APRIL ANNUAL REPORT 2022

Australasian
Pork Research
Institute Ltd
APRIL

CONTENTS

WELCOME TO APRIL

THE PORK INDUSTRY HAS ACKNOWLEDGED THE NEED FOR CONTINUED INVESTMENT IN COLLABORATIVE RESEARCH AND DEVELOPMENT SO APRIL WILL INVEST IN AND MANAGE:

- **COLLABORATIVE RESEARCH AND DEVELOPMENT**
- **EDUCATION AND TRAINING**
- **EXPLORE COMMERCIAL-ISATION OPPORTUNITIES**

FOR THE BENEFIT OF THE AUSTRALASIAN PORK INDUSTRY

THE AUSTRALASIAN PORK RESEARCH INSTITUTE LTD. (APRIL) OPERATED THE HIGHLY SUCCESSFUL CRC FOR AN INTERNATIONALLY COMPETITIVE PORK INDUSTRY FROM JULY 2005 TO JUNE 2011.

BACKGROUND

APRIL was succeeded by the CRC for High Integrity Australian Pork (Pork CRC Ltd.), which completed its objectives on 30th June 2019.

The CRC for an Internationally Competitive Pork Industry and the CRC for High Integrity Australian Pork have delivered on research, education, training and commercialisation objectives to deliver a wide range of relevant research outcomes for the Australasian pork industry.

In total, these CRC programs represented a combined total investment of more than $210 million into the pork industry. Their establishment reinvigorated pork industry research and development and education and training in Australia and demonstrated the value of collaborative research investment to Australasian producers and ancillary businesses.

In addition to research outcomes directly applicable on farm and post-farm gate, the CRCs have delivered numerous commercial outcomes that will generate financial returns to APRIL into the future.

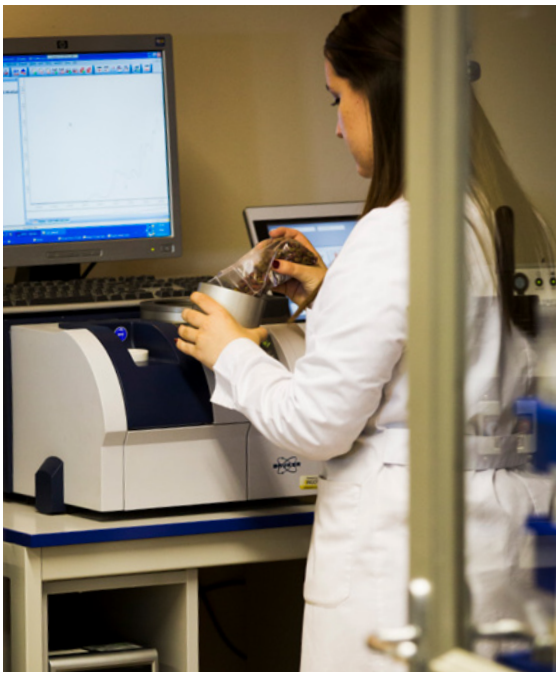
The Industry has acknowledged the need for continued investment in collaborative research and development that complements Australian Pork Limited's work, and so APRIL will invest in and manage collaborative research and development, education and training and explore commercialisation opportunities for the benefit of the Australasian pork industry, using the significant intellectual capital and facilities established by the two CRCs.

VISION

Collaborative, timely and effective industry-funded and directed research, education and training, and commercialisation activities focused on priorities and deliverables that ensure the sustainability of Australasian pork production.

MISSION

Facilitation of high priority research, education and training programs, and commercialisation opportunities, allied to effective investment management to generate optimal returns for all pork industry stakeholders.



MESSAGE FROM THE CHAIR

THE AMBITION OF THE AUSTRALASIAN PORK RESEARCH INSTITUTE LTD. CONTINUES TO FOCUS ON "TRANSFORMATIONAL" PROJECTS TO POSITIVELY CHANGE THE WAY WE PRODUCE PORK. WE HAVE A PROACTIVE AGENDA SO THAT THE INDUSTRY HAS ADDITIONAL TOOLS TO DEAL WITH BOTH EXTERNAL PRESSURES AND OPPORTUNITIES THAT CONTINUE TO CHALLENGE US. I INVITE YOU TO READ THIS ANNUAL REPORT TO SEE HOW OUR PAST AND FUTURE PROJECTS ARE INFLUENCING OUR INDUSTRY.

Just when we thought that we had seen enough challenges with COVID-19, parts of our industry were also confronted with floods and outbreaks of Japanese Encephalitis Virus. In addition, a heightened alert to Foot and Mouth Disease and African Swine Fever reminds us that consideration of the whole value chain is crucial for the pork industry. Due to the consolidated nature of R&D in this industry, it is well positioned to meet such challenges and even take advantage of opportunities that may result.

As such, and whilst we need to be prepared for problems and issues that arise, we need also to be proactive in continuing to set an R&D agenda that keeps taking the industry on an upward path. I will continue to encourage determined researchers to seek ways to transform the industry so that it grows in every way. With the Government's Climate Change Bills enshrined in legislation, Australia's emissions reduction target of 43% and net zero emissions by 2050 is applicable to us all, and our industry is already on the pathway to tackling these issues. We will need to continue collaborating with all stakeholders to ensure that we make good decisions that benefit all. The structure of APRIL, which focuses on R&D, education and training, and commercialisation focused on priorities and deliverables that ensure the sustainability of pork production, will enable us to support and enhance such decision making. We are uniquely placed to be involved in spaces that allow opportunities to be explored that only we can do.

The operating and governance model of APRIL is contingent upon stakeholder support. To that end, thank you to all our stakeholders for your continued support, as well as to those that previously supported APRIL. Stakeholders must be able to appreciate what APRIL can derive and deliver, which often takes time. In April this year, the Board approved a new Strategic Plan, 2022–2025, that sets APRIL on its next path and strives to ensure stakeholders can continue to support APRIL. In this sense, I was very pleased with the level of engagement from members in the development of the new Strategic Plan. Of note, the inclusion of Pillar 3 in the new Plan, *Industry relevant commercialisation activities for the Australasian pork industry*, crystallises and articulates more clearly the key roles that APRIL can play in commercialisation on behalf of the Australasian pork industry. As we have done before, we will continue to capitalise on these opportunities with the aim of delivering value wherever we can.

Thanks to the members of the Board who unreservedly provide good leadership and governance. Dr Gerard Davis has left the APRIL Board, and we thank him for excellent guidance. Thanks also to Dr John Pluske, Dr Charlie Rikard-Bell, Geoff Crook and Dr Sophie Ward, who continue to work as an excellent team delivering the APRIL program, and to APL for their support. We are also privileged to have excellent researchers who engage with us to seek outcomes to complicated problems that continue to challenge the pork industry. In conjunction with students and technical people, they continue to deliver results. I again acknowledge their dedication to Australia's pork industry.

Finally, but not least, the ongoing support of our Members is paramount to enable our success. I am pleased to commend this Annual Report to you.

Dr Tony Peacock

MESSAGE FROM THE CEO

THE REPORTING YEAR 2021–22 HAS SEEN APRIL CONTINUE WITH ITS OVERALL PURPOSES OF INVESTING AND PARTICIPATING IN COLLABORATIVE, INNOVATIVE, TIMELY AND EFFECTIVE RESEARCH AND DEVELOPMENT, EDUCATION AND TRAINING, AND COMMERCIALISATION ACTIVITIES FOCUSED ON PRIORITIES AND DELIVERABLES TO ENSURE THE SUSTAINABILITY OF AUSTRALASIAN PORK PRODUCTION.

The period has built upon the foundation of the many and various activities commenced previously, but also has advanced the overall objectives of APRIL. Unfortunately, the impacts of the Covid-19 pandemic continued to be felt in some projects and activities. Nevertheless, and as I mentioned in last year's Annual Report, the researchers, technical/support staff and (or) students involved in APRIL-funded projects are to be thoroughly commended and thanked for their efforts to have kept the work progressing.

As has been widely broadcast, a major success in this reporting period (September 2021) for the industry was the awarding of a Cooperative Research Centre-Project (CRC-P) from the Australian Government, *Eliminating pig tail removal to improve welfare and industry sustainability* (Tails CRC-P). This, being one of two Transformational Projects identified in the Strategic Plan 2019–2022, was the culmination of much hard work and effort. On-farm data collection and planning of other elements in the project, including the development of a Decision Support Tool being led by APRIL through Dr Sophie Ward, are well underway. Partners in the project, with SunPork Pty Ltd. as the Lead Applicant, include APRIL, Australian Pork Limited, The University of Melbourne, the University of New England, The University of Queensland, PIC Australasia Pty Ltd., Rivalea (Australia) Pty Ltd. and RSPCA Australia. The 3-year project requested approximately $2.89 million from the Commonwealth, supported by approximately $1.64 million in cash from the project partners ($750,000 from APRIL).

The other Transformational Project identified in the Strategic Plan addresses *Enhanced antimicrobial stewardship in the Australasian pork industry through targeted reduction of in-feed medications without adverse health consequences*. Earlier this year, Professor Sam Abraham at Murdoch University was awarded a new Transformational Project, "Novel approaches for combatting antimicrobial resistance in Australian pigs: Exploring nature's antimicrobial arsenals, naturally derived feed additives and natural bacterial flora to combat resistant bacteria". The overarching aim of this project is to determine the origin, transmission pathways and public health impact of newly emergent, critically important antimicrobial-resistant (CIA-R) *Escherichia coli* in pigs in order to develop novel control strategies for the pork industry. Partners in this project are SunPork Solutions, Rivalea (Australia) Pty Ltd., Feedworks Pty Ltd. and Australian Pork Limited, with Tecan Australia Pty Ltd. as a project subcontractor. All participants are thanked for their contributions and assistance.

The end of the reporting year saw a flurry of Final Reports being received, as projects funded in previous years came to an end and the impacts of Covid-19 waned. Some of these are reported later in this Annual Report. All Final

Reports and Project Summaries are accessible through the website (available at https://apri.com.au/research/project-reports/) and will continue to be placed on there as and when they become available, subject to any confidentiality restrictions. We are still awaiting a number of outstanding Final Reports from the first round of projects commissioned in 2018–19, but sincerely hope to have these finalised and approved in the next reporting period.

Investing in education and training, together with Australian Pork Limited, to further build human capacity for the pork industry, is a key goal for APRIL. During the reporting period, APRIL continued to support a number of undergraduate and postgraduate scholarship awards at Australian universities. A number of postgraduate theses from students supported by APRIL were also completed in the reporting period, and can be accessed on the APRIL website (https://apri.com.au/student-project-reports/).

In this regard, Dr Tanya Laird's PhD thesis (*Novel approaches for managing and controlling antimicrobial resistance in pigs*; supervisors Professor Sam Abraham and Drs Mark O'Dea and Shafi Sahibzada; Murdoch University) examined various aspects of antimicrobial resistance (AMR) in *E. coli* in pigs and nutritional interventions (in the forms of *Lactobacillus acidophilus* fermentation products and *Saccharomyces cerevisiae* fermentation products) for the control/reversal of AMR. A study also looked at the combination of bacteriophages and competitive exclusion clones *in vitro* as a novel and targeted approach for the control of extended-spectrum cephalosporin-resistant *E. coli*.

Additionally, Emma Goode's Master of Science in Agriculture thesis (*Seasonal fertility of the sow can be predicted by sow-factors*; supervisors Professor Susanne Hermesch, UNE, and Dr Kate Plush, SunPork Solutions) explored the identification of indicative traits of fertility, sow parities most affected by season, and the months of reduced breeding success.

A beneficial consequence of the industry receiving the Tails CRC-P is a strong investment into training and education, with a number of post-doctoral scientists, PhD students, and opportunities for undergraduate students (e.g., Honours) arising as a result. Three post-doctoral scientists (Dr Arun Kumar, The University of Queensland; Dr Megan Lucas, The University of Melbourne; Dr Sophie Ward, APRIL) and three PhD students (Abedin Abdallah, The University of Queensland; Rutu Galea, The University of Melbourne; Emmi Payten, University of New England) are now all working on various aspects of the project.

In support of industry training, APRIL was pleased to announce Dr Max Muller and Dr Nandi van Wyk as additional Industry Placement Program (IPP) awardees, joining Dr Maria Jorquera-Chavez (Rivalea (Australia) Pty Ltd.) and Dr Lauren Staveley (SunPork Group, South Australia). The Board's support of an additional IPP awardee in the reporting period, as well as support for the creation of a new Post-Doctoral Fellowship Scheme, bears strong testament to APRIL's merit in assisting with production- and science-based training for the benefit of the pork industry.

THE 3-YEAR PROJECT REQUESTED APPROXIMATELY $2.89 MILLION FROM THE COMMONWEALTH, SUPPORTED BY APPROXIMATELY $1.64 MILLION IN CASH FROM THE PROJECT PARTNERS ($750,000 FROM APRIL)

In line with the Stakeholders' Forum in November 2020, the Forum in 2021 was again held in a virtual/remote format. Despite this, the Forum still provided an excellent opportunity for exchange and communication of APRIL's activities and future plans, with more than 75 registrants. Presentations from David Baines (New Zealand Pork Industry Board), Dr Mark O'Dea (DPIRD, WA), and Dr Alice Weaver (SARDI) highlighted three of APRIL's current projects, and along with Dr Rob Smits (APL), allowed registrants to listen to industry outcomes and directions. A new initiative last year was a commercialisation activities session featuring Steve Lydeamore (Anatara Lifesciences Ltd.), Dr Ricardo Esquerra (Ridley) and Dr Tom Harrison (Apiam Animal Health), which alerted the industry to solutions and products addressing a number of industry needs. As such, commercialisation remains a key priority and objective for APRIL, and the last 12 months has seen continued effort and activity in this important area. A comprehensive Commercialisation Report from Dr Charles Rikard-Bell (Manager, Commercialisation and Research Impact) can be found later in this Annual Report.

A number of organisations ceased their memberships with APRIL during the reporting period. I would like to thank The University of Adelaide and Flinders University for supporting APRIL over the years. It is important that APRIL evolves with the changing landscape of the various environments it operates in, and attracting new members and stakeholders to APRIL will be a key priority in the years ahead. This has been identified in the new Strategic Plan approved by the Board in April 2022.

The new Strategic Plan also outlines the priorities and achievements APRIL wishes to make in the next 3 years, and I wish to thank all members who participated in the workshops held in December 2021 for their inputs into the Plan's formulation. Four pillars have been identified as key objectives in the new Plan, and we look forward to addressing the key deliverables to keep APRIL relevant and contemporary in the pork industry.

Finally, I am again highly appreciative to the APRIL staff in Dr Charles Rikard-Bell, Mr Geoff Crook (Company Secretary) and Dr Sophie Ward for their efforts to assist with APRIL's functions and objectives. I would also like to thank staff at Australian Pork Limited, and in particular Dr Rob Smits, Glenn Eppelstun, Gemarie Melendres, Sanjay Ghatani and Kylie Chapman, for their assistance and advice in helping APRIL during the reporting period. Many thanks, also, to the APRIL Chair Dr Tony Peacock and fellow Directors for their support, feedback and encouragement during the year.

Dr John Pluske
Chief Scientist and CEO, APRIL

STRATEGIC PL

STRATEGIC IMPERATIVES AND VALUES

TO ACHIEVE APRIL'S VISION AND MISSION, APRIL HAS DEFINED THE FOLLOWING STRATEGIC IMPERATIVES THAT FORM THE FOUNDATIONS OF APRIL'S STRATEGIC PLAN (2019–2022):

RELEVANCE means APRIL must be robust, agile and current in developing its research, education and training, and commercialisation programs and initiatives.

Research should be a balance of applied versus basic and short versus long-term research, as well as meeting stakeholder expectations.

LEVERAGE means APRIL is a catalyst for innovation and will always seek to leverage its limited funds against additional investment in priority research, education and training, and commercialisation programs to achieve necessary scale.

ALIGNMENT means APRIL is aligned with Australian Pork Limited's activities and residual Pork CRC Ltd. functions to avoid overlaps and duplication.

INVESTMENT AND GROWTH means APRIL is not a final funder (it is a co-funder) and will only actively invest in programs whose objectives cannot be achieved without our support.

COLLABORATION means APRIL will ensure its activities are collaborative, inclusive and informed across the stakeholder base.

RETURNS means measurable returns to stakeholders through research outcomes.

IN APPLYING THESE STRATEGIC IMPERATIVES, APRIL WILL APPLY THE FOLLOWING VALUES:

INNOVATION

APRIL always look for solutions

FOCUS

APRIL's members and the pork industry are the highest priorities

EXCELLENCE

APRIL strives for the best in research, management, education and training, and commercialisation activities

OPPORTUNITY

APRIL strives for the best in research, management, education and training, and commercialisation opportunities

NETWORKS

APRIL will collaborate locally, nationally and internationally to enhance capacity to solve local challenges and meet goals

COMMUNICATION

APRIL will build strong relationships through open communications

AN SUMMARY

CORE STRATEGIES

BASED ON APRIL'S STRATEGIC IMPERATIVES AND VALUES, THE FOLLOWING CORE STRATEGIES HAVE BEEN DEVELOPED:

1. Prepare a 3-year strategic plan for APRIL and a base research and development investment framework

Target Date: 30 June, 2019

Status: Achieved

2. Ensure existing and future commercialisation processes are efficient and are generating optimal returns

Target Date: Ongoing

Status: See Commercialisation Report

3. Develop organisational and research management models that utilise existing APL resources while maintaining operational independence for APRIL

Target Date: Ongoing

Status: Achieved

4. Seek additional investment in relevant research programs through strategic funding opportunities (e.g. Australian Research Council schemes; CRC-P program; State and Federal Regional Growth and Development Funds; international funding sources)

Target Date: Ongoing

Status: One CRC-P and two ARC-Linkage grant applications have been successful (total value $12.8m)

5. Initiate a communication framework that effectively disseminates the objectives of APRIL and the outcomes from relevant research programs

Target Date: Ongoing

Status: See Communication Report

6. Develop research priorities and balance strategic research domains with innovative research opportunities, low and high-risk projects, and projects with high potential for APRIL commercial income versus direct stakeholder returns

Target Date: Ongoing

Status: See Research Reports

7. Assist with human capacity building in the Australasian pork Industry

Target Date: Ongoing

Status: See Education and Training Report

8. Key deliverables and indicators to measure the overall performance of APRIL as a business and the effectiveness of the research program

Target Date: Ongoing

Status: Measures are in place and reviewed regularly

COMMERCIALI REPORT

SATION

THE APRIL BOARD DIRECTS COMMERCIAL DECISIONS REGARDING IP AND STRATEGY, SUBSEQUENTLY THE COMMERCIALISATION AND ADOPTION ACTIVITIES ARE REPORTED DIRECTLY TO THE APRIL BOARD. IN TERMS OF COMMERCIALISATION REVENUE AND ACTIVITIES, THE FOLLOWING OUTCOMES AND OPPORTUNITIES WERE ACHIEVED AND/OR DEVELOPED IN THE REPORTING PERIOD:

1. AUSSCAN ONLINE

It has been a very active reporting period for AusScan Online in 2021/22, with excellent local and global scanning results, the provision of value adding customer reports, studies in place for the improvement of calibrations and road testing a hand held NIR device that will potentially attract a new customer base and increase adoption of this unique technology.

AusScan Online again delivered a consistent income stream in the 2021/22 financial year and continues to be the main commercial income for APRIL. The total number of scans for 2021/22 within Australia was 39,247, which exceeded both 2019/20 and 2020/21 by 4.3% and 14.1% respectively, and further reinforcing the value to the Australian pork industry. The global scan numbers for the fourth year in a row have exceeded 40,000 scans with the 2021/22 scan numbers reaching 43,013, which was slightly under 2020/21 (99.7%) and exceeded 2019/20 by 6.3%.

The Early Harvest Report produced by APRIL is an initiative introduced to the animal feed industry in 2020/21, which reports the *in vivo* energy values of the new season cereal grains for wheat, barley, triticale and sorghum within each growing region. The 2021/22 reports included the additional parameters of protein and moisture measures alongside the energy values from feed mills in all mainland states including Western Australia. The reports are produced monthly from November through to April and published in the Australian Pork Newspaper. The data provides an early preview of the variation in feed grain quality as the mills move from stored to new seasons grain.

The 2021–22 harvest resulted in an estimated 40 to 45% of wheat grown in NSW being downgraded to feed wheat due to pre-harvest germination (sprouted grain) caused by an unusually wet summer. In the development of the AusScan Online calibrations, weather-damaged samples such as sprouted wheat grain were part of the data set. To demonstrate the soundness of the AusScan Online technology, an article published in the Australian Pork Newspaper described a study conducted by APRIL in which 23 samples of grain taken from the 2021–22 harvest, with varying degrees of pre-harvest germination, indicated little effect on the energy values. This year the application of the AusScan Online technology proved to be an invaluable resource as nutritionists confidently assessed the nutrient value of large quantities of sprouted grain and formulated rations without disrupting livestock flows.

APRIL has continued to manage the AusScan Online quality assurance (QA) scheme for the Australian laboratories. This year participating laboratories were transitioned to a fee-for-service program due to increasing enrolments and importation costs of the sample sachets. The program monitors the performance of NIR machines for both within- and between-laboratory variation for the *in vivo* energy and reactive lysine calibrations, providing piece of mind to the laboratory and end user. This year the program has enrolled the NSW Department of Primary Industries' second NIR machine, a Bruker MPA II, and there are now 10 machines participating in the QA program.

In May 2022, AusScan Online had a stand at the Australian Milling Conference which was held in conjunction with Poultry Information Exchange (PIX) and the SunPork Group conference, held at the Gold Coast Convention Centre, Queensland. AusScan Online sponsored the session "Mill optimisation using new low cost NIR sensor technology", which provided brand awareness as well as an excellent forum to network with key stakeholders from the milling, poultry and pig industries.

The metabolism study planned for the upgrade of the pig digestible energy (DE) calibrations had further unavoidable delays this reporting period. However, this enabled maize samples to be collected across two seasons, 2021 and 2022, and improved the scope of the study which is expected to start in 2023. Furthermore, the South Australian Research and Development Institute (SARDI) was awarded a grant from Australian Eggs to improve the layer apparent metabolisable energy (AME) and intake calibrations. The project is expected to add a further 80 samples to the layer AME data set with the objective to improve the calibration statistics and use the prediction to assess cereal grains for layer diets. The project partners are APRIL, Aunir and The University of Adelaide, and subject to execution of the grant, the study is due to start in early 2023 and will finish in June 2025.

AusScan Online assessed a hand-held device in 2018 and although the potential was noted, the device was not suitable for accurate prediction of *in vivo* grain energy. However, technology moves quickly and this year APRIL supported a commercialisation study proposed by Hone Ag and Aunir UK to compare the Hone Red hand-held device (HRH) with two bench-top NIR machines, a Bruker MPA II and a Foss XDS, housed at the NSW Department of Primary Industries in Wagga Wagga. The original AusScan Online samples were scanned by all three devices and the output

compared. The preliminary results are very promising with commercial validation studies for the HRH planned in 2023.

The outlook for AusScan Online in 2022–23 is exciting with the pig DE study due to be completed by June 2023 and the layer AME study starting in early 2023. The value and confidence in applying AusScan Online was clearly indicated this year due to the highly variable quality of feed grains across most regions, and it is expected this will continue into the 2022/23 harvest as higher than expected rainfall has already occurred. The validation of the excellent preliminary results for the HRH device will be a major focus for AusScan Online in Australia for 2022/23, and I am looking forward to reporting these results next reporting period.

2. RIDLEY ENRICH

The Ridley Enrich block sales have maintained the volumes reported in the previous year, marketing 47.0 t in 2021/22 which includes the largest quarterly sales to date of 18.8 t occurring in the final quarter. As indicated in the previous Annual Report, the sales are due to supermarket requirements, under APIQ standards to provide a form of enrichment to sows in the breeding cycle. With more consistent sales Ridley will now manufacture blocks every 6 months and have recently designed a smaller block of 15 kg for improved handling, which also includes attachment points enabling ease in hanging the block, the most common form of presentation. The block and the new mould were displayed at the APRIL booth during the PIX/AMC/SunPork Conference.

The USDA sow block study conducted by Dr Jeremey Marchant-Forde, a leading animal behaviouralist within the USDA, had the data recording and video components completed in May 2022. The study was conducted at the Agricultural Research Station (ARS) Farm Animal Behaviour Laboratory, West Lafayette Indiana USA. The project experienced delays for two years due to the Covid-19 pandemic. The study compared a sow block treatment suspended from the ceiling by a chain to a control group with only a suspended chain. The data set includes an assessment of lesion scores and the area of tear staining around the eye, a larger stain area being indicative of a lack of enrichment. The study also includes video footage to determine whether the sow block is a defendable resource as well as to assess any stereotypic behaviours observed in treatment and control pens. Outcomes of the research will be presented in the next reporting period.

THE OUTLOOK FOR AUSSCAN ONLINE IN 2022–23 IS EXCITING WITH THE PIG DE STUDY DUE TO BE COMPLETED BY JUNE 2023 AND THE LAYER AME STUDY STARTING IN EARLY 2023

In order to protect the intellectual property (IP) of the enrichment block in key European, Canadian and US markets, APRIL filed for an international patent (PCT) in January 2016. In early September 2021 APRIL was granted US patent #11,129,396 B2 ‘Product and method for providing enrichment facilitating expression of natural behaviours in pigs’. The European and Canadian patents are still under examination. In this reporting period, APRIL has been strengthening the enrichment block claims by applying to the US patent office for a divisional patent which will include the additional behaviour claims. Ridley have also commissioned a European consulting group to help identify potential distributorships of the technology in key European jurisdictions.

3. LAWSONIA qPCR

In this reporting period, Dr Tom Harrison presented an update of the diagnostic test at the APRIL Stakeholders Forum in November, 2021, and this was followed by an article in the Australian Pork Newspaper providing an update on Apiam’s activities with the Lawsonia qPCR test.

The test is used as a surveillance tool and has been shown to be excellent in pinpointing the risk periods of infection and refinement of control programs to alleviate sub-clinical disease and production losses. At present, the reporting system which accompanies the Lawsonia qPCR is in its infancy and we are looking to refine this in the next reporting period. We are hoping the test will be used by more users into the future.

4. THE APRIL COMMERCIALISATION PIPELINE

The APRIL pipeline has several projects that have potential to be commercialised. This reporting period produced some interesting outcomes from study 6A–103 *Easing the transition: large piglets from large pellets*. The project, conducted by the CHM Alliance (SunPork), indicated positive behavioural changes towards larger pellets and improved intake on large semi moist extruded creep (SMEC) pellets, as well as providing enrichment to weaned piglets.

A potential commercialisation study to validate NIR technology as a suitable method for detecting boar taint was further refined during the reporting period with the project parties, NZ Fresh Pork and NZ AgResearch. The project aims to investigate the ability of two rapid measurement techniques (NIR spectroscopy and REIMS;

Rapid Evaporative Ionisation Mass Spectrometry) to detect the presence and concentration of boar taint compounds in pork at the point of processing. After 100 samples are scanned the researchers will have a sufficient amount of data to determine whether a calibration(s) can be developed.

Finally, APRIL has been working with AgriFutures in order to present some of our commercial projects and opportunities to a wider network of investors, universities, start-ups, government and industry bodies through the AgriFutures website GrowAg.com. In February 2022, APRIL placed the call for commercialisation projects on the website under "New Opportunities". Additionally, in March 2022, a feature article on the success of AusScan Online and its application in the livestock industry was published in the GrowAg monthly Newsletter, which has a global distribution of over 18,000. Linked to the feature article was a call for licensing and research opportunities to enhance the utilisation of the AusScan Online technology, which created several useful proposals which are to be considered. Similarly, the Water Quality Assessment project was also showcased in the June 2022 GrowAg Newsletter as an editorial article. The project has also been placed under "Commercial Opportunities" on the GrowAg website. APRIL's involvement with the AgriFutures team has created several connections with research bodies, marketing groups and potential partners that may enhance current and future commercial projects. These will be followed up in the next reporting period.

STRATEGIC PLAN DELIVERABLES

A summary of progress against the Strategic Plan deliverables is provided below:

CORE STRATEGY 2: ENSURE EXISTING AND FUTURE COMMERCIALISATION PROCESSES ARE EFFICIENT

TASK	KEY DELIVERABLES	STATUS
2.1 Review all existing commercialisation projects and ensure those with greatest potential are adequately resourced	Allocation of adequate resources to ensure commercial income is realised in a reasonable timeframe	✔ Achieved
	Targets: Commercial income available for reinvestment of $650,000 by July 2020, $750,000 by July 2021, $1.0 million by July 2022	● Not achieved
2.2 Progress licensing of AusScan calibrations via Aunir in China	Capture a wider market using a Chinese base (i.e. Ao Bo Biotechnology Pte Ltd) and significantly increase income from AusScan technologies	● In progress
	Development of a strategic partnership in China for delivery of other research outcomes	● Not achieved
	Targets: More than 500 scans for DE and AME in cereals for pigs and poultry to Chinese customers by July 2021, and more than 3,000 reactive lysine scans for oilseeds for Chinese customers by July 2021	● Not achieved
2.3 Grow AB Vista business and extend service to one additional product	Scans generated by AB Vista increase 10% annually from June 2018	✔ Achieved
	Agreement/licence for at least one other product by January 2021	✔ Achieved
2.4 Develop a commercialisation pipeline and process from project submissions to project delivery and beyond	Clear understanding of commercialisation potential from the existing and future research program	✔ Achieved
	Revised Commercialisation Project proposal (20% cash investment), to facilitate greater interest in commercialisation of research (and not just from the pork Industry)	✔ Achieved
	Formal Commercialisation Report becomes a Standing item at each APRIL Board meeting	✔ Achieved
2.5 Allocate some research resources towards product development with commercial partners	Commercial income of $100,000 from investment in product development that can be reinvested in the APRIL R&D program (by June 2021)	● In progress

FEATURE PROJECT: 7C–001

BONIFF-SMEC: AN IN-FIELD PRACTICAL DELIVERY MECHANISM FOR IMPROVED WEANER PIGLET PERFORMANCE

PROJECT LEADER:
Mr. Steven Lydeamore (formerly Anatara Lifesciences Ltd)

PROJECT PARTICIPANTS:
Dr Diana Turpin (formerly Murdoch University), Elise Davine (Ridley Agriproducts Pty Ltd), Damian Wilson (Anatara Lifesciences Ltd)

PROJECT STATUS:
Completed

AIMS AND OBJECTIVES

This proof-of-concept experiment aimed to test a bromelain-based formulation (BONIFF) in combination with a semi-moist extruded creep (SMEC) feed in weaning pigs under an enterotoxigenic F4 *Escherichia coli* (F4-ETEC) challenge, to determine the efficacy of this combined post-weaning amelioration strategy on aspects of enteric health and pig performance after weaning.

EXPERIMENTAL DESIGN

The experiment, using 100 newly-weaned male pigs weaned at approximately 21 days of age obtained from a commercial farm, was a randomised block design that comprised five treatments, being:

1. Standard diet fed for days 1–11 after weaning, NO F4-ETEC challenge.
2. Standard diet fed for days 1–11 after weaning, WITH F4-ETEC challenge.
3. BONIFF/SMEC fed for days 1–11 after weaning, WITH F4-ETEC challenge.
4. BONIFF/SMEC fed for days 1–11 after weaning, NO F4-ETEC challenge.
5. SMEC fed for days 1–11 after weaning, WITH F4-ETEC challenge.

The standard diet and the BONIFF/SMEC diets did not contain a pharmacological level of ZnO nor a commercial level of organic acid products (organic acids for manufacturing purposes only were added), whereas the SMEC diet alone (Treatment 5) contained commercially relevant levels of ZnO, organic acids and phytogenic compounds. Pigs were kept in groups of 5 pigs per pen with 4 pens allocated per dietary treatment (n = 20) in a building maintained at ~28° C, and on days 5 and 6 after weaning, were inoculated with F4-ETEC or were sham-challenged.

Monitoring of production variables and measurements of enteric health, including post-weaning diarrhoea (PWD) and medications administered therapeutically for PWD, were recorded.

KEY FINDINGS

1. The BONIFF preparation was found to be stable on the SMEC pellets from the time of delivery to the end of the experiment, a period of 6–7 weeks, in March/April 2021. Stability studies continued beyond the trial period and continued to demonstrate good stability of BONIFF. This indicates that post-extrusion coating of BONIFF can viably be done.
2. There was no major mortality observed in this experiment, and was similar between treatments.
3. Pigs fed the SMEC-BONIFF diet WITH F4-ETEC challenge (Treatment 3) did not show any greater compromised intestinal health to pigs fed the SMEC (only) diet WITH F4-ETEC challenge (Treatment 5). The SMEC-only diet comprised a pharmacological level of ZnO and levels of organic acids and phytogenics seen commercially. This suggests that at least under the conditions of this experiment, BONIFF could be considered as a replacement for these additives during an F4-ETEC challenge.
4. Pigs fed a BONIFF-SMEC diet, with or without F4-ETEC inoculation, and pigs fed a SMEC (only) diet (that comprised a pharmacological level of ZnO and commercial levels of organic acids and phytogenics), generally performed better than pigs offered a Standard diet, also irrespective of with or without F4-ETEC inoculation. This period of greater performance generally coincided with the days immediately following the F4-ETEC challenge.
5. Pigs fed the BONIFF-SMEC diet performed similarly to pigs fed the SMEC (only) diet comprising commercially relevant levels of ZnO and organic acids and phytogenic products.

APPLICATIONS TO INDUSTRY

Further evaluation of this combination is suggested before a recommendation can be made.

FURTHER INFORMATION

For further information please see the Final Report at:
https://apri.com.au/research/project-reports/

PIGS FED THE BONIFF-SMEC DIET PERFORMED SIMILARLY TO PIGS FED THE SMEC (ONLY) DIET COMPRISING COMMERCIALLY RELEVANT LEVELS OF ZnO AND ORGANIC ACIDS AND PHYTOGENIC PRODUCTS

COMMUNICATI
REPORT

INTRODUCTION

APRIL has developed an over-arching communication framework as part of the Strategic Plan to ensure communications with all stakeholders provide relevant information at the right times. The framework also contains mechanisms for Members and other stakeholders to provide feedback to APRIL management and Board.

ON

THE KEY COMPONENTS OF THE COMMUNICATION FRAMEWORK ARE:

- **Present regular updates of APRIL's progress and outcomes at producer and scientific forums.**
- **Implement the Director-Ordinary Member buddy system.**
- **Convene an annual Stakeholder's Forum for all APRIL Stakeholders.**
- **Arrange annual one-on-one meetings with APRIL Members to understand needs and promote outcomes.**
- **Conduct an annual membership survey to ensure APRIL research remains relevant.**
- **Keep industry and stakeholders informed of research, education and training, and commercialisation activities and outcomes.**
- **Establish an independent website as a repository for key information and promotion of APRIL activities.**

COMMUNICATION ACTIVITIES

IMPLEMENT DIRECTOR-ORDINARY MEMBER BUDDY SYSTEM

The Director-Ordinary Member buddy system is a standing agenda at each Board meeting, where Directors are expected to contact their allocated Ordinary Members to provide an opportunity for Members to raise any issues at Board level.

CONVENE AN ANNUAL STAKEHOLDER FORUM FOR ALL APRIL STAKEHOLDERS

The annual Stakeholders' Forum provides an opportunity for all APRIL stakeholders to join together and discuss APRIL progress and issues. Research, education and training, and commercialisation updates are provided from an industry perspective, from project leaders and students as well as APRIL management and the Chair of the Board.

In line with the Stakeholders' Forum in November 2020, the Forum in 2021 was again held in a virtual/remote format. Despite this, the Forum still provided an excellent opportunity for exchange and communication of APRIL's activities and future plans, with more than 75 registrants.

Presentations from David Baines (New Zealand Pork Industry Board), Dr Mark O'Dea (DPIRD, WA) and Dr Alice Weaver (SARDI) highlighted three of APRIL's current projects, and along with Dr Rob Smits (APL), allowed registrants to listen to industry outcomes and directions.

A new initiative last year was a commercialisation activities session featuring Steve Lydeamore (Anatara Lifesciences Ltd.), Dr Ricardo Esquerra (Ridley) and Dr Tom Harrison (Apiam Animal Health), which alerted the industry to solutions and products addressing a number of industry needs. As such, commercialisation remains a key priority and objective for APRIL. Thanks to everyone who presented.

The next Stakeholder's Forum will be held as a face-to-face meeting on 15 November 2022.

ARRANGE ANNUAL ONE-ON-ONE MEETINGS WITH APRIL MEMBERS TO UNDERSTAND NEEDS AND PROMOTE OUTCOMES

During the reporting period, Chief Scientist Dr John Pluske met or communicated with a representative (or representatives) from all APRIL members either by telephone or Zoom. The ongoing travel restrictions caused by Covid-19 has made face-to-face meetings very difficult to arrange during the reporting period.

Chief Scientist Dr John Pluske and Dr Charles Rikard-Bell, Manager, Commercilisation and Research Impact, both receive regular, high-quality feedback from APRIL stakeholders through the buddy system reports and informal meetings.

…THE FORUM IN 2021 WAS AGAIN HELD IN A VIRTUAL/REMOTE FORMAT. DESPITE THIS, THE FORUM STILL PROVIDED AN EXCELLENT OPPORTUNITY FOR EXCHANGE AND COMMUNICATION OF APRIL'S ACTIVITIES AND FUTURE PLANS, WITH MORE THAN 75 REGISTRANTS

KEEP INDUSTRY AND STAKEHOLDERS INFORMED OF RESEARCH, EDUCATION AND TRAINING, AND COMMERCIALISATION ACTIVITIES AND OUTCOMES

In conjunction with the activities listed above and the APRIL website, Dr John Pluske and Dr Charles Rikard- Bell achieve this through regular monthly articles in Australian Pork Newspaper and through the APRIL member and stakeholder Newsletter and APRIL Announcements. Four editions of the Newsletter and 10 articles/announcements have been produced. All contain information and updates of interest with regard to the research program (e.g., funded projects, project Final Reports, funding calls), education and training (e.g., student awards) and commercialisation (e.g., AusScan Online updates, Early Harvest Reports) activities and outcomes, a Research Snapshot from completed or ongoing projects, and provide news and events of relevance and importance to APRIL Members and other Stakeholders.

ESTABLISH AN INDEPENDENT WEBSITE FOR PROMOTION OF APRIL ACTIVITIES

The APRIL website apri.com.au has continued to be revamped and revitalised and contains a wealth of information regarding all APRIL's funding opportunities as well as results of APRIL research and students' theses. The website also holds the Final Reports from the two Pork CRC programs (2005–2019), as well as a host of other CRC content.

PRESENT REGULAR UPDATES OF APRIL'S PROGRESS AT PRODUCER AND SCIENTIFIC FORUMS

The Covid-19 pandemic dramatically reduced the number of face-to-face meetings and other networking opportunities available for APRIL staff to attend. Despite this, Chief Scientist Dr John Pluske attended the following events during the year:

DATE	EVENT	FORMAT
30 August 2021	APRIL overview and update presented to APL Operational Leadership Team	Virtual
1 September 2021	APRIL Nutrition Forum seminar	Virtual
17 September 2021	Western Australian Pork Producers' Association Industry Day	Face-to-face
15 October 2021	APL Producer Engagement webinar, Research & Innovation	Virtual
12 November 2021	APRIL Stakeholders' Forum	Virtual
15–18 November 2021	Australasian Pig Science Association meeting	Virtual
29 March 2022	Invited presentation to 8th International Akademie Fresenius "Feed Conference" (Cologne); 'Some perspectives on pork production in Australia and New Zealand')	Virtual
19–21 April 2022	Australasian Pig Science Association Committee meeting, Brisbane	Face-to-face
16–17 May 2022	PIX/AMC/SunPork Conference, Gold Coast	Face-to-face
27 May 2022	Western Australian Pork Producers' Association Industry Day	Face-to-face

Manager, Commercialisation and Research Impact, Dr Charles Rikard-Bell attended the following events during the year:

DATE	EVENT	FORMAT
7 July 2021	The University of Adelaide Pig Science School; presentation "APRIL Commercialisation Update" to group	Face-to-face
31 August 2021	APRIL Product Development Workshop	Chaired session; virtual
1 September 2021	APRIL Nutritional Webinar	Host; virtual
15 October 2021	APL Producer Webinar Series	Virtual
12 November 2021	APRIL Stakeholders' Forum	Virtual
15–18 November 2021	Australasian Pig Science Association meeting	Face-to-face
21 March 2022	Hot Topics in Animal Science – 'Challenges and opportunities in cell-based meat production' (Prof. Robyn Warner, AAAS March Webinar)	Virtual
15–17 May 2022	PIX/AMC/SunPork Conference and APRIL/AusScan stand	Face-to-face
22 June 2022	South Australian AgTech Fund Awards/presentation	Face-to-face

STRATEGIC PLAN DELIVERABLES

A summary of progress against the Strategic Plan deliverables is provided below:

CORE STRATEGY 5: INITIATE A COMMUNICATION FRAMEWORK

TASK	KEY DELIVERABLES	STATUS
5.1 Present regular updates of APRIL's progress at producer and scientific forums	Presentation of APRIL objectives and research outcomes to representatives of a wide pig producer base in Australia and New Zealand, and to international forums (where appropriate)	✔ Achieved
	Present at a minimum of two member-based conferences, by November 2019	✔ Achieved
5.2 Implement Director-Ordinary Member buddy system	Established as Standing item on Board agenda (June 2018)	✔ Achieved
5.3 Convene an annual Stakeholder Forum for all APRIL stakeholders	Direct contact with APRIL members to extend latest results and receive direct feedback on progress	✔ Achieved
	Stakeholder Forum convened November 2019, 2020 and 2021	✔ Achieved
5.4 Arrange annual one-on-one meetings with APRIL members to understand needs and promote outcomes	Face-to-face meetings (Chair, Board members and (or) the Chief Scientist) convened with all members at least annually (commenced June 2018)	● In progress
5.5 Conduct an annual membership survey to ensure APRIL research remains relevant	First annual membership survey completed by November 2020, requesting feedback on the performance of APRIL	✔ Achieved
	Refined priorities for use in development of new research programs	✔ Achieved
5.6 Keep industry and stakeholders informed of research, education and training, and commercialisation activities and outcomes	Bi- or tri-monthly column in Australian Pork Newspaper	✔ Achieved
	Media releases (as appropriate)	✔ Achieved
	Quarterly newsletter to all members commencing June 2019	✔ Achieved
5.7 Establish an independent website for promotion of APRIL activities	APRIL website established and linked to the APL website in June 2018, for communication of research, education and training and commercialisation outcomes, and APRIL news	✔ Achieved
	APRIL to maintain the Pork CRC website (after July 2019)	✔ Achieved

THE NEXT STAKEHOLDER'S FORUM WILL BE HELD AS A FACE-TO-FACE MEETING ON 15 NOVEMBER 2022

RESEARCH RE

TRANSFORMAT

PROJECTS

WHAT IS A TRANSFORMATIONAL PROJECT?

APRIL Transformational Projects address major issues for the Australasian pork industry that, if successfully implemented, are likely to result in a step-change. Transformational Projects are highly collaborative, multi-disciplinary, and by their very nature require considerable resources and time to execute. Consequently, Transformational Projects require significant external investment and are targeted at, but not restricted to, the Australian Research Council schemes and the Cooperative Research Centre-Project (CRC-P) scheme.

PORT
TIONAL

KEY THEMES

APRIL has identified two key themes for Transformational Projects as follows:

6.1.1 ENHANCED ANTIMICROBIAL STEWARDSHIP IN THE AUSTRALASIAN PORK INDUSTRY THROUGH TARGETED REDUCTION OF IN-FEED MEDICATIONS WITHOUT ADVERSE HEALTH CONSEQUENCES

Judicious use of antibiotics is a high priority for the Australasian pork industry. One of the best ways to reduce total use of antibiotics in pig production systems is to limit the use of in-feed medications. When antibiotics are included in feed, every pig on that feed receives a dose whether they need it or not, and dosage continues until the batch of feed is consumed. Arguably, this contributes to elevated overall use of antibiotics, an increased number of doses per pig and potentially an increase in the mg of active constituent administered per kg of pork produced. While antibiotic use in agriculture has not contributed significantly to antimicrobial resistance to date, the Industry does have an obligation to minimise any chance that application of antibiotics in pork production systems renders any registered agents or high or medium importance ASTAG (Australian Strategic and Technical Advisory Group on Antimicrobial Resistance)-classified antibiotics unsuitable for use in human medicine.

This priority has been identified as a transformational project because of the multidisciplinary nature of the challenge. Reduction of in-feed medications will potentially require a higher reliance on vaccines, novel use of other nutritional mechanisms to control disease, enhanced capacity to apply pulse water medications, better systems for disease surveillance, capacity for targeted individual pig treatments, better piggery hygiene, higher health status herds and sources of genetics and, if in-feed antibiotics are not used, systems that allow efficient and targeted application of other antibiotics.

6.1.2 ELIMINATION OF THE NEED FOR TAIL DOCKING IN AUSTRALASIAN PORK PRODUCTION SYSTEMS

Tail biting is an insidious and costly manifestation that can occur without warning and indiscriminately within commercial pork production systems. Occurrence extends across the entire industry. The cause of tail biting is not understood but is likely to be an interaction between behaviour, environment, management, nutrition, housing and health status, among others, with no one factor necessarily contributing more than another. Costs of tail biting extend to compromised pig welfare, negative behavioural traits, sub-optimal growth rates and feed conversion efficiency, carcase damage and loss of a potentially marketable product (i.e., the tail). Current interventions for the control of tail biting are generally effective yet inconsistent but involve the removal of all or a portion of the tail shortly after birth without the use of anaesthesia. Other invasive husbandry procedures such as teeth-clipping and ear notching have largely been eliminated from many production systems already, and there is increasing pressure to cease tail docking.

However, to date, the industry has resisted without any alternative approach to eliminate tail biting. As a priority, the pork industry should be focussed on understanding the causal factors and interactions that contribute to tail biting with a view to eliminating or managing these factors, as opposed to investing in research that justifies tail docking based on minimal pain responses or through the introduction of anaesthesia options. The significant current and future costs of tail biting and its management should not be underestimated, nor should the multi-faceted challenge of understanding the causal factors, which is why APRIL has identified elimination of the need for tail docking in commercial production systems as a transformational project.

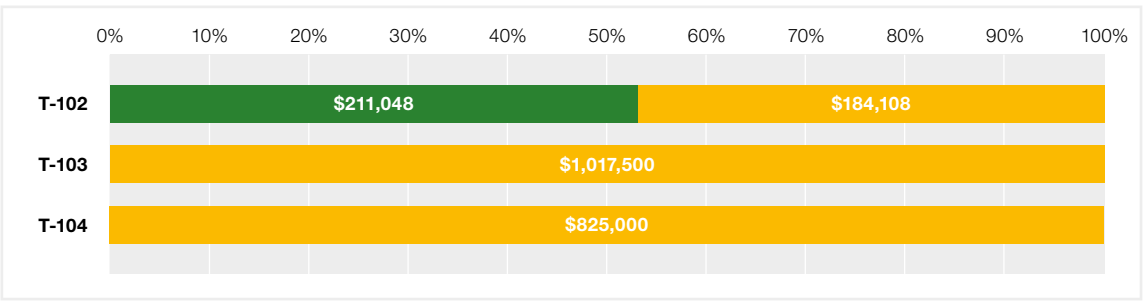
T-101: PATHWAYS TO REARING PIGS WITH TAILS TO MAXIMISE RETURNS TO PORK PRODUCERS and T-104: ELIMINATING PIG TAIL REMOVAL TO IMPROVE WELFARE AND INDUSTRY SUSTAINABILITY

In March 2020, APRIL (as Lead Party) submitted a Round 9 CRC-P application *Pathways to rearing pigs with tails to maximise returns to pork producers*. The application involved researchers from The Universities of Queensland,

PROJECTS

NO.	PROJECT NAME	LEAD PARTY
T-101	Pathways to rearing pigs with tails to maximise returns to pork producers	APRIL
T-102	How to make antimicrobials in pig feed redundant, naturally	The University of Queensland
T-103	Novel approaches for combatting critically important antimicrobial resistance development in livestock	Murdoch University
T-104	Eliminating pig tail removal to improve welfare and industry sustainability	SunPork Pty Ltd

TRANSFORMATIONAL PROJECT COMMITMENTS



THE APPLICATION REQUESTED, AND RECEIVED, AN AUSTRALIAN GOVERNMENT CASH INVESTMENT OF $2,892,374 OVER THREE YEARS … HAS BEEN ABLE TO LEVERAGE AN ADDITIONAL $3,345,078 OF COMBINED IN-KIND CONTRIBUTIONS FROM THE PARTNERS

Melbourne and New England, as well as strong industry involvement from Rivalea (Australia) Pty Ltd., SunPork Farms, and Australian Pork Limited. Unfortunately, the round was extremely competitive (8% success rate) and APRIL's application was unsuccessful.

APRIL met with the collaborators and determined that a new CRC-P application should be submitted. A new submission *Eliminating pig tail removal to improve welfare and industry sustainability* was made to the Round 11 CRC-P funding round led by SunPork Pty Ltd. We were informed on 7 September 2021 that this application was successful.

The application requested, and received, an Australian Government cash investment of $2,892,374 over three years, which combined with the project partners' cash contribution of $1,638,742 ($750,000 plus GST from APRIL), has been able to leverage an additional $3,345,078 of combined in-kind contributions from the partners. This represents an overall leverage for APRIL of ~10.5:1. Partners in the project are APRIL, Australian Pork Limited, PIC Australasia P/L, Rivalea (Australia) P/L, RSPCA Australia, The University of Melbourne, The University of Queensland, and the University of New England.

This is an exceptional outcome directly addressing one of APRIL's two Transformational Project themes for the Industry, and demonstrating again the value of APRIL in driving large scale industry collaborations.

T-102: HOW TO MAKE ANTIMICROBIALS IN PIG FEED REDUNDANT, NATURALLY

In July 2020, the Australian Research Council (Linkage scheme) announced that it has supported The University of Queensland-administered project 'How to make antimicrobials in pig feed redundant, naturally'. Other organisations involved in the successful grant are The University of Melbourne, the SunPork Group, DSM Nutritional Products, and APRIL.

Chief Investigators in the project are Professor Eugeni Roura (The University of Queensland), Professor Frank Dunshea (The University of Melbourne), Professor Mike Gidley (The University of Queensland), and Associate Professor Pat Blackall (The University of Queensland).

Total cash funding for the four-year project is $1,931,233, with the Australian Research Council contributing $852,000 and partners contributing an additional $1,079,233, of which $359,223 derives from APRIL.

The total value of the project (cash plus in-kind contributions) is $3,835,847.

This is a great example of APRIL partnering with its members to successfully leverage external funding for a major research project of critical industry-wide importance.

T-103: NOVEL APPROACHES FOR COMBATTING CRITICALLY IMPORTANT ANTIMICROBIAL RESISTANCE DEVELOPMENT IN LIVESTOCK

During the year, APRIL agreed to be a partner in an ARC – Linkage project application by Professor Sam Abraham (Murdoch University). The Project sought to:

- Identify the role of co-selection in persistence of critically important antimicrobials (CIA) -resistant bacteria.
- Clarify public and animal health impact of emerging CIA- resistant clones in pigs.
- Identify risk factors and exposure pathways on-farms for invading CIA-resistant *E. coli* clones.
- Quantify the level of spill over of CIA-resistant *E. coli* that happens between humans and pigs and other sources.
- Evaluate effectiveness of antimicrobial stewardship in reducing CIA-resistant bacteria.
- Assess the influence of dietary supplements, bacteriophages, pre and probiotics in decolonising and reducing CIA-resistant *E. coli*.

The Project involved collaboration with APRIL members SunPork Pty Ltd., Feedworks Pty Ltd., Rivalea (Australia) Pty Ltd., Murdoch University and The University of Adelaide. The project sought $1,198,614 from the Australian Research Council, and the Partner Organisations, Murdoch University and The University of Adelaide collectively provided $1,170,000 cash (including $420,000 from APRIL) and $1,202,932 in-kind contributions to this project.

Unfortunately, the application was not approved but was ranked in the top 10% of unsuccessful applications, which has encouraged APRIL to commission a smaller scope study, based on the ARC-Linkage application.

STRATEGIC PLAN DELIVERABLES

A summary of progress against the strategic plan deliverables is provided below:

CORE STRATEGY 6: RESEARCH PRIORITIES

6.1: TRANSFORMATIONAL PROJECTS

TASK	CONTEXT AND KEY DELIVERABLES	STATUS
6.1.1 Enhanced antimicrobial stewardship in the Australasian pork industry through targeted reduction of in-feed medications without adverse health consequences	Outcomes from this research portfolio will result in a demonstrable and sustained reduction in the number of in-feed doses of antibiotics administered by the Australasian pig industry each year	In progress
6.1.2 Elimination of the need for tail docking in Australasian pork production systems	Outcomes from this research will include a detailed understanding of the causal factors that interact to induce tail biting (and arguably be able to demonstrate that tail biting can be induced experimentally), mechanisms to predict and control tail biting, total elimination of the need for routine tail docking in commercial production systems, enhanced pig welfare, growth rates and feed conversion, and increased carcase yield	In progress

RESEARCH REPORT

INDUSTRY PRIORITY PROJECTS

WHAT IS AN INDUSTRY PRIORITY PROJECT?

APRIL has prioritised several industry challenges that if solved will assist in improving Australasian pork production. Industry Priority Projects are shorter-term, more focussed projects directed at solving these challenges through investments in collaborative research projects.

KEY THEMES

The priority challenges that APRIL has identified in the strategic plan are:

- Effective monitoring of foreign disease incursions in Australasia.
- Novel approaches to allow increased use of food wastes in pig diets.
- Making pigs more tolerant to heat.
- Improved water quality for use/re-use on-farm and in processing facilities.
- Alternate methods to control/eradicate endemic diseases.
- Development of real time monitoring and surveillance technologies under commercial conditions.
- Detecting sow reproductive state more efficiently and effectively.
- Establish pork as an integral part of a healthy lifestyle.
- Reducing variation in lifetime performance.
- Biodegradable packaging solutions for pork products.
- Heavier carcasses.

PROJECTS

APRIL has invested in the following projects addressing the "Making pigs more tolerant to heat", "Reducing variation in lifetime performance", "Development of real time monitoring and surveillance technologies under commercial conditions," "Detecting sow reproductive state more efficiently and effectively" and "Novel approaches to allow increased food wastes in pig diets" priorities:

6A–101 HEAT TOLERANCE (HT) IN LACTATING SOWS: DIETARY STRATEGIES, METABOLIC BIOMARKERS AND MICROBIOME SIGNATURE

PROJECT LEADER: PROFESSOR EUGENI ROURA, THE UNIVERSITY OF QUEENSLAND

- Test selected dietary supplements to increase the heat tolerance of the lactating sow.
- Identify individual variations in metabolism between heat tolerant and less heat tolerant sows during lactation (metabolic and microbiome markers in resilient compared to the most vulnerable individuals).

6A–102 HOT AND BOTHERED! LONG TERM IMPACTS OF LATE PREGNANCY HEAT STRESS ON SOWS AND PROGENY

PROJECT LEADER: DR KATE PLUSH, SUNPORK FARMS

- Demonstrate that heat stress results in a longer duration of farrowing.
- Identify the impacts longer farrowing duration has on (a) the sow and (b) the piglet, and how this impacts long term performance.
- Test dietary/water additives for reducing farrowing duration during times of heat stress and determine the production advantages at a commercial level.
- Conduct a cost:benefit analysis and assessment of farrowing room cooling in the hotter months.

6A–103 EASING THE WEANING TRANSITION: LARGE PIGLETS FROM LARGE PELLETS

PROJECT LEADER: MR ROBERT HEWITT, SUNPORK FARMS

- Reduce weight variability around weaning through combining two complimentary technologies, large pellets and semi-moist extruded feed, to improve feed intake in the period immediately post-weaning, sustaining weight gain.

6A–104 USE OF THERMOGRAPHIC TECHNOLOGY TO DETECT REPRODUCTIVE STATE IN SOWS AND IMPROVE PIGLET PERFORMANCE IN A COMMERCIAL FARROWING HOUSE

PROJECT LEADER: DR JESSICA CRAIG, RIVALEA (AUSTRALIA) PTY LTD

- Identify the optimum position on the sow for surface temperature measurements in order to predict success in lactation of sows, their health status, as well as the viability of their piglets at birth.
- Early detection of at-risk piglets, farrowing difficulties, and/or MMA to provide producers with the tools for early intervention for sows and piglets at risk.

6A–105 FOOD WASTE TO PIG FEED – SAFE AND BIO-SECURE

PROJECT LEADER: DR VALERIA TOROK, SARDI
JOINT PROJECT WITH THE FIGHT FOOD WASTE CRC

- Address novel approaches to allow increased use of food wastes in pig feed.
- Identify food safety/biosecurity risks and strategies to mitigate perceived risks of utilising food waste streams into pig feed.
- Identify waste streams with the least variability in quality and quantity.
- Determine the economic feasibility of utilising food waste for pig feed in key regional production areas.

6A–106A PRECISION MONITORING OF REPRODUCTIVE STATE VIA DEVELOPMENT OF PEN SIDE MUCUS TESTING AND CONTINUOUS REMOTE MONITORING

PROJECT LEADER: PROFESSOR PAUL VERMA, SARDI

6A–106B PRECISION MONITORING OF REPRODUCTIVE STATE VIA DEVELOPMENT OF PEN SIDE MUCUS TESTING AND CONTINUOUS REMOTE MONITORING

PROJECT LEADER: ASSOCIATE PROFESSOR ROS BATHGATE, THE UNIVERSITY OF SYDNEY

These studies will be conducted in parallel and both projects will contribute to two priority areas: detection of sow reproductive state and development of real-time monitoring technologies.

There are three aims to the projects, namely:

1. In sows and gilts, to determine whether oestrus and ovulation are accurately identifiable by:
   i. changes in the concentration of ions in cervical mucus using Near InfraRed Spectroscopy (NIRS)
   ii. the use of accelerometers
   iii. alterations in the glycomic profile of cervical mucus using liquid chromatography-mass spectrometry.

2. To devise and implement an innovative oestrous detection protocol using NIRS cervical mucus analysis to compare conception and farrowing rates with conventional oestrus detection following either double or single dose artificial insemination.
3. In sows, to determine whether the glycomic profile of cervical mucus accurately detects:
   i. seasonal infertility
   ii. pregnancy status prior to 28 days post-insemination
   iii. the onset of parturition.

6A–107 DEVELOPING HIGH-THROUGHPUT MOLECULAR SCREENING TECHNIQUES TO DETECT RECIPROCAL TRANSLOCATION IN BOARS

PROJECT LEADER: PROFESSOR TARIQ EZAZ, THE UNIVERSITY OF CANBERRA

This project aims to identify diagnostic DNA markers associated with Reciprocal Chromosomal Translocations (RCTs) in boars. It will use new methodologies to identify single nucleotide polymorphisms and Presence-Absence markers linked with chromosome rearrangements and therefore associated with boar infertility.

The primary objective is to enable detection of RCTs cheaply in a high-throughput manner, enabling the widespread adoption of this technology, and reducing the incidence of low litter size. A secondary objective will see an expansion of the original screening conducted in APRIL project A3B–103 to additional genetic suppliers to detect the incidence of RCTs in the wider boar population.

6A–108 HOW LOW CAN YOU GO? OPTIMISING THE USE OF CALCIUM NITRATE (CAN) IN GESTATING SOW DIETS TO REDUCE PIGLET BIRTHWEIGHT VARIATION AND IMPROVE THEIR LIFETIME PERFORMANCE

PROJECT LEADER: DR JESSICA CRAIG, RIVALEA (AUSTRALIA) PTY LTD

This project will investigate the use of calcium nitrate (CAN) in sow diets to improve piglet birth weights and reduce variation in birth weight and lifetime performance.

Following on from a previous APRIL project (5A–104), the current project will aim to optimise strategies for the practical use of CAN and investigate three different timings of CAN supplementation in gestation (i.e., throughout gestation, late gestation from day 90 until farrowing, and the pre-farrowing transition period from entry to the farrowing house until farrowing), to discover the most cost-effective strategy for producers.

The use of a low-dose, low-cost feed additive in the form of CAN, over a relatively short period of time, is anticipated to increase birth weights and reduce birth weight variability. In turn, this is expected to reduce variation in carcass weights and result in heavier carcasses overall, reducing cost of production and improving profitability.

6A–109 REVIEW: IDENTIFYING KNOWLEDGE GAPS AND STRATEGIES TO IMPROVE PROGENY UNIFORMITY OF PIGS

PROJECT LEADER: DR FAN LIU, RIVALEA (AUSTRALIA) PTY LTD

Carcass weight and fatness are the two most important factors that determine the carcass value in the Australasian pig industry. Improving the uniformity of carcass weight at a given slaughter age and the uniformity of backfat at a given carcass weight can reduce sorting required for marketing, shorten the selling duration of a progeny batch and improve carcass compliance, thereby improving profitability.

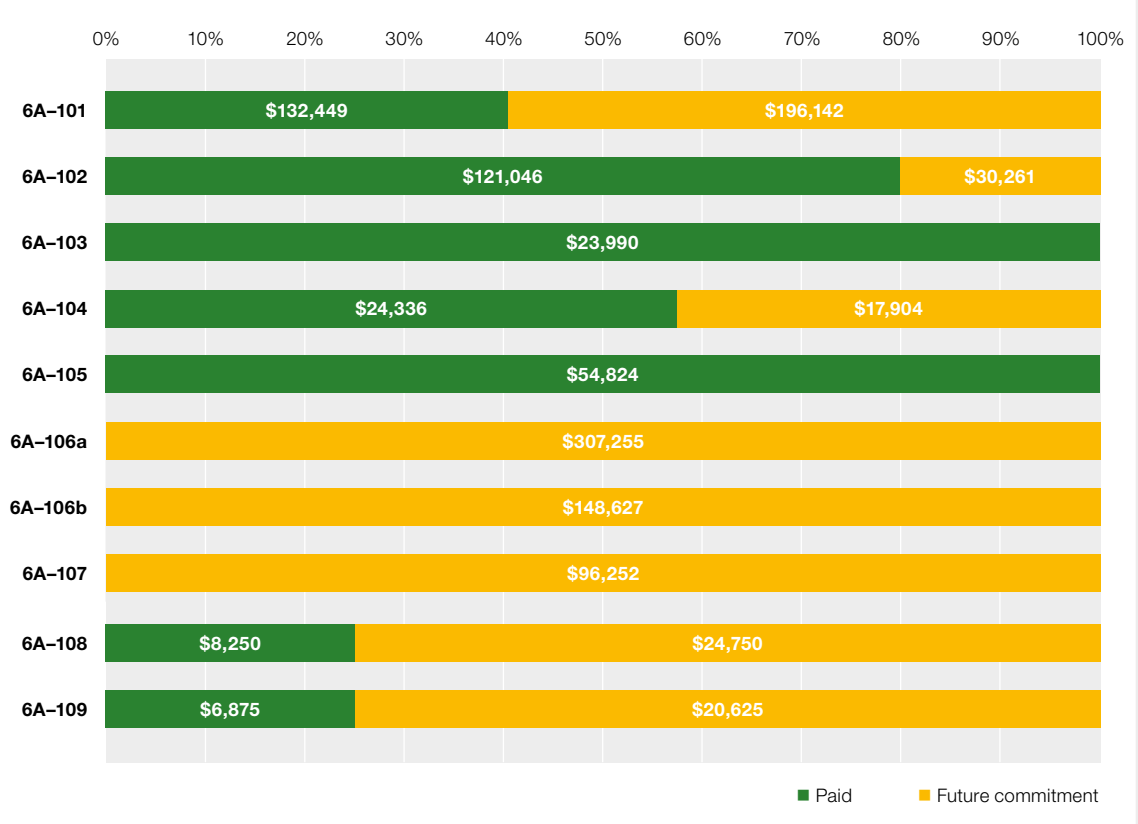
The variation of carcass weight and backfat in a progeny batch are a reflection of different lifetime tissue deposition rates among individual pigs. The individual variation in tissue deposition rate of progeny pigs originates from multiple factors in the foetal, preweaning, weaner, and grower/finisher phases (Figure 1).

A Literature Review will be conducted to explore the key physiological and nutritional factors during the prenatal, neonatal, or postnatal phase that are associated with the individual variation of tissue growth. The outcome of the review will facilitate the potential development of a research program to reduce the within-batch variation of progeny pigs.

FIGURE 1. SOURCES OF WITHIN-BATCH VARIATION IN PIG CARCASSES

NO.	PROJECT NAME	LEAD PARTY
6A–101	Heat Tolerance (HT) in lactating sows: dietary strategies, metabolic biomarkers and microbiome signature	The University of Queensland
6A–102	Hot and Bothered! Long term impacts of late pregnancy heat stress on sows and progeny	CHM Alliance Pty Ltd (SunPork)
6A–103	Easing the transition: large piglets from large pellets	CHM Alliance Pty Ltd (SunPork)
6A–104	The use of thermographic technology to detect reproductive state in sows and improve piglet performance in a commercial farrowing house	Rivalea (Australia) Pty Ltd
6A–105	Food waste to pig feed – Safe and Bio-secure	Fight Food Waste CRC
6A–106a	Precision monitoring of reproductive state via development of pen side mucus testing and continuous remote monitoring	SARDI
6A–106b	Precision monitoring of reproductive state via development of pen side mucus testing and continuous remote monitoring	The University of Sydney
6A–107	Developing high throughput molecular screening techniques to detect reciprocal translocation in boars	The University of Canberra
6A–108	How low CAN you go?: Optimising the use of calcium nitrate (CAN) in gestating sow diets to reduce piglet birthweight variation and improve their lifetime performance	Rivalea (Australia) Pty Ltd
6A–109	Review: Identifying knowledge gaps and strategies to improve progeny uniformity of pigs	Rivalea (Australia) Pty Ltd

APRIL INDUSTRY PRIORITY PROJECT COMMITMENTS



STRATEGIC PLAN DELIVERABLES

A summary of progress against the Strategic Plan deliverables is provided below:

CORE STRATEGY 6: RESEARCH PRIORITIES

6.2: INDUSTRY PRIORITY PROJECTS

TASK	KEY DELIVERABLES	STATUS
6.2.1 Effective monitoring of foreign disease incursions in Australasia	Develop new diagnostics and tools / adapt existing diagnostic and tools, to reduce risks of foreign diseases entering commercial herds	✔ Achieved
	Joint funding applications with Australian Government/APL	● Not achieved
6.2.2 Novel approaches to allow increased use of food wastes in pig diets	Establish sustainable and cost-effective methods for recovery of energy and nutrients from human food waste streams	● On target
	Better application of manufacturing / additive technologies to generate and (or) conserve energy and nutrients from food waste streams	● On target
	Maintenance and (or) improvement in feed conversion efficiency	● On target
	Joint funding applications with the CRC Fight Food Waste/other partners	✔ Achieved
6.2.3 Making pigs more tolerant to heat	Enhanced resilience of pigs (especially sows) to heat	✔ Achieved
	Enhanced productivity and welfare of pigs (especially sows and litters) caused by greater heat tolerance	✔ Achieved
6.2.4 Improved water quality for use/re-use on-farm and in processing facilities	Establish optimum water quality standards for better productivity and health under commercial conditions	● On target
	Optimise the quality of water as a delivery mechanism for water soluble additives	● On target
6.2.5 Alternate methods to control/eradicate endemic diseases	Alternative management methods/technologies to reduce the presence of economically significant diseases in commercial herds	● On target
6.2.6 Development of real time monitoring and surveillance technologies under commercial conditions	More efficient feeding/management systems and (remote) monitoring of the environment, performance, feed consumption (and waste), and health and welfare of pigs	✔ Achieved
	Early detection of health and welfare challenges	✔ Achieved
6.2.7 Detecting sow reproductive state more efficiently and effectively	Establish/validate new methods/technologies that reliably and cost effectively confirm reproductive state in sows	✔ Achieved
6.2.8 Establish pork as an integral part of a healthy lifestyle	Greater awareness of the role of pork as a key food component in a healthy lifestyle	● In progress
6.2.9 Reducing variation in lifetime performance	Establish/validate new reproductive and (or) management technologies, strategies and nutrient requirements that reduce weight variability from birth to finish	✔ Achieved
	Improved feed conversion efficiency	✔ Achieved
6.2.10 Biodegradable packaging solutions for pork products	Develop cost-effective, biodegradable packaging products for pork	● Not achieved
6.2.11 Heavier carcasses	Optimising the value of carcasses from heavier pigs	● In progress
	Establishing customer acceptance and value pathways for rind-off products, larger primals and export competitive pieces	✔ Achieved

FEATURE PROJECT: 6A–102

HOT AND BOTHERED! LONG TERM IMPACTS OF LATE PREGNANCY HEAT STRESS ON SOWS AND PROGENY

PROJECT LEADER:
Dr Kate Plush (CHM Alliance Pty Ltd (SunPork))

PROJECT PARTICIPANTS:
Professor Frank Dunshea (The University of Melbourne); Professor Eugeni Roura (The University of Queensland); Dr Jeremy Cottrell (The University of Melbourne); Weicheng Zhao (PhD candidate, The University of Melbourne)

PROJECT STATUS:
In progress

AIMS AND OBJECTIVES

The objectives of this project are as follows:

1. Demonstrate that heat stress results in a longer duration of farrowing.
2. Identify the impacts that longer farrowing duration has on (a) the sow and (b) the piglet, and how this impacts impact long term performance.
3. Test dietary/water additives for reducing farrowing duration during times of heat stress.
4. Determine the production advantages for both the sow and piglet when the most effective additive is applied at a commercial level.

EXPERIMENTAL DESIGN

The project will consist of three experiments.

The first study will be conducted under controlled conditions using climate chambers at The University of Melbourne to identify the costs that heat stress has during farrowing on both sow and piglet physiology. The second study will evaluate a series of in-water additives fed prior to farrowing to speed up parturition under heat stress conditions, and the final experiment will be a commercial validation of the most effective of these treatments administered to sows during summer to examine performance at SunPork.

KEY FINDINGS

Key findings from Experiment 1 are:

1. Sow heat stress in the lead up to and during farrowing increased stillborn rates and reduced the number of liveborn piglets (Figure 2).
2. Sow heat stress reduced oxygen supply in the umbilical cord, possibly explaining the increased piglet mortality. These data underpin the negative impact of sow heat stress on production efficiency in farrowing sheds over the summer months (Figure 3).

APPLICATIONS TO INDUSTRY

It is clear that sows undergoing heat stress just prior to farrowing have worse farrowing outcomes relative to sows kept in their thermoneutral zone. During times of heat stress, producers should consider strategies to minimise heat stress in order to improve farrowing performance.

HOT AND BOTHERED! LONG TERM IMPACTS OF LATE PREGNANCY HEAT STRESS ON SOWS AND PROGENY

FIGURE 2

Sow Heat Stress increased stillbirth and liveborn mortality rates

FIGURE 3

Sow Heat Stress increased stillbirth and liveborn mortality rates

RESEARCH REPORT INNOVATION PROJECTS

WHAT IS AN INNOVATION PROJECT?

The overall purpose of APRIL Innovation Projects is for the support of “out of the box” ideas for smart, new approaches to tackle current and emerging challenges for the Australasian pork industry.

Innovation Projects must demonstrate originality, uniqueness and creativity, establish new concepts or challenge existing ones, address significant challenges or critical barriers to progress, and be able to improve or apply new theoretical concepts, methodologies or tools that will benefit industry.


EVO
TECAN

PROJECTS

APRIL has invested in the following Innovation Projects, with the following aims:

5A–101 REAL TIME, IN-FIELD WATER TESTING

PROJECT LEADER: DR LOUISE EDWARDS, RIDLEY AGRIPRODUCTS PTY LTD

- To determine if portable spectral-based hardware is compatible for the development of a real-time, in-field multi-parameter water testing device.

5A–102 INSECT MEAL FROM PORK PROCESSING DERIVED MATERIAL

PROJECT LEADER: DR KRISTY DIGIACOMO, THE UNIVERSITY OF MELBOURNE

- To measure the growth performance of black soldier fly larvae (BSF) on a range of pork processing waste varying in nutrient content to optimise waste substrates for BSF bioconversion.
- To measure the nutrient composition of BSF and frass fertilizer derived from pork processing waste.
- To evaluate any microbial risks associated with insect meal derived from pork processing waste.
- To evaluate any chemical risks (such as heavy metals) associated with insect meal derived from pork processing waste.

5A–103 DEVELOPMENT OF A *STREPTOCOCCUS SUIS* VACCINE VIA MEASUREMENT OF IMMUNE RESPONSES TO FOUR DIFFERENT *STREPTOCOCCUS SUIS* VACCINE PREPARATIONS, USING AN AUSTRALIAN CPS2 ST25 STRAIN

PROJECT LEADER: DR MARK O'DEA, MURDOCH UNIVERSITY

- Produce the precursor to a vaccine combination targeting the major strains of *S. suis* associated with disease in Australia.
- Adopt serologic monitoring to better determine the effect of vaccines in a more robust manner than clinical signs alone.
- Determine the effectiveness of different bacterial inactivation methods, which have had little exploration in *S. suis* vaccine production, and which may have more effect in maintaining antigen structure and potency.

5A–104 LOW DOSE DIETARY STRATEGIES IN LATE GESTATION TO ENHANCE BORN ALIVE AND PIGLET SURVIVAL AND PERFORMANCE

PROJECT LEADER: DR JESSICA CRAIG, RIVALEA (AUSTRALIA) PTY LTD

- To evaluate the effects of supplementation of 0.5% arginine and three novel feed additives, B-hydroxy ß-methyl butyrate (HMB), N-Carbamylglutamate (NCG), and Calcium nitrate, on litter characteristics at birth when fed from day 90 of gestation.
- To assess each treatment for piglet vitality, number of still born, number born alive and weaned as well as subsequent reproductive performance of all sows.
- Provide the industry with effective strategies for improving the efficiency of reproduction and progeny performance.

5A–105 ORAL MEANS OF INCREASING ENDOGENOUS GROWTH HORMONE LEVELS AND ENHANCING THE PERFORMANCE AND CARCASS CHARACTERISTICS OF GROWING PIGS

PROJECT LEADER: DR FAN LIU, RIVALEA (AUSTRALIA) PTY LTD

- Validate the effects of NCG and HMB supplementation at two levels (0.15% and 0.3%) when fed to finisher pigs from live weight 60–100 kg for feed intake, growth rate and feed efficiency.
- Validate the effects of NCG and HMB supplementation to enhance commercial carcass traits (carcass weight, dressing percentage, loin muscle depth and back fat thickness) and IGF-1 secretion.
- Determine whether NCG is more potent than feeding arginine itself in increasing blood arginine concentration by measuring arginine plasma levels in control; 1% arginine supplementation and the NCG treatments.
- Determine for treatments that significantly alter either increased growth, feed efficiency, loin eye depth or reduced backfat thickness the magnitude of change in plasma amino acid profiles, and urea nitrogen.

5A–107 USING ALGAL EXTRACTS TO IMPROVE WEANER GROWTH PERFORMANCE AND DIGESTIBILITY

PROJECT LEADER: ROBERT PARKES, RIDLEY AGRIPRODUCTS PTY LTD

- Analyse the effect of supplementing weaner pig diets with different algal extracts on:

  1. Growth, feed efficiency and rate of digestion.
  2. The incidence of diarrhoea.
  3. The change in gut microbial populations and inflammation response markers, when compared to conventional weaner pig diets.

THIS PROJECT WILL DETERMINE THE RELATIONSHIP BETWEEN CIRCULATING CREATINE CONCENTRATIONS IN PREGNANT SOWS AND PIGLET BIRTHWEIGHT AND SURVIVAL

5A–108 WHAT SENSORY ATTRIBUTES ARE MOST CRITICAL FOR CONSUMER EVALUATION WITHIN AN AUSTRALIAN PORK EATING QUALITY PROGRAM?

PROJECT LEADER: PROFESSOR FRANK DUNSHEA, THE UNIVERSITY OF MELBOURNE

- Investigate what are the most critical sensory attributes influencing acceptability (overall liking) of Australian pork with Australian consumers.
- Identify what attributes should be used within an Australian pork eating quality program.
- Assess the effectiveness of the Check all that apply (CATA) rapid sensory method for discriminating sensory properties between six different Australian pork products.

5A–109 INVESTIGATING THE IMPACT OF CIRCULATING CREATINE CONCENTRATIONS IN GESTATION ON VITALITY AND SURVIVABILITY OF LOW BIRTH WEIGHT PIGLETS

PROJECT LEADER: DR TANYA NOWLAND, SARDI

In human pregnancies, maternal creatine levels correlate positively with foetal growth, with low levels linked to foetal growth restriction and reduced birthweight, due primarily to impaired placental blood flow and metabolism. Previously, it has been demonstrated that supplementing sows with creatine or guanidinoacetic acid (GAA) in late gestation improved piglet viability, particularly when birthweight is below 1.1 kg. This project will determine the relationship between circulating creatine concentrations in pregnant sows and piglet birthweight and survival. The impact of increasing circulating creatine by dietary strategies on piglet birthweight, within litter variation in birthweight and piglet survival, will also be established.

5A–110 REAL TIME DETECTION OF DEEP TISSUE ABSCESSES IN CARCASES USING LEAN MEAT YIELD ESTIMATION

PROJECT LEADER: DR DARRYL D'SOUZA, CHM ALLIANCE PTY LTD (SUNPORK)

APRIL agreed to a request from the Lead Party to cancel this project in 2022 due to technical issues preventing the project from proceeding.

5A–111 ESCAPING THE DAILY GRIND – COARSER GROUND DIETS FOR IMPROVED FOETAL GROWTH

PROJECT LEADER: DR KATE PLUSH, CHM ALLIANCE PTY LTD (SUNPORK)

Diets are processed into fine particle sizes to increase digestibility. This is especially important for the growing pig where feed conversion ratio drives profitability, and in lactating sows where high dietary energy is required for milk production. However, there is a paucity of information on the impact of particle size in gestating sow diets.

A coarser grind size will enhance hind gut fermentation, a process which involves the production of butyrate. The impact of increased circulating butyrate concentrations in sows is unknown, but in rats it has been shown to improve foetal growth. This experiment has been designed to determine if a coarser grind size fed to sows throughout gestation improves foetal growth, improving piglet weight and reducing variation at birth.

5A–112 NOVEL ASPIRIN SUPPLEMENTATION DURING GESTATION TO IMPROVE FARROWING RATE AND PIGLET BIRTH WEIGHT OF SOWS MATED IN SUMMER

PROJECT LEADER: DR FAN LIU, RIVALEA (AUSTRALIA) PTY LTD

Sows mated in summer have an increased abortion rate and produce an increased percentage of born-light piglets (≤1.1 kg), which compromises the efficiency of the pig industry and affects supply and market compliance. We propose to trial the supplementation of a low-dose of aspirin (240 ppm; sodium salicylate), a pharmaceutical intervention commonly used for improving conception and foetal development in humans, during the first 80 days of gestation as a strategy to improve farrowing rate and piglet birth weight of multiparous sows mated in summer. If effective, aspirin supplementation could be developed as an economical intervention to alleviate summer infertility and improve piglet birth weight for the pig industry.

5A–113 BRAIN MEASURES OF POSITIVE WELFARE IN PIGS

PROJECT LEADER: PROFESSOR ALAN TILBROOK, THE UNIVERSITY OF QUEENSLAND

"Quality of life" is a central concept in the welfare of production animals. To determine an animal's quality of life, we must understand how the animal's brain processes life experiences. This project is the first attempt to identify objective indicators of brain function in pigs. The project will contribute to the assessment and improvement of pig welfare by providing quantitative biological measures (biomarkers) of brain function during positive and negative experiences. The project will enable development of non-invasive biomarkers, which the Australasian pork industry can use to inform day-to-day management decisions and continuously improve the welfare of pigs.

WE PROPOSE TO TRIAL THE SUPPLEMENTATION OF A LOW-DOSE OF ASPIRIN (240 PPM; SODIUM SALICYLATE), A PHARMACEUTICAL INTERVENTION COMMONLY USED FOR IMPROVING CONCEPTION AND FOETAL DEVELOPMENT IN HUMANS, DURING THE FIRST 80 DAYS OF GESTATION AS A STRATEGY TO IMPROVE FARROWING RATE AND PIGLET BIRTH WEIGHT OF MULTIPAROUS SOWS MATED IN SUMMER

PROJECT 5A–114 SMART SENSORS FOR ANIMAL WELFARE MONITORING

PROJECT LEADER: ASSOCIATE PROFESSOR ABEL SANTOS, THE UNIVERSITY OF ADELAIDE

This project builds on the findings of APRIL project A1–106 *A lab on a chip for real time pain and animal welfare biomarker measurement,* which successfully developed multiplexed, cheap, portable on-chip sensing technologies to rapidly detect and assess multiple pain and welfare biomarkers in pigs. The technology enables high-throughput label-free detection, quantification, and molecular fingerprinting of biomarkers in biological samples.

The objective of this project is to verify and assess measures from manufactured plasmonic chips relative to previously analysed samples obtained from pigs by the South Australian Research and Development Institute. This will permit optimisation of concentrations of relevant biomarkers of pain and welfare in pigs.

Objective quantification of relevant biomarkers in biological fluids reflecting welfare states is central to improving animal health and welfare standards. Such information has potential to provide the industry with an evidence-informed, decision-making approach for safe, economical, rational, and sustainable assessment of physiological and affective states in pigs related to pain and welfare.

PROJECT 5A–115: IMPROVING THE FERTILITY OF EXTENDED SEMEN

PROJECT LEADER: ASSOCIATE PROFESSOR MARK NOTTLE, THE UNIVERSITY OF ADELAIDE

Artificial insemination (AI) is used in more than 90% of the Australian pig herd. Successful AI involves the collection of semen which is then diluted with extender to produce multiple doses which is then used for up to 5 days. However, AI pregnancy rates are generally lower than natural mating. This is because semen extenders are relatively simple and do not mimic seminal plasma or the female reproductive tract, where sperm undergo their final maturation.

The aim of the present study is to improve boar sperm function by adding factors found in semen back to commercial extenders.

The project is measuring a range of sperm parameters for up to 5 days after collection to mimic the use of extended semen commercially. The more promising factors will then be examined *in vitro* to determine effects on fertilisation and embryo development. Those that show an effect will then be examined in small scale insemination studies, before progressing to larger on-farm trials.

Part of this work is being undertaken by Ms Kaitlin Beltakis (pictured), an Honours Student at The University of Adelaide, who was awarded an APRIL Honours Scholarship and hopes to continue working in the field.

PART OF THIS WORK IS BEING UNDERTAKEN BY MS KAITLIN BELTAKIS, AN HONOURS STUDENT AT THE UNIVERSITY OF ADELAIDE, WHO WAS AWARDED AN APRIL HONOURS SCHOLARSHIP AND HOPES TO CONTINUE WORKING IN THE FIELD

PROJECT 5A–116 HEATING UP THE HOUSE: EVALUATING THE EFFECT OF NOVEL MONITORING AND HEATING SYSTEMS ON THE PRODUCTIVITY, WELFARE AND ECONOMICS OF FARROWING HOUSES

PROJECT LEADER: DR MARIA JORQUERA-CHAVEZ, RIVALEA (AUSTRALIA) PTY LTD

Investigation of novel ways to allow real time monitoring of pigs and innovative sustainable heating sources are required to ensure pork production systems are future proof. This project will further investigate the use of thermal imagery technology and FarrowCam (real time monitoring of farrowing) to evaluate health and welfare of sows and survival of piglets. These technologies will be implemented and tested in a project investigating the impact heat lamps have on the thermal comfort of sows and piglets, comparing the overall performance of the conventional heat lamps that are widely used in Australian piggeries, and two new heating-source options (ANIHEATER® and Hog Hearth® Heat Mats).

Due to the positive results reported in several countries, these two new heating methods are expected to provide better thermal conditions for piglets and sows, and to have a lower cost of maintenance than the conventional heat-lamps. This project will provide Australian pork producers with detailed information about novel monitoring devices and more cost-effective heating-sources to be used in farrowing houses, ensuring increased productivity and sustainability.

PROJECT 5A–117 USE OF AN INHIBIN VACCINE TO INCREASE LITTER SIZE IN PIGS

PROJECT LEADER: PROFESSOR PAUL VERMA [AFFILIATE PROFESSOR (THE UNIVERSITY OF ADELAIDE) AND SCIENCE PROGRAM LEADER – PIGS AND POULTRY (SARDI)]

Average litter sizes born in Australia remain lower than those observed in other pork-producing countries, largely as a consequence of restrictions associated with germplasm importation. One method with demonstrated litter size increase in other species, such as sheep, is vaccination against inhibin. Attenuation of the biological activity of inhibin, that regulates the production of follicle stimulating hormone (FSH), leads to an increase in circulating FSH and, consequently, the ovulation rate.

Studies conducted previously in gilts reported marked improvements in reproductive performance following vaccination against inhibin. This project proposes to extend these preliminary results and further assess the efficacy of inhibin vaccination on aspects of reproductive outcomes, thereby offering a possible means to increase fecundity in the herd.

NO.	PROJECT NAME	LEAD PARTY
5A–101	Real time, in-field water testing	Ridley Agriproducts Pty Ltd
5A–102	Insect meal from pork processing derived material	The University of Melbourne
5A–103	Development of a *Streptococcus suis* vaccine via measurement of immune responses to four different *Streptococcus suis* vaccine preparations, using an Australian cps2 ST25.strain	Murdoch University
5A–104	Low dose dietary strategies in late gestation to enhance born alive and piglet survival and performance	Rivalea (Australia) Pty Ltd
5A–105	Oral means of increasing endogenous GH levels and enhancing the performance and carcass characteristics of growing pigs	Rivalea (Australia) Pty Ltd
5A–107	Using algal extracts to improve weaner growth performance and digestibility	Ridley Agriproducts Pty Ltd
5A–108	What sensory attributes are most critical for consumer evaluation within an Australian Pork eating quality program?	The University of Melbourne
5A–109	Investigating the impact of circulating creatine concentrations in gestation on vitality and survivability of low birth weight piglets	SARDI
5A–110	Real time detection of deep tissue abscesses in carcases using lean meat yield estimation	CHM Alliance Pty Ltd (SunPork)
5A–111	Escaping the daily grind – coarser ground diets for improved foetal growth	CHM Alliance Pty Ltd (SunPork)
5A–112	Novel aspirin supplementation during gestation to improve farrowing rate and piglet birth weight of sows mated in summer.	Rivalea (Australia) Pty Ltd
5A–113	Brain measures of positive welfare in pigs	The University of Queensland
5A–114	Smart Sensors for Animal Welfare Monitoring	The University of Adelaide
5A–115	Improving the fertility of extended semen	The University of Adelaide
5A–116	Heating up the house: Evaluating the effect of novel heating and monitoring systems on the productivity, welfare and economics of farrowing houses	Rivalea (Australia) Pty Ltd
5A–117	The use of inhibin vaccine to increase litter size in pigs	The University of Adelaide

APRIL INNOVATION PROJECT COMMITMENTS

RESEARCH REPORT

LEGACY PROJECTS

WHAT IS A LEGACY PROJECT?

Legacy projects fall into two main categories – Pork CRC projects contracted through APRIL because they were not due to finish before the close of the Pork CRC, and APRIL Investment Round 1 projects approved prior to adoption of the Strategic Plan in 2019.

KEY THEMES

PORK CRC PROJECTS

Pork CRC projects followed the Pork CRC program structure:

- Program 1 – Reduced confinement of sows and piglets
- Program 2 – Herd health management
- Program 3 – Healthy pork consumption
- Program 4 – Carbon conscious nutrient inputs and outputs
- Commercialisation projects.

APRIL INVESTMENT ROUND 1 PROJECTS

APRIL Investment Round 1 projects were structured into three programs, as follows:

PROGRAM 1 – RESILIENCE

Under the Resilience program, APRIL sought proposals on the more judicious use of antibiotics targeted at:

- Reduction in the use of in-feed medications or more conservative delivery of in-feed medications (pulse medication post-feed mixing, in line blending of medications).
- Non-antibiotic alternatives (i.e. vaccines, nutritional strategies, microbiome, effective additives, and "natural" products).
- Elimination of critical antibiotics from the production system.
- Reduction in antimicrobial resistance.
- Development of "sentinel" pig systems that provide alerts to the early onset of disease or give an indication of the overall immune status of the herd.
- Novel diagnostics.

APRIL SOUGHT NEW SCIENCE AND TECHNOLOGIES TO ENHANCE MARKEDLY THE REPRODUCTIVE PERFORMANCE OF AUSTRALIAN SOWS WITHOUT THE NEED TO IMPORT FOREIGN GENETICS

PROGRAM 2 – COST

Under the Cost program, APRIL sought proposals which will help the Australasian industry reduce its reliance on the more conventional feed ingredients and help divorce the industry from the global grain and soybean markets.

This encompassed ideas on, but not limited to:

- Enhancing our capacity to utilise grain alternatives including milling co-products and pulses. Maintaining development of NIR calibrations for DE and available lysine in cereals and oilseeds, respectively.
- Developing effective means of measuring feed intake and wastage in pigs through all production phases.
- Enhancing methods for recovery of waste phosphorus and other high-demand nutrients. Improving application of enzyme and other feed additive technologies to conserve nutrients.
- Developing nutrient profiling and feeding practices of alternative or novel feed sources.

PROGRAM 3 – RETURN ON ASSETS

Program 3 was further divided into two sub-programs – Program 3A – Reproduction, and Program 3B – Progeny

Reproduction

APRIL sought new science and technologies to enhance markedly the reproductive performance of Australian sows without the need to import foreign genetics.

New ideas and science were sought but not limited to the following areas:

- Optimisation of intake during lactation and management of sow body condition to maximise/enhance subsequent reproduction.
- Relationship between seasonal fertility versus infertility.
- Quantification of methods to control seasonal market supply through breeder management.
- Investigate and review new reproductive technologies and nutrient requirements that optimise piglets weaned/sow and reduce litter weight variability.
- Develop alternatives to importation of genetics to facilitate faster rate of genetic gain in Australasia.

Progeny

APRIL sought new science and technology to improve the efficiency and survival of pigs from weaning to sale. New ideas and science were sought but not limited to the following areas:

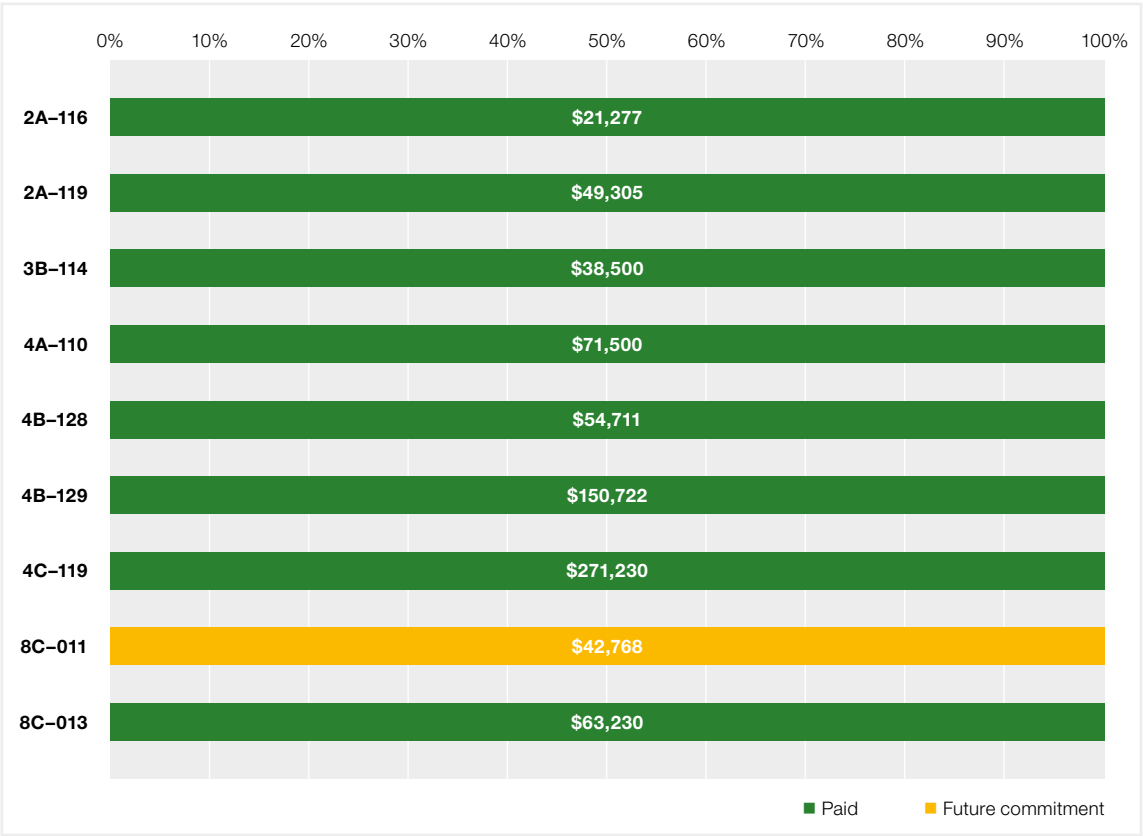
- Growth enhancement to improve inherent feed efficiency.
- Manipulation and monitoring of feed intake.
- Control and manipulation of carcass quality and variability.
- Measurement and reduction of feed wastage.
- Early detection of health challenges and improved control of sub-clinical health issues.
- Appropriate revision of nutrient requirements.

PROJECTS

PORK CRC PROJECTS

NO.	PROJECT NAME	LEAD PARTY
2A–116	Pre-farrowing health and welfare assessment of sows	Animal Genetics and Breeding Unit
2A–119	Development of a quantitative PCR test for swine dysentery	Murdoch University
3A–119	On line lean meat yield measurement of pig carcases – commercial validation	Australian Pork Limited
3B–114	Development of a 'healthy pork' resource for use by consumers, health professionals and regulatory bodies: summary and dissemination of Pork CRC human nutrition research	The University of South Australia
4A–110	Integrated wastewater treatment plant (iWWTP) data collection	Flinders University
4B–128	The use of 15N as a biomarker for feed conversion efficiency (FCE) in pigs using blood and hair samples	The University of Melbourne
4B–129	Grain collection, storage and distribution, and data management for 4B subprogram projects	The University of Sydney
4C–119	Bio-upgrading piggery biogas by growing algae, for value-add end uses	The University of Queensland
8C–011	The provision of a curative supplemental block provides enrichment, reduces mutilation and reduces the negative impact on production performance caused by tail and ear bite mutations in growing pigs	CHM Alliance Pty Ltd (SunPork)
8C–013	An assessment of an attenuated live streptomycin-dependent *Actinobacillus pleuropneumoniae* (APP) vaccine (serovar 15) delivered either intranasal or as a combination of intranasal and intramuscular injection	Rivalea (Australia) Pty Ltd

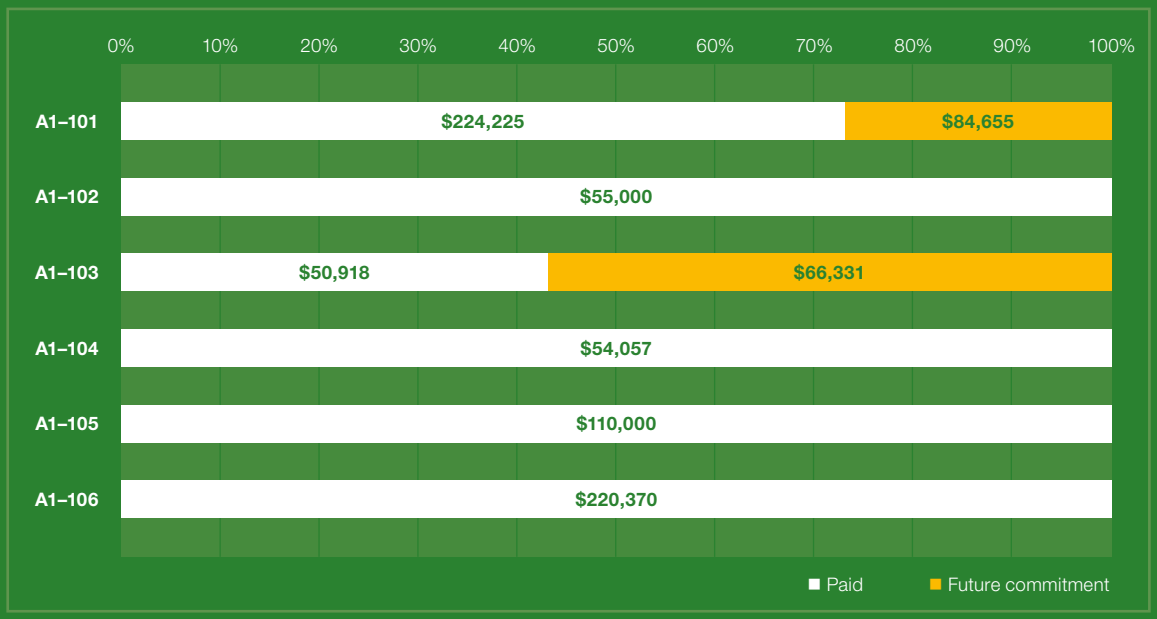
PORK CRC PROJECT COMMITMENTS



PROJECT COMMITMENTS
APRIL ROUND 1 PROGRAM 1

APRIL ROUND 1 PROGRAM 1 PROJECT COMMITMENTS
PROGRAM 1 – RESILIENCE

NO.	PROJECT NAME	LEAD PARTY
A1–101	Novel approaches for reducing antimicrobial resistant and pathogenic Gram-negative bacteria in the porcine gut	Murdoch University
A1–102	Proof of concept: Oral Fluids and quantitative assessment for Porcine Chronic Respiratory Disease (PCRD) in Australian field conditions	Rivalea (Australia) Pty Ltd
A1–103	Improving enteric health, understanding impact on gut microbiome and weaner performance through the use of protease enzymes	CHM Alliance Pty Ltd (SunPork)
A1–104	Developing remote monitoring methods for early detection of respiratory disease in pigs	The University of Melbourne
A1–105	Early stress experiences and stress resilience and emotionality in pigs	The University of Melbourne
A1–106	A lab on a chip for real time pain and animal welfare biomarker measurement	The University of Adelaide



FEATURE PROJECT A2–101

PROTECTED VITAMIN AND MINERAL PREMIXES MAINTAIN PERFORMANCE OF COMMERCIAL PIGS AT REDUCED INCLUSION RATES

PROJECT LEADER:
Robert Hewitt (CHM Alliance Pty Ltd (SunPork))

PROJECT PARTICIPANTS:
Robert Hewitt, Andres Corso, Sally Tritton (All CHM Alliance Pty Ltd (SunPork)), Wayne Bradshaw (Jefo Australia Pty Ltd)

PROJECT STATUS:
Completed

AIMS AND OBJECTIVES

This project aimed to investigate the ability to utilise encapsulation technology to reduce the levels of included vitamins and minerals and maintain pig performance, on the presumption there would be reduced degradation prior to reaching absorption sites within the small intestine.

A secondary aim of this project was to evaluate the ability of an encapsulated vitamin and mineral premix to alter indices of inflammation, given the strong roles vitamins and minerals can play in the immune response of pigs.

EXPERIMENTAL DESIGN

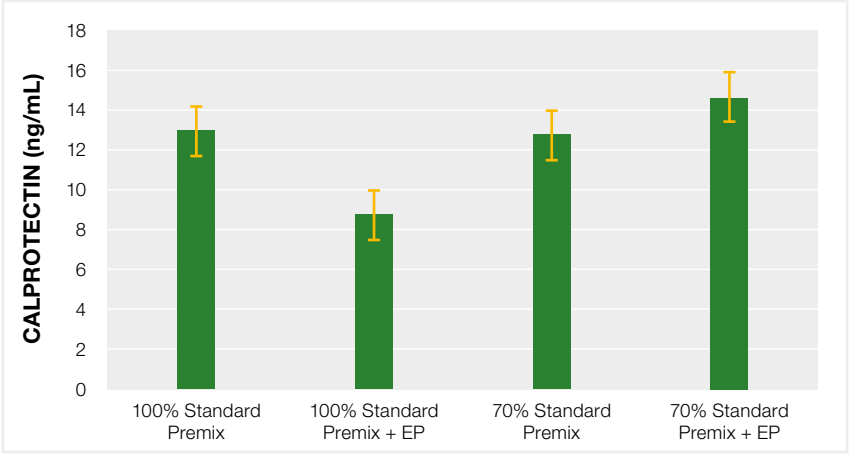
This study involved two identically designed experiments, one in weaner pigs and one in finisher pigs. The experiments were of a 2 x 2 factorial design with the first factor being the level of standard commercial loose-carrier vitamin-mineral premix, 100% or 70% of normal commercial inclusion rates, and the second factor being the inclusion of an encapsulated vitamin and mineral supplement at 0 or 0.6 kg/t (minimum level recommended by manufacturer).

Weaner pigs (n = 560, ~20 days of age, 6.42 ± 0.05 kg) were fed common first-stage weaner diets (14.85 MJ DE/kg, 0.89 g SID Lys/MJ DE) for 28 days, that differed in inclusion rate of standard and encapsulated premix. Growth performance and blood analysis of markers of inflammation and antioxidant capacity measured.

Finisher pigs (n = 264, ~15 weeks of age, 55.6 ± 0.35 kg) were fed common finisher diets (13.50 MJ DE/kg, 0.64 g SID Lys/MJ DE) for 42 days, that differed in inclusion rate of standard and encapsulated premix. Growth performance and blood analysis of markers of inflammation and antioxidant capacity were measured in both studies.

FIGURE 4

Interaction means for plasma calprotectin concentrations in weaner pigs (collected 8 days after weaning) fed either: (i) standard premix at 100% inclusion level (2.0 kg/t), (ii) standard premix (100%) plus 0.6 kg/t encapsulated premix (EP), (iii) standard premix at 70% inclusion level (1.4 kg/t), and (iv) standard premix (70%) plus 0.6 kg/t EP.



KEY FINDINGS

- No significant differences in performance in both weaners and finishers were observed when the standard vitamin and mineral premix was reduced to 70% of normal inclusion rates, although there was a tendency for poorer production during some periods measured.
- Including the encapsulated premix maintained, but did not enhance, finisher pig performance when fed at 70% of the normal inclusion rate.
- In weaners, when an encapsulated vitamin and mineral supplement was offered on top of the standard commercial rate of a loose-carrier vitamin and mineral premix, pigs were 5% heavier (0.6–0.8 kg) at 28 days after weaning ($P = 0.044$).
- A statistically significant reduction in calprotectin concentration was seen in weaners receiving the encapsulated premix on top of the standard level of a loose-carrier vitamin and mineral premix (Figure 4).
- In finishers, feeding 100% of the commercial level of vitamins and minerals tended ($P = 0.095$) to reduce calprotectin concentration, whilst the inclusion of the encapsulated premix resulted in a statistically significant reduction in calprotectin.
- Reducing the inclusion rate of the standard premix tended ($P < 0.1$) to increase the level of inflammation in both studies, as indicated by calprotectin concentrations.
- The lack of any performance gains in finishers, despite a reduction of inflammation using the encapsulated vitamin and mineral supplement, suggests a greater degree of robustness and ability to cope with an underlying base level of inflammation.

APPLICATIONS TO INDUSTRY

The use of a supplementary level of an encapsulated premix to protect degradation and chelation of “free” vitamins and minerals appears warranted, resulting in reduced inflammation in the weaner pig and improved post-weaning performance.

Blanket reduction of the quantity of standard vitamin and mineral premix is not recommended, with tendencies for reduced performance and a tendency for the inflammatory marker calprotectin to be increased in the reduced level of premix. If a reduction in vitamin and mineral premix is undertaken, extra care should be taken to ensure that those nutrients possessing anti-inflammatory and/or antioxidant characteristics are consumed at adequate levels.

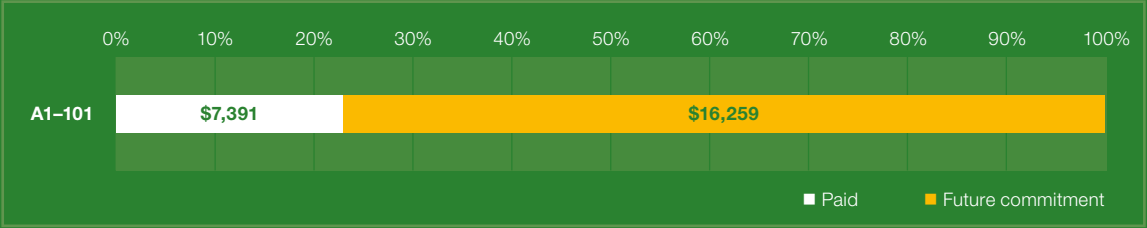
FURTHER INFORMATION

For further information please see the Final Report at:
https://apri.com.au/research/project-reports/

PROJECT COMMITMENTS
APRIL ROUND 1 PROGRAM 2
APRIL ROUND 1 PROGRAM 3A

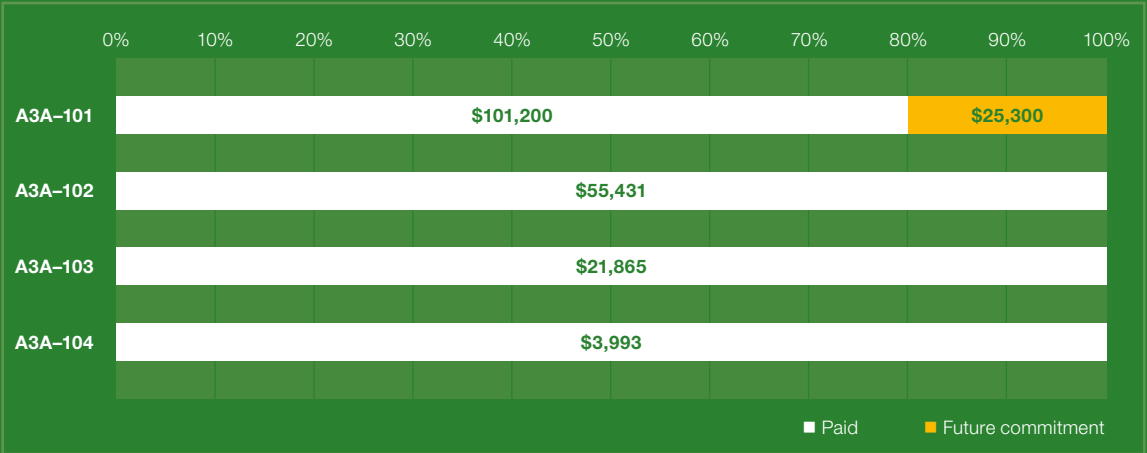
APRIL ROUND 1 PROGRAM 2 PROJECT COMMITMENTS
PROGRAM 2 – COST

NO.	PROJECT NAME	LEAD PARTY
A2–101	Protected vitamin and mineral premixes maintain performance of commercial pigs at reduced inclusion rates	CHM Alliance Pty Ltd (SunPork)



APRIL ROUND 1 PROGRAM 3A PROJECT COMMITMENTS
PROGRAM 3A – REPRODUCTION

NO.	PROJECT NAME	LEAD PARTY
A3A–101	Improved feed efficiency, control of P2 back fat and maintenance of pork quality in finishing pigs fed bitter extracts	The University of Queensland
A3A–102	Review relationship between energy intake and protein deposition in 60–110 kg pigs with modern genetics using DXA scanner	Rivalea (Australia) Pty Ltd
A3A–103	Feeding a single diet to pigs in the grower/finisher stage to reduce feed costs and improve feed efficiency	Pork Innovation WA
A3A–104	Base-Funded Experiment: Feeding a single diet versus phase feeding to pigs in the growing-finishing stage	CHM Alliance Pty Ltd (SunPork)
A3A–105	Base-Funded Experiment: Feeding a single diet versus phase feeding to pigs in the growing-finishing stage	Rivalea (Australia) Pty Ltd



FEATURE PROJECT A3B–102

NUTRITIONAL SUPPLEMENTATION TO INCREASE THE NUMBER OF PIGS WEANED AND FERTILITY OF SOWS WHICH FARROW AND ARE MATED DURING SUMMER/EARLY AUTUMN

PROJECT LEADER:
Associate Professor William van Wettere (The University of Adelaide)

PROJECT PARTICIPANTS:
Dr Jessica Craig (Rivalea (Australia) Pty Ltd) and Dr David Cadogan (Feedworks Pty Ltd)

PROJECT STATUS:
Completed

AIMS AND OBJECTIVES

During a typical Australian summer, it is common for sows to experience heat stress, which can result in increased peripheral blood flow and, thus, a reduction in uterine and ovarian blood flow. In peri-parturient sows, a reduction in uterine blood flow may reduce nutrient support for uterine contractions which, in concert with heat induced reductions in feed intake will increase farrowing duration and delay lactogenesis, resulting in increased piglet mortality and reduced growth to weaning. In weaned sows, reduced ovarian blood flow will reduce gonadotrophin and nutritional support for folliculogenesis and oogenesis, potentially reducing ovulation rate, decreasing oocyte and corpora lutea function and, thus, reducing fertility and fecundity.

EXPERIMENTAL DESIGN

A collaborative study between The University of Adelaide, Rivalea (Australia Pty Ltd) and Feedworks Pty Ltd was conducted to determine the effects of arginine supplementation with or without betaine from 7 days prior to farrowing until the first post-weaning oestrus, on piglet mortality and growth prior to weaning, as well as sow reproductive performance after weaning and at the following lactation.

This study consisted of two replicates, one in summer and one in winter/spring (spring), with four dietary treatments applied from farrowing shed entry until first post-weaning oestrus (n = 130 sows per treatment per seasonal replicate):

- Control, standard diet.
- Betaine, standard diet plus betaine (0.2%).
- Arginine, standard diet plus arginine (L-arginine; 1.0%).
- Betaine plus Arginine, standard diet plus betaine (0.2%) and L-arginine (1.0%).

Numerous reproductive and lactation indices were measured including in the following lactation.

DURING SUMMER, THE INCLUSION OF ARGININE IN SOWS REDUCED PIGLET MORTALITY, ADDING ARGININE AND BETAINE TO SOW DIETS IMPROVED SUBSEQUENT REPRODUCTIVE PERFORMANCE, WHILE THE ADDITION OF BETAINE (REGARDLESS OF THE PRESENCE OF ARGININE) ALSO IMPROVED SUBSEQUENT REPRODUCTIVE PERFORMANCE (ALL $P < 0.05$)

KEY FINDINGS

- During summer, the inclusion of arginine in sows reduced piglet mortality, adding arginine and betaine to sow diets improved subsequent reproductive performance, while the addition of betaine (regardless of the presence of arginine) also improved subsequent reproductive performance (all $P < 0.05$).
- Regardless of the inclusion of betaine in the diet, arginine reduced piglet mortality between fostering and day 3 of lactation from 19.8% to 14.7% ($P < 0.01$), reduced the number of piglets which died from fostering to weaning (2.20 ± 0.13 versus 2.55 ± 0.13; $P = 0.06$), and reduced the number of live born piglets which died prior to weaning (2.86 ± 0.15 versus 3.33 ± 0.15; $P < 0.05$).

Subsequent reproductive performance:

- Arginine and betaine together reduced the weaning to remating interval ($P < 0.05$) from 5.6 to 5.1 days, increased the number of piglets born alive from 12.3 to 12.9 piglets/litter, and decreased the number of piglets born dead from 1.7 to 1.0 at the subsequent litter ($P < 0.05$).
- When the main effect of betaine was analysed, its inclusion increased the number of piglets born alive at the subsequent litter from 12.3 to 12.8, and decreased the number and percentage of still born piglets from 1.64 to 1.18 and 10.9% to 8.1%, respectively ($P < 0.05$).
- For treatments applied in spring, there were no benefits of including either betaine and arginine, either together or separately, in the diets of sows from pre-farrowing to remating during spring, on measures recorded during the first and second lactation.

APPLICATIONS TO INDUSTRY

Adding betaine and arginine to the diets of sows which farrow and lactate during summer improved piglet survival and subsequent reproduction of sows. However, there appeared to be no benefits of adding these supplements to the diets of sows during spring.

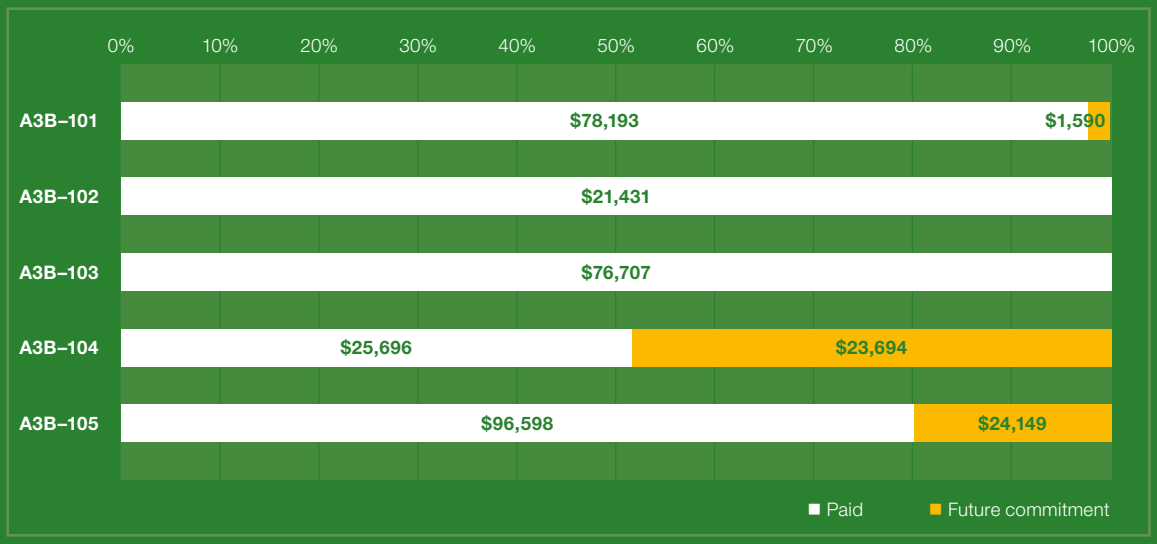
FURTHER INFORMATION

For further information please see the Final Report at:
https://apri.com.au/research/project-reports/

PROJECT COMMITMENTS
APRIL ROUND 1 PROGRAM 3B

APRIL ROUND 1 PROGRAM 3B PROJECT COMMITMENTS
PROGRAM 3B – PROGENY

NO.	PROJECT NAME	LEAD PARTY
A3B–101	Using GnRH analogues for fixed-time AI and pregnancy support to address seasonal infertility in sows	The University of Adelaide
A3B–102	Nutritional supplementation to increase the number of pigs weaned and fertility of sows which farrow and are mated during summer / early autumn	The University of Adelaide
A3B–103	Identifying reciprocal chromosomal transloactions to reduce early embryo mortality	CHM Alliance Pty Ltd (SunPork)
A3B–104	Seasonal fertility: a novel approach to alleviating seasonal infertility in sows	CHM Alliance Pty Ltd (SunPork)
A3B–105	Effects of negative DCAD and vitamin D in transition diets to increase piglet weaning numbers, improve piglet weaning weight, and minimise sow condition loss during lactation	J.A.Braun Investments Pty Ltd



EDUCATION AND TRAINING REPORT

APRIL EDUCATION AND TRAINING PROGRAM

APRIL is committed to helping build skilled human resources for the benefit of industry, whether it be through supporting tomorrow's researchers through undergraduate projects (e.g. Honours) and postgraduate support such as PhD scholarships and Doctor of Veterinary Medicine projects, or training highly skilled staff in pork production through the Industry Placement Program.

APRIL has a dedicated Education Advisory Committee that ensures APRIL's education and training programs are relevant and operating efficiently to meet these goals.

TOMORROW'S RESEARCHERS

Aa at 30 June 2022, APRIL has supported scholarships for the following undergraduate and postgraduate students:

...THE PHD STUDENTS INVOLVED IN THESE PROJECTS ARE WORKING ON REAL-WORLD ISSUES ON COMMERCIAL PRODUCTION UNITS...

STUDENT	UNIVERSITY	QUALIFICATION	STATUS
Brittany Silva	Murdoch University	DVM	Completed
Ryan Kristen	The University of Sydney	DVM	Ongoing
Eva Vidacs	The University of Melbourne	Honours	Completed
Suzanna Jones	Murdoch University	Honours	Completed
Stephanie Shields	The University of Sydney	Honours	Completed
Tanya Laird	Murdoch University	PhD	Ongoing
Elisabet Puig-Garcia	The University of Queensland	PhD	Ongoing

In addition, a number of projects involving APRIL funding also provide student support. Examples include the Australian Research Council-Linkage projects involving APRIL as a Partner Organisation, titled *Early stress experiences and stress resilience and emotionality in pigs* and *How to make antimicrobials in pig feed redundant, naturally*. The nature of these projects, directly involving industry, means that the PhD students involved in these projects are working on real-world issues on commercial production units, meaning not only do they gain a PhD but also are well equipped to enter the workforce having a greater understanding and appreciation of production.

INDUSTRY PLACEMENT PROGRAM

APRIL supports an Industry Placement Program (IPP), similar to that successfully initiated in the Cooperative Research Centre for High Integrity Australian Pork.

The Pork CRC's IPP placed more than a dozen highly credentialed young people in industry positions where they leveraged their academic skills and qualifications to add value to their workplaces, and APRIL seeks to continue this valuable legacy.

As part of an IPP Award, APRIL will provide the successful business applicant with $75,000 over the first two years to help cover salary and other costs associated with training the awardee for three years.

As at 30 June 2022, APRIL has supported the following IPP students:

AWARDEE	EMPLOYER	STATUS
Sofie Pridgeon	CHM Alliance Pty Ltd (SunPork)	Completed
Dr Jessica Craig	Rivalea (Australia) Pty Ltd	Completed
Lauren Staveley	CHM Alliance Pty Ltd (SunPork)	Ongoing
Dr Maria Jorquera-Chavez	Rivalea (Australia) Pty Ltd	Ongoing
Dr Maximiliano Müller	The University of Queensland	Ongoing
Dr Nandi van Wyk	Apiam Animal Health Ltd/Portec	Ongoing

FOCUS ON INDUSTRY PLACEMENT PROGRAM AWARDEE – DR MARIA F. JORQUERA-CHAVEZ

Maria commenced her Industry Placement Program in February 2021 as a Research Scientist at Rivalea (Australia) Pty Ltd, after graduating with a Doctor of Philosophy from The University of Melbourne (thesis title, *The use of computer vision techniques as non-invasive tools to monitor parameters related to the well-being and productive performance of cattle and pigs*).

During this time, Maria has been involved in the development and planning of external and internal projects including:

- APRIL Project 5A–116: Heating up the house: Evaluating the effect of novel monitoring and heating systems on the productivity, welfare and economics of farrowing houses.
- APRIL Project 6A–104: Use of thermographic technology to detect reproductive state in sows and improve piglet performance in a commercial farrowing house (with Dr Jessica Craig).
- Tails CRC-Project: Eliminating pig tail removal to improve welfare and industry sustainability (collaboration with The University of Melbourne, SunPork, APRIL, APL, RSPCA, The University of New England, The University of Queensland, and PIC Australasia Pty Ltd).
- APL Horizon Project: Developing and implementing technologies to provide robust tools that will enable Australian producers to ensure optimal health of pigs (APL proposal, collaboration with The University of Melbourne and University of Leuven).
- APL Horizon Project: Development of commercial single injection pig vaccines for the Australian pork industry using a unique, innovative, biopolymer vaccine delivery vehicle house (with Dr Jessica Craig).
- ARC-Linkage project: Early life stress and subsequent emotional and neurophysiological indicators of stress resilience (collaboration with The University of Melbourne).

Maria has also been working on a number of internal Rivalea projects, generally in collaboration with universities and other organisations, and has been working together with the "Smart Farming" team at Rivalea, participating in meetings, and being involved in the evaluation and implementation of new technologies and software. Additionally, Maria has participated in short courses and workshops related to data analytics, such as "Introduction to R and Reproducible Research" from The University of Melbourne, and also participated in the workshops of "Certificate III in Pork Production" as part of her training.

These projects and activities are a key component of APRIL's IPP scheme. Other activities conducted by Maria as part of her IPP include:

1. An oral presentation given at the APSA 2021 conference for the paper, "The effect of farrowing crate heat lamps on the skin and rectal temperature of sows".
2. Attendance at the APRIL Stakeholders' Forum in November, 2021.
3. Attendance at the PIX/AMC 2022 and APL Student Workshop in May, 2022.
4. Participation in APL's Improved Productivity Workshop (September 2021).
5. Joining the APEL (Australian Pork Emerging Leaders) Southern Group (December, 2021).

Within Rivalea (Australia) Pty Ltd, Maria has also gained training with 3 months of pig production and management experience at the Rivalea Huntly, Victorian site, and at Rivalea's main site in Corowa, NSW. In December 2021, Maria was recognised for her ability to work across departments, engage team members and encourage people to work together on research project proposals, with a DRIVE award.

STRATEGIC PLAN DELIVERABLES

A summary of progress against the strategic plan deliverables is provided below:

CORE STRATEGY 7: ASSIST WITH HUMAN CAPACITY BUILDING IN THE AUSTRALASIAN PORK INDUSTRY

TASK	KEY DELIVERABLES	STATUS
7.1 Industry Capacity Building	APRIL support for PhD/MSc (MS), either through project support funds or 'top-ups'	✔ Achieved
	Two postgraduates being trained and (or) employed in industry by 2022	✔ Achieved
	Four undergraduate students completed their Honours degrees by June 2021 and six by 2022	● In progress
	Postgraduate students embedded in APRIL research projects	✔ Achieved
	Investigate co-funding opportunities for postgraduate students (e.g. APRIntern)	✔ Achieved
	APRIL support of Honours students in APRIL and associated/related projects	✔ Achieved
	Continued support of the Industry Placement Program (first placements by February 2019)	✔ Achieved

CORPORATE GOVERNANCE

STRUCTURE

The Australasian Pork Research Institute Ltd ("APRIL") is a tax exempt Australian public not-for-profit company limited by guarantee.

At 30 June 2022, APRIL has 13 Ordinary (voting) Members, three (non-voting) Associate Members, and one (non-voting) Supporting Member.

There has been no change to this structure during the year under review.

GOVERNANCE

Board membership consists of:

- An independent Chairperson and one other independent Director nominated by the Board and appointed by vote of Ordinary Members at a general meeting.
- Two Directors appointed by Australian Pork Limited (APL).
- Four Directors appointed by vote of Ordinary Members at a general meeting from nominations provided by Ordinary Members.

All nominees must add skills to the Board in one or more of the following areas:

a. As a member of the Australian Institute of Company Directors or other appropriate qualifications or accreditations to be a Director.
b. Pork production and processing.
c. Business management.
d. Finance and accounting and/or auditing.
e. Corporate governance.
f. Marketing.
g. Administration and commercialisation of research and development.
h. Environment.
i. Animal science and welfare.
j. Education.
k. Any other skills determined by the Directors from time to time.

The Board has approved the Governance Manual and Code of Conduct which set out the expectations and responsibilities of Directors under APRIL's governance framework.

Individual Directors have a right to obtain information necessary for them to discharge their duties from executives employed by APRIL.

Directors may seek independent professional advice, at the expense of the company if any Director wishes to do so, subject to prior agreement of the Chairperson.

THE BOARD IS RESPONSIBLE FOR DECISIONS RELATING TO THE INVESTMENT OF APRIL FUNDS, THE RESEARCH PROGRAM, PROTECTION AND COMMERCIALISATION OF INTELLECTUAL PROPERTY, AS WELL AS MANAGEMENT OF APRIL

BOARD MEMBERS

APRIL's Board members are:

INDEPENDENT DIRECTORS

DR TONY PEACOCK (CHAIRPERSON)

SU MCCLUSKEY

MEMBER NOMINATED DIRECTORS

PROFESSOR ROBERT VAN BARNEVELD

DAVID HENMAN

APL APPOINTED DIRECTORS

MARGO ANDRAE

DR GERARD DAVIS (until 24 Feb 2022)

PROFESSOR FRANK DUNSHEA

NEIL FERGUSON

Details of each Director's skills and experience can be found in the Directors' report on page 62

BOARD COMMITTEES

APRIL has constituted the following Board Advisory Committees:

- Research and Development Advisory Committee
- Education Advisory Committee
- Audit Committee

Further detail on the functions of these committees is provided below.

RESEARCH AND DEVELOPMENT ADVISORY COMMITTEE

Clause 38.6 of APRIL's constitution requires the Directors to establish a Research and Development Advisory Committee, and also permit each Ordinary Member to appoint a member of the committee by notice to the Company Secretary.

The committee's purpose is to advise and assist the Board of APRIL on all matters relating to the establishment, conduct and monitoring of Projects undertaken by or on behalf of the company.

The members of the committee as at 30 June 2022 are:

- Dr Tony Peacock (Chair)
- Associate Professor Sam Abraham, Murdoch University
- Dr David Cadogan, Feedworks P/L
- Dr Kirsty Chidgey, New Zealand Pork Industry Board
- Dr Taya Clarke, Westpork P/L
- Dr Jeremy Cottrell, The University of Melbourne
- Dr Darryl D'Souza, CHM Alliance Pty Ltd (SunPork)
- Dr Hugo Dunlop, Apiam Animal Health Ltd
- Dr Rebecca Morrison, Rivalea (Australia) P/L
- Dr John Pluske, APRIL
- Professor Eugeni Roura, The University of Queensland
- Dr Jane Ryan, Anatara Lifesciences Ltd
- Dr Rob Smits, Australian Pork Limited
- Professor Paul Verma, SARDI

The committee held two meetings during 2021/22 on 29 October 2021 and 8 April 2022.

EDUCATION ADVISORY COMMITTEE

The Education Advisory Committee is established under clause 38.1(b) of the APRIL constitution as an Advisory Committee to advise and assist the APRIL Board in discharging its activities in relation to Education and Training within APRIL.

The members of the committee as at 30 June 2022 are:

- Professor Frank Dunshea, The University of Melbourne (Chair)
- Dr Rebecca Athorn, Australian Pork Limited
- Dr Tony Peacock, APRIL
- Dr John Pluske, APRIL (CEO/Chief Scientist)
- Professor Eugeni Roura, The University of Queensland
- Dr Stuart Wilkinson, Feedworks P/L

The committee held two meetings during 2021/22 on 6 September 2021 and 9 February 2022.

AUDIT COMMITTEE

The Audit Committee is established under clause 38.1(b) of the APRIL constitution as an Advisory Committee to advise and assist the APRIL Board in discharging its responsibility for the general oversight of APRIL affairs in the areas of financial accounting and reporting, Government reporting, governance, risk management, and the underlying internal control environment.

The members of the committee as at 30 June 2022 are:

- Su McCluskey (Chair)
- Neil Ferguson
- Sandra Di Blasio

The CEO and Company Secretary also attend all Audit Committee meetings.

The committee held five meetings during 2021/22 on 8 September 2021, 25 October 2021, 8 February 2022, 11 April 2022 and 31 May 2022.

MANAGEMENT

M 0410 436 871
E j.pluske@april.org.au

CEO/CHIEF SCIENTIST

DR JOHN PLUSKE
BSc (Agric) (Hons), PhD (UWA), RAnNutr., R. Anim. Sci.

Dr John Pluske is the Chief Scientist and CEO of The Australasian Pork Research Institute Limited (APRIL), and an Honorary Professorial Fellow at The University of Melbourne. His research career, including many years as a Pork CRC Subprogram Leader and Board member, has focused on nutrition-gut disease interactions in pigs, growth and development, feed and ingredient evaluation, and alternatives to dietary antimicrobial compounds.

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E c.rikardbell@april.org.au

MANAGER, COMMERCIALISATION AND RESEARCH IMPACT

DR CHARLES RIKARD-BELL
BSc.Agr, MSc, PhD

As Manager, Commercialisation and Research Impact for APRIL, Dr Rikard-Bell is responsible for the commercialisation of intellectual property (IP) generated by the company. Charles worked in UK, Belgium and USA as a pig geneticist before returning to Australia to work with a multinational animal health company for 11 years, holding technical, sales and marketing roles in Australia and Asia Pacific. Charles gained his PhD in nutrition and biology through the CRC for an Internationally Competitive Pork Industry.

COMPANY SECRETARY

MR GEOFF CROOK
BSc (Hons), FCA

Geoff has over 18 years' experience in senior financial roles in Australia. Geoff worked for the CRC for High Integrity Australian Pork as Business Manager, and as CEO for the final year of the CRC's operations. Prior to that Geoff held the roles of Business Manager and Company Secretary with the CRC for an Internationally Competitive Pork Industry, Finance and Compliance Manager with the Grape and Wine Research and Development Corporation and Chief Financial Officer and Company Secretary of an ASX listed software company.

MEMBERS

FOUNDATION MEMBERS

- Anatara Lifesciences Ltd
- Apiam Animal Health Ltd
- Australian Pork Limited
- Feedworks Pty Ltd
- Murdoch University
- New Zealand Pork Industry Board
- Ridley Agriproducts Pty Ltd
- Rivalea (Australia) Pty Ltd
- South Australian Research and Development Institute
- CHM Alliance Pty Ltd (SunPork)
- The University of Melbourne
- The University of Queensland
- Westpork Pty Ltd

ASSOCIATE MEMBERS

- Jefo Australia Pty Ltd
- DSM Nutritional Products Pty Ltd
- University of New England

SUPPORTING MEMBER

- RSPCA Australia

FINANCIAL STATEMENTS

AUSTRALASIAN PORK RESEARCH INSTITUTE LIMITED

ANNUAL REPORT FOR THE YEAR ENDED 30 JUNE 2022

DIRECTORS' REPORT

30 JUNE 2022

YOUR DIRECTORS PRESENT THEIR REPORT, TOGETHER WITH THE FINANCIAL STATEMENTS FOR AUSTRALASIAN PORK RESEARCH INSTITUTE LIMITED, FOR THE FINANCIAL YEAR ENDED 30 JUNE 2022 AND THE AUDITOR'S REPORT THEREON.

The following persons were Directors of the Company during the financial year and are at the date of this report, except as otherwise stated:

APL APPOINTED DIRECTORS

MS MARGO ANDRAE
PGCertMgt, MAICD

Margo joined APL as CEO on 1 August 2019. Prior to commencing with APL, Margo held positions with Cattle Council of Australia, CSIRO, University of NSW, Rural Industries Research and Development Corporation and QLD Local Government. She has extensive experience and networks across primary industries, regional Australia and research environments through these roles.

Margo has extensive experience in stakeholder engagement, marketing, communications, business development, operations and resource management and has a graduate certificate in management from Australian Graduate School of Management, UNSW.

Margo was a former Director of Agricultural Innovation Australia (AIA).

DR GERARD DAVIS
[resigned 24 February 2022]
BSc, Ph.D, MBA, GAICD

Dr Gerard Davis is an executive with extensive experience in agribusiness, biotech and agtech and a demonstrated ability to derive value from commercialising technology in companies ranging from start-ups to multi-national global leaders. Dr Davis has experience consulting to a range of organisations from agtech startups such as Mastaplex, research consortiums such as the CRC for Food Agility as well as major agribusinesses and organisations such as the Bill and Melinda Gates Foundation. These appointments have included developing strategic, organisational and technology commercialisation plans. The work has involved projects across Australia, New Zealand, Africa and South Asia.

Dr Davis has previously held senior roles with a series of major Australian and global companies, with more than 15 years' experience in commercialisation of technology. Most recently he was General Manager of Innovation and Strategic Development at Australian Agricultural Company. Prior to that he held senior roles with ThermoFisher Scientific and Pfizer's Animal Health Division, now Zoetis. In these roles he has been instrumental in enabling commercial success from the development and implementation of technology in the livestock and agri-food industries. Dr Davis spent 11 years as a researcher with Australia's leading research agency, CSIRO.

INDEPENDENT DIRECTORS

DR TONY PEACOCK
FTSE FAICD
Independent Chair

Dr Tony Peacock is a passionate advocate for applied research. A reproductive scientist by training, Tony has worked at the Universities of Sydney, Melbourne and Saskatchewan. He has a high media profile with regular spots on ABC Radio speaking on innovation. Tony holds a Diploma of the Australian Institute of Company Directors; Bachelor of Science Hons Agriculture and PhD Veterinary Science, University of Sydney. He is a Fellow of the Australian Institute of Company Directors, a Fellow of the Academy of Technology and Engineering, and is an Adjunct Professor at the University of Canberra.

Tony is considered an expert in collaboration between the public and private sectors on innovation. Tony has served on the Board of a number of start-up biotechnology companies and environmental groups, his current research interests are in science communication, research leadership and effective innovation systems. He is a Director of Peacock Consulting Pty Ltd, the Woodlands and Wetlands Trust, ACT, the Marine Bioproducts CRC and the CRC for Solving Antimicrobial Resistance in Agribusiness, Food and Environments. He is the Chairman of Wintermute Biomedical Inc., Wintermute Biomedical Australia Pty Ltd., Ten Carbon Chemistry Pty Ltd. He has an outstanding track record as a manager of the Pig Research and Development Corporation (1996–2000), the Pest Animal Control

Cooperative Research Centre (2001–2005), the Invasive Animals CRC (2005–2010) and most recently the Cooperative Research Centres Association (2010–2020).

He was a 2014 Monash University Churchill Fellow, investigating the relationship between business and research in the USA, the UK, Germany and Singapore. He has consulted to the Governments of Taiwan and Vietnam on innovation models and has represented Australian innovation in Japan, New Caledonia, Sweden, Denmark, the Netherlands, Germany, France and the UK. In 2013 he received the University of Sydney Alumni Award for Community Service and in 2010 the Australian Government Eureka Prize for Improving the Public Understanding of Science.

SU MCCLUSKEY
FCPA, B.Com, MAICD

Su is a Director of Australian Unity, LiveCorp Ltd and Energy Renaissance, a Commissioner for International Agricultural Research, and is the Special Representative for Australian Agriculture for the Australian Government. Su was a Commissioner on the National Covid-19 Commission Advisory Board, a member of the Charities Review, the NSW Review of the Regulatory Framework and the Small Business Digital Taskforce. She was also a member of the Independent Review Panel for CPA Australia, the Harper Review of Competition Policy and the Regional Telecommunications Independent Review. Su was previously a director of the Foundation for Young Australians and the NSW Rice Marketing Board.

Su was the CEO of the Regional Australia Institute and the Council of Rural Research and Development Corporations and the Executive Director of the Office of Best Practice Regulation. Su has held senior positions with the Business Council of Australia, the National Farmers' Federation and the Australian Taxation Office. She was named the Westpac/Australian Financial Review Regional Women of Influence in 2013 and received the Women in Agribusiness award in 2014 for outstanding contribution to policy development. Su is also a beef cattle farmer at Yass, NSW.

ELECTED DIRECTORS

PROFESSOR ROBERT VAN BARNEVELD
B.Agr.Sc. (Hons), PhD, RAnNutr, FAICD

Professor van Barneveld is Group CEO and Managing Director of the SunPork Group of Companies which includes SunPork Farms, SunPork Fresh Foods, Swickers Kingaroy Bacon Factory and SunPork Solutions. In addition, Professor van Barneveld is a Non-Executive Director of the Ridley Corporation, and Chair of Autism CRC Ltd. He is a former Director of Australian Pork Ltd, Roseworthy Piggery Pty Ltd, Social Skills Training Pty Ltd and Porkscan Pty Ltd. Professor van Barneveld has a PhD in pig nutrition and formerly worked as a consultant scientist and nutritionist in Australia and overseas for more than 26 years.

PROFESSOR FRANK DUNSHEA
B.Agric. Sci., PhD, FNSA, FAPSA, FAAAS, RegAnimSci

Frank Dunshea is a Redmond Barry Distinguished Professor and Chair of Agriculture at the University of Melbourne and Professor of Animal Growth and Development at the University of Leeds. He has had a research career spanning 37 years in farm animal and biomedical research. His area of expertise is in growth physiology and nutrition and understanding the interactions between the animal and the animal's environment. His research has had a high scientific impact and the results of much of his research have been rapidly adopted by industry. He has maintained a balanced approach to research, combining fundamental with applied research, providing commercial and public good outcomes. Frank is committed to ensuring that all animal industries operate in a responsible and sustainable manner and much of his work has focused on improving efficiency through reducing inputs and outputs while maintaining product quality and consumer health.

MR NEIL FERGUSON
BBus. (Agric)

Mr Ferguson is currently the Chief Executive Officer for Westpork Pty Ltd. and has had 23 years' experience in the pig industry. Mr Ferguson is an Australian Pork Limited Delegate, Chair of Agricultural Produce Commission of Western Australia – Pork Producers' Committee, and a member of Pork Innovation Western Australian and Pork Industry Training WA.

MR DAVID HENMAN
BScAgr., MSc.Vet.Sc., RAnNutr.

Completing his Agriculture Science degree at The University of Sydney, David began his career in the pig industry with PIC in 1987 as part of their management training program involved in the development of Auspig with the PIC genotype, and then moved to Colborn Dawes in Wagga Wagga as a nutritionist and support for the Format feed formulation system in Australia.

David has been nutritionist at Rivalea (Australia) Pty Ltd/ QAF/Bunge Meat industries since 1991 and since 1995 involved in developing research objectives for internal research, as well as being principal investigator for research work conducted on behalf of other commercial companies and pig industry research bodies. David obtained a Master of Science in Veterinary Science from The University of Sydney in 2004. As the Manager of Research and Innovation for the feed milling business, he is responsible for the formulation of 240,000 t/year for its internal pig business and 100,000 t/year for external clients across all species. With roles in the company across all of Rivalea's pig production systems over 26 years, David is very aware of the problems facing pig enterprises. David has also developed a worldwide network of commercial and academic contacts to collaborate with on projects to benefit the Australian pig industry.

DIRECTORS MEETINGS

The number of Directors' meetings (including meetings of Board Committees) and number of meetings attended by each of the Directors of the Company during the financial year are:

DIRECTOR		BOARD OF DIRECTORS	AUDIT COMMITTEE	R&D ADVISORY COMMITTEE	EDUCATION ADVISORY COMMITTEE
Ms Margo Andrae	Eligible	5	–	–	–
	Attended	4	–	–	–
Dr Gerard Davis	Eligible	3	–	–	–
	Attended	3	–	–	–
Dr Tony Peacock	Eligible	5	–	2	2
	Attended	5	–	2	2
Ms Su McCluskey	Eligible	5	5	–	–
	Attended	4	5	–	–
Professor Robert van Barneveld	Eligible	5	–	–	–
	Attended	4	–	–	–
Professor Frank Dunshea	Eligible	5	–	–	2
	Attended	5	–	–	2
Mr David Henman	Eligible	5	–	–	–
	Attended	5	–	–	–
Mr Neil Ferguson	Eligible	5	5	–	–
	Attended	5	4	–	–

PRINCIPAL ACTIVITIES AND OBJECTIVES OF THE COMPANY

The Company's objectives are focussed on enhancing the Australasian Pork Industry by investing in research, development, education and training, and commercialisation activities focused on priorities and deliverables that ensure the sustainability of Australasian pork production.

PERFORMANCE MEASUREMENT

The Company evaluates its performance against objectives, milestones and targets as set out in the strategic plan (available at http://apri.com.au/wp-content/uploads/2020/05/Strategic-Plan-APRIL-May-2019.pdf), and against the uptake of research outcomes, where appropriate, by Industry. Progress against activities is reported to Members annually. A new strategic plan for the period 1 July 2022 to 30 June 2025 was approved by the Board during the year.

MEMBERSHIP

The Company is limited by guarantee. As at 30 June 2022, 13 organisations continue as Ordinary Members and three organisations continue as Associate Members and one organisation continues as a Supporting Member of the Company. In the event of a winding up where there are insufficient assets to pay all liabilities, each of the members are required to contribute $10 each which would result in total additional funds of $170.

LEAD AUDITOR'S INDEPENDENCE DECLARATION

The lead auditor's independence declaration is set out on the following page and forms part of the Directors' Report for the financial year ended 30 June 2022.

This report is made in accordance with a resolution of the Directors:

Dr Tony Peacock
Chair

4 October 2022
Canberra

INDEPENDENCE DECLARATION

30 JUNE 2022

RSM Australia Partners

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AUDITOR'S INDEPENDENCE DECLARATION

As lead auditor for the audit of the financial report of Australasian Pork Research Institute Ltd for the year ended 30 June 2022, I declare that, to the best of my knowledge and belief, there have been no contraventions of:

(i) the auditor independence requirements of the *Corporations Act 2001* in relation to the audit; and

(ii) any applicable code of professional conduct in relation to the audit.

RSM AUSTRALIA PARTNERS

Canberra, Australian Capital Territory
Dated: 17 October 2022

GED STENHOUSE
Partner

STATEMENT OF INCOME AND RETAINED SURPLUS

FOR THE YEAR ENDED 30 JUNE 2022

	NOTE	2022	2021
		$	$
Revenue	2	2,477,641	2,232,387
Expenses			
Research programme and other costs		(1,312,368)	(1,385,592)
Management expenses	3	(528,353)	(483,738)
Other expenses	4	(279,620)	(266,199)
Surplus from operating activities		**357,300**	**96,858**
Financial income		12,973	19,894
Net financial income	5	**12,973**	**19,894**
Surplus before income tax		**370,273**	**116,752**
Tax expense		–	–
Surplus for the period		**370,273**	**116,752**
Retained surplus brought forward		**3,786,437**	**3,669,685**
Retained surplus carried forward		**4,156,710**	**3,786,437**

The above statement of income and retained surplus should be read in conjunction with the accompanying notes

STATEMENT OF FINANCIAL POSITION

AS AT 30 JUNE 2022

	NOTE	2022	2021
		$	$
ASSETS			
Current assets			
Cash and cash equivalents	7	4,022,826	4,348,164
Trade and other receivables	8	344,471	280,102
Investments	9	751,426	–
Other assets	10	211,020	139,406
		5,329,743	**4,767,672**
Total assets		**5,329,743**	**4,767,672**
LIABILITIES			
Current liabilities			
Trade and other payables	11	568,483	523,756
Unearned income	12	551,705	412,180
Provisions	13	21,162	24,257
		1,141,350	**960,193**
Non-Current liabilities			
Provisions	13	31,683	21,042
		31,683	**21,042**
Total liabilities		**1,173,033**	**981,235**
Net assets		**4,156,710**	**3,786,437**
Equity			
Retained surplus		4,156,710	3,786,437
Total equity		**4,156,710**	**3,786,437**

The above statement of financial position should be read in conjunction with the accompanying notes

STATEMENT OF CASH FLOWS

FOR THE YEAR ENDED 30 JUNE 2022

	NOTE	2022	2021
		$	$
CASH FLOWS FROM OPERATING ACTIVITIES			
Cash receipts from members and customers		2,728,947	2,822,847
Payments to suppliers and employees		(2,315,832)	(2,167,664)
Net cash from operating activities		**413,115**	**655,183**
CASH FLOWS FROM INVESTING ACTIVITIES			
Interest received		12,973	19,894
Purchase of Term Deposits		(751,426)	–
Net cash investing activities		**(738,453)**	**19,894**
Net (decrease) / increase in cash and cash equivalents		(325,338)	675,077
Cash and cash equivalents at beginning of financial year		4,348,164	3,673,087
Cash and cash equivalents at end of financial year	7	**4,022,826**	**4,348,164**

The above statement of cash flows should be read in conjunction with the accompanying notes

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEAR ENDED 30 JUNE 2022

NOTE 1. SIGNIFICANT ACCOUNTING POLICIES

Australasian Pork Research Institute Limited is a public company incorporated and domiciled in Australia. The financial statements are presented in Australian dollars, which is Australasian Pork Research Institute Limited's functional and presentation currency.

The Company is a not-for-profit entity.

The financial report was authorised for issue by the Directors on 4 October 2022.

The principal accounting policies adopted in the preparation of the financial statements are set out below. These policies have been consistently applied to all the years presented, unless otherwise stated.

NEW OR AMENDED ACCOUNTING STANDARDS AND INTERPRETATIONS ADOPTED

The company has adopted all of the applicable new or amended Accounting Standards and Interpretations issued by the Australian Accounting Standards Board ('AASB') that are mandatory for the current reporting period.

AASB 1060 General purpose financial statements – simplified disclosures for for-profit and not-for-profit tier 2 entities

The company has adopted AASB 1060 from 1 July 2021. The standard provides a new Tier 2 reporting framework with simplified disclosures that are based on the requirements of IFRS for SMEs. As a result, there is increased disclosure in these financial statements for key management personnel and related parties. As permitted by AASB 1053 for early adoption of AASB 1060, comparative information has not been provided for these new disclosures.

Any new or amended Accounting Standards or Interpretations that are not yet mandatory have not been early adopted.

BASIS OF PREPARATION

These general purpose financial statements have been prepared in accordance with Australian Accounting Standards – Simplified Disclosures and Interpretations issued by the Australian Accounting Standards Board ('AASB') and the Corporations Act 2001, as appropriate for not-for-profit oriented entities.

Historical cost convention

The financial statements have been prepared under the historical cost convention.

GOODS AND SERVICES TAX ('GST') AND OTHER SIMILAR TAXES

Revenues, expenses and assets are recognised net of the amount of associated GST, unless the GST incurred is not recoverable from the tax authority. In this case it is recognised as part of the cost of the acquisition of the asset or as part of the expense.

Receivables and payables are stated inclusive of the amount of GST receivable or payable. The net amount of GST recoverable from, or payable to, the tax authority is included in other receivables or other payables in the statement of financial position.

Cash flows are presented on a gross basis. The GST components of cash flows arising from investing or financing activities which are recoverable from, or payable to the tax authority, are presented as operating cash flows.

Commitments and contingencies are disclosed net of the amount of GST recoverable from, or payable to, the tax authority.

CURRENT AND NON-CURRENT CLASSIFICATION

Assets and liabilities are presented in the statement of financial position based on current and non-current classification.

An asset is classified as current when: it is either expected to be realised or intended to be sold or consumed in the company's normal operating cycle; it is held primarily for the purpose of trading; it is expected to be realised within 12 months after the reporting period; or the asset is cash or cash equivalent unless restricted from being exchanged or used to settle a liability for at least 12 months after the reporting period. All other assets are classified as non-current.

A liability is classified as current when: it is either expected to be settled in the company's normal operating cycle; it is held primarily for the purpose of trading; it is due to be settled within 12 months after the reporting period; or there is no unconditional right to defer the settlement of the liability for at least 12 months after the reporting period. All other liabilities are classified as non-current.

EMPLOYEE BENEFITS

Short-term employee benefits

Liabilities for wages and salaries, including non-monetary benefits, annual leave and long service leave expected to be settled wholly within 12 months of the reporting date are measured at the amounts expected to be paid when the liabilities are settled.

Other long-term employee benefits

The liability for annual leave and long service leave not expected to be settled within 12 months of the reporting date are measured at the present value of expected future payments to be made in respect of services provided by employees up to the reporting date using the projected unit credit method. Consideration is given to expected future wage and salary levels, experience of employee departures and periods of service. Expected future payments are discounted using market yields at the reporting date on national government bonds with terms to maturity and currency that match, as closely as possible, the estimated future cash outflows.

Wages and salaries

Liabilities for wages, salaries and annual leave that are expected to be wholly settled within 12 months of reporting date, represent present obligations resulting from employee's services provided to reporting date, are measured as the undiscounted amounts based on remuneration wage and salary rates that the Company expects to pay as at reporting date including related on-costs.

Non-accumulating non-monetary benefits are expensed based on the net marginal cost to the Company as the benefits are taken by the employees.

PROVISIONS

A provision is recognised in the Statement of Financial Position when the Company has a present legal or constructive obligation as a result of a past event, and it is probable that an outflow of economic benefits will be required to settle the obligation. Provisions are determined by discounting expected future cash flows at a pre-tax rate that reflects current market assessments of the time value of money of the risks specific to the liability.

RESEARCH PROJECT COSTS

Expenditure on research activities, undertaken with the prospect of gaining new scientific or technical knowledge and understanding, is recognised in the Statement of Income and Retained Surplus as an expense as incurred.

NOTE 1. SIGNIFICANT ACCOUNTING POLICIES (continued)

FOREIGN CURRENCY TRANSLATION

Foreign currency transactions and balances

Foreign currency transactions are translated into the functional currency of the Company, using the exchange rates prevailing at the dates of the transactions (spot exchange rate). Foreign exchange gains and losses resulting from the settlement of such transactions and from the re-measurement of monetary items at year end exchange rates are recognised in profit or loss.

FAIR VALUE MEASUREMENT

When an asset or liability, financial or non-financial, is measured at fair value for recognition or disclosure purposes, the fair value is based on the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date; and assumes that the transaction will take place either: in the principal market; or in the absence of a principal market, in the most advantageous market.

Fair value is measured using the assumptions that market participants would use when pricing the asset or liability, assuming they act in their economic best interests. For non-financial assets, the fair value measurement is based on its highest and best use. Valuation techniques that are appropriate in the circumstances and for which sufficient data are available to measure fair value, are used, maximising the use of relevant observable inputs and minimising the use of unobservable inputs.

CRITICAL ACCOUNTING JUDGEMENTS, ESTIMATES AND ASSUMPTIONS

Coronavirus (COVID-19) pandemic

Judgement has been exercised in considering the impacts that the Coronavirus (COVID-19) pandemic has had, or may have, on the company based on known information. This consideration extends to the nature of the products and services offered, customers, supply chain, staffing and geographic regions in which the company operates. Other than as addressed in specific notes, there does not currently appear to be either any significant impact upon the financial statements or any significant uncertainties with respect to events or conditions which may impact the company unfavourably as at the reporting date or subsequently as a result of the Coronavirus (COVID-19) pandemic.

The preparation of the financial statements requires management to make judgements, estimates and assumptions that affect the reported amounts in the financial statements. Management continually evaluates its judgements and estimates in relation to assets, liabilities, contingent liabilities, revenue and expenses. Management bases its judgements, estimates and assumptions on historical experience and on other various factors, including expectations of future events, management believes to be reasonable under the circumstances. The resulting accounting judgements and estimates will seldom equal the related actual results.

NOTE 2. REVENUE

	2022	2021
	$	$
Research and project co-funding	80,719	41,195
Membership fees	2,075,000	1,945,000
Commercialisation income	321,922	246,192
	2,477,641	**2,232,387**

ACCOUNTING POLICY

Grants

Grant revenue is recognised in profit or loss when the company satisfies the performance obligations stated within the funding agreements.

If conditions are attached to the grant which must be satisfied before the company is eligible to retain the contribution, the grant will be recognised in the statement of financial position as a liability until those conditions are satisfied.

Research and project co-funding and commercialisation revenue

Revenue is recognised at an amount that reflects the consideration to which the company is expected to be entitled in exchange for transferring goods or services to a customer. For each contract with a customer, the company: identifies the contract with a customer; identifies the performance obligations in the contract; determines the transaction price which takes into account estimates of variable consideration and the time value of money; allocates the transaction price to the separate performance obligations on the basis of the relative stand-alone selling price of each distinct good or service to be delivered; and recognises revenue when or as each performance obligation is satisfied in a manner that depicts the transfer to the customer of the goods or services promised.

Membership revenue

Membership fees comprise annual subscription fees, application fees, fees upon cessation of membership and contribution fees.

NOTE 3. MANAGEMENT EXPENSES

	2022	2021
	$	$
Management fees	528,353	483,738
	528,353	**483,738**

Australian Pork Ltd and SciEcons Consulting charges the Company management fees on a reimbursement basis which is calculated based on the time spent by each of the organisation's employees on providing corporate services to the Company.

NOTE 4. OTHER EXPENSES

	2022	2021
	$	$
Legal fees	7,979	4,172
Directors fees	73,250	110,000
Travel	14,360	4,376
Bad debt provision	21,114	–
Communication costs	4,545	3,182
Commercialisation costs	95,035	104,627
Other	63,337	39,842
	279,620	**266,199**

NOTE 5. FINANCIAL INCOME

Interest income from investments and cash and cash equivalents	12,973	19,894
	12,973	**19,894**

ACCOUNTING POLICY

Interest income is recognised in the Statement of Income and Retained Surplus as it accrues, using the effective interest method.

NOTE 6. INCOME TAX EXPENSE

The Company is a non-profit scientific institution and as such the Company's constitution prohibits the distribution of income and assets to members except as bona fide compensation for services or goods provided to, or expenses incurred on behalf of, the Company. Accordingly, the Company is not subject to income tax.

NOTE 7. CASH AND CASH EQUIVALENTS

Cash at bank	1,821,730	454,606
Term deposits – original maturity date of 3 months or less	2,201,096	3,893,558
	4,022,826	**4,348,164**

The Company holds term deposits with interest rates of between 0.70% and 2.25%.

ACCOUNTING POLICY

Cash and cash equivalents comprise cash balances, at call deposits and term deposits with an original maturity of 3 months or less. Bank overdrafts that are repayable on demand and form an integral part of the Company's cash management are included as a component of cash and cash equivalents for the purpose of the Statement of Cash Flows.

NOTE 8. TRADE AND OTHER RECEIVABLES

	2022	2021
	$	$
Trade receivables	227,926	124,331
Other receivables	137,659	155,771
Less: Bad debt provision	(21,114)	–
	344,471	**280,102**

ACCOUNTING POLICY

Receivables are stated initially at their fair value and subsequently measured at their amortised cost less for any allowance for expected credit losses.

NOTE 9. INVESTMENTS

Term deposits	751,426	–
	751,426	**–**

The company holds a term deposit which accrues interest at 1.77% per annum and matures in September 2022 (2021: nil).

NOTE 10. OTHER CURRENT ASSETS

Prepayments	211,020	139,406
	211,020	**139,406**

NOTE 11. TRADE AND OTHER PAYABLES

Trade and other payables	568,483	523,756
	568,483	**523,756**

ACCOUNTING POLICY

Trade and other payables are initially measured at fair value and subsequently measured at amortised cost. Trade payables are normally settled on 30 day terms.

NOTE 12. UNEARNED INCOME

	2022	2021
	$	$
Current		
Contract liabilities	551,705	412,180
	551,705	**412,180**

ACCOUNTING POLICY

Contract liabilities

Contract liabilities represent the company's obligation to transfer goods or services to a customer and are recognised when a customer pays consideration, or when the company recognises a receivable to reflect its unconditional right to consideration (whichever is earlier) before the company has transferred the goods or services to the customer.

NOTE 13. PROVISIONS

Current	21,161	24,257
Non-current	31,683	21,042
	52,844	**45,299**

NOTE 14. REMUNERATION OF AUDITORS

During the financial year the following fees were paid or were payable for services provided by RSM Australia Pty Ltd, the auditor of the company.

Audit services – RSM Australia Pty Ltd		
Audit of the financial statements	13,943	12,400
	13,943	**12,400**

NOTE 15. KEY MANAGEMENT PERSONNEL DISCLOSURES

The following were key management personnel of the Company for the entire reporting period, unless otherwise stated:

Directors

1. Ms Margo Andrae – PGCertMgt, MAICD
2. Dr Gerard Davis – BSc, Ph.D, MBA, GAICD (resigned 24 February 2022)
3. Dr Tony Peacock – BScAgr(Hons), PhD, FAICD, FTSE – Independent Chair
4. Ms Su McCluskey – FCPA, B.Com, MAICD
5. Professor Robert van Barneveld – B. Agr.Sc. (Hons), PhD, RAnNutr, FAICD
6. Professor Frank Dunshea – B. Agric. Sci, PhD, FNSA, FAPSA, FASAP, RAnNutr
7. Mr Neil Ferguson – B.Bus (Agric)
8. Mr David Henman – BScAgr., MSc.Vet.Sc., RAnNutr.

Executives

9. Dr John Pluske – Chief Executive Officer, BSc (Agric) (Hons), PhD (UWA), RAnNutr, R. Anim.Sci

KEY MANAGEMENT PERSONNEL TRANSACTIONS WITH THE COMPANY

During the year the Company transacted with entities for which key management persons hold positions that result in them having control or significant influence over the financial or operating policies of these entities. The terms and conditions of the transactions with key management personnel and their related parties were no more favourable than those available, or which might reasonably be expected to be available, on similar transactions to non-key management personnel related entities on an arm's length basis.

Compensation

The aggregate compensation made to directors and other members of key management personnel of the company is set out below:

	2022	2021
	$	$
Aggregate compensation	266,587	295,226
	266,587	**295,226**

NOTE 16. RELATED PARTY DISCLOSURES

Transactions with key management personnel related entities. In the following table, superscripts refer to the key management personnel affiliations (from the numbered list of directors in Note 15) with each related party. Net transactions with the Company by director related entities were as follows:

Project and program expenditure		
Australian Pork Limited (1,2)	85,497	68,072
SunPork Group (5)	511,317	301,155
The University of Queensland (5)	295,050	166,578
The University of Melbourne (6)	33,334	100,876
Australasian Pig Science Association (9,6)	10,450	–
Rivalea (Australia) Pty Ltd (8)	269,188	332,802
Ridley Agriproducts Pty Ltd (5)	34,473	29,597
SciEcons Consulting (9)	193,462	50,000
The University of New England (5)	–	4,326
Current receivables		
Trade receivables from related parties	37,754	11,118
Current payables		
Trade payables to related parties	219,573	161,913

Transactions with key management personnel related entities consist of the receipt of membership fees and commercialisation income, and the payment of research costs, consultancy fees and costs related to the Company's Industry Placement Program.

Terms and conditions

All transactions were made on normal commercial terms and conditions and at market rates.

NOTE 18. COMMITMENTS

The Company has entered into Research and Development contracts which require the Company to make future cash payments to counterparties once certain obligations have been performed by those counterparties.

At 30 June 2022 these commitments (exclusive of GST) total $1,788,866 (2021: $1,700,067) and will be funded by cash balances and future receipts from member and research participant contributions.

NOTE 19. SUBSEQUENT EVENTS

The impact of the Coronavirus (COVID-19) pandemic is ongoing and while it has not financially impacted the company up to 30 June 2022, it is not practicable to estimate the potential impact, positive or negative, after the reporting date. The situation continues to evolve and is dependent on measures imposed by the Australian Government and other countries, such as maintaining social distancing requirements, quarantine, travel restrictions and any economic stimulus that may be provided.

No matter or circumstance has arisen since 30 June 2022 that has significantly affected, or may significantly affect the Company's operations, the results of those operations, or the Company's state of affairs in future financial years.

NOTE 20. REGISTERED OFFICE

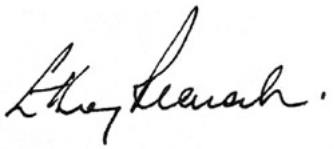
The address of the Company's registered office is LEVEL 2, 2 BRISBANE AVENUE, BARTON, ACT 2600.

DIRECTORS DECLARATION

IN ACCORDANCE WITH THE RESOLUTION OF THE DIRECTORS OF AUSTRALASIAN PORK RESEARCH INSTITUTE LIMITED MADE PURSUANT TO SECTION 295(5)(A) OF THE CORPORATIONS ACT 2001, THE DIRECTORS DECLARE THAT:

- The attached financial statements and notes comply with the Corporations Act 2001, the Australian Accounting Standards – Simplified Disclosures, the Corporations Regulations 2001 and other mandatory professional reporting requirements;
- The attached financial statements and notes give a true and fair view of the company's financial position as at 30 June 2022 and of its performance for the financial year ended on that date; and
- There are reasonable grounds to believe that the company will be able to pay its debts as and when they become due and payable.

On behalf of the Directors



Dr Tony Peacock
Chair

4 October 2022
Canberra

Ms Su McCluskey
Audit Committee Chair

4 October 2022
Canberra

INDEPENDENT AUDITOR'S REPORT

RSM Australia Partners

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INDEPENDENT AUDITOR'S REPORT

TO THE MEMBERS OF

AUSTRALASIAN PORK RESEARCH INSTITUTE LTD

Opinion
We have audited the financial report of Australasian Pork Research Institute Ltd (APRIL), which comprises the statement of financial position as at 30 June 2022, the statement of comprehensive income, the statement of changes in equity and the statement of cash flows for the year then ended, and notes to the financial statements, including a summary of significant accounting policies, and the directors' declaration.

In our opinion, the accompanying financial report of APRIL is in accordance with the Corporations Act 2001, including:

(i) giving a true and fair view of APRIL's financial position as at 30 June 2022 and of its financial performance for the year then ended; and

(ii) complying with Australian Accounting Standards *Simplified Disclosures* under AASB 1060 *General Purpose Financial Statements – Simplified Disclosures for For-Profit and Not-for-Profit Entities*.

Basis for Opinion
We conducted our audit in accordance with Australian Auditing Standards. Our responsibilities under those standards are further described in the *Auditor's Responsibilities for the Audit of the Financial Report* section of our report. We are independent of APRIL in accordance with the auditor independence requirements of the Corporations Act 2001 and the ethical requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants* (the Code) that are relevant to our audit of the financial report in Australia. We have also fulfilled our other ethical responsibilities in accordance with the Code.

We confirm that the independence declaration required by the Corporations Act 2001, which has been given to the directors of APRIL, would be in the same terms if given to the directors as at the time of this auditor's report.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Other Information
The directors are responsible for the other information. The other information comprises the information included in APRIL's annual report for the year ended 30 June 2022, but does not include the financial report and the auditor's report thereon.

Our opinion on the financial report does not cover the other information and accordingly we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial report, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial report or our knowledge obtained in the audit or otherwise appears to be materially misstated.

If, based on the work we have performed, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Responsibilities of the Directors for the Financial Report
The directors of APRIL are responsible for the preparation of the financial report that gives a true and fair view in accordance with Australian Accounting Standards – *Simplified Disclosures* under AASB 1060 *General Purpose Financial Statements – Simplified Disclosures for For-Profit and Not-for-Profit Entities* and the Corporations Act 2001 and for such internal control as the directors determine is necessary to enable the preparation of the financial report that gives a true and fair view and is free from material misstatement, whether due to fraud or error.

In preparing the financial report, the directors are responsible for assessing the ability of APRIL to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the directors either intend to liquidate APRIL or to cease operations, or have no realistic alternative but to do so.

Auditor's Responsibilities for the Audit of the Financial Report
Our objectives are to obtain reasonable assurance about whether the financial report as a whole is free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of this financial report.

A further description of our responsibilities for the audit of the financial report is located at the Auditing and Assurance Standards Board website at: http://www.auasb.gov.au/auditors_responsibilities/ar4.pdf. This description forms part of our auditor's report.

RSM AUSTRALIA PARTNERS

GED STENHOUSE
Partner

Canberra, Australian Capital Territory
Dated: 17 October 2022

AUSTRALASIAN PORK RESEARCH INSTITUTE LTD

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Willaston SA 5118

APRI.COM.AU

Australasian
Pork Research
Institute Ltd
APRIL