

Honours Projects in Parasitology – Jointly supervised by UNE and CSIRO Potential projects for the Southcott Honours Scholarship

DNA markers for population differentiation in *Haemonchus contortus*.

Understanding how parasites evolve is key to understanding drug resistance and virulence in these populations. Through the *H. contortus* genome sequencing project and associated EST projects, a wide range of single nucleotide polymorphism (SNP), insertion/deletion events (indels) and microsatellite repeat markers (MS) are predicted which could be used to differentiate populations. Not all markers are equally useful however because of technical limitations and mechanisms of mutation. What markers are useful for differentiating between different populations of parasites within Australia?

How many hemoglobin genes does *Haemonchus contortus* have?

Bioinformatic analysis suggests that *H. contortus* has up to eight genes encoding hemoglobins, and that there are amino acid changing SNP polymorphisms in these genes. Is EST clustering a sufficient way of estimating gene number when overlaid by allelic diversity? Are these predicted allelic variants actually seen in Australian populations? We may be able to use laboratory based work to validate or invalidate bioinformatic methodologies which are failing to assemble the difficult genome of *H. contortus*. The globin gene family is a good model as it contains both recent and more ancient gene duplications which can be analysed through both intra and inter-genomic comparisons.

Regulation of gut immunity to *Trichostrongylus* by trace elements

The protective immune response of sheep to *Trichostrongylus colubriformis* is influenced by the dietary trace element balance. This project would investigate the upstream mechanisms using real time PCR, immunohistology and DNA methylation analysis.

Possible role of pasture components in confounding the faecal occult blood test and in spring scours

Both spring scours and false positives in the occult blood test occur on young pasture but not in penned sheep fed dry feed, suggesting that these conditions are multifactorial. This project would attempt to reproduce these effects using penned sheep whose diets were supplemented with components which are candidates for an interaction with worm larvae and the gut immune response.

Are cytokine expression profiles (Th1 vs Th2) in periparturient ewes responsible for their susceptibility to gastrointestinal nematodes.

A previous PhD project has confirmed that the main driver of the PPR is lactation, and found circumstantial evidence that these ewes had a bias towards a Th1 response (required for resistance to bacteria and intracellular parasites) rather than a Th2

response (required for resistance to gastrointestinal nematodes). It is planned to carry out gene expression studies on a small number of cytokines in tissue that has been stored from these PhD experiments to confirm that there is indeed a bias towards a Th1 response that is responsible for the increased susceptibility associated with the PPR.

Biasing the immune response for optimal protection against parasites in lambs.

As part of a larger project on the ontogeny of mucosal immunity responsible for protection against gastrointestinal nematodes, it is proposed to characterise cytokine responses generated against parasite and bacterial antigens in young lambs. Furthermore, it is planned to investigate whether this immunological priming alters the cytokine expression profile and interferes with subsequent immunity.

Establishment of a gut specific parasite model in laboratory rats.

Background: The sheep parasitic nematode *Trichostrongylus colubriformis* spends a significant amount of its lifecycle exclusively in the jejunum of sheep. Current research at CSIRO includes gene expression studies on the host response to *T. colubriformis* infections. Greater than 100 host genes have been identified as differentially expressed in response to *T. colubriformis* infection in sheep. It is important to understand the *in vivo* function of these differentially expressed gene candidates in a biologically relevant model, however there currently does not exist a biologically relevant rodent model for the *T. colubriformis* sheep paradigm. If a biologically relevant rodent for *T. colubriformis* is found then we can assay the function of the host gene candidates using rat reagents such as monoclonal and polyclonal antibodies. *Odilia emanuelae* (a Trichostrongylina: Heligmonellidae) is a nematode which parasitizes *Rattus fuscipes*, the bush rat possibly in the duodenum. Thus, this would potentially provide a biologically relevant experimental model for *T. colubriformis*.

Aim: The aim of the project is to isolate *Odilia emanuelae* from the bush rat and establish it in laboratory rats.

Inheritance of macrocyclic lactone resistance in *Trichostrongylus colubriformis*.

Trichostrongylus colubriformis is one of the major pathogenic species of nematode parasites in major sheep producing areas of Australia. Control of this parasite is primarily dependent on the use of anthelmintic chemicals. Use of anthelmintics has led to the development of strains of *T. colubriformis* in some areas that are resistant to most available anthelmintics. Up to the present time, resistance to macrocyclic lactone anthelmintics is rare for this species. This project will use *in vitro* and *in vivo* methods to produce F2 offspring from macrocyclic lactone resistant and susceptible isolates of *T. colubriformis* to determine the mode of inheritance of resistance and produce DNA for genomic studies targeted at identifying genes associated with resistance.

Bioactive forages for controlling *Haemonchus contortus*.

Haemonchus contortus is a major pathogenic species of nematode parasite in summer rainfall zones of Australia and in tropical and subtropical areas throughout the world. Control of this parasite is reliant on anthelmintic chemicals but strains of parasites have developed that are resistant to most available anthelmintics. A number of forage plant species have demonstrated some anthelmintic properties against other nematode species. This project will carry out a detailed assessment of some of the more promising species of forage plants against *H. contortus* in sheep in order to identify potential candidates for further development as options for non-chemical control of this parasite.