Research Showcase:
Moving beyond 'the number 8 fencing wire' approach

Using epigenetics to increase economic returns to farmers

UniServices
Auckland UniServices Limited

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

Improving farm animal productivity – be it lamb or beef growth, disease resistance or milk production – is related to the early stages of life and especially the condition of the mother.

We now know that the environment of the early developing fetus, which is principally determined by maternal condition and nutrition, has a major influence on the programming of key productivity related genes and that impacts on the life time performance of farm animals. This occurs through the process of developmental epigenetics – an area where the Liggins Institute and key collaborators such as AgResearch are world leaders.

One example of developmental epigenetics in practice: progeny from dams that are undernourished during pregnancy are likely to be born small, have reduced survival through to weaning, grow slowly and lay down fat rather than lean meat.

The process of developmental programming is thought to occur through the fetus receiving nutritional and related "cues" from its mother from which it "predicts" the environment after birth by the programming of key genes. The developmental trajectory (for example to lean or fat) is then determined by the goodness of fit between the predicted and actual post natal environment. This is the "new" biology of gene/environment interactions known as developmental plasticity and epigenetics.

The Liggins Institute at The University of Auckland and AgResearch are applying their complementary capabilities and expertise in a new collaboration in developmental epigenetics to identify opportunities for improved animal productivity. Examples include "tests" applied near birth that can predict future productive potential (e.g. lean carcass composition), epigenetics informed feed strategies and feed supplements.

Importantly conventional genetic selection procedures take no account of epigenetics which is the major source of variation in selected populations such as flocks and herds. For this reason too developmental epigenetics has major potential to impact positively on the economics of farming.

The goal is to increase economic returns to farmers through application of epigenetic technologies

We seek industry partnerships to assist with later stage development and commercial translation of the new "epigenetic informed" tools for farmers.

Liggins researchers working with the Sequenom epigenetic analysis technology platform that underpins the new test development.

By leveraging New Zealand's strengths in agricultural and developmental science, we can identify the genetic markers for animal development and health and develop the means to re-shape where those markers have been adversely affected. For example, climatic extremes can be mitigated by both maternal health and post-birth bioactive feed supplements to alter the developmental pathway of animals. Beyond on-farm quality, productivity and value, developmental epigenetics and plasticity can also be applied to the design of new animal-based foods to improve human health.

Epigenetics: the science of how genes interact with the environment and the long term consequences of this for health, disease and productivity in farm animals. "Epigenetics builds on premium stock genetics and will unlock the doorway to the next revolution in on-farm productivity."

21st century farm animal health and productivity is determined by more than just good genes.

Developmental epigenetics and plasticity research areas

- Growth, development, metabolism, nutrition, developmental biology, embryonic fetal and neonatal biology
- Using advanced scanning technologies developed for humans to determine animal phenotypes
- Prognostics to predict productive potential in livestock under prevailing environmental conditions
- Food and feed strategies to optimize farm animal productivity

Potential applications

- Increased animal productivity, newborn survival and meat composition through prognostic tools to identify animals requiring intervention and bioactive feed supplements to improve development
- New animal-based functional foods to reduce rates or minimize the impact of metabolic diseases such as obesity and diabetes in humans.
- Support for future scientists as a key strategy in underpinning the development of a knowledge economy that is vital to New Zealand's future.
- Improved economic and social returns, including the identification of New Zealand for blue-skies applied research and commercial development of mammalian developmental epigenetics.

The Liggins Institute

The Liggins Institute is a world-class multidisciplinary medical research institute focused on research for a healthy start to life and was the first large-scale research institute established by The University of Auckland. The Institute is committed to world-class biomedical and clinical research into areas of major health importance.

The National Research Centre for Growth and Development is a collaboration with AgResearch, the University of Otago and Massey University, and The University of Auckland. The Centre focuses on the biology of early periods of life and the consequences for health and disease in humans and productivity for farm animals. The Centre is internationally pre-eminent in studying epigenetics and has developed state-of-the-art technology, including the Sequenom® MassArray System that translates genomic science into solutions for biomedical research.

The Institute and AgResearch are two of the four founding partners of EpiGen, an international research consortium in the developmental epigenetics space, particularly in the areas of prognostics (predictive diagnostics) and nutritionals for both humans and farm animals.

- **www.liggins.auckland.ac.nz**
- **www.growthcentre.ac.nz**
- **www.agresearch.co.nz**

UniServices

Auckland UniServices Limited is a wholly owned company of The University of Auckland. Established in 1988, UniServices manages all the University's commercial research and consultancy partnerships, forms new business ventures based on University research, and owns and develops the University's intellectual property estate. Its mission is to apply the University's research and expertise to client needs and business opportunities, enabling organisations based on new knowledge to grow, expand the University's research capability and benefit the broader community.

contact

Mark Burgess
General Manager, Research and Consulting
UniServices

Postal address

c/o The University of Auckland
Private Bag 92019, Auckland 1142
New Zealand

Street address

Level 10, UniServices House
70 Symonds Street, Auckland
New Zealand

T +64 9 373 7522 ext 85110
E m.burgess@auckland.ac.nz
www.uniservices.co.nz

UniServices
Auckland UniServices Limited

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

August 2008