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ANIMAL PRODUCTION IN AUSTRALIA

PROCEEDINGS OF THE AUSTRALIAN SOCIETY OF ANIMAL PRODUCTION

VOLUME 26

TWENTY-SIXTH BIENNIAL CONFERENCE

SCIENCE AND INDUSTRY – HAND IN GLOVE

A special issue of the *Australian Journal of Experimental Agriculture*

Editors: NR Adams, KP Croker, DR Lindsay, CA Anderson and LE Webb

The University of Western Australia, Nedlands, 10–11 July
The Grange, Upper Swan, 12 July
Burswood Convention Centre, Burswood, Western Australia, 13–14 July 2006

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REFEREEING OF PAPERS

All papers in this volume have been refereed to the journal standards. The material is subject to copyright and may not be presented elsewhere.

The criteria for acceptance of papers are that the material is of interest to ASAP members, has some novel aspect, is sound, advances scientific knowledge or its application in any field of animal science or animal production, and is presented in a form consistent with instructions to authors.

ETHICAL CLEARANCE

It is incumbent upon the authors, where necessary, to have had experiments approved by a relevant animal ethics committee.

AUTHENTICITY

The Journal assumes that the authors of a multi-authored paper agree to its submission.

The Journal has used its best endeavours to ensure that work published is that of the named authors except where acknowledged and, through its reviewing procedures, that any published results and conclusions are consistent with the primary data. It takes no responsibility for fraud or inaccuracy on the part of the contributors.

CITATION OF PAPERS

The papers in this Volume were presented at the 26th Biennial Conference of the Australian Society of Animal Production held at The University of Western Australia, Nedlands, Western Australia, 10–14 July 2006.

Papers should be cited as:

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or in the abbreviated form:

Aust. J. Exp. Agric. **46** (followed by the page numbers).

WELCOME FROM THE 26th COUNCIL OF THE AUSTRALIAN SOCIETY OF ANIMAL PRODUCTION

The 26th Biennial Conference in 2006 will be the 50th anniversary of the proud institution that is 'The Australian Society of Animal Production' – a society of scientists and farmers that has largely existed to hold local meetings on topical subjects and a national conference every 2 years. These conferences have produced many memorable moments and thick proceedings of refereed papers and non-refereed abstracts. These proceedings are often well thumbed by their owners. In Western Australia, the Federal Council has traditionally had a farmer president and an equal balance of scientists and farmers in attendance at meetings.

While the papers have tended to be more on the applied side, much of the key research in sheep production is still to be found *only* in past ASAP proceedings along with a bookshelf of good applied papers on beef, dairy and even pigs if you go back a few years. Unfortunately, the last few conferences have coincided with a fall in membership of the Society to almost unsustainable levels and a view that the proceedings are no longer regarded as a 'full publication'. Hence, the challenge was there for the current Federal Council to either continue the orderly 'wind down' process or alternatively to propose a radical new look conference and proceedings.

We have chosen the latter and recruited a cohort of young enthusiastic scientists and farmers who will rebuild the Society in Western Australia and help rebuild the Society nationally. First, we chose a theme that recognises the necessary symbiotic 'win–win' relationship between animal scientists and animal producers. Second, we have negotiated that the proceedings of the 26th and future conferences will be published as a special edition of the *Australian Journal of Experimental Agriculture* but retain the ASAP name and traditions.

In addition, the Society and industry have recognized the importance of past proceedings. All past proceedings will be available online through 'The Livestock Library' (see www.asap.asn.au), an electronic library of key industry information for the Beef and Sheep industries. This electronic library will provide a search engine for a range of industry publications including journal articles, conference proceedings, agriculture department fact sheets, brochures, booklets and html pages.

To give voice to the overall theme of the 2006 conference **'Science & Industry – Hand in Glove'**, the program committee has chosen to adopt the classic 'paired feeding design'. Invited speakers in every plenary session will be challenged to compare and contrast the view from the laboratory and the paddock; each session will explore both the science and practical implications of successful research and/or key issues facing the animal industries of Australia.

Chris Oldham
President

Roger House
Vice President

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D.S. Wishart	1956–57	Melbourne
T.K. Ewer	1958–60	Brisbane
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	Dudley Martin Smith
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	William Henry Southcott
1988	John Lovick Corbett
	Haydn Lloyd Davies
	Peter Everard Geytenbeek
	Geoffrey Roger Pearce
	Laurence Cecil Snook
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	James Philip Hogan
	Trevor William Scott
	Robert Humphrey Weston
1992	Michael Freer
	Hugh McLeod Gordon
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	John Clive Ratcliffe
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1998	Robert Thomas Cowan
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2002	Frank Annison
	John Nolan
	Barry Norton
2004	Keith William Entwistle
	Neil Patrick McMeniman
	William Anthony Pattie
2006	**Norman Adams**
	Heather Burrow
	Graham Faichney
	David Masters
	David Pethick

Dr Norman Adams
BVSc, PhD, FTSE

Norm graduated in veterinary science at Sydney University in 1965, and completed a PhD at Iowa State University before returning in 1971 to take up a research scientist position with the CSIRO Division of Animal Health in Western Australia. He quickly recognised clover disease as a major issue facing the sheep and wool industry, and his pioneering work on its histopathology remains the definitive work in this area. He showed that permanent infertility in ewes after prolonged grazing on oestrogenic clover pastures results from mild sexual redifferentiation during adult life, and developed and applied diagnostic tests that remain the standard today. He also helped to develop the use of testosterone treatment of wethers to replace vasectomised rams as the method of detecting oestrus in ewes, which was a major research advance. His work on phyto-oestrogens is recognised as world class, as evidenced by the fact that he was being invited to write reviews on clover disease 20 years after he completed the research work.

After 10 years research on clover disease, Norm's research interests shifted to the role of metabolic and reproductive hormones as mediators of interactions between nutrition, reproduction and wool growth. This work led to provisional patents for a treatment to improve feed intake in wethers during live shipment and for growth promotant treatment for improved wool growth to reduce tender wool. This research activity led to Norm being appointed leader of projects responsible for developing technologies to increase wool strength within the CRC for Premium Quality Wool. The program expended $2 million annually developing technologies to increase staple strength and transferring results to industry. His wide range of responsibilities included the development and coordination of research projects across CSIRO and the WA Department of Agriculture; projects that ultimately defined the biology of staple strength and led to the development and adoption of genetic, nutritional and management methods for overcoming the problem. In 1998, Norm was appointed as Deputy Director of the wool CRC and held that position until its completion in 2001.

Norm has an outstanding publication record, with 117 scientific papers and invited reviews, in addition to 65 conference papers and numerous industry and rural press articles, His reputation as a leader in the field of animal science is seen by the fact that he has been invited to speak at international conferences in South Africa (1999 International Symposium on Ruminant Physiology), Minnesota (1997 Annual Meeting of the America Society of Animal Science) and Arkansas (1994 International Conference on Phytoestrogens).

In addition to his research output, Norm has cosupervised four PhD students at the University of WA and presents honorary lectures to animal science students. He has also made a contribution to the Society through his role as WA Council member in 1986–87 and President of the WA Council 2002–03 and continues to be a member of the committee of the WA branch. He has also been an executive member of the Association for the Advancement of Animal Breeding and Genetics and the Australian Merino Society.

Dr Heather Burrow

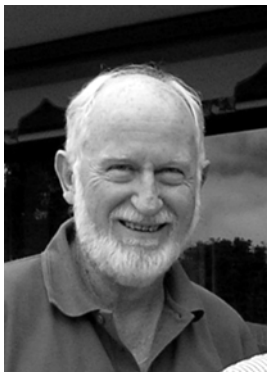
Dr Burrow was bred in the outback. Her early education was by correspondence and radio, and after attending boarding school in country NSW, she completed a Bachelor of Arts degree in Nursing at the University of NSW. She worked on cattle stations in the Northern Territory for a few years before joining the staff of CSIRO in Rockhampton as a Technical Officer in 1978. Her commitment, competence and diligence soon saw her responsible for major sections of the mating programmes for various breeding experiments at the National Cattle Breeding Station, Belmont, and the management of the large associated database. She enrolled as a postgraduate student and completed a diploma in advanced animal breeding, and after qualifying for a Master's degree, continued to complete a PhD entitled "*Genetic analysis of temperament and its relationships with productive and adaptive traits in tropical beef cattle".* This was ground breaking work because it involved the development and application of a relatively simple and extremely practical measuring device for temperament, based on the speed with which an animal leaves a weighing crush. The measure was quantitative and was shown to be highly correlated with other measures of temperament so that she could then derive the phenotypic and genetic relationships between temperament and other productive and adaptive traits, including meat quality, feed efficiency, parasite resistance and other important traits in grazing and lot-fed cattle. Her ideas have recently received recognition in the USA, which is only now following her lead in this area. The flight speed device has been commercialised by Ruddweigh Australia.

Heather has been a key person in the Beef and Cattle Cooperative Research Centre. She has led the largest project, been the Northern Coordinator, and was then the deputy CEO. She is now Director of the new CRC for Beef Genetic Technologies.

Heather's work is characterised by its relevance to industry, her ability to enlist the cooperation of other organisations and individuals, and her work with beef producers. She is an excellent communicator and has mentored or cosupervised several staff towards higher degrees. She has over 100 scientific publications, most of which have been published in highly reputable refereed journals and proceedings.

Heather has served on editorial boards (Chair of the Editorial Board of *Australian Journal of Experimental Agriculture*), edited scientific conference proceedings, examined PhD and MSc theses and grant proposals and has held several offices in the Central Queensland Branch of the Australian Society of Animal Production. She was the President of the Australasian Association of Animal Breeding and Genetics (AAABG), 2003–2005. She has also been active in promoting the 'Women in Science' initiative.

Although comparisons are not always instructive, there are interesting parallels between the careers of Heather Burrow and Helen Newton Turner, the former in the northern cattle industry and the latter in the Merino industry. Both were initially trained in other disciplines, both accepted the challenge of a new career path, both have been successful in doing so, and both are highly regarded by producers. Heather is a truly remarkable scientist.



Dr Graham Faichney
BAgrSc(Melb)
MScAgr(Syd) PhD(Melb)
DAgrSc(Melb)

After graduating BAgrSc from Melbourne University, Graham Faichney was awarded a MScAgr degree by Sydney University for a study of the protein and energy requirements of milk-fed lambs. Returning to Melbourne University, he was awarded his PhD for studies of volatile fatty acid production in the rumen of sheep. He served as Teaching Fellow in Animal Nutrition at Sydney University and Lecturer in Animal Husbandry at Melbourne University during his PhD candidacy. He travelled on a post-doctoral scholarship to the Rowett Research Institute, Aberdeen, Scotland, where he made the first quantitative measurements of volatile fatty acid production in the ruminant hind-gut, the caecum/proximal colon of sheep.

He returned to Australia to a position with CSIRO Division of Animal Physiology (later Animal Production) focusing on the role of protected protein in growth and meat production in sheep and cattle. He developed a new approach to the use of markers to measure digesta flow and mean retention time that became the standard for measurement of these parameters. His studies of growth in lambs and calves and nutrient partitioning showed that additional protected protein in the diet could increase amino acid supply beyond the requirements of the growing animal, while treatment of the diet could reduce protein requirements by enhancing nitrogen recycling and microbial synthesis. He also measured the rate at which polyunsaturated fatty acids, protected from microbial hydrogenation in the rumen, were incorporated into body lipids in cattle and sheep.

With colleagues Dr J.L. Black and Dr N.M. Graham he initiated the first attempts to integrate current knowledge of nutritional and environmental conditions into a computer simulation model of the sheep, firstly milk-fed lambs and then a model of an adult sheep. A model of rumen function was then developed to overcome the limitations imposed by the need for empirical equations to describe nutrient supply. These models were proposed as the basis for an Australian national system of feeding standards for ruminants but were rejected in favour of an empirical system similar to that developed in the UK. The modelling approach was subsequently taken up in the USA.

Pursuing quantitative information for mechanistic descriptions of digestive and body functions, Graham studied nutrition during pregnancy, and particle and microbial dynamics in the rumen, studying effects of the developing conceptus on rumen function and the effects of nutrient supply on placental and fetal growth. He made the first quantitative measurements of fetal urea synthesis and showed that amino acid oxidation could account for up to one-third of fetal oxygen consumption in the unstressed ewe, increasing to 60% of fetal oxygen consumption in the chronically undernourished ewe. Developing a new approach to the description of particle passage through the rumen, he demonstrated that grinding and pelleting a forage did not affect the mean retention times of solutes and particles when the diets were offered to appetite but, as intake was reduced, rumen fill declined less than did digesta flow, disproving the common assumption that grinding a forage reduces mean retention times. He also showed that grinding did not affect the critical size of particles able to leave the rumen. He made the first quantitative measurements of the contribution of anaerobic fungi to rumen function. These make a major contribution to fibre digestion in the rumen, but contribute less than 4% of the rumen microbial nitrogen. His finding that they are completely suppressed when dietary free lipid exceeds 4% helps to explain the well-known depression of forage digestibility caused by increasing dietary lipid.

Graham has worked as a visiting scientist in laboratories in England and France and has more than 130 publications to his credit, 75% of which he is the senior author. He has been an Honorary Research Associate in the Departments of Animal Husbandry and Biological Sciences at Sydney University where he has acted as a supervisor to some and adviser to many graduate students. He has long been involved with ASAP as an office-bearer and committee member of the Victorian and NSW branches and of its Federal Council when it was based in those States. He has been an Editorial Committee member, a Conference Registrar and undertook a major revision of the Society's constitution at the request of Federal Council. It is notable that he has had a parallel involvement with the Nutrition Society of Australia (NSA) as a founding member of its Sydney Group, a member of the subcommittee appointed to draft the Society's constitution and serving as an office-bearer and committee member and as National Secretary, National Newsletter Editor, and National President.

Dr David Masters

BSc(Agric), MSc(Agric), PhD

David graduated in Agricultural Science from UWA in 1973, and went on to complete his Masters followed by a PhD on zinc nutrition under Max Somers. On completion of his PhD, he was offered a postdoctoral research fellowship at the University of California Davis with Lucille Hurley, who was then a world-leading zinc researcher. David returned to Western Australia in 1983 to take up a research position at UWA, and in 1984 joined the CSIRO Division of Animal Production at Floreat.

David quickly established an international reputation in the field of zinc nutrition, and his papers on zinc and pregnancy, especially on interactions between calcium and zinc, and on zinc deficiency in pregnant ewes in WA and novel methods of supplementation, remain as major milestones in zinc research. In 1985, he was appointed as project leader for an ACIAR project investigating the mineral status and requirements of sheep in China, and he led this project for almost 10 years. The outcome was a detailed description of mineral deficiency and imbalances in Chinese sheep flocks as well as the establishment under David's guidance of a high quality analytical laboratory in China. The benefits flowing back to Australian sheep growers included a well funded mineral research laboratory at Floreat, with exchange of scientists and information between China and Australia. The book resulting from this project, entitled the 'Detection and Treatment of Mineral Nutrition Problems in Grazing Sheep', was produced and edited by David, and remains the most useful practical reference book on this subject.

As funding for research on mineral nutrition diminished in the mid 1990s, David used his experience of working with pregnant animals to redirect his research effort into understanding effects of pregnancy on wool growth.

He was appointed project leader in the CRC for Premium Quality Wool in 1995, and was instrumental in developing nutritional strategies for minimising tender wool in pregnant sheep. His landmark papers on the role played by amino acids in pregnancy-induced tender wool provided the scientific basis for developing nutritional strategies to prevent and manage tender wool.

More recently, David has turned his research and management skills to the problem of the remediation and productive utilisation of saltland. In 2003, he was appointed as program leader of the grazing systems component within the CRC for Plant-based Management of Dryland Salinity. Through his leadership, this program has generated a large amount of practical and scientific information on sustainable grazing systems on saline land and this information is being adopted by participating farmers throughout Australia. Through direct involvement in the research, and through communicating with producers, David has played a leading role in the reversal of land degradation by salinity. He is much in demand for farmer workshops and in writing and presenting reviews at national and international scientific conferences on sheep production from saltland.

David has published over 160 scientific, industry and technical publications, including 80 scientific papers in refereed journals and 20 invited reviews. He has also contributed to the training of future animal scientists through his role as an honorary lecturer at UWA and as supervisor of postgraduate students. He has also served as national Editor of ASAP, and has made a significant contribution to the WA group as an active branch member at meetings and the various scientific forums organized by the local branch.

Associate Professor David Pethick
BAgSc(Hons), PhD

David Pethick is currently Associate Professor in the School of Veterinary Science at Murdoch University, Western Australia. He graduated BAgSc (Hons 1) from the University of Adelaide in 1975, and gained his PhD from Cambridge University in 1981, studying ruminant lipid metabolism with Professor Derek Lindsay.

Early in his career he undertook pioneering studies in ruminant metabolism, focused on glucose and fatty acid metabolism in sheep under a variety of physiological scenarios (fed, fasted, pregnancy, lactation and exercise). This work, which has been heavily cited, has contributed substantially to world knowledge of integrated tissue metabolism in ruminants.

This fundamental metabolic work has more recently been applied to the meat science of beef cattle, lambs and sheep. David pioneered a new approach to the understanding of Dark Cutting in sheep and cattle by using innovative biopsy procedures and glycogen measurement. The work underpinned the importance of preslaughter nutrition and genetic influences affecting the Dark Cutting syndrome. His work on the genetic and nutritional regulation of fatty acid metabolism and marbling in beef cattle has been nationally and internationally recognised.

Pethick's meat science research has been integrated into a consumer focus, with David being a key researcher in the development of the Beef MSA grading scheme which has been heavily adopted in WA guided by his drive. He has lead the national consumer project for lamb and sheep meats which has culminated in a special edition of the *Australian Journal of Experimental Agriculture* (Volume 45, Issue 5, 2005) and, finally, in a commercial quality scheme known as MSA lamb and sheep meats, currently being adopted Australia wide again with WA leading the way.

David has made ground-breaking contributions in the area of nutritional control of enteric disease expression in pigs – particularly those diseases with a hindgut focus. Additional hindgut research in dogs and horses has complemented this work, which is internationally recognised and has been adopted by large companies such as Masterfoods Pet Foods (Mars Corporation).

David has 11 graduated PhDs with 5 more near completion and another 7 enrolled. He teaches undergraduate Biochemistry and Nutrition to Veterinary, Biomedical and Animal Science students, Biochemistry to Chiropractic students, and holds University prizes for teaching excellence and has received Murdoch University service awards.

He has made a huge commitment to increasing awareness and adoption of research in red meat supply chains (producers, processors and retailers). He averages some 20 presentations per year to producer, seedstock and processor forums throughout Australia (over last 6 years). His position at Murdoch University is sponsored by Wesfarmers Ltd and recently he toured as a guest 'livestock expert' for Rabobank – clear evidence of a very strong industry connection.

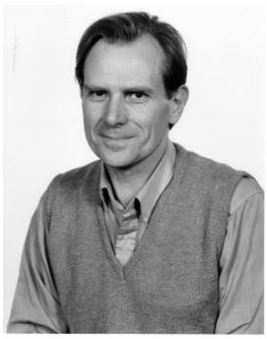
In his field, David is at the forefront of research leadership in Australia and currently leads the Centre for Production Animal Research at Murdoch University, Meat & Livestock Australia's Sheep Meat Eating Quality program, the Sheep CRC Meat Science program and the Beef CRC's 'Beef for global consumers' program.

David has in excess of 100 refereed publications plus numerous conference, industry and rural press publications. He has undertaken invited international lecture tours in Japan (1997 and 2000) and France (2002) and has made numerous international and national conference presentations. He has recently been awarded several prestigious prizes including 'The International Meat Secretariat Millennium Prize for Meat Science and Technology' awarded to the Meat Standards Australia Pathways Team, September 2000, and the 'Howard W Yelland Award' awarded by the Beef Improvement Association in recognition of his outstanding contribution to the Beef Industry, July 2005.

HONORARY MEMBERS OF THE AUSTRALIAN SOCIETY OF ANIMAL PRODUCTION

Honorary Members shall be those who, in the opinion of the Council, have rendered eminent service to the Society.

1976	Joseph Phillip Kahler
1980	Clarence James Daley
1982	Ian Neville Southey
1986	John Murray George Andley George Ward
1988	Edward Ben Byers John Terrell Williams
1990	Barry Graham Lukins
1994	Christopher John Thwaites Edmund Wyndham
1996	Eric John Hilder
1998	Narelle Yvonne Morse Evan Hollinworth Macdonald Barnet
2000	Gordon Terrell Williams
2002	David Macfie Richard Moss
2004	David Hennessy
2006	**Anthony (Tony) Schlink**



Dr Anthony Schlink
BScAgr, PhD

Tony Schlink graduated in Agriculture and received his PhD from the University of Adelaide in 1978. His research since then has focused on practical issues associated with the sheep and cattle industries. He worked on slow release systems and growth promotants with Elanco. He then travelled to Melbourne University to work in a post-doctoral role with Professor A. Egan, before moving to CSIRO Tropical Animal Production in North Queensland, where his work on cow/calf nutrition resulted in early weaning systems widely used during droughts. Tony also had a program that evaluated at range of tropical legumes for the cracking clay soils of the sheep areas of Queensland, as well as, evaluating the nutritional potential of 'new' tropical legumes. In 1992 Tony moved to CSIRO Animal Production in Western Australia, and defined the role of stress in low staple strength of wool. More recently, he has developed systems to measure characteristics of raw wool that affect its processing performance and consumer satisfaction of the finished products.

Tony has contributed to every ASAP Biennial meeting since 1978. He has presented 14 four-page papers, 27 one-page papers and been a contributor in 2 contract presentation since 1978. He has served ASAP as committee member and as secretary of both the North Queensland and the Western Australian branches. When the WA branch of ASAP was revived in 2000, Tony was soon elected Secretary, and has been the mainstay of the branch ever since. Tony has kept the WA branch functioning through a series of presidents during that time, despite being under immense time pressures. He maintains communication with farmer members, ensures members stay informed of seminars, and ensures that branch activities take place. It is no exaggeration to say that the WA Branch owes him its viability, and this viability underpins the capacity for the branch to undertake the current biennial meeting in Perth.

THE UNDERWOOD LECTURE

In honour of **Professor E.J. Underwood,** AO, CBE, BSc(Agric)(Hons)(WA), PhD(Cantab), Hon. DRurSc(UNE), Hon. DSc(Wis), Hon. DSc(Agric)(WA), Hon. DSc(Melb), FRS, FAA, FFA, FAIAS, FASAP, Hon. FACVS. Agricultural Scientist 1905 to 1980.

The Lecturers have been:

1984 R.J. Moir
1986 H.J. Lee
1988 I.W. McDonald
1990 A.D. Robinson
1992 J. Stocker
1994 K.W. Entwistle
1996 D.E. Beever
1998 H. Dove
2000 N.F. Suttle
2002 J.E. Vercoe
2004 Professor J.C. MacRae

The 2006 Underwood Lecturers are: David Lindsay and Beth Paganoni

THE McCLYMONT LECTURE

The 22nd Federal Council introduced this lecture to honour **Professor G.L. (Bill) McClymont,** AO, BVSc(Syd), PhD(Cantab), Hon. DRurSc(UNE*),* FAIAS, FASAP, Foundation Professor (1955 to 1976) of Rural Science at the University of New England, and a pioneer in the development and application of ecological principles to the teaching and practice of agriculture.

The Lecturers have been:

1998 B.E. Norton
2000 A.R. Sykes
2002 G. Grigg
2004 Professor T Reeves

The 2006 McClymont Lecturers are: Jim Scott, Tim Coventry and Hugh Sutherland

THE MOIR LECTURE

The 26th Council presents a lecture to honour **Professor R.J. (Reg) Moir**, AO, BSc(Agric) (Hons)(WA), Hon DSc(Agric)(WA), FTSE, FASAP, FAIAS. Reg was recognised nationally and internationally for his contributions to our understanding of rumen microbiology, nitrogen and sulphur metabolism in the rumen and our understanding of the physiology of ruminants. Reg supervised 32 post-graduate students and their contribution to animal production and ASAP is testimony to his teaching and to his ability to instil dedication and imagination in his students.

The 2006 Moir Lecturers are: Phil Vercoe, Mike Humphry and Adrian Egan

THE MORLEY LECTURE

The 26th Council presents this lecture to honour **Professor F.H.W. (Fred) Morley**, HDA, BVSc(Agric) (Hons), PhD, FASAP, FACVSc. Fred is remembered by ASAP attendees because of his insightful questions and comments over the whole gambit of subjects published in ASAP. He was able to do this because of his extraordinary intellect but also because he had published over the whole range. In 1944, he established the Trangie Agricultural Research Station (home of some of the most influential sheep breeding experiments ever conducted). In 1954, Fred joined CSIRO Plant Industries and turned his hand to breeding new and improved pasture species and then in the 1960s and beyond he turned to questions of pasture management and systems modelling, then moving to the University of Melbourne Mackinnon Group.

The 2006 Morley Lecturers are: Andrew Vizard and Tim Watts

ACKNOWLEDGMENTS

The Australian Society of Animal Production gratefully acknowledges the support from the following organisations:

Department of Agriculture and Food Western Australia
CSIRO Livestock Industries
The University of Western Australia

Three significant meetings have been organised for the week of the 26th Biennial Conference. The organisers of the Department of Agriculture and Food Agribusiness Sheep Updates and the 7th World Merino Conference are thanked for their co-operation and collaboration in running these meetings in conjunction with the Australian Society of Animal Production Conference.

SPONSORS

The sponsors of the 26th Biennial Conference of the Australian Society of Animal Production are also thanked for their assistance:

Gold

Meat and Livestock Australia
CSIRO Livestock Industries
Department of Agriculture and Food Western Australia
World Merino Conference

Bronze

Australian Wool Innovations
Land, Water and Wool
Wool Agency

LIST OF REFEREES CONSULTED

The ASAP Editorial Committee and AJEA Editors thank the referees listed below, and those who have chosen not to have their names listed, for their assistance in maintaining the high standards demanded by this international journal.

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C.A. Anderson (Australia)
R. Apfelbach (Germany)
C. Arnould (France)
P.F. Arthur (Australia)
K.C. Bachman (North America)
R. Barlow (Australia)
E.G. Barrett-Lennard (Australia)
T.N. Barry (New Zealand)
J.A. Basarab (Canada)
D.E. Beever (Ireland)
R. Bencini (Australia)
R.B. Besier (Australia)
I.M. Brookes (New Zealand)
A. Boudon (France)
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M.E. Dikeman (North America)
K.G. Dodds (New Zealand)
H. Dove (Australia)
P.M. Dowling (Australia)
C.M. Dwyer (Scotland)
S.J. Eady (Australia)
G.P. Edwards (Australia)
N. Edwards (Australia)
G.J. Faichney (Australia)
L.M. Ferreira (Portugal)
M.R. Fleet (Australia)
G. Fordyce (Australia)
M. Freer (Australia)
M.A. Friend (Australia)
K. Geenty (Australia)
J.F. Graham (Australia)
T. Grandin (North America)
B.C. Granzin (Australia)
P.L. Greenwood (Australia)
R.R. Grummer (North America)
S.K. Gulati (Australia)
S. Hatcher (Australia)
M. Hebart (Australia)
G.N. Hinch (Australia)
C.W. Holmes (New Zealand)
D.L. Hopkins (Australia)
R.H. Jacob (Australia)
J.W. James (Australia)
P.J. James (Australia)
L.E. Jeremiah (Canada
P.W. Johnson (Australia)
L.R. Kahn (Australia)
H.T. Kim (Japan)
S.M. Kitessa (Australia)
P. Kuber (North America)
S.C. Langley-Evans (United Kingdom)
G.W. Levot (Australia)
R.P. Lewer (Australia)
S.R. McLennan (Australia)
M.R. McCaskill (Australia)
C. Marley (United Kingdom)
D.G. Masters (Australia)
G. Mata (Australia)
R.W. Mayes (Scotland)
D.R. Mertens (North America)
D.L. Michalk (Australia)
M. Olivan (Spain)
E.R. Orskov (Scotland)
R.P. Pech (Australia)
D.W. Pethick (Australia)
L.R. Piper (Australia)
W.S. Pitchford (Australia)
P. Polidori (Italy)
R.R. Purchas (New Zealand)
I.W. Purvis (Australia)
H.W. Raadsma (Australia)
J.B. Rowe (Australia)
A.L. Schaefer (Canada)
F.D. Shaw (Australia)
W.R. Shorthose (Australia)
J.W. Steel (Australia)
K. Stelwagen (The Netherlands)
P.E. Strydom (South Africa)
D.L. Thomas (North America)
R.D. Warner (Australia)
P.D. Warriss (United Kingdom)
J. van der Werf (Australia)
J.D. Wood (United Kingdom)
D.T. Vere (Australia)