

# **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**

**ISBN: 978-1-61738-632-9**

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2005) by AAABG – Association for the Advancement of Animal Breeding and Genetics  
All rights reserved.

Printed by Curran Associates, Inc. (2010)

For permission requests, please contact AAABG – Association for the Advancement of Animal Breeding and Genetics at the address below.

AAABG – Association for the Advancement of Animal Breeding and Genetics  
The University of Adelaide  
Roseworthy, SA Australia 5371

[www.aaabg.org](http://www.aaabg.org)

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2634  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

## TABLE OF CONTENTS

### **Keynote Address**

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

*John Pollak*

### **Genetic Evaluation Systems**

Genetic evaluation for the beef industry in Australia	2
<i>H.-U. Graser, B. Tier, D.J. Johnston and S. A. Barwick</i>	
Practical aspects of a genetic evaluation system using parentage assigned from genetic markers	3
<i>K.G. Dodds, J.A. Sise and M.L. Tate</i>	
Implementing genetic evaluation in the New Zealand deer industry	4
<i>J.A. Archer, J.F. Ward, S-A.N. Newman, G.J. Cruickshank and A.J. Pearse</i>	
The alliance central progeny test (CPT): an evaluation of sheep meat genetics in New Zealand	8
<i>A.W. Campbell, N.B. Jopson, N. J. McLean, K. Knowler, M. Behrent, T. Wilson, G. Cruickshank, C.M. Logan, P.D. Muir, and J.C. McEwan</i>	

### **Genetic Parameters in Merino Sheep**

Genetic relationships between carcass quality and wool production traits in Australian Merino rams	12
<i>J.C. Greeff, G. Cox, L. Butler, and M. Dowling</i>	
Merino strains with high wool production have lower lifetime reproduction rates	16
<i>J.C. Greeff</i>	
Reliability of estimates of correlations between reproduction and production traits from a Merino resource flock	20
<i>M.J. Kelly, A.A. Swan and S. Dominik</i>	
Genetic parameters and trends for hogget traits in Merino lines divergently selected for multiple rearing ability	24
<i>S.W.P. Cloete, J.J. Olivier, J.B. van Wyk, S.J. Schoeman and G.J. Erasmus</i>	
Analysis of lamb survival in Australian Merinos	28
<i>E. Safari, K.D. Atkins, N.M. Fogarty and A.R. Gilmour</i>	
Genetic parameters for ultrasound scan and wool traits at yearling and hogget age in Merino sheep	32
<i>A.E. Huisman and D.J. Brown</i>	

## Contents

### Poultry CRC

Chicken functional genomics <i>R.J. Moore, K. Granger, T.M. Crowley, S. Riddell, T.J. Doran</i>	36
RNA interference as a tool for chicken functional genomics <i>T. Doran, D. Schafer, T. Wise and R. Moore</i>	40
Application of immunogenomic technologies to poultry: building a better chicken <i>J.W. Lowenthal, A.G.D. Bean, T.J. Doran and R.J. Moore</i>	44
Immunogenomics in the chicken: innate immune molecule analysis <i>A.G.D. Bean, K.A. Jenkins, A.J. Karpala, S.G. Tyack, and J.W. Lowenthal</i>	48

### Cattle and Sheep Growth

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

### Young Scientists 1

Dust penetration is not genetically and phenotypically the same trait as dust content: 3 years of data <i>M.E. Dowling, A.C. Schlink and J.C. Greeff</i>	68
Breeding for body condition score in dairy cows <i>J.E. Pryce, B.L. Harris and W. Montgomerie</i>	72
Sire breed differences for net feed intake in feedlot finished beef cattle <i>K.L. Moore, D.J. Johnston and H.M. Burrow</i>	76
Multi-trait selection of crocodiles using CROCPLAN <i>S.R. Isberg, P.C. Thomson, F.W. Nicholas, E.M. Gray, F. Ahmadi-Esfahani, S.G. Barker and C. Moran</i>	80
Expression of body weight, fleece weight and fibre diameter in across flock genetic evaluation <i>D. J. Brown, K. Atkins and A.E. Huisman</i>	84

## **Genomics: The advent of new genetic technologies**

Harnessing the bovine genome sequence for the Australian cattle and sheep industries <i>B.P. Dalrymple</i>	88
Comparative genomic analysis of non-coding sequences and the application of RNA interference tools for bovine functional genomics <i>A.E. Lew, L.A. Jackson and M.I. Bellgard</i>	89

## **Pig Genetics 1**

Insulin-like growth factor-I (IGF-I) measured in juvenile pigs is genetically correlated with economically important performance traits <i>K.L. Bunter, S. Hermesch, B.G. Luxford, H.-U. Graser and R.E. Crump</i>	90
Potential quantitative genetic indicators of pig temperament <i>R.E. Crump, A.C. Hansson, H.-U. Graser and R. Sokolinski</i>	91
Genetic correlations between juvenile insulin-like growth factor-I (IGF-I) and measures of sow reproductive performance are low <i>K.L. Bunter, C. Bennett and B.G. Luxford</i>	95
Genetic correlations between the performance of purebred and crossbred pigs <i>S. Nakavisut, R. Crump, M. Suarez and H-U. Graser</i>	99

## **Young Scientists 2**

Estimation of the distribution of QTL effects <i>A.J. Chamberlain, T.H.E. Meuwissen, M.E. Goddard</i>	103
Combining two markov chain monte carlo approaches for linkage and association studies with a complex pedigree and multi marker loci <i>S.H. Lee, J.H.J. Van der Werf and B. Tier</i>	107
QTL for meat colour and pH in <i>Bos taurus</i> cattle <i>A. Esmailizadeh Koshkoih, W.S. Pitchford, Z.A. Kruk, C.A. Morris, N.G. Cullen, A.M. Crawford and C.D.K. Bottema</i>	111
A genome scan for quantitative trait loci for resistance to the gastrointestinal parasite <i>Haemonchus contortus</i> in sheep <i>K. Marshall, J.H.J. van der Werf, J.F. Maddox, H-U. Graser, Y. Zhang, S.W. Walkden-Brown and L. Kahn</i>	115
A study on the association of genotypes at the interferon gamma microsatellite locus with faecal strongyle egg counts in sheep <i>V.S.R. Dukkipati, H.T. Blair, P.L. Johnson, A. Murray and D.J. Garrick</i>	119

## **General Issues**

Adaptability in tropical beef cattle: genetic parameters of growth, adaptive and temperament traits in a crossbred population <i>K.C. Prayaga and J.M. Henshall</i>	123
Productive, reproductive and economic performance of dairy cattle in Bangladesh <i>M.K.I. Khan, H.T. Blair, N. Lopez-Villalobos and P.L. Johnson</i>	124
Calving traits and their relationship with production, conformation and workability traits in Holstein-Friesian cows <i>S.E. McClintock, K.T. Beard and M.E. Goddard</i>	128
Genetic parameters for reproduction in ostriches <i>S.W.P. Cloete, K.L. Bunter and Z. Brand</i>	132

## **Pig Genetics 2**

Challenges for pig breeding: 2005-2015 <i>P.W. Knap</i>	136
Genetic parameters for characteristics of pork bellies <i>S. Hermesch and J.M. O'Shea</i>	137
Relationships among temperament and production traits of pigs <i>A.C. Hansson, R.E. Crump, H.-U. Graser and R. Sokolinski</i>	141
Estimates of genetic parameters for reproductive traits at different parities in Australian hyperprolific Large White sows <i>Matías Suárez, Susanne Hermesch, Jeffrey A. Braun and Hans-Ulrich Graser</i>	145
Construction of more refined comparative maps for pig chromosomes 9 and 10 <i>Jaclyn Aldenhoven, Yizhou Chen and Chris Moran</i>	149

## **Gene Expression Profiling for Beef**

Molecular and bioinformatic strategies for gene discovery for meat traits <i>I.J. Hagen, A. Zadissa, J.C. McEwan, B.A. Veenvliet, S.M. Hickey, N.G. Cullen, C.A. Morris and T. Wilson</i>	153
Transcriptional profiling of adult muscle in Japanese Black cattle to identify genes involved with the development of intramuscular fat <i>Y.H. Wang, A. Reverter, H. Mannen, M. Taniguchi, G.S. Harper, K. Oyama, K.A. Byrne, A. Oka, S. Tsuji and S.A. Lehner</i>	154
Construction of gene interaction and regulatory networks in bovine skeletal muscle from expression data <i>A. Reverter, W. Barris, N. Moreno-Sánchez, S. McWilliam, Y. H. Wang, G.S. Harper, S.A. Lehner and B.P. Dalrymple</i>	155

## Selection Index and Genetic Progress

Development successes and issues for the future in deriving and applying selection indexes for beef breeding <i>S.A. Barwick and A.L. Henzell</i>	156
Response to selection for age at puberty in an Angus herd <i>C.A. Morris and N.C. Amyes</i>	157
“Stocktake” – genetic audit software for Australian seedstock beef producers <i>D.J. Johnston and K.L. Moore</i>	161
Genetic progress in the T13 Merino breeding program <i>A.A. Swan and I.W. Purvis</i>	165
Quantifying the selection response using a residual feed intake DNA marker for two Australian breeding objectives <i>B.J. Wood, J.H.J. van der Werf and P.F. Parnell</i>	169

## Advanced Statistical Techniques in Genetics

Advances in methodology for random regression analyses <i>Karin Meyer</i>	173
The use of linkage disequilibrium to map quantitative trait loci <i>M.E. Goddard and T.H.E. Meuwissen</i>	174
Using mixture models to detect differentially expressed genes <i>G.J. McLachlan, R.W. Bean, L. Ben-Tovim Jones and J.X. Zhu</i>	175

## Sheep CRC and Genomics Program 1

Optimal development of the Australian sheep genetic resources <i>J.H.J. van der Werf</i>	176
Preliminary genetic parameters for clean fleece weight, fibre diameter, hogget weight and number of lambs born in merinos <i>E. Safari, N.M. Fogarty, A.R. Gilmour, K.D. Atkins, S.I. Mortimer, A.A. Swan, F. Brien, J.C. Greeff and J.H.J. van der Werf</i>	180
Heritabilities for skin follicle traits and their correlations with production traits in Australian fine wool Merino sheep <i>M. Asadi Fozi, J.H.J. Van der Werf and A.A. Swan</i>	184
Australian Piebald: incomplete penetrance or incomplete picture? <i>L.D. Brash, J.H.J. van der Werf, Y. Li and B.J. Norris</i>	188
Observations on white spotting in a Damara x Merino family <i>M.R. Fleet, D.I. Våge, H. Klungland, R.O. Olsen, G.S. Nattrass and M.J. Bennie</i>	192
Optimising selection on growth and carcass development trajectories in lamb <i>T.M. Fischer and J.H.J. van der Werf</i>	196

## *Contents*

### **Aquaculture**

How can microarrays assist shrimp breeding and production? <i>K. Wilson and E. de la Vega</i>	200
Rates of inbreeding using DNA fingerprinting in aquaculture breeding programs at various broodstock fitness levels – a simulation study <i>M. Macbeth</i>	201
Live weight genetic parameters in two production environments in the gift strain of Nile Tilapia ( <i>Oreochromis niloticus</i> ) <i>R. W. Ponzoni, A. Hamzah, N. Kamaruzzaman and Hooi Ling Khaw</i>	202
Response to selection in two production environments in the gift strain of Nile tilapia ( <i>Oreochromis niloticus</i> ) <i>R.W. Ponzoni, A. Hamzah, N. Kamaruzzaman and Hooi Ling Khaw</i>	206

### **Sheep CRC and Genomics Program 2**

Sheep genomics – core technologies and resources <i>V.H. Oddy, T.J. Longhurst, F.W. Nicholas, J.F. Maddox and M.B. McDonagh</i>	209
Expression of imprinted genes surrounding the <i>Callipyge</i> mutation in ovine skeletal muscle <i>T. Vuocolo, N.E. Cockett and R. Tellam</i>	213
Gene expression profiling of ovine skin and wool follicle development using a combined ovine-bovine skin cDNA microarray <i>B.J. Norris, N.I. Bower, W.J.M. Smith, G.R. Cam and A. Reverter</i>	214

### **Young Scientists 3**

A comparison of different non-genetic models to describe lamb weights when using DNA to assign sire <i>P.L. Johnson and H.T. Blair</i>	215
The effect of different reproductive technologies on the efficiency of marker assisted introgression in Merino breeding <i>S. Dominik, J.G. O'Grady and J.M. Henshall</i>	219
The role of selected wether flocks in Merino wool enterprises <i>J.S. Richards and K.D. Atkins</i>	223
Relationships between LAMBPLAN EBVS for rams and post weaning performance of their crossbred progeny <i>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</i>	227
Breed differences and crossbreeding effects for liveweight traits in Australian meat sheep breeds <i>M. Khusro, D. J. Brown, J.H.J. Van der Werf and H -U. Graser</i>	231

## New Genetic Technologies for Pigs

The potential of new genetic technologies in selecting for stress resistance in pigs <i>C.A. Kerr and B.M. Hines</i>	235
Westran - highly inbred pigs for xenotransplantation research <i>C. Moran</i>	236

## QTL in Cattle

Identifying genes for QTL in cattle and other livestock <i>Bill Barendse</i>	237
QTL analyses of growth traits on cattle chromosome 14 <i>N. G. Cullen, C. A. Morris, W.S. Pitchford, C.D.K. Bottema, T.R. Manley, B.C. Glass and M.A. Lee</i>	238
Phenotype definition and the identification of QTL for puberty traits in crossbred dairy cattle <i>L.R. McNaughton, R. Bennett, G. Stanley, S. Harcourt and R.J. Spelman</i>	242

## Young Scientists 4

Associations between plasma concentrations of IGF-1 in young Holstein-Friesian heifers and productive and reproductive parameters in their first lactations <i>T.E. Moyes, S. Humphrys and K.L. Macmillan</i>	246
Multiple trait linkage across flocks <i>A.E. Huisman, B. Tier, and D.J. Brown</i>	250
South African Merinos divergently selected for multiple rearing ability: a preliminary study of divergence based on rapd markers <i>P. Naidoo, S.W.P. Cloete and A. Fossey</i>	254
Association of the exon 9 single-nucleotide polymorphism of CAPN1 with beef tenderness <i>A. Esmailizadeh Koshkoih, C.D.K. Bottema, Z.A. Kruk, C.A. Morris, N.G. Cullen, A.M. Crawford and W.S. Pitchford</i>	258
Analysis of microarrays incorporating adjustments for spatial effects <i>A.F. Woolaston, R. Murison and B. Tier</i>	262

## Dairy Cattle

Review: bovine mammary epithelial cells, initiators of innate immune response to mastitis <i>Christian Gray, Ylva Strandberg, Laurelea Donaldson and Ross Tellam</i>	266
Quantifying energy balance in crossbred dairy cows <i>B. Harris, J. E. Pryce, L. McNaughton, G. Stanley, S. Harcourt and R. Spelman</i>	267

## *Contents*

Hidden costs of dystocia: fertility and long term survival in dairy cows <i>S. E. McClintock, K. T. Beard, M.E. Goddard and D.J. Johnston</i>	271
Interactions between gestation length, calf size, dystocia and calf mortality <i>S. E. McClintock, K. T. Beard, M.E. Goddard and D.J. Johnston</i>	275
<b>Cattle and Beef Quality CRC 1</b>	
Genetics research in the cooperative research centre for cattle and beef quality <i>H. Burrow and B. Bindon</i>	279
Maternal productivity of Angus cows divergently selected for postweaning residual feed intake <i>P. F. Arthur, R. M. Herd, J. F. Wilkins and J. A. Archer</i>	280
CRC "Regional Combinations" project – effects of genetics and growth paths on beef production and meat quality: experimental design, methods and measurements <i>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</i>	281
<b>Computing Techniques: Developments and Validations</b>	
Ordering strategies to reduce computational requirements in variance component estimation <i>Karin Meyer</i>	282
Sampling behaviour of reduced rank estimates of genetic covariance functions <i>Karin Meyer</i>	286
Developments in utilizing pedigrees in genetic analysis within ASReml <i>A. Gilmour</i>	290
Predicted and observed responses in BLUP estimates of genetic gain <i>J.W. James</i>	294
Implementing look ahead mate selection <i>R.K. Shepherd</i>	298
A method that predicts the genetic composition and inbreeding of the future Australian dairy herd <i>M. Haile-Mariam, P.J. Bowman, K. Beard and M.E. Goddard</i>	302
<b>Breeding and Genetics of Sheep</b>	
The influence of ewe weight at mating on lamb performance and reproduction of the ewe <i>D. J. Brown, A. Ball and A. E. Huisman</i>	306
Genetic parameters for body weight and carcase traits in Australian based south African meat Merino sheep <i>D. J. Brown and M. Asadi Fozi</i>	310

Age changes in wool traits of Merino sheep in western NSW <i>S. Hatcher, K.D. Atkins, and K.J. Thornberry</i>	314
Inheritance of yarn shrinkage of Merino wool <i>J.C. Greeff, A.C. Schlink and M.E. Dowling</i>	318
Selection demonstration flocks - what have we learnt? <i>F.D. Brien, K.S. Jaensch, R.J. Grimson, K.E. Kemper, D.H. Smith, M.L. Hebart and A.M.M. Ramsay</i>	322
The relationship of early lamb growth with ewe age and milk production <i>J. E. Morgan, N. M. Fogarty, S. Nielsen and A. R. Gilmour</i>	326

## Cattle and Beef Quality CRC 2

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

## QTL: Advanced Statistical Approaches

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

## *Contents*

### **Visions**

Integrated and comparative maps in livestock genomics <i>F.W. Nicholas</i>	370
Animal biotechnologies and their potential impact on animal breeding and production <i>H. W. Raadsma and I. Tammen</i>	371
Challenges in investing in genetics and biotechnology for the Australian extensive livestock industries <i>R.G. Banks</i>	372

### **Posters**

Undesirable biological correlates of sheep with a high genetic value for clean fleece weight <i>N.R. Adams, J.C. Greeff, J.R. Briegel, E.N. Bermingham and S.M. Liu</i>	373
Fibre diameter and wool growth efficiency estimated from wa wether trials <i>L.G. Butler, M.F. D'Antuono, J.C. Greeff and S.R. Brown</i>	377
Sire selection for yield or intramuscular fat and beef quality <i>M.P.B. Deland, B. Siebert, J.F. Graham and M. Hebart</i>	381
Genetic and biological approaches to modulate nematode resistance mechanisms in sheep <i>D.L. Emery and K.J. Beh</i>	385
Merino breeding values – how do they compare? <i>J.E. Hocking Edwards, N.J. Edwards and T.M. Starbuck</i>	389
Annotation analysis of a bovine cDNA microarray for expression profiling of muscle and adipose tissue <i>S.M. McWilliam, S.A. Lehnert, and A. Reverter</i>	393
Genetic parameters for physiological characters in Merino ewes in central and north west Queensland <i>Mary Rose and P.M. Pepper</i>	397
Feltball diameter measurement lacks repeatability over the lifespan of a Merino ewe <i>M.E. Dowling, J.C. Greeff and A.C. Schlink</i>	401
Delivering new CRC technologies to the northern beef industry <i>R.A. Farrell, V.J. Edmondston, J.D. Bertram, P. Venamore and S. Hudson</i>	405
The gametic covariance matrix between relatives for a chromosomal segment <i>M. Sargolzaei and H. Iwaisaki</i>	409