

ANIMAL PRODUCTION IN AUSTRALIA

Proceedings of the Australian Society of Animal Production

Volume 29

**Bridging the Gap –
Australian and New Zealand Animal Production Research**

Twenty-Ninth Biennial Conference

Editors: David Hopkins, Sue Hatcher and Chris Anderson

Lincoln University, Christchurch, New Zealand, 2–5 July 2012

Meeting held jointly with the 72nd Annual Conference of the New Zealand Society
of Animal Production

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The 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 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. It is also expected that one of the authors of a paper would be present at the conference to present the material as an oral or poster presentation.

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.

For submitted manuscripts, unpublished data and personal communications the Journal assumes that the authors have obtained permission from the data owner to quote his or her unpublished work.

Citation of Papers

These papers were presented at the Second Joint Conference of the New Zealand Society of Animal Production and the Australian Society of Animal Production held at Lincoln University, Christchurch, New Zealand, 2–5 July 2012. Invited Plenary and four-page papers submitted in Australia are published in Volume 52(6–7) of *Animal Production Science*.

Papers should be cited as:

Animal Production Science, **52** (followed by the page numbers).

or in the abbreviated form:

Anim. Prod. Sci. **52** (followed by the page numbers).

Papers that were submitted in New Zealand are published in the Volume 72 of the *Proceedings of the New Zealand Society of Animal Production*.

One page papers submitted in Australia are published in the Proceedings of the 29th Biennial Conference of the Australian Society of Animal Production.

Welcome from the 29th Council of the Australian Society of Animal Production

For the 29th Biennial Conference, our society has again joined with our New Zealand Society of Animal Production colleagues to conduct a joint meeting at Lincoln University, 2–5 July 2012. This follows on from the highly successful inaugural joint conference held in Brisbane in 2008 and aligns with the aims and objectives of our societies. Given the similar challenges associated with livestock production in Australia and New Zealand, as well as maintaining the momentum and success of our respective societies, this close association between societies is very appropriate and timely.

The mix of youth and experience in attendance at this forum provides an ideal opportunity to build and enhance linkages across the Tasman as well as between generations. The informative and topical program covers a range of issues that will be of interest to members across a wide range of disciplines. The traditional ASAP special lectures will also be featured and include: the McClymont (Agricultural Systems), Underwood (Livestock Nutrition), Stobbs (Grazing Management) and the John Barnett (Animal Welfare) lectures.

On behalf of the 29th Federal Council I would like to acknowledge and congratulate the NZSAP local organising committee for their efforts in convening such a meeting. We would also like to acknowledge David Hopkins, Sue Hatcher, Michael Friend and Gaye Krebs for coordinating the review and subsequent acceptance of the large number of contributed four-page and one-page papers. This is a time-consuming task and your efforts are greatly appreciated.

It is envisaged that a large contingent of ASAP members will be in attendance to present papers as well as contribute to discussions. As it is extremely important to encourage attendance by postgraduate researchers, we have provided funding for two ASAP student members to attend, in addition to the traditional presentation of Young Scientists Awards and up to two Young Member Travel Awards.

The Federal Council is keen to continue raising the profile of ASAP over the coming year. An integral element to achieving this will be the promotion of activities and achievements from regional branches to cultivate the interest of potential new members as well as inform all ASAP members of what is being achieved. The Southern NSW branch conducts two seminars per year on topical issues and has found this to be an effective tool in increasing membership through attracting interested stakeholders. At a Federal level this will be assisted through effective communication, including regular newsletters where all branches are encouraged to contribute.

I would like to make special mention of Bill Pattie along with Jackie Kyte and Janine King (JK Connections) who have managed the ASAP membership and kept members informed through the website and distribution of newsletters. This role has now moved to ICMS Australasia, who is the 2014 biennial conference organiser. In 2014, the Federal Council will also host the International Symposium on the Nutrition of Herbivores (ISNH) and International Symposium on Ruminant Physiology (ISRP). This joint meeting will be held at the Canberra Convention and Exhibition Centre, 8–12 September 2014. Please go to <http://www.herbivores2014.com/> for more information and to register your expression of interest.

Finally, the 29th Federal Council commend this special edition of *Animal Production Science* to you as an invaluable record to assist in the continuing improvement of the livestock industries. The Council trusts that you find these peer-reviewed papers, along with the short papers published by our Society in the companion edition of *Animal Production in Australia*, informative and insightful as we all strive towards improving the productivity and profitability of the livestock sector.

Russell Bush
President

Office Bearers 2010–2012

President	Dr Russell Bush
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Presidents of the Society

M. C. Franklin	1954–55	Armidale
D. S. Wishart	1956–57	Melbourne
T. K. Ewer	1958–60	Brisbane
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H. N. Turner	1962–64	Sydney
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I. W. McDonald	1972–74	Sydney
C. H. S. Dolling	1974–76	Adelaide
N. M. Tulloh	1976–78	Melbourne
J. H. Shepherd	1978–80	Perth
D. J. Minson	1980–82	Brisbane
J. L. Corbett	1982–84	Armidale
W. J. Pryor	1984–86	Canberra
G. E. Robards	1986–88	Sydney
J. C. Radcliffe	1988–90	Adelaide
A. R. Egan	1990–92	Melbourne
I. P. Barrett-Lennard	1992–94	Perth
J. H. Temouth	1994–96	Brisbane
C. J. Thwaites	1996–98	Armidale
F. W. Nicholas	1998–00	Sydney
P. I. Hynd	2000–02	Adelaide
A. R. Egan	2002–04	Melbourne
C. M. Oldham	2004–06	Perth
D. P. Poppi	2006–08	Brisbane
R. M. Herd	2008–10	Armidale
R. D. Bush	2010–12	Sydney

Fellows of the Australian Society of Animal Production

Fellows shall be Members who, in the opinion of the Council of the Society, have rendered eminent service to animal production in general or within Australia.

1956	Charles Euston Young	1990	Alan Axelsen James Philip Hogan Trevor William Scott Robert Humphrey Weston
1962	Mervin Clarence Franklin Hedley Ralph Marston		
1964	Phillip Gurner Schinckel	1992	Michael Freer Hugh McLeod Gordon John Ryves Hawker David Roy Lindsay Mary Esther Rose
1966	Helen Newton Tumer		
1968	Keith Valentine Leighton Kesteven Archibald James Vasey Rodger Henry Watson	1994	Russel William Moubray Hodge Keith Johnston Hutchinson James Patrick Langlands Douglas Barrie Purser John Edward Vercoe
1970	Eric John Underwood David Sutcliffe Wishart		
1972	Hector John Lee George Russell Moule	1996	Ronald Alfred Leng John Clive Ratcliffe Frank William Nicholas
1974	Frederick Harold William Morley		
1976	Alan Charles Hassall Lancelot Harnilton Lines Ian Wilbur McDonald Patrick Reginald McMahon	1998	Robert Thomas Cowan David James Farrell Justin Joseph Lynch John Lionel Wheeler
1978	Albert Henry Bishop Victor Gordon Cole Leslie Alfred Downey Reginald John Moir Robert Lovell Reid Wallace Carl Skelsey Percival James Skerman Dudley Martin Smith Neil Tolmie McRae Yeates	2000	Bernard Michael Bindon Barrie John Restall Geoffrey Edward Robards
		2002	Frank Annison John Nolan Barry Norton
1980	Graham Ian Alexander Gordon Lee McClymont Terence James Robinson Derek Edward Tribe	2004	Keith William Entwistle Neil Patrick McMeniman William Anthony Pattie
1982	Sydney John Miller Norman McCall Tulloh Henry Greig Turner William Maxwell Willoughby	2006	Norman Adams Heather Burrow Graham Faichney David Masters David Pethick
1984	William George Alden Robert Henry Hayman James Irwin Faithfull Maple-Brown Jim Harcourt Shepherd	2008	David Blair Coates Hugh Dove Peter Thomas Doyle Adrian Roderic Egan Christopher Morris Oldham
1986	George Alexander Charles Hoani Scott Dolling Ian Lind Johnstone Dennis John Minson William Henry Southcott	2010	Laurie Robert Piper Philip Ian Hynd Dennis Paul Poppi Cyril Richard Stockdale Peter Charles Wynn
1988	John Lovick Corbett Haydn Lloyd Davies Peter Everard Geytenbeek Geoffrey Roger Pearce Laurence Cecil Snook	2012	Wayne Leslie Bryden Geoff Norman Hinch Stuart Ross McLennan Victor Hutton Oddy

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 Hennessey
2006	Anthony (Tony) Schlink
2010	Michael Leo Tierney

The Underwood Lecture

In honour of **Professor E. J. (Eric) 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. MacRea
2006	D. Lindsay and B. Paganoni
2008	G. Atwood
2010	D. Poppi

The 2012 Underwood Lecturer is **Professor Roger Hegarty**

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
2006	J. Scott, T. Coventry and H. Sutherland
2008	W. Winter and P. Doyle
2010	P. Morris

The 2012 McClymont Lecturer is **Professor Wayne Bryden**

The Harry Stobbs Lecture

The 27th Council presented a lecture to honour **Professor H. (Harry) Stobbs**, BSc(Agric), Ph.D. Harry was recognised nationally and internationally for his contributions to our understanding of the plant/animal interaction, particularly his work on understanding grazing behaviour on different sward types in the tropical environment.

The Lecturers have been:

2008	G. Edwards
2010	D. Swain

The 2012 Harry Stobbs Lecturer is **Dr Pablo Gregorini**

The John Barnett Lecture

The 28th Federal Council inaugurated this lecture on animal welfare to honour **Associate Professor J. L. (John) Barnett** (1949–2009), BSc (Zool)(Hons)(Sheffield), PhD (Monash). John was nationally and internationally recognised for his outstanding contributions to stress physiology and stress-related problems of animal welfare. Over 30 years, his research provided a timely balance on discussions within science on the scientific assessment of animal welfare and its interpretations.

The Lecturers have been:

2010	P. Hemsworth
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The 2012 John Barnett Lecturer is **Dr Greg Cronin**

**Wayne Leslie Bryden**

BRurSc (University of New England), DipEd (University of New England), MRurSc (University of New England), PhD (Sydney University)

Wayne Bryden completed a Bachelor (1972) and Master of Rural Science (1978) at the University of New England and a PhD at the University of Sydney, Camden (1983) under the guidance of Professor Frank Annison. He was subsequently appointed as a lecturer in the Department of Animal Husbandry in the University of Sydney and was promoted to Senior Lecturer and Associate Professor. He is currently Foundation Professor of Animal Science at the University of Queensland and prior to that appointment was Pro-Dean of the Faculty of Veterinary Science at the University of Sydney, where he was also Director of the Poultry Research Foundation. He is currently an Honorary Governor of the Foundation and an Adjunct Professor at North Carolina State University, USA. During his time at the University of Sydney and the University of Queensland he has lectured to students in both Agricultural Science and Veterinary Science.

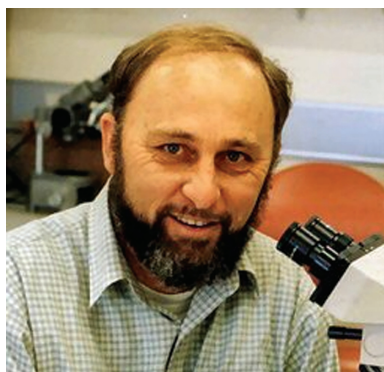
Professor Bryden has published over 500 papers of which 200 appear in international journals or as book chapters and he has supervised some 50 postgraduate students. His current research interests include various aspects of monogastric nutrition, especially feed quality and amino acid metabolism and nutritional toxicology of ruminants. His research on amino acid digestibility and the application of feed enzymes has made a significant contribution to the efficiency of broiler nutrition internationally. The relationship between diet and immunity, and the influence of maternal nutrition on equine foetal development are important areas in which his group is currently working. The impact of feed and forage toxins, especially mycotoxins, on the health and productivity of all farm animals has been an ongoing research theme. He has made significant contributions to

delineating the aetiology of the fatty liver and kidney syndrome in broiler chickens, bovine hyperthermia in beef and dairy cattle, flood plain staggers and Stuart Range tremors in beef cattle, signal grass ill-thrift in beef cattle, and equine amnionitis and foetal loss in pregnant mares.

In 2003 Professor Bryden was awarded the Centenary Medal for his contributions to science and education. He Co-Chaired the Gordon Research Conference on Mycotoxins and Phycotoxins in 2005 and is a member of the WHO Expert Panel on Food Safety. He is a Fellow of the Australian Institute of Agricultural Science and Technology (AIAST) (1998) and the Nutrition Society of Australia (2008). He was the 2009 recipient of the Australian Poultry Award for his contributions to poultry science and the industry.

Wayne Bryden has been a member of the Australian Society of Animal Production (ASAP) since graduation. He has provided long term service to ASAP as a committee member of the Sydney and Queensland branches of ASAP and has been a member of the Federal Council of ASAP (2008–10) and President of the Sydney branch. He is a member of the Nutrition Society of Australia serving as Secretary, Vice President and President of the Society and is currently a member of the executive committee of the Queensland Branch of AIAST. He is currently President of the Australasian Equine Science Society and the Editor-in-Chief of *Animal Production Science*.

For his significant contribution to the animal industries of Australia in research, education and leadership, the Australian Society of Animal Production is pleased to enrol him as a Fellow of the Society.



Geoffrey Norman Hinch

BRurSc (University of New England), PhD (University of New England)

Geoff Hinch came from a rural background, with his parents running a wheat/sheep property in the Riverina area of NSW. Geoff spent his high school years at Wagga Wagga before moving to Armidale (University of New England, UNE) to undertake a Rural Science degree, graduating in 1974. Subsequently, he took on a tutoring role while doing a PhD with Drs John Thwaites and Justin Lynch at UNE, focussing on cattle behaviour and meat quality. He then went to New Zealand (MAF, Invermay) in 1980 to take up a 2-year post-doctoral role where he focussed on lamb survival in high fecundity sheep. He then returned to UNE in 1982, firstly as a postdoc, examining the production impacts of long term selection for increased weaning weight, and then as part of the academic staff of the Animal Science group, where he has maintained an academic portfolio: first and foremost as a teacher of undergraduates, a mentor for postgraduates and a facilitator for researchers. Geoff has successfully retained a role as a generalist, being able to integrate and apply research skills across a broad base of agricultural science knowledge, but has always been active in the area of animal behaviour and reproduction, where he is internationally recognised for his research on management and behaviour and the physiology of maternal/offspring interactions. Major research has covered two primary areas of applied science (animal behaviour and welfare and animal reproduction), but he has also been actively involved in teaching and learning research. Recent research has been focussed mainly through postgraduate supervision and active participation in CRC research programs.

With a strong commitment to education he has provided leadership for a small team dedicated to the application of agricultural systems teaching in the agriculturally related degrees and since 1990 has been a key member of unit and curriculum development. He presently teaches all undergraduate year cohorts in both internal and external modes at UNE and into at least 10 subjects in most years and in 2000 was recognised with an Associate Professorship and in 2010 as a Professor. From 2003–07 he was Head of the School of Rural Science and Agriculture at UNE and during that time maintained and coordinated activities of one of largest and most research active schools at UNE and facilitated UNE links with CRCs, NSW DPI

and CSIRO. More recently in the ‘new’ School of Environmental and Rural Science he fulfils the role of Deputy Head of School (academic) and convenor of the Animal Science discipline.

With a strong dedication to mentoring students Geoff has supervised 47 honours students, 26 Masters students and 25 PhD students and is currently supervising nine students. He retains a considerable time commitment to the education programs for poultry and sheep and is presently committed to behaviour/welfare research components of the Beef, Poultry and Spatial CRC’s and to leadership of the reproduction project of the Australian Sheep CRC where the focus is on a national research program for lamb and weaner survival. He also has an ongoing involvement with international research and development projects being a participant in a number of ACIAR projects most notably ‘Improved productivity, profitability and sustainability of sheep production in Maharashtra, India through genetically enhanced prolificacy, growth and parasite resistance’ that focused on the reproductive management of high fecundity sheep. This involvement reflected a long term career involvement (in high fecundity sheep management). He is presently involved in the development of AusAid funded livestock training programs.

He has published over 200 scientific publications (139 refereed papers, 56 conference papers and 16 book/book chapters) covering diverse areas of animal science and teaching in agriculture. He presently acts as one of the Chief Editors of: *Animal Reproduction Science* and is a regular referee for the *Australasian Journal of Animal Science*, *Animal Production Science*, *Animal and Applied Animal Behaviour Science*. He has maintained consistent membership of Australian Society of Animal Production (since 1974), Australasian Society for the Study of Animal Behaviour and Australian Society for Reproductive Biology with particular involvement as a member of ASAP having served as a local branch committee member (1975–80, 1983–90), as President of the New England Branch (1984), as a member of the National Council (1996–98) and as a Federal Council member for the 28th biennial conference held in 2010. The Australian Society of Animal Production is pleased to enrol him as a Fellow of the Society.

**Stuart Ross McLennan**

BAgricSc (University of Queensland), MSc (James Cook University), PhD (University of New England)

Stu McLennan graduated in 1972 from the University of Queensland, starting his first job at Swans Lagoon Research Station, Ayr and has spent his entire research career in northern Australia investigating the nutrition of beef cattle. He has worked on nearly every beef research station in the north, taking his work to where the problems and conditions required. He did a Masters degree at James Cook University as part of his work at Swans Lagoon (1983) and a PhD at the University of New England (UNE, 1991). He returned to the Animal Research Institute, Brisbane in 1991 and rose to become a Senior Principal Research Scientist within the Queensland Department of Primary Industries. He moved to the EcoScience Precinct and joined the Queensland Alliance of Agriculture and Food Innovation in 2010 and was interim Director of the Centre for Animal Science within that Institute in 2011. He continues to provide leadership for staff and students across northern Australia and maintains an active research program into the nutrition and management of beef cattle in the north. In addition he has been actively involved with ACIAR programs in Indonesia and has supervised postgraduate students from Indonesia and Vietnam as part of his interest in international agricultural research.

Stu's work is characterised by good science, well executed and with a strong focus on practical and industry relevant issues. He was involved in the development of many of the supplement mixes based on urea that are used widely across the north. Stu did some of the first work on the behaviour of cattle at supplement stations and on the use of stylo and its maintenance within pasture-based systems. He was able to pursue more in-depth studies in his PhD at UNE and his work on feeding molasses to cattle examined rumen digestion and metabolism in great depth with respect to the role of lipids in high molasses-based diets. On his return to Queensland he set up a series of supplement experiments which reflected his attention to detail and his insightful view of doing practical research, but with a clear vision of scientific principles. As a consequence this work provides a unique data set being used by many people around the world to

examine the response of animals to supplements and to assess the various international feeding standards. His most recent work on growth paths provides practical advice to producers on how to meet various targets, but at the same time has scientifically outlined key biological phenomena that control the response. One significant example of his wider interests has been his collaborative work on sorghum ergot and its effects on animals.

He has published work at many Australian Society of Animal Production conferences and at many international meetings. Most recently he has been invited to present work in the USA and Brazil at key meetings on the nutritional basis of the response to supplements and the modification of the international feeding standards. He has published 80 scientific and conference papers. However, he has always participated in producer forums and field days and has been invited to speak at every North Australia Beef Research Update Conference and at several BeefUp forums from the Pilbara to the east coast of Queensland because he is a good communicator, always has something relevant to say and has very professional presentations. He was one of the early developers of the Nutrition Edge program for extension staff and producers. Stu is frequently invited to workshops of scientists or producers setting research agendas for the north. He is a member of the committee hosting the 2014 International Workshop on Modelling Nutrition and Metabolism of Farm Animals.

Stu has been actively involved in the Australian Society of Animal Production being a member since 1973, serving on the Queensland committee since 1991, as Queensland President (1993–95), Federal Council member (1994–96) and Federal Treasurer (2006–08). His clear vision and administration has served the Society well. For his role in advancing animal production in northern Australia, his long and involved role in the Australian Society of Animal Production and his contribution to scientific leadership, the Australian Society of Animal Production is pleased to nominate him as a Fellow of the Australian Society of Animal Production.

**Victor Hutton Oddy**

BSc (University of NSW), MScAgr (University of Sydney), PhD (University of Cambridge)

Hutton Oddy was born in Deniliquin, NSW, where his family had a long association with the livestock and wool industries. He began his animal production career with CSIRO in their Prospect laboratories in 1967. He was employed as a Technical Assistant under Dr John Hemsley and then Dr Graeme Faichney, where he learned the fundamentals of ruminant nutrition and physiology. Not content with being a technician, he undertook part-time study at the University of NSW. In 1972, he took up a position as Chemist with the NSW Department of Agriculture in the Drought Research Unit at Glenfield. During this time Hutton developed a drought feeding manual for sheep and cattle based on the metabolisable energy system. This publication became the bible for drought feeding management strategies in Australia. He completed a Masters in Agricultural Science at the University of Sydney under Professor Frank Annison, with whom he continued a productive collaboration. Always asking questions, his enquiring mind took him to further post-graduate study under Professor Derek Lindsay at the Institute of Animal Physiology at Babraham, near Cambridge, UK. His thesis was titled 'Muscle protein metabolism: measurement and manipulation in lambs'.

His scientific interests have mainly involved aspects of biochemistry and physiology of growth and development, with practical diversions into feed evaluation, effect of nutrition on carcass composition in sheep and cattle, modelling physiological

processes involved in these and more recently, genomics. Hutton was Deputy Director and leader of the Growth and Nutrition Program in Beef CRC I and II, before moving into a position with MLA as a research manager. There he developed and implemented three major research and development investments by MLA – the Southern Beef Program, a Strategic Science Program and the Sheep Genomics Program. He was Inaugural Director of sheep GENOMICS and established the International Sheep Genomics Consortium (ISGC). In 2006, he returned to Armidale as a Senior Research Fellow with the University of New England. Hutton recently re-joined the NSW Department of Primary Industries as a Principal Research Scientist leading research into mitigating methane emissions from ruminants.

Hutton has supervised 11 PhD, four Masters students and at least three Honours students. He has published 76 refereed papers, invited reviews and theses, 110 conference papers and numerous industry plans and reports. Hutton's first publication in ASAP (1976) was on rumen epithelial changes of lambs fed high grain diets and their effect on liveweight. Since then he has been a regular attendee and contributor at ASAP conferences and has been a member of the Sydney and New England branches. He served as a Federal Council member of the 2009–10 biennial conference and is currently the President of the New England Branch. The Australian Society of Animal Production is pleased to enrol him as a Fellow of the Society.