# PhD scholarship opportunities | Grazing livestock

## In brief

Two PhD scholarships dedicated to pastoral livestock are funded though trust funds associated with the CSIRO F. D. McMaster Laboratory at the Armidale site Chiswick, the Ian McMaster scholarship, and the William McIlrath scholarship.

1. The scholarships are awarded in the form of top-up scholarships, consisting of a stipend of $12,000 per annum, plus operating funds $8,000 per annum, for research expenses, development and travel.
2. Successful candidates are expected to hold a Research Training Program (RTP) scholarship or equivalent university scholarships for additional financial support. Current applicants and current holders of RTP scholarships, or equivalent, are eligible to apply.
3. Selection of candidates will be merit-based, with consideration given to academic excellence, training and/or work experience relevant to the chosen areas of research, and alignment of research interests with the strategic research foci of the Livestock and Aquaculture research program.
4. Successful candidates will choose one of the following project opportunities offered in the Livestock and Aquaculture program, with applications to grazing livestock and/or animal husbandry (see below).

## Relevant research focus areas in Livestock and Aquaculture (2024)

|  |  |  |  |
| --- | --- | --- | --- |
| Breeding | Health Interventions | Sustainable Production Systems | Data Decisions |
| Approaches to improve the animal | Interventions directed at making animals healthier | Business agnostic production systems with triple bottom line impacts | Collecting data to turn into insights and knowledge for improving businesses |

## Offering the following postgraduate research opportunities

## Project 1

### Title

Precision genome engineering for functional validation of suspected causal variants for single gene diseases

### Primary supervisor

Dr Peter Hunt

### Brief description

All animals are likely to carry multiple -often recessive - deleterious variants that can cause disease. This can be particularly detrimental in endangered species and rare breeds and can impact profitability and animal welfare in livestock production. We have shown that the identification of variants that are likely to cause disease has become possible, even if only a small number of affected animals are available for analysis, but validation that such variants are pathogenic is essential and can be difficult. The use of PGE within tissue culture can be a powerful tool for the functional validation of likely causative variants and has the potential to correct deleterious variations in animals. The technology holds therefore great promise for increasing the viability of endangered species and rare breeds and for improved breeding practises in livestock. With supervision across two sites in CSIRO (Dr Peter Hunt and Dr James Wynne) the University of Sydney (A.Prof Imke Tammen) and NSW DPIRD Dr Brendon O’Rourke), the student will work to establish appropriate cell lines and cell function assays to analyse genetic variants identified through studying genetic diseases. Working closely with the teams in Sydney and Hobart, but based in Armidale, the student will validate causative variants for multiple genetic diseases affecting sheep, cattle and goats. The research conducted will help establish a pipeline for variant validation and correction, which will underlie future solutions for constrained animal populations and for improving agricultural productivity.

This project will allow the student to see across the impact pathway toward future outcomes. The student will have first-hand experience with sheep and cattle and will be exposed to people working in livestock industries who will benefit from the research. They will also gain a deep knowledge of PGE and cell culture techniques and will gain deeper understanding of the genomic and bioinformatic approaches which are used to identify likely causal variants in livestock.

### Selection criteria

* Bachelor degree with first or upper second-class honours, or a master's degree performed at a high academic standard, which includes a substantial component of research in science or applied science with specialisation in biology, for example biomedical, agricultural, animal or environmental science.
* Eligibility to enrol in a PhD at the University of Sydney.
* Sound knowledge of cell and molecular biology.
* Knowledge of genetics and livestock agriculture.

For more information on this project, please contact peter.hunt@csiro.au.

## Project 2

### Title

### Functional integrity in grazing livestock as a long-term indicator of health and welfare

### Primary supervisor

Dr Hannah Ford

### Brief description

In recent times, the focus of animal welfare has shifted from avoiding negatives to promoting positive welfare and from predicting welfare to identifying how individual animals experience their lives. One approach is to identify animals that are better able to cope with stressful events and can bounce back to normal functioning as quickly as possible. Research suggests that the functional integrity of animals, the degree to which their physiology and behaviour enable them to flourish, may manifest in the way tissues are laid down (Colditz et al., 2023) and could provide a historical picture of an animal’s health and welfare. E.g., major stress events or nutritional deficits may be demonstrated in incremental patterns in growth lines in the hoof of cows and sheep or in minor deviations from a growth trajectory.

With the availability of new technology that can measure surface topography using photogrammetry or 3D scanners, we propose that the application of this technology in collaboration with Data61 can provide a record of long-term welfare. Having quantifiable longitudinal data on animal experiences and resilience would not only inform better decision making on farm, but also provide traceability of health and welfare leading to more sustainable production systems and revolutionising welfare assessment and assurance.

It is anticipated that this project would commence in early 2025 and could be aligned with the “Sustainable Chiswick project” based at the CSIRO research property in Armidale NSW. Project supervisors would include Dana Campbell, Hannah Ford and Dadong Wang (Data61). Specific outcomes include: identification of with- and between-animal variation in hoof profiles, correlation of hoof profiles with other health and welfare data, longitudinal analysis of the development of deviations in hoof profiles or growth trajectories in response to stressors and identification and validation of commercially available 3D scanning technologies.

This project will allow students will develop skills in animal handling, welfare assessment, and temperament testing as well as 3D scanning and quantification of surface topography. They will also develop skills in statistical analysis and project management.

### Selection criteria

* Students with a degree in animal, veterinary or agricultural fields would be suitable. Students with a degree related to computer science, statistics or modelling may also be suitable as long as they were interested and comfortable working with large animals.
* The student must have an interest in animal welfare and sustainable livestock production systems.
* Ideally the student should also have knowledge of statistical analysis or a willingness to learn.

For more information on this project, please contact Hannah.ford@csiro.au.

## Project 3

### Title

### Greening the Grazing Fields: AI Innovations for Sustainable Cattle Farming

### Primary supervisor

Dr Aaron Ingham

### Brief description

The primary goal of this research project is to enhance the sustainability of cattle farming enterprises by using generative Artificial Intelligence (AI) to develop innovative solutions to challenges posed by climate change. This research aligns with the data-driven decisions and sustainable production systems focus areas.

Data collected from accelerometer sensors attached to cattle can be classified into behaviour profiles that represent time spent grazing, ruminating, walking, drinking or resting. The large pre-existing datasets that were collected to develop this behaviour classification ability also contains a wealth of environmental information such as the daily weather measures.

Generative AI models can be applied to this data and used to characterize cattle behavioural responses to changing weather patterns (response to high or low daily temperatures). The resulting relationships between behaviour and weather measures such as temperature can then be extended to model how grazing, intake and growth of cattle might change under the predicted extreme conditions and the potential impacts on animal health and productivity. Insights gained will inform sustainable strategies that benefit both animal welfare and environmental health. The research seeks to enhance data-driven decision-making in cattle farming.

This multidisciplinary project will be conducted under the guidance of Dr. Aaron Ingham from CSIRO Livestock & Aquaculture (Animal Science and Digital Technologies), Dr. Reza Arablouei from CSIRO's Data61 (Data Science), and Dr. Kieren McCosker from QAAFI (Animal Science and Digital technologies).

### Selection criteria

* Demonstrated eligibility for, or enrolment in a PhD level postgraduate program.
* Required skills: Coding, Statistical analysis, animal science.
* Skills the student will develop: Advanced coding, Generative AI approaches, working with multidisciplinary team.

For more information on this project, please contact aaron.ingham@csiro.au.

## Information for all applicants

Please provide in your application

* documentation of your academic record and achievements
* a statement of your chosen project, and why it is of interest to you
* a description of how your skills, training and background relevant to the chosen project
* your motivation to pursue a PhD project in a science field relevant to grazing livestock.

Selection of candidates will be merit-based with consideration given to academic excellence, training and/or work experience relevant to the chosen areas of research, and alignment of research interests with the strategic research foci of the Livestock and Aquaculture research program.

## Background information on the available scholarships

William McIlrath (1876 – 1955)

William McIlrath and his brother, Sir Martin McIlrath, were born in Ireland and arrived in Victoria in 1889 and 1890. The brothers were successful in and farmed Merino sheep and Hereford cattle. Both brothers were generous benefactors and supporters of research. In 1953, William gave £50,000 to the Commonwealth Scientific and Industrial Research Organization for animal husbandry research.

### William McIlrath Trust scholarship

The William McIlrath Trust supports animal husbandry research. The trust is held by CSIRO.

Frederick Duncan McMaster (1873 – 1954)

Sir Frederick Duncan McMaster was a pastoralist and breeder of Merino sheep and Hereford cattle, born at Surry Hills, Sydney to a Scottish-born pastoralist. McMaster was a leader in pasture management and soil conservation, and actively sought and practised the most advanced scientific knowledge available. In 1929, McMaster donated £20,000 to establish the FD McMaster Research Laboratory, and added a further gift of £50,000 in 1954 in memory of this son Ian Frederick McMaster who in 1942 had been killed in battle. The Ian McMaster Bequest supports research for pastoral livestock.

### Ian McMaster Bequest scholarship

The Ian McMaster Bequest Scholarship is part of the donation which enabled the establishment of the FD McMaster Laboratory which is located at Chiswick. The Bequest specifies the aim to support research relating to pastoral (that is grazing) livestock. The funds of the Bequest are held by the University of Sydney.