New Zealand Society for Parasitology

Annual Meeting No.44

26-27 October 2016
Rydges Lakeland Resort Queenstown

38-54 Lake Esplanade
Queenstown

The Society would like to thank the following sponsors for their generous support

Bayer NZ Ltd

Elanco NZ Ltd

Gribbles

Merial NZ Ltd

MSD Animal Health

New Zealand Veterinary Pathology

PGG Wrightson Ltd

Ravensdown Ltd

Zoetis NZ Ltd

Programme

Date	**Tuesday 25 October 2016**
9:00am – 5:30pm	Parasite Advisory Day
10:30 – 11:00am	Morning Tea supported by Gribbles
11:00am – 12:30pm	PAD
Where	
1:00 – 1:45pm	Lunch supported by Merial
3:00 -3:30pm	Afternoon Tea supported by PGG Wrightsons
6:30pm	Drinks supported by Elanco
7:00pm	Dinner at Winnies

Date	**Wednesday 26 October 2016**
8:30 – 9:20am	Registration
9:20 – 10:30am	Welcome and Helminth Parasitology Chair: Victoria Chapman
1.1	**Sheep worms in young cattle** Tania Waghorn
1.2	**The efficacy and plasma profiles of abamectin plus levamisole combination anthelmintics administered as oral and pour-on formulations to cattle.** D.M. Leathwick, C.M. Miller, C.S. Sauermann, P.M. Candy, S. Ganesh, K. Fraser, T.S. Waghorn.
1.3	**The cross infectivity of *Haemonchus contortus* between calves and sheep** Tania Waghorn
1.4	**Dose titration studies in deer using Benzimidazole and Macrocyclic Lactone oral drenches** D.M. Leathwick, C.M. Miller, P.M. Candy.
10:30 – 11:00am	Morning Tea supported by Merial
11:00am – 12:30pm	Helminth Parasitology Chair: Robin McAnulty
1.5	**Parasitic gastrointestinal nematodes coping with chemotherapy, resistant hosts and unfavourable climatic environments: An experimental evaluation** Caroline Chylinski, Jacques Cortet, Jacques Cabaret, Alexandra Blanchard.
1.6	**Use of a growing degree-day model to estimate the risk of infection with liver fluke (*Fasciola hepatica*) over the previous 40 years and predictions for change using climate change models** Haydock LAJ, Pomroy WE, Stevenson MA, Lawrence KE.
1.7	**Are fallow deer a reservoir for Haemonchus?** Paul Mason, Chris Miller, Tony Rhodes, Dave Leathwick.
1.8	**Chasing the end of the Rainbow**: A history of the 56 years of development of the EG95 vaccine against *E.granulosus*. Heath DD, Lightowlers M W and 66 other authors.
1.9	**The half-truths, distortions, and failures-to-mention that industry continues to perpetuate** Tony Rhodes
12:30 – 1:30pm	Lunch supported by Bayer

1:30 – 3:00pm	Horse session Chair: Tania Waghorn
1.10	**<u>Equine cyathostomins – modelling biology and drug resistance</u>** <u>Christian Sauermann</u>, Jay Donecker, Thomas Geurden, Martin K. Nielsen, Dave Leathwick.
1.11	**Survey of the efficacy of ivermectin in foals on 6 Thoroughbred stud farms in New Zealand?** <u>Ian Scott</u>, Patrick Sells, Chris Rogers, Sarah Rosanowski, Charlotte Bolwell.
1.12	**Equine *Parascaris* spp. – modelling biology and drug resistance** <u>Christian Sauermann</u>, Jay Donecker, Thomas Geurden, Martin K. Nielsen, Dave Leathwick.
1.13	**Slowing the development of anthelmintic resistance in equine nematodes – has the horse bolted?** <u>Ian Scott</u>, Patrick Sells, Chris Rogers, Sarah Rosanowski, Charlotte Bolwell.
3:00 -3:30pm	Afternoon Tea supported by Gribbles
3:30 – 4:00pm	Chair: Bill Pomroy
1.14	**How wormy are our pet dogs and cats? The results of parasitological analyses of faecal samples from dogs and cats, 1983-2015** <u>Ian Scott</u>, Naomi Cogger, Bill Pomroy, Barbara Adlington, Anne Tunnicliffe.
4:00 – 5:30pm	NZSP AGM
6:30pm	Drinks supported by Elanco
7:00pm	Conference Dinner supported by Elanco

Date	**Thursday 27 October 2016**
9:00 – 10:30am	Chair: Paul Mason
2.1	**The recent evolution of parasite discovery and taxonomy** Robert Poulin and Bronwen Presswell.
2.2	**Differential impacts of parasite species on host fitness in four intermediate hosts** Olwyn Friesen, Robert Poulin, and Clément Lagrue
2.3	**Parasitic infection: a missing piece of the ocean acidification puzzle** Colin MacLeod
2.4	**Alterations to neuronal activity as a function of metacercariae infection intensity** Anthony Stumbo and Robert Poulin
2.5	**Comparative population genetics in two host-parasite systems of New Zealand's South Island.** Zachary Tobias and Robert Poulin
10:30 – 11:00am	Morning Tea supported by PGG Wrightsons
11:00am – 12:30pm	Chair: Robert Poulin
2.6	**Feeling blue? Body colour and behaviour are linked to parasitism in a marine amphipod** Bronwen Presswell, Kate Heaphy, Robert Poulin & Clément Lagrue
2.7	**Use of a real-time PCR to explore disease dynamics of avian malaria in a mixed New Zealand ecosystem** D.C. Sijbranda, D.B. Gartrell, Z.L. Grange and L. Howe
2.8	**Visually improved Loop-mediated isothermal amplification (LAMP) for detection of *Plasmodium falciparum* as a point-of-care test** Dr Rakesh Sehgal, Ms Hargobinder Kaur, Dr Kapil Goyal, Dr Ashish Bhalla, Dr Sunit C Singhi, Ram Singh.
2.9	**Use of fluorescent lectin binding to distinguish eggs of gastrointestinal nematode parasites of sheep** **S. Umair,** L.W. McMurtry, J.S. Knight and H.V. Simpson.
12:30 – 1:30pm	Lunch supported by New Zealand Veterinary Pathology

1:30 – 3:00pm	Chair: Paul Mason
2.10	**Natural variation in Galectin-11 (LGALS-11) - A tale of two variants in antiparasitic activity** Dhanasekaran Sakthivel, Sarah Preston, Tatiana P. Soares da Costa, Adam Shahine, MD Shakif--Azam, Peter Lock, Dene Littler, Jamie Rossjohn, Matthew A Perugini, Robin B Gasser, David Piedrafita and Travis Beddoe.
2.11	**Investigating the role of DAF-12-like nuclear hormone receptor of the parasitic nematode *Parastrongyloides trichosuri*** Gowtam C Chalasani[1], Kirsten Grant[2], Nathan Hall[1] and Warwick N Grant[1]
3:00 -3:30pm	Afternoon Tea supported by Merial End of Conference

Abstracts

Wednesday 26 October

1.1 Sheep worms in young cattle

Tania Waghorn

Whilst working to develop a lab test that could be used to determine the presence of resistant Ostertagia in young cattle, we found a large number of sheep worms present in the samples. This complicated the test and led us to ask how prevalent sheep worms were in beef calves and at what age the calves became immune to these parasites?

Over the past two seasons we have run a number of trials looking at the prevalence, generic composition and possible impact of these worms in beef calves. In the first season we followed three groups of calves for approximately a year, collecting and culturing faecal samples to determine which species were present when.

Results from the first season showed that a number of sheep worm species were commonly present in calves. On some farms, the sheep worms *Cooperia curticei* and *Haemonchus contortus* were present in all the samples collected from calves through until March, and in quite high numbers. Two studies were subsequently undertaken to further assess the prevalence and impact of *H. contortus* in calves. The first involved collecting samples from undrenched calves on farms in areas where *H. contortus* could be an issue, and determining the species present. The second looked at the impact of *H. contortus* on pre-weaning beef calve production in three farms.

Results from all three studies will be presented.

Thanks go to Beef + Lamb NZ for funding this work and to the farmers and vets involved for allowing access to their farms and sample collections.

1.2 The efficacy and plasma profiles of abamectin plus levamisole combination anthelmintics administered as oral and pour-on formulations to cattle.

D.M. Leathwick, C.M. Miller, C.S. Sauermann, P.M. Candy, S. Ganesh, K. Fraser, T.S. Waghorn

AgResearch Grasslands, Palmerston North 4442, New Zealand.

`In phase I, faecal egg count reduction tests (FECRT) were conducted on six commercial cattle farms to compare the performance of two pour-on and one oral combination anthelmintic. Groups of 12-15 calves were sampled for faecal nematode egg count (FEC) before treatment with either abamectin oral, levamisole oral, an abamectin + levamisole oral combination or one of two abamectin + levamisole combination pour-ons. Samples were collected again 14 days after treatment to calculate the percentage reduction in FEC. The proportions of infective stage larvae (L3) in faecal cultures were used to apportion egg counts to, and calculate efficacy against, the main parasite genera.

Abamectin oral was effective against *Ostertagia* except on one farm where resistance was indicated, but had reduced efficacy against *Cooperia* on four farms. Levamisole oral was effective against *Cooperia* on all farms, but had variable efficacy against *Ostertagia*. The abamectin + levamisole oral was effective against both species on all farms. The abamectin + levamisole pour-ons were effective on some farms but not on others. In particular, pour-on 2 failed to achieve 95% efficacy in 45% of evaluations, 4/6 against *Cooperia* and 1/5 against *Ostertagia*. On some farms the combination pour-ons were less effective than their constituent actives administered alone as orals.

In phase II, 8 groups of 6 calves, grazing parasite-free pasture, were infected with putatively ML-resistant isolates of *Cooperia oncophora* and *Ostertagia ostertagi*. Once infections were patent groups were treated with oral or pour-on formulations of abamectin alone, levamisole alone, abamectin + levamisole (two pour-ons) or remained untreated. Blood samples were collected for analysis and after 8 days all calves were euthanized and abomasa and intestines recovered for worm counts.

All treatments were effective against *O. ostertagi* and all treatments containing levamisole were effective against *C. oncophora*. Animals treated with the oral combination had higher Cmax and AUC values for abamectin in plasma than animals treated orally with abamectin alone. In contrast, animals treated with the combination pour-ons tended to have lower plasma levels for abamectin than those treated with abamectin alone as a pour-on, with differences in the Cmax and AUC values approaching statistical significance (p-values ≤0.07). There were no differences detected in plasma concentrations of levamisole.

The inconsistent and sometimes poor efficacy of the combination pour-ons on-farm is likely due to reduced levels of abamectin in the plasma and hence less active reaching the target worms in the gut.

1.3 The cross infectivity of *Haemonchus contortus* between calves and sheep

Tania Waghorn

The practise of mixed or rotational grazing, cattle following or co-grazing with sheep, is common on a lot of New Zealand sheep and beef farms. These practises are recommended as clean-up measures for parasites of both cattle and sheep, with the thinking that few parasite species cross infect and when they do, they do poorly in the non-preferred host. However, with the finding of *H. contortus* in reasonable numbers in young beef calves, it raises the question as to what the potential role of these young calves is in maintaining, if not exacerbating, a *H. contortus* problem on North Island farms? Remembering that on many farms these calves will be co-grazing with sheep and do not normally receive any drench treatments over the peak Haemonchus-risk period (January-March).

A slaughter study was undertaken to look at the ability of a field strain of *H. contortus* to cross infect sheep and calves. This involved the isolation of a new field isolate of *H. contortus,* the bulking up of that isolate and then cycling it through sheep and calves for three cycles prior to infecting both sheep and calves with each strain. Abomasa were collected from all animals in the final cross infection stage of the trial. They were washed out and all worms collected for counts, size measures and inter uterine egg enumeration.

Results to date show that *H. contortus* will infect both sheep and calves. Analysis of the final counts and measures is underway and results will be presented.

Thanks go to Beef + Lamb NZ for funding this work

1.4 Dose titration studies in deer using Benzimidazole and Macrocyclic Lactone oral drenches

D.M. Leathwick, C.M. Miller, P.M. Candy.

AgResearch Grasslands, Private Bag 11008, Tennent Drive, Palmerston North 4442, New Zealand.

Two dose titration studies slaughter studies were conducted on Landcorp stations (Rangitaiki and Weka) in November-December 2015. Each involved evaluating a range of dose rates, and some variations in active, for the macrocyclic lactone (ML) (Rangitaiki) and benzimidazole (Weka) classes of anthelmintics against *Ostertagia*-type parasites.

On each farm a mob of deer were set aside for use in the trial and these were monitored for faecal nematode egg count (FEC) until counts indicated the likely presence of sufficient worms to proceed. Three to four deer were then sacrificed and their abomasa recovered for worm count. On both farms these counts indicated sufficient worm burdens for a successful outcome and so the trials commenced.

The deer were randomly allocated into treatment groups of 6 animals each (8 animals in the untreated group) and the appropriate treatments administered. Ten days later all deer were sacrificed and the abomasa recovered for worm count. The efficacy of each treatment was calculated as the mean reduction in worm count compared with the untreated control group.

The dose titration studies produced similar outputs in that as the dose rates increased, efficacy tended to remain more or less the same. For example, dose rates of 10, 20 and 30 mg/kg of albendazole all produced similar efficacies, and 4 times the registered dose rate of 10 mg/kg was required to achieve efficacy greater than 95%. Similarly with abamectin, although the efficacies were somewhat variable, the effectiveness of 0.5 mg/kg (86%) was only marginally different to a dose rate of 0.2 mg/kg (83%).

In both studies three species of *Ostertagia*-type worms were present in the untreated groups and in most cases these same three were also present after treatment. It is noticeable that in all cases the proportion of *O*. *leptospicularis* increased after treatment which probably indicates a difference in susceptibility to the treatments by this species. While this could indicate a level of resistance to these drugs by this species, it is also known from cattle studies that *O*. *leptospicularis* is less susceptible to the ML class of drenches than most other species. Hence an increase in the proportion of this species following treatment with both drug classes could simply reflect it increased tolerance to both anthelmintic classes.

1.5 Parasitic gastrointestinal nematodes coping with chemotherapy, resistant hosts and unfavourable climatic environments: An experimental evaluation

Caroline Chylinski, Jacques Cortet, Jacques Cabaret, Alexandra Blanchard

AgResearch Grasslands, Private Bag 11008, Tennent Drive, Palmerston North 4442, New Zealand.

Over the last sixty years, the biological stability of gastrointestinal nematodes (GIN) of sheep has been increasingly challenged with attempts at control. While anthelmintic drugs initially provided an effective measure of control, this has been blunted with their widespread use resulting in anthelmintic resistant populations of GIN common throughout the globe. Future control strategies are looking towards selectively breeding sheep for resistance against infection. Impending climate change will present further environmental challenges to future populations of GIN. The aim of this study was to explore, for the first time, how anthelmintic resistance impacts the adaptive capacity of GIN in interacting with and surviving the challenges of heightened protective host responses and variations in climate.

Using *Haemonchus contortus* as a model species, the study compared three isolates with different anthelmintic exposure histories including i) a susceptible, ii) a levamisole resistant and iii) a multi-anthelmintic resistant (i.e. levamisole, benzimidazole and avermectins) isolate. The infectivity of the isolates was determined in resistant and susceptible sheep. The resulting free-living stages were challenged under three different climatic conditions, altering temperature and moisture. Their adaptive potential was measured using the phenotypic trait of fitness i.e. the culmination of survival and reproduction in one complete generation. A comparison of the isolates performance at various life history traits was also conducted to identify where changes in fitness may be taking place. The global transcriptomic expression of the isolates was explored using cDNA Amplified Fragment Length Polymorphism (AFLP) to provide a general overview of the differential expression profiles for each isolate.

The results showed fitness costs were incurred by both of the anthelmintic resistant isolates making them more susceptible to control by resistant sheep and the effects of temperature extremes. The isolates further differed in their transcriptomic expression patterns. This distinction in fitness carries important implications for understanding how differing GIN populations will respond to selective pressures. The increased genetic resistance of the sheep host was found to increase virulence (i.e. hematocrit loss/worm) in two of the isolates tested and increase the survival capacity of the eggs (i.e. egg to L3 development). Finally, the study highlights that flexibility in the *H. contortus* life history strategies heightens their adaptive potential to differing selective pressures.

1.6 Use of a growing degree-day model to estimate the risk of infection with liver fluke (*Fasciola hepatica*) over the previous 40 years and predictions for change using climate change models

Haydock LAJ[1], Pomroy WE[1], Stevenson MA[2], Lawrence KE[1]

1. Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Palmerston North, New Zealand.
2. Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Parkville, Victoria 3010, Australia

Liver fluke have been considered to be parasites of secondary importance relative to gastrointestinal nematodes in New Zealand. There is very little recent information on their prevalence or their clinical/production impacts other than anecdotal reports. Farmers in many areas use anthelmintics that include flukicides so they certainly consider them important. New Zealand's National Institute of Water and Atmospheric Research (NIWA) have a series of Virtual Climate Stations which are distributed on a 5 km^2 grid across the country (n = 11491). Their data is interpolated from actual weather stations. A previously described growing degree-day model (Malone et al 1998) was used to estimate the risk of infection with liver fluke from 1972-2012. To estimate the effects of climate change a suite of global climate models have been adapted for New Zealand by NIWA (Mullan et al 2008). These were used to estimate the risk of fluke infections within New Zealand for the years 2040 and 2090. The growing degree-day model was validated against the most recent survey of infection within New Zealand in 1984 (Charleston et al 1990). A strong positive linear relationship for 1984 between *F. hepatica* prevalence in lambs and infection risk ($p<0.0002$; $R^2=0.71$) was found indicating the model was effective for New Zealand. A linear regression for risk values from 14 regions in New Zealand for 1972-2012 did not show any discernible change in risk of infection over this time period ($p>0.05$) although there was considerable year-to-year variation. Post-hoc comparisons indicate the risk in Westland was found to be substantially higher ($p<0.05$) than all other regions with Northland ranked second highest. Notable predicted changes in *F. hepatica* infection risk in 2040 and 2090 were detected although they did vary between different climate change scenarios. The highest average percentage changes in infection risk were found in regions with low initial risk values such as Canterbury and Otago; in these regions 2090 infection risk is expected to rise by an average of 186% and 184%, respectively. Despite the already high levels of infection risk in Westland, values are expected to rise by a further 76% by 2090. The model does show some areas with little change with Taranaki predicted to experience only very minor increases in infection risk with average 2040 and 2090 predicted changes of 0% and 29%, respectively. Overall, these results suggest the significance of *F. hepatica* in New Zealand farming systems is probably underestimated at present and that this risk will generally increase with global warming following climate change.

1.7 Are fallow deer a reservoir for *Haemonchus*?

Paul Mason[1], Tony Rhodes[2], Chris Miller[3], Dave Leathwick[3]

1 Mason Consulting, 317 Dunns Crossing Road, RD8, Christchurch 7678

2 PGG Wrightson Consulting, PO Box 42, Dannevirke 4942

3 AgResearch Grasslands, Private Bag 11008, Palmerston North 4442

In parts of the central North Island feral Fallow Deer (*Dama dama*) are common and invade grazing land. Tony Rhodes wondered if the fallow deer were acting as a reservoir for *Haemonchus contortus*, as appears to happen with goats. To investigate this I was sent 5 frozen fallow deer abomasums, 2 from one farm and 3 from another farm, and asked to do worm counts on them.

The deer had relatively low abomasal worm burdens ranging from 0 to 750 worms. All the worms were Ostertagia-like worms. No *Haemonchus* were seen. The male worms were speciated and identified as *Ostertagia leptospicularis* and *Spiculopteragia asymmetrica*, with *S. asymmetrica* predominating.

1.8 Chasing the end of the Rainbow: A history of the 56 years of development of the EG95 vaccine against *E.granulosus*.

Authors: Heath DD, Lightowlers MW[1] and 66 other authors.

AgResearch New Zealand Limited, Hopkirk Research Institute, Grasslands Research Centre, Palmerston North 4442, New Zealand. Tel: 021646553 email: david.heath@agresearch.co.nz
1 University of Melbourne, Veterinary Clinical Centre, 250 Princes Highway, Werribee, Victoria 3030, Australia

The New Zealand hydatid control research programme started in 1958. Gemmell published in 1966 that protective antigens did occur in the oncosphere or the developing cyst. By 1970, Heath and Smyth had developed the methodology for in vitro culture of oncospheres. In 1975 a dog isolation unit was built in New Zealand that safely supplied E.granulosus eggs for the next 30 years. By 1994 the antigenic polypeptides of E.granulosus had been analysed and tested for protective ability, after a large scale analysis of adjuvants. In Marshall Lightowler's lab various recombinant iterations were created. These were then tested in New Zealand. One clone, EG95, showed the best protection, and this was sequenced and patented. A world-first anti-parasite vaccine was published in 1996, using QuilA as the adjuvant. Best technology for 10 litre production using GMP was followed by 1000 litre production of the vaccine in New Zealand, and registration of the vaccine for commercial use. From 1997 field trials were conducted in Xinjiang, China, using vaccine made in New Zealand. Good results meant that by 2004 large-scale production of vaccine occurred in Beijing. Safety testing led to the registration certificate in 2007. A new factory was built in Chongqing in 2011. The Chinese Government has this year provided money for large scale use of the vaccine.

After testing the vaccine in Chile and Argentina for 10 years from 1996, the vaccine technology was taken up by Tecnovax, Buenos Aires in 2007. The Argentine Government has prepared an action plan for hydatid control including the vaccine. Large scale field trials using the commercial vaccine are ongoing in Argentina and Chile.

1.9 The half-truths, distortions, and failures-to-mention that industry continues to perpetuate

Tony Rhodes
PGG Wrightson Consulting, PO Box 42, Dannevirke 4942

Observing practice and behaviour, particularly around internal parasite management, highlights the diversity in awareness, knowledge and understanding that exists throughout the farming community. Combine that with the different drivers that farmers and their advisers bring to the issue of parasite management and it is no surprise that some strange and unintended outcomes arise – and unfortunately, they arise far too often.

Inexcusably, the industry that talks with farmers around the issue of parasite management is part of the problem. Farmers make decisions based on a set of criteria that are important to their business, commercial parties exist to make profit and that means selling product while animal health advisors council clients based on a range of beliefs. All these groups have different priorities and perspectives which invariably lead to different opinions and advice. Where this becomes a problem is when the perspective and aims of the individual lead to misrepresentation of the 'truth', or at least the truth based on the sum of the available evidence.

The gap between current on-farm practice around parasitism and best practice should be no surprise. Farmers are participants in an information and communication process where there are many players – all with different understandings, motivations, and outlooks. Sometimes, they may even align with the farmers'.

Unfortunately, all too often, they don't. There are numerous examples of where the message being presented to both farmers and advisers is factually weak or even flawed; where a selected range of data is used to present a favourable story; where practices are being promoted without consideration or the obvious exceptions and risks; and where the subtlety of wording provides a cover for what is otherwise an untruth.

Misinformation and the stories our industry continues to perpetrate only serve to confuse farmers and their advisers, and to result in inefficiency and lost opportunity in the application of best practice parasite management, and in many situations, unnecessary cost and expenditure and continued selection for anthelmintic resistance.

Ultimately, as is always the case, it's the farmer and their business which is most affected – they are the one who ends up paying.

We need to decide if this is right and whether this state of affairs needs to change. We all value our freedoms, but how is responsibility evidenced? In the words of Thomas Friedman "The hidden hand of the market will never work without a hidden fist".

If we wish to encourage responsibility and accountability for the messages that industry provides around internal parasite management how should we go about that? What role does this Society have in nurturing accountability and responsibility so that New Zealand farmers receive the best possible advice, guidance and support around internal parasite management?

1.10 Equine cyathostomins – modelling biology and drug resistance

Christian Sauermann, Jay Donecker, Thomas Geurden, Martin K. Nielsen, Dave Leathwick

AgResearch Grasslands, Private Bag 11008, Palmerston North, 4442, New Zealand

A model has been constructed which describes the biology and development of anthelmintic resistance in the equine cyathostomins. Because of the complexity of the cyathostomin species mix and the general paucity of knowledge on their biology the model deals with the complex as a single unit rather than individual species. Biological assumptions were based on a literature search on parasite dynamics of both external and internal stages of cyathostomin parasites. By using temperature and rainfall data to estimate the development of eggs to infective larvae and their subsequent survival and migration on pasture the model can be tailored to any site for which weather data is available. The model was calibrated using historic data and fine-tuned using weather station data from different climatic regions from which parasitology data were also available. This is important because anthelmintic treatment regimes which are suitable for one environment may be completely inappropriate for another. The parasitic phase of the cyathostomin life cycle was modelled using data from several recent and historic necropsy studies with generation of full worm counts of both intestinal and mucosal stages. Within the host, the model follows the development of ingested larvae from encysted L3, with a variable period of arrested development, through moulting to the L4 stage and migration into the gut lumen before moulting to become an adult. When adult worms are removed by anthelmintic treatment they are rapidly replaced by the maturation of L3 / L4 stages in the lumen or mucosa, depending on the differential efficacy of different anthelmintics against each of these stages. This presentation will outline the structure of the model, before discussing the benefits of using drugs in combination and the advantages of leaving a proportion of horses untreated based on model output. This will be evaluated for two contrasting environments.

Author Contact Details;

Tel: 06 351 8332

E-Mail: christian.sauermann@agresearch.co.nz

1.11 Survey of the efficacy of ivermectin in foals on 6 Thoroughbred stud farms in New Zealand?

Ian Scott, Patrick Sells*, Chris Rogers, Sarah Rosanowski, Charlotte Bolwell
Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11-222, Palmerston North 4472.
*Chasemore Farm LLP, Bookham Road, Downside, Cobham, Surrey, KT11 3JT, United Kingdom

The objective of the following work was to determine if resistance was present in equine strongylid nematodes to ivermectin on stud farms in New Zealand.

In December 2014, 12 to 39 yearlings on 6 Thoroughbred stud farms were selected based on positive faecal egg counts and treated with ivermectin. These yearlings were then sampled again on days 7, 14 and 21 for faecal egg counts, to investigate the effectiveness of treatment with ivermectin and possible egg reappearance period. Full data were available for 5 studs. Additional data were also collected for days 28 and 35 (one stud each) and day 42 (two further studs). One stud farm (Stud 5) did not provide full data, although a day 7 sample was available for analysis.

The samples were processed by NZVP and the results are summarised below. Efficacy was calculated by comparing egg counts on days after treatment with pre-treatment counts.

		Days after treatment						
	n	7	14	21	28	35	42	
Stud 1	30	72.9%	94.2%	96.1%			50.5%	
Stud 2	30	99.8%	100%	99.9%				
Stud 3	12	100%	100%	100%			100%	
Stud 4	39	99.8%	99.4%	99.2%		62.2*		(*n=5)
Stud 5	30	100%						
Stud 6	12	99.3%	99.3%	98.5%				

In total, 153 horses were treated with ivermectin and of these, 145 (95%) had zero egg counts 7 days after treatment. The low efficacy (73%) observed 7 days after treatment on Stud 1 was the result of continued shedding of eggs by only 3/30 animals, with 1500, 425 and 50 eggs per gram of faeces respectively. It is possible that at least one of the 3 animals may not have been adequately treated. Efficacy on this stud was greater and can be considered adequate when measured at 14 and 21 days after treatment.

Despite the findings on Stud 1, the above results may be consistent with the continued high efficacy of ivermectin, and do not necessarily suggest that resistance has developed to this drug, at least not in egg-laying adult stages.

Reduced efficacy was however observed on 3 studs (Studs 1, 4 and 6) when counts were made 28 to 42 days after treatment[1], although on at least one other farm efficacy was still 100% at 42 days. Finding reductions of the egg-reappearance periods for ivermectin on some properties provides some evidence for the development of ivermectin-resistance in the larval stages of the parasites - stages that were still developing when the ivermectin was administered, were not killed at that time, but later matured and started producing eggs.

[1] The normal egg-reappearance period for ivermectin should be in the order of 8-14 weeks.

1.12 Equine *Parascaris* spp. – modelling biology and drug resistance

Christian Sauermann, Jay Donecker, Thomas Geurden, Martin K. Nielsen, Dave Leathwick

AgResearch Grasslands, Private Bag 11008, Palmerston North, 4442, New Zealand

A model has been developed for the biology of Parascaris spp. in the young horse. The model incorporates four main variables; the rate at which larvae migrate through host tissues to return to the small intestine, the proportion of migrating larvae which succeed in returning to the small intestine, the rate of growth in size of maturing and adult worms and the survival rate of maturing and adult worms. The most influential variable in determining model output is the survival rate of worms in the small intestine, which in the model, declines in response to the increasing age of the horse and the increasing cumulative length of worms in the intestine as a proxy for crowding. Given the importance of this variable to model behaviour and the paucity of experimental data on this topic this is identified as a priority for future study. The model was calibrated using necropsy data generated from several published studies. Very little information was available describing development and survival of external stages (embryonated eggs) in the environment, so simple general assumptions had to be made.

Incorporating genetics for anthelmintic resistance allows for a comparison of the long-term effect of different treatment strategies on the development of resistance. This presentation will compare the effect of varying the timing of first treatment on the contamination of pastures with eggs as a source of 'refugia', and the development of resistance.

Author Contact Details
Tel: 06 351 8332
E-Mail: christian.sauermann@agresearch.co.nz

1.13 Slowing the development of anthelmintic resistance in equine nematodes – has the horse bolted?

Ian Scott, Patrick Sells*, Chris Rogers, Sarah Rosanowski, Charlotte Bolwell

Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11-222, Palmerston North 4472.
*Chasemore Farm LLP, Bookham Road, Downside, Cobham, Surrey, KT11 3JT, United Kingdom

To date, there have been no confirmed findings in NZ of resistance of the dominant strongylid nematodes of horses to drugs like ivermectin and pyrantel, but resistance to the benzimidazole class is presumed to be widespread. Targeting the use of equine anthelmintics to animals that need it most (e.g. those exceeding a specified threshold of faecal egg output) has been widely advocated as a means of reducing anthelmintic use and delaying the development of resistance.

Shortening of the egg reappearance period (ERP) following treatment with ivermectin and moxidectin has been recorded overseas and is seen as providing advance warning of the development of overt resistance. Shortening of the ERP occurs when efficacy against the egg laying adults is still high but efficacy against larval stages has declined.

Data were collected from one of the large Thoroughbred horse studs in 2013 and 2014. Groups of weanling foals were brought in for faecal egg counts at intervals to decide if they needed treatment (if counts were equal to or greater than 150epg). Foals were resampled at varying time intervals when convenient. Foals treated with the same drug/drug combination and resampled after the same amount of elapsed time were grouped together to calculate percentage faecal egg count reductions. The time taken for % reduction to decline to around 90% or less was taken as indicating the ERP.

The ERP for treatment with a pyrantel/oxfendazole combination was as low as 3 weeks. There are no published reports of what the ERP for abamectin should be, but for ivermectin it should be at least 8 weeks. The ERP for an abamectin/morantel combination was 3-4 weeks. After all weanlings were treated in July 2014 with abamectin/morantel, 70% of those sampled 4 weeks after treatment had egg counts in excess of the threshold for treatment and required retreatment. By 5 and 6 weeks this figure had risen to 80% and by weeks 7 and 8 all sampled foals needed to be treated. The normal ERP for moxidectin is meant to be in the order of 13-15 weeks. Yet, alarmingly, there was a very short ERP (5 weeks) for a moxidectin/oxfendazole combination used in the foals.

On this stud at least, shortened ERP has resulted in animals being retreated at an interval of as little as four weeks, some even sooner. On this basis the targeted approach may not be dramatically reducing the overall number of anthelmintic treatments and may be little delaying the eventual onset of resistance.

Author Contact Details;
E-Mail: I.Scott@massey.ac.nz

1.14 How wormy are our pet dogs and cats? The results of parasitological analyses of faecal samples from dogs and cats, 1983-2015

Ian Scott, Naomi Cogger, Bill Pomroy, Barbara Adlington, Anne Tunnicliffe
Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11-222, Palmerston North 4472.

During the past 33 years, 1609 canine and 795 feline faecal samples have been submitted from the University's Teaching Hospital. These samples come from a mixture of cases where animals may or may not have clinical signs of disease. Of those where the submitted history included clinical signs, the majority (80%) had signs of gastrointestinal disease. Between 2006 and 2015, 797 samples were also collected from dogs held at the Palmerston North City Council Pound.

Methodology used to detect helminth ova and other parasitic structures has varied over the years with older samples processed with the same Modified McMaster egg counting technique used in production animals, often in combination with a faecal float technique, whereas latterly samples have been processed using a $ZnSO_4$ centrifugation/floatation technique.

There has been a marked decline in the finding of helminth eggs in dog and cats over the studied period. Between 1983 and 1990, nematode eggs were found in 31.5% of dog and 23.2% of cat samples. Between 1996 and 2015, however, eggs could be found in 11.1% of canine samples and 7.3% of feline samples. Most dramatic has been the decline in the finding of whipworm (*Trichuris vulpis*) eggs. Between 1983 and 90, whipworm eggs were found in 23.2% of samples; by 2006-10, this had declined to 3.7%, and between 2011-15, 0.6%. In the period 2006 to 2015, *Toxocara* spp., hookworm and whipworm eggs could be found respectively in 12.3, 23.5, and 11.7% of the Pound dogs, whereas in the Hospital population the corresponding findings were 6.0, 3.4 and 2.3%.

For client-owned animals, *Toxocara* spp. eggs could be found in 16.8% and 11.1% respectively of puppies and kittens <6m, but in only 2.6% and 6.9% of adults (>12m). Hookworm eggs could be found in only 3% of puppy samples, 8.6% of samples from dogs older than 6m, but <12m, and 5.4% of dogs >12m. In contrast, whipworm eggs were more frequently found in older dogs (10.2%), with fewer in dogs >6m, <12m (9.5%), and the least number of findings in puppies (2.0%).

Of dogs with clinical signs of gastrointestinal disease, only 8.9% had nematode eggs in their faeces. The figure was even lower for cats (3.8%). Whilst far from confirming that nematodes were the cause of illness, these findings nevertheless suggest that worms are an uncommon cause of GI upset in pet dogs and cats.

One of the reasons given for regular anthelmintic use in companion animals is the prevention of human infections with *Toxocara* spp., yet, based on these results, the vast majority of dogs (and cats) are unlikely to be shedding eggs. The use of modern, effective anthelmintics has almost certainly contributed to the low prevalence of helminth infections, but it must also be recognised that animals kept in relatively hygienic environments are less likely to ever be reinfected. It may be possible to identify animals at very low risk of infection based on age and husbandry and to recommend replacing regular anthelmintic use in these animals with regular faecal sample analysis, with no resulting increase in worm prevalence and/or threat to human health.

Author Contact Details;
E-Mail: I.Scott@massey.ac.nz

Thursday 27 October

2.1 The recent evolution of parasite discovery and taxonomy

Robert Poulin and Bronwen Presswell

Department of Zoology, University of Otago, PO Box 56, Dunedin

While concerns are being raised about a potential shortage of taxonomists and systematists, recent analyses suggest instead that the number of researchers involved in taxonomic descriptions is higher than ever. But does this mean more taxonomists, or more people helping taxonomists? Here, using several metrics of taxonomic quality, such as the number of morphological traits measured, the number of separate line drawings included, and whether or not gene sequences are provided, we explore variation in taxonomic quality as a function of the number of authors and other potential determinants across 2366 descriptions of parasitic helminths published in 1337 articles between 1980 and 2014. Taxonomic quality has generally increased over time, but unequally among different groups of helminths. For example, the number of scanning electron micrographs per description has risen significantly over time in cestodes and nematodes, but decreased for digeneans. For most metrics used, the greater the number of authors per species description, the higher its quality, suggesting not more taxonomists but more collaborations between taxonomists and experts from other fields to produce more comprehensive species characterisations. Re-descriptions of species were of higher quality than their original descriptions, and the improved quality correlated with the number of years elapsed between them; however, the extent of this improvement varied among helminth species with different host taxa. Overall, our findings taxonomic quality is improving over time through collaborative efforts. They also reveal cultural differences among taxonomists working on different groups of parasites that can serve to identify areas for potential improvement.

Author Contact Details;
Tel: **03 479-7983**
E-Mail: **robert.poulin@otago.ac.nz**

2.2 Differential impacts of parasite species on host fitness in four intermediate hosts

Olwyn Friesen, Robert Poulin, and Clément Lagrue

Department of Zoology, University of Otago, PO Box 56, Dunedin

Individual effects of parasites on their hosts can eventually translate to impacts on their community structure. Direct effects of parasitism on a host can include changes in survival, feeding rates, behaviour, and reproductive abilities. The extent of these effects can vary both inter- and intraspecifically. Direct impacts of infection can lead to more subtle changes that may be highly influential to population dynamics. We examined if the impact of shared parasites varied from host to host within the same community. Specifically, we examined the impacts of the acanthocephalan *Acanthocephalus galaxii*, trematodes *Coitocaecum parvum* and *Maritrema poulini*, and the nematode *Hedruris spinigera*, on two amphipod species, *Paracalliope fluviatilis* and *Paracorophium excavatum*, and congeneric isopods, *Austridotea annectens* and *A. lacustri*, in the littoral zone of a South Island lake. We examined the relationships between parasitic infection and survival, behaviour, and fecundity. A variety of relationships were found between parasite infection and measures of survival and behaviour, with parasite species having different impacts on varied hosts. *Maritrema poulini* was most abundant in *P. excavatum* yet had no effect on its survival, whereas it negatively affected *P. fluviatilis'* survival. The behaviour of the isopod *A. annectens* was impacted by *M. poulini* infection, with higher infection negatively related to time spent inactive. The differential effects on amphipods and isopods may lead to community-wide effects. Understanding the consequences of parasitic infection and differences between host species is key to gaining greater insight into the role of parasite mediation in ecosystem dynamics.

Author Contact Details;
Tel: **21 554-661**
E-Mail: **olwyn.friesen@postgrad.otago.ac.nz**

2.3 Parasitic infection: a missing piece of the ocean acidification puzzle

Department of Zoology, University of Otago, PO Box 56, Dunedin

Ocean acidification (OA) research has matured into a sophisticated experimental and theoretical scientific discipline, which now utilises multiple stressor, mesocosm experiments, and mathematical simulation models, to predict the near-future effects of continued acidification on marine ecosystems. These advanced methodological approaches to OA research also include the study of inter-specific interactions that could be disrupted if participant species exhibit differential tolerances to stressors associated with OA. The host-parasite relationship is one of the most fundamental ecological interactions, alongside competition and predation, which can regulate individuals, populations, and communities. The recent integration of competition and predation into OA research has provided great insight into the potential effects of differential tolerances to acidified seawater, and there is no reason to believe that expanding OA research to include parasitology will be less fruitful. This presentation outlines our current, limited understanding of how OA will affect parasitism as an ecological process, describes potential pitfalls for researchers who ignore parasites and the effects of infection, and suggests ways of developing parasitology as a sub-field of OA research.

Author Contact Details:
Tel: **03 471 6146**
E-Mail: **colin.macleod@otago.ac.nz**

2.4 Alterations to neuronal activity as a function of metacercariae infection intensity

Anthony Stumbo and Robert Poulin

Department of Zoology, Universiry of Otago, PO Box 56, Dunedin

Eye infecting metacercariae can alter a fish's ability to interact with its environment, such as impeding predator avoidance or limiting foraging ability. Less is understood on the neuronal mechanisms resulting from infection by such parasites that may induce these behavioural changes. In experimental conditions, fish infected with a higher intensity of metacercariae of the eye fluke *Tylodelphys* sp. (Trematoda) exhibit a reduced threat response to a light stimulus. As the amount of retinal obstruction associated with *Tylodelphys* sp. infection is independent of the number of metacercariae present, we hypothesised that the reduced response observed results from altered sensory information processed by the tectum opticum. To verify this, we analysed the level of neuronal activity of fish exposed to a flashing light stimulus. An immunohistochemical analysis was performed on cryosectioned brain tissue, using expression of a *fos* protein as an assessment of neuronal activity. Fish with higher intensity infections showed significant increase in neuronal activity within the optic lobes, a trend not present in control fish. This suggests that high numbers of metacercariae result in increased information reaching the tectum opticum via the optic tract, suggesting altered behaviour via sensory saturation. Our results provide a possible mechanistic link between infection and behavioural alterations in the host.

Author Contact Details;
Tel: **02 366-0636**
E-Mail: **stumboan@gmail.com**

2.5 Comparative population genetics in two host-parasite systems of New Zealand's South Island.

Zachary Tobias and Robert Poulin

Department of Zoology, University of Otago, PO Box 56, Dunedin

The genetic structure of parasite populations should theoretically reflect that of the most mobile host in the parasite's life-cycle. In parasites with low prevalence and/or small effective population size, low levels of gene flow may contribute to extensive genetic differentiation between populations, which could result in eventual allopatric speciation. Here we investigated the congruence of population genetic structure between host and parasite in two similar host-parasite systems. Members of the nematode order Mermithida and horsehair worms of the phylum Nematomorpha share many characteristics, including their morphology, host taxa, and ability to induce water-seeking behaviour in definitive hosts. The first parasite in our study, the mermithid *Thaumamermis zealandica*, parasitises the sand hopper *Bellorchestia quoyana*, a common amphipod on New Zealand's sandy beaches. Sequencing of *cytochrome oxidase I* (*COI)* and subsequent analyses revealed moderate levels of genetic differentiation between populations of sand hoppers. However, analyses of several genetic markers of *T. zealandica* expected to exhibit high levels of polymorphism revealed absolutely no sequence variation between populations. This finding is interesting in light of recent developments suggesting that the link between host and parasite population genetic structure may not be as straightforward as predicted by previous models. The second parasite in our study is the horsehair worm (Nematomorpha), a parasite of orthopterans and other insects most common in alpine and sub-alpine regions of the central South Island. Through sequence analyses of *COI* and rDNA regions amplified from free-living worms, we investigated comparative host-parasite population genetics using previously published studies of hosts and carried out the most comprehensive genetic characterisation of New Zealand's nematomorphs to date.

Author Contact Details;
Tel: **027 415 2752**
E-Mail: **zactobias44@gmail.com**

2.6 Feeling blue? Body colour and behaviour are linked to parasitism in a marine amphipod

Bronwen Presswell, Kate Heaphy, Robert Poulin & Clément Lagrue

Department of Zoology, Universiry of Otago, PO Box 56, Dunedin

Phenotypic variation is common among conspecifics from the same population, but its causes are not always clear. Parasites may often play a role, as their ability to induce phenotypic changes in their hosts is well established, though not widely acknowledged among marine ecologists. We tested for a possible role of parasites as determinants of marked colour polymorphism, as well as variation in several distinct behavioural traits, in the supralittoral amphipod *Transorchestia chiliensis* (Talitridae). Our results indicate that the juvenile stages of two parasites, the acanthocephalan *Plagiorhynchus allisonae* and a dilepidid cestode, are disproportionately common in certain colour morphs, i.e. green and dark grey in the case of acanthocephalans and green and blue in the case of cestodes, relative to other colour morphs. In addition, amphipods preferring a light background substrate over a dark one were more likely to harbour acanthocephalans, whereas amphipods that either stayed at the surface or did not burrow very deeply, harboured more cestodes than those that burrowed deep into the sediment. Our findings also indicate that later developmental stages of *P. allisonae* are associated with more pronounced host phenotypic variation, suggesting that phenotypic changes escalate in parallel with parasite growth within the host. Furthermore, the two parasite species tend not to co-occur in the same individual hosts; their distinct phenotypic effects thus apply to different subsets of the host population. We suggest that the role of parasitism in inducing and maintaining phenotypic variation within populations of marine invertebrates is probably more important than currently recognised.

Author Contact Details;
Tel: **03 479-5215**
E-Mail: **bpresswell@hotmail.com**

2.7 Use of a real-time PCR to explore disease dynamics of avian malaria in a mixed New Zealand ecosystem

D.C. Sijbranda[1], D.B. Gartrell[2], Z.L. Grange and L. Howe[1]

[1]*Institute of Veterinary, Animal and Biomedical Sciences, Massey University, Private Bag 11 222, Palmerston North 4442, New Zealand*

[2] *Wildbase, Massey University, Private Bag 11 222, Palmerston North 4442, New Zealand*

Avian malaria, caused by *Plasmodium* spp., is an emerging disease in New Zealand. To detect *Plasmodium* spp. infection and quantify parasite load in New Zealand birds, a real-time PCR (qPCR) protocol was used and compared to a nested PCR (nPCR) assay. Two hundred and two blood samples from 14 bird species with known nPCR results were tested. The qPCR prevalences for introduced, native and endemic species groups were 70%, 11% and 21% respectively, with a qPCR sensitivity and specificity of 96.7% and 98% when compared to nPCR. The qPCR appeared to be more sensitive in detecting low parasitaemias then the nPCR. The mean parasite load was significantly higher in introduced bird species (2,245 parasites per 10,000 erythrocytes) compared to endemic species (31.5 parasites per 10,000 erythrocytes. In New Zealand robins, a significantly lower PCV was found in *Plasmodium* positive compared to negative birds. Our data suggest that introduced bird species, such as blackbirds, have a higher tolerance for circulating parasite stages of *Plasmodium* spp. than endemic and native species, indicating that introduced species in New Zealand are an important avian malaria reservoir due to a high infection prevalence and parasite load.

Author Contact Details; Laryssa Howe
Tel: (021)522452
E-Mail: L.Howe@massey.ac.nz

2.8 Visually improved Loop-mediated isothermal amplification (LAMP) for detection of *Plasmodium falciparum* as a point-of-care test

Dr Rakesh Sehgal[1],Ms Hargobinder Kaur [1], Dr Kapil Goyal[1], Dr Ashish Bhalla[2], Dr Sunit C Singhi [3], Ram Singh[4]
[1] Department of Medical Parasitology, [2] Department of Internal Medicine,[3] Department of Peadiatric Medicine, Postgraduate Institute of Medical Education and Research, Chandigarh, India,[4]Department of Medicine, Government Medical College and Hospital, Chandigarh, India

Corresponding author: Dr. Rakesh Sehgal, Prof & Head, Department of Medical Parasitology, PGIMER, Chandigarh, India. E-mail: sehgalpgi@gmail.com

Introduction: Majority of the malaria cases in India are caused by *Plasmodium vivax* and *Plasmodium falciparum*. Microscopy has been considered as a gold standard for the diagnosis of malaria but its sensitivity is affected by the level of expertise of the microscopist and this further decreases in patients having low parasitemia. In an era of molecular microbiology, PCR is increasingly being used as a highly sensitive and specific test for the diagnosis of various infections. However, it requires costly equipment which are not readily available in the resource limited countries. Therefore, the present study has been planned to evaluate the utility of LAMP for the detection of *P. falciparum.*

Methods & Materials: A total of 4,341 patients were screened for malaria by microscopy from May 2013 to January 2015**.** Nested-PCR and LAMP was performed for the confirmation of microscopic positive cases by targeting 18S rRNA gene of *P. falciparum*. The results of LAMP were read visually after addition of SYBR Green 1 in the amplified LAMP reaction product. The amplified products were further checked by running these products on agarose gel and visualized under gel documentation system.

Results: Among the collected samples 105 (2.41%) were positive for *Plasmodium* spp by microscopy. Out of 105 positive samples 26 were positive for *P. falciparum* (24.7%). The sensitivity and specificity of LAMP and nested PCR for the diagnosis of *P. falciparum* as compared to microscopy was found to be 88% and 99.9 % respectively. As the sensitivity and specificity of LAMP is almost similar to nested PCR, therefore same can be used as a point of care test for the diagnosis of malaria. LAMP does not require costly equipments such as thermocycler, gel documentation system, and can easily be performed in a water bath.

Conclusions: Loop-mediated isothermal amplification (LAMP) thus provides a new stage for an early and easy diagnosis of malaria caused due to *P. falciparum.* In future, efforts will be done to standardize the multiplex LAMP to detect both the parasites (*P. falciparum* and *P. vivax*) in the same sample.

2.9 Use of fluorescent lectin binding to distinguish eggs of gastrointestinal nematode parasites of sheep

S. Umair, L.W. McMurtry, J.S. Knight and H.V. Simpson

Hopkirk Research Institute, AgResearch Ltd, Private Bag 11-008, Palmerston North, New Zealand.

Fluorescently labelled lectins may form the basis of a rapid test to identify, to genus, parasite eggs from faecal samples. The binding of a panel of 19 lectins to carbohydrates on the eggs of economically important nematode parasites of sheep has been assessed as the basis of a rapid test to distinguish parasite eggs, at least at the genus level. A total of six lectins can be used to identify eggs of six nematode parasites: peanut agglutinin (PNA) for *Haemonchus contortus*; *Lens culinaris* agglutinin (LCA) for *Teladorsagia* sp; *Aleuria aurantia* agglutinin (AAL) for *Trichostrongylus* sp; *Psophocarpus tetragonolobus*-II (PTLII) for *Nematodirus* sp; *Lotus tetragonolobus* lectin (LTL) for *Cooperia* sp and wheat germ agglutinin (WGA) for *Chabertia ovina*. For LCA, weak binding was also observed to *Trichostrongylus* sp and *C. ovina* eggs, and for LTL, weak binding was observed to *C. ovina* and *Nematodirus* sp eggs. Nematode eggs from two field collected faecal samples were identified using lectin binding, PCR and visual techniques. The results were identical except for the Nematodirus sp. eggs which did not lyse and hence could not be identified by PCR. This result indicates the utility of this method for future development into a test for rapid determination of parasite eggs to genus from field samples.

Author Contact Details;
Tel: 06 251 8664
E-Mail: saleh.umair@agresearch.co.nz

2.10 Natural variation in Galectin-11 (LGALS-11) - A tale of two variants in antiparasitic activity

Dhanasekaran Sakthivel[a,b,c], Sarah Preston[e], Tatiana P. Soares da Costa[f], Adam Shahine[a], MD Shakif--Azam[b], Peter Lock[g], Dene Littler[a], Jamie Rossjohn[a,c], Matthew A Perugini[f], Robin B Gasser[e], David Piedrafita [a,b,e*] and Travis Beddoe[a,c*]

[a]Department of Biochemistry and Molecular Biology, Monash University, Clayton, Victoria 3800, Australia.

[b]School of Applied and Biomedical Sciences, Federation University, Churchill, Victoria 3842, Australia.

[c]Department of Animal, Plant and Soil Science and Centre for Agri Bioscience (Agri Bio), La Trobe University, Victoria 3086, Australia.

[d]ARC Centre of Excellence in Advanced Molecular Imaging, Monash University, Clayton, Victoria 3800, Australia.

[e]Faculty of Veterinary and Agricultural Sciences, The University of Melbourne, Victoria, 3010, Australia.

[f]Department of Biochemistry & Genetics, La Trobe Institute for Molecular Science La Trobe University, Victoria 3086, Australia.

[g]Bioimaging facility, La Trobe Institute for Molecular Science La Trobe University, Victoria 3086, Australia

Gastrointestinal (GI) parasites affect human health and cause economic losses in production animals. Development of host immunity is complex and understanding the basis of effective host immune regulation is incompletely understood. This study highlights the functional roles of galectin-11 (LGALS-11), a glycan-binding protein involved in protective innate host immune responses. X-ray crystallographic studies of LGALS-11 identified a amino acid variation in residues forming the dimer interface, integrin binding site and mostly in the Glycan-binding groove. Quaternary solution structure analysis by analytical ultracentrifuge confirmed that the genetic substitution in LGALS-11 affects the dimer and tetramer formation. We further observed that this natural genetic variation in the dimer/tetramer formation property resulted in differential effects on the parasitic larvae, of *Haemonchus controtus in vitro*. Genetic variant-1 (tetramer) limits motility by paralysis and larval development compared to variant-2 (monomer/dimer) or mutants of the dimer interface (DIMGal-11) and carbohydrate recognizing residues (CRDMGal-11). This study demonstrates for the first time, that the dimerization property of LGALS-11 is essential for the anti-parasitic activity to be mediated.

Author Contact Details;
Tel: +61414547007
E-Mail: dhansay.sakthivel@monash.edu

2.11 Investigating the role of DAF-12-like nuclear hormone receptor of the parasitic nematode *Parastrongyloides trichosuri*

Gowtam C Chalasani[1], Kirsten Grant[2], Nathan Hall[1] and Warwick N Grant[1]

[1]Department of Animal, Plant and Soil Sciences, School of Life Sciences, La Trobe University, Bundoora 3083, Victoria, Australia

[2]The Florey Institute of Neuroscience and Mental Health, University of Melbourne, Victoria 3010, Australia.

Parasitic nematodes cause severe health ailments and economic losses worldwide. Understanding the evolutionary conserved mechanisms of non-parasitic and parasitic nematodes will provide more insights in discovering new biological targets for the control or prevention of nematode infections. The dauer hypothesis suggests that the diapause stage dauer larvae of free-living nematodes such as *Caenorhabditis elegans* is a pre-adaptation to parasitism. DAF-12, a nuclear hormone receptor, plays a vital role in dauer regulation in the response to environmental cues. A *daf-12*-like gene has been identified in the parasitic nematode *Parastrongyloides trichosuri* that encodes a protein showing high amino acid sequence conservation with the conserved domains of *C. elegans* DAF-12. On the basis of the similarity in the conserved domains between the *C. elegans* and *P. trichosuri* DAF-12, we hypothesised that *P. trichosuri daf-12* (*Ptr-daf-12*) is the orthologue of *Cel-daf-12* and will show similar developmental regulation to the *C. elegans* gene and play a role in the entry into and exit from the infective third- larval (iL3) stage. To investigate this, an RNA-sequencing analysis was performed from five developmental stages of *P. trichosuri,* and identified three isoforms of *daf-12* that differ at their 5' ends, similar to that found in *C. elegans daf-12*. Unlike *C. elegans*, one of the identified isoforms is highly expressed in iL3. The function of *Ptr-daf-12* was investigated further in a *C. elegans* complementation assay in which the ability of *Ptr-daf-12* to rescue *Cel-daf-12* mutations. No complementation was observed due to cryptic splicing of the *P. trichosuri daf-12* transgene that was predicted to encode a truncated, non-functional protein. A different approach using recently developed genome editing with engineered nucleases to induce *daf-12* specific mutations in *C. elegans* and *P. trichosuri* were tested but further optimisation of the protocol is required to generate effective genome editing in *P. trichosuri*.

Author Contact Details:
Tel: +61430009700

Conference Registrations:

Matt Airey	Franklin Vets	mairey@fvs.co.nz
Kiliana Bekelaar	AgResearch Ltd	
Jerusha Bennett	University of Otago	benje870@student.otago.co.nz
Dallas Bishop	Private Consultant	mitomiro@xtra.co.nz
Gowtam Chowdary Chalasani	La Trobe University	gowtam.chalasani@gmail.com
Victoria Chapman	Zoetis	Victoria.chapman@zoetis.com
Cathryn Christie	Vetora Waikato	cathryn.c@vetora.nz
Caroline Chylinski	AgResearch Ltd	Caroline.chylinski@agresearch.co.nz
Andrew Cockrane	NSVS Ltd	andrew@nsvs.co.nz
Trevor Cook	Totally Vets	trevor.cook@tvg.co.nz
Geoff de Lisle	Private Consultant	miromiro@xtra.co.nz
Andrew Dowling	PGG Wrightson	adowling@pggwrightsons.co.nz
Urthe Engel	The Vet Centre Marlborough	Urthe@vetmarlborough.co.nz
Warren Featherston		wfeather@inspire.co.nz
Olwyn Friesen	University of Otago	olwynfriesen@gmail.com
David Heath	AgResearch	david.heath@agresearch.co.nz
Laryssa Howe	Massey University	L.Howe@massey.ac.nz
Justin Hurst	Merial New Zealand	justin.hurst@merial.com
Kirstie Inglis	Bayer	Kirstie.inglis@Bayer.com
Kim Kelly	MSD Animal Health	kim.kelly@merck.com
Ash Keown	Vetora Te Awamutu	ashley.k@vetora.nz
Jill MacGibbon	NSVS Ltd	jill@nsvs.co.nz
Colin MacLeod	University of Otago	colin.macleod@otago.ac.nz
Bernad Mariadass	Gribbles Veterinary Pathology	Bernad.mariadass@gribbles.co.nz
Paul Mason	Mason Consulting	masonp@earthlight.co.nz
Robin McAnulty	Lincoln University	Robin.mcanulty@lincoln.ac.nz
Colin McKay	Elanco	colin.mckay@elanco.com
Paul McKee	Ravensdown	pfm@ravensdown.co.nz
Chris Miller	AgResearch Ltd	Chris.miller@agresearch.co.nz
Janna Nicol	Ravensdown	
Rob Nottingham	PharmVet Solutions	Rob@pharmvetsolutions.com
Andrew Oakley	Sirona Animal Health	claire@sironaanimalhealth.com
Bill Pomroy	Massey University	W.Pomroy@massey.ac.nz
Robert Poulin	University of Otago	robert.poulin@otago.ac.nz
Bronwen Presswell	University of Otago	bpresswell@hotmail.com

Tony Rhodes	PGG Wrightson Consulting	trhodes@pggwrightson.co.nz
Dhanasekaran Sakthivel	Monash University	dhansay@gmail.com dhansay.sakthivel@monash.edu
Christian Sauermann	AgResearch Ltd	Christian.sauermann@agresearch.co.nz
Richard Scott	AgResearch Ltd	Richard.scott@agresearch.co.nz
Ian Scott	Massey University	I.Scott@massey.ac.nz
Rakesh Sehgal	Postgraduate Institute of Medical Education and Research	sehgal@gmail.com
David Seifert	Ruapehu Veterinary Services Ltd	david@ruapehuvets.co.nz
Richard Sides	Vetent Aspiring	richard.sides@vetent.co.nz
John Smart	Clutha Vets Animal Health Centre	jsmart@cluthavets.co.nz
John Southworth	Agvet NZ Ltd	agvet@iprolink.co.nz
Antony Stumbo	University of Otago	stumboan@gmail.com
Zachary Tobias	University of Otago	ZactobiasYY@gmail.com
Saleh Umair	AgResearch Ltd	Saleh.umair@agresearch.co.nz
Hinrich Voges	LIC	hinrich.voges@lic.co.nz
Tania Waghorn	AgResearch Ltd	Tania.waghorn@agresearch.co.nz
Julie Wagner	Ravensdown	julie.wagner@ravensdown.co.nz
George Williams	Ravensdown	george.williams@ravensdown.co.nz

Agenda for the AGM 2016

26th October 2016 at Rydges Lakeland Resort Queenstown

- Attendees
- Apologies
- Last AGM minutes
- Matters arising (Parasitology strategic plan, correspondence, membership applications)
- Presidential address
- Treasurer's report
- Election
- Next Meeting
- General business

NZSP AGM 2015 Minutes
5.30pm 1st July, Crowne Plaza Hotel Auckland.

Attendees

Victoria Chapman, Tania Waghorn, Saleh Umair, Cathyrn Christie, David Heath, Haseeb Randhawa, Dallas Bishop, Dave Cole, Geoff de Lisle, Sarah Lochore, Robin McAnulty, Laryssa Howe, Tony Rhodes, Paul Mason, Dave Leathwick, Trever Cook, Robyn Lundall, Goh Sheen Yee, Robert Poulin, Olivia McPherson, Sorrel O' Connell-Milne, John Southworth, Richard Scott, Ian Sutherland, Justin Bailey, Tony Charleston, Yan Huang

Apologies

Barry Hosking, Richard Porter, Ian Scott, Bill Pomroy, Chris Mulvaney, Chris Miller, Colin McKay

Minutes

The minutes of the previous AGM were accepted as an accurate record.
Moved – Tony Rhodes
Seconded – Robin McAnulty

Matters arising

- No

Correspondence

Inwards

- There was an increase in newsletters from the Royal Society.
- Membership enquiries

Outwards

- information for members
- newsletter

Presidents Report

- Appendix I

The president's report was accepted.

Moved – Paul Mason
Seconded – Laryssa Howe

Treasurer's Report

Tania Waghorn presented the accounts report.

Because the financial report was presented on the first day of new financial year, it was not audited. The audited financial report will be sent to the members through email.

Moved – David Heath
Seconded – Sarah Lochore

Election of Officers

President - Victoria Chapman
nominated – Dave Cole
seconded – Ian Sutherland

Vice President - Cathryn Christie
nominated – Dallas Bishop
seconded – Saleh Umair

Treasurer - Tania Waghorn
nominated – Victoria Chapman
seconded – Richard Scott

Secretary - Saleh Umair
nominated – Victoria Chapman
seconded –Tania Waghorn

Next Conference

Next conference will be held in Dunedin. A committee of volunteers including Haseeb Randhawa, Paul Mason and Robin McAnulty will decide the dates and venue.

Other

Haseeb thanked the society for funding his students to attend the conference. David Heath emphasised on making a strategic plan for the society and taking the initiative, Richard Scott, David Heath and Trever Cook have agreed to discuss (in next 2 months) the strategic plan and increased collaboration with Royal Society. Yan Huang thanked NZSP for providing the letter of support to attend the conference. Trevor Cooke updated the society on the status of Wormwise and how it is now a standalone independent entity run as a charitable trust.

Presidents report 2016 for New Zealand Society for Parasitology xxth Annual General Meeting Queenstown

Presidents Report NZSP AGM
October 2016

Welcome fellow parasitologists, to the AGM of the New Zealand Society for Parasitology, here in Queenstown. I am delighted that we have over 50 delegates attending this year's conference, and thank all of you for staying on for this AGM. We have much to discuss so it may not be the quick AGM you were hoping for, sorry!

Firstly, what have we been up to this year? One of the projects we embarked on was nominating David Heath for the Thomson medal, through the Royal society. Saleh has worked endlessly on this, chasing up his referees and pulling the nomination together. We had a whole year, and it took that long! Unfortunately, David wasn't successful. The winner must have been truly outstanding. Thank you Saleh and the committee for your work on this.

We also wrote a letter to ministers Nathan Guy and Steven Joyce on the planned downsizing of AgResearch, stressing the importance of science and agriculture to them and how science is what will help us reach the governments GDP goals. This strategy worked when I wrote to Mr Muldoon over the planned aluminium smelter at Taiaroa Heads, but alas, it doesn't appear to have worked this time.

Unfortunately also, Dallas Bishop is retiring from being our editor at large of the newsletter and despite a plea earlier in the year we have had no volunteers to take up this prestigious role. So I will ask again now, would anyone like to be editor, even co-editor? Most of the material is supplied, although you may find a thing or two to add.
Thank you for your efforts over the past 10 years Dallas, you have provided members with a valuable link to their society and kept them up to date between conferences.

An idea that came out of last years combined ASP-NZ conference and raised by David Heath at the AGM was for us to have a strategic plan as our Australian counterparts do. The three members of this strategic planning subcommittee (David Heath, Trevor Cook and Richard Scott) were challenged with this task and drew up the framework for this. It was a bold plan, taking parasites to the people. Alas, we don't have quite the resources that the Australians have, so the main committee has massaged it a bit further into the plan that we have to present to you for your endorsement or further improvement. Thank you subcommittee for your work on this, often getting started is the hardest part. More on that later.

Despite government cut backs and members moving to other countries or out of this field, member numbers have remained reasonably constant since last year at 110. Once the strategy has been agreed by you today, more effort will be put into raising awareness and driving parasitology, next year. This membership and conference has been boosted by attendees from the parasite advisory day, held yesterday. I would again like to thank SVS for printing and distributing the PAD flyers to vet clinics and Merial for helping with the design

The younger generation and the wonder and intrigue they have are crucial to the continuation of new science in this field. Without new scientists coming into to the fold, discoveries will stop and progress will be impeded. Whatever progress may look like. To this end, we have again funded 6 students to come to conference, including 2 from Australia. They each received a subsidy of $500 each to help

with their costs. However, it is noted that the will power of government or private institutions to invest in science needs to be increased in order to maintain the attractiveness of science as a career choice.

On a more sober note, we should remember the passing of some of our members this year. Alex Familton in April this year. Alex was a past member of this society and a true gentleman. Paul Mason and Robin McAnulty attended his funeral. Dave Rutherford died suddenly on 6 July 2016. Dave was really the person who instigated the creation of the New Zealand Society for Parasitology and was a Life Member of the Society. Another Life Member, Lloyd Whitten, turned 100 in August this year, and several members of the Society joined him and others for a High Tea put on by the NZVA in Christchurch.

I would like to thank the conference organisers Robin McAnulty and Paul Mason, for the sterling job they have done, in choosing the venue (can't go wrong with QT), the programme and the smooth running of the show. Unless you have organized something like this you don't realise the extent of the logistics you have to go to and the minutiae that can trip you up, so well done.

Your committee of Tania (treasurer) Saleh (secretary extraordinaire), Cathryn (VP) and I have been meeting regularly by teleconference to ensure things are moving along. I would like to thank each of you very much for your continued efforts on this committee and patience dealing with a procrastinating and forgetful president.

I would also like to acknowledge again the generous financial support of this year's conference provided by: Gribbles Veterinary, Bayer, Elanco, Ravensdown, Zoetis, MSD, Merial, PGGWrightson and chief sponsor New Zealand Veterinary Pathology. This sponsorship helps keep our costs down, provides drinks and may even boost the coffers a little, so that we have more options available for the future.

The Society funds are still in good shape, thanks to the thorough record keeping of Tania. Because of this there is enough cash for the annual sharing of the whiskey bottle which will no doubt get knocked off at the dinner tonight!

I now ask if there are any questions, and ask that the President's report be accepted

Victoria Chapman
President NZSP

Presidents report