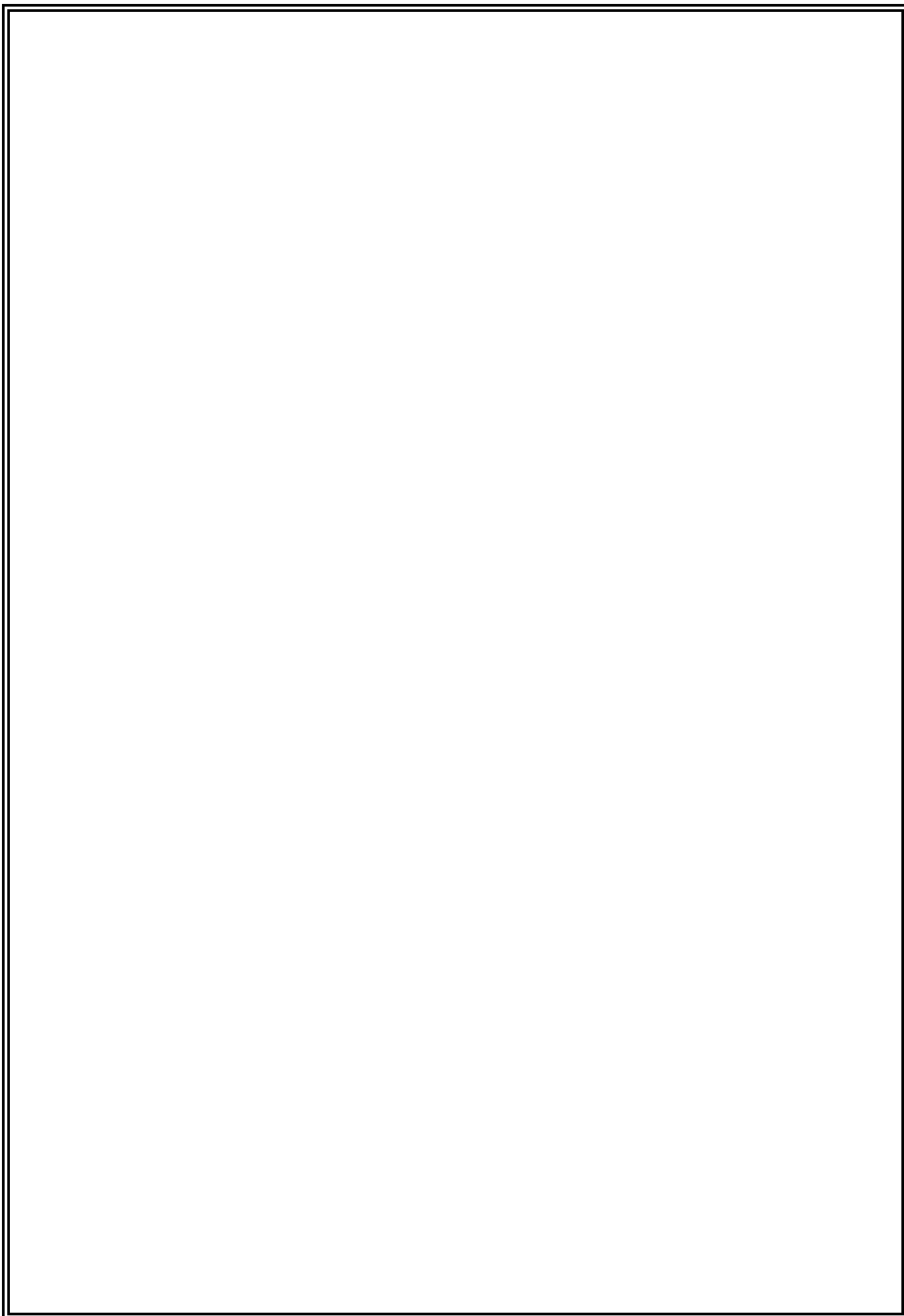


RUSC490

**Honours
Projects**

2010



Introduction

All students wishing to be considered for award of the BRurSc with Honours must undertake and complete this unit in their final year of candidature. The award of Honours is based on the student's performance in the second, third and fourth years of candidature including the thesis.

Potential topics are listed after this introduction, many of which have scholarships attached. Please don't select a topic simply because a scholarship is attached to it, it is essential you select a topic that is of INTEREST to you. There is considerable risk associated with choosing something for financial reasons, as motivation to complete is essential in what is essentially a self-driven course and unit. In many instances, even those topics that are not listed as directly offering scholarships may be able to provide one upon request – so ensure you seek a topic that is of interest to you!

Learning outcomes:

By the end of this unit students have developed:

- ❖ • expertise and increased knowledge in a given field
- ❖ • ability to conceive, conduct and report original research
- ❖ • ability to correctly review and reference scientific material
- ❖ • ability to critically assess own and other scientific work
- ❖ • ability to communicate findings in professional manner and in accordance with national and international standards

Assessment

RUSC 490 is assessed on the basis of two marks. The first mark, worth 80% of the final mark, is based solely on the submitted Honours thesis. Two examiners, one of whom is the supervisor of the project, independently assess the thesis using the marking criteria set out below. If the grades vary too greatly and the two examiners can not agree on a final mark, it is referred to a third examiner. The Unit coordinator asks the supervisor for advice in selecting examiners and sends out theses (bound copies) for examination, with advice on the nature of the thesis and the grading scale.

The second mark, worth 20% of the final mark, is based on a seminar undertaken in the fourth term and assessed by both peers and academics in a public forum. The principal supervisors (or their nominee) of the presenting Honours students for that year, will be required to attend and grade seminars. All Honours students will be part of the Panel, and peer-assessment will make up 40% of the final Symposium grade. Each seminar will be presented in an allocated 20 minute time slot (15 minute presentation + 5 minutes for questions). Attendance at Symposia presentations is compulsory. For those unable, (for significant reasons), to complete the presentation at the designated time, slots can be made available within the standard Rural Science Seminar sessions on Wednesdays at 1pm.

Enrolment

Students are required to be accepted by a member of academic staff for approval of the project topic and supervision. Supervisors will be available to discuss the work and provide as much guidance as necessary on the presentation of the material. It is the responsibility of the student to maintain contact with his/her supervisor.

Students are to submit a form to the RUSC490 Unit Co-ordinator indicating they have located a supervisor/s and project topic. The form is to be signed by the supervisor indicating that they have been formally approached and they are willing and available to supervise the project.

Critical dates

1) Students are to deliver an informal 3 minute introduction seminar early in the semester.

2) **JUNE 4, 2010** - RUSC490 students will deliver a completed first draft of their literature review to their supervisor, and if not completed 5% will be deducted from their final thesis grade. The literature review is to be submitted directly to the supervisor who will endeavor to provide feedback within 2 weeks. The review is ALSO to be submitted by email to the Honours Co-ordinator to determine completion. The literature review is not assessable at this stage.

3) **OCTOBER 11 2010** – Seminar presentations commence on Monday at 1pm for 4 hours. This is worth 20% of RUSC490 final grade as indicated in the assessment section.

4) **OCTOBER 29 2010** - the student will submit two soft bound copies of their thesis and a CD containing all data (and a PDF of the Thesis) to the Administrative Assistant in Agronomy and Soil Science. Both copies will be returned by the examiner's without being written upon; one to be given to the supervisor and a second to be stored in the School library. Corrections to the thesis are not required following examination.

There is a sliding scale of penalties for late submission of Theses. The scale is 5% for every increment of 4 days late up to 12 days and 30% thereafter. Honours is like any other unit and will be graded accordingly from HD through N. A failure (N) can be given not only for a poor standard of work but also if the report is not submitted within one month of the due date. Re-enrolment in the Project requires a new topic for investigation and report. Students who believe that they have a valid reason to explain late submission of project reports should prepare, in consultation with their supervisor(s), a substantial case in writing for consideration by the School TLC. If extension of time is granted, a grade of SET is given to the student. In such circumstances, the thesis must be submitted before 30 January in the following year.

Calculation of Honours grades

Final honours grade is calculated by the Unit coordinator. In 2010 the following protocol in RUSC490 will be used. Weighting is based on years and units according to the level that they are taught.

BRURSC					
% weighting	10%	15%	20%	20%	35%
Unit cluster	2 nd yr core	3 rd yr core	Electives	AGSY410, AGEX310	Project

BLISC				
% weighting	10%	30%	25%	35%
Unit cluster	2 nd yr core	3 rd and 4 th yr core	3 rd and 4 th yr elective	Project

The point scoring system awarded to each grade is set out below:

Grade	Point	Total Point Score
N	-3	
P	0	
C	1	100
D	2	200
HD	3	300

To increase sensitivity for the thesis point score, ½ points will be attributed e.g. 2.5 for > 81 but < 85. Each unit grade is awarded a point, these are added per unit cluster multiplied by % weighting and divided by number of units in cluster, for example (3rd year core RURSC):

ECON22	AGRO31	AGRO32	ANUT22	ANPR32	SOIL31	GENE35	ENVE33	TOTA
3	1	1	1	1	0	1	5	L
3	2	2	1	2	2	1	1	14

The 14 points are then multiplied by 15 (weighting %) and divided by 8 (units) to give 26.3 points. Honours grades are based on a combination of total coursework and thesis point score as follows:

Honours	Coursework and thesis total point score
Pass	<145
2b	145-169
2a	170-199
1	200-240
UM	>240

Only coursework units completed at UNE will be considered for Honours grading.

Thesis presentation

The thesis style and presentation should be as follows:

Typed, A4 paper, one side only; wide left-hand margin of 2.5-3.0 cm; 1.5 spacing; 12 font

A good thesis is concise, proof-read and consistent with respect to labeling and language. Aim to keep them short, under 10000 words, and reference them according to the CSIRO Journal Style (AJAR) if using Endnote, which you are all encouraged to use! Please consult UNE's *Referencing Guide*-

<http://www.une.edu.au/tlc/students/publications/referencing.pdf> when writing your thesis for correct referencing, formatting, etc.

Theses may not be longer than 14 000 words (excluding References, Appendices, Figures and Tables) and penalties will apply for theses that are longer. A penalty of 5% of thesis grade for every 2000 words over the limit will be enforced. To give you some idea of the importance of each aspect of the thesis, the following scheme will be used as a guideline for the marking of your thesis.

MARKING SCHEME FOR HONOURS THESIS

1. Literature Review - scientific content (~6000 words)

- Correctness of citing references
- Critical assessment of literature cited
- Adequacy of coverage of literature
- Incorporation of suggestions for future work
- Presentation/writing style/overall organization

2. Materials and Methods - appropriate to task able to be followed by others

- Suitable controls
- Sufficient replicates
- Appendices

3. Experimentation - appropriate strategies/experimental designs

- Logical sequence
- Presentation of results
- Suggestions of next step

4. Results/Discussion/Conclusion - observations of all results

- Interpretation of results
- Discussion of results
- Connecting results obtained in different sections
- Relating student's results to published work

5. Presentation - logical presentation

- Presentation of results (figures, tables)
- Writing style

Animal Science Projects

Supervisor: Professor Geoff Hinch

Dairy Production - possible topics on nutritional management and milk production in collaboration with NSW DPI

Supervisor: Geoff Hinch

Maternal behaviour differences in Merino and Crossbred ewes (Sheep CRC project)

Considerable resources are being allocated by the Sheep CRC to improving the survival of lambs and weaners in Australia. Poor maternal behaviour is one component of lamb loss and this project would attempt to quantify measurements that could be used for selection for improved maternal behavior.

Creating aversions to reduce cannibalism in laying hens (Poultry CRC project)

This project is presently in process and is looking at whether exposure to aversive substances in early life can be used as a means to reduce pecking in layer hens later on. The project would need to be completed in the latter half of 2009.

Measures of welfare of farm animals using motivation or emotions (collaboration with CSIRO)

Experimentation on use motivation or cognition as a means to determining welfare state of farm animals is presently being conducted at CSIRO Chiswick. There are a number of potential experiments that you could be involved in usually with sheep and cattle.

Improved measures of animal welfare

Assessment of the welfare of livestock involves determining the physiological, behavioural, immunological and emotional status of the animal. The student will work in CSIRO's internationally recognized Animal Welfare Science team to develop improved measures of animal welfare in sheep. The project will provide training in cutting edge research that will underpin the development of new methods for assessing the welfare of livestock.

Measurement of sheltering behavior and paddock use by sheep (collaboration with Assoc Prof David Lamb and Mark Trotter)

We are presently using GPS tracking systems to help define the use of shelter by sheep for shade or shelter from cold. Projects using this technology as a means to further understanding the factors determining utilization of paddocks and how we can manipulate this are open for discussion.

Lamb survival - measures of cold resistance (with CSIRO) Lamb survival - twins and the likelihood of survival

Considerable resources are being allocated by the Sheep CRC to improving the survival of lambs in Australia. We are presently interested in determining if there is genetic variability in lamb survival or causes of lamb loss and if so how we can manage this. Projects to answer this question can be developed around utilizing the Information Nucleus flock at Kirby. This project is possibly best started in 2009 so discuss this earlier rather than later.

Artificial Breeding technologies - possibilities with CSIRO

The group at CSIRO are interested in the interface between molecular biology and reproductive technologies and particularly in the manipulation of gametes. If you are interested in a project in this area I can put you in contact with the relevant people to identify a project

See Geoff for more details on any of these projects. (Note any of the projects associated with CSIRO can often be linked to summer scholarships based at Chiswick. Ask for further details if you are interested.)

Projects with Working Dogs

Supervisor: Wendy Brown (Ext 5125; Email: wbrown@une.edu.au)

Summary: What are the traits of a good working dog? Can any dog be trained to herd? Is the success of the working dog due to good genetics or good training? Can we improve the performance of working dogs through targeted nutrition? Can we select and train dogs more effectively if we have a better understanding of their natural instincts and behaviours? What do we know about sensory perception in the dog and how does this impact on its ability to perform specific tasks? These are just some of the questions that you could investigate in a project with working dogs.

Co-Supervisor: Professor David Cottle

Notes:

1. Prof. Cottle will be on SSP leave from June 1 2009, so he is only able to be a co-supervisor in 2010.
2. Students working on sheep and wool projects can apply for AWET \$5000 honours scholarships.

Is more fleece weight without higher diameter possible?

Co supervisor: L Kahn

Summary: Design of feed rations for Sharlea sheep aimed at economic production of superfine wool

Wool quality in dual purpose/meat merinos

Co supervisor R Mortimer Centre Plus

Summary: Using @Risk Gross Margin spreadsheets to compare the economic performance of different dual purpose sheep enterprises, e.g. Centre Plus and Dohnes.

Sheep feeding preferences

Summary: Sheep prefer to graze a mix of 70% clover: 30% grass when given free choice. Paradoxically, sheep which have a higher preference for clover can have lower clover (and protein) intakes as they may initially overgraze the clover. Dietary preference has a genetic component. Project will study sheep dietary preferences versus their nutritional requirements and their possible incorporation into sheep and pasture breeding programs.

Feed efficiency and methane modeling - metabolic pathways- gene expression

Co supervisors: NSW DPI staff

Summary: Feed costs for maintenance are over 60% of the feed requirements of a flock/herd. Feed costs make up about 60% of production costs with protein and energy accounting for 90% of feed costs. Projects may include modelling the effects of management practices on methane production on farms to improve the maintenance efficiency of flocks/herds, studying sheep with high and low breeding values for pasture feed efficiency and developing models to describe variance in feed efficiency due to environmental and genetic influences. Measurement of pasture feed efficiency and its relationship to other traits.

Use of decision support tools, e.g. Grassgro3, SGS Pasture

Co supervisors: D Lamb, L Kahn (AIMS), A Moore, (CSIRO PI), I Johnson (IMJ)

Summary: Case studies on Northern Tablelands properties and/or model development, e.g. incorporating FD, SS/SL/style, remote sensing validation, potential impacts of over grazing on soil parameters, nutrient loss and subsequent recovery, fodder crops, climate parameters/drenching impacts on internal parasite loads and stocking rate and grazing management choices.

New England Merino sire evaluation

Summary: Assessment of the progeny of fine wool rams (outliers/extremes for bare crutch, muscle Merino, high SGA EBV for wool-meat-reproduction-disease measured for standard

and non-standard traits, e.g. feed efficiency, feed selectivity (pen feeding), temperament (box flight), stayability via conformation traits, drought tolerance (leptin etc.).

Information Nucleus Flocks wool traits

Co supervisors: J van der Werf

Summary: Data from the Sheep CRC's information nucleus flocks will be explored for relationships between traits, the physiological basis of any relationships and implications for applied breeding programs.

Genotype by environment interaction corrections

Co supervisor: D Brown, AGBU

Summary: Classifying sheep grazing environments using various data, e.g. spatial data and studying the use of environmental classes in Sheep Genetics Australia breeding value analyses of wool traits.

Wool Market segmentation

Co supervisor: S Champion, Meat and Wool NZ; S Causer, Merino NZ

Summary: Analysis of relative economic values for wool in different product process groupings and their changes over time and between countries.

Development of strategy and a decision aid tool for establishing a new beef breeding program through population screening. (In collaboration with an industry partner in USA)

Supervisor: Brian Kinghorn

Summary: The partner is an interesting technology company and the application is real. The student will have an understanding of quantitative genetics for animal breeding, and interest in computer programming is desirable. Some level of confidentiality will be involved on practical outcomes, but I aim to keep method and tools unconstrained.

Animal Nutrition

\$5000 scholarships are available for projects in animal nutrition this year – see Geoff or Darryl for the application details.

Supervisor: A/Prof. Paul A. Iji (Room 20, Woolshed Building)

Phone: 02 6773 2082; email: piji@une.edu.au

How much litter material do chickens consume?

Broiler chickens are known to consume litter material, which is routinely placed on the floor on which they are raised. The reasons behind this habit are unclear but litter intake is believed to aid the development of the gastrointestinal tract (GIT), particularly the gizzard. It has also not been established how much litter material chicks consume and if consumption varies between litter types. Such knowledge would inform the choice of material that is used for litter, to aid the development of the GIT, and possibly to improve health and productivity. It is our belief that litter consumption by birds can be quantified through an adaptation of methods used to quantify forage selection and intake in ruminant animals as well as through redevelopment of existing techniques in poultry science. The proposed study will set the scene for larger scale studies into a greater understanding of litter preferences by poultry. This project is designed to provide proof-of-concept data for future research. It is not meant to assess the effect of litter on productivity and gut function. The specific objectives will be to quantify litter consumption by broiler chickens, and evaluate reliability of methods that can be used for quantifying litter consumption.

Stimulating the early development of the gut in broiler chickens

There is a current drive towards early feeding of broiler chickens, to enhance subsequent body growth and final body weight. A variety of products and feeding systems are being tested but the mechanisms associated with the response to many of the products are still unknown. An early development of the intestinal function may be one such mechanism. Butyric acid is known to be utilized as a fuel by intestinal cells but it is only recently that products based on this acid have been introduced as supplement for early feeding of chickens. The aim of this project is to examine the effects of such a product on intestinal development, body growth and health of broiler chickens.

Feeding effects on sheep methane production

Supervisors: Roger Hegarty, Darryl Savage, John Goopy

Summary: Two thirds of Australia's agricultural greenhouse gas emissions are released as methane from the gut of ruminant livestock. Methane emissions are typically measured using sheep or cattle fed once daily while in respiration chambers. This feeding pattern is not representative of what occurs in grazing livestock and so it is important to discover how feeding pattern affects daily methane output. A study is required to assess the change in daily methane output associated with feeding frequency and this can be undertaken using the open circuit respiration chambers (5) at UNE.

Title: *Comparative fermentative capacity of divergent herbivores.*

Supervisors: John Goopy, Ian Godwin,

Summary: While numerous microbial studies indicate macropods have few if any methanogens in their sacciform forestomach, there is a dearth of studies in which methane production (or its absence) has been monitored in live macropods. This study will examine the fermentive capacity of the rumen (sheep), forestomach (macropods) and caecal (Koala) fermenters, with special attention to methane production and the role of tannins in vitro.

Title: *Novel antiprotozoal compounds*

Supervisors: Roger Hegarty, John Goopy and Simon Bird

Elimination of protozoa from the rumen typically increases protein supply to the intestine by 15%. Commercial defaunation (elimination of protozoa) has proved extremely difficult, but a new project is underway to test a suite of potential antiprotozoal compounds. There is opportunity to be part of this initiative & study the biology and control of these rumen anaerobes.

Meat Science Projects

Supervisor: Dr. Geert Geesink (Meat Sci. Building)

Phone: 02 6773 3257; e-mail: geert.geesink@une.edu.au

Enzyme tenderizers for red meat

The possibility to tenderize meat using exogenous enzymes is well known, but difficulties in controlling the extent of tenderization has resulted in limited adoption in the Australian beef industry. This contrasts to the US where meat tenderizing strategies, like enzymatic treatment, is more common for food service products. The current project aims to characterize a range of commercially available tenderizing enzymes. The characterization involves determination of degradation patterns of their protein substrates, tenderizing effect and determination of optimal combinations of enzymes for practical application. The first phase of this project involves experiments on laboratory scale. The second phase involves testing of optimal enzyme combinations under processing conditions.

A mechanistic model for meat tenderness

The Meat Standards Australia (MSA) grading system predicts the eating quality of beef cuts based on a number of carcass characteristics, processing conditions, aging time and cooking options. This grading system is based on large scale consumer testing of factors affecting palatability of beef. However, consumer testing is very costly. Therefore, any refinement of the current grading system, or the uptake of new factors affecting palatability would need a large investment. For one of the main factors affecting palatability of beef, e.g. tenderness, it is known that it is affected by three components: muscle contraction, connective tissue content and amount of tenderization during chilled storage (aging). All of these can be measured objectively in the laboratory at lower costs than consumer testing. The current project aims to develop a mechanistic model to predict meat tenderness which can be used to refine, and add new factors to the current MSA grading system.

Characterization of the effect of gene markers for tenderness

Within the current Beef CRC gene markers for tenderness have been extensively tested for their effect, but the mechanism through which they exert their effect is largely unknown. The gene markers are based on polymorphisms in the genes for enzymes involved in tenderization (calpains) and their inhibitor (calpastatin). The current project aims to purify these enzymes and their inhibitor from muscle tissue and characterize their activity and interactions in a series of in vitro assays. The person taking on this project will gain experience in a broad range of laboratory techniques including chromatography, electrophoresis, immunological techniques and enzyme assays.

Animal genetics and breeding projects

Inbreeding and inbreeding depression in the Angus breed

Supervisor: Julius van der Werf and David Johnston (AGBU)

Modern breeding programs use across herd genetic evaluation and artificial insemination to enable wide usage of the best sires. However, intensive usage of only a few sires might lead to inbreeding. Inbreeding is undesirable as it leads to a decrease in genetic variation and possibly inbreeding depression. The extent of inbreeding can be derived from the pedigree and inbreeding trends can be plotted. The amount of inbreeding depression can be derived by relating individual inbreeding coefficient to performance data.

Genetic correlations between sexes in Merino sheep (rams and ewes)

Supervisor: Julius van der Werf and Andrew Swan

Selection for wool production traits is usually based on performance evaluation of potential breeding rams. However, the majority of wool is produced by ewes or wethers. This project will investigate whether wool production of rams is based on the same set of genes as wool production of ewes (and wethers). If this is not the case, selection of rams would be more efficient if it was more based on ewe and wether performance, i.e. on relatives of the male selection candidates.

The influence of fibre diameter profile characteristics on wool processing performance.

Supervisors: John Goopy, Ian Godwin,

Genetic improvement of wool sheep relies on accurate performance measurement. To improve wool quality, on farm performance measurement on individual animals needs to have a high correlation with processing attributes of this wool. Selection for wool quality is based on objective measurements such as fibre diameter and staple strength and on farm fibre measurement now also allows determination of fibre diameter profiles. CSIRO has collected wool from sheep with different fibre diameter profile measurements and has evaluated the processing performance of this wool. This allows estimation of the relevance of individual animal measurement of fibre diameter profiles for processing quality of wool.

Variation between and within breeds for sheep production traits

Supervisor: Julius van der Werf

This project will use data from the Sheep CRC information nucleus flock. A few thousand animals from one hundred sires are tested every year at different sites across Australia, and sires are from different breeds and breed types. A large number of traits is measured on these animals, e.g. weights and scan traits, visual traits, wool traits and meat traits. You can analyse some data from this invaluable source allowing you to answer many questions about sheep production traits. What are differences between sites, between sires and between breeds? Do sires rank differently at different sites? How do visual traits for breach score correlate to other wool traits? And many more.

The potential benefit of whole genome selection

Supervisor: Julius van der Werf and Cedric Gondro

Modern molecular technologies provide now the potential to genotype individual animals for a large amount of dense SNP markers. This gives the potential to predict more accurately the breeding value based on more detailed information of the whole genome as inherited from parents. The potential benefit of whole genome selection can be assessed through modelling and using first results of whole genome scans.

Cross platform integration of microarray data

Supervisor: Cedric Gondro

Gene expression studies provide parallelized measurements of thousands of genes at the same time. Many of these gene studies have been conducted on various different platforms but it is unclear how to use this data in cross experiment studies. This project will work on the development of computational and statistical methods to integrate the results from different platforms.

Replication of classic population genetics experiments using Artificial Life

Supervisor: Cedric Gondro

Artificial Life concerns mimicking the processes of life in silico. In this project we will use Artificial Life agents to generate population data to replicate classical population genetics experiments that were conducted in *Drosophila*.

CSIRO

Identification of immunogenic parasitic antigens from sheep challenged with gut parasites by screening a large phage display library

Supervisor: Cedric Gondro and Nick Andronicos

This is a biotechnology-based project. Hypothesis: Anti-parasite antibodies generated in sheep challenged with live gastrointestinal nematodes will recognize a discrete set of peptide antigens which are expressed in a large phage display library. The aim of this project is to define the peptide antigens that sheep generate antibodies against during a protective immune response by screening a phage display peptide library. Plasma antibodies from sheep which have been challenged with gut parasites will be used to screen a phage display peptide library to determine the peptide antigens. The sequences of the peptides will be blasted against worm libraries to determine the identity of the peptides and if any of the

peptides resemble helminth proteins. These candidates will form the basis of novel vaccine candidates against gastrointestinal parasites. Techniques: Phage display technology, cloning, sequencing, ELISA and bioinformatics.

AGBU

A \$5000 scholarship is available for these projects.

Analysis of fibre diameter profile traits in Merino sheep

Supervisor: Daniel Brown

The fibre diameter profile describes the changes in fibre diameter throughout the year for each sheep. This project will use data from a large Sheep CRC database which contains fibre diameter profiles from several ram breeding flocks across Australia. The project would involve calculating traits to describe the shape of the fibre diameter profile and then conducting genetic analysis of these traits to estimate their heritabilities and correlations with other traits.

Relationship between heifer calving rate and BREEDPLAN EBVs for Days to Calving

Supervisor: David Johnston and Hans Graser

Beef cattle breeders regularly record the start of a mating season and the birth dates of the resulting calves. BREEDPLAN, Australia's genetic evaluation system for beef cattle, uses this data to calculate an EBV for Days to Calving (DC). Our hypothesis is that this EBV is an excellent selection criteria to genetically increase the calving rate of heifers and cows. In addition, the daughters of sires with low EBVs for DC will have a more condensed calving season, which provides for a more even line of progeny. This project will test this hypothesis on field data from a number of breeds. Required: affinity to computer work.

Do EBVs predict performance differences of next generation calves?

Supervisor: Wayne Upton and David Johnston

BREEDPLAN EBVs are calculated for 16 different traits from performance data on quite a large number of additional traits. Precise genetic correlations are quite important to accurately calculate those EBVs, which have little or no data directly recorded, eg. carcase information for 300 kg steers. This project will investigate how well current BREEDPLAN EBVs for growth, carcase and fertility predict performance differences of future generations from data of a number of breeds.

I&I NSW

All candidates are encouraged to apply for the Beef CRC scholarship:
<http://www.beef.crc.org.au/default.asp?page=/education/scholarships>

Gene expression study of white blood cell in cattle selection lines with low and high feed efficiency

Supervisor: Yizhou Chen and Cedric Gondro

Feed efficiency is an economically important trait in beef cattle and it is affected by several physiological systems such as basal metabolic rate, generation of ATP, regulation of growth and development and homeostatic control of body mass. Previous studies of global gene expression of liver tissue with bovine long oligo microarray have identified number of differentially expressed genes between animals with high and low net feed intake. Cluster analysis of differential expressed genes provides evidence of the potential use of gene expression profiles as predictor of net feed efficiency phenotype. As the complicated procedure of taking liver biopsy limited the practical use of such technology in beef industry, the proposed project will study the global gene expression profiles of white blood cells (WBC) with bovine long oligo microarray to identify set of differentially expressed genes in WBCs between cattle selection lines with high and low net feed intake.

Real-time quantitative RT-PCR analysis of genes differentially expressed in cattle with high and low net feed intake

Supervisor: Yizhou Chen and Cedric Gondro

DNA microarray analysis in cattle selection lines with high and low net feed intake has revealed more than hundred differentially expressed genes. However, extraction and understanding the underlying biological processes involved in net feed intake remains a significant challenge. By gene network and pathway analysis, we have identified several networks and canonical pathways linked to up and down-regulated differentially expressed genes. The objective of the project is to quantify gene expression of selected candidate genes from gene networks and pathways involved in net feed intake and to elucidate the biology of net feed efficiency.

Anti-oxidation and feed efficiency in cattle

Supervisor: Yizhou Chen and Robert Herd

While molecular oxygen is essential for a wide array of organisms, O₂ and reactive oxygen species (ROS) can be toxic. Increased production of ROS and/or a decrease in the anti-oxidative capacity of cells causes oxidative stress which can compromise essential cellular functions. Gene expression studies of liver and mitochondria proteomic work in liver tissue have identified a couple genes/proteins differentially expressed in cattle with high and low net feed intake. The objective of the project is to measure the total antioxidant power (TAP) and key anti-oxidants in the serum from cattle selection lines with high and low net feed intake and to determine the association between anti-oxidation capacity and net feed intake in cattle.

Agronomy Projects

Supervisor: Dr. Chris Guppy

Phone: 02 6773 3567; email: cguppy@une.edu.au

Students with an interest in soil fertility, crop nutrition, plant nutrition, horticulture, or farming systems resource use efficiency or nutrient cycling can see me for ideas on topics. A few are listed below and I am also happy to co-supervise students on Scholarships. Some of the projects listed below may be able to attract a Scholarship also.

Possible research topics

Hyperspectral imagery to distinguish sulfur from nitrogen deficiency

Sulfur nutrition in pastures

Phosphorus and silicon interactions in highly weathered soils

Nutrient bioassay screening and assessment

Enhanced zinc uptake by grain in the presence of sulfur fertiliser

Cattle compaction effects on grain yield

Water use efficiency effects of cover cropping as affected by N application

Supervisor: Dr Paul Kristiansen

Phone: 02 6773 2962; email: paul.kristiansen@une.edu.au

Students with an interest in exploring new crop development (e.g. viticulture, olives, medicinal plants), complementary farming systems (e.g. organics, farm forestry), and agricultural impacts on the environment are encouraged to contact me. I am also working on projects associated with invasive weeds, soil fertility management and monitoring, environmental management systems and energy use in agriculture.

In addition to the project listed below, I'm happy to develop projects in areas of interest to students.

Possible research topics

Evaluation of non-chemical weed control methods (bioherbicides x weeds species x growth stages)

Inventory of weeds in organic broadacre farming

Interaction of tillage and soil amendments: effect on soil physical characteristics

Effect of soil management history on phosphorus cycling

Factors affecting growth of pine plantations in the New England

Allelopathic effects of soils in pine plantations

Modelling temperature changes in cold climate vineyards

Desktop study of energy flows in different farming systems

Clonal propagation of native medicinal plants

Supervisor: Craig Birchall and Dr Darryl Savage

Phone: 02 6773 2721; email: craig.birchall@une.edu.au

Forage brassicas

Description: There has been little recent work done on the use of forage brassicas on the Northern Tablelands. The project will be an evaluation of different varieties, looking at forage production and livestock production while grazing the forage. The brassicas will be a range of the recently released varieties from many of the seed companies in Australia and NZ, and will be run in conjunction with Auswest Seeds, a company responsible for the distribution of most of the pasture seed in eastern Australia. The project will give you a chance to develop expertise in forage crop agronomy, livestock nutrition and utilisation of forages, and to develop networks with seed companies.

Supervisor: Chris Guppy and Dr Darryl Savage

Phone: 02 6773 3567; email: cguppy@une.edu.au

Nitrogen cycling through grazing systems

Description: There has been recent work done on the efficiency of transfer of nitrogen through grazing animals into soil in the form of either urine or manure and then into subsequent forage species. This project will use ¹⁵N to trace the fate of N and the efficiency of its cycling through an animal soil plant system typical of low input production systems of south-east Asia. The project will give you a chance to develop expertise in forage crop agronomy, livestock nutrition and utilisation of forages, and soil N processes critical to feeding an expanding world population.

Supervisor: Chris Guppy and David Backhouse

Phone: 02 6773 3567; email: cguppy@une.edu.au

Link between flower colour and disease resistance/ organic matter breakdown in peas

Description: Research has identified that there is a link between flower colour and disease resistance in peas; those with white flowers succumb to diseases more readily than those with coloured flowers. This project will examine that link, related to anthocyanin production and tannin pathways, and assess both resistance to disease and breakdown rate of pea residues. The project will give you an opportunity to examine plant genetics, biochemistry and nutrient cycling and disease resistance using heirloom pea varieties.

Supervisor: Chris Guppy and Peter Gregg

Phone: 02 6773 3567; email: cguppy@une.edu.au

Identifying feed source using 15N isotope and GCMS

Description: An interesting problem has arisen seeking to identify whether heliothis are eating the leaves of cotton or pigeonpea plants. This project will use depleted ¹⁵N to spray onto cotton plants and analyse the insects after feeding to identify if they have consumed these cotton leaves. A cotton CRC scholarship may be applied for, for this project (\$6000)

Supervisor: Associate Professor Brian Sindel
Phone: 02 6773 3747; email: bsindel@une.edu.au

Honours scholarships may be available

Competitive impact of fireweed on pasture production

Description: There is great debate amongst the farming community and researchers as to what impact fireweed has on pasture productivity in coastal pastures. But the few studies aimed at investigating this, were either not fully representative, or came up against the effects of drought. This project would involve a field study of fireweed either at Dorrigo or near Coffs Harbour comparing pasture productivity with and without fireweed, as well as livestock consumption of fireweed.

Herbicide resistance in fireweed?

Description: Most herbicide resistance has been shown to occur in cropping weeds but some pasture weeds that are sprayed often have also been found to possess resistance to certain herbicides. This project would involve growing fireweed in the glasshouse from different populations with a long history of herbicide use and testing their resistance to several herbicides. This information will be important for future management.

Fireweed seed longevity in the soil

Description: It is not clear how long fireweed seed survives in the soil. This is important information needed in the management of fireweed. This project would involve burial of fireweed seed in special seed bags at different depths and then exhumation and testing of viability of those seeds over a period of time to follow seed longevity.

Seed population dynamics of cropping weeds in northern NSW.

Description: The Director of the Tamworth Centre for Crop Improvement (NSW Agriculture) has approached UNE to identify students who may be interested in doing a project in collaboration with them. One possibility is to investigate the seed population dynamics of weeds such as *Fallopia convolvulus* (black bindweed) and *Rapistrum rugosum* (turnip weed) in broadleaved crops such as chickpea and canola, as a basis for designing weed management strategies. Other projects could also be suggested.

Emergence patterns of annual pasture weeds on the Tablelands of NSW.

Description: This project looks at the emergence patterns of a range of annual pasture weeds of agricultural importance on the Tablelands of NSW, e.g. *Vulpia*, thistles, Paterson's curse, Bathurst burr, St John's wort and horehound, as a basis for designing grazing strategies which promote strong pasture growth and competition at peak emergence times and so suppress weed growth and reduce the size of weed infestations.

*The effects of frost and other environmental factors on the germination, growth and reproduction of fireweed (*Senecio madagascariensis*) on the Tablelands of NSW.*

Description: Previous research suggested that this weed of coastal pastures in south-eastern Australia would not spread to cooler Tablelands areas where there was a high incidence of frost. However, there are reports of its recent spread to these areas. This project will investigate the success of fireweed in the Tablelands environment (as measured by emergence, growth and reproduction) when grown at different times of the year to help indicate if these previous indications are correct. The effects of frost will be particularly studied.

The advantages and disadvantages of chipping versus chemical control of weeds.

Description: Hand-chipping of weeds is still widely practised in the pastoral industry in high rainfall environments and in the cotton industry where it is thought to help prevent the development of herbicide resistance in weed populations. However, some growers have opted for chemical spot spraying over manual methods. This project could either be carried out in a pasture trial at UNE or in a cotton cropping system at Narrabri and would compare the benefits and deleterious effects of hand-chipping of weeds with those of chemical spot spraying and combined with reseeding.

The effect of night cultivation and sowing on weed competition on cereals and grain legumes.

Description: Several recent honours projects have shown that cultivation and sowing of field crops at night in the dark can delay weed emergence and reduce weed competition. This project aims to extend that work to a poorly competitive legume crop such as chickpeas in comparison with a highly competitive cereal crop such as triticale.

Survey of nodding thistle in the New England region.

Description: 30 years ago Dick Medd surveyed the distribution of nodding thistle (*Carduus nutans*) on the New England Tablelands as part of his PhD. In this project we wish to find out where the weed has spread to and how successful has control and suppression of nodding thistle been.

Supervisor: Dr. Susan Wilson

Phone: 02 6773 2789; email: swilso24@une.edu.au

Soils in many areas of Australia are affected by contamination to some degree manifesting in lost productivity or causing real hazards to human health and the environment. Understanding the fate and behaviour of contaminants in the soil environment is important for recognizing and assessing adverse effects and also for deciding on appropriate, effective management and remediation, including rehabilitation of mine areas. Research into soil clean up options is also important which will be helped by funding from the CRC in Contamination Assessment and Remediation of the Environment. If a student has a particular interest within this area we can discuss specific project ideas. Alternatively, a number of possible project ideas are described below. We will be applying for scholarships from industry and CRC.

Investigation of contaminants associated with biochar application to soils.

Description: Within the current interest in reducing impact on climate change, biochar is currently seen as a potential benefit for soils in terms of carbon additions. However, no one has yet considered the potential of biochar to add contaminants to the soils system and whether those contaminants would present a risk to the system. This project would aim to investigate the contaminant load of different biochars and assess the bioavailability of those contaminants.

Investigation of human exposure to As, Cr and Cu from vegetable gardens lined with treated timber.

Description: Many vegetable gardens in Australia are lined with timber treated with copper, chromarsenate and/or creosote as preservatives. Use of treated timber for decks and play areas where there is significant human contact has recently been discouraged. However, there is insufficient information to produce definitive guidelines for timber use in vegetable gardens. This project would aim to investigate both contaminant mobility and plant uptake and also potential exposure for humans growing and consuming vegetables grown in a treated timber lined vegetable garden.

The bioavailability of pesticides in NSW soils

Description: Pesticide use has been widespread in NSW. Many of the persistent pesticides such as DDT still remain in the soils and due to the unique nature and extent of degradation of many Australian soils may be relatively more bioavailable than expected. This project aims to investigate the bioavailability of a number of persistent pesticides in NSW soils.

Biological remediation of soil contaminated with petroleum hydrocarbons and PAHs.

Description: Biological remediation of petroleum contaminated soil is a well recognized clean up option. There are a number of projects in this area. The feasibility and optimum treatment conditions for treating specific contaminated soils in the Armidale area would be investigated.

Bioavailability and risk associated with contaminants in soils from mine site activities.

Description: There are a number of projects in this area. These include investigating uptake of mine derived metals into vegetable crops for the purposes of risk assessment, effectiveness of soil rehabilitation using plants and investigating mobility and bioavailability.

Primary Industries Innovation Centre

A \$5000 scholarship is available for these listed projects

Supervisor: Professor Bob Martin
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Barriers to adoption of conservation farming practices

Description: Conservation farming practices developed for adaptation to a variable climate can also provide capacity for adaptation to climate change. However, no-tillage and conservation practices have only been adopted by 50% of farmers in north-western NSW. It is suggested that shifting the focus from male-oriented extension strategies to the farm business management team might be more effective in facilitating change. This project aims to (a) determine the effectiveness of current extension strategies to influence non-adopters and (b) identify alternative strategies to facilitate change. The project will involve a survey of farm business management teams from 2 study groups (adopters and non-adopters) in at least 2 North West NSW locations. The project will identify extension and training needs from a farm business perspective.

Supervisor: Professor Heiko Daniel
Phone: 02 6773 2080; email hdaniel@une.edu.au

Assessing three types of bio-char for amelioration of degraded soils

Description: Bio-char is a highly biologically resistant form of carbon resulting from carbonization or pyrolysis of plant or animal material in the absence of air at a temperature above 300°C. Bio-char can provide long term storage of a significant proportion (eg 25-40%) of biomass carbon that would otherwise cycle back to the atmosphere over time scales of decades and therefore could be accountable with respect to carbon trading. The properties of bio-chars vary with the type of organic material from which they are made (eg wood, green waste, manures, crop residues. Research to date has found that bio-chars can improve the productivity of crops in low fertility soils through four main mechanisms, they can: modify soil pH; enhance soil microbial activity; increase the retention of nutrients; and increase water holding capacity. The aim of this study is to determine the effect on two soil types of three types of bio-char (chicken manure, chicken litter and wood).

Supervisor: Dr Mike Sissons
Phone: 02 67631119; email mike.sissons@industry.dpi.nsw.gov.au

*Interplay of protein and starch in the establishment of durum wheat (*Triticum durum* desf.) pasta quality*

Description: The way the interplay between starch and gluten in the pasta controls pasta texture and cooking properties is poorly understood. A lot of emphasis is on the raw material but little work has looked at the processing and cooking and how this can determine the pasta texture. An "assay" for this could prove to be the definitive predictive test for pasta quality and is urgently needed.

Phase 1

Prepare semolina samples with potentially different starch-gluten matrix and make pasta by extrusion (fixed extrusion speed, temperature, die diameter, mixing conditions) but use different pasta drying regimes (LT, early HT, late HT) to alter the S-G matrix

Samples

- Good quality durum semolina (Bellaroi)
- Weak durum semolina (Bellaroi)
- Soft wheat semolina
- Non-gluten starch composite
- bran-semolina mixture-to interfere with a S-G formation
- CMC or HPMC -semolina to provide a mucilagenous layer over the S-G matrix
- *-Disrupt the S-S bonds in dough with additives (to weaken, strengthen, block)
- A selection of commercial pasta samples of similar diameter with varying quality

data [i have a range of samples for which there is a lot of data-quality, RVA, SE-HPLC which could be useful]

Analysis

examine semolina mixtures and uncooked pasta for swelling power, SDSEP, RVA, DSC, protein, microscopy to assess the starch gluten matrix (S-G matrix). What is the impact of these treatments relative to the Bellaroi control?

Phase 2

Cook pasta for different times-undercooked (one third of OCT, 2/3 of OCT), at OCT, overcooked (OCT+5min, OCT+10min) to look at the changes in the S-G matrix during cooking.

Measure -texture, cooking loss, water absorption, swelling power, SDSEP, RVA, DSC, protein, microscopy to assess the S-G matrix

Phase 3

Assess the starch hydrolysis rates in vitro reducing sugar release to see if the difference in the S-G matrix are related to predictive glycaemic index

Pasta brownness-an assessment and development of a rapid test

Pasta colour is an essential factor in assessing pasta quality made from durum wheat. It results from a desirable yellow component, an undesirable brown component and under some drying conditions, a red component. Pasta brownness is defined as 100-L (brightness) and is the result of an inherent brownness of the endosperm, the degree of bran contamination of the semolina and of Malliard reactions when pasta is dried at high temperatures. It is the first factor thought to be the most important with control over the other factors being possible. Inherent brownness is thought to be due to a water soluble copper protein and /or action of oxidizing enzymes produced during grain maturation. This project will investigate (i) relationship between semolina brownness and water soluble protein content in different genotypes grown at different locations (samples provided) to determine the best test (ii) to follow the production of polyphenol oxidase (PPO) and the water soluble protein content during grain maturation (samples provided) to determine any relationship (iii) determine if there is any genetic variation in PPO activity in three sections of the grain (aleurone, bran layer, endosperm) as potential selection tool for breeder's to

produce a durum wheat with a lower PPO content in the bran as a means of lowering inherent browning. Technical assistance and samples will be provided to assist the student.

Supervisor: Carol Harris

Phone: 02 6730 1937; **email** carol.harris@industry.nsw.gov.au

Assessing summer dormancy of fescue

Description: New varieties of fescue vary in their response to summer rainfall and capacity to recover and store carbohydrates for reshooting. This project would work with existing genetic material and rain-out shelters to assess summer dormancy in field plots at the Glen Innes Research Station, and potentially with plant-out sites throughout the north west of NSW.

Supervisor: Dr Heather Nonhebel

Phone: 02 6773 2083, email: hnonheb2@une.edu.au

My research interests are in the area of plant molecular biology and functional genomics. Specifically I am interested in using genome sequence information to identify genes which may impact on the yield of cereal crops. Projects will introduce you to a variety of techniques in bioinformatic analysis, and molecular biology.

Genes affecting grain fill in rice

Rice is arguably the **world's number one food crop** and is the staple food of more than half the world's population. As a result of its relatively small genome as well as its importance as a food crop, the full genome sequence of rice has been completed. Work is now underway to study gene function with a view to using this information to improve yield in rice as well as other cereal crops.

My lab is studying the role of putative genes/enzymes for the synthesis of plant hormones auxin and abscisic acid in maximizing grain fill. Several genes have been identified as likely candidates.

Work in progress includes:

- Expressing rice genes in *E. coli* and characterizing the function of the gene product.
- Analysis of hormone precursors in developing rice seeds and observing correlations with grain size.
- Phenotypic characterisation of over-expression or knock-out mutants obtained either from seed banks and/or construction of hairpin gene silencing constructs and transformation of rice.

Identification of plant hormone synthesis genes in soil bacteria

This work will be carried out in collaboration with Dr Lily Pereg-Gerk and Assoc Prof. Ashari Bano in Islamabad, Pakistan. Assoc Prof. Bano has identified a number of strains of bacteria from arid and/or saline soils in Pakistan which appear to protect crop plants from salt/water stress by synthesizing the plant hormone abscisic acid. She is interested in further characterisation of the mechanism of protection, and the role of ABA with a view to using these bacteria as biofertilisers. She has asked for our assistance in this work. Biofertilisers are a major growth industry in several Asian and South American countries but have had little impact in Australia. For their effective use in any situation, more information is required on the scientific basis of their action.

Using bioinformatic analysis of draft *Azospirillum* and completed *Bradyrhizobium* genomes, I have identified likely abscisic acid synthesis genes. The aim of this project is to isolate and characterise genes for ABA synthesis in laboratory and/or field-isolated strains of *Azospirillum* and/or *Bradyrhizobium*. Work may also be carried out to further investigate uptake of bacterial ABA into the plant and its effect on growth/transpiration rate/ survival in saline soils.

Scholarships



Each scholarship will be for \$5000, \$2500 for the student and \$2500 to the University appointing the supervisor supporting the student, to subsidise costs connected to the student and the student's project.

Applications should be forwarded to the Secretary of Trustees, nominating (if possible) the applicant, (if possible) the supervisor, and a description of the project to be undertaken by the student.

In awarding the scholarships the sub-committee will consider the following questions.

- Is the project clearly linked to the sheep, wool and/or wool textile industry?
- Does the project provide the student with an opportunity to directly interact with an industry segment?
- Will the student be undertaking one or more of the units on offer by UNE as part of their Honours year?
- Will the project assist in preparing the student to participate in the industry if they so choose?

Please note that these are general questions and not specific criteria that must all be met by each applicant. However, a positive response to any one of these will add weight to the application. I suggest that you consider them in preparing the description of the project.

Secretary of Trustees – Peter Sommerville
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