

ANIMAL PRODUCTION IN AUSTRALIA

Proceedings of the Australian Society of Animal Production

Volume 32

Fostering innovation through the value chain

32nd Biennial Conference

Guest Editors: Michael Friend, Sue Hatcher, David Hopkins, Phil Hynd

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The criteria for acceptance of papers are that the material is of interest to members and industry, has some innovation 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

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Citation of Papers

These papers were presented at the 32nd biennial conference of the Australian Society of Animal Production (ASAP) held at Charles Sturt University, Wagga Wagga, Australia (2–4 July 2018).

Invited Plenary and four-page papers are published in a special issue of Volume 58 of *Animal Production Science*. The one-page papers are published online only as an accessory publication to the special issue of the Proceedings of the 32nd Biennial Conference of the Australian Society of Animal Production.

Papers should be cited as:

Animal Production Science, **58** (followed by the page numbers).

or in the abbreviated form:

Anim. Prod. Sci. **58** (followed by the page numbers).

Welcome from the Australian Society of Animal Production President

Is ASAP still relevant as an organisation?

I ask this question as we enter ASAP's 64th year as a society and as it heads towards its 32nd Biennial Conference. In an age of competing demands for our time and financial constraints on individuals and institutions it is critical that we invest in activities that provide value for time and money. Does ASAP deliver this? For probably 30 years from the 50s to the 80s ASAP was THE forum at state and national level that brought together those with a stake in animal production at all levels. It was aimed at *all production species* and *all disciplines*, and could be described as 'systems-based' and 'paddock-to-plate' in today's parlance. DS Wishart noted in the Presidential Address in 1954 that 'the value of our activities has been considerably enhanced by our unique range of membership, from producers to research workers'. For many young people in animal agriculture (like myself at the time!) it provided an opportunity to network with the key folks in animal production; exposed us to the 'gurus' of the time (Fred Morley, Reg Moir, Graham Faichney, Bob Weston, Jim Hogan, Helen Newton Turner, George Alexander, Dennis Minson and many others), and made us aware that our research and development must be squarely focused on application of our work by producers. Indeed the involvement of producers was a key feature of conferences and activities at the branch level. Branches were very active and held regular and frequent meetings/forums/field days and the like.

The 80s were characterised by a splintering of the Society into discipline groups that catered particularly for research scientists whose motivation and progression was enhanced by limiting their involvement to discipline-specific conferences and to publication in high-impact factor (i.e. not read by anyone but those in the discipline!) journals. At the same time the different animal species groups hived off into single-species societies. This took place at a time when the gene revolution took place and great scientific emphasis was placed on the development of molecular biology solutions to animal production problems, which directed funding away from broader, systems-based disciplines. It also led to a tendency for the single-species folks to become trapped in a 'more-of-the-same' thinking because they only talked to themselves and weren't exposed to technologies being developed in other species.

It is time to reinvent ASAP along the following lines:

- Focus on all production animal species to ensure idea and technology swapping
- Focus on application of real-world animal production systems and value chains
- Focus on young people in animal production in all sectors of the industry
- Provide better value for members by instigating an Executive Office to coordinate interaction with other societies (AARN, Grasslands, AAABG, APSA, APSS, ASAS, EAAS, World Society etc.); coordinate branch activities and share articles/information between branches; coordinate opportunities for students to travel interstate and overseas; provide a point of contact for funders of animal research and so on. A robust financial model needs to be developed perhaps in conjunction with other societies.

The 32nd Biennial Conference is clearly focused on the objectives of the founders of our society in the 1950s, and this is reflected in the breadth and depth of papers being presented at this important conference.

I look forward to seeing you in Wagga!

Professor Phil Hynd
Deputy Head School of Animal and Veterinary Sciences
The University of Adelaide

Welcome from the Animal Production 2018 Conference Chair

Our theme for the 32nd conference is ‘Fostering Innovation through the value chain’, and for the first time in the history of ASAP we welcome the Biennial Conference to Wagga Wagga. The Organising Committee agreed on the theme because to realise benefits for our animal production industries we need to support innovation not only on-farm, but right through the supply chain. The potential for innovations in our animal industries has never been greater, with the growth in new technologies such as gene editing, fetal and microbiome programming, individual animal monitoring and management, and methods of better quantifying product value. Combined with the increased availability of ‘big data’ and methods to extract valuable information from this, advances in other industries with application to livestock industries, and an increased willingness to adopt innovations by stakeholders along the value chain, our industries are well poised to capture the benefits afforded by innovation.

The conference seeks to provide opportunity to discuss the latest in innovations across our livestock industries. The conference is unique in that it is the only multi-species conference in Australia, providing a rich opportunity to learn from each other. The full papers in this special issue include keynote papers from our invited speakers, and invited papers selected from submitted abstracts. These are complemented by contributed one-page papers and together form a volume that addresses innovation across the industries and throughout the value chain, covering themes including animal welfare, nutritional and reproductive management, genetics, meat science, precision livestock management, use of big data and changing consumer demand. A large number of papers have been contributed by the next generation of innovators – our students, and ASAP will continue to seek ways to provide opportunities for them to shine.

It is my hope that this special issue will be a valuable resource for years to come, and that the conference will result in outcomes of benefit to the industries ASAP serves.

Professor Michael Friend
Director, Graham Centre for Agricultural Innovation
(An alliance between Charles Sturt University and
NSW Department of Primary Industries)

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D. S. Wishart	1956–57	Melbourne
T. K. Ewer	1958–60	Brisbane
H. J. Lee	1960–62	Adelaide
H. N. Turner	1962–64	Sydney
R. H. Watson	1964–66	Melbourne
N. T. M. Yeates	1966–68	Armidale
G. I. Alexander	1968–70	Brisbane
F. H. W. Morley	1970–72	Canberra
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
R. D. Bush	2012–14	Sydney
P. I. Hynd	2014–16	Adelaide
P. I. Hynd	2016–18	Adelaide

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	1992	Michael Freer Hugh McLeod Gordon John Ryves Hawker David Roy Lindsay Mary Esther Rose
1962	Mervin Clarence Franklin Hedley Ralph Marston		
1964	Phillip Gurner Schinckel	1994	Russel William Moubray Hodge Keith Johnston Hutchinson James Patrick Langlands Douglas Barrie Purser John Edward Vercoe
1966	Helen Newton Tumer		
1968	Keith Valentine Leighton Kesteven Archibald James Vasey Rodger Henry Watson	1996	Ronald Alfred Leng John Clive Ratcliffe Frank William Nicholas
1970	Eric John Underwood David Sutcliffe Wishart	1998	Robert Thomas Cowan David James Farrell Justin Joseph Lynch John Lionel Wheeler
1972	Hector John Lee George Russell Moule		
1974	Frederick Harold William Morley	2000	Bernard Michael Bindon Barrie John Restall Geoffrey Edward Robards
1976	Alan Charles Hassall Lancelot Harnilton Lines Ian Wilbur McDonald Patrick Reginald McMahon	2002	Frank Annison John Nolan Barry Norton
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	2004	Keith William Entwistle Neil Patrick McMeniman William Anthony Pattie
1980	Graham Ian Alexander Gordon Lee McClymont Terence James Robinson Derek Edward Tribe	2006	Norman Adams Heather Burrow Graham Faichney David Masters David Pethick
1982	Sydney John Miller Norman McCall Tulloh Henry Greig Turner William Maxwell Willoughby	2008	David Blair Coates Hugh Dove Peter Thomas Doyle Adrian Roderic Egan Christopher Morris Oldham
1984	William George Allden Robert Henry Hayman James Irwin Faithfull Maple-Brown Jim Harcourt Shepherd	2010	Laurie Robert Piper Philip Ian Hynd Dennis Paul Poppi Cyril Richard Stockdale Peter Charles Wynn
1986	George Alexander Charles Hoani Scott Dolling Ian Lind Johnstone Dennis John Minson William Henry Southcott	2012	Wayne Leslie Bryden Geoff Norman Hinch Stuart Ross McLennan Victor Hutton Oddy
1988	John Lovick Corbett Haydn Lloyd Davies Peter Everard Geytenbeek Geoffrey Roger Pearce Laurence Cecil Snook	2014	Frank Rowland Dunshea Robert Maxwell Herd
		2016	Alan William Bell John Langtree Black Robert Menzies Dixon
1990	Alan Axelsen James Philip Hogan Trevor William Scott Robert Humphrey Weston	2018	Bruce Lipson Hancock Sue Faye Hatcher David Lawrence Hopkins Athol Victor Klieve Christopher Simon McSweeney

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 Barnett
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	J. C. MacRea
2006	D. Lindsay and B. Paganoni
2008	G. Atwood
2010	D. P. Poppi
2012	R. S. Hegarty
2014	J. L. Jacobs
2016	J. L. Black

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 (1955–1976) 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	T. G. Reeves
2006	J. Scott, T. Coventry and H. Sutherland
2008	W. H. Winter and P. T. Doyle
2010	P. Morris
2012	W. L. Bryden
2014	P. L. Greenwood and A. W. Bell
2016	H. Dove

The Harry Stobbs Lecture

The 27th Council presented a lecture to honour **Professor H. (Harry) Stobbs**, BSc(Agric), PhD. 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
2012	P. Gregorini
2014	D. Pacheco
2016	A. de Vega

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. H. Hemsworth
2012	G. M. Cronin, J. L. Barnett and P. H. Hemsworth
2014	I. Veissier and M. Miele
2016	A. J. Tilbrook and C. R. Ralph

Fellows elected 2016



Alan William Bell

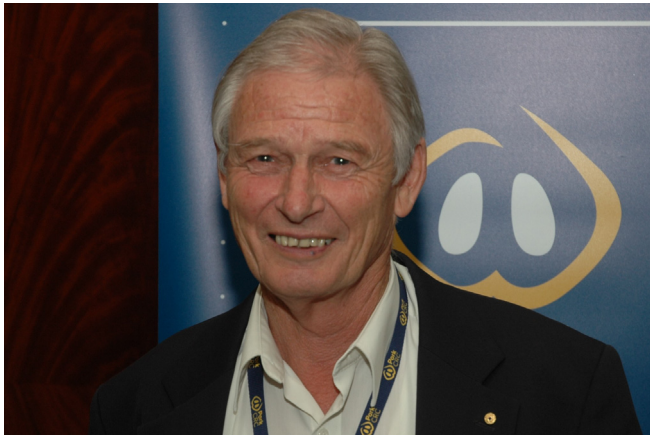
BRurSc (Hons) (University of New England), PhD (University of Glasgow)

Alan Bell grew up on a dairy and beef farm in South Gippsland, Victoria. He graduated with a first-class honour in Rural Science from the University of New England in 1969. After working with the CSIRO Division of Animal Physiology at Prospect he moved to Scotland and undertook PhD studies at the Hannah Research Institute, graduating from the University of Glasgow in 1976. He returned to Australia to lecture at La Trobe University. Alan then went to Cornell University in 1985 and rose up the ranks to be Department Chair of Animal Science from 1997–2007. He returned to Australia in 2007 to progressively take up the roles of Chief of CSIRO Livestock Industries, Interim Chief CSIRO Food and Nutritional Sciences and Interim CEO Food Science Australia. These positions are testament to his leadership qualities as many of them were undertaken in challenging times of continuous change. Alan brought honesty and vision to these roles, always arguing for good science with the result that staff respected and followed him.

Alan's great contribution to science has been through his own research and leadership. His own work has been outstanding and he is internationally recognised for his research on the nutritional physiology of pregnancy, lactation and growth in sheep and dairy cattle. He has published more than 150 peer-reviewed original papers and reviews with a total of over 5000 citations. His research has been directed towards the physiology of the animal at a basic level but addressing issues of practical importance to the dairy, sheep and beef industries. The breadth of his work is outstanding and his papers are key references in each field with extensive citations indicating his impact in science and the ground-breaking nature of his research.

Alan has made major contributions to professional organisations within Australia and the USA. He had many positions on committees within Cornell University in addition to his role as Chair of the Department of Animal Science. Alan held senior professional roles with the American Institute of Nutrition (1994–1997), the American Society of Animal Science (1999–2002), the organising committee of the X International Symposium on Ruminant Physiology (1999–2004), the Council for Agricultural Science and Technology (CAST) and the organising committee of the VIII International Workshop on Modelling Nutrient Digestion and Utilisation in Farm Animals (2014). Within Australia he has provided leadership and measured advice to the Food and Nutrition Steering Committee, the National Primary Industries RD&E Framework (2008–2009), the PISC Industry Development Committee (2008–2012), the MLA Environmental Science Advisory Committee (2008–2010), the Australian Animal Welfare Strategy Research and Development Working Group (2012–2013), the Whole Farm Systems Analysis for Greenhouse Gas Abatement Options for the Southern Australian Grazing Industries Investors Steering Group (2012–2015; Chair) and the Sheep CRC Board Selection Committee (2014–present).

Alan has made a major contribution through his own research to animal science and the animal production industries and he has made equally important contributions in his leadership of organisations and committees, both national and international. Since returning to Australia he has made a major contribution in leadership and direction of the Australian animal industries. For these reasons the Australian Society of Animal Production is pleased to enrol Professor Alan Bell as a Fellow of the Society.



John Langtree Black

AM; BAgrSc (Hons) (University of Melbourne), Dip Ed (University of Melbourne), PhD (University of Melbourne); FAIAST; FTSE

John Black completed a Bachelor of Agricultural Science with first-class honours in 1964, a Diploma of Education in 1965 and a PhD in 1971 at the University of Melbourne. In 1970 he was a temporary lecturer in the Department of Animal Husbandry at Melbourne University followed by a CSIRO Postdoctoral fellowship at the National Institute for Research in Dairying at Reading, UK. Between 1971 and 1996 John was a Research Scientist in the CSIRO Division of Animal Production and during that period he undertook many roles including Program Leader for the Quantitative Biology Program, Chief Research Scientist, Assistant Chief and Officer-In-Charge of the Prospect Laboratory and Acting Chief of Division. In 1996 he formed John L. Black Consulting, a research consultancy company of which he is Director.

John's work has spanned a wide range of disciplines and animal species. He has led teams to develop a mechanistic computer simulation model, new experimental techniques and theories to identify factors determining diet selection and intake in sheep and pigs, and completion and commercialisation of the AUSPIG Decision Support Software. The latter has resulted in a NPV for Australia of \$40m and benefit:cost ratio of 16:1. His research on protein and energy requirements of ruminants utilising a novel, complete synthetic feeding system, led to the first determination of true amino acid requirements for wool and body growth. He pioneered computer simulations of sheep nutrition, amino acid and energy utilisation in pigs, and impacts of environmental stresses (high temperatures and disease) on physiological responses in pigs. Recently he has jointly developed an artificial pollen for Australian honeybees.

John has published some 250 scientific publications, including 51 refereed journal papers, 54 book chapters, 58 refereed conference papers, 47 conference abstracts and 24 industry publications. He has been invited to speak at more than 40 national meetings and 40 international meetings.

John has received numerous awards for his outstanding work, including being made a Member of the General Division of the Order of Australia (AM), the Urrbrae Memorial Award, the Centenary Medal of Australia, the American Medal of Honor for contribution to Animal Science, and he was elected amongst the 2000 Outstanding Scientists of the 21st Century. He has been elected a Fellow of the Australian Institute of Agricultural Science and Technology, and is an elected Fellow of the Australian Academy of Technological Sciences and Engineering. John has contributed substantially to the Australian Society of Animal Production having served as a member of the Federal Council from 1972–1974, as committee member of the NSW branch from 1975–1979, as President of the NSW Branch in 1978, and as a member of the Federal Council from 1986–1988. He was national Secretary of the Nutrition Society from 1977–1979.

For his outstanding contribution to animal science and production, the Australian Society of Animal Production is pleased to enrol Professor John Black as a Fellow of the Society.

The papers presented at a Festschrift in honour of Professor John L. Black AM appeared as a special issue of Animal Production Science Volume 58(4), 2018.

**Robert Menzies Dixon**

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

Rob Dixon completed a PhD (1979) in ruminant nutrition at The University of New England with Professor John Nolan and Professor Ron Leng. After a postdoctoral position at the University of Alberta, Canada, Rob took up a position as an Assistant Professor at the Central University of Venezuela where he established a ruminant physiology laboratory and research group. Rob returned to Australia in 1983 to the University of Melbourne, and in 1992 moved to Swans Lagoon in the Burdekin region of North Queensland as a Senior Research Scientist in the Queensland Department of Primary Industries. Rob's research since that time has focused on development and application of improved technologies and knowledge of nutrition and production systems for grazing cattle in the extensive rangelands of northern Australia. He rose to Principal Research Scientist, relocating within the Department to Rockhampton in 2002 and then in 2010 joining the Queensland Alliance of Agriculture and Food Innovation (University of Queensland) while continuing to be based in Rockhampton. Rob is also an Adjunct Associate Professor at Central Queensland University.

For more than four decades Rob has made significant scientific contributions in the fields of ruminant physiology and nutrition particularly in relation to nutrition management in extensive pastoral systems in the tropics and sub-tropics. His early studies included nitrogen metabolism in sheep and cattle and the capacity for endogenous salvage mechanisms to reduce dietary protein requirements, and the control and manipulation of digesta passage through the gastrointestinal tract. Research in Venezuela and Melbourne focused on interactions in rumen digestion of forages and concentrates, the consequences for rumen efficiency and animal production, and the prediction of responses of young growing sheep to various classes of supplements to increase efficiencies in the use of inputs of low-cost forages and/or high-cost concentrates. Rob has also made a major commitment to the development and improvement of ruminant nutrition and ruminant production in developing countries, including 3 years managing the AAFARR network in Southern Asia, and involvement in projects (FAO, IAEA, local funding) in Latin America and Africa.

Since relocating to north Queensland, Rob has played lead roles in research of the nutritional management of the breeder cow for survival and productivity and for the efficiency of delivery systems to provide supplements to rangeland cattle. Rob is well known for his flair for integrating research outcomes across different disciplines to provide practical management solutions for improved livestock production and efficiency, including economic considerations. A good example is how he has integrated his work on the principles of supplementation, particularly with N and P, with faecal NIRS technology to develop practical and economic management systems that can be applied in the commercial cattle industry.

Rob's focus has always been to use good science to develop practical solutions to industry problems. He has had a major influence on beef extension in Queensland through his willingness to engage with industry and extension officers, and nurture and train younger researchers. His work on breeder nutrition and management has played a critical role in the development and implementation of the breeder management systems used in northern Australia. He is a regular presenter at field days, workshops and conferences at the national and international level. He has published 145 scientific papers (60 journal papers, 85 conference papers) and a number of major reviews. Rob has edited three books of conference proceedings and was a major contributor to the recent updated book for cattle producers on phosphorus nutrition of cattle. He has held editorial positions with several journals including *Animal Production Science*, and has been a reviewer for numerous papers across a range of animal science journals. He was a Queensland International Fellow (2012–2014). Rob has been a member of the Australian Society of Animal Production (ASAP) since graduation, and provided service to ASAP as a committee member and Treasurer for the Victorian branch while at the University of Melbourne.

For his role in advancing animal production in northern Australia, and his contribution to scientific leadership and ASAP, the Australian Society of Animal Production is pleased to enrol Dr Robert Dixon as a Fellow of the Society.

Fellows elected 2018



Bruce Lipson Hancock

Dip AppSc (Agr) (Roseworthy)

After growing up on a farm in southeast South Australia, Bruce graduated with a Diploma in Applied Science (Agriculture) from Roseworthy Agricultural College in 1979. He subsequently completed training in AUS-MEAT assessment (1998) and a Certificate IV in Assessment and Workplace Training (2002). After Roseworthy, Bruce joined the SA Department of Agriculture (now Rural Solutions SA within Primary Industries and Regions) specialising in livestock with a focus on dairy and pastures before his extremely fruitful time in the lamb industry.

Bruce is currently the National Supply Chain Coordinator for Meat and Livestock Australia (MLA), Sheep CRC and Advanced Livestock Measurement Technologies program. This involves coordinating meetings with a range of MLA managers, red meat processors and scientists. It also involves targeted meetings within supply chains to ensure effective delivery of technologies to improve meat yield and eating quality. Bruce has also delivered numerous producer workshops across southern Australia and is a sought after facilitator. Moreover, he has assisted the industry internationally through three missions in the Middle East (Iraq 1983–1985, Jordan 1990–1991 and Palestine 1999), and by developing and coordinating the Iraq short course in Livestock Reproduction Technologies for 26 trainees in Australia (2008).

Bruce is absolutely committed to developing our livestock industries and especially developing young people. He relentlessly sends reminders to colleagues challenging them to think about linking more closely with industry and providing opportunities for young people. He has a long list of people in industry where he sends job opportunities and other information that they may benefit from. Bruce was a big part of the 2016 ASAP committee success in attracting sponsorship and focussing on development of junior scientists. Bruce was a huge driver of the SA LambEx in 2014 and then after it was successful, rather than accept pats on the back, he challenged the SA industry to build further. This led to the development of the SA Sheep Industry Blueprint, and partnership with Davies Research Centre at the University of Adelaide. This has become part of SAMRC and the SA Beef Industry Blueprint.

Bruce's input into the Australian Society of Animal Production and livestock industries is legendary due to his relentless drive for the application of the latest advances in technology and the upskilling of those working in the industry. It is for these contributions to the livestock industries in Australia that the Australian Society of Animal Production is pleased to enrol Bruce Hancock as a Fellow.



Sue Faye Hatcher

BSc (Agric) (Hons) (University of Western Australia), PhD (University of Western Australia)

Sue Hatcher commenced studying agricultural science at the University of Western Australia with the aim of gaining knowledge that would enable her to improve the productivity of sheep. After graduating with Honours in 1989, she undertook a PhD on the potential of Awassi sheep and their crosses to cause wool fibre contamination. She then worked as an extension specialist with the Woolmark Company based in Fremantle. During this time, she made the most of opportunities to involve herself in early stage wool processing and mill operation.

Her commitment to on-farm research led her to accept a position in 1997 with NSW Agriculture in Orange to specialise in Merino breeding. In this position, Sue focused her research on genetic selection for wool traits, which influence the processing efficiency of the fleece, and sheep productivity and welfare. More recently, she has investigated aspects of breeding ewe management including both lamb and weaner survival and the consequences of selecting sheep for high wool production. Sue has led NSW DPI's involvement in the development of the national Merino Ewe Lifetime Productivity project. She was also a member of the Steering Committee for the development of the national PISC Wool RD&E Plan. Her research has led to the publication of 28 papers in high impact journals and over 40 full conference papers, many of which have been presented at applied scientific meetings targeting the woolgrowers of Australia. She has supervised Masters and PhD students from the University of New England and Deakin University. It was therefore not surprising that Sue rose rapidly through the research ranks of the NSW DPI to Principal Research Scientist.

During this time, Sue has made significant contributions to the Australian Sheep CRC program, in leading the Wool Biology project, which included the genetic analysis of the wool production and quality data from the Sheep CRC's Information Nucleus. She also led the 'Applications of Nutrient Partitioning' project in the CRC that increased understanding of the partitioning of nutrients between wool, meat production

and reproduction in Merino sheep. The development of management options to improve the whiteness and handle of Australian Merino wool and correlations with reproductive performance were also important aspects of this program. Her research outcomes have made an important contribution to the development of precision sheep production systems throughout Australia.

While Sue has made important contribution to the scientific literature, it is Sue's determination to ensure her experimental findings are translated into extension messages for the Merino wool growers of Australia that has been a major part of her career legacy. She was responsible for the development of two industry training programs; *Merino Breeding: A Commercial Focus*, developed in 1999, and *Keeping Productive Older Ewes* in 2012. She also led the publication of two important newsletter series 'Finewool Outwest' (1997–2000) and 'NSW Lifetime Wool' (2005–2008) both of which were distributed nationally. Demonstrating her commitment to extension, Sue was an integral member of the team that won the CRC Star Award in 2014 for high-level engagement with small and medium size businesses through the success of the Managing Scanned Ewes program; importantly she was also a part of the RamSelect team that won the award for Excellence in Innovation.

Sue has served in many editorial capacities with literature targeting farmers at branch member meetings within NSW through to the editing of the Biennial proceedings of the Society. This has extended to her role as Associate Editor of *Animal Production Science*. Sue has also acted as branch Treasurer of ASAP for many years and as National Treasurer for the years leading up to the 2014 and 2018 conferences.

In recognition of Sue Hatcher's contribution to the economic viability of the Australian sheep industry through research and extension leadership, and her unwavering support ASAP, the Australian Society of Animal Production is pleased to enrol her as a Fellow of the Society.



David Lawrence Hopkins

BAgrSc (University of Melbourne), MAgrSc (University of Melbourne), PhD (University of New England) GradDipDiv (Morling College)

David Hopkins has translated his genuine, respectful and inquisitive ethos into an exceptional career. Growing up in southwest Victoria, David learnt to shear, support the Carlton Football Club and the joys of motorcycling. He completed a Bachelor of Agricultural Science (1982) and a Masters of Agricultural Science (1985) at the University of Melbourne. He then accepted a position with the Tasmanian Department of Agriculture where, over the next six years David established himself professionally and became instrumental to the state, and nation's meat research capability. In 1991, David accepted a newly created role as the NSW Department of Primary Industries (NSW DPI) resident meat scientist. David balanced work and study, receiving his PhD from the University of New England (2001) on biochemical mechanisms of meat tenderisation; a Graduate Diploma in Divinity from Morling College (2012); and distinction as a Senior Principal Research Scientist within NSW DPI.

David has published more than 500 scientific journal papers, chapters and technical/extension papers, and collaborated broadly to address industry issues. His research includes work on sheep carcass yield and consistency of quality; novel processing methods and device validation; and, the preservation and prediction of consumer appeal. David has an ongoing interest in understanding meat tenderness and this has resulted in many practical innovations – for example VIASCAN®, new generation electric stimulation, SMARTSHAPE™, amongst many technologies designed for objective carcass evaluation. His expertise in tenderness is exemplified by the requests to author *The Eating Quality of Meat: II-Tenderness* in 'Lawrie's Meat Science 8th edition' and each of the *Electrical*

Stimulation, *Chemical* and *Mechanical* tenderisation entries in the 'Encyclopedia of Meat Sciences 2nd edition' – books widely considered as the Bible(s) of meat science. David's academic status also prompted his appointment as an Associate Editor of *Animal Production Science* and the *International Journal of Sheep and Wool Science*; Editorial Board Member of *Recent Patents on Food, Nutrition & Agriculture*, and *Agriculture*; and the first Australian Editor-in-Chief of the international journal *Meat Science*.

David has always proven generous with his time and experience, whether discussing practical opportunities and solutions with industry stakeholders or presenting a keynote address at a scientific conference. Moreover, 'Hoppy' is an active mentor, supervisor and friend for post-graduate students, his research team members, and visiting or junior scientists alike, and from around the globe. These actions have merited formal recognition with David an Adjunct Professor at Charles Sturt University, University of New England and Shandong Agricultural University (China). He is also as one of few Distinguished Professors of the Chinese Academy of Agricultural Science. David's commitment to high professional standards resulted in his receipt of the Rotary Vocational Excellence Award (2012). David has been a member of ASAP since his student days, most recently playing an integral role in the organisation of the 2014 and 2018 conferences.

David has made a significant contribution to the future security of Australia's red meat sector and is an inspiration to others. In recognition of his success, the Australian Society of Animal Production is pleased to enrol David Hopkins as a Fellow of the Society.

**Athol Victor Klieve**

BAgrSc (University of Adelaide), MRurSc (University of New England), PhD (University of New England)

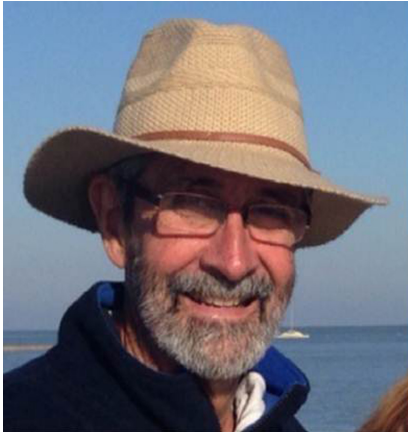
Dr Athol Klieve graduated from the University of Adelaide in Agricultural Science in 1981, a Master of Rural Science (University of New England; UNE) in poultry viruses and vaccines in 1986, and a PhD (UNE) in rumen bacteriophages in 1989. He completed a postdoc at UNE on genetic manipulation of rumen bacteria before joining the Queensland Government (Department of Agriculture and Fisheries; DAF) as a senior research scientist in 1993. Athol joined the University of Queensland in 2009 in a joint appointment with DAF, and is currently Associate Professor at the University of Queensland in the School of Agriculture and Food Sciences and the Queensland Alliance for Agriculture and Food Innovation. He has worked with organisations such as the International Atomic Energy Agency, the Australian Greenhouse Office, and the Organisation for Economic Cooperation and Development. Currently he leads the joint microbiology team within UQ and the Queensland Government.

Athol has made a major contribution to rumen microbiology with his work on methane production, bacteriophages, probiotics

and the microbial degradation of mimosine in ruminants fed leucaena. His research has also extended to a study of microbes in marsupials and dugong. He was the Director of the Queensland Enteric Methane Hub 2010–2014, and a member of the Beef CRC and the Australian Tropical Dairy Institute. Athol has been an editor and reviewer for a number of major international journals. He has published 66 journal articles, and 49 books, book chapters, reviews and full conference papers, 110 conference abstracts and 30 major reports. He coordinates and lectures into a number of courses within UQ in microbiology and has supervised 28 postgraduate students.

Athol has contributed to the Society as a committee member of the Queensland branch since 1995, branch secretary 1995–1997 and he was a member of the Federal Council in 2006–2008. He is also a member of the Australian Society of Microbiology.

For his contribution to research and leadership in the field of rumen microbiology, the Australian Society of Animal Production is pleased to enrol Athol Klieve as a Fellow of the Society.

**Christopher Simon McSweeney**

BVSc (Hons) (University of Queensland), PhD (University of Queensland)

Dr Christopher McSweeney graduated from the University of Queensland with an Honours degree in Veterinary Science in 1976, and then practiced privately as a veterinarian. He subsequently completed a PhD at the University of Queensland in 1982 for his research on the gastrointestinal toxicology of lantana in ruminants. He then joined CSIRO, initially in Townsville and then in Brisbane where he undertook research on the major nutritional problems faced by the northern Australian cattle industry including mineral and nitrogen deficiencies, indigestibility of plant fibre, poor reproductive performance of cows, and toxic plants.

Chris was a Visiting Research Scholar in gut microbiology at the University of Illinois in 1989 and on returning to Australia, he set up an anaerobic microbiology laboratory at CSIRO in Brisbane. This facilitated the study of recombinant bacteria with enhanced capacity for rumen digestion. In 2001, Chris spent time at Ohio State University to study the functional genomics of fibrolytic rumen bacteria under the Australian Academy of Science's international exchange program. Since then he has been a stream and/or group leader of research teams with capabilities embracing gastrointestinal microbiology and the metagenomics of gut microbiota in both livestock and humans. He is currently a Chief Research Scientist with CSIRO.

Throughout his career, Chris has maintained an interest in ruminant toxicology with projects that have continued to provide new strategies for the management of leucaena feeding systems and a focus on plants, especially the Heart-leaf bush

that are responsible for fluoroacetate intoxication of livestock. The identification of rumen bacteria capable of degrading fluoroacetate is a significant step in solving this problem by adapting the rumen microbiome to be resilient to this toxin. In addition to his current focus on gastrointestinal microbiology and metagenomics, Chris has started work on behavioral, digestive and metabolic factors that underpin feed conversion efficiency in ruminant livestock with an aim to identify phenotypic markers for the trait.

Chris has published more than 230 peer-reviewed publications and in the last five years, he has published more than 60 peer-reviewed papers, 17 invited reviews/book chapters, 35 conference papers and presented invited papers at several international conferences. His academic standing has resulted in his appointment as an Adjunct Professor at the University of Queensland, and RMIT University, Melbourne. He is also a visiting Professor at Zhejiang University in China and a reviewer for major international journals. Since graduation Chris has been a member of the Queensland Branch of the Australian Society of Animal Production, a member of the Queensland committee since 1989, and a member of the Federal Council in 2006–2008.

In recognition of Christopher McSweeney's contribution to the ruminant industries in Australia through research leadership in rumen microbiology and metagenomics, and his ongoing support of ASAP, the Australian Society of Animal Production is pleased to enrol him as a Fellow of the Society.

Keynote Speakers and Memorial Lectures 2018

Professor Paul Hemsworth, The University of Melbourne

Barnett Memorial Lecture: Key determinants of pig welfare: implications of animal management and housing design on livestock welfare. (pp. 1375–1386)

Professor Wendy Umberger, The University of Adelaide

Demand for animal welfare and ethical attributes in meat: what do consumers really value?

Professor Joao (Joe) Vendramini, University of Florida – IFAS

Stobbs Memorial Lecture: Forage management and concentrate supplementation effects on performance of beef calves. (pp. 1399–1403)

Dr Jay Johnson, United States Department of Agriculture – Agricultural Research Service

Heat stress: impact on livestock well-being and productivity and mitigation strategies to alleviate the negative effects. (pp. 1404–1413)

Dr Stuart Wilkinson, Feedworks

Big data for monogastrics – what is possible? (p. cxxi)

Dr Anthony Clark, NSW DPI

New agricultural technologies – implications for applied livestock systems modelling. (p. cxx)

Professor Fred Provenza, Utah State University, Logan

McClymont Memorial Lecture: Palates link soil and plants with herbivores and humans. (pp. 1432–1437)

Dr Dave Masters, University of Western Australia

Underwood Memorial Lecture: Practical implications of mineral and vitamin imbalance in grazing sheep. (pp. 1438–1450)