16th Biennial Conference of the Association for the Advancement of Animal Breeding and Genetics 2005

Application of New Genetic Technologies to Animal Breeding

Queensland, Australia
25-28 September 2005

TABLE OF CONTENTS

Keynote Address

Application and impact of new genetic technologies on beef cattle breeding: a “real world” perspective
John Pollak 1

Genetic Evaluation Systems

Genetic evaluation for the beef industry in Australia
H.-U. Graser, B. Tier, D.J. Johnston and S. A. Barwick 2

Practical aspects of a genetic evaluation system using parentage assigned from genetic markers
K.G. Dodds, J.A. Sise and M.L. Tate 3

Implementing genetic evaluation in the New Zealand deer industry

The alliance central progeny test (CPT): an evaluation of sheep meat genetics in New Zealand

Genetic Parameters in Merino Sheep

Genetic relationships between carcass quality and wool production traits in Australian Merino rams
J.C. Greeff, G. Cox, L. Butler, and M. Dowling 12

Merino strains with high wool production have lower lifetime reproduction rates
J.C. Greeff 16

Reliability of estimates of correlations between reproduction and production traits from a Merino resource flock
M.J. Kelly, A.A. Swan and S. Dominik 20

Genetic parameters and trends for hogget traits in Merino lines divergently selected for multiple rearing ability
S.W.P. Cloete, J.J. Olivier, J.B. van Wyk, S.J. Schoeman and G.J. Erasmus 24

Analysis of lamb survival in Australian Merinos
E. Safari, K.D. Atkins, N.M. Fogarty and A.R. Gilmour 28

Genetic parameters for ultrasound scan and wool traits at yearling and hogget age in Merino sheep
A.E. Huisman and D.J. Brown 32

xxv
Contents

Poultry CRC

Chicken functional genomics
   R.J. Moore, K. Granger, T.M. Crowley, S. Riddell, T.J. Doran 36
RNA interference as a tool for chicken functional genomics
   T. Doran, D. Schafer, T. Wise and R. Moore 40
Application of immunogenomic technologies to poultry: building a better chicken
   J.W. Lowenthal, A.G.D. Bean, T.J. Doran and R.J. Moore 44
Immunogenomics in the chicken: innate immune molecule analysis

Cattle and Sheep Growth

Estimates of covariance functions for growth of Angus cattle from random regression analyses fitting b-spline functions
   Karin Meyer 52
Reduced rank estimates of the genetic covariance matrix for live ultra-sound scan traits
   Karin Meyer 56
Variation among maternal sires for lamb and wool gross margin performance of their crossbred daughters
   N.M. Fogarty, V. Ingham, L. McLeod, G. Gaunt and L. Cummins 60
Using assortative matings to maximise sales of homozygous favourable sheep sires, a simulation study
   P.R. Amer R.G. Sherlock and M.L. Tate 64

Young Scientists 1

Dust penetration is not genetically and phenotypically the same trait as dust content: 68
   3 years of data
   M.E. Dowling, A.C. Schlink and J.C. Greeff
Breeding for body condition score in dairy cows
   J.E. Pryce, B.L. Harris and W. Montgomery 72
Sire breed differences for net feed intake in feedlot finished beef cattle
   K.L. Moore, D.J. Johnston and H.M. Burrow 76
Multi-trait selection of crocodiles using CROCPLAN
Expression of body weight, fleece weight and fibre diameter in across flock genetic evaluation
   D. J. Brown, K. Atkins and A.E. Huisman 84
Genomics: The advent of new genetic technologies

Harnessing the bovine genome sequence for the Australian cattle and sheep industries

B.P. Dalrymple

Comparative genomic analysis of non-coding sequences and the application of RNA interference tools for bovine functional genomics

A.E. Lew, L.A. Jackson and M.I. Bellgard

Pig Genetics 1

Insulin-like growth factor-I (IGF-I) measured in juvenile pigs is genetically correlated with economically important performance traits


Potential quantitative genetic indicators of pig temperament

R.E. Crump, A.C. Hansson, H.-U. Graser and R. Sokolinski

Genetic correlations between juvenile insulin-like growth factor-I (IGF-I) and measures of sow reproductive performance are low

K.L. Bunter, C. Bennett and B.G. Luxford

Genetic correlations between the performance of purebred and crossbred pigs

S. Nakavisut, R. Crump, M. Suarez and H-U. Graser

Young Scientists 2

Estimation of the distribution of QTL effects

A.J. Chamberlain, T.H.E. Meuwissen, M.E. Goddard

Combining two markov chain monte carlo approaches for linkage and association studies with a complex pedigree and multi marker loci

S.H. Lee, J.H.J. Van der Werf and B. Tier

QTL for meat colour and pH in Bos taurus cattle


A genome scan for quantitative trait loci for resistance to the gastrointestinal parasite Haemonchus contortus in sheep


A study on the association of genotypes at the interferon gamma microsatellite locus with faecal strongyle egg counts in sheep

V.S.R. Dukkipati, H.T. Blair, P.L. Johnson, A. Murray and D.J. Garrick

xxvii
## General Issues

Adaptability in tropical beef cattle: genetic parameters of growth, adaptive and temperament traits in a crossbred population  
*K.C. Prayaga and J.M. Henshall*  
123

Productive, reproductive and economic performance of dairy cattle in Bangladesh  
*M.K.I. Khan, H.T. Blair, N. Lopez-Villalobos and P.L. Johnson*  
124

Calving traits and their relationship with production, conformation and workability traits in Holstein-Friesian cows  
*S.E. McClintock, K.T. Beard and M.E. Goddard*  
128

Genetic parameters for reproduction in ostriches  
*S.W.P. Cloete, K.L. Bunter and Z. Brand*  
132

## Pig Genetics 2

Challenges for pig breeding: 2005-2015  
*P.W. Knap*  
136

Genetic parameters for characteristics of pork bellies  
*S. Hermesch and J.M. O’Shea*  
137

Relationships among temperament and production traits of pigs  
*A.C. Hansson, R.E. Crump, H.-U. Graser and R. Sokolinski*  
141

Estimates of genetic parameters for reproductive traits at different parities in Australian hyperprolific Large White sows  
*Matías Suárez, Susanne Hermesch, Jeffrey A. Braun and Hans-Ulrich Graser*  
145

Construction of more refined comparative maps for pig chromosomes 9 and 10  
*Jaclyn Aldenhoven, Yizhou Chen and Chris Moran*  
149

## Gene Expression Profiling for Beef

Molecular and bioinformatic strategies for gene discovery for meat traits  
*I.J. Hagen, A. Zadissa, J.C. McEwan, B.A. Veenvliet, S.M Hickey, N.G. Cullen, C.A. Morris and T. Wilson*  
153

Transcriptional profiling of adult muscle in Japanese Black cattle to identify genes involved with the development of intramuscular fat  
154

Construction of gene interaction and regulatory networks in bovine skeletal muscle from expression data  
155

xxviii
Selection Index and Genetic Progress

Development successes and issues for the future in deriving and applying selection indexes for beef breeding  
S.A. Barwick and A.L. Henzell  
Response to selection for age at puberty in an Angus herd  
C.A. Morris and N.C. Amyes  
“Stocktake” – genetic audit software for Australian seedstock beef producers  
D.J. Johnston and K.L. Moore  
Genetic progress in the T13 Merino breeding program  
A.A. Swan and I.W. Purvis  
Quantifying the selection response using a residual feed intake DNA marker for two Australian breeding objectives  
B.J. Wood, J.H.J. van der Werf and P.F. Parnell

Advanced Statistical Techniques in Genetics

Advances in methodology for random regression analyses  
Karin Meyer  
The use of linkage disequilibrium to map quantitative trait loci  
M.E. Goddard and T.H.E. Meuwissen  
Using mixture models to detect differentially expressed genes  
G.J. McLachlan, R.W. Bean, L. Ben-Tovim Jones and J.X. Zhu

Sheep CRC and Genomics Program 1

Optimal development of the Australian sheep genetic resources  
J.H.J. van der Werf  
Preliminary genetic parameters for clean fleece weight, fibre diameter, hogget weight and number of lambs born in merinos  
Heritabilities for skin follicle traits and their correlations with production traits in Australian fine wool Merino sheep  
M. Asadi Fozi, J.H.J. Van der Werf and A.A. Swan  
Australian Piebald: incomplete penetrance or incomplete picture?  
L.D. Brash, J.H.J. van der Werf, Y. Li and B.J. Norris  
Observations on white spotting in a Damara x Merino family  
Optimising selection on growth and carcase development trajectories in lamb  
T.M. Fischer and J.H.J. van der Werf
Contents

**Aquaculture**

How can microarrays assist shrimp breeding and production?  
*K. Wilson and E. de la Vega*  
Rates of inbreeding using DNA fingerprinting in aquaculture breeding programs at various broodstock fitness levels – a simulation study  
*M. Macbeth*

Live weight genetic parameters in two production environments in the gift strain of Nile Tilapia (*Oreochromis niloticus*)  
*R. W. Ponzoni, A. Hamzah, N. Kamaruzzaman and Hooi Ling Khaw*

Response to selection in two production environments in the gift strain of Nile tilapia (*Oreochromis niloticus*)  
*R.W. Ponzoni, A. Hamzah, N. Kamaruzzaman and Hooi Ling Khaw*

**Sheep CRC and Genomics Program 2**

Sheep genomics – core technologies and resources  
*V.H. Oddy, T.J. Longhurst, F.W. Nicholas, J.F. Maddox and M.B. McDonagh*

Expression of imprinted genes surrounding the *Callipyge* mutation in ovine skeletal muscle  
*T. Vuocolo, N.E. Cockett and R. Tellam*

Gene expression profiling of ovine skin and wool follicle development using a combined ovine-bovine skin cDNA microarray  
*B.J. Norris, N.I. Bower, W.J.M. Smith, G.R. Cam and A. Reverter*

**Young Scientists 3**

A comparison of different non-genetic models to describe lamb weights when using DNA to assign sire  
*P.L. Johnson and H.T. Blair*

The effect of different reproductive technologies on the efficiency of marker assisted introgression in Merino breeding  
*S. Dominik, J.G. O’Grady and J.M. Henshall*

The role of selected wether flocks in Merino wool enterprises  
*J.S. Richards and K.D. Atkins*

Relationships between LAMBPLAN EBVS for rams and post weaning performance of their crossbred progeny  
*V. M. Ingham, N.M. Fogarty, A.R. Gilmour, D.J. Brown, L.J. Cummins, G.M. Gaunt, J. Stafford and J.E. Hocking Edwards*

Breed differences and crossbreeding effects for liveweight traits in Australian meat sheep breeds  
*M. Khusro, D. J. Brown, J.H.J. Van der Werf and H -U. Graser*
New Genetic Technologies for Pigs

The potential of new genetic technologies in selecting for stress resistance in pigs

C.A. Kerr and B.M. Hines

Westran - highly inbred pigs for xenotransplantation research

C. Moran

QTL in Cattle

Identifying genes for QTL in cattle and other livestock

Bill Barendse

QTL analyses of growth traits on cattle chromosome 14


Phenotype definition and the identification of QTL for puberty traits in crossbred dairy cattle

L.R. McNaughton, R. Bennett, G. Stanley, S. Harcourt and R.J. Spelman

Young Scientists 4

Associations between plasma concentrations of IGF-1 in young Holstein-Friesian heifers and productive and reproductive parameters in their first lactations

T.E. Moyes, S. Humphrys and K.L. Macmillan

Multiple trait linkage across flocks

A.E. Huisman, B. Tier, and D.J. Brown

South African Merinos divergently selected for multiple rearing ability: a preliminary study of divergence based on rapid markers

P. Naidoo, S.W.P. Cloete and A. Fossey

Association of the exon 9 single-nucleotide polymorphism of CAPN1 with beef tenderness


Analysis of microarrays incorporating adjustments for spatial effects

A.F. Woolastone, R. Murison and B. Tier

Dairy Cattle

Review: bovine mammary epithelial cells, initiators of innate immune response to mastitis

Christian Gray, Ylva Strandberg, Laurelea Donaldson and Ross Tellam

Quantifying energy balance in crossbred dairy cows

B. Harris, J. E. Pryce, L. McNaughton, G. Stanley, S. Harcourt and R. Spelman
## Contents

### Hidden costs of dystocia: fertility and long term survival in dairy cows
*S. E. McClintock, K. T. Beard, M.E. Goddard and D.J. Johnston*

Interactions between gestation length, calf size, dystocia and calf mortality
*S. E. McClintock, K. T. Beard, M.E. Goddard and D.J. Johnston*

### Cattle and Beef Quality CRC 1

Genetics research in the cooperative research centre for cattle and beef quality
*H. Burrow and B. Bindon*

Maternal productivity of Angus cows divergently selected for postweaning residual feed intake
*P. F. Arthur, R. M. Herd, J. F. Wilkins and J. A. Archer*

CRC "Regional Combinations" project – effects of genetics and growth paths on beef production and meat quality: experimental design, methods and measurements
*W.A. McKiernan, J.F. Wilkins, S.A. Barwick, G.D. Tudor, B.L. McIntyre, J.F. Graham, M.P.D. Deland and L. Davies*

### Computing Techniques: Developments and Validations

Ordering strategies to reduce computational requirements in variance component estimation
*Karin Meyer*

Sampling behaviour of reduced rank estimates of genetic covariance functions
*Karin Meyer*

Developments in utilizing pedigrees in genetic analysis within ASReml
*A. Gilmore*

Predicted and observed responses in BLUP estimates of genetic gain
*J.W. James*

Implementing look ahead mate selection
*R.K. Shepherd*

A method that predicts the genetic composition and inbreeding of the future Australian dairy herd
*M. Haile-Mariam, P.J. Bowman, K. Beard and M.E. Goddard*

### Breeding and Genetics of Sheep

The influence of ewe weight at mating on lamb performance and reproduction of the ewe
*D. J. Brown, A. Ball and A. E. Huisman*

Genetic parameters for body weight and carcase traits in Australian based south African meat Merino sheep
*D. J. Brown and M. Asadi Fozi*
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age changes in wool traits of Merino sheep in western NSW</td>
<td>314</td>
</tr>
<tr>
<td><em>S. Hatcher, K.D. Atkins, and K.J. Thornberry</em></td>
<td></td>
</tr>
<tr>
<td>Inheritance of yarn shrinkage of Merino wool</td>
<td>318</td>
</tr>
<tr>
<td><em>J.C. Greeff, A.C. Schlink and M.E. Dowling</em></td>
<td></td>
</tr>
<tr>
<td>Selection demonstration flocks - what have we learnt?</td>
<td>322</td>
</tr>
<tr>
<td><em>F.D. Brien, K.S. Jaensch, R.J. Grimson, K.E. Kemper, D.H. Smith, M.L. Hebart and A.M.M. Ramsay</em></td>
<td></td>
</tr>
<tr>
<td>The relationship of early lamb growth with ewe age and milk production</td>
<td>326</td>
</tr>
<tr>
<td><em>J. E. Morgan, N. M. Fogarty, S. Nielsen</em> and <em>A. R. Gilmour</em></td>
<td></td>
</tr>
</tbody>
</table>

**Cattle and Beef Quality CRC 2**

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>When pastures limit growth rate of steers those bred for low residual feed intake grow faster</td>
<td>330</td>
</tr>
<tr>
<td><em>R.M. Herd, P.F. Arthur and J.A. Archer</em></td>
<td></td>
</tr>
<tr>
<td>Selection for residual feed intake can change methane production by feedlot steers</td>
<td>334</td>
</tr>
<tr>
<td><em>R.S. Hegarty, R.M. Herd, J.P. Goopy, B. McCorkell and P.F. Arthur</em></td>
<td></td>
</tr>
<tr>
<td>Effect of post weaning growth and bulls selected for extremes in intramuscular fat and</td>
<td>338</td>
</tr>
<tr>
<td>retail beef yield on liveweight and carcass traits</td>
<td></td>
</tr>
<tr>
<td><em>J.F. Graham, J. Byron, M.P.D. Deland and G. Kearney</em></td>
<td></td>
</tr>
<tr>
<td>Effect of time of calving and sire types on growth of progeny to weaning</td>
<td>342</td>
</tr>
<tr>
<td><em>D.M. Read, B.L. McIntyre, E.G. Taylor, and G.D. Tudor</em></td>
<td></td>
</tr>
</tbody>
</table>

**QTL: Advanced Statistical Approaches**

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selective genotyping for determination of a major gene associated with cranial cruciate ligament disease in the Newfoundland dog</td>
<td>346</td>
</tr>
<tr>
<td><em>P. E. Macrossan, B.P. Kinghorn, V.L. Wilke and M.F. Rothschild</em></td>
<td></td>
</tr>
<tr>
<td>On the power of QTL detection in outbred populations</td>
<td>350</td>
</tr>
<tr>
<td><em>B. Aufray and K.G. Dodds</em></td>
<td></td>
</tr>
<tr>
<td>QTL mapping using logistic regression</td>
<td>354</td>
</tr>
<tr>
<td><em>Yuandan Zhang and Bruce Tier</em></td>
<td></td>
</tr>
<tr>
<td>Constraints to multiple trait major gene models in outbred populations: a wool sheep example</td>
<td>358</td>
</tr>
<tr>
<td><em>J.M. Henshall, S. Dominik and I.W. Purvis</em></td>
<td></td>
</tr>
<tr>
<td>A simple generalisation of Kinghorn's genotypic probability index</td>
<td>362</td>
</tr>
<tr>
<td><em>Bruce Tier</em></td>
<td></td>
</tr>
<tr>
<td>Limits to genotypic probabilities for single loci</td>
<td>366</td>
</tr>
<tr>
<td><em>Bruce Tier and John M. Henshall</em></td>
<td></td>
</tr>
</tbody>
</table>

xxxiii
Contents

Visions

Integrated and comparative maps in livestock genomics 370
F.W. Nicholas

Animal biotechnologies and their potential impact on animal breeding and production 371
H. W. Raadsma and I. Tammen

Challenges in investing in genetics and biotechnology for the Australian extensive livestock industries 372
R.G. Banks

Posters

Undesirable biological correlates of sheep with a high genetic value for clean fleece weight 373
N.R. Adams, J.C. Greeff, J.R. Briegel, E.N. Bermingham and S.M. Liu

Fibre diameter and wool growth efficiency estimated from wa wether trials 377
L.G. Butler, M.F. D’Antuono, J.C. Greeff and S.R. Brown

Sire selection for yield or intramuscular fat and beef quality 381
M.P.B. Deland, B. Siebert, J.F. Graham and M. Hebart

Genetic and biological approaches to modulate nematode resistance mechanisms in sheep 385
D.L. Emery and K.J. Beh

Merino breeding values – how do they compare? 389
J.E. Hocking Edwards, N.J. Edwards and T.M. Starbuck

Annotation analysis of a bovine cDNA microarray for expression profiling of muscle and adipose tissue 393
S.M. McWilliam, S.A. Lehnert, and A. Reverter

Genetic parameters for physiological characters in Merino ewes in central and north west Queensland 397
Mary Rose and P.M. Pepper

Feltball diameter measurement lacks repeatability over the lifespan of a Merino ewe 401
M.E. Dowling, J.C. Greeff and A.C. Schlink

Delivering new CRC technologies to the northern beef industry 405
R.A. Farrell, V.J. Edmondston, J.D. Bertram, P. Venamore and S. Hudson

The gametic covariance matrix between relatives for a chromosomal segment 409
M. Sargolzaei and H. Iwaisaki

xxxiv