Poultry Research Foundation

ANNUAL REPORT
2008

UNIVERSITY OF SYDNEY

CONTENTS

OBJECTIVES OF THE FOUNDATION

The objectives of the Poultry Research Foundation are to advise the Senate of the University of Sydney and the Vice-Chancellor on matters associated with poultry research, education and scholarship within the University of Sydney and to provide an interface between the Australian poultry and allied industries and the University.

In doing so, the Foundation shall increase the resources of the University by way of membership to the Foundation and utilising benefits given by members in provision of services and other non-financial contributions.

AIMS OF THE FOUNDATION

1. To provide an interface between the poultry and allied industries in Australia and the University of Sydney.
2. To undertake research of relevance to these industries.
3. To assist in the training of scientific and technical personnel to service the private and public sectors of these industries.
4. To act in an industrial liaison capacity.

PRIORITIES 2008

1. Develop links between the University of Sydney and the Poultry CRC
    a. Research projects
    b. Educational programs
    c. Postgraduate scholarships
2. Develop research projects lead by the Chair of Poultry Science
3. Complete infrastructure maintenance of the Poultry Unit
4. Promote postgraduate opportunities within the Poultry Research Foundation
5. Organise the 2009 Australian Poultry Science Symposium

Management of the Foundation is vested in a Council which comprises the President, Deputy President, Director, Faculty of Veterinary Science Dean and DVC (External Relations) along with elected Industry Members from the categories of Governor, Company member and Member, and Honorary Governors and Ex Officio Members.

The administrative office and Research Unit are based at Camden.

Faculty of Veterinary Science
University of Sydney
425 Werombi Road
Camden, NSW
2570

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Jo-Ann Geist, Administrative Assistant
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Facsimile: 02 4655 0693
Email: jogeist@camden.usyd.edu.au

Peter Groves, Acting Director
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Facsimile: 02 4655 0693
Email: pgroves@uysd.edu.au

PRESIDENT'S REPORT

In 2008, our 50th anniversary year, the Australian Poultry Science Foundation, has again provided a strong, relevant and positive interface between our Australian Poultry Industry and the Veterinary Science department of Sydney University.

This has been undertaken under the professional and highly effective leadership of our acting director Dr Peter Groves. Peter has given valuable time, working effectively and selflessly, providing solid guidance based on years of experience, common sense, great intellect and a strong research direction. Thank-you Peter!

Alongside Peter, I wish to thank our Poultry Research Foundation staff, Dr Jeff Dowling, Dr Peter Selle and Dr Wendy Muir for their excellent teaching and research contributions along with Mrs. Joy Gill and Mrs. Melinda Hayter for their technical support in these areas. Together they provide the backbone of our foundation providing great knowledge, and experience to our industry.

On behalf of all of us, I would very much like to thank Jo-Ann Geist, who with great enthusiasm, great efficiency and wonderfully good grace, administers the everyday functioning of our foundation. Thank-you Jo for your tremendous efforts!

2008 saw the Foundation continuing to seek a full time Director, ongoing advertising and a couple of interviews were held but to date the position is still unfilled. It is here that I would like to add my sincere thanks to Emeritus Professor Chis Maxwell for his dedicated support to the Foundation during these unsettling times. Chis, who has retired from his direct academic role continues to work effectively for the great benefit of our Foundation. I would also wish to thank Sydney University and more specifically our Dean Professor Leo Jeffcott who has continued to support and assist our Foundation.

On behalf of the Foundation, I wish to acknowledge the invaluable support from RIRDC Chicken Meat Programme for both the Foundation in general, and also more specifically the financial support for the position of Director.

As we all know the Australian Poultry Science symposium is regarded by many as the flagship of our Foundation, due to the XXIII World Poultry Congress being held in Brisbane in June, APSS was not held this year, but we are looking forward to a very successful APSS in 2009.

It is with great sadness we saw the passing of our highly respected colleague, Jack Houweling who lost his brave and terrific fight against cancer. We were so fortunate to have Jack present a talk to us last February at our 50th Anniversary Celebration Day in which he outlined the broiler industry and his experiences within it. Our sincere and heartfelt condolences go to his loving wife Sandy and his loving family. It is such a great loss and Jack will be so sadly missed.

As the 50th anniversary year of our Foundation draws to a close, please may I remind you of the purpose of our Foundation, namely a research orientated vehicle for ensuring a successful interface between the Australian Poultry Industry and Sydney University . This purpose has not changed in 50 years, our Poultry Research Foundation will continue to provide relevant, applied research, and an effective forum for the dissemination of both Australian and international research.

Linda Browning

ACTING DIRECTOR'S REPORT

2008 saw a lot of activity devoted to conducting the 2009 APSS meeting in February. The theme of "Surviving Climate Change" was timely and added value and interest for the industry. The organising committee worked together well and the outcome was highly satisfying. The invited speakers, both overseas and local were outstanding and made valuable contributions. The symposium attracted about 150 delegates which was a pleasing result and continues to illustrate the international standing of the conference. Sponsor and Foundation member support was extremely good. Dr Peter Selle did a remarkable job in editing the proceedings. Mrs Jo-Ann Geist provided an enormous input in organisation, administration and oversight of the whole symposium and made the event a wonderful triumph – our depth of gratitude cannot be overly conveyed; thanks so much Jo!

Also, once again, thanks go to the staff of the Poultry Unit without whom we just could not produce the outcomes we expect. The success of our students and researchers is so dependent on their expertise and dedication and their contribution cannot be commended enough.

Two research projects submitted for full proposals for funding in 2008 but both were denied after some long deliberation. They were however both invited for re-application in 2009.

With some magnificent assistance by the Research Support Group, which we formed at our AGM in 2008, several research proposals were submitted to RIRDC and AECL. All of them were requested to submit as full research proposals and we are awaiting the final decisions from those two bodies.

A major achievement for 2008 was the acquisition of a steam pelleting facility for the poultry unit's feed mill. Very few experimental facilities have this ability and this will make feeds formulated at the poultry unit more relevant to the commercial world and provide an opportunity for industry to produce small batches of steam pelleted feed for their own purposes. This is a major step in improving the relevance of our trial work to the broiler industry in Australia. A huge vote of thanks for this is owed to Dr Jeff Downing, who sought out and pursued the funding for this equipment. Jeff procured funds through a major equipment grant, some from RIGB funds and some contributions from the Dairy Group and the Farm Animal Health Group, who will also benefit from being able to produce feed at the unit. All up this amounted to about $123,000. Dr Peter Selle was instrumental in identifying and locating the right equipment and the machinery was delivered to the unit in March 2009. We are being assisted by Mr Brad Hopkins, National Milling Manager for Bartters Enterprises, in advising the best way to install the unit. We have a shortfall in funds to completely install the equipment (probably about $20,000). We are confident of being able to fund the shortfall but the Foundation may wish to consider further support to complete this project.

On a disappointing note, we have not been successful in appointing a new Director, despite several candidates being considered throughout the year. Realistically it will be very difficult to attract the calibre of candidate desired while only offering the position at Senior Lecturer level. Unfortunately this is constrained by the budget available. Perhaps the Foundation needs to look at this more candidly. The Foundation needs a recognised and respected nutritionalist at its helm for it to go forward with the quality of poultry science research that the membership desire and the industry needs.

Peter Groves

POULTRY RESEARCH FOUNDATION MEMBERS

Governors

Bartter Enterprises

Inghams Enterprises Pty Ltd

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ADM Australia Pty Ltd

DSM Nutritional Products Pty Ltd

Ridley AgriProducts

Members

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The Egg Basket (Sales) Pty. Ltd

Honorary Governors

Emeritus Professor E. Frank Annison

Dr. Balkar S. Bains

Dr. Derick Balnave

Professor Wayne Bryden

Mr. John Darling

Mr. Ern Newton

Invitees

The Deans of Agriculture and Natural Resources
A representative, NSW Agriculture
The President, World's Poultry Science Association (Australian Branch)
The Program Manager, RIRDC Chicken Meat Program
The Program Manager, Australian Egg Corporation Ltd
A representative, Australian Egg Industry Association
The Executive Director, Australian Poultry Industry Association

POULTRY RESEARCH FOUNDATION COUNCIL

President	Ms. Linda Browning
Deputy President	Ms. Judith O'Keeffe
Director	Dr. Peter Groves (Acting)

General Members

ADM Australia Pty Ltd
Mr. John McLeish

Baiada Poultry Pty. Limited
Mr. Greg Hargreave

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Dr. Ron MacAlpine

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Ms. Judith O'Keeffe

Weston Animal Nutrition
Mr. Todd Middlebrook

University Council Members

Executive Dean – Faculties of Science
Professor Leo Jeffcott

DVC (External Relations)
Professor Andrew Coats

The Pro-Dean and Associate Dean for Research, Faculty of Veterinary Science

POULTRY UNIT STAFF AND STUDENTS

Academic Staff

Dr. P. Groves BVSc. (Sydney) MACVSc. (Epidemiology) PhD (Sydney)
Acting Director Poultry Research Foundation

Dr. W.I. Muir, B.Sc.Agr., PhD (Sydney), GradDipEd(UNE)

Dr. J.A. Downing, WDA (Wagga Agr. Col.), B.Sc., PhD (Macquarie)

Honorary Research Fellows

Dr. P.H. Selle, B.V.Sc, PhD (Sydney)

Faculty Support Staff

Mrs. R.J. Gill
Mrs. M.E. Hayter
Mrs. N.K. Ganguli

Foundation Staff

Mrs. J. Geist (Administrative Assistant)

Postgraduate Students

Mr. Mohamed Sayed

Honours Students (conducted thesis projects in poultry)

This year three fourth year animal production students have conducted thesis projects under supervision of the Poultry Research Foundation.

1. **Patrick Haddad (Supervisor: Downing)** "The effect of strain, reducing dietary protein and altering the wheat to sorghum ration of duck feed on performance under Australian summer conditions ".
2. **Rebecca Noad , (Supervisor: Downing)** "Supplementing broiler diets with antioxidants (Vitamin E and Selenium) to ameliorate the adverse effects of heat stress "
3. **Lauren Audet (Supervisor: Downing)** "Measurement of faecal cortisol metabolites as a non-invasive method of measuring stress."

External Appointments

Peter Groves:

Member of the R & D Committee - Australian Poultry CRC
President – Australian Veterinary Poultry Association
Member – National Avian Influenza Vaccination Expert Group
Member – Newcastle Disease National Management Steering Committee
Adjunct Senior Lecturer, Charles Stuart University – Department Agriculture & Veterinary Sciences
Member – RIRDC Chicken Meat Advisory Committee

Degrees Awarded

-

Doctor of Philosophy

-

Master of Agriculture

-

Conference Attendance

Poultry Research Foundation 50th Anniversary Seminar, included presentations by Dr. P.H. Selle, Dr. W.I. Muir, Dr. P. Groves and Dr. J.A. Downing

Avian Immunology Research Group – Gold Coast June 2008 attended by Dr. W.I Muir

Poultry Information Exchange 2008 – Brisbane July 2008, included presentations by Dr. Peter Groves.

XXIII World's Poultry Congress 2008 incorporating 6th Asian-Pacific Poultry Health Congress - Brisbane June 2008 attended by Dr's. W.I Muir, J.A.Downing, P.H. Selle Presentations given by Dr. P.Groves.

8th International Symposium on Marek's Disease – 7-9 July 2008 Townsville included presentation by Dr. Peter Groves.

The 13th Animal Science Congress of the Asian –Australasian Association of Animal Production Societies – Vietnam September 2008 included presentations by Dr. J.A.Downing

Coolum 2008 Nutrition Workshop organised by Feedworks – November 2008 included presentations by Dr. P.H. Selle

"Making Sense of Science": Critical appraisal of epidemiological studies and clinical trials – Massey University NZ 17-19 November 2008

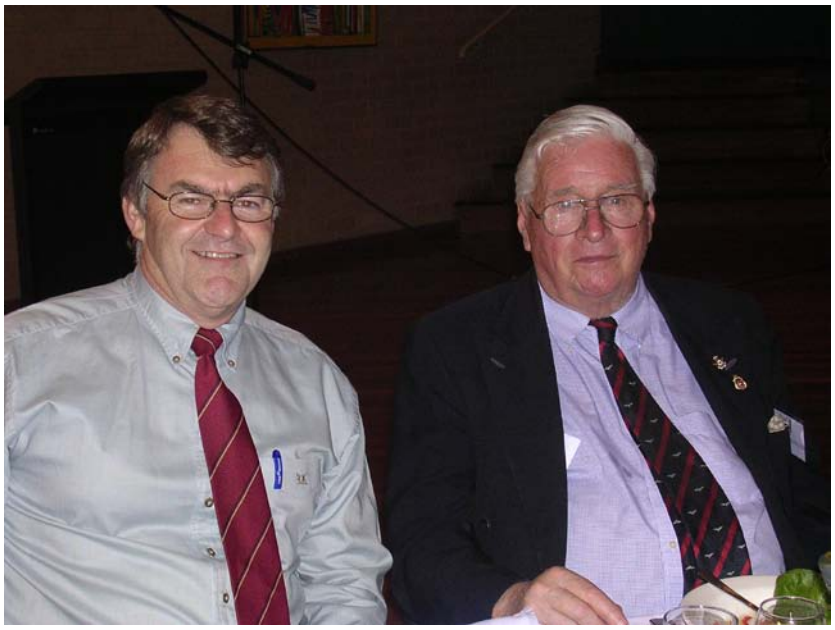
Acknowledgments & Awards

Poultry Award Winner 2008 - Rebecca Noad

Monetary support is given to the Veterinary Science Postgraduate Conference annually.

POULTRY RESEARCH FOUNDATION 50TH ANNIVERSARY SEMINAR

The Australian Poultry Science Symposium was not held in 2008 due to the World's Poultry Congress being held in June in Brisbane, this decision was made many years prior between the Poultry Research Foundation and WPSA. A one day 50th Anniversary Conference was held to celebrate 50 years of the Poultry Research Foundation. Guest speakers included past students and members of the Poultry community.



Current Director Dr. Peter Groves and Honorary Governor and Founding Member Mr. John Darling

Sponsorship of the 50th Anniversary Seminar was kindly supported by:

Gold Sponsors	DSM Nutritional Products Pty Ltd
Silver Sponsors	Alltech Australia BEC Feed Solutions Evonik Degussa Australia Pty Ltd
Bronze Sponsors	Biomin Australia Elanco Animal Health JEFO Australia Kemin (Aust) Pty. Limited OziBioPharm Pty. Limited

FOUNDATION RESEARCH IN REVIEW

For more than 40 years the Poultry Research Unit at Camden has been very active in both broiler and layer research. Some major achievements during the last decade are listed below. This is a very succinct summary with research findings and industry outcomes listed for each major research area. Organisations that appear in brackets e.g. RIRDC indicate the major source of funding for the research area.

1. Amino Acid Digestibility Studies (RIRDC)

Research Findings

i) Development of an assay model for the determination of endogenous amino acid losses under a continuous feeding regimen using guanidinated proteins.

ii) Comparison of excreta and ileal-based assays to measure amino acid digestibility; the results showed that ileal digesta analysis is more appropriate.

iii) Development of an ileal digestibility assay for routine determination of amino acid digestibility.

iv) Compilation of a database of the apparent ileal amino acid digestibilities of feedstuffs.

v) Development of a method for tryptophan analysis and compilation of ileal tryptophan digestibility of feedstuffs.

vi) Evaluation of feed enzymes on digestible amino acid supply.

vii) Application of digestible amino acids to feed formulation.

Industry Outcomes

- Publication of a database: "Digestible Amino Acids in Poultry Feedstuffs" (RIRDC)
- Favourable cost/benefit analyses of industry outcomes (RIRDC)
- Standardized Ileal Digestibility of Amino Acids in Poultry - International Compilation (Industry)
- Reference data for development of *in vitro* test methodology (Industry)
- Feature article in Feedstuffs (July 3, 2000) "Digestible amino acid values more appropriate than total amino acids".

2. Modulation of lean tissue deposition by dietary fatty acids (RIRDC; ARC)

Research Findings

i) Demonstration that dietary inclusion of n-3 and n-6 fatty acids can reduce carcass fatness.

ii) Demonstration that dietary inclusion of n-3 and n-6 fatty acids can improve feed conversion efficiency.

Industry Outcomes

- Recommendations for inclusion of fatty acids that will optimise growth and feed conversion efficiency.
- Enriched meat and eggs as functional foods (Smart Food Centre, University of Wollongong).

3. Development of a non-invasive test for stress in laying hens (RIRDC)

Research Findings

i) The relationship between corticosterone and catecholamines in egg albumen was established.

ii) Corticosterone and not catecholamine concentrations in egg albumen reflect stress in hens.

Industry Outcome

- Egg albumin concentrations of corticosterone could provide a non-invasive measure of stress in hens.

4. Mucosal immunity in chickens (RIRDC)

Research Findings

i) Identification of the site of precursors of IgA producing cells.

ii) Identification of cytokines involved in regulating secretory IgA.

iii) Investigation of *in ovo* vaccinations.

iv) Investigation of the potential for nutrients to modulate the immune response in chickens.

Industry Outcomes

- Facilitate improved mucosal immunity.
- Development of oral vaccines.

5. Nutritional and toxicological evaluation of transgenic plants (CSIRO Division of Plant Industry)

Research Findings

i) Enrichment of lupins with sulphur containing amino acids.

ii) Insect resistant field peas.

Industry Outcome

- Improved poultry feed sources.

6. Application of feed enzymes (Industry)

Research Findings

i) Antinutritive effects of phytate with regard to energy and protein.

ii) Enzyme combinations and improved nutrient utilization.

Industry Outcome

- Estimation of the value of feed enzymes in modifying feed formulations.

7. Mycotoxins in poultry feeds (ADAB)

Research Findings

i) Contamination of corn by aflatoxin, zearalenone and fumonisins and effects on nutritive value.

ii) Toxicology of ergot alkaloids in poultry.

Industry Outcome

- Improved understanding to reduce the risk posed by mycotoxin contamination of poultry feeds.

8. Egg Shell Quality (RIRDC)

Research Findings

i) Defining conditions for beneficial responses to dietary sodium bicarbonate supplementation.

ii) Influence of intermittent lighting at high temperatures.

Industry Outcome

- Defining conditions for improving egg shell quality

9. Amino acid balance for heat stressed broilers (Industry)

Research Findings

i) Identification of need for increased dietary arginine:lysine ratio.

ii) Interaction of dietary sodium bicarbonate with arginine:lysine ratio.

iii) Influence of dietary arginine:lysine ratio on the relative efficacy of different methionine sources.

Industry Outcomes

- Identification that dietary amino acid balance varies with ambient temperature.
- Defining optimum dietary arginine:lysine ratios.

10. Nutritional requirements of recently imported layer stock (RIRDC)

Research Findings

i) Lysine requirement of ISABrown layers.

ii) Methionine requirement of ISABrown layers.

Industry Outcome

- Defining lysine and methionine requirements of ISABrown laying hens under Australian conditions.

CURRENT RESEARCH PROJECTS

Dr. Jeff Downing:

Dr Jeff Downing is continuing work on the following research projects

1. RIRDC Chicken Meat. Project No: US152A 'Physiological and nutritional approaches to alleviate heat stress in broiler chickens.'
   In the second year of this project two studies were undertaken to investigate

i) The role of antioxidants (vitamin E and Selenium) in alleviating the adverse effects of heat stress in broilers. Diets were supplemented with either vitamin E or selenium or combinations of both antioxidants. The broilers were exposed to high ambient temperature and high humiidity in weeks 5 and 6 of production. We found no significant treatment effect. Birds were not adversely affected by heat in week but but performance was diminished in week 6.

ii) The effects of supplementing the drinking water with carbohydrate-electrolyte fluids (oral re-hydration therapy) with or without betaine on the performance of heat stressed broilers.
In this study broilers were placed under high temperature and humidity during days 32-42 of a 6 week production period. During the period of heats tress the birds were provided with oral hydration therapy (ORT) with or without betaine.
The ORT supplementation improved performance, reduced physiological stress and maintained water and electrolyte balances.
Betaine as an independent supplement had no effect in overcoming the effects of heat stress. The administration on 500 mg betaine/l with ORT fluids further improved the performance under heat stress. Long term administration of ORT-bicarbonate resulted in a reduction in the performance during the last 6 days of the 10 heat treatment period compared to the performance in the first 4 days.The response to ORT was most marked in the first 4 days. This suggests that the control birds adapted to the high temperature. The effect of the ORT might be more beneficial in the last 5-7 days prior to slaughter were the effects on heat stress would be more marked because of the greater BW and hence metabolic heat production.
There is a need to identify the significance of the essential components of the ORT. Are the glucose and/or the electrolytes needed?

2. RIRDC New Animal Industries- Project No: US150A. Efficient, environment and bird friendly duck Production.
   This project is in its second year. In 2008 we have investigated the effects of changing the diet composition (protein content) and replacing wheat with sorghum) on the growth and carcass composition of Pekin ducks.. In year 3, we will continue to investigate the effect of dietary protein Content on performance.

3. Pork CRC - Induction of oestrus in lactating sows
   In 2008 work was undertaken in acommercial piggery. Sows were induced into oestrus and then mated while lactating. A similar number of sows were mated as was obtained with the conventional weaning and mating at 21 days (20/23 sows in both groups). Piglets remained on the induced sows until day 35 of age. At 35 days post mating the pregnancy rate was the same for both groups.

4. AECL Non-invasive assessment of stress in commercial housing systems
   This is a new project which will begin in April 2009. The objective of the work is to evaluate the levels of stress in hens maintained in commercial conevntional cages, free range or barn housing.

5. RIRDC New Animal Industries-. Improving the production efficiency, welfare and processing of commercial ducks. A ful research proposal has ben submitted for consideration bt the RIRDC in the present round of funding.

Dr. Wendy Muir:

Dr Muir returned from maternity in April 2008. She is involved in the following projects:

1. Australian Poultry CRC project 04:15 US: Oral delivery system for poultry health products in conjunction with PerOs Technologies Pty Ltd, Canada. The final report for this project has been reviewed and approved by the CRC.

2. Meat and Livestock Australia funded project A.COP.0047: Strategies to identify and develop bioactive peptides in meat and bone meal. PhD student, working on this project Elisabeth Ovelgonne withdrew from her candidature in July 2008. However project work has continued. This project has two main components: proteomics work which is being supervised by Professor Peter Williamson at the Camperdown campus, University of Sydney, and the use of an *in-ovo* delivery system to assess bioactivity. . This work is being undertaken by Dr Wendy Muir at Camden

Dr. Peter Selle:

Dr Selle was involved in a RIRDC Chicken-meat project to review the nutritive value of sorghum in broiler chickens, which culminated in the submissions of a final report to RIRDC and a review article to Livestock Science.

The inconsistent performance of broilers offered sorghum-based diets is of concern to the chicken-meat industry. Variations in amino acid digestibility coupled with variable concentrations of amino acids in sorghum appear to be the prime causal factor. Sorghum contains phytate and may contain tannin; both components are capable of depressing amino acid digestibility. The storage protein, kafirin, is unique to sorghum and may comprise more than 50% of total protein but this proportion does fluctuate. However, kafirin is a relatively poorly digested protein source and is deficient in lysine. Consequently, as the kafirin proportion of sorghum protein increases amino acid digestibility and lysine concentrations decline. Kafirin is also associated with harder grain textures and higher starch gelatinisation temperatures. The kafirin proportion of sorghum protein almost certainly contributes to variations in concentration and digestibility of amino acids.

The texture and particle size of sorghum, and method of grinding, can tangibly impact on broiler performance but the effects of texture and particle size are interactive so the definition of optimal processing conditions is complicated. Sorghum is highly vulnerable to 'moist-heat' because it induces disulphide linkages in β- and γ-kafirin, which are located on the periphery of protein bodies and this, in turn, reduces the digestibility of the centrally located α-kafirin component. Starch granules are intimately associated with protein bodies in the endosperm and disulphide linkage formation in keratin (and the glutelin protein matrix) depresses gelatinisation and digestion of starch. Therefore, the critical, but unanswered, question is whether or not steam-pelleting sorghum-based broiler diets at ~90°C constitutes sufficient 'moist-heat' to compromise protein and starch digestibility.

Bryden WL, Selle PH, Cadogan DJ, Li X, Muller ND, Jordan DR, Gidley MJ, Hamilton WD (2009) A review of the nutritive value of sorghum for broilers. RIRDC publication (in press).

Selle PH, Cadogan DJ, Li X, Bryden WL (2009) Composition and interactions of kafirin, tannin and phytate change nutrient utilisation of sorghum. *Livestock Science* (submitted for publication: LIVSCI-D-09-1775).

RESEARCH COLLABORATION AND INDUSTRY SERVICES

Dr Muir is involved with an ongoing collaborative research project that has been funded by the Australian Poultry CRC on Oral delivery system for poultry health products in conjunction with PerOs Technologies of Canada.

In addition to his involvement in Professor Wayne Bryden's "Team Sorghum", Dr Peter Selle has continued his collaboration with Professor 'Ravi' Ravindran (Massey University, NZ) and Dr Aaron Cowieson in the phytate and phytase area. Also, Dr Selle completed two contract research projects and it is intended to publish the results of one of these projects. Peter Selle was invited to present a paper entitled "Sorghum Unveiled" at the Coolum 2008 Nutrition Workshop organised by Feed works.

COMMUNICATIONS

Publications:

Barnett, J.L., Tauson, R., **Downing, J.A.**, Janardhana, V., Lowenthal, J.W., Butler, K.L., and Cronin, G.M. **(2008)** XXIII World,s Poultry Science Congress, Brisbane, Australia. p295.

Cowieson A.J, Ravindran V, **Selle PH (2008)** Influence of dietary phytic acid and source of microbial phytase on ileal endogenous amino acid flows in broiler chickens. *Poultry Science* 87, 2287-2299.

Cronin, G.M., **Downing, J.A**., Borg, S.S. Storey, T.H., Schirmer, B.N., Butler, K.L and Barnett, J.L. **(2008)** The importance of nest-boxes to stress physiology of young adult laying hens. XXIII World,s Poultry Science Congress, Brisbane, Australia. p243.

Downing, J.A. and Bryden. W.L. **(2008)** Determination of corticosterone concentrations in egg albumen: A non-invasive indicator of stress in laying hens. Physiology and Behaviour, 95, 381-387.

Groves, P.J., Pavic, A., Sherwood, D., Jabloncikova, B. and Wright, C., **(2008)** Sodium butyrate in control of Salmonella Typhimurium colonisation of the gastrointestinal tract of chickens. *XXIII Worlds Poultry Congress*

Groves, P.J., Islam, A.F.M.F., Walkden-Brown, S.W., Reynolds, P. and Sharpe, S.M. **(2008)** An epidemiological survey of MDV in Australian broiler flocks. *8th International Symposium on Marek's Disease*

Groves, P.J., (2008) Implementing food safety assurance on free range and barn egg farms *Poultry Information Exchange 2008*

Kopinski, J., Blaney, B., and **Downing, J**. **(2008)** Tolerance of pigs to sorghum ergot (*Claviceps Africana*) during growth and finishing, and effect on conception of replacement gilts. Australian Journal of Experimental Agriculture, 48, 672-679.

Kopinski, J., Blaney, B., Murray, S-A and **Downing, J**. **(2008)** Effect of feeding sorghum ergot (Claviceps africana) to sows during mid-lactation on plasma prolactin and litter performance. Journal of Animal Physiology and Animal Nutrition. 92: 554-561.

Muir, W.I. (2008) Strategies to improve the intestinal immune response in the chicken, *Poultry Research Foundation 50th Anniversary Seminar*. 39-41.

Muir, W.I., Vandenberg, G and T.A. Scott **(2008)**. The oral delivery of antigen to chickens using an antigen carrier diet. *Proceedings of the 10th Avian Immunology Research Group Conference,* P36.

Ovelgonne, E.A.S, **Muir, W.I.** and Scott, T.A. **(2007)**. Meat and bone meal, future nutraceauticals for poultry? A review. *Australian Poultry Science Symposium,* **19,** 195 – 198.

Ravindran V, Cowieson AJ, **Selle P.H., (2008)** Influence of dietary electrolyte balance and microbial phytase on growth performance, nutrient utilization and excreta quality of broiler chickens. *Poultry Science* **87**, 677-688.

Scott, T.A. and **Muir, W.I. (2007)**. Variation in broiler performance dueto wheat source and enzyme supplementation. *Australian Poultry Science Symposium,* **19,** 67-70.

Selle P.H., Ravindran V **(2008)** Phytate-degrading enzymes in pig nutrition. *Livestock Science* **113**, 99-122.

Selle P.H., (2008) New insights into phytase inclusion in broiler diets. *Poultry International* **47**, (3) 16-20.

Shini, S., **Muir, W.I.,** Shini, A. and Bryden, W.L. **(2007).** Ultrastructural examination of heterophils of chickens exposed to corticosterone. *Australian Poultry Science Symposium*, **19,** 84.

Walkenden-Brown, S.W., Cooke, J., Islam, A., Renz, K., Hussain Z., Islam, F., Reynolds, P, Burgess, S., Tannock, G. and **Groves, P.J.,(2008)** Pathotyping of Australian isolates of Marek's disease. *8th International Symposium on Marek's disease*

Walkenden-Brown, S.W., Islam, A., Burgess, S. and **Groves, P.J.,(2008)** Validation of poultry dust as suitable material for the detection and quantification of of Marek's disease virus. *8th International Symposium on Marek's disease*

Walkenden-Brown, S.W., Reynolds, P.S., Islam, A.F.M.F., Cooke, J. and **Groves, P.J.,(2008)** Broiler strains differ in resistance to Marek's disease. *8th International Symposium on Marek's disease*

Invited presentations:

Downing, J.A.,(2008) The importance of nest-boxes to stress physiology of young adult laying hens. *XXIII Worlds Poultry Science Congress – Brisbane – June 2008*

Downing, J.A.,(2008) 13th Animal Science Congress of the Asian-Australasian Association of Animal Production Societies - Vietnam – September 2008

Groves, P., (2008) Sodium butyrate in control of Salmonella Typhimurium colonisation of the gastrointestinal tract of chickens. *XXIII Worlds Poultry Science Congress- Brisbane – June 2008*

Groves, P., (2008) Implementing food safety assurance on free range and barn egg farms. *Poultry Information Exchange – Brisbane – July 08*

Groves, P., (2008)
1. Pathotyping of Australian isolates of Marek's disease virus.
2. Validation of poultry dust as suitable material for the detection and quantification of Marek's disease viruses.
3. Broiler strains differ in resistance to Marek's disease.
4. An epidiological survey of MDV in Australian broiler flocks.

8th International Symposium on Marek's Disease – Townsville – July 2008

Selle., P.H., (2008) Sorghum Unveiled – a broiler chicken's perspective -*Coolum 2008 Nutrition Workshop – Queensland - November 2008*

The University of Sydney

The Poultry Research Foundation

Income Statement

for the year ended 31st December 2008

	2008 $	2007 $
INCOME		
Business and Investment Income	18,816	20,306
Memberships & Subscriptions	51,680	55,600
Symposium Income	41,576	74,920
Other Income	13,217	12,081
Total Income	**125,289**	**162,906**
EXPENDITURE		
Salaries	69,141	90,379
Consumables	7,827	16,970
Equipment and Repairs/Maintenance	9,052	(2,439)
Services and Utilities	7,662	48,505
Travel, Conferences, Entertainment	18,078	3,362
Contributions to University areas	1,050	(3,129)
Other expenses	24,432	(7,632)
Total Expenditure	**137,243**	**146,016**
SURPLUS / (DEFICIT)	**(11,953)**	**16,890**
Accumulated Funds as at 1st January	192,405	175,515
ACCUMULATED FUNDS AS AT 31ST DECEMBER	**180,452**	**192,405**

The University of Sydney

The Poultry Research Foundation

Balance Sheet

as at 31st December 2008

	2,008 $	2007 $
ASSETS		
CURRENT ASSETS		
Cash		500
Funds Participating in University Pool Interest	180,452	191,905
Total Current Assets	**180,452**	**192,405**
TOTAL ASSETS	**180,452**	**192,405**
NET ASSETS	**180,452**	**192,405**
EQUITY		
Accumulated Funds	180,452	192,405
TOTAL EQUITY	**180,452**	**192,405**

Notes to Financial Statements

1. The financial statements have been prepared on a modified accrual accounting basis.
2. All fixed assets expenses are expended in the year of purchase.
3. Employee entitlements for Long Service Leave are held centrally in the University's accounts.
4. The University (including the Foundations) is exempt from income tax.

I certify that the Income Statement and Balance Sheet of the Foundation have been prepared in accordance with the University's accounting practices and procedures. These Foundation accounts form part of The University of Sydney's financial reports which have been audited by the Auditor-General, New South Wales.

Greg Robinson
Finance Director
Faculties of Sciences, Engineering and Technology
18th March 2009