## RESEARCH PROJECTS UNDER MANAGEMENT

<table>
<thead>
<tr>
<th><strong>Title</strong></th>
<th>An epidemiology and pathobiology, training and research unit at the University of Sydney (AHW.007)</th>
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</thead>
</table>
| **Farm Animal Health Staff** | Professor Richard Whittington  
Dr Jenny-Ann Toribio  
Dr Nick Malikides  
Ms Hannah Forsyth  
Mrs Anna Waldron  
Ms Marion Saddington |
| **National Collaborators** | Australian Biosecurity CRC |
| **International collaborators** | Professor Ian Gardner, University of California Davis |
| **Summary** | In 1999 the gross value of Australian livestock production was $13.4bn of which $11.5bn came from exports. The Australian economy and the rural sector depend on this trade, which is based on efficient production, marketing, quality assurance and access to major markets in the developed world. Most of these markets have a favourable status for the major epidemic diseases of livestock. Compared to many competitors, Australia enjoys privileged access due to the historical absence of important livestock diseases.  
This project was undertaken because a critical shortage of the skills required by the livestock industries is looming. The loss of animal health laboratories, trained livestock health specialists, together with the loss of government employed district veterinary officers and epidemiologists, has dramatically weakened the national defences against disease incursions, threats to product integrity and market access.  
The aim of this project was to establish a new teaching and research unit in the Faculty of Veterinary Science. Research and training programs in epidemiology, disease surveillance, pathobiology and food safety were developed and delivered to postgraduate and undergraduate students. A new post graduate degree program in Veterinary Public Health Management commenced. Ties were established with overseas universities to enable future development of joint teaching and research programs. Staff from the unit are active in the research community, in industry groups and the media, ensuring wide communication of research results. Staff work together with stakeholders in the livestock sector to promote the benefits of the research programs. This MLA project has led to immediate benefits for industry, and many of these will endure into the long term: undergraduate veterinary students are better equipped to enter rural veterinary practice; graduates working in animal health now have a flexible post graduate coursework program to learn skills in epidemiology and public health for immediate application; a steady stream of young post graduates is becoming available to fill retirement positions; young post doctoral fellows and PhD research students have greater opportunity to work on real world problems and provide service longer term to the livestock sector; significant critical mass now exists to conduct research on priority livestock health issues. |
| **Source of Funding** | Meat and Livestock Australia Limited |
| **Project timeframe** | February 2002 – January 2006 |
**Summary**

The aim of this project was to demonstrate whether pastures of low infectivity can be prepared and effectively used to reduce the level of OJD infection, potential production losses and mortalities from OJD in adult sheep in endemically infected flocks.

Sheep were exposed to different levels of *M. ptb*, from birth to weaning and/or from weaning onwards. The different levels of exposure were high (H), medium (M) and low (L) with the level of exposure in the H groups about 10 times higher than in the M groups. The L groups were not deliberately exposed to *M. ptb* but accidental contamination at very low levels did occur. The experiment was replicated.

The study demonstrated that careful management of young sheep can reduce the level of OJD in the flock and reduce the death rate. Steps taken to limit the degree of exposure of pre-weaned lambs to infection from pastures will lead to reduced rates of severe infection in those sheep in later years. Continuous exposure to OJD bacteria throughout early life results in higher infection rates than exposure which is limited to either the pre-weaning or the post-weaning period alone. A critical factor in management is to provide ‘low risk’ pastures to young sheep at weaning to give them a break from exposure to infection which occurs in the lambing paddocks.

Producers who successfully limit the infection will find themselves in an improved position. Additionally, by using the library of samples collected during the experiment, many more insights will be gained into the epidemiology of OJD, including the relationship between age at first exposure and the time before excretion of the organism, seroconversion, sub-clinical disease effects, clinical disease and death. These insights may allow the development of additional management options and systems which restrict the impact of OJD in flocks and will also improve the overall understanding of the pathogenesis of the disease, interpretation of existing and new diagnostic tests and the value of emerging research tools.

**Source of Funding**

Meat and Livestock Australia

**Project timeframe**

September 1999 – December 2004
Title: Effects of whole-flock vaccination for OJD (OJD.015)

Farm Animal Health
Associate Professor Peter Windsor
Professor Richard Whittington
Dr Om Dhungyel

Staff
PhD Student
Ms Helen McGregor

Summary
Vaccination with Gudair ® vaccine in OJD infected flocks has commenced in Australia. To date, use of vaccine has been recommended to be limited to lambs in an attempt to protect sheep before OJD pathology becomes advanced. As vaccination is considered by many graziers to be their best option for reducing losses and managing the disease, careful documentation of the effects of vaccination in a high prevalence infected flock and in older sheep will enhance knowledge and understanding of the benefits of the whole-flock vaccination strategy.

The proprietors of a farm reported a very high mortality believed to be due to OJD. Early estimates suggested that 25% of the flock had died in 1999. A preliminary investigation by The University of Sydney supported the owner’s initial suspicion, with post mortem findings suggesting an annual mortality rate of 18.1% (+/- 12%). Vaccination of all sheep was favoured as the quickest way to reduce the OJD-contamination of pastures, the incidence of OJD and the death rate due to OJD.

The study concluded that vaccination combined with management changes led to a significant decline in the risk of OJD mortality and effective control of OJD in a heavily infected flock. Findings also suggested that vaccination may be beneficial in sheep as old as 8 months, even when exposed to a heavily contaminated environment since lambing.

This information will have immediate application to a large number of affected producers in NSW who have chosen or are considering vaccination as their major or initial method of OJD control.

This study provided the first estimate of flock mortality due to OJD based on objective data and was central to explaining the economic impact of OJD in high prevalence flocks. This information assisted development of rational control programmes.

Source of Funding
Meat and Livestock Australia

Project timeframe
September 2000 – June 2004
A study of the biological and economic impacts of OJD in affected sheep flocks in NSW (OJD.023)

Dr Jenny-Ann Toribio
Associate Professor Peter Windsor
Mr Russell Bush

Anecdotal reports of the extent of mortality due to ovine Johne’s disease ranged from less than 1% to over 20% of adult sheep per year, but there were no objective data. The aim of this study was to estimate the annual mortality rate due to OJD on twelve affected sheep flocks in four different regions of NSW using the methods developed in project OJD.015.

OJD mortality estimates were derived from farm records (livestock inventories) and quarterly farm visits (necropsy inspections). A most likely cause of death was determined for 362 sheep on the basis of findings related to the environment, clinical signs, gross pathology and histopathology. OJD was most likely to have contributed to the death of 250 of these sheep. OJD mortality increased from 1 year of age (10.4%) to peak at 4 years of age (35.6%) and was very similar between wethers (49.6%) and breeding ewes (50.4%).

On the 12 farms, the average OJD mortality rate based on inventory records was 6.2% (range 2.1% to 17.5%), more than twice that considered acceptable (from all causes) in sheep flocks in southern Australia. The OJD prevalence in 2-year old sheep based on pooled faecal culture ranged from 0.7% to > 23% on the 12 farms and was found to be associated with OJD mortality rate.

The average decrease in gross margin due to a farm being infected with OJD was 6.4% (range 2.2% to 15.4%) and the average estimated cost of OJD losses on the 12 farms over the 12-month study period was $64,100 ($15,569 to $154,083). The average estimated cost of annual OJD losses/DSE was $7.68 ($0.84 to $20.51) while annual OJD losses/ha were $65.92 ($6.75 to $244.80).

This study provided the first objective data on the true impact of OJD and the findings are generally applicable to sheep flocks in southern Australia. Industry groups claiming that OJD does not present a threat on-farm can now be provided with accurate figures on direct losses attributable to OJD within the endemic area of NSW. There was a wide range of impacts, with some very high mortality rates. The data can be used to justify vaccination programs, other control options and the general concept of disease control and prevention.

The challenge for industry is to use the scientific findings from this study and other recent research to prepare education and extension material to address issues of misinformation about OJD and to develop cost effective strategies for the future control and management of OJD.

Meat and Livestock Australia
September 2001 – October 2005
Title: Epidemiology of ovine Johne’s disease – pasture contamination level, age susceptibility and diagnostic tests (OJD.028)

Farm Animal Health Staff:
- Professor Richard Whittington
- Dr Om Dhungyel
- Mrs Anna Waldron
- Ms Natalie Schiller
- Ms Angela Reeves

PhD Students:
- Ms Helen McGregor
- Mr Sanjeev Gumber

National collaborators:
- Australian Animal Health Laboratory, CSIRO

Summary:
The aim of this project was to determine whether pasture contamination rates and the age of sheep when they are first exposed to infection influence the occurrence of ovine Johne’s disease. The outcomes were targeted to improve understanding of the development of OJD and will facilitate development of control strategies based on pasture management.

The principle conclusions from this study were that post-weaning lambs were highly susceptible to infection with *M. paratuberculosis* and if exposed to high levels of contamination a proportion will develop severe infection leading to clinical disease and death. Hoggets and adult ewes are less likely than lambs to develop clinical disease after exposure to *M. paratuberculosis*. Nevertheless, even adult ewes may become infected and later act as a source for transmission of the disease. Lateral spread of OJD is a serious threat; it is not necessary for infected sheep to be present in a paddock for transmission of infection to occur if infected sheep are present in neighbouring paddocks. Conventional wire strand fences do not prevent spread of infection. For diagnosis on a flock basis, pooled faecal culture is more effective than the agar gel immunodiffusion assay for detection of the infection at relatively early stages in young sheep. Pooled faecal culture detected infection in sheep only 6 months after first exposure to contaminated pasture, when they were 11 months of age.

Samples were stored from sheep in this project for later research, for example in project OJD.031. In addition, blood samples were provided regularly to CSIRO for validation of the gamma-interferon assay for diagnosis of OJD.

The results of this study will have immediate impact on the management and control of OJD as they provide objective data to support and extend current recommendations for livestock grazing management.

Source of Funding: Meat and Livestock Australia Limited

Project timeframe: November 2001 – June 2005
Ovine Johne’s disease is a chronic and intractable problem. Spread of the disease has continued despite stringent regulatory measures, and in the absence of compensation for affected producers has led to severe division within the industry. Vaccination and risk-based trading have been accepted as an interim approach to limit further spread of the disease.

There is clearly an urgent need for better diagnostic tests. The main requirement is for a test that can detect infection in young sheep before the onset of faecal shedding. The test needs to be sensitive, specific, accurate, cost effective and able to distinguish an active infection from one that has died out. New automated technology platforms will be needed if tests are to have wide application in the sheep industries.

None of the work on OJD to date has included basic research. However, the need for this has been recognised and there are opportunities to take advantage of new technologies. Consequently the aims of this program are to research fundamental aspects of OJD including host-pathogen interactions at the cellular level. Proteomics, genomics and advanced immunology techniques will be applied to *in vivo* and *in vitro* models to study the early stages of infection and contrast these with events later in the disease process. The aim is to discover new pathways for disease development and expression that can be exploited later for development of diagnostics, vaccines and chemotherapeutics.
The purpose of the project is to validate the widespread use of Gudair® vaccine for the reduction of bacterial shedding in medium/high prevalence flocks and the prevention of increased shedding in low prevalence flocks. The major outcome from the project will be to allow producers to predict the infectivity of flocks over time following the commencement of a vaccination program.

There is much producer interest, both at an individual and industry level, in the use of Gudair® vaccine to control the impact of OJD in flocks varying in disease prevalence from very low to very high. This project will observe changes over time in the prevalence of mycobacterial shedding following the commencement of a Gudair® vaccination program in flocks varying in initial OJD prevalence. Up to four flocks, each with high, medium or low OJD prevalence at the commencement of a vaccination program will be sampled over a six-year period to estimate changes in the prevalence of shedding as the proportion of vaccinates in the flock increases.

The relevant industry questions being addressed in this project are as follows:

- how long will it take for a vaccination program to reduce mycobacterial shedding to a level where safe trade in low risk sheep can occur?
- can the disease be eradicated by long-term vaccination?
- how effective will vaccination be in low prevalence flocks in the control zone?
- will vaccination prevent the increase in losses commonly seen in long-term infected flocks?
- can healthy sheep be vaccinated on arrival at an infected property so that infection and shedding is prevented?

**Source of Funding**
Meat and Livestock Australia

**Project timeframe**
January 2003 – March 2008
Identification of risk factors for OJD-infection level in sheep flocks (OJD.038)

Dr Jenny-Ann Toribio  
Professor Richard Whittington  
Mr Navneet Dhand  
Dr Jeff Eppleston, Central Tablelands Rural Lands Protection Board  
Dr Evan Sergeant, AusVet Animal Health Services

The level of clinical disease experienced due to ovine Johne’s disease (OJD) appears to vary considerably between infected sheep flocks in Australia, even for flocks in the same locality that appear to have similar characteristics. This has led to considerable speculation about the potential importance of flock management, soil type, pH and micro-nutrients. Sound understanding about factors that influence disease expression will lead to management recommendations that improve on-farm disease control.

The aim of this project was to identify risk factors for OJD expression in infected flocks and improve the understanding of the epidemiology of the infection. The project consisted of a cross-sectional study on 92 infected properties located in New South Wales, Victoria, Tasmania and Western Australia. The information obtained from each included the OJD prevalence in specific groups of adult sheep measured using pooled faecal culture, details of farm and flock management and soil analyses from paddocks on which the sheep sampled had grazed.

A total of 31 significant farm/flock/management and soil variables were found. Some were likely to be a consequence of OJD infection, but the remainder appeared to be potential risk factors for the severity of the disease. There was a strong relationship between the PFC results and the duration of flock infection, the level of OJD mortality, dam stocking rates, as well as a relation with parent soil type. There was also a consistent but statistically non-significant trend for lower OJD levels in 4-year olds compared to 3-year olds, which may be due to deaths of affected sheep from 2 to 3 years of age. Wethers had significantly higher OJD levels than ewes, which strongly supports the anecdotal observation of higher losses in wether mobs. Higher OJD prevalence was linked to measures correlated with soil fertility including cation exchange capacity, phosphorus buffer index and organic matter content of soil.

Successful completion of this project enables the development of additional recommendations for on-farm control measures for OJD to support vaccination, and may help clarify the ecological niche of *M. paratuberculosis*, the potential for disease spread into areas not currently affected and the likely level of disease that would be experienced in these areas.

Meat and Livestock Australia  
January 2004 – June 2005
<table>
<thead>
<tr>
<th>Title</th>
<th>Enabling technologies of RNAi and cell culture for internal parasites of sheep (AHW.032)</th>
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<tr>
<td>Farm Animal Health Staff</td>
<td>Professor Nick Sangster</td>
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<tr>
<td>Postdoctoral Fellow</td>
<td>Dr Michelle Power</td>
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<tr>
<td>Technical Officer</td>
<td>Ms Krishanthi Gunarathnam</td>
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<tr>
<td>Summary</td>
<td>Research into the biology of sheep nematode parasites suffers from the lack of molecular techniques to study gene function and cell biology. Techniques such as RNA interference and cell culture have potential to improve our understanding of parasites and to identify novel control targets. RNAi is a technique of gene silencing where individual genes can be switched off and the effects observed. If the affected worms are affected (for example, are paralysed) the gene product may be a good candidate as a control target. Cell culture allows the study of isolated worm components. Given that it is difficult to cultivate these parasites in vitro, cell culture could open up approaches to studying cell biology that are currently unavailable. In this project we have developed phenotyping tools that will be used to measure RNAi effects and have commenced the gene knockout experiments. These are currently available in the free-living stages of the parasite, but the ultimate aim is to develop the technique for parasites in sheep. Cells recovered from worms have been grown in culture. These will be used to study defined cell types and as a platform for RNAi. They offer several potential advantages as it may be easier to deliver RNA to these cells and their responses will be simpler to interpret than responses in sheep. The aim is to develop tools for further research. This project falls into a multi-institutional research program with the aim of discovering targets for improved parasite control.</td>
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<tr>
<td>Source of Funding</td>
<td>Meat and Livestock Australia Australian Wool Innovation</td>
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<tr>
<td>Project timeframe</td>
<td>February 2004 – February 2006</td>
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</table>
Title: Neuromuscular physiology of nematode parasites of sheep

Farm Animal Health Staff
Professor Nick Sangster

International collaborators
Dr Janina Demeler
Dr Arbeit Fellow (University of Hannover)

Summary
The neuromuscular physiology of nematodes is a rich source of potential parasite control targets. Nerves and muscle are also the site of the action of a range of current anthelmintic drugs. This project has two parts, one to explore the neuromuscular basis of ivermectin resistance with a view to developing resistance detection assays and the second is to discover novel neuropeptides and their receptors which may be useful targets for parasite control.

Several assays are used in the laboratory to measure: muscle contraction (using a force transducer), development, motility, migration and electrical responses in the pharynx of worms. The laboratory is equipped with electrophysiology gear that can be used to measure a range of electrical responses, including patch clamp and voltage clamp.

The project aimed to understand the pharmacology of avermectin/ivermectin resistance in sheep nematodes. This information will help develop tools for molecular diagnosis in the future. The work showed that:

- drug action and resistance occurred at two distinct sites, pharynx and body muscle of worms
- the two major drug classes act in similar ways but their receptor populations are not identical in distribution in the worms or/and the three species of parasites
- resistance is most likely due to different mechanisms in the different species and even isolates of the same species. A single test for resistance is not likely to be found

Janina Demeler who carried out this work was awarded her Dr Arbeit at the Tierartzliche Hochschule Hannover and the prize for the best thesis in 2005.

Source of Funding
Australian Research Council
Pfizer Australia

Project timeframe
August 2003 – August 2005
Title: Analysis of critical genes in the sheep/\textit{Haemonchus} relationship

Farm Animal Health Staff:
- Professor Nicholas Sangster
- Associate Professor David Emery
- Dr Tony Rowe

National Collaborators:
The SGP includes scientists from:
- CSIRO Livestock Industries,
- University of Melbourne
- and the University of Sydney

Summary:
This project dovetails in with our existing project on the sheep/\textit{Haemonchus} relationship. The emphasis in this new project is to add value by carrying out DNA microarray experiments to identify sets of sheep genes which are up or down regulated during critical events in establishing immunity to \textit{Haemonchus}. Further work to validate these genes will be performed using quantitative PCR and immunocytochemistry. The aim is to identify genes which may act as future markers for selection of sheep able to mount effective immune responses to worms.

Source of Funding:
- Meat and Livestock Australia
- Australian Wool Innovation

Project timespan:
May 2004 – April 2007

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Linked Project: Characterisation of critical genes in the sheep/\textit{Haemonchus} relationship

Source of Funding:
- Meat and Livestock Australia and Australian Wool Innovation within the Sheep Genomics Project (SGP)

Project timeframe:
Eradicating footrot by specific vaccination (EC511)

Summary

Footrot is caused by the bacterium *Dichelobacter nodosus*, a parasite of the feet. This bacterium is unable to survive off the foot for more than one week. Eradication of footrot is therefore possible if all sheep with footrot are removed from a flock. Current techniques to achieve this are labour intensive, expensive and often take several years to achieve eradication. Vaccination is an alternative approach.

Current footrot vaccines contain ten strains of bacteria to provide coverage of the major *D. nodosus* serogroups. These vaccines offer only temporary (12 weeks) protection against footrot, so they are used in control campaigns, rather than for eradication. It has been demonstrated that eradication of footrot using vaccines is possible if the vaccines only target one or two groups of the bacterium at a time because immunity is long-lasting. This project will evaluate this approach under Australian conditions.

Objectives of the project:

1. Produce specific footrot vaccines for local (Australian) strains of the footrot bacterium.
2. Evaluate the use of these targeted footrot vaccines using one or two different antigens per vaccination in the eradication of virulent footrot in Australian sheep.
3. Demonstrate the use of these vaccines to remove virulent footrot on 12 commercial farms across areas of high footrot prevalence in southeast Australia.
4. Evaluate the minimum interval between vaccination with different vaccines to deliver an accelerated eradication program (less than twelve months between different vaccines).
5. Enable application for a minor use permit from the Australian Pesticides and Veterinary Medicines Authority (APVMA) to allow the use of these vaccines on-farm and also aid transfer of the vaccine to commercial production facilities.

Source of Funding: Australian Wool Innovation

Project timeframe: July 2005 - June 2010
Title
The role of Dichelobacter nodosus genes in pathogenesis of footrot in sheep

Farm Animal Health Staff
Professor Richard Whittington
Dr Om Dhungyel
Mr Craig Kristo

National Collaborators
Dr Leslie Reddacliff,
NSW Department of Primary Industries,
Elizabeth Macarthur Agricultural Institute
Professor Julian Rood*, Monash University

Summary
Ovine footrot is a highly infectious bacterial disease that is of major ongoing concern to the Australian wool industry, causing significant economic losses as a result of its effect on wool production, farm management, animal welfare and the cost of control and treatment programs. The causative bacterium is Dichelobacter nodosus.

The overall objective of this research is to develop improved methods for the control and treatment of ovine footrot. The specific research aims are:

1. To identify D. nodosus genes that are differentially expressed in the virulent footrot lesion.
2. To determine the role of differentially expressed genes in the disease process.
3. To determine the value of whole genome based microarrays for the epidemiological analysis and diagnosis of field isolates of D. nodosus.
4. To identify surface or secreted D. nodosus antigens that induce the production of bactericidal antibodies in sheep.
5. To determine the vaccine potential of D. nodosus antigens that are either essential for the disease process or induce the production of bactericidal antibodies.

The successful completion of the project should lead to the subsequent commercial development of a protective footrot vaccine, with significant cost savings to wool producers and the Australian wool industry. It will also lead to a greater understanding of the epidemiology of footrot infections and may result in the development of improved methods for the laboratory diagnosis of ovine footrot.

This research program represents the pre-commercialisation phase of the development of a new generation of footrot vaccines. The successful identification of candidate antigens that can be used to develop a protective footrot vaccine will be subject to the uncertainty of dealing with a variable biological system.

Source of Funding: Australian Research Council, Centre for Structural and Functional Microbial Genomics

Project timeframe: February 2005 – December 2010

* Principal investigator
The first cases of footrot in Bhutan were reported in the flock at the National Sheep Breeding Centre (NSBC) in Bumthang in 1990. This Centre supplies breeding animals to village flocks throughout Bhutan. Despite the presence of footrot at the Centre the distribution of sheep continued. In 1998 The Royal Government of Bhutan and the Australian Centre for International Agricultural Research began a joint project in footrot research. This was aimed initially at identifying the strains of *Dichelobacter nodosus* responsible for the disease at NSBC. Forty isolates were cultured from cases in that flock. All isolates were identified antigenically as belonging to serogroup B. Vaccine was prepared from these isolates and shown in a controlled trial to accelerate cure of cases and to prevent infection at a time when the disease spread in unvaccinated animals. The same vaccine was used to treat all sheep at NSBC for two successive years. After the first year no further cases of footrot were seen at NSBC despite close surveillance for two years after the cessation of vaccination.

Cases of footrot had been reported in village flocks soon after the disease was diagnosed at NSBC. In order to establish the distribution and prevalence of footrot in Bhutan, a national survey was designed and implemented. This survey revealed that footrot was present in nine of 13 districts surveyed, but with the exception of one district, Bumthang, the prevalence of disease was lower than expected. There was an association between the receipt of animals from NSBC and the presence of footrot.

During the survey 234 isolates of *D. nodosus* were cultured from affected sheep in all districts where it occurred. Once again all isolates tested proved to be of serogroup B. When examined with a series of tests they were found to be phenotypically indistinguishable from one another. Genotypically there were minor variations in OMP gene patterns among the isolates. The conclusion was reached that all the isolates studied from Bhutan were essentially the same and were probably all derived from the same source. The presence of a single strain is most unusual in other sheep producing countries.

The presence of only one strain of *D. nodosus* in Bhutan suggests that it could be eliminated from village sheep by using specific vaccine for two years as was done at NSBC.

The experience in Bhutan with footrot reinforces the necessity to ensure the health of animals imported into a country and in those distributed from its animal breeding centres.

**Source of Funding**

Australian Centre for International Agricultural Research
Royal Government of Bhutan

**Project timeframe**

June 1999 – July 2002
Management of footrot in small ruminants in the hill districts of Nepal and Control of footrot in small ruminants in Nepal – vaccination and serosurveillance.

Emeritus Professor John Egerton
Dr Om Dhungyel
Professor Richard Whittington
Dr Shiva Chandra Ghimire

Overseas Development Administration, Government of U K
Lumle Agricultural Research Centre, Royal Government of Nepal.

Footrot was introduced into the migratory flocks of Siklis village of Kaski district in Nepal during the 1960s with imported sheep from New Zealand and formally reported by Lumle Agriculture Centre (LAC) in 1971. Control measures were initiated during 1975 with the assistance of the United Nation's Development Programme (UNDP) and LAC. However, by that time the disease had spread to the flocks of the adjoining districts of Lamjung and Manang. The UNDP programme terminated in 1977 and the sole responsibility footrot eradication was handed over to LAC. The footrot eradication programme continued in the conventional manner with the organization of campaigns to carry out foot trimming, foot bathing and removal of non-responding animals. However, despite the apparent recovery of animals at the beginning of each monsoon season, many became re-infected during their annual migration to alpine pasture. Hence, although the problem was contained, disease eradication remained unachievable.

A footrot management project funded by ACIAR was developed. During this initial project the disease epidemiology was investigated and the strains of *Dichelobacter nodosus* involved in the disease in Nepal were identified. Specific vaccines were developed based on the two infecting serotypes and these vaccines were used in a controlled field trial which was done in association with the LAC normal programme. The results indicated that flocks treated with specific vaccine had less footrot than others treated with conventional vaccines or controls. All previously vaccinated flocks were treated with the specific vaccine and within 2 years there was no evidence of virulent footrot in the population of sheep and goats in the study area.

The present project provided evidence that virulent footrot has been eradicated from the flocks of Kaski, Lamjung and Manang districts where the disease had persisted for nearly 30 years.

The second part of the project aimed at surveillance for virulent footrot in the endemic area and in surrounding non-endemic areas using clinical examination, microbial culture and ELISA serology. It confirmed that virulent footrot had been eradicated from the study area in Nepal. It was shown also that benign footrot persisted in the flocks and occurred in other flocks remote from the project area, and established the existence of some other important diseases in the migratory small ruminant population.

The development of an anamnestic diagnostic test which can be used for the retrospective assessment of the life experience of sheep and goats with respect to infection with virulent organisms was another achievement. This could provide a basis for field testing and certification for the freedom from virulent footrot.

Australian Centre for International Agricultural Research (ACIAR)
Overseas Development Administration, UK
Royal Government of Nepal

July 1993 – June 1999
Mulesing was introduced to the Australian sheep industry by J.H.W. Mules in 1931 as a measure for the prevention of blowfly strike in sheep, and in particular, the Merino. The wrinkliness and wooliness of the Merino sheep breech makes it highly susceptible to urine and faecal staining, leading to a high risk of blowfly strike. Mulesing involves the removal of skin from around the breech and tail to decrease wrinkles and increase the size of the bare area around the perineum. The result is a significant reduction in staining, with the area drier and less attractive to blowflies.

Mulesing prevents debilitating illness and death due to blowfly strike. However, it is acknowledged that sheep suffer short-term stress and pain as the operation is performed without analgesia or anaesthesia. The Australian sheep industry is trying to find effective humane alternatives to this procedure and as part of a nationwide effort, the Faculty team is studying the conformation of the breech, examining the skin and assessing the best patterns for applying chemical or other non-surgical alternatives to mulesing.

The project will apply specialist surgical skills and evaluate the skin resection pattern used in the mulesing operation. Wound healing will be examined, focusing on the microscopic, ultrastructural and molecular changes that occur. The project will focus on characterising features that are present in the normal breech skin of sheep and comparing how these change with wound healing after the mulesing operation compared to the healing that occurs with the use of chemicals or other mulesing alternatives. The systemic inflammatory response incited by surgical mulesing and its alternatives will be examined by measuring a range of haematological and biochemical parameters.

This project is one of a suite of AWI projects aimed at assisting Australian wool growers to find an alternative to mulesing as a preventative measure for flystrike. The primary objectives are to put the mules operation on an evidence-based, scientific and quantitative footing as a foundation for investigating, devising and comparing alternative procedures.
Title  Biotechnology and epidemiology to control nodavirus in barramundi aquaculture

Farm Animal Health Staff  Professor Richard Whittington

National Collaborators  Mr Glenn Schipp, Darwin Aquaculture Centre
Mr Craig Foster, Marine Harvest Ltd
Ms Lorna Melville and Dr John Humphrey, Berrimah Veterinary Laboratory

Summary  Production of farmed barramundi has increased by more than 1200% in the Northern Territory since 2001 but is threatened by nodavirus infection.

To achieve growth targets for barramundi aquaculture in northern Australia the University of Sydney and the three industry partners will collaborate to:
1. Control nodavirus infection
2. Develop new technologies to detect nodavirus using immunoassay and surface enhanced laser desorption ionisation mass spectrometry (SELDI)
3. Develop an integrated disease control strategy based on epidemiological survey data, and ensure that it is practical and able to be widely adopted.

Control of nodavirus infection is required also to meet the national goal to boost aquaculture production to $2.5 billion by 2010. This project meets two designated national research priorities: frontier technologies for building and transforming Australian industries and protecting Australia from invasive diseases and pests. It will develop biotechnological and epidemiological tools to control nodavirus, improve biosecurity of finfish in the wild and on farms in Northern Territory, Queensland, Victoria, New South Wales, South Australia and underpin growth of the barramundi aquaculture industry in regional areas. The benefit will be increased employment and investment with economic and social returns. This project has support from all States and Territories.

Source of Funding:  Australian Research Council Linkage Grant

Project timeframe  January 2006 – December 2009
**Title**
Development of diagnostic and reference reagents for epizootic haematopoietic necrosis virus of finfish (FRDC 2003/621)

**Far Animal Health Staff**
Professor Richard Whittington
Ms Kylie Deece

**National collaborators**
Australian Animal Health Laboratory, CSIRO

**Summary**
The quantity and value of aquaculture production will increase relative to wild harvest fisheries globally and as a consequence the international community is taking great interest in disease threats to finfish aquaculture. Epizootic haematopoietic necrosis (EHN) is one of the viral diseases of fish listed by the Office International des Epizooties (OIE) and occurs in parts of Australia. Due to the extreme virulence of the causative agent EHN virus (EHNV), its restricted geographic range and limited opportunities for study outside Australia, this country hosts the OIE Reference Laboratory for EHNV, based jointly at the University of Sydney Faculty of Veterinary Science and CSIRO Australian Animal Health Laboratory. In addition to providing research and diagnostic referral services to the Australian industry, the reference laboratory provides technical advice, protocols and reagents to laboratories throughout the world, thereby ensuring international diagnostic capability. This is required under international guidelines in trade in aquatic animal products, administered by the OIE. The OIE Reference Laboratory for EHNV represents an important contribution by Australia to the international community.

EHNV reference laboratory functions were identified as one of a number of high priority issues for funding under the Federal Government’s “Building a National Approach to Animal and Plant Health” program. The OIE Reference Laboratory for EHNV has provided reagents, protocols and diagnostic referral services to fish health laboratories in Australia and other countries for more than 10 years. Research on protocols for improved viral detection and differentiation from related viruses has been ongoing, and has been published in high quality journals. However, many of the original reagents were prepared in 1989-1992 and stocks of quality-controlled batches were almost exhausted. Furthermore, new protocols had recently been developed using modern tools of molecular biology but standardized DNA reagents were not available. The aim of this project was therefore to provide quality-controlled viral, tissue, antibody and DNA reagents and protocols to detect EHNV and to differentiate it from related viruses including BIV. A further aim was to develop and assess new storage conditions, guidelines for reconstitution and shelf life for these reagents.

Reagents and protocols for the detection of EHNV using the latest technology in ELISA, immunohistochemistry and molecular biology have been prepared, evaluated at an independent laboratory and are now available to laboratories in Australia and internationally. EHNV is a very serious pathogen. Consequently the reagents have been prepared using a new approach which will facilitate easy shipment in a stable form with no biosecurity risk. This is important in the current era of bioterrorism.

**Source of Funding**
Fisheries Research and Development Corporation

**Project timeframe**
March 2003 – August 2004
In 1995 and 1998 there were major epizootics in pilchards which spread from South Australia around the southern coastline of Australia until the entire geographic range of pilchards in Australian waters was affected. A herpesvirus was identified as the cause. There was a loss of 60% of pilchard biomass, devastation of the pilchard fishery and secondary effects on piscivorous birds such as penguins which failed to breed. The Joint Pilchard Scientific Working Group (JPSWG) was established under the Consultative Committee on Exotic Animal Diseases. The working group set priorities and coordinated research on the virus. Development of molecular diagnostic techniques was given highest priority as these will enable epidemiological studies to determine whether the virus is dormant in the pilchard population and whether or not it is coming into the country through imported pilchard bait.

The aim of this study is to validate molecular diagnostic tests for pilchard herpesvirus and to put them to use in elucidating the biology of the virus, including a survey of wild pilchards. Sequencing of the viral genome will continue, in order to design more specific tools and also to compare the virus obtained in 1995 with that collected in 1998. Objectives include:

- To improve the polymerase chain reaction and in situ hybridization diagnostic assays which are based on limited sequence data by generation of further viral genome sequence data from the available stocks of virus
- To independently establish the sensitivity and specificity of the diagnostic assays at other laboratories
- To investigate basic aspects of the virus and the disease: tissue distribution of virus in infected fish, and the correlation between disease in fish and the presence of virus
- To survey wild pilchard populations to determine whether the virus is still currently detectable and causing disease
- To compare the herpesvirus strains from 1995 and 1998, and to compare, at the molecular level, this herpesvirus and this disease with two other similar herpesvirus fish diseases which have been reported elsewhere in the world
Aquatic animal health service providers have expressed concern that there is a shortfall of aquatic animal health professionals to support Australia’s aquaculture industries. Despite this need, most current Australian education systems/institutions do not adequately cover aquatic animal health. For example, there is a need for research and training in subjects such as invertebrate immunology, identification of nutritional disorders, water quality issues, taxonomy of pathogens, development and implementation of modern diagnostic methods and development of vaccines. As an example of this wider educational approach, the University of Tasmania currently provides a training course in histopathology of aquatic animals that is targeted at, and in part run by, non-veterinarians. There is also a need for continuing education. Identifying accreditation mechanisms to ensure competency in professionals providing aquatic animal health services to the aquaculture sector is another requirement for the industry.

The aim of this project is to evaluate and clearly define current and future needs for aquatic animal health training and for systems for merit-based accreditation and competency assessment. Stakeholder consultations will define current and future needs for aquatic animal health support among Australia’s aquaculture industries, both established and emerging. The needs identified will determine the training that is required to provide those services. However, consultations will also take into account issues such as succession planning, merit-based accreditation of experts, and competency assessment, as well as the reluctance of institutions to provide training for what may be perceived to be a very small and specialised market. After the consultations, an issues paper will be prepared that identifies the problems and solutions, for formal submission to the Aquatic Animal Health Committee (AAHC).
The lack of many serious diseases is one of Australian aquaculture’s prime competitive advantages to meet future global demand for seafood. Maintenance of this high health status through initiatives which reduce the risk of disease incursions and facilitate early detection and response to emerging disease problems is seen as critical to continuing industry expansion. The range of commercially significant aquatic animal species, and their diseases, is increasing steadily. Due to limited resources it is clear that diagnostic laboratories cannot develop proficiency in the diagnosis of all significant diseases. As a consequence, expertise in specific diseases has developed in different laboratories throughout the country. To take advantage of this development, to ensure that expertise in different diseases is available Australia-wide, and to create a consistent system of aquatic animal disease diagnosis and reporting, it is proposed that a national network of laboratories be established for the diagnosis and monitoring of aquatic animal diseases. This needs to be underpinned by a formal quality assurance program. Through a consultation process, uniform data standards and reporting formats need to be developed and adopted by all jurisdictions. Standard diagnostic tests and operating procedures also need to be developed and subsequently adopted by laboratories within the network.

This project is concerned with the establishment of the network and commencement of activities, including proficiency tests (“ring tests”) designed to assist laboratories in further developing their diagnostic capabilities and/or to allow demonstration that performance of a particular test is at a nationally accepted standard, using Australian and New Zealand Standard Diagnostic Procedures (ANZSDPs). In this way the confidence of stakeholders in the quality of the diagnostic service is increased.

Specific objectives include to:

• Make recommendations on the structure and function of the network of receival and reference laboratories

• Establish a laboratory network for aquatic animal disease diagnosis

• Facilitate transfer of knowledge and technology in aquatic animal diagnostics

• Develop a model for national laboratory proficiency (ring) testing as a mechanism to enhance the proficiency of the diagnostic network.
Salmonellae are important pathogens of animals and man. They can cause food poisoning in humans upon consumption of contaminated meat and animal products. This proposal is based on our previous discovery that Salmonella typhimurium containing mutations in the dam gene that prevent DNA adenine methylase (dam) expression are virulent yet confer protective immunity as modified live vaccines in murine, avian, and calf models of typhoid fever. One of the principal challenges to the development of commercial livestock vaccines is that multiple Salmonella strains are often endemic on farms, and traditional vaccines normally elicit protection against a single strain. We have recently shown that dam mutant Salmonella confer cross-protective immunity to multiple Salmonella strains when used as modified live vaccines in murine and avian models of typhoid fever.

Specific aims include to:

- determine if Salmonella dam mutant vaccines can confer cross-protective immunity against multiple Salmonella isolates in calves. A principal concern with all modified live vaccines is safety.
- introduce additional attenuating mutations (e.g., aroA) to reduce the virulence capacity of the Salmonella dam vaccine without compromising efficacy in calves.
- determine if Salmonella dam vaccines can be used as a platform for delivering passenger antigens to elicit protection against the cognate pathogen. We have chosen the Enterotoxogenic E. coli (ETEC) K99 fimbriae as a model passenger antigen since ETEC strains that express K99 fimbriae account for nearly all cases of ETEC infection in newborn calves and K99 fimbriae are a known immunogen that confers protective immunity against clinically relevant ETEC infections in calves and other species. The K99 fimbriae antigen from ETEC clinical isolates will be expressed in dam Salmonella. Vaccine efficacy will be assessed by elicitation of protective immunity against ETEC diarrheal disease in calves via passive colostral transfer of protective antibodies from vaccinated cows.
- develop safe and effective vaccines against Salmonella infection of cattle, and to demonstrate that this vaccine platform may be used to express cognate antigens from other pathogens thereby promoting the health and productivity of livestock, reducing Salmonella contamination of livestock, livestock-derived food products, and enhancing food safety.
Infectious bovine keratoconjunctivitis (IBK) is considered the most common ocular disease of cattle throughout the world. IBK is important both in terms of animal welfare and as a cause of lost production. Despite the susceptibility of the causative bacterium, *Moraxella bovis*, to a large number of antimicrobial compounds the treatment of affected cattle has many disadvantages and the prevention of IBK is therefore preferable. *M. bovis* virulence factors including the production of leukotoxin, protease, and β-hemolysin along with the presence of fimbriae on the bacterial cell surface that play a role in adherence. *M. bovis* fimbrial proteins act as immunogens and vaccination with isolated fimbriae stimulates bovine anti-fimbrial antibodies. However, strains of *M. bovis* are known to differ in their fimbrial antigens, with two types of fimbriae identified along with at least seven distinct serogroups of fimbriated *M. bovis*. Efficacious application of fimbrial based IBK vaccines requires production of a polyvalent vaccine targeting specific regional isolates.

The aims of this project are:

- to conduct a survey of *Moraxella bovis* strains in Australia to determine the prevalence of different serotypes across the country
- to determine which virulence attributes are common to most isolates
- to design a pink eye vaccine applicable to prevention of bovine infectious keratoconjunctivitis in Australia.

**Funding**

Schering Plough Animal Health

**Project timeframe**

Due for completion - January 2006
The prevalence of contagious mastitis in dairy cattle has dropped over the last 20 years. Environmental mastitis subsequently accounts for the largest proportion of intramammary infections and the associated losses in production. Surveys of mastitis conducted in Australia have reported that *Streptococcus uberis* is the most frequent environmental mastitis pathogen and suggest that coliform mastitis is relatively infrequent in Australian dairy cattle. These prevalence surveys have been conducted in Victoria and reflect the prevalence of disease in pasture fed dairy cattle.

Over the last 10 years there has been a steady and continuing trend toward intensification of the dairy industry with more farms providing supplementary feeding and some farms feeding total mixed rations similar to dairy production systems in Europe and the United States. Working with intensive dairy production systems in NSW we have observed a higher incidence of coliform mastitis than reported in Victorian surveys.

The objective of this study is to determine the prevalence of different mastitis pathogens on intensive dairies in NSW and to investigate the interaction between diet and environment on the major groups (coliforms and streptococci) of environmental pathogens.
<table>
<thead>
<tr>
<th>Title</th>
<th>Reducing antibiotic usage in pig herds: controlling <em>Lawsonia intracellularis</em> by vaccination, housing and hygiene</th>
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</thead>
</table>
| Farm Animal Health Staff | Dr Trish Holyoake  
Associate Professor David Emery |
| National Collaborators | Dr Alison Collins, Elizabeth Macarthur Agricultural Institute,  
NSW Department of Primary Industries  
Boehringer Ingelheim Pty Ltd, Australia |
| PhD Students | To be appointed |
| Summary | Proliferative enteritis (PE) is a major disease in the global pig industry. It is caused by *Lawsonia intracellularis* and is currently prevented by feeding pigs antibiotics. The project will provide two scientists (APAIs) with training in epidemiology and immunology applicable to livestock industries and biosecurity. The ultimate aim of the project is to reduce antibiotic use on pig farms to make the pork industry in Australia more globally competitive, and to benefit human health by reducing the risk of amplifying strains of antibiotic-resistant bacteria. There are three complementary streams of the research plan. The first stream will provide essential research to maximise the adoption of a commercial vaccine (Enterisol® Ileitis, Boehringer Ingelheim) as an alternative to antibiotics to control PE. Experiments will be undertaken to improve the efficacy of Enterisol® to control PE under Australian pig management systems and to induce immunity to Australian field isolates of *Lawsonia intracellularis* (LI). In particular, we will:  
- measure the protective efficacy and the immune response of vaccinated pigs against Australian LI isolates;  
- increase the ability of the vaccine strain of LI to induce an effective immune response in vaccinated pigs by modifying its administration (extending the “antibiotic-free” window);  
- identify the antibiotics that do not interfere with the vaccine strain of LI’s ability to infect pigs, hence allowing producers to continue to medicate in the face of concurrent disease while they vaccinate against LI;  
- establish the feasibility of vaccinating pre-weaning as an alternative to post-weaning as a way of avoiding the inherent post-weaning problems of concurrent medication and ease of administering vaccine through bulk water-delivery systems;  
- elucidate immune “markers” of protection to provide the commercial partner, veterinarians and pig producers world-wide with an objective measure of vaccine efficacy. |
| The second stream will compare the infection dynamics of LI in pigs reared in “traditional” concrete-based housing and in increasingly popular, welfare-friendly, bedded housing, so management strategies can be developed to control PE in these systems, as an adjunct to vaccination.  
The third stream will provide accurate and definitive data on the impact of PE on the pig industry in Australia, including the seroprevalence of LI infection on farms in Australia, the cost of antibiotics used to control PE and direct measures of the effect of LI infection on pigs’ carcass composition using a CT scanner. This data will provide accurate information on the impact of LI infection on the use of antibiotics and the profitability of the Australian pig industry and so supply the rationale to vaccinate and/or modify management to reduce antibiotic use. |
<p>| Source of Funding | Australian Research Council Linkage Grant |
| Project timeframe | February 2006 – December 2008 |</p>
<table>
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<tr>
<th>Title</th>
<th>Peri-urban and remote regional surveillance for biosecurity within the pig industry in eastern Australia</th>
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<tr>
<td>Farm Animal Health</td>
<td>Dr Trish Holyoake</td>
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</tbody>
</table>
| Staff | Dr Jenny-Ann Toribio  
| | Dr Fortune Sithole |
| PhD Student | Mrs Nicole Schembri |
| National Collaborators | Department of Agriculture, Fisheries and Forestry  
| | NSW Department of Primary Industries  
| | Victorian Department of Primary Industries  
| | Queensland Department of Primary Industries  
| | WA Department of Agriculture  
| | Rural Lands Protection Boards of NSW  
| | QAF Meat Industries  
| | Australian Pork Ltd |
| Summary | Preliminary studies have found disturbing gaps in our ability to identify and monitor pig health in a significant sector of the pig-rearing community in Australia – the small-scale pig producers in peri-urban and regional areas. Currently pigs raised in small-scale enterprises pose a high risk to Australia’s animal health industries due to our lack of knowledge about their movements, health and management practices implemented in these herds. In this project we will develop systems to minimise the risk of exotic disease occurring in Australia by targeting this sub-population of the pig-rearing community. In particular work will focus on: |
| | • Identification of the locations and practices of peri-urban pig producers  
| | • Improved methods for tracking pig movements  
| | • Mechanisms for health surveillance  
| | • Improved extension in relation to disease detection and swill feeding |
| Funding | Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease |
| Project timeframe | February 2005 – February 2008 |
Title | Specialised management of gilts and their progeny
---|---
Farm Animal Health Staff | Dr Trish Holyoake
National Collaborators | QAF Meat Industries
PhD Student | Ms Yvette Miller
Summary | This project seeks to address two problems. The first is the broad issue of a shortage of veterinarians with pig-specialist skills in Australia. There are few veterinarians entering the industry, despite many opportunities available to them working with commercial farms, educational institutions, pharmaceutical companies and regulatory organisations.

The second problem this project seeks to address is the relatively poor health and performance of gilt progeny relative to sow progeny. Gilts are completely different animals than mature sows and can act as a health destabilising factor in herds. Overseas, producers are segregating gilt progeny and sow progeny to:

1. stabilise PRRS in the progeny, to the extent that PRRS does not occur clinically in the mature sow herd; and
2. manage Mycoplasma pneumonia.

On farms that segregate progeny, vaccines are only used in gilt progeny. Segregation has resulted in a 3 fold decrease in pneumonic lung lesions at processing in P2 progeny (35% incidence of lesions in P1 progeny vs 12% in the progeny of mature sows). On farms where only sow progeny are housed, nursery drug costs are less than half that of gilts ($1.85US/pig vs $0.72US/pig).

The proposed project seeks to:

1. provide extensive training for a post-graduate veterinarian in pig health and production to provide for succession in the Australian pig industry
2. improve the pre-weaning growth performance of gilt progeny using supplemental milk
3. identify risk factors that explain why gilt progeny perform poorly, relative to sow progeny
4. develop management strategies to control the risk factors and hence improve their performance

Funding | Australian Pork Ltd
| QAF Meat Industries
Title  
Building capacity to model emerging disease threats in the intensive livestock industries

Farm Animal Health Staff  
Dr Jenny-Ann Toribio

PhD student  
Mr Sam Hamilton

National Collaborators  
Dr Graeme Garner and Dr Mike Nunn  
Department of Agriculture, Fisheries and Forestry

Summary  
Emerging infectious diseases have the potential to cause significant impacts on animal health, public health, the economy and/or the environment. A good understanding of the epidemiology and likely spread of these diseases, should they be introduced to Australia, is a necessary component of effective preparedness and response planning. At present there is a shortage of people in Australia with skills to undertake comprehensive epidemiological modelling of animal and human diseases.

This project offers the opportunity to develop advanced skills in disease modelling through the development of a stochastic spatial simulation model for a disease of concern to the Australian intensive livestock industries. Diseases that pose a serious threat include Newcastle disease and highly pathogenic avian influenza for the poultry industry and classical swine fever for the pig industry. Disease modelling, by evaluating the behaviour of an exotic disease under Australian conditions and the effect of alternate control strategies, is recognised as an important tool to support Australia’s preparedness for a disease incursion. This project, working with government and industry, will develop a new model of the spread of highly pathogenic avian influenza within the Australian intensive livestock population to address issues associated with assessing the extent, impact and control of disease outbreaks. This model will be used to enhance national disease planning and will provide technical underpinning for Australia’s outbreak management policies.

Funding  
Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease

Project timeframe  
February 2005 – February 2008
## Title

*Enhancing the contribution of livestock within smallholder mixed farming systems in the Philippines - The Leyte Livestock Improvement Program (LLIP)*

## Farm Animal Health

**Staff**

Dr Jenny-Ann Toribio

## National collaborators

- Dr Richard Clark – Project leader - Queensland DPI
- Dr Fay Rola-Rubzen – Curtin University
- Dr Bob Pym – University of Queensland

## International collaborators

- Dr Alberto Taveros – Project Leader
- Dr Agnes Taveros
- Dr Eugene Lañada
- Dr Fe Gabunada
- Leyte State University

## Summary:

Livestock are an important contributor to the social and economic wellbeing of resource-poor smallholder families in low-income countries. They provide tangible household benefits as a ready source of income, as well as benefits that are less tangible including the generation of employment, and the supply of inputs and services for crop production. Work from Africa suggests that livestock of all types on average make up 70% of farm investment and 40% of farm-generated income to smallholder families.

To date, most of the research and development work with smallholder farmers and their livestock in low-income countries has been conducted using traditional scientific methods. These methods have a strong focus of output-production such as the identification of new or improved knowledge or the development of a tangible solution to an identified problem. This is generally followed by a relatively linear sequence of problem identification, resolution and communication, and involved smallholder farmers as participants rather than partners in the research process. This project represents a substantial shift from traditional methodologies. Rather than focusing on the production of outputs, we are specifically seeking to build the capacity of farmers to improve the management, profitability and long-term sustainability of their livestock production systems through continuous improvement in their creativity, decisions, processes, practices and performance. Our work is focused on chicken and pig production systems, which play a key role in household income and nutrition for smallholder families in the Philippines.

### LLIP Mission

‘Enhancing the wellbeing of smallholder families in western Leyte by increasing the capacity of farmers to continuously improve their pig and chicken production systems to achieve an average of 5% improvements in profit (gross margin), environment (specific KPIs), and energy efficiency (specific KPIs), this year and in the future’.

### LLIP Objectives

1. To increase the capacity of participating producers to improve the management, profitability and long-term sustainability of their livestock systems through continuous improvement in their creativity, decisions, processes, practices and performance

2. To improve the contribution of livestock, in a measurable and sustainable way, to the social and economic wellbeing of smallholder families in western Leyte.

## Source of Funding

Australian Centre for International Agricultural Research (ACIAR)

## Project timeframe

February 2000 – December 2005
Title | Advanced surveillance systems - electronic data collection and decision support
---|---
Farm Animal Health Staff | Dr Jenny-Ann Toribio
National Collaborators | Professor Peter Thomson
Dr Angus Cameron and Dr Chris Baldock (deceased)
PhD Student | AusVet Animal Health Services
Mr Richard Shephard

Summary

Under-reporting of disease events in farm animals has been identified in numerous studies and is a significant gap in Australia’s national surveillance processes in that it becomes difficult to generate information to support claims of freedom from disease and reduces our capacity for early detection of emerging disease problems. The main sources of animal health surveillance information are veterinary laboratories, but these sources have been declining and represent only a small proportion of animal disease events and provide virtually no information on the health status of livestock in the remote pastoral regions of northern Australia which are the main supply areas of our beef exports. This project is a collaboration between researchers and industry to develop tools that assist with the collection of animal disease information using electronic systems based on a pilot project involving beef producers in northern Queensland. The outcome will assist producers and disease managers in collecting and analysing information on disease in Australian livestock and providing evidence for regional freedom from disease.

Electronic data capture can be achieved either by using a web-based data submission system (providing real-time access to a centralised database and allowing instant analysis), or by the use of hand held computing devices. In this current project both systems will be developed in a staged fashion. A web-based system will be followed by a hand-held device for data entry. A central component of each system is the Bovine Syndromic Surveillance System (BOSSS) a tool to assist farmers identify disease problems. This artificial intelligence system controls flow of information about individual diseases, disease investigation and control based on examination of reported signs, and will promote the capture of negative sign data (ie signs that are definitely not present). It provides producers with information about the most likely diseases that can explain reported signs and undertakes a differential examination of these listed signs by questioning the user about the presence (or absence) of key differential signs. The data are entered into a syndromic database that includes negative signs and has enhanced ability to differentiate disease and investigate potential exotic disease events.

This project will result in:

- An internet-based animal health information system enabling data entry, data analysis and reporting as a syndrome surveillance system for use by producers in remote areas.
- User-friendly computer-assisted diagnostic aids to help producers in remote areas.
- Software to be used on hand held devices which permits data entry and access to computer-assisted diagnostic aids in the field.
- Software and simple methods to transfer data from hand held devices to a centralised database for more sophisticated analysis of aggregated data as part of Australia’s overall disease surveillance system for cattle.

Source of Funding | Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease

Project timeframe | February 2004 – March 2007
**Title**  
Investigations of Borna Disease Virus in Australia

**Farm Animal Health**  
Associate Professor Jennie Hodgson

**Staff**  
Dr Robert Flower*  
Ms Sandra Kamieh  
North Shore Hospital

*Principal investigator

**National collaborators**

**Summary**

Borna disease virus (BDV) is a neurotropic RNA virus that can cause clinical disease in humans, horses, cats and sheep. Reports of its presence in Australia have been made, but have been unsubstantiated. These reports required verification with regard to human and animal health in this country as well as implications for export of animals from Australia.

The aim of this study is to investigate in various species whether BDV could be detected in Australia, by use of various serological and molecular techniques. Specific objectives include:

- Investigate and determine the prevalence of BDV in horses and cats using serological and molecular techniques.
- Investigate whether BDV or a BDV-like agent can be detected in the human population and if so, to determine the prevalence of BDV infection in humans, primarily blood donors, pregnant women, long-term multiply transfused haematology and depressed patients.
- Investigate whether BDV is associated with altered cytokine production in depressed patients, as opposed to a control population.
- Use definitive confirmatory serological tests for the detection of BDV.
- Obtain sequence data of isolates of BDV in Australia and compare to existing sequences of BDV for evidence of variation.

**Source of Funding**  
Rural Industries Research and Development Corporation

**Project timeframe**  
February 2003 – January 2006
Title: Interdisciplinary Network in Public Health

Farm Animal Health Staff: Ms Meg Vost, Dr Nicholas Malikides

National collaborators: Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease

International collaborators: Centres for Disease Control and Prevention

Summary: The clear and strong parallels between human and animal health have been recognised for millennia. Recent collaborative endeavours in developing and industrialised countries between the World Health Organisation, Food and Agriculture Organisation of the United Nations, and the Office International des Epizooties have redefined the role of veterinary public health and have involved veterinarians and other health professionals and scientists in a broad range of government and non-government sectors. However, in Australia, few lasting and significant collaborations have been formed between veterinary and medical science, and education, training and research activities in animal and human health have remained only tenuously linked.

In 2004, the veterinary, medical, and public health schools of the University of Sydney and public health institutions within Sydney and New South Wales formed a working group, the Interdisciplinary Network in Public Health (INPH). The INPH now has an expanding group of representatives from the University of Sydney, Westmead Hospital and the Public Health units in Lismore, Broken Hill, and Moree. Meeting every four months by teleconference, the INPH aims to create key partnerships between multiple health disciplines, including epidemiology, environmental and occupational health, clinical veterinary and human medicine and public health, pathology, wildlife and agricultural science, and to enhance, and capitalise on members’ areas of expertise in teaching, research and community service.

Joint projects in infectious diseases of public health importance, seminars given by experts in emerging infectious diseases and development of a unique animal and human based zoonoses fact sheet website were the major tasks of the INPH for 2004-2005. Through conferences related to communicable diseases, and through major government, industry, university and international organisations such as the Australian Biosecurity Cooperative Research Centre for Emerging Infectious Disease and the Centres for Disease Control and Prevention, we aim to enhance these and other similar initiatives while promoting the need for ongoing interdisciplinary animal and human health collaboration.

Source of Funding: Multi-institutional

Project timeframe: February 2004 – ongoing
**Title**  Exploring animal welfare education materials currently available to primary, secondary and tertiary students

**Farm Animal Health Staff**  Dr Robert Dixon

**Summary**  The project will explore current education materials available in all forms for primary, secondary and tertiary (including TAFE and Vocational Education and Training – VET) students in the area of animal welfare providing:

- a summary of the key animal welfare issues covered and the perspective they are present from;
- level of demand for animal welfare education resources;
- explore the activities of other organisations ie NFF, RSPCA, AVA and CIWF in this field;
- recommendations regarding a need for education materials for either primary, secondary or tertiary students

At completion, the industry will have the required data to determine the level of demand for and possible uptake of educational materials in animal welfare. This will enable MLA to make an informed decision as to whether they proceed to fund the development and delivery of these materials.

**Source of Funding**  Meat and Livestock Australia

**Project timeframe**  October 2005 – January 2006