences between breeds, with short-nosed dogs being less likely to act like a running predator and hunt in packs and more likely to be able to focus on human faces, using their area centralis. Mirrored by Paul’s similar findings in horses, this work has been complimented by the discovery that brain shape and orientation are also associated with skull morphology.

Paul’s team have also recently determined whether objective measures of laterality could be used to identify dogs with a high probability of successfully completing a Guide Dog Training Program. Three categories of laterality (motor, sensory, and structural), were assessed in 114 dogs entering guide dog training. Significant predictors of success were identified: the direction of laterality, paw preference category in the ‘Kong’ test, hindpaw clearance height laterality indices for a number of measures in the Sensory Jump test, and chest hair whorl direction. This is the first study to report a structural marker of canine behaviour. All three categories of laterality may be used to predict the suitability of dogs for guiding work, and by identifying predictors of success, resources can be more efficiently utilised on dogs with greater potential.

The McGreevy lab is also interested in the canine model in human psychiatric disorders. We have recently completed a major study on dementia in dogs. Canine cognitive dysfunction (CCD) is an age-related neurobehavioural syndrome which, although common, is severely under-diagnosed in community-based dogs. Using data from a large cross-sectional survey of older dogs (n = 957), our study aimed to develop a clinical scale for assessing CCD. Data-driven analytical techniques were used to distil 27 significant behavioural items (previously identified as relevant to CCD) into an assessment tool with maximal cognito-behavioural breadth whilst maintaining clinical utility. The resulting CCD rating scale (CCDR) comprised 13 behavioural items, of which three were sensitive to the severity of the disease stage. When tested on an independent survey sample, the CCDR had an overall 98.9% diagnostic accuracy with a 77.8% positive predictive value and a 99.3% negative predictive value. Test–re-test reliability of the CCDR over 2 months was also high. In conjunction with veterinary assessment, the CCDR could be a valuable tool in research and clinical settings for both the assessment and longitudinal tracking of cognitive change.

Variation in breed longevity in the dog has led to the inference that large dogs age at a faster rate than small dogs, possibly because of an increased oxidative load. Potential differences in behavioral aging (the rate of age-related decline in cognito-behavioral performance) across breeds represent a significant challenge to veterinarians and scientists. Using data from a large cross-sectional survey of older dog owners, we aimed to identify breed differences in behavioral aging in successfully aged dogs over 8 years of age. Significant breed differences across longevity group were seen in only two behavioral responses: dogs drinking and aggression. However, in general, these data did not suggest an increased rate of behavioral aging in large, short-lived dogs. It is possible that size-dependent aging affects body systems differently or, alternatively, owner’s management may differ between small and large dogs, resulting in differences in behavior.

Breed differences are of growing importance to veterinary science and indeed the genomic revolution, so Paul’s online Listing of Inherited Disorders in Animals (LIDA) initiative www.vetsci.usyd.edu.au/lida promises to provide critical data for vets and dog breeders alike. LIDA receives more than 25,000 hits per month. This project compliments Paul’s collaboration with the Royal Veterinary College and their VetCompass project -www.rvc.ac.uk/VetCOMPASS/Index.cfm

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**Image 1**: Pugs and 2. Afghans are likely to see the world very differently. ©OLIVER Image Library; Photo supplied by P. McGreevey
Improvements in coaching and equipment will also reduce the rate of euthanasia because of unacceptable horse behaviour.

Tension and pressure detecting technologies could equally be used to measure the qualities of effective coaching, not just effective signalling to the horse. They may also provide objective information and test novel technology for riders who are geographically isolated. For example, because Australia is removed geographically from Europe, its elite competition riders struggle to readily access higher levels of coaching. The validation of novel measuring and feedback technology will be the first step towards elite riders accessing real-time feedback from remote coaches.

As clinical equine behavioral medicine matures, we will become better at identifying individuals that are high risk for certain disorders and managing them accordingly. We should also become more skilled at identifying horses that have true learning deficits rendering them likely to show dangerous or sustained fight and flight responses. The impact of such advances on human safety will be significant.

Despite the unique challenges that the study of horse riding and horse handling presents, the future of equitation science seems fertile and fascinating. It promises to tell us a great deal about our beloved horses and possibly about ourselves.

As part of his interest in ethical equitation, Paul has recently published a series of studies that have challenged assumptions about the use of the whip in racing.
STUDENT PROFILE
LIZ ARNOTT
Liz Arnott graduated from the University of Sydney in 2003. She began her veterinary career as a mixed animal practitioner on the mid north coast of New South Wales. After a year of working in the United Kingdom she took a veterinary position in Tamworth focusing on small animal medicine. Liz achieved a masters degree in small animal practice from Murdoch University and membership to the Australian College of Veterinary Scientists in 2011. Throughout her career she has also had a keen interest in issues of animal welfare and particularly in increasing adoption rates of shelter animals. Working in rural communities has given her an appreciation of the working partnership between farmers and their dogs and she is looking forward to further exploring this relationship during her research into compliance and trainability of working dogs.

STUDENT PROFILE
JOHATHAN EARLY
Jonathan graduated in Veterinary Science from the University of Sydney in 2005. It was during his undergraduate training that he developed a particular interest in animal behaviour and welfare. Since graduation he has worked in mixed practice in Victoria, small animal and exotics practice in Hobart, Tasmania and locummed across England. Prior to beginning his PhD in working dogs, Jonathan worked in the Animal Health Policy Branch within the Australian Government Department of Agriculture, Fisheries and Forestry in Canberra. He recently attained his membership of the Australian and New Zealand College of Veterinary Scientists in Veterinary Behaviour. Jonathan says he is excited about his forthcoming research into working dogs on Australian farms and getting to meet and talk to those with a passion for working Kelpies.
EQUINE CLINICAL RESEARCH: RESEARCH AND CLINICAL TRIALS UNIT (REaCT)

The REaCT was developed to address diminishing funding opportunities for Equine Clinical Research and the changes in the role of the Teaching Hospitals to be more commercially. It has become increasingly more important to provide opportunities for the residents and clinical staff at Camden to maintain research activity. This has become increasingly more important with the new Masters programs of the residents and the University focus on research output. The REaCT unit business and research model has generated international interest from other Universities struggling with the same issues. The REaCT unit lies within the Teaching Hospital with the benefits of using shared facilities but contributed to the Teaching Hospital and Faculty in terms of income generation and research output. However this association limits growth and expansion of the unit. Nevertheless the unit continues to generate a financial surplus each year, has substantial financial reserves and produces enviable clinical research outputs published and presented at international and national meetings every year.

The REaCT unit has stimulated a renewed interest into clinical research and as been remarkably successful since it was endorsed by the Faculty in 1997. Clinical research is the activity that distinguishes Veterinary Teaching Hospitals from private practice and places the University at the pinnacle of the profession. The success of the equine research at the University is the commitment and enthusiasm of the students who have been involved in a wide range of research projects in various areas of equine veterinary science and science in general.

The unit is directed by Professor Andrew Dart. Professor Leo Jeffcott recently retired Dean of Veterinary Science and Emeritus Professor continues to contribute to the unit several days a week. A/Professor Christina Dart provides specialist anaesthesia support and supervision. There has been a focus on ensuring that the postgraduate clinical staff who are undertaking residency programs which aim to prepare for examinations to become clinical specialists, are able to complete their research obligations for credentials submission. However there is also a variety of undergraduate students undertaking BSc (vet), AVBS honours projects and BVSc honours projects as well as overseas undergraduate and postgraduate students all participating in research activities.

There are projects underway looking at wound healing and airway disease in horses, tendinitis, spinal disease and techniques for cartilage resurfacing in humans using animal models, effects of different concentrations of inspired oxygen concentration during anaesthesia in horses, investigations into various drugs for treatment of osteoarthritis in horses. There are currently strong associations with the Raymond Purves Bone and Joint Laboratory at Royal North Shore Hospital where we are collaborating on projects using animal models to study tendinitis and the effect of stem cells in humans. There have been exciting results investigating the effect of Manuka honey on wound healing in horses that has already provided substantial benefits to the equine industry. The unit continues to work closely with industry in the clinical evaluation of various potential therapies for horse health.

A generalised tightening of the financial picture globally and within the University and Faculty are without doubt limiting some opportunities. Various global and local companies and industry bodies have tightened spending on workshops and research and funding bodies have limited budgets for research grants. Within the University and Faculty staff cuts have increased workloads in administrative and clinical commercial activities. This has limited time and resources available for research. The unit has also been limited by the freeze on reserves. Nonetheless there are projects currently underway, new workshops and projects booked for early next year and a substantial opportunity for a 3 year project working with the mining industry. The embarrassing challenge will be apportioning time, and resources. There continues to be strong interest in current research areas, particularly wound healing with ongoing international interest in future projects that need to be realised.

STAFF PROFILES

PROFESSOR ANDREW DART BVSc, PhD, Dip ACVS, Dip ECVS

Andrew is a graduate of the University of Queensland and an alumnist of the University of Sydney. He has been a veterinarian for 28 years and a registered equine surgical specialist in the USA, Europe and Australia for over 19 years. After spending time in private practice and as a resident and an Equine Surgeon at the University of California, Davis he returned to the University of Sydney in 1994. Since then he has been Surgical Registrar, Head of Equine Services, Hospital Director and now Professor of Equine Veterinary Science and Director of the REaCT unit. Despite holding full time clinical position throughout his career Andrew has published over 110 refereed scientific manuscripts and mentored over 40 clinical postgraduates. Amongst a variety of University, Faculty and External professional appointments he has held positions as Deputy Chair of the Animal Ethics committee, Chair of the Animal Research Review Panel, member of the Australian Veterinary Boards Council committees for Registration of Veterinary Specialists and the National Veterinary Examination, member of the Administrative Decisions Tribunal, and sits on the editorial board of several international journals. His focus is on contributing to the current growth and development of the profession internationally through clinical research and supporting the new generation of veterinarians and specialists. His aim is to accomplish this by continuing to
1. Studying a novel drug using a carpal chip model of osteoarthritis in horses on the treadmill. This was a collaborative study with Colorado State University and the Raymond Purves laboratory at Royal North Shore Hospital.

2. Clinical research not only provides opportunity for students to undertake research, it also provides substantial opportunities for final year students to get hands on experience in technical procedures. The sheep model is used for studying the effect of stem cells on tendon and intervertebral disc repair.

3. Creating osteochondral fragments in the carpus of horses to study the effects of surgery on CS446 as a biomarker of arthritis in the horse.

4. An undergraduate honours student undertaking research on the effect of different suture patterns on airway diameter in the horse.

5. A study on the effects of manuka honey on wound healing in horses.

Promote the Veterinary Teaching Hospital at Camden and the REaCT Unit as an internationally recognised research and training facility. The aim is to mentor and encourage young veterinarians to aspire to providing excellent service to the public and profession by developing their passion for clinical and clinical research work.

ASSOCIATE PROFESSOR CHRISTINA DART Dr med vet, MSc, DVSc, Dip ACVA

Christina is a graduate of the University of Zurich. She has worked in the prestigious AO institute in Davos, Switzerland, before undertaking and internship in small animal medicine and surgery then a residency in veterinary anaesthesia at the University of Guelph. She was on Faculty at the University of California before coming to the University of Sydney in 1994. At that time she developed a formal anaesthesia service at the Teaching Hospital and remains the only board certified anaesthesiologist in the Faculty. She has been a Senior registrar and Head of Anaesthesia at Camden for the past 17 years. During that time Christina has trained many interns and residents in Veterinary Anaesthesia. Christina was promoted from Senior Lecturer to Associate Professor at which time she took the position as year 4 coordinator. Over the past few years Christina’s focus has centred on teaching. She has taken over the didactic Anaesthesia teaching within the faculty and focussed more on teaching outcomes. Since 1997 Christina continues to contribute to the clinical anaesthesia services and the anaesthesia services within the REaCT Unit.

EMERITUS PROFESSOR LEO JEFFCOTT PhD, MA, BVetMed, FRCVS, DVSc, VetMedDr

Professor Jeffcott has had a stellar career and remains one of the outstanding role models for Equine Veterinarians globally. Professor Jeffcott was formerly Dean of the Veterinary School in Cambridge University in the UK and subsequently the School of Veterinary Science at Sydney University. Being an FEI veterinarian who led the veterinary teams at 6 consecutive Olympic Games is only one of a long list of contributions Professor Jeffcott has made to the equine industry, to the education of many veterinary leaders and to the development of the profession. It was Professor Jeffcotts’ foresight that led to the formalisation of the REaCT unit to provide an avenue to improve the research opportunities and outcomes from the Teaching Hospital and provide an avenue for young veterinarians in an academic environment an opportunity to continue to engage in research. This vision was and remains well ahead of its time and represents only one of Professor Jeffcott’s many contributions as Dean of the Faculty of Veterinary Science at Sydney University.

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FARM ANIMAL AND VETERINARY PUBLIC HEALTH (FAVPH)

ANIMAL BIOSECURITY RESEARCH

PROGRAM AREAS

Our work encompasses both teaching and research, and links these to provide the greatest possible benefit for the community. Academics and support staff form a critical mass and are able to provide service to the community across many species, industries and scientific disciplines. We work extensively with collaborators from other institutions and the private sector both in Australia and overseas. We have a large network of contacts in government, industry, academia and business and strive to ensure that our work is relevant and meets current and future community need.

Most staff are funded through external competitive research grants, illustrating the calibre of the projects. We place high value on our post graduate students as they will be future leaders. Overall, there have been many scientific publications and conference proceedings from our work, a further measure of success.

We promote the traditional disciplines of veterinary microbiology, epidemiology and pathology by developing programs of research in areas such as infectious diseases, public health, food security, animal welfare and disease control. A range of the traditional and some emerging farm animal species and industries is included: sheep, cattle, other ruminants, pigs, chickens and aquatic animals. We also have research program addressing companion animal infectious diseases. To cover so much the Faculty has made significant investments in staff and because of its commitment to disease control and prevention and animal welfare. It will continue to play a key leadership role in ensuring animal health professionals have the skills needed to support and strengthen Australia's livestock industries, public and animal health.

Veterinary Public Health & Food Safety

The focus of the Veterinary Public Health & Food Safety program within the Faculty is on infectious diseases of livestock, wildlife and companion animals with the ability to cause human infections via direct contact or foodborne, and diseases that impact the economic wellbeing of livestock industries. The disciplinary foundation of the program is epidemiology and microbiology.

This program was founded with funding from Meat & Livestock Australia Ltd. and the appointment in 2007 of Professor Michael Ward. Since that time it has grown to become the leading Veterinary Public Health & Food Safety program in Australasia. The program has been developed with funding from a broad range of agencies, including Australian Research Council, Commonwealth Department of Agriculture, Fisheries and Forestry, Meat & Livestock Australia, Australia Pork Limited and the United States Department of Agriculture (Agricultural Research Service, National Research Initiative).

Research highlights, 2010 -2012 include:

- Risk assessment: animal diseases as they relate to food safety.
- Campylobacter jejuni through the food chain: from range through processing.
- E. coli O157 colonisation and shedding in cattle.
- Comprehensive risk factor analysis of E.coli scours in the piggery environment.
- Modeling and evaluation of effectiveness of avian influenza mitigation options.
- What role does wildlife play in emergency disease? The case of the feral pig.
- A risk assessment and simulation modelling framework for exotic disease prioritisation in the Australian pig industry.
- Rabies risk assessment in eastern Indonesia, East Timor, Papua New Guinea and northern Australia.

During this period 61 papers have been published in the international peer-reviewed literature, including the high-ranking journals PLoS Neglected Tropical Diseases, Emerging Infectious Diseases and Veterinary Research. A total of 18 postgraduate students have been trained. In addition, the Faculty's postgraduate coursework program in Veterinary Public Health has graduated 50 professionals during 2003-2010 (27 since 2008). To advance the key areas of One Health, emerging infectious diseases, and biosecurity strategic links have been developed with the Sydney
Institute for Emerging Diseases and Biosecurity, the New South Wales Centre for Animal and Plant Biosecurity, and the Australian Centre for Emerging Infectious Diseases.

Community Service and Outreach Transmission Studies

We provide advice to animal health agencies. For example, during 2008 we undertook consultancies addressing:

- Improving productivity and profitability of smallholder shrimp aquaculture and related agribusiness in Indonesia
- Control of nodaviral disease in tropical marine finfish hatcheries: Enhanced Biosecurity through the application of contemporary biotechnology, epidemiology and pathobiology - Indonesia
- Determinants for WSD outbreaks in Indonesian smallholder shrimp ponds – a pilot study of both locality factors, WSSV genotype distributions and pond factors
- Diversification of smallholder coastal aquaculture in Indonesia
- Scoping study for fish health-mariculture and rabbitfish aquaculture development in Indonesia
- Best practice health and husbandry of cattle and buffalo in Lao PDR
- Livestock movement and managing disease in Eastern Indonesia and Eastern Australia
- Cost-effective biosecurity for non-industrial commercial poultry operations in Indonesia
- Brucellosis in West and East Timor
- Rabies Risk Assessment in Eastern Indonesia, East Timor, Papua New Guinea and northern Australia
- Strengthening food security through family poultry and crop integration in Eastern and Southern Africa

International aid projects and food security

We have been very successful in obtaining ACIAR (Australian Centre for International Agricultural Research) funding to conduct research projects that inform the regional development of the livestock and fisheries and aquaculture industries to address rural poverty in less developed countries in south east Asia. Major projects in cattle and buffalo health and production are current in Laos and Cambodia and have informed regional FMD control programs and identified limits to production imposed by parasites of economic significance. Our staff are also involved in projects in Indonesia, China and Pakistan and new projects are being developed in eastern Africa. We have a major fisheries program in Indonesia.

- Arbovirus Surveillance Needs and the National Animal Monitoring Program, and the Technical Merits of Introducing Mandatory Recording for Sheep and Goat Movements, National Accreditation of Laboratory Diagnostic Tests, Disease Spread Minimisation in Access to Farmland for National Infrastructure Engineering Works, and Risks of Disease Spread in Creation of Public Water Storages. Advice and support was also provided to industry organisations (for example, Meat and Livestock Australia), the NSW Department of Primary Industries and the NSW Livestock Health and Pest Authorities (formerly the Rural Lands Protection Boards).

1. Dr Om Dhungyel and Craig Kristo sampling calves for E-coli 0157

2. Dr John Humphrey demonstrating techniques used in aquaculture health and production to visitors from Indonesian Laboratories

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- Strengthening food security through family poultry and crop integration in Eastern and Southern Africa
Livestock Welfare

In response to growing demand from consumers for improved welfare in livestock husbandry including pain management during mulesing in the sheep industry, since 2007 we have been conducting a very successful ARC Linkage funded research program in partnership with Animal Ethics Pty Ltd and Bayer Animal Health Australia. This research has developed practical solutions for delivery of analgesia for improved animal welfare during routine husbandry procedures involving surgery that has been widely adopted for mulesing. Ongoing research is evaluating application of pain management in other procedures such as castration, tail docking, dehorning and ear notching and for other industries, including beef and dairy cattle, pigs and poultry.

Endemic diseases in cattle and sheep

Major research program in Johne’s Disease

In the most concerted effort yet to come to grips with a complex and frustrating disease, the Faculty has joined with Meat and Livestock Australia (MLA) to undertake intensive research into Johne’s Disease (JD), a devastating and ultimately fatal disease of ruminants already entrenched in south eastern Australia. MLA provided a large grant to support research focused on the early diagnosis of infection in sheep. This was extended in 2011 and now addresses bovine Johne’s disease. This complemented other grants to enable a comprehensive on-farm and laboratory-based research program. As this is such a complex and difficult disease, quarantine restrictions have failed to halt its spread, industry has been polarised in its views on control options and the newly released vaccine does not fully prevent infection in sheep. The lack of basic knowledge about the disease is hindering the design of improved tests, treatment and vaccines. The MLA grant has enabled a team of four leading post doctoral scientists and additional research students to be established to study the basics of Johne’s infection. The latest genomics and proteomics technology were applied to the problem, and over three years discoveries were made leading to new tests capable of detecting the infection much sooner; three patents are pending on new technologies as well. In addition, our group has a number of projects evaluating disease control options for OJD and in particular, establishing the efficacy of Gudair® vaccine. Introduction of the vaccine in 2002 has had a major impact on reducing mortality from the disease but current research has identified that the disease persists in some infected flocks, with important disease control policy implications.

Vaccination program for virulent footrot in sheep

Footrot is a disease with serious animal welfare concerns, and also causes substantial production losses. We have completed research funded by Australian Wool Innovation to validate specific vaccination to control and eradicate footrot in Southern Australia. The project was very successful and has been extended by the Departments of Primary Industries in South Australia and Tasmania in programs to vaccinate tens of thousands of sheep. Currently we are exploring opportunities for commercial manufacture of the vaccine.

We will start an exciting new research project in 2013 to develop new diagnostic tests for footrot, thanks to a substantial gift from Merino producer Mr Peter Wrigley that will fund a new PhD scholar. The latest molecular and genomic tools will be used to produce a rapid and accurate test for use in the vaccination program.

Aquatic Animal Health

Finfish health research

Leadership in teaching and research in aquatic animal health is on the Faculty’s agenda with a vertically integrated program of study in the BVSc curriculum and a 6 cp unit in the AVBS degree. This provides the background and motivation for students to continue in higher degree research pathways. Aquatic animal epidemiology is included as a unit of study in the Veterinary Public Health Management post graduate program and aquatic disease research was made available for the first time in 2004 to students in the BSc(vet) program, a one year full-time research stream within the BVSc curriculum. The Faculty is well-connected to the aquatic animal industries through national and international research projects, participation in
the Subcommittee on Aquatic Animal Health which advises government and the Fisheries Research and Development Corporation Scientific Advisory Committee. Research projects funded by Fisheries Research and Development Corporation, ACIAR and the Murray Darling Basin Authority commenced in 2007 and cover topics as diverse as best management practice in shrimp aquaculture through to environmental impacts of fish viruses in threatened species. New diagnostic tests have been developed for nodavirus infection in barramundi aquaculture and to detect emerging viral pathogens which enter Australia with live ornamental fish imports.

Environmental immunology and oyster health

A new research program commenced in 2011 using oysters as a model organism to develop better understanding of how major environmental disturbance affects population health. With the appointment of a new post doctoral fellow in environmental immunology we commenced research on Pacific oyster mortality syndrome, which has devastated oyster production in France and New Zealand. Fisheries Research and Development Corporation has provided substantial funding to continue this project in 2012, and we are working very closely with the oyster industry in order to develop practical husbandry solutions for this disease. A website was created to provide information to industry as the results of research come to hand www.oysterhealthsydney.org

International reference laboratories

The Faculty has an internationally-recognised role in epidemiology and diagnosis of the notifiable viral disease of finfish, epizootic haematopoietic necrosis virus. The Faculty and the Australian Animal Health Laboratory host the World Organisation for Animal Health (Office International des Epizooties, OIE) Reference Laboratory for EHNV. This Laboratory provides research and a diagnostic referral service to the Australian industry, and ensures international diagnostic capabilities by providing technical advice, protocols and immunological and molecular biological reagents to laboratories worldwide. This supports international trade in aquatic animal products. Diseases such as EHNV present real challenges to both commercial fisheries and to the management of ecosystems worldwide. The Faculty was asked to lead a second international reference laboratory in 2009, for ranavirus. This group of pathogens is one of the causes of global amphibian declines. The reference laboratory will underpin conservation efforts for amphibians.

Capacity building in animal disease diagnosis

Australia faces an imminent shortage of expertise in animal health. In one project we found that 70% of experts in aquatic animal health in Australia are aged more than 50 years. There is a similar situation in terrestrial animal pathology. Furthermore, there is a shortage of people who can train the next generation. The Faculty of Veterinary Science is making an important contribution by establishing this strong program in Farm Animal and Veterinary Public Health to build scientific capacity. In addition, we initiated a NSW training program ‘Pathology for Field Veterinarians’ and ran successful 12 day courses in 2009, 2010 and 2011 to both improve animal disease diagnosis and the supervision of our final year veterinary students on rotations in Rural Public Practice with the NSW Livestock Health and Pest Authority and Department of Primary Industry.

Rural and regional communities

The benefits of the research and post graduate activity covered in this five year report will accrue directly to rural communities and the wider community. The statistics on agricultural production are impressive; 17% of working Australians are employed directly and indirectly in farming, 50% of these in capital cities; farming contributes 12% of gross domestic product ($72 billion), 24% of goods and services exports ($26 billion), utilises 60% of the Australian landmass, and there have been productivity increases of 3 to 4% annually for 20 years.

1. Aquaculture facilities in the JL Shute Building
2. Professor Richard Whittington at Botany Bay checking Oysters used in the FRDC funded PCM5 Project.
STAFF PROFILE

BRENDAN COWLED

Brendan is a Sydney graduate in Veterinary Science. Following practice in Australia, New Zealand and the United Kingdom, he completed a PhD (also at Sydney) on the ecology and control of feral pigs in Australia. He then was employed within the Office of the Chief Veterinary Officer, Canberra. Within this position he led much of the investigation into the spread of the 2007 Equine Influenza outbreak.

In 2010, Brendan joined the Faculty as a Research Associate as the recipient of an Australian Research Council Postdoctoral (Industry) Research Award.

About Brendan’s project

Wildlife populations have been responsible for many recent disease emergencies including SARS, Nipah, Hendra and Menangle viruses, avian influenza, classical swine fever and foot-and-mouth disease. Yet our understanding of how such diseases move through and emerge from wildlife is poor and inadequate for developing and applying successful response, control and prevention programs. This project is using feral pigs in northern Australia as a case study for characterising wildlife disease dynamics (based on Salmonella as a case study) with a novel integration of population and epidemiological genetic approaches, demographics and simulation modelling. Through this knowledge, a problem of great importance to agriculture in Australia – the role of feral pigs in trans-boundary infectious disease transmission – is being addressed together with project partners (the Commonwealth Department of Agriculture, Fisheries and Forestry, Cattle Council of Australia, the Western Australian Department of Agriculture and Food, and New South Wales Department of Primary Industries, Meat & Livestock Australia and Australian Pork Limited).

STAFF PROFILE

IKA PAUL-PONT

Ika is a Post Doctoral Research Fellow in environmental Immunology. She has a BSc (Biology), Masters (Marine ecology) and PhD (Ecotoxicology) from the University of Bordeaux and joined the Faculty of Veterinary Science in 2011 after working as Assistant Professor in ecology and microbiology in France. Ika has research interests in mollusc ecology and pathobiology of pathogens affecting marine bivalves, including aspects of immune responses and the role of environmental factors on disease emergence/virulence. Ika has extensive academic training in marine ecology, ecotoxicology and microbiology. Previously, her research has centred on the sensitivity and adaptation of marine bivalve populations undergoing multiple stresses (metal exposure, parasite infestation and microbial contamination), in terms of immune responses and detoxification processes.

About Ika’s project

Ika is currently involved in a new research initiative involving oysters as models for environmental disturbance on the immune system in the context of emerging and re-emerging diseases. This project seeks to explain why and how diseases spread, by identifying the main risk factors associated with disease outbreaks, how individuals populations respond during and after an outbreak, and then how the disease can be prevented and managed, with a focus on environmental stress factors and immunology. This project involves collaboration with scientific communities, government authorities as well as oyster industries (oyster farmers, hatcheries and fisheries) from Australia. Collaborations are developing also with New Zealand and France.
Karen Williams

Karen is from England, and has been with The Faculty for several years as a technician in charge of animal husbandry and instruction of undergraduates. She holds an MSc degree in Applied Molecular Biology of Infectious Diseases from the prestigious London School of Hygiene and Tropical Medicine (University of London).

Early 2011 Karen made the decision to pursue a PhD to fulfill a lifelong dream of biomedical research. She is now studying Shiga Toxin producing E. coli, within a project funded by Meat & Livestock Australia and led by Professor Michael Ward. Her associate supervisors include Dr Om Dhungyel, Dr Karen Plain and Prof. Richard Whittington.

About Karen’s project

Cattle are a reservoir of the human pathogen E coli O157 which ‘colonises’ the intestinal tract of the animal and is shed in the faeces. The nature of this shedding is heterogeneous with regards both level and duration of shedding. This variation between animals and more specifically the phenomenon of super-shedding is poorly understood with significant public health implications.

This project involves a longitudinal study of cattle to monitor the levels of O157 excreted by cattle over time in the course of natural infection. This will provide a clearer picture of shedding levels and variability. The project will be looking at the patterns from an epidemiological point of view and aiming to identify risk factors that affect the level or duration of shedding.

In vitro studies to assess the nature of bacterial attachment to the bovine gastro-intestinal tract (GIT) will further investigate the nature of differential shedding. The use of primary bovine cells isolated from the GIT will be used as a model for adhesion trials.

Sonevilay Nampanya

Sonevilay is a Lao PDR national who had worked for NGO’s in livestock projects in Laos prior to completing a BAnVetBiosc (Hons) degree from this faculty in 2009, supported by AusAid. His Hons project was supported by the Australian Biosecurity CRC and led to a very good publication in the journal Transboundary and Emerging Diseases, on farmer knowledge gaps in large ruminant production, health and biosecurity. Sonevilay then worked as a research associate for us for 2 years in Laos on the ACIAR funded research project ‘Best practice large ruminant health and husbandry, Lao PDR’. This project commenced in 2008 and the project completion workshop will be held in July 2012 with project end in December 2012. In addition, Sonevilay has had a critical role in the training of government livestock extension and research staff, with support from the Crawford Fund, work that in 2011 was extended the local university and college sector. In 2012, he was awarded a prestigious John Alwright Fellowship to commence his PhD with us on FMD and Biosecurity in northern Lao PDR.

About Sonevilay’s project

Foot and Mouth Disease (FMD) is endemic in the Mekong region of SE Asia and a SEACFMD roadmap (South East Asia and China FMD) for possible control and eradication of the disease has been developed by the OIE (world organisation for animal health) office in Bangkok that aims to coordinate FMD activities of countries in the region. However little is known of the epidemiology of disease transmission or the socioeconomic impact of FMD and farmer, trader and extension worker knowledge of the role of vaccination and biosecurity in disease management is severely deficient in Lao PDR. Sonevilay is conducting a range of studies that address these questions in addition to cattle productivity research that explores whether sustainable FMD vaccination and biosecurity can be incorporated into village-level smallholder systems. He recently had a paper that identified and described risk factors associated with FMD ‘hotspots’ in northern Laos also accepted into Transboundary and Emerging Diseases.
MEMBERS OF THE GROUP

PRINCIPALS:
John House, Katrina Bosward, Alison Gunn and Paul Sheehy.

POST-GRADUATE STUDENTS:
Matt Izzo, Andrew Thomson, Virginia (Jennie) Mohler, Shahab Ranjbar, Derek Keeper

HONOURS STUDENT:

RESEARCH PROJECTS 2010 - 2012

Title: Strategies for low cost molecular screening of contagious mastitis pathogens
Funding: Gardiner Research Foundation

Title: Development of quantitative diagnostic methods for diagnosing and investigating calf scours
Funding: Meat and Livestock Australia

Title: Further molecular characterisation of Moraxella bovis and Moraxella bovoculi to monitor species and strain prevalence in response to vaccination.
Funding: Intervet/Schering-Plough Animal Health

Title: Prevention of Mastitis
Funding: Elanco Animal Health

Title: Salmonella Vaccines in Livestock.
Funding: United States Department of Agriculture
MEDICAL AND BEHAVIOURAL GENETICS

Our lab spends its time unravelling the secrets of genome biology using next generation sequencing and building better breeding programmes using the latest statistical methods. Our particular interests are in the application of new genomic technologies to improve our understanding of diseases and behavioural traits in domestic animals and wildlife and our understanding of the links between DNA and phenotype in general.

THE TEAM
Professor Claire Wade
Dr Natasha Hamilton
Dr Bianca Haase

RESEARCH STUDENTS
Cali Willet
Jessica Gurr
Diane van Rooy
Belinda Wright
Elizabeth Arnott
Jonathan Early

STUDENT PROFILE
BRANDON VELIE
Brandon’s thesis focuses on racing durability, or resilience, in Thoroughbreds and it centres on one main idea: improving the well-being of racing Thoroughbreds through genetic selection. Brandon and his supervisors, along with a few other geneticists, aim to develop a methodology that will allow the genetic potential for racing durability or resilience to be objectively evaluated for any given individual within a racing population. This methodology will take as many of the environmental variables known to influence horse-racing into account as possible, thereby providing a common platform so those making selection and management decisions can be confident they are comparing like with like, regardless of the breeding facility or training system a horse was/is associated with. This will then enable owners and breeders to better select horses that are suited to withstand the rigors associated with racing and provide additional information to trainers that may aid in training and management decisions.
STAFF PROFILE
CLAIRE WADE

Professor Wade is developing a programme in medical and behavioural genetics with particular focus on the horse and the dog. In recent years her canine focus has included playing key roles in the analysis leading to the Canine Genome Sequence (Nature, December 2005), the development of three canine gene mapping arrays (Two for Affymetrix and one for Illumina), and the mapping of several genes for canine diseases leading thus far to three commercially available genetic tests for genetic diseases (Parathyroid tumors in Keeshonden, Rod-cone dystrophy in the Wire-haired dachshund, and Degenerative myelopathy in many breeds). She has current projects exploring the genetics of separation-related distress disorder, aggression, deafness, congenital birth defects, behaviour and pigmentation in the dog. From 2005-2009, Professor Wade led the equine genome sequencing project (Science, November 2009) and assisted the equine community to develop an equine genotyping array to assist with genetic mapping. Her current equine research includes exploring the genetics of equine obsessive compulsive disorders, durability in thoroughbred race horses, and understanding the genetics underlying pigmentation.

In addition to her special interests in the genomics of companion animals, Professor Wade has a strong involvement with the Australian sheep industry with current projects relating to sheep genome analysis and the mapping of genes for medical disorders in sheep and to develop better genetic prediction of working dog traits for sheep dogs (Australian working kelpie).

Professor Wade has an interest in broader genomic biology with particular emphasis on understanding the special characteristics of genomes within different populations and using these to design better strategies and resources for the understanding of evolutionary processes and the management of wildlife.

STAFF PROFILE
NATASHA HAMILTON

Natasha is an early career academic at the Faculty of Veterinary Science. After completing her PhD in equine molecular genetics with Professor Raadsma’s Reprogen group, she worked for two years as a postdoctoral researcher investigating the effect of inflammation caused by hypoxia on myocardial muscle at the ANZAC Research Institute, Concord Hospital. Natasha’s preference for working within animal industries soon saw her return to Sydney University at Camden for another postdoctoral position, this time investigating the molecular basis for resistance to parasitic infection in sheep. However, it is only since becoming a full time academic that she has had the opportunity to combine her University work with her other love, the horseracing industry, which is now the focus of much of her research. Natasha’s research interests include equine genetics and attrition in the racing industry, and she has supervised a number of honours students within these areas. Her research has been aided by her close links to the racing industry, as she has also been a casual raceday official for over 15 years. Current specific research interests include equine performance genetics, investigation of factors contributing to EIPH in racehorses, investigation of factors contributing to retirement of racehorses in NSW and co-supervision of her PhD student Brandon Velle, who is working on the genetics of durability in racehorses. Natasha is looking forward to setting up her own research group and continuing to work closely with the racing industry in the future.
MOLECULAR AND DIAGNOSTIC PARASITOLOGY

We conduct a research program in which we combine traditional and molecular techniques and a detailed knowledge of how modern parasitology has emerged, to analyze the ecological role and understand the origin of parasitic species, and to identify new species. We used our expertise to ensure that University of Sydney now has laboratory that attracts talented students and increased competitive research funding. Our research program embraces experimental biology of protozoa with emphasis on the identification of the intimate relationship between the parasite and its host. The outcomes are host-parasite differences as the foundations for novel control strategies and techniques for screening for antiparasitics, and the improvement of the health and welfare of animals for community benefit. This research area is attractive to postgraduate and Honours students, and we have been keen to use its potential to harness their enthusiasm for scientific inquiry.

Arising from my research initiatives, the laboratory has an ongoing collaborations within farm and small animals and wildlife animals clinics to develop methods to rapidly diagnose and identify parasitic organisms using molecular and experimental tools and generate the data for better understanding parasitic life histories. The leadership of the laboratory is recognized by continuing University of Sydney (School of Molecular and Microbial Biosciences, School of Biological Sciences), national (University of Technology Sydney, Charles Sturt University, University of Western Sydney, Murdoch and Adelaide University) and international collaborations in France, Switzerland, Italy, Spain, New Zealand, the Czech Republic and the UK.

Significant research outputs (2010-2012)

We have discovered novel parasites, Cystodiscus spp. (myxosporidia), for which there is mounting evidence that their recent spread coinciding with the spread of the invasive Cane Toad and the decline of Australian frogs published in PloS ONE. The discovery of the new myxosporidian disease affecting Australian frogs is considered significant and the key disease in the recently released “A report for the Australian Government Department of Sustainability, Environment, Water, Population and Communities” called the Guidelines for minimising disease risks associated with captive breeding, raising and restocking programs for Australian frogs [June 2011]. The world-wide importance of the disease in endangered amphibians (i.e. Yellow-spotted bell frog, possibly the most critically endangered frog in Australia) is recognised by acceptance of our publication in the Centers for Disease Control and Prevention, USA flagship journal Emerging Infectious Disease. Moreover, the publication in PloS ONE has been highlighted on the University of Sydney front page of and attracted attention in the “blogosphere”, including a blog by an award winning writer of Scientific American.

We established collaboration with a leading laboratory at Institute Jacques Monod in Paris to study iron metabolism and applied our imaging and cell biology expertise leading to the discovery of Fe uptake via a nonreductive system published in Plant Physiology. This is significant because such a high affinity transport system for free Fe3+ has never been described in any eukaryotic cell. Among related research output is a recent paper in the journal Protist. Here, our expertise in culture and observation of life cycle stages
and understanding of evolutionary morphology was critical in the identification and characterization of the invasive stage of Chromera velia. This finding confirms that C. velia can be used model organism to study the evolution of parasitism within the Apicomplexa, providing a glimpse of what the ancestors of malaria parasites were like million years ago. The recognition of the high quality standing of our fundamental research is The University of Sydney Postdoctoral Fellowship awarded to Dr Neil Portman (2012-2015) to pursue project on the parasites’ flagellum in disease in our laboratory.

We led the team that produced the first direct evidence that, now Australian endemic, Neospora caninum - a parasite causing abortions in cattle - can cause significant pathology in a carnivorous marsupial Fat-tailed dunnart. This experimental model where neosporosis is dominated by production of tissue cysts opens new avenues in Neospora research, because tissue cysts so far escaped characterization, despite their ubiquitous presence in reconvalescent animals. The article published in Veterinary Research is now ranked as “highly accessed” by the publisher.

STAFF PROFILE

JAN SLAPETA
Jan Slapeta joined the Faculty of Veterinary Science, University of Sydney in 2007 as a veterinary parasitologist. Jan studied veterinary medicine at the University of Veterinary and Pharmaceutical Sciences Brno, Czech Republic, and obtained his MVDr degree in 1999. Jan’s passion for parasitology led him to the completion of his PhD, and postdoctoral research programs in US, France and Australia. He has a broad understanding of the biology of parasites of both medical and veterinary importance, as well as the diseases caused by them. Jan is author and co-author of over 80 peer-reviewed scientific publications. On moving to the University of Sydney he established a parasitological laboratory with a focus on emerging protozoan parasites. His research group studies apicomplexan parasites and mechanisms that control their life cycles strategies. The major outcomes during 2010-2012 are the discovery of new emerging parasite that threaten native frogs in Australia and development of a new laboratory model to study cyst formation of Nesopora caninum. The laboratory studies parasites such as Neospora, Toxoplasma, Cryptosporidium, Myxozoa and Tritrichomonas as well as free living organism that share common ancestry with parasite as targets of his experiments. Jan embraces research with teaching to apply new teaching strategies including virtual microscopy to create an environment that encourages students to acquire advanced analytical and intuitive skills in veterinary parasitology and medicine. He is a member of the Australian Society for Parasitology, where he served as New South Wales representative. Jan is the current co-Editor-in-Chief of Veterinary Parasitology.
PATHO BIOLOGY GROUP

GROUP MEMBERS
Dr Rachael Gray
Dr Damien Higgins
Associate Professor Mark Krockenberger
Associate Professor Jacqui Norris
Dr Derek Spielman
Scott Lindsay
Lydia Tong

Understanding pathogenesis via host-pathogen-environment interaction

The Pathobiology Group encompasses researchers and postgraduate students applying expertise in anatomical and clinical pathology, microbiology and immunology, to a broad range of interdisciplinary research projects. Members share a common interest in advancing our understanding of the role of altered host-pathogen-environment interaction in disease pathogenesis in domestic and non-domestic species.

Research by A/Prof Mark Krockenberger into koala cryptococcosis highlights an increased recognition of the important role of environment in this interaction. As part of the Koala Infectious Diseases Research Group he has published widely on environmental adaptations within Cryptococcus species (C. neoformans, C. gatti) that are integral to promoting disease within koalas. The causative organisms, now considered neither contagious nor zoonotic, depend on environment factors for endemicity and acquisition by immunocompetent or immunocompromised animal hosts (including human).

A/Prof Krockenberger and Dr Higgins have collaborated with A/ Prof Merran Govendir and the Pharmacology Group on the treatment of other koala diseases; including pharmacokinetic studies finding ineffective in vivo availability of enrofloxacin and marbofloxacin following oral and subcutaneous administration, and limited effectiveness of chloramphenicol in treating chlamydiosis (see Pharmacology section). Furthermore, both have worked with A/Prof Kathy Belov to investigate MHCII diversity in the koala as a limiting factor to host response and an altered host-pathogen-environment interaction (see Australasian Wildlife Genomics Group). Dr Higgins has advanced our understanding of chlamydiosis in koalas by examining strain diversity of Chlamydomphila pecorum (ompA VD1-VD3 and the ORF663 hypothetical gene), with implications for future management options such as vaccination and animal relocation. His studies into the diversity and function of MHCII genes in koalas, as well as those into the role of retiroviral immunosuppression, provide a clearer understanding of disease susceptibility within this species. Scott Lindsay (Pathology Registrar) is also investigating the immune response to infection in a marsupial species, in work building on initial studies by Dr Jan Šlapeta into the susceptibility of fat-tailed dunnarts to Neospora caninum infection (see Molecular and Diagnostic Parasitology section).

Widespread collaboration and strong investigation of infectious diseases by the Pathobiology Group is exemplified by the research of A/Prof Jacqui Norris into antibiotic resistance surveillance. One of her current projects involves an Australia-wide collection of multidrug-resistant extraintestinal pathogenic Escherichia coli and methicillin-resistant Staphylococcus species isolated from animal infections to determine their significance to public health. Furthermore, she is aiming to develop new diagnostic approaches and novel therapeutic options for Feline Infectious Peritonitis, including the use of short inhibitory RNA molecules and antimalarial drugs. Her team of PhD
students seek to progress important recent advances in our understanding of the causes of kidney disease in domestic felids to work with endangered, non-domestic felids (captive large cats), in which it is a common cause of death.

**COMMON INTERESTS, SHARED KNOWLEDGE, CONSERVATION BENEFITS**

As already outlined, the Pathobiology Group maintains a strong focus on wildlife disease investigation. Working with researchers from the NSW RSPCA, CSIRO and Taronga Conservation Society, Dr Derek Spielman has investigated the prevalence of rat lungworm (Angiostrongylus cantonensis) infection in Sydney wildlife – finding 80% prevalence in tawny frogmouths and 13% in brush tailed possums showing neurological disease. Identification of endemic and emerging disease within these proposed sentinel populations has significant implications for this zoonotic parasite that is the most common cause of eosinophilic meningitis in humans. Dr Spielman and A/Prof Krockenberger are currently investigating the potential role of haematophagous Laticlerada insects and leeches inhabiting possum dreys (nests) in the pathogenesis of a debilitating and often fatal necrotising limb and facial syndrome, which shows some similarity to diseases observed in dogs and human.

Ongoing research includes that of Drs Rachael Gray and Damien Higgins, investigating the high prevalence of hookworm and its contribution to elevated mortality rates in Australian sea lion pups. Their projects investigate potential predisposing causes such as low genetic diversity and the role of immune development, and assess the impact of the disease on population recovery in this threatened Australian species. Lydia Tong, (Pathology Resident) in collaboration with pathologists at Taronga Wildlife Hospital, is developing an effective antemortem molecular diagnostic faecal test to detect avian mycobacteriosis. Intended outcomes will overcome the difficulties associated with culturing these fastidious agents of disease and have widespread benefits in disease management in captive bred avian populations.

Investigating tumour biology to improve outcomes

A/Prof Krockenberger has collaborated with A/Profs Vanessa Barrs and Julia Beatty over the past 5 years working on small cell lymphosarcoma projects in cats. He also collaborates with Prof Rosanne Taylor and A/Prof Peter Williamson in the investigation of canine mast cell tumours. Intended outcomes of these and other ongoing diagnostic and tumour related research projects include improve diagnosis, prognostication and treatment.

**STAFF PROFILE**

**DAMIEN HIGGINS**

Damiens’ interests cover diverse areas within wildlife disease ecology and pathobiology. His background is in a variety of Australian and exotic species,starting as a Zoo Veterinarian and obtaining a Masters in Wild Animal Medicine and Husbandry at Taronga Zoo in 1996. Since then, he has made significant contributions to marine mammal research and whale stranding management plans and assisted field projects on a wide range of species while acting as a veterinarian at Taronga Zoo, a field veterinarian for the Australian Antarctic Division and AMMRC, a consultant for the Australian Registry of Wildlife Health and an academic at the University of Sydney. Since 2005, as part of the Koala Infectious Diseases Research Group, Damien has led research into various aspects of the host-pathogen-environment relationships associated with chlamydial disease of koalas; conducting and supervising research on chlamydial treatment, diagnosis and epidemiology, koala immunology and immunogenetics and chlamydial strain diversity. He currently supervises projects that investigate the impact of the koala retrovirus on the immune system of koalas, the role of immune development and genetics on susceptibility of Australian sea lion pups to hookworm, and the impact of that disease on populations of this threatened species. Through recent supervision of a project on disease in the Owston’s civet, he has also developed a growing interest in capacity-building for wildlife-associated disease management in south-east Asia.
Dr. Vivienne Reeve has played a major influencing role on research in Photobiology in Australia since the early 1980s. The research has been largely based on the hairless mouse, a model that is internationally acknowledged for its relevance to the responses of human skin to UV radiation exposure. Dr Reeve and her group maintain the only viable inbreeding colony of these mice in Australia, in addition to other relevant genetically modified mouse strains. The research has focussed primarily on strategies for the prevention of photoimmune suppression and the consequent development of photocarcinogenesis in the mouse, using dietary supplements or topical applications of a variety of sunscreens, drugs and phytochemicals. Endogenous pathways that protect against UV-induced photodamage have thus been identified for the first time. For example, the role of UV-inducible cutaneous antioxidants (haem oxygenase, metallothionein) and an important role for signalling by the oestrogen receptor-beta (a steroid hormone receptor that shares some properties with the nuclear vitamin D receptor) have been established. The relationship of these endogenous mechanisms with specific UV wavebands, UVA and UVB, has also been an important focus for the research. The group’s expertise in modelling photocarcinogenesis in the mouse is well recognised. Overall, the group has published 79 peer-reviewed journal papers (6 have been cited more than 25 times, 4 more than 40 times), 8 book chapters and one book, the majority of papers being in the top dermatological journal (J Invest Dermatol) and in the major international photobiology journals (Photochem Photobiol and Photochem Photobiol Sci).

Dr. Reeve and her students have played a prominent role in the international photobiology societies (American, European and Asia-Oceania), and in convening the photobiologists of Australia at regular annual national conferences.

CURRENT RESEARCH PROJECTS

• The influence of oestrogen receptor signalling on skin responses to UV Radiation.
• Dietary Supplementation of goji berry (Lycium barbarum) juice and protection from UV radiation-induced skin damage.
• The projects are based on campus, using mice from the Veterinary Science mouse colony.

TECHNICAL SERVICES

We have established reproducible models of skin carcinogenesis in mouse, that we have used for testing of many potential anti-cancer agents, in pure basic research and in collaboration with industry partners, such as sunscreens, phytochemicals, antioxidants, anti-inflammatory drugs, dietary alterations, other natural compounds. We use a laboratory source of solar simulated UV radiation for acute and chronic non-burning exposure of the mouse skin that models human sunlight exposure.

Skin tumours (squamous cell carcinoma) can be induced in mice by chronic UV exposures, and systemic or topical agents tested for effects on the rate of tumour development. Transplantable tumours (melanoma, squamous cell carcinoma) are maintained as cultured cells, and can be injected into recipient mice intradermally, subcutaneously or intravenously, and agents tested for effects on rate of tumour growth.

As UV radiation is immunosuppressive, immune modulating drugs can be tested by their effects on the suppression of the contact hypersensitivity response in mice, an immune response that is relevant to human T cell mediated immune reactions. We have acknowledged expertise in this sensitive assay. Supporting evidence of immune mediators such as cytokines or key enzymes in the skin using molecular biology and immuno-histochemistry.
SMALL ANIMAL MEDICINE RESEARCH

The unit’s research is currently focussed on infectious diseases and oncology. We also have active studies on hyperthyroidism, renal disease and we will soon expand our research in cardiology. Current funding provided from competitive grants, bequests and industry is approximately $180,000.

Our team comprises academic clinicians, residents, postgraduate interns, BSc honours and year V honours students. Our clinical facilities, the UVTHS dog centre and the unique, feline-only Valentine Charlton Cat Centre make for a high case load and excellent clinical research opportunities. We have two feline medicine specialists, two small animal medicine specialists and on staff and we have recently expanded our team to include a cardiologist and are currently recruiting an oncologist. Productive collaborations have been formed with industry partners and other researchers in our Faculty and beyond including the Australasian wildlife genomics group, the genetics and pathology groups, the Universities of Bristol and Glasgow and Colorado State University.

Current Research Projects

- Infectious causes of cancer in cats. What causes feline immunodeficiency virus (FIV)-associated lymphoma?
- Evaluation of serum galactomannan measurement as a new non-invasive test for the diagnosis of feline upper respiratory tract aspergillosis (manuscript in review)
- Computed tomographic findings in feline upper respiratory aspergillosis
- What causes hyperthyroidism in cats? A prospective study evaluating the potential involvement of flame retardant environmental toxins
- A retrospective study of the role of diet in hyperthyroidism
- B-cell receptor rearrangements as a diagnostic tool for feline lymphocytic-plasmacytic enteritis and alimentary lymphoma.
- Investigation of a familial bleeding disorder in kelpies
- Surface antigens as prognostic indicators in canine B cell lymphoma.
The veterinary biomedical research unit is a collaborative group led by Associate Professors Peter Williamson, Paul Sheehy, Jacqui Norris and Professor Rosanne Taylor. The unit has a focus on companion animal biology and disease, with projects that also draw on comparative studies in other species. The areas of research interest cover medical genomics, physiological genomics, molecular pathophysiology, stem cell biology and emerging therapies.

**MEMBERS:**

**Principals:** Rosanne Taylor, Jacqui Norris, Paul Sheehy, Peter Williamson.

**Research Fellows:** Dr Garry Lynch; Dr Jerry Wei

**Post-graduate students:**

**PhD:** Sebastian Bowman, Jessica Fletcher, Pauline Geale, Vinuthan Melakote Kodappa, Hamutal Mazrier, Phillip McDonough, Christopher Tan, Rayson Tan.

**Masters Students:** Mark Westman

**Honours students:** Tom Branighan, Matthew Crossley, Annabelle Fulmer, Jenna Lurie, Sally-Anne Mortlock, Carmel Safranko, Polly Yau.

**BSc (Vet):** Katherine Gregory, Monica Liu, Seung Hee Woo

**RESEARCH PROJECTS 2010-2012**

- The Canine Biobank: a genomics resource for Australian dogs.
- Immune disorders and canine atopic disease.
- Genomic analysis of immunophenotype.
- Canine Lymphoma
- Breed prevalence and molecular pathology of canine mast cell tumours.
- Skin cancer in dogs
- Molecular pathogenesis of canine inherited neurological disorders.
- Brain pathology in canine fucosidosis and effect of intrathecal enzyme infusion.
- Lactation genomics and neonatal growth.
- Bioactive proteins: proteomic analysis and cellular responses.
- Canine mesenchymal stem cells.
- Induced pluripotency in canine somatic cells.
- Characterisation of canine adipose derived mesenchymal stem cells for treatment of diseases and disorders in dogs.
- Generation of ‘clinic ready’ canine induced pluripotent stem cells for regenerative medicine
- Investigation of the role of bovine mammary stem cells in the lactation cycle
- Generation and characterisation of induced pluripotent stem cells (iPSCs) from canine tissues for application in regenerative medicine.
- Generation and characterisation of ‘clinic ready’ canine induced pluripotent stem cells (iPSCs) for application in regenerative medicine.
- Can short interfering RNAs (siRNAs) be a new treatment for controlling Feline Coronavirus infections such as Feline Infectious Peritonitis?

**RESEARCH FUNDING ORGANISATIONS**

NIH (USA); Canine Research Foundation; Australian Companion Animal Health Foundation; Dairy Australia; Maple Simmons Fund; Aird Bequest; Flood Bequest
ANIMAL BEHAVIOUR AND LIVESTOCK WELFARE SCIENCE

Livestock behaviour is investigated to identify deficiencies in welfare and productivity.

![A Pig Farrowing](image)

Research is focussed on improving the welfare and productivity of livestock. Projects employ different techniques to study animal behaviour, including direct observation and the use of technologies such as video cameras, GPS tracking collars and accelerometers (motion sensors). The behavioural measures contribute to a multidisciplinary approach to the evaluation of welfare and production issues, including the measurement of stress physiology and growth and productivity variables.

**Highlights**

The behaviour and productivity of sows and their litters are being studied in two contrasting housing systems – prototype Norwegian UMB farrowing pens, in which the sow is not confined, and conventional farrowing crates. In her Honours project conducted during 2011, Ms Rebecca Matthews found that piglet production and survival were similar in the two housing environments. This is an encouraging step in a long-term research programme to evaluate new farrowing/lactation accommodation systems that will be required by industry in future decades.

**Current activities**

Research projects, including Honours, Masters and PhD student projects, are investigating the behaviour, welfare and production of a range of farmed species.

Free-range laying hens: Masters student Ms Kate Hartcher is investigating the development of feather pecking behaviour by free range poultry. Feather pecking is a behavioural vice in poultry in which birds pull out the feathers of their flock-mates. The behaviour adversely impacts bird welfare, for example causing pain to the birds that are pecked. Further, if the plumage cover becomes inadequate due to feather pecking, nutrients may be directed away from growth or egg production and used to increase the generation of metabolic heat for maintenance of body temperature. Thus, production efficiency may be adversely impacted. This project is being conducted in collaboration with Professor Paul Hemsworth (Animal Welfare Science Centre, University of Melbourne) and is funded by the Australian Egg Corporation Limited. Ms Hartcher is the recipient of a post-graduate scholarship from the Australian Poultry CRC.

Farrowing/lactating sows: The development and evaluation of practical farrowing pens for use in the Australian pig industry is the focus of collaborative research between the University of Sydney, the Norwegian University of Life Sciences, and the Australian pig industry. The project also aims to identify key factors that will facilitate the anticipated change-over to non-confinement housing for sows around parturition and during lactation. The research is being co-funded by Australian Pork Limited and the Australian Pork CRC.

Spatially-enabled livestock management: Collaborative research with Dr Russell Bush (University of Sydney) and Dr Mark Trotter (Precision Agriculture Research Group, University of New England) is on-going, with the aim of evaluating the use of remote...
Mary Tran graduated from the AVBS degree with Honours in 2011 and is employed as a Research Assistant with the Poultry Research Foundation, Camden. Mary manages the Free Range Experimental Laying Facility at Camden. This includes the day-to-day running of the AECL project on the influence of factors during rearing of pullets on the development of feather pecking in free range laying hens. Mary has an interest in poultry welfare, and a particular focus on the improvement of welfare in livestock production in general. In the longer term, Mary foresees further involvement in poultry research, concentrating her research efforts in improving poultry welfare within the industry.

Kate graduated in 2010 with an AVBS Honours degree from the University of Sydney. Kate completed her honours research project under the supervision of Dr Jeff Downing, on corticosterone concentrations in the albumen of abnormal eggs, and was awarded the Poultry Research Foundation Prize in Animal Science. With a strong interest in animal behaviour and welfare science, Kate hopes to pursue a career in this area, in particular related to livestock production.

During her undergraduate training, Kate completed her professional experience placements with a variety of organisations including the Animal Welfare League, the Centre for the Integrative Study of Animal Behaviour at Macquarie University (a research position on chicken behaviour), the University of Queensland, a chicken hatchery and a Sea turtle conservation program.

In February 2012 Kate was awarded a post-graduate scholarship from the Australian Poultry CRC to undertake a Masters by Research under the supervision of Dr Greg Cronin at the Faculty of Veterinary Science, Camden. Kate’s research is part of an Australian Egg Corporation Limited project led by Greg Cronin, investigating the development of injurious feather-pecking behaviour in laying hens.

The mechanism underlying feather-pecking behaviour is not well understood. Nevertheless, feather-pecking can be a serious welfare and production issue for laying hens managed under alternative (non-confined) housing systems. Kate’s research is focussed on factors in the rearing environment of free-range laying hens that affect injurious feather-pecking behaviours. The research involves the conduct of detailed observation of the birds’ behaviour in-situ in their home pens, as well as in a variety of standard behaviour-test situations (e.g. open field test, tonic immobility test and competition tests) conducted away from the home pens. Stress response of the birds will also be measured via stress hormone metabolites in the faeces (especially for the birds during rearing) and in egg albumen. In addition, birds will be screened regularly for feather and integument condition, weighed to monitor growth and flock uniformity, while egg production will be measured throughout the laying period. These combined measures will hopefully yield a better understanding of the causes of feather-pecking in laying hens, to assist industry by recommending rearing practices to reduce the occurrence of the behaviour.
Enhancing livestock production through the provision of improved nutrition has favourable implications for farm profitability. Research being conducted in these areas incorporates key aspects associated with climate change and utilisation of grain by-products as well as applied strategies to improve on-farm productivity through better feeding and management.

The ultimate inspiration behind and focus of Dr Chaves’s research efforts is to be able to characterise the environmental impact of all livestock greenhouse gas emissions using a whole-system approach (e.g.: use of flux towers), achievable through my international collaborations and with the requisite funding.

Dr Bush is well aware of the global need to improve food security and the role of improved animal health and production in achieving the desired outcomes. Hence, his research focuses primarily on nutritional and production strategies to address on-farm problems nationally and within developing countries.

**Highlights**

Since June 2010 Dr Chaves:
- Focused his research program on the use of supplements in ruminant diets to optimise animal performance and reduce methane emissions, with promising findings that emissions decrease when glycerol and saponins are added in animal diets;
- Pursued a very productive collaboration with Agriculture and Agri-Food Canada in researching the effects of feeding algae meal to sheep (together with the University of Alberta and supported by Australian Wool Innovation) and in researching the effects of bacteria supplementation in diets containing canola or flaxseed oils, resulting in 8 published manuscripts and 10 conference presentations;
- Developed and implemented animal research projects in conjunction with the Federal University of Minas Gerais (Brazil), Taronga Zoo, DPI Victoria, AgResearch (New Zealand) and the Biomedical Engineering Department at USYD, leading to 5 publications;
- Received recognition internationally as an expert in the measurement of ruminant methane emissions and create the requisite inventory for Brazilian’s compliance with the Kyoto Protocol with a joint project in Brazil for EMBRAPA (Brazil’s CSIRO equivalent).
- The by-products (distillers grains, pressed oil seeds and glycerol) resulting from the increasing production of biofuels from food crops (grains and oil seeds) are being tested as a cost-effective energy source in ruminant diets. The role of ruminants as a contributor to greenhouse gas emissions is also being investigated along with more efficient feeding practices.
- The provision of research, development and extension in animal nutrition and livestock production is being delivered for projects in Pakistan, Cambodia and Lao PDR to improve the capacity of smallholder farmers. Improvement in buffalo and cattle productivity and profitability is being achieved through improved feeding practices, fodder conservation and access to feed resources.

Since June 2010 Dr Bush:
- Continued his involvement with Australian Centre for International Agricultural Research (ACIAR) funded project in Cambodia, Lao PDR and Pakistan. This included the development of a feed calendar which contains information on the growing and feeding of forages year round to address current deficiencies in availability and the gross underfeeding of animals.
- Developed and implemented animal research projects in conjunction with the Tablelands Livestock Health and Pest Authority and NSW Department of Primary Industries (DPI).
- Initiated a PhD project investigating the quality attributes of Alpaca meat in order to develop a viable product and source...
Russell joined the Faculty of Veterinary Science after spending 15 years in commercial agriculture and then completing a Bachelor of Science in Agriculture at the University of Sydney. His research focus is on improving livestock health and production both nationally and in developing countries. This commenced with his PhD investigating the on-farm biological and financial impact of ovine Johnes’ disease (OJD) under the guidance of Associate Professor Jenny-Ann Toribio and Professor Peter Windsor. This work was the basis for implementing a risk-based trading system for the movement of sheep within Australia in order to minimise the spread of this disease. Russell’s interest in primarily ruminant health and production has been continued with research into the impact of diseases such as Caseous Lymphadenitis (CLA) and sheep lice in collaboration with Dr Jeff Eppleston and Dr Bruce Watt from the Tablelands Livestock Health and Pest Authority. His long-term practical experience in livestock production, combined with more recent academic experience in agricultural science, has led to ongoing research in developing countries along with Professor Peter Windsor. This involves the provision of improved nutrition to cattle and buffalo to increase milk production (Pakistan) and meat production (Cambodia and Lao PDR). More recent initiatives have seen Russell become involved in the applied use of spatial technologies to better manage and monitor sheep and cattle production along with Dr Greg Cronin, an animal behaviour and welfare specialist, as well as commence supervision of a student investigating the quality attributes of Alpaca meat in order to develop a viable product and source of income for producers. Russell is well aware of the global need to improve food security and the role of improved animal health and production in addressing this issue.

Statement of current activities

Nutrition is regarded as a central science for improving animal production, health and reproductive performance. The team of Dr Alex Chaves and Dr Russell Bush combines expertise in ruminant nutrition with a sound knowledge of production systems. This network is further expanded with behaviour and welfare input from Dr Greg Cronin.

In a joint future project between The University of Sydney, the EMBRAPA – CNPGL (Dairy Research Centre) in Brazil, Federal University of Sao Joao and Agriculture and Agri-Food Canada our aims are to determine the effect replacing feed sources in livestock diets with press oils seeds and glycerol by-products of biodiesel production on ruminal fermentation patterns; feed digestibility; ruminal microbial populations; and methanogenic activity of ruminal archaea; animal performance; and the environmental safety and project sustainability. Expected results are

1 Environmental: (i) to determine the extent to which bio-fuel livestock feeds have the potential to reduce GHG emissions; (ii) to quantify the optimal proportion of these by-products that are required in farm animal diets to generate the best outcome.

2 Nutritional: By reducing methane production, animal performance is likely to improve.

3 Milk and meat composition: Increase the concentration of conjugated linoleic acid (CLA): a potent anti-carcinogenic.

4 Improve public perception of the bio-fuel industry: Through scientifically demonstrating the bio-fuel contribution to improved food production and reduction in GHG.

A commitment to improving livestock production in developing countries to address the global food crisis has lead to an increased commitment to improving available nutrition for cattle and buffalo in countries such as China, Pakistan, Cambodia and Laos. These projects aim to improve the productivity and profitability of smallholder farmers producing milk and beef in these countries and are funded by federal government agencies such as the Australian Centre for International Agricultural Research (ACIAR), Australian Agency for International Development (AusAID) and the Department of Agriculture, Forestry and Fisheries (DAFF).

Strategies used include growing and conserving forages as well as understanding the importance of meeting animal requirements. A combination of developing extension resources and participatory training is being used to provide effective capacity building within these countries.

Other domestically focused applied research activities associated with the sheep and cattle industries include investigating welfare implications and application patterns for SkintractionTM, a non-surgical alternative to mulesing; conducting a NSW sheep lice and caseous lymphadenitis (CLA) prevalence survey; and developing management strategies for extensive cattle production in central Australia.
1. Melanie’s PhD Project is working with Alpacas.
2. Dr Russell Bush attended a farmer meeting in Pakistan in January 2012 to introduce a feed calendar developed to improve the availability of year-round forages.

STUDENT PROFILE

MELANIE SMITH
Melanie (PhD Candidate) will investigate the fundamental quality parameters of Alpaca meat under Australian conditions, including optimal slaughter age and sex as well as the effect of quality enhancement techniques such as electrical stimulation and tender stretch at processing. This will also include investigation of the differences in meat quality of animals grazing different feed systems (pasture Vs. pasture + supplement). Alpaca producers will be provided fundamental information on production and processing to assist with animal management as well as the development of markets for Alpaca meat. This will enable the Alpaca industry to move beyond the current reliance on fibre as the sole means of income.
STUDENT PROFILE

JORGE AVILA STAGNO

Jorge (PhD Candidate and Assistant Professor Universidad de Concepcion, Chile). Jorge’s PhD project is investigating the use of two biofuel co products in ruminant nutrition, namely wheat based dry distillers’ grains with solubles (WDDGS), a co product from ethanol industry, and glycerol, a residual from biodiesel production. In a first trial at Mayfarm, Camden he found increased lamb performances with high concentrations of WDDGS as replacement of barley. In Canada, Jorge showed that these performances were revoked when the diets were isonitrogenous showing that the protein contents of WDDGS plays an important role in growth performance.

Based on the findings from earlier studies, Jorge suspected that the digestibility of glycerol should be very high. It is chemically very close to propionate, the three-carbon volatile fatty acid normally produced in the rumen. If glycerol results in an increase in the production of propionate, it could also reduce methane emissions because both propionic acid and methane require hydrogen in order to form in the rumen. Results showed increased propionate with only numerical reductions in methane emissions from finishing lambs in metabolic chambers. However, an increased performance with moderate concentrations of glycerol (7% of the diet) and linear improvements in fatty acid profiles proved glycerol to be an interesting dietary ingredient. Currently, Jorge is testing the effects of glycerol in forage based diets in a semi continuous fermentation trial.

STUDENT PROFILE

SARAH MEALE

Sarah (PhD Candidate) is investigating the potential of nutritional strategies to improve the end products of ruminant production systems. Ruminants are becoming increasingly important as the human population grows, due to their ability to convert feeds unsuitable for human consumption into readily consumable high protein products. Similarly, increasing the feed conversion efficiency in ruminants has the potential to not only increase animal productivity but also, to reduce methane emission intensity. With this in mind, she examined the effect of glycerol, a by-product of biodiesel production, on animal growth performance and wool production in Merino sheep and its effects on methane production. This is an encouraging nutritional strategy to mitigate methane emissions which also showed promise in its ability to improve wool quality.

Currently based at the Agriculture and Agri-Food Canada (Lethbridge, AB), Sarah is investigating the ability of microalgae to improve wool yield and quality as well as meat quality in sheep, with the additional aim of identifying the genes that influence these traits. The inclusion of microalgae in the diets of ruminant livestock is considered to increase the DHA (docosahexaenoic acid) level of foods of animal origin. Similarly, the high fat content indicates the potential to favourably alter ruminal fermentation such that, propionate production is increased and therefore, methane production may be decreased. These strategies can potentially offer both production and environmental benefits.
The Animal Reproduction Group has a strong track record in the development and application of advanced reproductive technologies for animal production and wildlife conservation. Current research projects focus on further enhancing the efficiencies of these technologies in a number of species, including sheep, cattle, pigs, horses, alpacas and rabbits.

With andrology and embryology labs located at both the Camperdown and Camden campuses, Chris Grupen, Roslyn Bathgate and Simon de Graaf manage an enthusiastic team of postgraduate research students and honours students, and have an established network of academic and veterinarian collaborators at numerous research centres, animal breeding companies, human fertility clinics, and Taronga Zoo.

Zamira Gibb, a recipient of the Faculty’s James Ramage Wright Award, recently completed her PhD studies investigating the effects of treatments used to cryopreserve and sex-sort stallion semen. Her findings have revealed that dimethyl formamide is a superior cryoprotective agent to the commonly used glycerol, and that the efficiency of semen sex-sorting is increased by using an optically clear diluent. Working with collaborators at EquiBreed in New Zealand, the improvements she developed enabled them to achieve the highest reported rate of pregnancy in mares artificially inseminated with sex-sorted and cryopreserved stallion semen. Zamira’s outstanding accomplishments have undoubtedly advanced the use of this technology for equine breeding.

The role of seminal plasma in sperm function and fertility is currently being explored by PhD student Jessica Rickard. Using cutting edge proteomic tools, Jessica is studying the composition of seminal plasma and the changes that occur to spermatozoa during ejaculation, liquid storage and cryopreservation. She is also investigating the effect of seminal plasma proteins and sperm membrane composition on the ability of spermatozoa to interact with and navigate the cervix. Jessica is in the second year of her PhD and is the recent recipient of an award from the Australian Sheep CRC for her outstanding research and communication skills. It is hoped that Jessica’s research will help facilitate low-cost cervical AI of frozen semen for the sheep industry.

A number of exciting advances in the field of camelid reproduction have recently been made by postdoctoral fellow Claire Kershaw-Young. Claire identified Mucin 5B as the protein responsible for viscosity in alpaca seminal plasma and an enzymatic regime to reduce this viscosity. A reduction in viscosity of alpaca semen is a necessary precursor to semen cryopreservation and AI in this species. Claire also identified Nerve Growth Factor as the long sought component of alpaca seminal plasma responsible for the induction of ovulation in this species. This discovery opens the way for alternative methods of ovulation control in camels. Claire’s work is continued by PhD student Cassandra Stuart who aims to use these findings to develop semen freezing and artificial insemination protocols for the Australian alpaca industry.

1. Developing Day 7 sheep embryos after recovery from cryopreservation (freezing/thawing).
2. PhD Candidate Jessica Rickard collecting ram semen.
STAFF PROFILE
ROSLYN BATHGATE

Dr Roslyn Bathgate specialises in applied reproductive biology in her role as Lecturer in Animal Reproduction in the Faculty of Veterinary Science. After completing a PhD in pig sperm preservation, Roslyn worked as an endocrinologist, andrologist and embryologist in the human IVF industry before returning to the Faculty to assume a postdoctoral position working on the sex pre-selection of dairy cattle. Following her appointment as a lecturer with the faculty in 2009, she has strengthened her ties with the pig industry and created new collaborations with the alpaca and rabbit industries in an effort to increase the use assisted reproductive technology and production sustainability in these species. Roslyn enjoys a strong research partnership with Taronga zoo and is directly involved in research projects and reproductive management of a number of species within their collection. Her role in the highly successful Asian elephant breeding program has been recognised by Taronga zoo as invaluable. As a senior member of the active and thriving reproduction group in the Faculty, Roslyn supervises numerous PhD, Masters and Honours students on a variety of projects, from preservation of rabbit spermatozoa to reproductive endocrine analysis of Tasmanian devil oestrus cycles and the reproductive profiling of in bred mouse strains.

STAFF PROFILE
CHRISTOPHER GRUPEN

Dr Chris Grupen heads the Animal Reproduction Group, and has extensive research and teaching expertise in the areas of gamete and embryo physiology, and advanced reproductive technologies. He graduated from the University of Adelaide and commenced his research career developing pig embryo production technologies at the Reproductive Biotechnology Division of BresaGen Limited in 1993. He was awarded a PhD from Meiji University, Tokyo, for his work on the artificial activation of oocytes and was a member of the research team that produced the first cloned pigs in Australia in 2001. His postdoctoral research at the University of Adelaide focused on oocyte maturation in pigs and embryo production in marmoset monkeys. Since Dr Grupen’s appointment to the University of Sydney in 2006, he has extended his research programmes to other livestock species, including sheep, cattle and horses, as well as wildlife species. While his main research interest continues to focus on understanding and improving oocyte quality, his current projects also aim to increase the efficiencies of reproductive technologies, including in vitro fertilisation, embryo culture and embryo freezing. Not only will advances in these areas benefit animal production for agricultural and biomedical purposes, they will also inform the development of treatments for infertile couples.
Dr Simon de Graaf specialises in andrology and the application of modern reproductive technologies in domestic animals and wildlife. After completing his PhD on ‘sperm sorting for sex preselection of sheep’ in 2006, he spent a brief period as a lecturer at the Royal Veterinary College, London before his academic appointment to the Faculty of Veterinary Science in 2009. Dr de Graaf has built a strong international research profile in the field of applied animal reproduction and is recognised as a world expert in sheep reproduction, sperm sexing and artificial insemination. This has been recognised through current appointments to the editorial board of Animal Reproduction Science, the executive board of the Association of Applied Animal Andrology and the standing committee of the International Congress on Animal Reproduction. His published works include a book chapter on reproduction in sheep, over 20 refereed articles in international journals and presentation of research findings at several national and international conferences. Dr de Graaf manages an active research program in subjects as diverse as controlled breeding, sperm sexing, semen cryopreservation and artificial insemination, as well as proteomic and functional investigations of the interaction between sperm, seminal plasma and the female reproductive tract. His current research aims to increase the use of assisted reproductive technologies in the rabbit, alpaca and sheep industries as well as increase our understanding of male reproductive biology and fertility.

Danielle Johinke graduated from the University of Sydney with a Bachelor of Animal and Veterinary Biosciences in 2008 after completing her Honours project in Tammar Wallaby genomics. Following graduation, she spent eight months studying the reproductive behaviour of orang-utans as part of the Orang-utan Health Project in North Sumatra, Indonesia. This incredible experience furthered Danielle’s passion for research leading her to pursue a PhD in the field of animal reproduction. In 2011, she was awarded a PhD scholarship from the RIRDC to commence studies in “Developing an effective diluent for the transport of rabbit semen” at The University of Sydney under the supervision of Drs. Roslyn Bathgate and Simon de Graaf. This project aims to develop an effective transport regime for chilled rabbit semen that results in commercially acceptable conception rates. Such an outcome would facilitate significant genetic gain in the Australian farmed rabbit population. In addition to her work with the University of Sydney, Danielle is completing a Certificate III in Captive Animals with the Taronga Training Institute at Taronga Zoo, Sydney and is an active member of the Management Committee for Australian Support Dogs, Inc.
DAIRY RESEARCH FOUNDATION

The Dairy Research Foundation (DRF) is located at the Camden Campus as part of the University of Sydney. The Foundation has a research laboratory known as the M.C.Franklin Laboratory and the responsibility of overseeing the dairy operation at Corstorphine farm. These facilities are key for carrying out a wide range of research in the areas of pasture and forage crops production and utilisation, animal nutrition, and whole farm systems studies. Through the project FutureDairy, the DRF has direct involvement with the Automatic Milking System at EMAI, DPI NSW. A key role of the Dairy Research Foundation is to inform the dairy and general community on the work undertaken by the University and this is achieved by running an annual Symposium at Camden.

THE IMPORTANCE OF DAIRY RESEARCH

The Dairy Research Foundation of the University of Sydney serves a unique role within Australia’s dairy industry by integrating a program of basic and applied research at the cutting edge of dairy science and production with extension activities to disseminate this information among dairy farmers nationwide.

The commercial competitiveness of our dairy producers relies heavily on the establishment of new technologies for managing and feeding cows to maximise productivity within our Australian environment. These programs would not be possible without the close co-operation and generous financial support of both dairy producers and corporate sponsors.

RESEARCH

The Foundation has supported research in Dairy Science for more than five decades, achieving a reputation for excellence in animal research of worldwide standing. With over 90 completed postgraduate degrees and more than 500 peer-reviewed journal publications, the DRF continues to build its legacy for advancing the dairy industry from solid scientific basis. This has been due in no small part to the leadership provided by the Foundation Directors, namely Dr. W. Whittlestone, Dr. A.K. Lascelles, Dr. R.C. Kellaway, Emeritus Professor E.F. Annison, Dr. G.H. McDowell, Dr. Jim Gooden, Dr. Bill Fulkerson and at present Associate Professor Yani Garcia.

THE DAIRY SCIENCE SECTION HAS A PROUD RECORD OF RESEARCH ACHIEVEMENT IN THE AREAS OF:

- Lactational Physiology.
- Lipid Metabolism.
- The Partitioning of Nutrients during Lactation.
- Control of Enteric Disease in Young Calves.
- Artificial Induction of Lactation.
- Control of Milk Fever.
- Regulation of Lactation at the Cellular Level.

At present the focus for research is on forage production and utilisation, feed management and future (robotic) farming systems and innovations. See Future Dairy for further details.

DAIRY RESEARCH FOUNDATION ANNUAL SYMPOSIUM

The Annual Symposium is the main fundraising event of the Dairy Research Foundation. Every year attendees have access to the latest research being conducted by the Dairy Science Group at Camden as well a vast variety of speakers from all over the globe. These speakers can be from Industry or Industry-related backgrounds, often including Australian dairy farmers.

More recently the focus has been on providing a forum for Australian speakers and showcasing successful on farm adoption of relevant practices. Both the practical topics and the low registration fees have meant a gradual increase in the number of dairy farmers attending.

The Symposium also offers the opportunity for young scientists to stage short presentations on their work. This provides the opportunity for young scientists to sharpen their presentation skills but also allows them to become familiar with the dairy industry.
FUTURE DAIRY

FutureDairy is a research program designed to help Australia’s dairy farmers manage the challenges they are likely to face during the next 20 years. The challenges are expected to be related to:

- The availability and cost of land and water resources
- The availability and cost of labour and associated lifestyle issues

PROJECT STAGES

Phase 1, from 2004 to 2008 was unique in that all work carried out considered science, systems and people issues and focusing on Forages, Feeding and Innovations. We explored how our findings work under commercial conditions through partner farms. Key outcome was the achievement of over 40 t DM/ha/year with complementary forage rotations (CFR) and the establishment of the first Automatic Milking System (AMS) research farm at Camden.

Phase 2, from 2008 to 2011 FutureDairy concentrated on Feedbase (more milk from home-grown feed) and Precision Farming (Automatic Milking Systems [AMS] and other new technologies). We continued working in direct collaboration with farmers and extension, obtaining great success with the implementation of CFR in commercial farms in the the Hunter Valley.

Phase 3 (2011-2015) is being developed but will focus on Sustainable Automatic Milking Systems and how we can best support farmers adoption and adaptation of this technology.

RESEARCH STAFF

Associate Professor Sergio (Yani) Garcia
Project Supervisor, Science Leader - Feedbase area

Dr Kendra Kerrisk
Project Leader - Precision Farming area

Dr Cameron Clark
Senior Research Fellow (Feedbase)

Dr Rafiq Islam
Forage Options, Nitrogen x water interactions
Crop modelling

Dr Ravneet Kaur Jhajj
Research Fellow

Dr Ajantha Horadagoda
Forage preferences, Forage quality

For more information visit www.futuredairy.com or contact Assoc. Prof. Sergio (Yani Garcia) at sergio.garcia@sydney.edu.au or Admin. Assistants Michelle Heward at and Sherry Catt at michelle.heward@sydney.edu.au / sherry.catt@sydney.edu.au
Kendra is a senior researcher originally from Taranaki, New Zealand who completed her BAppSc (Hon) at Massey University. In 1999 Kendra secured a scholarship through the New Zealand Large Herds Association to conduct doctorate studies at the University of Melbourne under the supervision of internationally known Prof. Jock Macmillan. She went back to New Zealand in 2001 to work in the Greenfield Project - the world’s first pasture-based Automatic Milking System research farm. In 2005 she accepted a position with the University of Sydney as AMS Research Leader within the FutureDairy program based at Camden, NSW. Kendra made very significant contributions to dairy science regarding application of Automatic Milking Systems with pasture-based dairying. Her work across both side of the Tasman has been instrumental in increasing our understanding of the implications of robotic milking when cows are grazed at pasture. One of the highlights of her career has been her leadership role in the co-development of the world’s first Robotic Rotary (Automatic Milking Rotary DeLaval). This internationally recognised work will increase the feasibility of robotic milking for large dairy herds that are more common within the Australian and New Zealand industries. Currently, Kendra is the Project Leader of FutureDairy 3 and is working towards the consolidation of Camden as the most advanced dairy centre for automated-pasture based systems and voluntary milking.

After spending 5 years as a DairyNZ farm systems scientist in New Zealand, Cameron has returned home to the University where he completed his PhD in dairy cow physiology. Having a keen interest in the dairy farming system, Cameron has conducted research across a broad range of topics. Cameron’s current research focus is on automatic milking systems, specifically, increasing the volume of grazable home grown feed within close vicinity to the dairy and the impacts of the forages on cow traffic and farm system management. This area of research is of increasing priority as the size of automatic milking system herds grow and with the impending commercial adoption of the high throughput robotic rotary. Cameron will also be working together with commercial farms during the decision making phase and in the early stages of implementing automatic milking to help ensure their success.
The DRF has a leadership role in the development of a Dairy Science Centre at Camden. This centre will be in turn the vehicle for broader participation of Faculty of Veterinary Science researchers (so called Sydney Dairy Science group). The Dairy Centre activities will pivot around key farm facilities at Corstorphine (conventional milking) and EMAI (robotic milking) to provide excellence in research, teaching and training in all aspects of dairy science. The Sydney Dairy Science group will:

- enhance Faculty’s outputs and outcomes in relation to dairy-related research
- highlight extensive capabilities in dairy research
- capture future research opportunities; and
- integrate research into teaching at both undergraduate and graduate levels

The Sydney Dairy Science group is open to anyone interested in dairy science and comprises many individual researchers and lectures from the Faculty. It draws on core Faculty research strengths (Nutrition and Metabolism, Genetics and Reproduction, Livestock Veterinary Teaching and Research Unit, and Future Dairy) but it will logically include all the activities of the Dairy Research Foundation. Further collaborative linkages are being developed with other faculties of The University of Sydney, and external R D&E organisations.

For more information please contact Associate Dean for Research, Assoc. Prof. Peter Williamson p.williamson@sydney.edu.au or Dairy Research Foundation Director Assoc. Prof. Sergio (Yani) Garcia sergio.garcia@sydney.edu.au.
GENETICS & GENOMICS

Farm animal Genomics at Camden
The genetic researchers at the Reprogen Bio-science group at Camden use an extensive range of animal based experiments to map and characterize genes influencing economically important traits and genes responsible for inherited disorders. Other areas of genetic research include the evolutionary origin and phylogeny of domesticated animals, the conservation and management of Australia’s native fauna, and building comparative genomic maps between diverse animals species.

A broad range of molecular biological techniques, including DNA cloning, DNA sequencing, genetic marker analysis (e.g., STRs, SNPs, and microarray analysis), gene expression analysis and sophisticated statistical and bioinformatic methodology are routinely applied in achieving these objectives. Much of the work lies at the interface of molecular and quantitative genetics and the group maintains strong quantitative skills relevant to the discovery and application of molecular findings as well as to basic genetic improvement.

Inherited diseases
The inherited disease team focuses on the molecular characterisation of inherited diseases in farm animals with a specific interest in equine, ovine and bovine variants of neuronal ceroid lipofuscinosis. Research highlights have been the identification of three disease causing mutations in Devon cattle and Merino and South Hampshire sheep. A Merino NCL research flock has been established as these sheep are a valuable model for the corresponding human lethal disease, and in collaboration with colleagues these sheep are used to develop longitudinal in vivo biomarkers for disease progression for future use in preclinical trials.

Mapping complex production traits in sheep/cattle
In sheep and cattle the group has developed a very large resource base around many 1000s of animals in which performance records can be matched with high density genotyping profiles. Such resources are being used to map regions in the genome for most of the important traits and this is a foundation step in the discovery of genes responsible for variation in such traits. The resources are also being used to make genomic predictions around breeding values using high density genome wide SNP information. This is termed genomic selection and is currently being applied in the dairy and sheep industries.

Bioinformatic tools for genome and population analyses
Genotype imputation strategies have been developed to predict high-density SNP genotypes in silico for gene discovery and genomic selection. Applications are primarily for genetic improvement of dairy cattle but they can also be applied to other species.

A high density Copy Number Variation (CNV) map of the bovine genome has been developed using Next Generation Sequencing (NGS) and 800K SNP signal intensity data to reveal if higher order genomic structural variation is important in cattle traits.

The group developed a high-definition network-visualization tool “NetView” for biodiversity analyses of animal populations, and applied this for detection of fine-scale population structures for dog, African wild dogs, dingos, sheep and cattle breeds.

Developed a new mapping tool called LODE for assignment of map locations for unassigned SNPs/scaffolds using LD information.
New opportunities

A recent collaborative project with a team of researchers at James Cook University on pearl oyster (Pinctada maxima) and shrimp (P. vannamei) is focused on the application of genomic selection techniques for improving the economically important traits.

The current set of skills and tools developed for the livestock industries can also be applied for analyses of wildlife populations in biodiversity and conservation context. Our group is now applying these tools in characterizing Australian Koala populations.

STUDENT PROFILE
MARY ABDELSAYED

Mary is a PhD student of Professor Herman Raadsma and Associate Professor Peter Thomson, currently in my 3rd year of my research which is looking at the genetics of extended lactation and lactation persistency in Australian dairy cows. More specifically my PhD is looking at estimating genetic parameters and breeding values both traditionally and using new technology known as genomic selection which is currently to date unavailable for extended lactation traits. I have been a student of Sydney University for the past seven years where I completed my undergraduate degree in Animal and Veterinary Bioscience in 2009 and went on to continue with my PhD. As part of my PhD I have had the opportunity to study a component of my research overseas in the United States for 3 months at Iowa State University where it is known for its animal science department and strong quantitative genetics department and group.
The Poultry Research Foundation was one of the original Foundations established within the University of Sydney by the University Senate, in October 1958. The purpose of the Foundation was and still is to provide an interface between the Australian poultry and allied industries, and the Faculty of Veterinary Science.

The Foundation sponsors industry related research, assists in the training of scientific personnel and acts in an industrial liaison capacity. The Foundation’s contribution to the development of the Australian poultry and stockfeeds industries has been achieved through research programs directed at achieving better understanding of the metabolism and nutritional requirements of poultry.

The Foundation regularly hosts workshops, seminars and symposia. In 1989 the annual Foundation Symposium became the Australian Poultry Science Symposium through a joint collaboration with the Australian Branch of the World’s Poultry Science Association.

Current Research Programs

AECL funded project “Salmonella control in commercial layer flocks”. A two year project looking at approaches to reduce intestinal colonisation of layer chickens by Salmonella with the use of live and inactivated vaccine in various combinations.

RIRDC funded project “Effects of incubation differences on broiler chicken skeletal integrity” 18 month preliminary project involving effects of differences in temperature and humidity at time of early incubation.

RIRDC New Animal Industries funded project “Efficient, environment and bird friendly duck production”

RIRDC, AECL and Feedworks Pty financially support the Faculty toward salary costs for the Director - PRF

AECL funded project to explore the anti-nutritional effects of dietary phytate

DuPont/Danisco funded project to predict feed enzyme efficacy through in vitro models

AB Vista funded project to explore the performance gap between free-range and conventional poultry production

Collaborative projects with the University of Melbourne and AECL resulted in two projects “The welfare of laying hens in cages” and “The importance of rearing environment, space and nests for laying hens in cages”

AECL funded project to explore environmental enrichment and beak trimming during pullet rearing and the subsequent effects on laying hen welfare in free-range production.
STAFF PROFILE
STUART WILKINSON
Stuart Wilkinson is a Postdoctoral Research Associate with the Poultry Research Foundation at Camden. His research is the area of calcium, phosphorus and phytate nutrition. Stuart is a co-supervisor to a number of postgraduate and undergraduate students across both poultry and pigs. In 2011 Stuart completed his PhD with the faculty investigating the effects of the n-6:n-3 polyunsaturated fatty acid ratio on pig growth and performance. From his PhD studies he has been an invited speaker at a number of international conferences and has been successful in attracting funding to continue his research further. Stuart began his research career working with the Poultry Research Foundation after completing his degree in Agricultural Science in 2000. During this time he became interested in applied animal science and continues to work closely with industry. Stuart is excited about the future of his research projects as well as working in a highly diverse, talented and dedicated research group.

STAFF PROFILE
DR. YUMIN BAO
Dr Yumin Bao hails originally from China where he worked from 1987-2002 for BaoTou Research institute of Rare earth as a Senior Engineer. Dr Bao came to Australia in 2002 as a visiting scientist at SARDI and then went onto the University of New England to read for his PhD in Poultry Nutrition, graduating in 2007. From 2008-2010 Dr. Bao worked as a postdoctoral research fellow for a major international biotechnology business based in Bangkok, Thailand where he was involved in next generation feed enzyme development. In 2011 Dr. Bao was headhunted to the role of postdoctoral research fellow within the Poultry Research Foundation to lead a commercially-funded project on nutritional modelling and feed enzyme bioefficacy for poultry. Dr. Bao has published more than 10 articles in the past 4 years in areas of organically-chelated trace minerals and other microingredients for poultry.
The Australasian Wildlife Genomics Group studies the molecular genetics and evolution of gene and genomes of our native wildlife. They are particularly interested in the immune system.

AREAS OF RESEARCH
- Comparative Genomics
- Immunogenetics
- Molecular Evolution

THE TASMANIAN DEVIL
We are studying the immunogenetics of Tasmanian devil facial tumour disease (DFTD). DFTD has led to the loss of 85% of our devils and may lead to the extinction of the species in the wild. We are also making inroads in understanding how DFTD is evolving in the wild and hope to identify animals that may show some resistance to the disease.

We are working closely with the Zoo and Aquarium Association to manage the genetic diversity of devils in Australia’s largest captive breeding program. This is the first time that next-generation genomic technologies will be used to assist with a captive breeding program. More information about the project can be found at sydney.edu.au/vetscience/Foundation/help/devil.shtml

THE TAMMAR WALLABY
We are have recently participated in a large collaborative project to sequence the genome of the tammar wallaby. Our role was to describe the Major Histocompatibility Complex (MHC) and to characterise antimicrobial peptides, cytokines, NK receptors and other immune genes. This work provides fundamental tools to allow us to study immune responses in healthy and diseased marsupials. We have recently described novel antimicrobial peptides, found in wallaby milk and in the skin of pouch young that are able to kill a broad range of microbes, including multi-drug resistant clinical isolates.

THE KOALA
Together with the Koala Infectious Disease Group we are looking at the role the MHC plays in disease susceptibility of koalas to Chlamydia.

THE PLATYPUS
We are characterizing the molecular composition of platypus venom. Platypus venom is produced during the breeding season by males. Envenomated humans experience excruciating pain that cannot be relieved by traditional painkillers like morphine. By characterising genes involved in these pain pathways we hope to develop novel painkillers.

IMMUNOLOGICAL FITNESS OF ANIMAL POPULATIONS
The AWGG are measuring the immunological fitness of Australian animals to determine their ability to respond to infectious diseases. In particular we are focusing on cane toads, frogs, platypuses and even domestic cats.
Dr. Beata Ujvari is a postdoctoral research fellow with the Australasian Wildlife Genomics Group, Faculty of Veterinary Science, The University of Sydney. Her qualifications include a PhD from the Eotvos Lorand University, Budapest, Hungary and an MSc from the Agriculture University, Godollo, Hungary. Her research interest covers the broad topic of evolutionary ecology. Dr. Ujvari has over fifty published peer-reviewed papers and two book chapters, and currently she is the head of the Comparative Oncology Special Interest Group. Her current research is focusing on understanding the progression and evolution of the Tasmanian Devil Facial Tumour Disease, a clonally transmissible cancer, which threatens the Tasmanian devils (Sarcophilus harrisii) with extinction. Dr. Ujvari uses her evolutionary biology background to understand how the genetic and epigenetic plasticity of DFTD contributes to the exceptional success of this parasitic cancer. Dr. Ujvari also hopes that her research will provide important information for traditional cancers that arise and die with their hosts.

I am a PhD student in my fourth and final year. My research is on Tasmanian devils and the Devil Facial Tumour Disease (DFTD), a contagious cancer which is threatening Tasmanian devils with extinction. This disease first emerged in 1996 and since this time has wiped out over 80% of the devil population. I have three research projects focussed on this disease. In order to understand why Tasmanian devils are susceptible to this disease I have been looking at immune diversity in devils over time. I have discovered that diversity at key immune genes has been low for many thousands of years making devils susceptible to disease outbreaks including DFTD. I have also been investigating whether DFTD is able to escape the immune system of the devils by producing molecules which down regulate the immune response of the devil host. Lastly, I have been involved in developing immune reagents and have used these to look a T cell sub-populations in devils and DFTD to better understand the devil immune system and its response to DFTD.
The Veterinary Pharmacology Group is involved in investigating the pharmacokinetics of drugs i.e. the profile of various drugs with reference to the rate of drug absorption, distribution, metabolism and excretion, in Australian native animals such as koalas and possums. The purpose of these investigations is to determine the most efficacious drug dose rate, dosing frequency and route of administration for various therapeutic drugs to optimize therapeutic outcomes. The Veterinary Pharmacology Group is also engaged in monitoring the development of resistance of bacteria from many veterinary species of animals to antibacterial drugs and investigating ways to prevent the selection of resistant bacteria due to the use of long-term antibacterial administration to animals.

Since 2010 PhD student Benjamin Kimble has optimised an in-vitro microsome assay to detect the rate of formation of drug metabolites by koalas (see left). PhD Student Lisa Black is currently exploring growing cell cultures infected with a koala Chlamydia spp. to ascertain the concentration of antichlamydial drugs to kill this pathogen.

STAFF PROFILE
ASSOCIATE PROFESSOR MERRAN GOVENDIR

Merran has focused on conducting clinical projects that have direct relevance to improving animal health. Her recent work has focused on clinical pharmacology. She was first investigator to publish a clinical trial in epileptic dogs to ascertain whether the human anticonvulsant drug gabapentin, reduced seizure activity. She was a member of an anaesthesia unit which was the first to publish a clinical trial using the agent sevoflurane in cats and ferrets, establishing sevoflurane as a new and useful agent for fast general anaesthetic inductions in small animals. Her most recent publications involved quantification of the development in resistance of common feline and canine bacterial pathogens to the fluoroquinolone therapeutic drugs and reporting on the susceptibility of Rapidly Growing Mycobacteria spp. (that cause skin diseases in cats and dogs) to the human fluoroquinolone moxifloxacin and the new veterinary registered fluoroquinolone pradofloxacin. Due to her ability assay concentrations of antibiotic concentrations in biological fluids she was invited to join the Faculty group investigation the treatment of chlamydiosis and cryptococcosis in koalas. With her PhD students, she has found that many drugs given to koalas at the recommended dose rate and dosing frequency are not reaching therapeutic concentrations. She hypothesises that the koala has poor oral drug absorption and that the koala uses it very active liver enzymes (required to detoxify their very toxic Eucalypt diet) to rapidly eliminate many drugs. Preliminary studies also indicate that koalas have very poor oral drug absorption from the gastrointestinal tract. This research will ultimately result in her group making recommendations to improve the dose rates and dosage frequencies of drugs used in koalas.

Chromatogram generated from a photodiode array detector illustrating the peak of the non-steroidal anti-inflammatory drug meloxicam (Metacam®) (A) and its metabolites (B) in the plasma of a koala injected with 0.4 mg/kg intravenously. This chromatogram represents a plasma sample collected 15 minutes after injection. Four chromatograms demonstrating the disappearance of meloxicam (shaded peaks) in koala plasma when injected at 0.4 mg/kg intravenously.

Since 2010 PhD student Benjamin Kimble has optimised an in-vitro microsome assay to detect the rate of formation of drug metabolites by koalas (see left). PhD Student Lisa Black is currently exploring growing cell cultures infected with a koala Chlamydia spp. to ascertain the concentration of antichlamydial drugs to kill this pathogen.

Time course of total products of meloxicam generated from enzymatic reaction (rat vs koala)
INTRODUCTION
Glenn Shea is Senior Lecturer in Veterinary Anatomy in the Faculty of Veterinary Science. Whereas his teaching responsibilities are in the anatomy of domestic mammals and birds, his research interests have always diverged from this and are focussed on herpetology.

Glenn has been working on systematics and biology of the herpetofauna of Australia and the Pacific region since the late 1970s and as such, has a lot of experience in this area. His 1992 Ph.D. thesis is one example of this, where he investigated the systematics and reproduction of the bluetongue lizards of the genus Tiliqua.

Glenn is heavily involved in herpetology and research outside of the University too. He is an Honorary Research Associate of the Australian Museum, Sydney and of the Queensland Museum, Brisbane, and the Bishop Museum, Honolulu. He was involved in the development of the Action Plan for Australian Reptiles (Australian Nature Conservation Agency, 1993), and has been a consultant to Environment Australia. In the latter role he was involved in the development of survey protocols for endangered Australian reptile species, 2003; herpetological surveys for revision of Action Plans for two species of endangered lizard in the Norfolk Island group, 2005), Goro Nickel in New Caledonia (herpetological survey of the proposed Goro Nickel Mine, New Caledonia, 2003) and the Province Sud Government, New Caledonia (herpetological survey of several reserves in Province Sud, 2004).

Glenn is also the editor of the Australian herpetological journal Herpetofauna, and represents the Australian Herpetological Society on the Native Animal Keepers’ Consultative Committee (NSW National Parks and Wildlife Service) and private keepers of reptiles and mammals on the Non-Indigenous Animals Advisory Committee (NSW Agriculture).

AREAS OF RESEARCH
- Systematics
- Reproductive biology
- Diet and distribution of the reptiles of Australia, New Guinea and the Pacific

CURRENT RESEARCH
- Systematics of the scincid lizard genus Sphenomorphus in New Guinea and the Solomon Islands (collaboration with Fred Kraus and Allen Allison, Bishop Museum;
- Steve Richards, South Australian Museum)
- Systematics and natural history of the lizard fauna of New Caledonia (collaboration with Ross Sadlier, Australian Museum; Aaron Bauer, Villanova University; Hervé Jourdan, IRD, New Caledonia)
- Male reproductive cycles of Australian elapid snakes (collaboration with Rick Shine, School of Biological Sciences, University of Sydney)
- Systematics of the Australian skinks of the Egernia striolata species-group (collaboration with Sarah Smith, Charles Darwin University; Ross Sadlier, Australian Museum)
- Phylogenetic systematics of pygopodid lizards (collaboration with Arnold Kluge, University of Michigan)
- Reproductive biology of Australian lizards
- Systematics of Australian typhlopid snakes
- History of Australian herpetology

REPTILE RESEARCH

1. Tiliqua occipitalis. Photos courtesy of G. Shea, converted to digital by K. Ellis
2. Tiliqua rugosa palarra
CURRENT RESEARCH

Blood parasites (Haematozoa) of Australian Birds. This work has shown that several blood parasites causing disease in Australian birds are in fact introduced to Australia.

Coccidia in Echidnas. Our honours student Johd Dedenham has recently published a paper on the natural occurrence of coccidia in wild echidnas, the prevalence of coccidian infection in captive echidnas, and response to treatment.

Trichomonas in Snakes. Staff of the Avian Reptile and Exotic Pet Hospital with Dr. Jan Šalpeta have documented upper respiratory and eye disease caused by newly described single-celled parasites (Trichomonas) in pythons.

Sarcocystis in Barn Owls. Staff of the Avian Reptile and Exotic Pet Hospital with Dr. Jan Šalpeta have genetically characterized for the first time a parasite (Sarcocystis) in barn owls. This work was supported by the Australian Wildlife Health Network and WIRES. Toxoplasmosis in Wombats. The veterinary staff at the Avian Reptile and Exotic Pet Hospital have investigated an outbreak of neurological disease in Wombats in the Kangaroo Valley and found that it was caused by Toxoplasmosis.

Humane and Safe Immobilization of Australian Crocodiles. Dr. Annabelle Olssen (PhD Student) with the support of Hartley’s Crocodile Adventures, Queensland Parks and Wildlife and spent the past 4 years testing a range of immobilizing agents on Estuarine and Australian fresh water crocodiles. Her work has shown that for immobilizing agents to be effective, they must be given in the front legs. She has developed protocols that result in reliable immobilization across a range of body temperatures that will allow safe handling of these animals and rapid recovery with no long term effects. This work has resulted in four publications so far.

Eastern Water Dragon Anaesthesia, Reproduction and Overwintering. In collaboration with Nadav Pezaro and M. Thompson (Biology, University of Sydney) and Sean Doody and Ashley Lyons (Monash University) the Veterinary Staff at the Avian Reptile and Exotic Pet Hospital have developed new anaesthetic protocols for Eastern water dragons that have direct field applications and a new protocol for the surgical implantation and removal of temperature recording devices. This research has resulted in the discovery of the role that core body temperature plays in the onset of egg laying and hot core body temperatures of dragons change prior to, during and after hibernation.

Koala Genetic Diversity, Population Structure and Ecology. Tristan Lee (PhD Student), in collaboration with Robert Close (University Western Sydney), Chris Allen (National Parks), and Victorian Veterinarians and Wildlife Rehabilitators has demonstrated the impact of the fur trade on the populations of koalas in the Greater Sydney area and their resilience. It has identified important genetic populations in New South Wales and importantly shown that koalas in South Gippsland from a unique genetic population that needs to be managed separately from the koalas in western Victoria.

Christmas Island Flying Foxes. The Staff of the Wildlife Health and Conservation Centre with members of the Australian Registry of Wildlife Health and National Parks Staff on Christmas Island are investigating the genetic diversity and origins of the Christmas Island Flying Fox.

Herpesviruses in parrots. In collaboration with investigators from the University of California Davis, Private Practitioners, investigators from the Department of Primary Industry, New South Wales, and the Schubot Exotic Bird Health Centre, Texas A&M University, the staff at the Wildlife Health and Conservation Centre have discovered an new herpesvirus causing respiratory disease in parrots and have shown that it occurs in both North America and Australia.
Dr Gongora’s team was established in 2008 after he was appointed as a permanent academic staff member of the Faculty of Veterinary Science in the areas of wildlife and animal genetics and conservation. The core research programs that Dr Gongora has established relate to phylogeography, population genetics, immunogenetics and endogenous retroviruses (ERVs). Some of the species investigated in those studies are peccaries, suids, crocodilians, monotremes and chickens.

As director of this vibrant team, Dr Gongora has supervised various international and local research students who have provided new insights into these areas. The current team members include: Mr Alvaro Perdomo who has been investigating the evolution of the Major Histocompatibility Complex (MHC) among species of peccaries and wild pigs; Mr Weerachat Jaratlerdsiri, who has been studying the structure and diversity MHC of the saltwater crocodile; Ms Amanda Chong who has been investigating the distribution and expression of endogenous retroviruses in the same species;

Dr Gongora has progressively increased the foundations of his research program with the establishment of international and local collaborations as well as links with industry and successful grant applications, including a collaborative ARC-DP and RIRDC grants to study the origins of Pacific chickens and diversity of ERVs in crocodiles. Dr Gongora is also involved in two key international initiatives: sequencing the genome of Crocodilians in collaboration with the University of Georgia and Mississippi State University; and characterising genomic regions of interest among suids in collaboration with the National Institute of Agronomical Research (INRA), France.

Over the past 3 years, Dr Gongora and his team, as a result of their own and collaborative research, have published 9 papers, 2 book chapters, more than 14 conference abstracts as well as oral presentations and a diversity assessment for the IUCN. He has recently undertaken a sabbatical period at INRA investigating immunogenetic and genomic aspects of wild pigs and peccaries. Dr Gongora has also been involved in building capacity in developing countries by providing training opportunities to international visitors and engaging in collaborative studies, including with colleagues from South-East Asia and Latin America.
Alvaro Perdomo, a Colombian biologist and current doctoral student in the Faculty of Veterinary Science under the supervision of Dr Jaime Gongora, was previously involved in studies into the ecology, conservation and population genetics of tropical species. He studied the reproductive biology and feeding habits of characids, a family of freshwater subtropical and tropical fish. Alvaro made his move into genetics when he started his master in Biological Science at the National University of Colombia in 2005. After completing his master in population genetics, studying an endangered catfish from South American streams, he worked as a research assistant for the Conservation Genetics group from the same University. There, he made significant contributions to the understanding of the dynamics that have shaped the population genetics of the most important commercial, but also endangered, fish from Colombian rivers, Pseudoplatystoma fasciatum. He worked for two other Universities (Universidad de La Sabana and Universidad de La Salle), where he performed administrative tasks related to the evaluation and improvement of quality in higher education programs (graduate and postgraduate). Alvaro is excited to be embarking on the forthcoming research into immunogenetics and the evolution of the Major Histocompatibility Complex (MHC) of several species of wild pigs (Suidae) and its related family peccaries (Tayassuidae). He aims to shed light on the mechanisms of evolution and selection that have shaped the diversity of the MHC these two families and make a significant contribution to this scientific area.
# Faculty Bequests 2010 - 2012

## Postdoc/New Academic Travel Funds

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## New Academic Start Up Funds

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## Deans Research Discretionary Funds New in 2012

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## VSF Canine and Feline Funds New in 2012

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AWARDS

STAFF AWARDS 2010

Professor Leo Jeffcott who has been appointed to the Chair of the National Veterinary Exam (NVE) Board of Examiners at the Australasian Veterinary Boards Council (AVBC).

Professor Michael Ward who has received an International Science Linkages Academies program 2010-11 grant for his research into infectious disease.

Dr Vanessa Barrs, was awarded the 2011 Endeavour Research Fellowship to undertake research in feline disease with Professor MJ Day at the University of Bristol. Vanessa will also be visiting the university of ulrecht for research for research on fungal disease in cats

Dr Kate Bosward, was awarded the Brown Fellowship for Research career development in 2011

STUDENT AWARDS 2010

Santiago Farina has won the “Australian Government Department of Agriculture, Fisheries and Forestry 2010 Young Dairy Scientist Communication Award” at the Australian Dairy Farmers Conference in Wollongong. There were over  350 dairy farmers from all over Australia and several other countries and international speakers from North and South America, Europe and China.


Jessica King for the top student award at the Invasive animals CRC, Chief Executive’s prize for achievement as an IA CRC student. Ms Jessica King, IA CRC-supported student with the University of Sydney (affiliated with the UTS and ANU) Jess has significantly enhanced our knowledge of invasive animals during her candidature. Her work is crucial to our current understanding of the lifecycle of Neospora. She has a remarkably successful publishing record and has actively communicated her findings.

Jeffery Go, was awarded the Vice-Chancellor’s Research Scholarship, Jeffery is the first recipient of this scholarship in the faculty.

Jessica Fletcher, Won a best poster prize “Gene expression profiling in canine fucosidosis.” at the International Canine and Feline Genomics Conference!

Rayson Tan, Has been selected as a 2010 Morris Animal Foundation Veterinary Student Scholar, for his research “Genomic Studies into Canine Mast Cell Tumours”.

Michael Campbell Won the Dairy Australia-sponsored Young Scientists Award at the Dairy Research Foundation Symposium 2010r.

Helen Golder was the runner up to the Dairy Australia-sponsored Young Scientists Award at the Dairy Research Foundation Symposium 2010.

Ashlie Hartigan, Australian Society for Parasitology - Network Travel Award awarded the prestigious JD Smyth Postgraduate Travel Award for Ashlie’s Researcher Exchange to The Academy of Sciences, Institute of Parasitology in Ceske Budejovice, Czech Republic “for the purpose of travelling overseas to gain knowledge on techniques that may not be available in Australia, to form liaisons that may benefit their careers in the longer term and to promote the cause of parasitology in Australia.
STAFF AWARDS 2011

A/Prof Heather Greenfield was presented by Dr Ruth Charrondiere, Director of INFOODS, with the Nevin Scrimshaw Award from FAO-INFOODS, as “a recognised leader in food composition data and its importance worldwide” Dr Nevin Scrimshaw was instrumental in setting up INFOODS in 1984, and was the first recipient of the Award in 2009. The First International Food Data Conference was organised by Heather Greenfield and Professor David Southgate in Sydney in 1993.

Prof Paul McGreevy The 2011 Eureka Awards, Research and Innovation, Research that contributes to Animal Protection. Hon Associate Professor David Evans, Dr Bidda Jones, Prof Paul McGreevy and Dr Andrew McLean.

A/Prof Kathy Belov The 2011 Eureka Awards, Research and Innovation, Environmental Research, The Devils’ Advocates, Associate Professor Kathy Belov, Dr Menna Jones, Professor Hamish McCallum, Mrs Anne Maree Pearse and Associate Professor Greg Woods.

Dr Emily Wong, Emily is a finalist in the Australian Fresh Science Awards 2011.

Prof Peter Windsor Awarded the 2011 Kesteven Medal in recognition of his distinguished contribution to international veterinary science including his remarkable career and achievements in livestock health, inherited disease, public health and international development. This award was inaugurated by the late Dr. KVL Kesteven and is a joint award of the Australian College of Veterinary Scientists and the Australian Veterinary.

Associate Professor Robyn Alders, AO, has received the prestigious University of Sydney Alumni Award for International Achievement for 2011

STUDENT AWARDS 2011

Jessica Rickard: Best overall 1st year student at the combined annual postgraduate conferences of the Sheep, Beef and Pork CRCs.

Ashlie Hartigan: Best Presentation award at the Australian Society for Parasitology Conference

Mary Abdelsayed: the Dairy CRC Forum 2011 Student Presentation Award

Simon Freestone; “Best oral presentation by a student” at the Sydney Emerging infectious Disease and Biosecurity Conference

Matthew van de Saag: Best “Early Stage” presentation at the Faculty of Veterinary Science Postgraduate conference”

Jeffery Go: Best “Middle Stage” presentation at the Faculty of Veterinary Science Postgraduate conference”

Tie to Hayley Pearson and Joanna Whitney: Best “Final Stage” presentation at the Faculty of Veterinary Science Postgraduate conference”

Tenzin: Best Poster presentation at the Faculty of Veterinary Science Postgraduate conference”

Justin Ng: best “Early bird abstract award” at the Faculty of Veterinary Science Postgraduate conference”

Vidya Bhardwaj: A finalist for the advanced flow cytometry prize awarded by Becton Dickinson

Helen Golder: Best paper award at 2011 DRF Symposium

Greg Tuckett: Best poster award at the Australian Pig Science Association 2011 conference
2010 PhD
Ravneet Kaur Jhajj – Effects of forage type, mixed diets and feeding practices on the efficiency of feed utilisation in sheep
Gauthami Sudhamayee Kondagari – An experimental study of combined enzyme infusion in canine fucosidosis and investigation of other storage diseases in animals
Tamara Leahy - Effect of seminal plasma on sperm integrity
Fabricia Nascimento - Origin, evolution, transfer and recombination of porcine endogenous retroviruses (PERVs) DNA sequences in their natural host (family Suidae)

2011 PhD
Abdullah Al Alanazi - Epidemiological studies on internal parasites of horses and anthelmintics resistance in NSW Australia
Katrina Louise Bower - Aspects on pathogenesis and diagnosis of ovine Johne’s disease
Sally Kristen Browne - Apoptotic responses during the pathogenesis of Mycobacterium avium subsp paratuberculosis in sheep
Junlae Cho - Anit-photocarcinogenic effect of oestrogen
Santiago Rafael Farina - Nutrient balance in dairy systems utilizing complementary forage rotation systems as the main source of forage
Samuel Alexander Hamilton - Simulating the transmission and control of highly pathogenic avian influenza epidemics in the Australian poultry industries
Tamara Keeley - Reproductive physiology of the Tasmanian Devil (Sarcophilus Harrisii) and the development of assisted reproductive technology
Jessica Susanne King - Are wild canids associated with neospora abortion in cattle? Improving the diagnosis of neosporosis and investigating the prevalence, life cycle and risk to cattle of neopora caninum in wild canids.
Sabrina Lomax - Investigating the efficacy of topical anesthesia for the alleviation of pain associated with husbandry interventions in lambs and calves
Kate Janice Makin - Investigating mortality in the live sheep trade
Vinuthan Melakote Kodappa - A study of functional and variation in the dairy proteome
James Sebastian Neal - Water use efficiency of forages used in dairy industry
Hannah Salvin - The natural history of canine cognitive dysfunction
Mini Singh - Identification of candidate genes for milk traits in sheep using an integrated genomics approach
Helen Smith - Pattern of change in the concentration of milk acetone in dairy cows on a predominantly grazed pasture system: associations with reproduction, Nutrition and the environment
Lisa Tomkins - Identifying predictors of success in the guide dog program
Jerry Chih Yu Wei - Genome-wide studies of lactation performance in mouse models
Joanna Denise White - Investigations into the epidemiology and aetiology of chronic renal disease in domestic cats
Camilla Whittington - Evolution of venom: gene discovery in the platypus
Stuart John Wilkinson - The role of dietary fatty acids in growth and carcass composition of the developing pig

2011 MASTER’S DEGREE AWARDED - MScVETSc
Daniel Dickeson - Quantification of the effects of inaccurate pasture allocation in a pasture based automatic milking system
Megan Patricia Donahoo - Reducing antibiotic usage in pigs herds by controlling Lawsonia Intracellulares by vaccination
2011 MASTER’S DEGREE AWARDED MVetClinStud
Matthew M Izzo - Prevalence and detection of enteric pathogens in Australian dairy calves with diarrhoea
JOURNAL ARTICLES
Au, F, McKeown, L, MccAllister, T, Chaves, A V 2010, Fermentation characteristics of corn-, triticale-, and wheat-based dried distillers' grains with solubles in barley-based diets determined using continuous and batch culture systems, Journal of the Science of Food and Agriculture, 90, 2074-2082
Belov, K 2010, The role of the Major Histocompatibility Complex in the spread of contagious cancers, Mammalian genome, doi 10.1007/s00335-010-9294-2
Bertoldo, M J, Holcape, P, Evans, G, Grupen, C G 2010, Follicular Progesterone Levels Decrease During the Period of Seasonal Infertility in Sows, Reproduction in Domestic Animals., 1-6
Bertoldo, M J, Holcape, P, Evans, G, Grupen, C G 2010, Oocyte developmental competence is reduced in sows during the seasonal infertility period, Reproduction, Fertility and Development, 22, 1222-1229
Bishop, S, King, J S, Windsor, P A, Reichel, M, Ellis, J, Slapeta, J 2010, The first report of ovine cerebral neosporosis and evaluation of Neospora caninum prevalence in sheep in New South wales, Veterinary Parasitology, 170, 137-142
Bower (Goldsmith), K L, Begg, D J, Whittington, R 2010, Optimisation of culture of Mycobacterium avium subspeciesÂ paratuberculosis from blood samples, Journal of Microbiological Methods, 80, 93-99
Brock, K E, Huang, W, Fraser, D R, Ke, L, Tseng, M, Stolzenberg-Solomon, R,

Dunlop, R, Cato, D H, Noad, M 2010, Your attention please: increasing ambient noise levels elicits a change in communication behaviour in Humpback whales (Megaptera novaeangliae), Proceedings of the Royal Society of London. B Biological Sciences, 277, 2521-2529

Dusan, F, Toribio (Lee), J-A L M L, East, I 2010, Assessment of the risks of communicable disease transmission through the movement of poultry exhibited at agricultural shows in New South Wales, Australian Veterinary Journal, 88(9), 333-341


Fletcher, J L, Williamson, P, Horan, D, Taylor, R M 2010, Clinical signs and neuropathologic abnormalities in working Australian Kelpies with globoid cell leukodystrophy (Krabbe disease), Journal of the American Veterinary Medical Association, 237(6), 682-688


Gadeock, S, Tran, NSN, Georgiou, J, Jalilian, I, Taylor, R M, Wiley, J S, Sluyter, R 2010, TGF-B1 prevents up-regulation of the P2X7 receptor by IFN-y and LPS in leukemic THP-1 monocytes, Biochimica et Biophysica Acta-Biomembranes, 1798(11), 2058-2066


Hartigan, A, Phalen, D N, Slapeta, J 2010, Museum material reveals a frog parasite emergence after the invasion of the cane toad in Australia, Parasites and Vectors, 3(June 2010), 501-50-6


Hick, P M, Tweedie, A, Whittington, R 2010, Preparation of fish tissues for optimal detection of betanodavirus, Aquaculture, 310, 20-26

Hick, P M, Whittington, R 2010, Optimisation and validation of a real-time reverse transcriptase-polymerase chain reaction assay for detection of betanodavirus, Journal of Virological Methods, 163, 368-377


Highfield, L, Ward, M P, Laffan, S, Norby, B, Wagner, G 2010, The impact of potential mitigation strategies on the predicted spread of foot and mouth disease in white-tailed deer in south Texas, Preventive Veterinary Medicine,
Bioinformatics, 11, 1 of 13-13 of 13

scaffolds based on pair-wise linkage locations for unassigned SNPs/


Kawai, S, Zhong, L, Whittington, R 2010, Partial proteome of Mycobacterium avium subsp. paratuberculosis under oxidative and nitrosative stress, Veterinary Microbiology, 145(3-4), 252-264


King, J S, Slapeta, J, Jenkins, D, Al-Gassab, S, Ellis, J, Windsor, P A 2010, Australian dingoes are definitive hosts of Neospora caninum, International Journal for Parasitology, 40, 945-950


Kluger, E K, Caslake, M, Baral, R, Malik (Krochmalik), R, Govendir, M 2010, Preliminary post-prandial studies of Burmese cats with elevated triglyceride concentrations and/or presumed lipid apheresis, Journal of Feline Medicine and Surgery, 12(8), 621-630


Leahy, T M, Celi, P, Bathgate, R A, Evans, G, Maxwell, W M C, Marti, J 2010, Flow-sorted ram spermatozoa are highly susceptible to hydrogen peroxide damage but are protected by seminal plasma and catalase, Reproduction, Fertility and Development, 22(7), 1131-1140


Lee, T, Zenger, K, Close, R, Jones, M, Phalen, D N 2010, Defining spatial genetic structure and management units for vulnerable koala (Phascolarctos cinereus) populations in the Sydney region, Australia, Wildlife Research, 37(2), 156-165

Leehongdee, S, Kershaw-Young, C M, Scaramuzza, R, Khalid, M 2010, Intra-cervical application of Misoprostol at estrus alters the content of cervical hyaluronic and the mRNA expression of follicle stimulating hormone receptor (FSHR), luteinizing hormone receptor (LHR) and cyclooxygenase-2 in the ewe, Theriogenology: an international journal of animal reproduction , 73, 1257-1266


Leahy, T M, Celi, P, Bathgate, R A, Evans, G, Maxwell, W M C, Marti, J 2010, Flow-sorted ram spermatozoa are highly susceptible to hydrogen peroxide damage but are protected by seminal plasma and catalase, Reproduction, Fertility and Development, 22(7), 1131-1140


of Steroid Biochemistry and Molecular Biology, 121(40210), 164-188
Slapeta, J 2010, Monophyly of marsupial intraerythrocytic apicomplexan parasites from South America and Australia, Parasitology (Cambridge), 137, 37-43
Miller, E, Eldridge, M, Cooper, D, Herbert, C A 2010, Dominance, body size and internal relatedness influence male reproductive success in eastern grey kangaroos (Macropus giganteus), Reproduction, Fertility and Development, 22(3), 539-549
Morton, K M, Evans, G, Maxwell, W M C 2010, Effect of glycerol concentration, Equex STM supplementation and liquid storage prior to freezing on the motility and acrosome integrity of frozen-thawed epididymal alpaca (Vicugna pacos) sperm, Theriogenology: an international journal of animal reproduction, 74, 311-318
Munn, A J, Kern, P L, McAllan, B M 2010, Coping with chaos: unpredictable food supplies intensify torpor use in an arid-zone marsupial, the fat-tailed dunnart (Smithornis crassicaudata), Naturwissenschaften, 97(6), 601-605
Nagata, R, Kawaji, S, Minakawa, Y, Wang, X, Yanaka, T, Mori, Y 2010, A Specific induction of interleukin-10 by the Map41 recombinant PPE antigen of Mycobacterium avium subsp. paratuberculosis, Veterinary Immunology and Immunopathology, 135, 71-78
Nampanya, S, Rast, L, Khounsy, S, Windsor, P 2010, Assessment of Farmer Knowledge of Large Ruminant Health and Production in Developing Village-Level Biosecurity in Northern Lao PDR, Transboundary and Emerging Diseases, 57, 420-429
Neal, J S, Fulkerson, W, Campbell, L C 2010, Differences in yield among annual forages used by the dairy industry under optimal and deficit irrigation, Crop and Pasture Science, 61(8), 625-638
O’Brien, J K, Robeck, T 2010, Preservation of beluga (Delphinapterus leucas) spermatozoa using a trehalose-based cryodiluent and directional freezing technology, Reproduction, Fertility and Development, 22, 653-663
Pavic, A, Groves, P, Cox, J 2010, Utilization of a novel autologous killed tri-vaccine (serogroups B[Typhimurium], C [Mbandaka] and E [Orión]) for Salmonella control in commercial
poultry breeders, Avian pathology, 39(1), 31-39
Phaedrifa, D, Spithill, T, Smith, R, Raadsma, H W 2010. Improving animal and human health through understanding liver fluke immunology, Parasite Immunology, 32(8), 572-581
Plain, K, Purdie (williams), A, Begg, D J, de Silva, K I, Whittington, R 2010. Toll-like receptor (TLR)6 and TLR1 differentiation in gene expression studies of Johnne's disease, Veterinary Immunology and Immunopathology, 137(1-2), 142-148
Podadera, J M, Bell, R J, Dart, A J 2010. Using magnetic resonance imaging to diagnose non-displaced fractures of the second phalanx in horses, Australian Veterinary Journal, 88(11), 439-442
Rast, L, Windsor, P A, Khounsy, S 2010. Limiting the impacts of foot and mouth disease in large ruminants in Northern Lao People's democratic republic by vaccination: A case study, Transboundary and Emerging Diseases, 57, 147-153
Reddcliff, L, Marsh, I, Fell, S, Austin, S, Whittington, P 2010. Isolation of Mycobacterium avium subspecies paratuberculosis from muscle and peripheral lymph nodes using acid-pepsin digest prior to BACTEC culture, Veterinary Microbiology, 145(1-2), 122-128
Reeve, V E, Allanson, M, Arun, SJ, Titmuss (nee Domanski), D, Painter, N L 2010. Mice drinking goji berry juice (Lycium barbarum) are protected from UV radiation-induced skin damage via antioxidant pathways, Photochemical & Photobiological Sciences, 9(4), 601-607
Selle, P H, Cadogan, D, Li, X, Bryden, W 2010. Implications of Sorghum in Broiler Chicken Nutrition, Animal Feed Science and Technology, 156(1), 57-74
Slapeta, J, Craig, S, McDonell, D, Emery, D L 2010. Trichichomias foetus from domestic cats and cattle are genetically
distinct. Experimental Parasitology, 126(2), 209-213

Smith, S, Belov, K, Hughes, J 2010, MHC screening for marsupial conservation: extremely low levels of class II diversity indicate population vulnerability for an endangered Australian marsupial, Conservation Genetics, 11(1), 269-278


Stefanski, E, Garcia, S C, Farina, S R, Tan, D K, Tanne, D 2010, Effects of sowing rate and grazing management of forage rape (Brassica napus) on grazing behaviour and utilisation by dairy cattle, Animal Production Science, 50(6), 560-567


Tenzin, T, Sharma, B, Dhand, N K, Timsina, N, Ward, M P 2010, Reemergence of Rabies in Chhukha District, Bhutan, 2008, Emerging Infectious Diseases, 16(12), 1925-1930


Tomkins, L M, McGreevy, P 2010, Hair Whorls in the Dog (Canis familiaris), Part II: Asymmetries. Anatomical Record - Advances in Integrative Anatomy and Evolutionary Biology, 293, 513-518

Tomkins, L M, McGreevy, P 2010, Hair Whorls in the Dog (Canis familiaris), I. Distribution, Anatomical Record - Advances in Integrative Anatomy and Evolutionary Biology, 293, 338-350


Tran, NSN, Pupovac, A, Taylor, R M, Wiley, J S, Byrne, S N, Sluyter, R 2010,
Murine epidermal Langerhans cells and keratinocytes express functional P2X7 receptors, Experimental Dermatology, 19(8), e51-e57


Vernerson, M, Belov, K, Aveskogh, M, Hellman, L 2010, Cloning and Structural Analysis of two Highly Divergent IgA Isotypes, IgA1 and IgA2 from the Duck Billed Platypus, Ornithorhynchus anatinus, Molecular Immunology, 47, 785-791


White, J, Malik (Krochmalik), R, Norris, J M, Malikides, N 2010, Association between naturally occurring chronic kidney disease and feline immunodeficiency virus infection status in cats, Journal of the American Veterinary Medical Association, 236(4), 424-429

White, P, Ward, M P, Toribio (Lee), J-A L M L, Windsor, P A 2010, The association between congenital chondrodystrophy of unknown origin (CCDU) in beef cattle and drought in south-eastern Australia, Preventive Veterinary Medicine, 94(3-4), 178-184

White, P, Windsor, P A, Dhand, N K, Toribio (Lee), J-A L M L 2010, Risk factors for congenital chondrodystrophy of unknown origin in beef cattle herds in south-eastern Australia, Preventive Veterinary Medicine, 96, 36-48


Whittington, R, Becker, J, Dennis, M 2010, Imduvirus infections in finfish - critical review with emphasis on ranavirus infections, Journal of Fish Diseases, 33(2), 95-122


Williams, A, Karlsson, L, Palmer, D, Vercoe, P, Williams, I, Greeff, J, Emery, D L 2010, Relationships between faecal dry matter, worm burdens and inflammatory mediators and cells in parasite-resistant Merino rams, Veterinary Parasitology, 171(3-4), 263-272


Windsor, P A, Whittington, R 2010, Evidence for age susceptibility of cattle to Johne’s disease, The Veterinary Journal, 184, 37-44

Wong, E, Lillie, M C, Belov, K 2010, Genome Analysis of the Platypus, . . . 1-8

Zhong, L, Taylor, D L, Whittington, R 2010, Proteomic profiling of Ovine Serum by SELDI-TOF MS: Optimisation, reproducibility and feasibility of biomarker discovery using routinely collected samples, Comparative Immunology, Microbiology & Infectious Diseases: the international journal for medical and veterinary researchers and practitioners , 33(1), 47-63

BOOK CHAPTERS

Barrs, V R, Beaty, J A 2010, Diagnosis and Treatment of Low-Grade Alimentary Lymphoma, Consultations in Feline Internal Medicine (6th Ed), Saunders (Elsevier), St. Louis, 187-199

Barrs, V R, Beaty, J A 2010, Pyothorax, Consultations in Feline Internal Medicine (6th Ed), Saunders (Elsevier), St. Louis, 3-12

Barrs, V R, Beaty, J A 2010, Upper Respiratory Tract Aspergillosis, Consultations in Feline Internal Medicine (6th Ed), Saunders (Elsevier), St. Louis, 36-52


Miller, E, Eldridge, M, Herbert, C A 2010, Dominance and paternity in the tammar wallaby, Macropods: The Biology of Kangaroos, Wallabies & Rat-kangaroos, CSIRO Publishing, Victoria, Australia, 77-86

Miller, E, Herbert, C A 2010, Breeding...
and Genetic Management of Captive Marsupial Populations, Marsupial Genetics and Genomics, Springer Science + Business Media, Australia, 5-32


Barrs, V R, Beatty, J A 2010, Diagnosis and Treatment of Low-Grade Alimentary Lymphoma, Consultations in Feline Internal Medicine (6th Ed), Saunders (Elsevier), St. Louis, 187-199

Barrs, V R, Beatty, J A 2010, Pyothorax, Consultations in Feline Internal Medicine (6th Ed), Saunders (Elsevier), St. Louis, 3-12

Barrs, V R, Beatty, J A 2010, Upper Respiratory Tract Aspergillosis, Consultations in Feline Internal Medicine (6th Ed), Saunders (Elsevier), St. Louis, 36-52


Miller, E, Eldridge, M, Herbert, C A 2010, Dominance and paternity in the tammar wallaby, Macropods: The Biology of Kangaroos, Wallabies & Rat-kangaroos, CSIRO Publishing, Victoria, Australia, 77-86

Miller, E, Herbert, C A 2010, Breeding and Genetic Management of Captive Marsupial Populations, Marsupial Genetics and Genomics, Springer Science + Business Media, Australia, 5-32


Cleary, L., Van herk, F.H., Gibb, D., McAllister, T., Chaves, A.. Dry Matter Digestion Kinetics of Two Varieties of Barley Grain Sown with Different Seeding and Nitrogen Fertilization Rates in Four Different Sites Across
Gonzalez, J., Hernandez-Jover, M., Cogger, N., conservation:1-12
Hernandez-Jover, M., Cogger, N., conservation:1-12


James, J. Is gene loss in pedigree dogs surprisingly rapid? The Veterinary Journal:189:211-213


Jori, F., Brahmabhatt, D. P., Fosgata, G., Thompson, P., Budike, Ward, M., C., Ferguson, K., Gumnow, B., and A questionnaire-based evaluation of the veterinary cordon fence separating wildlife and livestock along the boundary of the Kruger National Park, South Africa. Preventive Veterinary Medicine. 100:210-220


Kawaji, S., Begg, D., Plan, K., and Whittington, R. A longitudinal study to evaluate the diagnostic potential of a direct faecal quantitative PCR test for Johne’s disease in sheep. Veterinary Microbiology. 148:1:35-44


Krockenberger, M., S Pegrum, K Hoffman, D Barfield, C Lauer and
R Malik (In Press). Small bowel infarction due to vasculitis and venous thrombosis in a cat with inflammatory bowel disease. Australian Veterinary Practitioner (accepted 20/5/10)


McDonagh, P., Sheehy, P., Norris, J. In vitro inhibition of feline coronavirus replication by small interfering RNAs. Veterinary Microbiology:150:3-4:220-229


Parasitology: 180:3-4:383-388
Van der Saag, M., Mc Donell, D., and Slapeta, J.. Cat genotype Tritrichomonas foetus survives passage through the alimentary tract of two common slug species. Veterinary Parasitology. 177:3-4:262-266
Voute, L., Henson, F.M.D., Platt, D., Jeffcott, L.. Osteochondrosis lesions of the lateral troclear ridge of the distal femur in four ponies. The Veterinary Record:168:10:265-269
Whittington, R., Begg, D., de Silva, K., Plain, K.. Comparative immunological and microbiological aspects of paratuberculosis as a model
2011. Proceedings of the Australian College of Veterinary Scientists Science Week 2011
Broek, K., Ke, L., Koo, F., Jiang, H., Clemson, L., Mpofu, E., Fraser, D., Mason, R.. The association between Vitamin D and Metabolic Syndrome in an older population of immigrant Asian women living in Sydney. American Heart Association
Ellis (Hamilton), N., Tammen, I., Thomson, P., Forheer, A., Head, M., Coomer, R., Houweling, P., Wade, C., Hill, E.W., Raadsma, H.. Intronic equine ACE polymorphisms are associated with lower circulating ACE levels. 9th Dorothy Russell Haremeyer Horse Genome Mapping Workshop. Proceedings of the 9th Dorothy Russell Haremeyer Horse Genome Mapping Workshop
Ellis (Hamilton), N.. Characterization of the equine angiotensin converting
MAJOR PUBLICATIONS

Church, D., Brodbelt, D., McGreevy, P., and Thomson, P. (2011). Disease surveillance project in pedigree dogs and cats. (Letter) Veterinary Record 168, 414 PDF


Salman, M.D., Doher, M.G., Erb, H.N., Franken, K., Gardner, I., Stegeman, J., Stryhn, H., Weigel, R., Ward, M., 100 volumes of Preventive Veterinary Medicine - The past, the present and the future. Preventive Veterinary Medicine100:1-3


Slapeta, J.. Naming of Cryptosporidium pestis is in accordance with the ICZN Code and the name is available for this taxon previously recognised as C. parvum “bovine genotype”. Veterinary Parasitology:177:1:2-1-5


Toribio, J.A., Rushton, J.. Participatory Epidemiology: The Emergence of a Sub-Discipline. The Veterinary Journal: in press


Windsor, P., Leptospirosis and other zoonoses from cattle in Australia. Australian Veterinary Association Annual Conference.

Windsor, P., Perspectives on Australian Animal Health Aid Projects in South-East Asia. Transboundary and Emerging Diseases (Online)


Bryant, B, Blyde, D, Eamens, G, Whittington, R 2012, Mycobacterium Avium subspecies Paratuberculosis Cultured from the Feces of a Southern black Rhinoceros (Diceros Bicornis Minor) with Diarrhea and Weight Loss, Journal of Zoo and Wildlife Medicine, 43(2), 391-393


Cheng, Y, Belov, K 2012, Isolation and characterisation of 11 MHC-linked microsatellite loci in the Tasmanian devil (Sarcophilus harrisii) , Conservation Genetics Resources, 4(2), 463-465

Cheng, Y, Sanderson, C, Jones, M, Belov, K 2012, Low MHC class 11 diversity in the Tasmanian devil (Sarcophilus harrisii), Immunogenetics, 64(7), 525-533


Graham, K, Wilkinson, M, Culvenor, J, Dhand, N K, Churcher, R 2012, Intraoperative parathyroid hormone concentration to confirm removal of hypersecretory parathyroid tissue and time to postoperative normocalcaemia in nine dogs with primary hyperparathyroidism, Australian Veterinary Journal, 90(6), 203-209

Gurang, R, Purdie (Williams), A C, Begg, D J, Whittington, R 2012, In silico identification of epitopes in Mycobacterium avium subsp. paratuberculosis proteins that were upregulated under stress conditions, Clinical and Vaccine Immunology, 19(6), 855-864

Gurang, R, Purdie (Williams), A C, Begg, D J, Whittington, R 2012, In silico screened Mycobacterium avium subsp. paratuberculosis (MAP) recombinant proteins upregulated under stress conditions are immunogenic in sheep, Veterinary Immunology and Immunopathology, 149(3-4), 186-196


Masters, K, McGreevy, P 2012, The reproductive cycle of the Tasmanian devil (Sarcophilus harrisii) and factors associated with reproductive success in captivity, General and Comparative Endocrinology, 176(2), 182-191


Kershaw-Young, C M, Maxwell, W M C 2012, Seminal Plasma Components in Camelids and Comparisons with Other Species, Reproduction in Domestic Animals, 47(Suppl. 4), 369-375

Khatkar, M S, Moser, G C, Hayes, B P, Raadsma, H W 2012, Strategies and utility of imputed SNPs for genomic analysis in dairy cattle, BMC Genetics,


King, J S, Brown, G, Jenkins, D, Ellis, J, Fleming, P, Windsor, P A, Slapeta, J 2012, Oocysts and high seroprevalence of Neospora caninum in dogs living in remote Aboriginal communities and wild dogs in Australia, Veterinary Parasitology, 187(1-2), 85-92


Kolbach, R, Kerrisk (nee Davis), K L, Garcia, S, Dhund, N 2012, Quantifying the frequency of successful reattachment (after one vs. three hours) of un-milked quarters with a prototype Robotic Rotary, Computers and Electronics in Agriculture,


Lau, Q, Canfield, P J, Higgins, D P 2012, Expression and in vitro upregulation of MHCII in koala lymphocytes, Veterinary Immunology and Immunopathology, 147(1-2), 35-43

Leathy, T, de Graaf, S P 2012, Seminal Plasma and its Effect on Ruminant Spermatozoa During Processing, Reproduction in Domestic Animals, 47(Suppl. 4), 207-213


Ling, M, Norris, J M, Kelman, M, Ward, M P 2012, Risk factors for death from canine parvoviral-related disease in Australia, Veterinary Microbiology, 158(3), 280-290

Lo, N, Li, B, Ujvari, B 2012, DNA methylation in the termite Coptotermes lacteus, Insectes Sociaux, 59(2), 257-261

Luck, N, Thomas, K, Morin-Adeline, V,

Lunn, J A, Lee, R, Smaller, J, Mackay, B, King, T, Hunt, G B, Martin, P A, Krockenberger, M B, Spielman, D, Malik (Krochmalik), R 2012, Twenty two cases of canine neural angiostrongylosis in eastern Australia (2002-2005) and a review of the literature, Parasites and Vectors, 5(70), 1-18

Lynch, G W, Selleck, P, Church, W B, Sullivan, J 2012, Seasoned Adaptive antibody Immunity for Highly Pathogenic Pandemic Influenza in Humans, Immunology and Cell Biology, 90, 149-158


McGreevy, P, Ralston, L 2012, The distribution of whipping of Australian Thoroughbred racehorses in the penultimate 200 m of races is influenced by jockeys’ experience, Journal of Veterinary Behavior: clinical applications and research, 7(3), 186-190

McGreevy, P, Ralston, L 2012, The distribution of whipping of Australian Thoroughbred racehorses in the penultimate 200m of races is influenced by jockeys’ experience, Journal of Veterinary Behavior: clinical applications and research, 7, 186-190


Mohler, V L, Heithoff, D, Mahan, M, Hornitzky, M, Thomson, P C, House, J K 2012, Development of a novel in-water vaccination protocol for DNA adenine methylation deficient Salmonella enterica serovar Typhimurium vaccine in adult sheep, Vaccine, 30(8), 1481-1491


Morin-Adeline, V, Foster, C, Slapeta, J 2012, Identification of Chromera velia by fluorescence in situ hybridization, FEMS Microbiology Letters, 328(2), 144-149


Munn, A J, Tomlinson, S, Savage, T R, Clauss, M 2012, Retention of different-sized particles and derived gut fill estimate in tammar wallabies (Macropus eugenii): Physiological and methodological considerations, Comparative Biochemistry and Physiology, Part A: Molecular and Integrative Physiology, 161(2), 243-249


Muscatello, G 2012, Rhodococcus equinum in the foal - Part 2: Diagnostics, treatment and disease management, The Veterinary Journal, 192(1), 27-33

Nampanya, S, Suon, S, Rast, L, Windsor, P A 2012, Improvement in Smallholder Farmer Knowledge of Cattle Production, Health and Biosecurity in Southern Cambodia between 2008 and 2010, Transboundary and Emerging Diseases (Online), 59, 117-127

Nampanya, S, Suon, S, Rast, L, Windsor,


Neal, J, Murphy, S, Harden, S, Fulkerson, W 2012, Differences in soil water content between perennial and annual forages and crops grown under deficit irrigation and used by dairy industry, Field Crops Research, 137, 148-162


Nipperess, D, Beattie, A, Faith, D, Ginn, S, Kitching, R, Reid, C, Russell, T, Hughes, L 2012, Plant phylogeny as a surrogate for turnover in beetle assemblages, Biodiversity and Conservation, 21(2), 323-342


Olsson, A R, Phalen, D N 2012, Medetomidine immobilisation and atipamezole reversal in large estuarine crocodiles (Crocodylus porosus) using metabolically scaled dosages, Australian Veterinary Journal, 90(6), 240-244

Olsson, A R, Phalen, D N 2012, Preliminary studies of chemical immobilization of captive juvenile estuarine crocodiles (Crocodylus porosus) and Australian freshwater (C. johnstoni) crocodiles with medetomidine and reversal with atipamezole, Veterinary Anaesthesia and Analgesia, 39(4), 345-356


Parker, E M, Jenson, I, Jordan, D, Ward, M P 2012, Development of an algorithm for assessing the risk to food safety posed by a new animal disease, Zoonoses and Public Health,


Parr, Z, Lillie, M C, Miller, R 2012, A model for the evolution of the mamalian T cell receptor a/d and u loci based on evidence from the duckbill platypus, Molecular Biology and Evolution, 29(10), 3205-3214


Plain, K, Begg, D J, de Silva, K I, Purdie (Williams), A C, Whittington, R 2012, Enhancement of the interferon gamma assay to detect paratuberculosis using interleukin-7 and interleukin-12 potentiation, Veterinary Immunology and Immunopathology, 149(1-2), 28-37

Po, E, Horsburgh, K, Raadsma, H W, Celi, P 2012, Yerba mate (Ilex paraguarensis) as a novel feed supplement for growing lambs, Small Ruminant Research, 106(2 - 3), 131-136


Purdie (Williams), A C, Plain, K, Begg, D J, de Silva, K I, Whittington, R 2012, Expression of genes associated with the antigen presentation and processing pathway are consistently regulated in early Mycobacterium avium subsp.
tissue from Grey horses, BMC Genomics, 13, 365.


Whittington, R, Begg, D J, de Silva, K I, Plain, K, Purdie (Williams), A C 2012, Comparative immunological and microbiological aspects of paratuberculosis as a model mycobacterial infection, Veterinary Immunology and Immunopathology, Article in press.

Widyarini, S, Titmuss (nee Domanski), D, Painter, N L, Reeve, V E 2012, Photoimmune protective effect of the photoestrogenic isoflavonoid equol is partially due to its antioxidant activities, Photochemical and Photobiological Sciences, 11(7), 1186-1192.


Wong, E, Lo, N, Ujvari, B, Belov, K 2012, Identification of natural killer cell receptor genes in the genome of the marsupial Tasmanian devil (Sarcophilus harrisii), Immunogenetics, Article in Press.


Young, J, Suon, S, Andrew, CA, Henry, L A, Windsor, P A 2012, Assessment of Financial Impact of Foot and Mouth Disease on Smallholder Cattle Farmers in Southern Cambodia, Transboundary and Emerging Diseases, Article in Press.

Young, L J, Cross, M, Duckworth, J, Flenady, S, Belov, K 2012, Molecular identification of interleukin - 2 in the lymphoid tissues of the common brushtail possum, Trichosurus vulpecula, Developmental and Comparative Biology and Evolution, 29(1), 167-177.

**BOOK CHAPTER - COMMERCIAL PUB**


**CONFERENCE PROCEEDING**

Browning, L, Antipatis, C, Cowieson, A J 2012, The Interactive Effects of Vitamin D, Phytase, Calcium, and Phosphorus in Broiler Performance and Skeletal Integrity, 23rd Annual Australian Poultry Science Symposium, Poultry Research Foundation, University of Sydney, Sydney, Australia, 81-84


Selle, P H, Cadogan, D, Creswell, C, Partridge, G 2012, Phytase Supplementation of Sorghum-based Broiler Diets with Reduced Phosphorus Levels, 23rd Annual Australian Poultry Science Symposium, Poultry Research Foundation, University of Sydney, Sydney, Australia, 70-73

Wilkinson, S J, Selle, P H, Bedford, M, Cowieson, A J 2012, Exploiting the Calcium Specific Appetite of Broilers, 23rd Annual Australian Poultry Science Symposium, Poultry Research Foundation, University of Sydney, Sydney, Australia, 48-51

**REVIEW-ABSTRACT-CASE STUDY-COMMENTARY-NOTE**

Amev, A, Couper, P, Shea, G M 2012, Intellagarna leseueuri (Gray, 1831), the correct binomial combination for the Australian Eastern Water Dragon (Sauria, Agamidae), Zootaxa, 3390, 65-67


Hawson, L 2012, Compliance, cooperation, conditioning and cognition: Four C’s in the assessment of the horse-rider dyad, The Veterinary Journal, 192(1), 4-5


Little, C B, Zaki, S 2012, What constitutes an “animal model of osteoarthritis” - the need for consensus ?, Osteoarthritis and Cartilage, 20, 261-267


Malik (Krochmalik), R, 2012, Cats, foxes and scabies: the epidemiological puzzle of sarcoptic mange, The Veterinary Record, 171, 346-347

Noordeen, F, Rajapakse, R, Horadagoda, N U, Abdul-Careem, M, Arulkanthan, A 2012, Cryptosporidium, an important enteric pathogen in goats - a review, Small Ruminant Research, 106(2-3), 77-82


Tee, S Y E, Horadagoda, N U, Mogg, T D 2012, Kunjin flaviviral encephalomyelitis in an Arabian gelding in New South Wales, Australia, Australian Veterinary Journal, 90(8), 321-324


Toribio (Lee), J-A M L M, Rushton, J 2012, Participatory Epidemiology: The Emergence of a Sub-Discipline, The...
Major Publications

Veterinary Journal, 19(2), 145-146

Weeks, C, McGreevy, P, Waran, N 2012, Welfare issues related to transport and handling of both trained and unhandled horses and ponies, Equine veterinary Education, 24(8), 423-430


Wong, E, Belov, K 2012, Venom evolution through gene duplications, Gene, 496(1), 1-7


Abstracts-Posters-Short Paper

Bao, Y, Romero, L, Cowieson, A J 2012, A Systematic Geometric Approach to the Prediction of Feed Enzyme Efficiency in Broilers, 23rd Annual Australian Poultry Science Symposium, Poultry Research Foundation, University of Sydney, Sydney, Australia, 75-75


Downing, J A 2012, Nutritional Strategies to Alliviate Poor growth Performance of Commercial Ducks under high Temperature, 23rd Annual Australian Poultry Science Symposium, Poultry Research Foundation, University of Sydney, Sydney, Australia, 307-307


Liu, S Y, Selle, P H, Peron, A, Cadogan, D, Gill, R J, Cowieson, A J 2012, Microbial Phytase Influences Kinetics of Starch-Protein Digestion in Broiler Chickens, 23rd Annual Australian Poultry Science Symposium, Poultry Research Foundation, University of Sydney, Sydney, Australia, 271-271

Marsh, I, Plain, K, Galea, F, Waldron, A M, Whittington, A, Whittington, R 2012, A New and Improved Semi-Automated direct faecal PCR Test for Johne’s Disease , 94th District veterinarian’s Conference, District veterinarian’s association, Wollongong, 142-142

Morris, K M, Austin, J, Belov, K 2012, Low MHC diversity in the tasmanian devil pre-dates European settlement, 33rd Conference of the International Society for Animal Genetics, University of Queensland Press, Brisbane

Muir, W I, Lynch, G W, Williamson, P 2012, Improved Broiler Performance Following the early Administration of Protein Fractions Extracted from Meat and Bone Meal, 23rd Annual Australian


Windsor, P A 2012, Control of FMD in the mekong region using Village-based Approaches to Vaccination and Biosecurity, 94th District veterinarian’s Conference, District veterinarian’s association, Wollongong, 164-174
