



2016 CSC - CSIRO: Project Opportunity in Agriculture

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Understanding the heat stress response in animals

CSIRO supervisor full name:	Drs Yutao Li, Tony Reverter, Gene Wijffels
CSIRO supervisor contact details:	Dr Yutao Li yutao.li@csiro.au , 07 3214 2392, LI042
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Understanding the heat stress response in animals - development of an integrated system approach for the analyses of temporal and diverse datasets.
Research area:	Statistics and Computational Biology
Project opportunity:	The physiological and inflammatory responses to heat stress in mammals is complex and not well understood in any species. Large datasets have been collected from repeated measurements of large number of environmental, physiological, blood biology and chemistry, and inflammatory parameters in beef cattle over several winter and summer seasons. The goals of the PhD project are to develop and apply advanced statistical models to unblock the underlining mechanisms involving heat stress response and recovering processes. Specifically, the aim is to develop parametric and non-parametric multivariate nonlinear approaches to model and describe the heat stress response in the entire population or subpopulations, and develop predictive models that will identify vulnerable individuals.
Skill required from student:	<ul style="list-style-type: none"> • Biostatistics or applied mathematics • Experience with R program or Unix language • Preference for biologically oriented research
Developmental outcomes for student:	<ul style="list-style-type: none"> • First author papers in high-quality international journals. • Attendance to graduate-levels courses in biostatistics and computational biology. • Experience and knowledge in working at a multi-disciplinary and multicultural environment. • Confidence in oral science presentations in English
Any additional comments:	<p>The heat stress project is a large, well-funded, 5 year project and offers some stability.</p> <p>All supervisors have had good experience with CSC students from number of universities including Shanghai East Normal University, Nanjing Agriculture University, Xiamen University and Donghua University. All students have published first author papers with us and have been a delight to mentor.</p> <p>Feel free to obtain more information about us at https://www.researchgate.net/profile/Yutao_Li and ResearcherID H-2834-2013</p> <p>http://www.csiro.au/Organisation-Structure/Divisions/Animal-Food-and-Health-Sciences/Our-People/GeneWijffels.aspx and ResearcherID H-7938-2013</p> <p>http://www.csiro.au/Organisation-Structure/Divisions/Animal-Food-and-Health-Sciences/Our-People/ToniReverter-Gomez</p>

Manipulation of Rumen

CSIRO supervisor full name:	Chris McSweeney
CSIRO supervisor contact details:	chris.mcsweeney@csiro.au 07 32142665
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Manipulation of Rumen
Research area:	Manipulation of Rumen Ecosystems to Maximise Energy Yield in Response to Methane Inhibition of Cattle Fed Tropical Diets
Project opportunity:	<p>Methane is the main greenhouse gas emitted from ruminant livestock and represents greater than 70% of the agriculture sector's emissions and one of the major emissions for environmental pollution. Livestock populations worldwide are the major contributors to anthropogenic methane emissions with ruminant populations being responsible for 82% of the total emissions from all domesticated livestock species. Therefore it is necessary to inhibit the methanogenic organisms to reduce methane production. This would potentially improve productivity by nearly 10% for the same energetic intake by the animal. Management of hydrogen in the rumen is an important factor to be considered when developing strategies to control ruminant methane.</p> <p>Objectives</p> <ol style="list-style-type: none"> 1. Determine the microorganisms and pathways involved in H₂ utilisation during reduced methanogenesis in cattle 2. Study the effects of H₂ accumulation in the rumen on digestion 3. Evaluate the effects of dietary supplements on reductive acetogenesis
Skill required from student:	Ruminant nutrition Rumen microbiology Molecular biology and molecular microbial ecology
Developmental outcomes for student:	Genomic studies of complex microbial communities are a rapidly developing field with application in many areas including human biomedical, agricultural and waste treatment. Training in (meta)genomics will place the candidate at the cutting-edge of techniques in molecular microbial ecology and gene discovery. In addition the scholar will develop proficiency in anaerobic culturing and physiological characterisation of rumen bacteria. The expertise gained on methane inhibition by feeding unconventional feedstuffs will facilitate new efficient feeding approaches for ruminants in China.
Any additional comments:	I have established collaboration with several universities in China and have hosted several previous CSC scholars.

Plant lipid metabolism

CSIRO supervisor full name:	Xue-Rong Zhou
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PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	<ol style="list-style-type: none"> 1. Biochemically characterization of fatty acid desaturase substrate type 2. Comparative mechanism of DHA accumulation in oil seeds 3. Transgenic production of higher value unusual fatty acids in linseed
Research area:	Plant lipid metabolism
Project opportunity:	<p>Expected outcome:</p> <ul style="list-style-type: none"> • Better understanding of fatty acid desaturase activities and their substrate type • Application of the techniques to the selected fatty acid desaturases for insight of fatty acid metabolism • Understanding the mechanisms of novel fatty acid accumulation in different oil seeds • Providing the guideline for plant lipid engineering • Production of novel industrial oil in oil crops • Potential new IP position • Scientific publications
Skill required from student:	Basic molecular biology skill and protein experience will be beneficial for the projects
Developmental outcomes for student:	<p>The visitor will</p> <ul style="list-style-type: none"> • Obtain skills on biochemical analysis of lipid metabolism • Expand experience from range of techniques including molecular biology, biochemistry, protein expression, fatty acid analysis, lipidomics • Publish papers jointly
Any additional comments:	Other lipid metabolism related projects are also available

Investigation of sulfonylurea herbicide tolerance in soybeans

CSIRO supervisor full name:	Dr. Andrew James; Dr. Aijun Yang
CSIRO supervisor contact details:	andrew.james@csiro.au ; aijun.yang@csiro.au +617 3214 2278; +617 3214 2616 JAM139; YAN009
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Investigation of sulfonylurea herbicide tolerance in soybeans
Research area:	Biochemical and molecular studies of the mechanism and mode of action of sulfonylurea (SU) herbicide tolerance in soybeans
Project opportunity:	<ul style="list-style-type: none"> • Investigate SU target site sensitivity, specifically the expression and activity of the key enzyme (acetolactate synthase) in SU tolerant and susceptible soybeans; • Study the metabolism and detoxification mechanism of SU in contrasting soybean genotypes; • Apply the knowledge and results acquired during the training for selecting herbicide-tolerance in soybeans; • Actively participate in relevant research seminars, workshops and trainings; and • Publish research findings in SCI journals.
Skill required from student:	Reasonably competent in basic techniques and knowledge with plants, biochemistry and molecular biology
Developmental outcomes for student:	<ul style="list-style-type: none"> • Have access to a wide range of research facilities and be able to work alongside CSIRO scientists while enjoying generous personal development and learning opportunities. • Acquire and apply molecular and biochemical knowledge and methodology with an aim to understand the selection basis for herbicide tolerance in soybeans.
Any additional comments:	The student/visitor will have the opportunity to get to know the Australian soybean industry and to apply the knowledge and results acquired during the training for herbicide-tolerance selection in soybeans.

Heat tolerance in soybeans

CSIRO supervisor full name:	Dr. Andrew James; Dr. Aijun Yang
CSIRO supervisor contact details:	andrew.james@csiro.au ; aijun.yang@csiro.au +617 3214 2278; +617 3214 2616 JAM139; YAN009
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Heat tolerance in soybeans
Research area:	Molecular and physiological investigation of heat tolerance in contrasting soybean genotypes and comparison with Australian perennials
Project opportunity:	<ul style="list-style-type: none"> • Investigate heat-induced changes in the expression of key genes, transcription factors and/or proteins in contrasting soybeans genotypes; • Study the differential expression between heat- and drought-induced changes in key genes, transcription factors and proteins in these soybeans genotypes; • Compare these changes with those in Australian perennials grown under similar conditions; • Provide knowledge and applicable experimental data for selecting heat-tolerant soybeans; • Actively participate in relevant research seminars, workshops and trainings; and • Publish research findings in SCI journals.
Skill required from student:	Reasonably competent in basic techniques and knowledge with plants and molecular biology
Developmental outcomes for student:	<ul style="list-style-type: none"> • Have access to a wide range of research facilities and be able to work alongside CSIRO scientists while enjoying generous personal development and learning opportunities. • Acquire and apply molecular and physiological knowledge and methodology with an aim to understand the basis of heat tolerance in soybeans.
Any additional comments:	The student/visitor will have the opportunity to get to know the Australian soybean industry and to apply the knowledge and results acquired during the training for heat-tolerance selection in soybeans.

Improving nutritional and functional properties of soybeans

CSIRO supervisor full name:	Dr. Andrew James; Dr. Aijun Yang
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PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Improving nutritional and functional properties of soybeans
Research area:	Investigation of the effect of content and composition of seed proteins and oils on nutritional and functional properties of soybeans
Project opportunity:	<ul style="list-style-type: none"> • Compare soybeans of different protein content, solubility and subunit composition and how these factors affect the properties and functionality of soy foods; • Investigate and utilise currently available soybean resources to improve the nutritional profile of soybean oil which may contain a higher level of omega-3 fatty acids and/or a lower ratio of omega-6 to omega-3 fatty acids ; • Provide knowledge and applicable experimental data for selecting soybeans with proved nutritional and functional properties; • Actively participate in relevant research seminars, workshops and trainings; and • Publish research findings in SCI journals.
Skill required from student:	Reasonably competent in basic techniques and knowledge in the area of protein and analytical chemistry
Developmental outcomes for student:	<ul style="list-style-type: none"> • Have access to a wide range of research facilities and be able to work alongside CSIRO scientists while enjoying generous personal development and learning opportunities. • Acquire and apply knowledge and methodology relevant to protein and lipid analyses and functional properties which are important for soybean utilisation.
Any additional comments:	The student/visitor will have the opportunity to get to know the Australian soybean industry and to apply the knowledge and methods acquired during the training for improving traits in soybeans.

Identifying genes conferring Fusarium resistance in wheat

CSIRO supervisor full name:	Chunji Liu
CSIRO supervisor contact details:	Email: Chunji.liu@csiro.au phone: 0732142223
PhD or Scholar Program:	Looking for both PhDs (24 months)
Project title:	Identifying genes conferring Fusarium resistance in wheat
Research area:	Wheat genetics and genomics
Project opportunity:	Fusarium pathogens cause two serious diseases in cereals, Fusarium head blight (FHB) and crown rot (FCR). To enhance the capacity of breeding highly resistant wheat varieties, we have identified several QTL, develop near isogenic lines & a NIL-derived population for a QTL on 3BL, generated a mutagenesis population from a resistant isoline, obtained transcriptome data from several NIL sets, and defined the 3BL locus with an interval of about 0.7 cM or 1.5 Mb. By exploiting these resources, the CSC student will work on the identification and characterization of genes underlying the 3BL locus conferring FCR resistance.
Skill required from student:	Basic understanding of cereal genetics; familiar with linkage analysis; and familiar with techniques required in plant DNA and RNA isolation and cloning.
Developmental outcomes for student:	<ul style="list-style-type: none"> a) Solid understanding of cereal genetics/genomics; b) Advanced skills and theoretical knowledge in fine mapping and gene cloning; c) Advanced skills in bioinformatics in analysing and exploiting large data sets; d) Knowledge and skills needed for marker-assisted breeding; e) 2-3 high quality publications.

Uncertainties in simulating crop and soil processes

CSIRO supervisor full name:	Dr Enli Wang
CSIRO supervisor contact details:	Enli.Wang@csiro.au (WAN076) Tel: +61-2-62465964 GPO Box 1666 Black Mountain, Canberra, ACT 2601, Australia
PhD or Scholar Program:	Looking for both PhDs and scholars
Research area:	Uncertainties in simulating crop and soil processes
Project opportunity:	Predictions from process-based soil-plant systems models are subject to great uncertainty, due to imperfect knowledge, model structure, errors input data and inappropriate parameterisation. In spite of the wide application of models to investigate impact of climate and management changes on productivity and environmental performances of agro-ecosystems, the prediction uncertainties have not been properly addressed. This project aims to better quantify these uncertainties using the farming systems model APSIM combined with a data assimilation approach, which use observational data to infer model parameters and initial conditions, thereby constraining APSIM to reduce the uncertainty in simulations of both crop and soil processes.
Skill required from student/scholar:	<ul style="list-style-type: none"> • University/PhD degree in Agricultural/Environmental Sciences; • Sound knowledge in crop/soil response to climate change; • Experience in agricultural systems modelling; • Skills in statistical analysis and computer programming; • Ability to communicate in English.
Developmental outcomes for student:	<ul style="list-style-type: none"> • Improved understanding of crop productivity as affected by climate, soil properties and management systems; • Improved knowledge for development of best management practices in agricultural production; • 1~2 research papers published in international journals.
Any additional comments:	The candidate will based in Canberra, and will liaise with other CSIRO scientists who are working on agricultural systems modelling, to ensure that the research is connected to a wider community of practice, in particular across the CSIRO Agriculture and Land and Water.

Mechanisms of lipid droplets formation in non-seed plant tissues

CSIRO supervisor full name:	Qing Liu
CSIRO supervisor contact details:	Qing.Liu@csiro.au ; +61 262464919; Liu017
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Mechanisms of lipid droplets formation in non-seed plant tissues
Research area:	Numerous modern microscopy methodologies will be applied in combination with plant lipid biochemical analysis to explore the mechanisms of lipid accumulation in non-seed plant tissues.
Project opportunity:	Non-seed plant tissues, such as leaf and tuber, accumulating high level of storage lipids have recently been developed, which provide valuable and novel genetic materials for understanding the mechanisms of lipid formation and accumulation in both photosynthetic and non-photosynthetic tissues where oil was not normally accumulated in abundance. The designated project will study the lipid droplet formation by confocal microscopy and scanning microscopy analyses, in conjunction with the phenomic analysis, lipid biochemical analysis and identification of key genes through numerous -omics approaches and microscopic co-localization methodologies.
Skill required from student:	A good understanding of molecular genetics and biochemistry in plant metabolism is essential. Skills in cytological and immunological analysis are advantageous.
Developmental outcomes for student:	The student is expected to gain knowledge in metabolic engineering of plant lipids through transgenic approaches, and develop skills in modern molecular cytological analyses of key genes involved in plant lipid accumulation. Research publications will be anticipated as a major research output.
Any additional comments:	In our plant lipid group, we have developed the unique plant materials with ultra-high level of lipid accumulation, which has made such a study possible.

Extraction of crop phenotype information from aerial imagery

CSIRO supervisor full name:	Scott Chapman
CSIRO supervisor contact details:	Scott.Chapman@csiro.au , 07 3214 2254
PhD or Scholar Program:	Looking for both PhDs
Project title:	Extraction of crop phenotype information from aerial imagery
Research area:	Development of hardware and software processing systems to allow capture and analysis of high-throughput image information from field crop experiments in wheat, sorghum, sugarcane and cotton.
Project opportunity:	A key component of modern breeding programs is to quantify valuable traits on breeding lines using methods of high-throughput phenotyping. The Pheno-Copter aerial platform allows rapid capture of images for crop canopies <i>in situ</i> using various cameras. The main challenge is to efficiently process these images to provide useful information. In the GRDC water productivity traits project (CSP00179), vegetative growth-related traits are to be improved in the crop model. However, frequent measurement of traits requires substantial resources. The main task of this student project is to develop new processing algorithms to extract wheat phenotype information from images collected by the Pheno-Copter platform, including plant height, ground cover, nitrogen, biomass, etc. The extracted traits will be used to develop wheat model.
Skill required from student:	<ul style="list-style-type: none"> • Understanding of crop physiology, agronomy, biology, environment science. • Experience in R program language and high performance computers. • Familiar with the visualization tools to browse and processing of large datasets.
Developmental outcomes for student:	<ol style="list-style-type: none"> 1. Develop tools/knowledge to analyse large datasets from high throughput phenotyping, especially UAV photography. 2. Develop the skill to conduct the scientific research. 3. Achieve experience to integrate knowledge in multiple disciplines, e.g. plant physiology, agronomy and breeding. 4. Understand the workflow to delivery scientific outputs to stakeholder. 5. Publish at least two papers in high impact journals.

Metabolic phenotyping of heat stress and recovery in cattle by NMR metabolomics

CSIRO supervisor full name:	Gene Wijffels, Horst Schirra (University of Queensland)
CSIRO supervisor contact details:	Gene.Wijffels@csiro.au 617 3214 2510 WIJ007
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Metabolic phenotyping of heat stress and recovery in cattle by NMR metabolomics
Research area:	We are interested in describing the metabolic, physiological and inflammatory responses to heat stress in growing cattle to better inform farmers of how to prepare and protect their animals from the worst effects of heat stress, and to find the best path to recovery.
Project opportunity:	The objective of the project is to describe the metabolic trajectories of the recovery phase after acute heat stress in growing cattle using NMR metabolomic techniques.
Skill required from student/fellow:	This will be somewhat dependent on the nature of the project finally negotiated with the student <ul style="list-style-type: none"> • A strong interest in metabolic and physiological responses to stress • A understanding of NMR of biological materials • Some biostatistics • evidence of some experience/skills relevant to a molecular or chemistry laboratory
Developmental outcomes for student:	Within the timeframe of this project, we hope to <ul style="list-style-type: none"> • Detect differences in the metabolic fingerprints of stressed and unstressed but pair-fed animals (controls). • Identify low molecular weight metabolites that could serve as biomarkers for future diagnostics • Understand the role of these biomarkers in the context of the whole animal metabolism • Preparation toward a publication
Any additional comments:	<p>The candidate needs initiative and some independence. Along with passable English, the candidate needs good social skills as they will be working within a multi-disciplinary team and potentially using shared equipment and computers. The candidates need to be willing to ask questions when in doubt, since misuse of expensive equipment could be dangerous and costly in dollars and time.</p> <p>The candidate will access and use NMR instruments in a state-of-the art NMR facility at the University of Queensland. Furthermore, the overall cattle heat stress project is a large well-funded 5 year project and offers some stability.</p> <p>All supervisors have had good experience with CSC students from number of universities including Shanghai China East Normal University, and Northwest A&F University. All students have published first author papers with us and have been a delight to host and mentor.</p>

Role of extra-pituitary prolactin (ePRL) in heat stress

CSIRO supervisor contact details:	Gene Wijffels, Ross Tellam Gene.Wijffels@csiro.au 617 3214 2510 WIJ007
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Role of extra-pituitary prolactin (ePRL) in heat stress
Research area:	Population genetic studies in production animal species have highlighted the genes encoding the prolactin (PRL) system as being important. This information has been interpreted in terms of PRL's well-established role in lactation. However, PRL impacts multiple tissues throughout life, especially metabolically active tissues, and may be as important as the insulin system in regulating energy metabolism and modulating stress responses.
Project opportunity:	The objectives of the project are: <ul style="list-style-type: none"> a) To identify expression profiles for the prolactin system in ruminants using massive and existing RNA-Seq datasets (>40 adult & fetal tissues). Computational methods will be used to identify tissue and developmental specific expression patterns for the PRL gene and PRL-like genes expressed in heat stress challenges using gene expression assays. and/or <ul style="list-style-type: none"> b) To validate circulating ePRL as a marker of resilience in ruminants using existing tissue and plasma samples from challenge experiments. Potentially, immunoassays for the most informative ePRLs and a unique ePRL mass spectrometry assay will be developed.
Skill required from student/fellow:	This will be somewhat dependent on the nature of the project finally negotiated with the student. <ul style="list-style-type: none"> • A strong interest in gene expression and physiological responses to stress • Good understanding of gene structure and transcription • An interest and understanding of <ul style="list-style-type: none"> ○ computational biology and/or ○ assay of specific proteins (by immuno-assay and mass spectrometry) • evidence of some experience/skills relevant to a molecular laboratory
Developmental outcomes for student:	The candidate can anticipate developing skills and knowledge in: <ul style="list-style-type: none"> • Project design based on review of the literature, technical approaches and resources at hand • In depth technical knowledge of advanced bioinformatics around gene transcription and expression of gene variants in large data sets • Skills in immuno-assays and proteomics • Preparation toward publications
Any additional comments:	The candidate needs initiative and some independence. Along with passable English, the candidate needs good social skills as they will be working within a multi-disciplinary team and potentially using shared equipment and computers. The candidate needs to be willing to ask questions when in doubt, since misuse of expensive equipment could be dangerous and costly in dollars and time. The team has had extensive experience in supervising CSC PhD students and all students have published first author papers with us and have been a delight to host and mentor.

Understanding gluten digestion

CSIRO supervisor full name:	Dr Michelle Colgrave
CSIRO supervisor contact details:	Email Address: michelle.colgrave@csiro.au Phone: +61732142697 Fax: +61732142900
PhD or Scholar Program:	Looking for both PhDs and scholars
Project title:	Understanding gluten digestion
Research area:	Coeliac disease involves damage to the small intestine after ingestion of gluten, but the mechanisms of gluten digestion remain unclear.
Project opportunity:	Using a laboratory-based system that models the complex biological processes involved in food assimilation in the human gut and mass spectrometry (MS) the products of gluten digestion will be characterised. The peptide products will then be assessed for transport across the intestinal membrane. This project will provide an understanding of the mechanisms that underlie gluten intolerance, specifically the molecular mechanisms behind gluten activation, digestion and transport <i>in vitro</i> . This will be facilitated by cross-disciplinary collaboration with experts in nutrition and gut physiology. Expected outputs will involve publication and/or conference presentation.
Skill required from student:	Required: Good Laboratory Practice, Record Keeping, Sample Preparation (e.g. pipetting) Desirable: Protein Chemistry, Analytical Chemistry (HPLC), Mass Spectrometry (MS), Bioinformatics
Developmental outcomes for student:	The student should anticipate developing skills and knowledge in <ul style="list-style-type: none"> • Literature review • Project design • Gut physiology and nutrition • Discovery and targeted proteomics • Data analysis and interpretation • Bioinformatics knowledge and expertise • Report writing and possible publication
Any additional comments:	This project will involve travel to Adelaide, but will be primarily based in Brisbane.