final report

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Prepared by: Emily Walker
Meat & Livestock Australia

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Locked Bag 991
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Co-Product Adoption Workshop 2015

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Executive Summary

Since inception, Meat & Livestock Australia (MLA) together with its partners has completed extensive research in to various co-product technologies. MLA has an ongoing commitment to keep the Red Meat Value Chain updated with the most relevant information, research and insights. This is to ensure that maximum value is captured for the red meat industry. MLA presented the results of recent red meat co products research to industry in the form of a workshop on 27 April 2015.

Seventy six delegates were invited to the workshop which focussed on four technologies where the research phase has recently been completed and/or a business case has recently been generated.

These technologies were:

- Powdered meat and desiccated liver
- Chondroitin Sulphate
- Blood products
- Bioplastics

The workshop was held in Brisbane with 18 attendees in total. This allowed interested industry processor to receive a customised presentation in the days following the workshop while the presenters were all still available (V.COP.0078).

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1 Background

Co-products can be defined as any non-red meat part or product derived from these parts. Co-products comprise a significant - but potentially much larger - proportion of the returns from animal processing.

Advancements in technology and knowledge have identified a new range of co-products that offer significant potential for the Australian red meat industry to increase profitability.

Co-products account for approximately 11% of the value of a slaughtered animal (with skins and hides making up 6%, offal 4% and other rendered products making up the remaining 1% of the value). The remaining 89% of the value is the meat. Co-products make up approximately 62% of the weight of a slaughtered animal.

With an estimate value of $1.7 billion per annum, co-products deliver valuable returns, but have yet to be fully leveraged by the industry in Australia. In many cases, co-products offer more opportunities for innovation and profit than meat and can provide a valuable competitive edge for processing plants.

Co-products can be divided into two main groups:

- conventional co-products
- bioactives

The technologies presented in the 2015 Co-Product Adoption Workshop came from both of these groups.

** Note: additional information is available from MLA in Co-Products compendium version 2.0, July 2009

The background of MLA's projects in these areas along with the presenters' background is as follows:

Powdered meat and desiccated liver (A.MPT.0027, A.MPT.0029, A.MPT.0035, A.MPT.0036)

Co-Product background

Co-products within the Australian red meat industry typically have a short 'shelf life' window in which stabilising for value-added products can be considered before being rendered or such. While bioactives are being viewed as a desirable part of this added value net, processing or recovery of the co-products in a stabilised and functional form is often too expensive for the relatively small volumes recovered at the scattered facilities around Australia.

There is a clear opportunity to add value to the 62% of the slaughtered animal going into co-products. One way to assist this is to stabilise these materials maintaining their functional aspects for use in food or further co-product processing.

Powdered meat coproducts can be achieved a number of ways. The familiar ones being spray or freeze drying. Some commercial operators already providing this service, they do however tend to be very expensive. MLA over the last few years has investigated flash

drying using a simple rotor-mill system. Initial trials evaluated lungs, blood, bones, trim and hide on a small prototype unit, successfully drying each in less than one second. Larger sized trials on trim and bone also were successful again with drying times around one second – with desirable powdered profile < 10 um.

Presenter Background

Chris Dahm, R&D Consultant, Thricor Pty Ltd - Chris Dahm has 35 years' experience in food R&D predominantly in fast moving consumer goods. Chris started consulting as Thricor Pty Ltd in 1991 while setting-up and running his own small snack food manufacturing business. Thricor Pty Ltd has focussed over the last 15 years in assisting to ensure long term food supply through improved utilisation of materials.

Chondroitin Sulphate (A.BIM.0041)

Co-Product background

Chondroitin sulphate (CS) has an established global market as a nutraceutical addressing issues of joint health, osteoarthritis treatment & pain management.

Together with CSIRO, MLA has adapted an aqueous extraction process for chondroitin sulphate manufacture, which is organic solvent-free & has significantly reduced costs of production. To date, the process has been developed to laboratory scale & requires further confirmation of market opportunities before increasing to pilot, and ultimately, commercial scale.

Blood products (A.BIM.0040)

Co-Product background

There are potential commercial opportunities to be derived from the utilisation of by-product streams from meat processing, which may add value for stakeholders within the Australian meat and livestock industry. MLA has commissioned research which has led to the development of a compendium of animal-based compounds and extracts with potential commercial value. The priority compounds and extracts are immunoglobulin G (IgG) and haemoglobin, as well as bovine serum albumin (BSA), with a well-established history of use within the pharmaceutical and research sectors as a growth medium component to support the growth and maintenance of eukaryotic cells including stem cells.

Presenter Background

Dr Dianne Glenn, Principal, Corelli Consulting - Dianne Glenn has a breadth of experience within the biotechnology and life sciences sector in assessing the commercial opportunity of innovation. Her experience in this sector encompasses hands-on bench and pilot scale research and development, investment analysis, technology due diligence, and the development of strategies for commercialisation. Her recent work has included the development of a bio-refinery framework for production of chemicals and polymers from sustainable agricultural feedstocks.
Dianne is the principal of the Corelli Consulting, based in Sydney. She has a background in commercialisation and corporate activities, at KPMG; as an analyst within a boutique institutional investment bank; in a private biotechnology company, in both research and management positions; and as a research scientist in government and academic research institutes.

V.COP.0078 is the project code used to engage Corelli Consulting and to have Dr Dianne Glenn construct the reports and presentation necessary for Blood Products and Chondroitin Sulphate.

Bioplastics (P.PSH.0632)

Co-Product background

Aduro has developed a scalable method and process for the manufacture of a thermoplastic bio-resin called Novatein. Novatein is manufactured from bloodmeal to be competitive in price and performance with many hydrocarbon resins, a key advantage which many bio-resins have been unable to achieve. Whilst Novatein has many potential applications Aduro chose to formulate a resin to meet product criteria for a lamb rectal plug designed by Bestaxx Innovations, Sydney. Called the 'Port Jackson' the lamb rectal plug helps to reduce the rate of faecal contamination across a wide range of flock conditions received at the processing plant, and helps to reduce the incidence of plastic contamination in rendering material. Aduro intends to set-up an Australian manufacturing operation to supply Novatein to Bestaxx for production of the Port Jackson.

Presenter Background

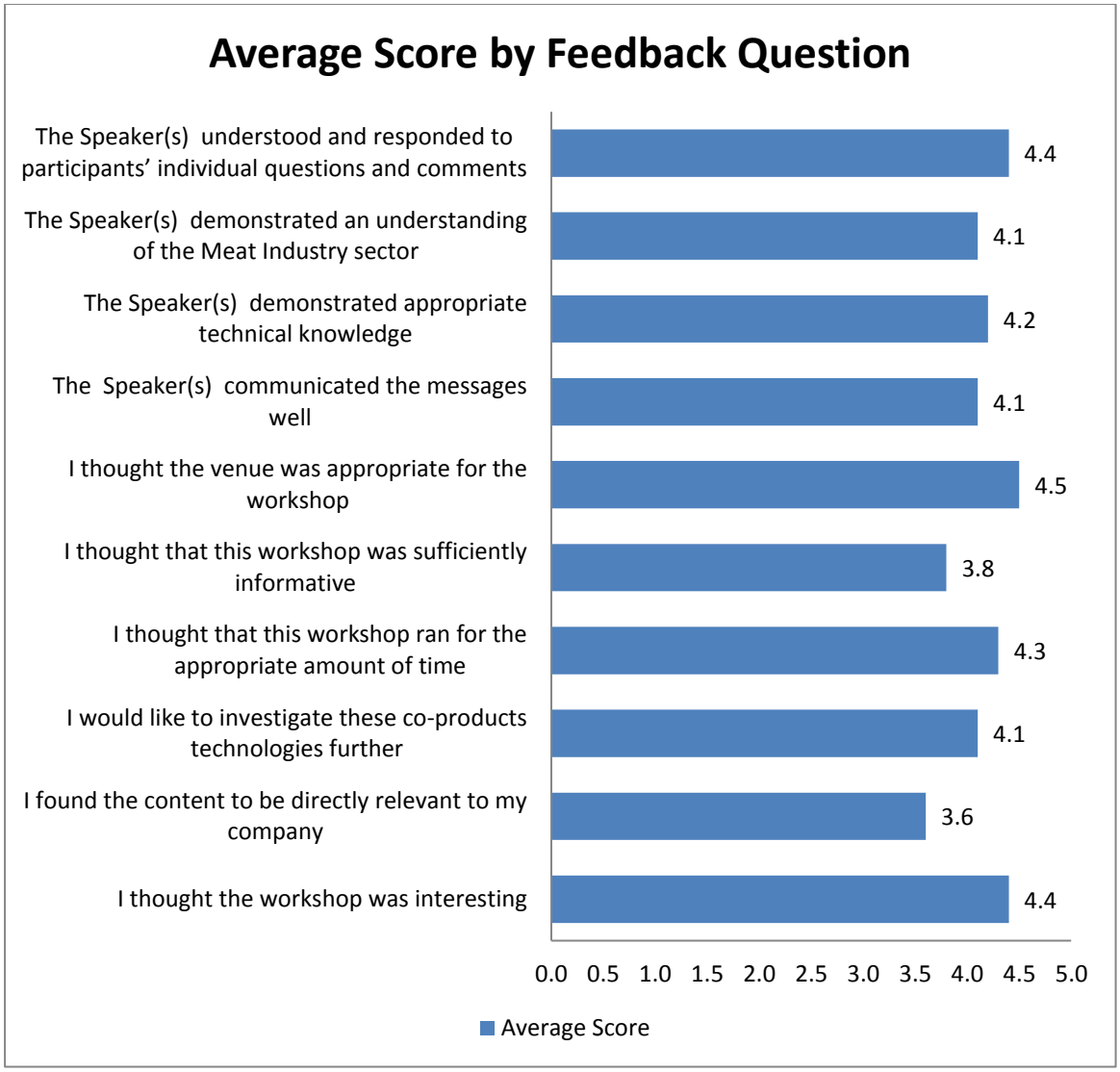
Darren Harpur, CEO, Auduro Biopolymers LP - Darren Harpur has owned several of his own businesses and comes from a background of 15 years' experience in the financial sector, ranging from international trade and finance, retail banking and commercial finance. Darren has recent experience in early stage technology start up's having been responsible for the management and business development of several companies spun out of research conducted at the University of Waikato in Hamilton New Zealand. He was made CEO of Aduro Biopolymers in 2013 after leading an investment round and securing Wallace Corporation in New Zealand is a major shareholder.

2 Results

The feedback forms completed by the attendees of the Co-Product Adoption Workshop reflect that the content was well received with an overall average response to the qualitative questions of 4.2 out of 5 (84%).

The question "Prior to the workshop I have previously received information on these topics from MLA or searched on MLA's website" received an average weighting of only 2.7 out of 5 (54%), suggesting that the workshop filled a gap that existed in communicating co-product results.

The following graph below illustrates average responses to feedback questions.



3 Conclusions/Recommendations

The 2015 Co-Product Adoption workshop was well received overall and enabled presentation of recently or soon to be completed project findings to be reported with the challenge now to industry to take up and adopt these technologies. MLA will continue to present such opportunities to industry and look to support early adopters further develop their innovation capability in this theme.

The attached appendixes include the investment briefs which can be found on the MLA website to inform value chain members interested in further adoption.

4 Appendix 1: Investment briefs

4.1 Powdered Co-products

Powdered Co-products

Chris Dahm Thricor Pty Ltd
Ph: 0409559915 Email:chrisdahm@bigpond.com

Coproduct adoption workshop- Brisbane Riverside Hotel, Monday 27 April 2015

Background	*Red meat coproducts have had many opportunities identified for adding value, most require considerable risks, be it market, investment or logistical. Powdering is an option that aims to enable a stepping stone to a number of these added value opportunities, by stabilising coproducts while maintaining functionality and food grade status.* *Powdered meat coproducts can be achieved a number of ways, familiar ones being spray or freeze drying with some commercial operators already providing this service, but they tend to be very expensive. MLA over the last few years has investigated flash drying using a simple rotor-mill system (see full report here). Initial trials evaluated lungs, blood, bones, trim and hide on a small prototype unit, successfully drying each in less than one second. Larger sized trials on trim and bone also were successful again with drying times around one second – with desirable powdered profile < 10 um.*
Market for products	*The main customers are existing food processors seeking flavour or bases for stuffing's, sauces, soups, stock powder, soup powders, baby food, fillings, bouillon cubes, seasonings, coatings, ready meals and snacks or added protein for dietary supplements, sports nutrition or weight management.* *Future markets include; infant nutritional supplements such as liver powder for iron, vitamin A and zinc supplementation for Indonesia, along with the potential to supply other coproducts in a stabilised and functional form for other bioactive applications, like collagen.*
Value Proposition	*Cost for a 1 T/hr feed system in stainless steel is approximately €300,000. Selling powdered trim at half the current market price, running the plant 1 shift/day at 20% rated capacity (allowing for $1 million total investment with a 30% ROI), breakeven is in 3 years.* *Additionally providing the potential to:* *1. Convert materials that will lose value through spoiling into a stabilised powder.* *2. Increase the yield per carcass with new streams of materials (offals, bone, hide, trim and maybe blood) for human food (e.g. High Moisture Extrusion Cooked HMEC) or pharmaceutical utilisation.* *3. Reduce the cost of transport for added value products for further processing.*
Competition and other risks	*These flash dryers have not been utilised to dry coproducts yet. There is a manufacturer of powdered meat in Queensland using a refractance dryer that retails trim powder for $58/kg, which is more than twice that required to provide the above value proposition; and pork (collagen) powder remains a popular ingredient in ham, bacon and smallgoods today along with soy and maize protein which typically retail for $11/kg.*
Next Steps	*Facilitated Adoption and Commercialisation via MLA's MDC PIP or PSH funding program is possible along with, further applied research and extension once up and running*
Potential Partners	*Meat processors may partner with a large customer (preliminary discussions with a customer have been had), or operate independently*
For further information contact	*Michael Lee* *mlee@mla.com.au* *Ph: 07 3620 5242*

Co-products adoption workshop investment brief: Powdered Coproducts

4.2 Chondroitin Sulphate

Chondroitin Sulphate

Dr Dianne Glen, Principal Corelli Consulting
Ph: 0411216929 Email: dianne.glenn@corelli-consulting.com

Coproduct adoption workshop- Brisbane Riverside Hotel, Monday 27 April 2015

Background	*Chondroitin sulphate (CS) has an established global market as a nutraceutical addressing issues of joint health, with claims to benefit joint health, osteoarthritis treatment & pain management.* *Together with CSIRO, MLA has adapted an aqueous extraction process for chondroitin sulphate manufacture, which is organic solvent-free & has significantly reduced costs of production. To date, the process has been developed to laboratory scale & requires further confirmation of market opportunities before increasing to pilot, and ultimately, commercial scale*
Market for products	*The joint health ingredients market, dominated by glucosamine & CS, is the largest & most rapidly growing subset of the nutraceutical market, with US$584.2 million in retail sales generated within the US & Europe (2012); in Japan, bone & joint support is worth ~A$1.7 billion. The volumes of CS consumed are substantial: the US imports the majority of CS used: ~3500 tonnes (2012). The estimated annual global market for CS as a human nutraceutical ingredient ranges from US$420 million to US$1 billion. The pet food and supplements provides additional opportunity: in the US veterinary supplements market, joint heath is the leading category, with a 4% growth rate and sales of US$690 million, or 45% of total sector sales. Chondroitin sulphate is among the best established pet supplements.*
Value Proposition	*The market for CS is predominantly supplied by product manufactured in China, which is reported by the international nutraceutical industry to be of low & variable quality & purity, low & variable concentration, unknown bioactivity, of ill-defined or unknown animal origin, & subject to intentional adulteration. Therefore, there is a substantial opportunity for Australian meat processors (read full market report here) to supply a growing international market with a reliable source of high & uniform quality & concentration CS from a defined & sustainable animal source, by means of a transparent & auditable supply chain.*
Competition and other risks	*Based on the specificity of the separation technology and the mild conditions of operation, the new process may present the opportunity for the Australian meat industry to redefine the gold standard in bioactive polymers in the global market, particularly for chondroitin sulphate, for the nutraceutical & potentially the pet feed markets. Australian bovine-derived CS reliably produced at consistent & high concentration by a cost-effective process from sustainable meat industry feedstocks with a transparent supply chain may have significant competitive advantages over existing competitor products.*
Next Steps	*The next steps in a staged roll out strategy would consider:* *Product assessment: Define & demonstrate CS at pilot scale; estimate industry uptake.* *Strategic partnerships: Identify strategic partners; establish collaborative relationships or joint venture.* *Define the supply chain: hub & spoke precinct model for feedstock processing within meat producing regions, with a refining hub at the centre of the spokes of meat processors.* *Opportunities for funding for first movers may be available through MLA's PIP/PSH program as well as the R&D tax incentive scheme.*
Potential Partners	*A value-adding business may be established as a JV or partnership with* *Contract manufacturer to establish the scalability of the technology, and the market-readiness of the products.* *Established value-adder/refiner with the appropriate manufacturing capability.* *End-user, e.g. a nutraceutical manufacturer; feed ingredients producer or feed compounder.* *The advantages for the meat industry include access to technical capability, highly valuable off-take agreements as well as financial and risk mitigation benefits.*
For further information contact	*Duncan Veal* *dveal@mla.com.au* *Ph: 029463 9366*

Co-products adoption workshop investment brief: Chondroitin Sulphate

4.3 Blood Products

Blood Products

Dr Dianne Glen, Principal Corelli Consulting
Ph: 0411216929 Email: dianne.glenn@corelli-consulting.com

Coproduct adoption workshop- Brisbane Riverside Hotel, Monday 27 April 2015

Background	*There is potential for commercial opportunity to refine valuable bioactive components such as bovine serum albumin (BSA), immunoglobulins and haemoglobin from bovine and ovine blood. A recent MLA market review of Blood Based proteins describes the market demand and dynamics for blood derived- bioactive ingredients that improve animal health and growth performance.*
Market for products	*Commercial opportunity exists for blood products within the key sectors of animal feeds and pet foods and supplements. There is potential for commercial application of these red meat industry blood-based bioactive ingredients in the following target markets:* *1. Pet foods and supplements: based on the large scale of the market, the high margins reported and consumer demand for "natural", meat-based products to support pet wellbeing;* *2. Animal-feeds: for improved growth and performance and to mitigate the stresses of industrial production, especially of pigs and poultry;* *3. Aqua- feeds: for improved growth and performance in a burgeoning global market, as well as potentially a sustainable replacement for fishmeal.*
Value Proposition	*There is market demand for bioactive ingredients to improve animal health and growth performance, especially of those animals raised under conditions of intensive cultivation. These and related blood products potentially have additional value as nutritional feed ingredients.* *Key drivers are the acceptance and uptake of comparable blood-based ingredients, the need for new bioactives in animal feeds, as well as the trend to animal-derived pet food ingredients.*
Competition and other risks	*Gaps in the commercial landscape within the feed and pet food industry for bioactive supplements and feed additives have been identified which could be filled by the Australian meat industry. To this end, the production of blood-derived bioactive proteins for the feed and pet foods industries would be advantaged by* *• Cost-effective refining technology;* *• Adequate feedstock;* *• BSE-free production;* *• Transparent and auditable supply chain; and* *• Sustainable manufacture.*
Next Steps	*The next steps in a staged roll out strategy would consider:* *• Build an evidence pack for blood-based bioactives in target animals and to determine an optimal inclusion rate within the feed and/or supplement. This is ideally done in collaboration with the end user (eg feed/pet food manufacturer)* *• Demonstrate the refining technology at large pilot-scale operation: Industry requires evidence of sustainable production of these products at a scale to meet commercial demand, by means of a transparent supply chain. This is ideally done in collaboration with a contract manufacturer or refiner.* *• Understand the product characteristics (purity, concentration and formulation) to satisfy each end-user and application.* *Opportunities for funding for first movers may be available through MLA's PIP/PSH program as well as the R&D tax incentive scheme.*
Potential Partners	*The key partners within the value-adding venture are:* *• Meat processing operators for provision of feedstock.* *• End-users of the blood-based bioactive proteins, specifically: pet food and supplements manufacturers; animal feed compounders; and aquafeed compounders.* *• Manufacturers, especially contract manufacturers, to translate the lab-scale refining technology to commercial scale.* *The advantages of early partnering for the meat industry include access to technical capability, highly valuable off-take agreements as well as financial and risk mitigation benefits.*
For further information contact	*Duncan Veal* *dveal@mla.com.au* *Ph: 029463 9366*

Co-products adoption workshop investment brief: Blood Products

4.4 Bioplastics

Bioplastics

Darren Harpur, CEO Aduro Biopolymers LP
Email:darren@adurobiopolymers.com

Coproduct Adoption Workshop - Brisbane Riverside Hotel, Monday 27 April 2015

Background	*Aduro has developed a scalable method and process for the manufacture of a thermoplastic bio-resin called **Novatein**. Novatein is manufactured from bloodmeal to be competitive in price and performance with many hydrocarbon resins, a key advantage which many bio-resins have been unable to achieve. Whilst Novatein has many potential applications Aduro chose to formulate a resin to meet product criteria for a lamb rectal plug designed by Bestaxx Innovations, Sydney. Called the 'Port Jackson' the lamb rectal plug helps to reduce the rate of faecal contamination across a wide range of flock conditions received at the processing plant, and helps to reduce the incidence of plastic contamination in rendering material. Aduro intends to set-up an Australian manufacturing operation to supply Novatein to Bestaxx for production of the Port Jackson.*
Market for products	*Global biopolymer demand was estimated at 258 million tonnes in 2010. While the conventional commonly used polymers cost around US$1000-1500/t, biopolymers cost from about US$4000/ with Novatein forecasts sale price at $2,000/t (see independent CBA). The CBA indicates a simple value per head of around $3.50. The addressable market for the Port Jackson in Australia is approximately 22 million lamb, 10 million mutton, and 650,000 bobby calves that are slaughtered every year. The Port Jackson has also been trialled in goats. An independent cost benefit analysis (CBA) of the production of Novatein, using the Port Jackson as the first product application completed in October 2014 describes the opportunity for a Novatein plant producing 1000 tons per annum for product applications that include and extend beyond the Port Jackson into Beef plugs, Sheep and Beef Weasand clips and horticultural pots and containers.*
Value Proposition	*Novatein repurposes a bloodmeal commodity product into a higher value material that helps to solve niche problems, particularly in the meat processing sector. The issue of plastic contamination in animal products delivered by meat processors to renderers is a hot discussion point within the industry. The use of Novatein in the Port Jackson has been shown to lower the rates of faecal contamination, improving the yield per head for processors and suppliers, as well has helping to address the downstream plastic contamination issues. Looking wider, Novatein can be tailored to meet other meat industry specific product criteria, creating a new category of meat industry product lines where bloodmeal is converted into plastic consumables which are renderable.*
Competition and other risks	*The bulk of competitor products are made from a narrow range of hydrocarbon plastics unsuitable for receipt by renderers. More recently some of these products have been made from a "soluble" hydrocarbon or synthetic resin which dissolves into liquid form in the rendering process in an attempt to address the plastic contamination issue. In trials undertaken by Aduro over 10,000 Port Jacksons were used in the processing of lambs and mutton in New Zealand and Australia. The Port Jackson was retained in the rectum with less than a 2% failure rate compared to reports from meat processors that competitor products including products made from soluble resin failed 5% to 15%. The superior retention of the Port Jackson in the rectum throughout the processing cycle was evidenced by a vastly reduced number of plugs lying on the processing floor, and in reduced faecal contamination measurements.*
Next Steps	*Aduro is looking to establish a Novatein production facility in Australia to feed the supply of resin to our parts production partner Bestaxx Innovation. The plant will be the second to be established following the construction of Aduro's pilot plant in New Zealand scheduled for late 2015. The plant will initially supply Novatein to Bestaxx for the Port Jackson. Resin production will grow as further Novatein formulations are developed for follow on product applications Aduro is looking for expressions of interest from meat processors who may be interested in partnering with Aduro for the Australian plant, ranging from providing pace for the location of the plant through to a joint venture with Aduro.*
Potential Partners	*Aduro Biopolymers NZ will lead all aspects of the identification and development of current and future product applications for Novatein, and the development of Novatein resins for those applications. This includes understanding and building out the value and supply chains, product design and the formulation of Novatein for identified product applications. The meat processing partner will not be required to have any expertise in plastics, polymer science and polymer manufacturing however access into markets with which the meat processor is familiar would be attractive to a future partnership.*
For further information	*Duncan Veal Ph: 029463 9366* *dveal@mla.com.au*

2015 Co-products adoption workshop investment brief: Bioplastics

5 Appendix 2: Workshop invitation

The Speakers

Michael Lee, Program Manager- Value Chain Innovation, Meat & Livestock Australia
Michael comes from a food technology background with 18 years' experience across the meat supply chain. Following his studies, Michael worked for Woolworths in their Smallgoods manufacturing division and National office within the Meat Trading division where he commercialised various new product launches and product specifications from farm gate to Meat and Deli retail unit.
Michael then moved on to Hans Smallgoods where he set up their Fresh Meat Technical program, before moving on to JBS and the role of Commercial Manager - Value Add Division. Since 2012, Michael has been with MLA working on off-farm demand building RD&E and innovation capability development programs to create and capture value for industry.
As a part of Michael's role, he looks forward to exploring novel co-/by-products adoption and commercialisation opportunities with stakeholders.

Dr Dianne Glenn, Principal, Corelli Consulting
Dianne Glenn has a breadth of experience within the biotechnology and life sciences sector in assessing the commercial opportunity of innovation. Her experience in this sector encompasses hands -on bench and pilot scale research and development, investment analysis, technology due diligence, and the development of strategies for commercialisation. Her recent work has included the development of a bio-refinery framework for production of chemicals and polymers from sustainable agricultural feedstocks.
Dianne is the principal of the Corelli Consulting www.corelli-consulting.com based in Sydney. She has a background in commercialisation and corporate activities, at KPMG; as an analyst within a boutique institutional investment bank; in a private biotechnology company, in both research and management positions; and as a research scientist in government and academic research institutes.

Chris Dahm, R&D Consultant, Thricor Pty Ltd
Chris Dahm has 35 years' experience in food R&D predominantly in fast moving consumer goods. Chris started consulting as Thricor Pty Ltd in 1991 while setting-up and running his own small snack food manufacturing business. Thricor Pty Ltd has focussed over the last 15 years in assisting to ensure long term food supply through improved utilisation of materials.

Darren Harpur, CEO, Auduro Biopolymers LP
Darren Harpur has owned several of his own businesses and comes from a background of 15 years' experience in the financial sector, ranging from international trade and finance, retail banking and commercial finance. Darren has recent experience in early stage technology start up's having been responsible for the management and business development of several companies spun out of research conducted at the University of Waikato in Hamilton New Zealand. He was made CEO of Aduro Biopolymers in 2013 after leading an investment round and securing Wallace Corporation in New Zealand is a major shareholder.

Co-Product Adoption Workshop 2015

Monday 27 April 2015, Brisbane Riverview Hotel

Thank you for joining us.

MLA , together with its partners, has completed extensive research using industry funds into various co-product technologies. With the research phase complete and or business cases generated, MLA is proud to present to the industry details of the commercial opportunity.

The focus of today's workshop will be:

- *Powdered meat and desiccated liver*
- *Chondroitin Sulphate*
- *Blood products*
- *Bioplastics*

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AMPC

The Agenda

9am	Tea and Coffee
9.15am	Introduction from Michael Lee, Program Manager– Value Chain Innovation, MLA
9.30am	**Technology One: Bioplastics**
	Presenter: Darren Harpur, CEO Aduro Biopolymers LP
10am	**Technology Two: Blood Products**
	Presenter: Dr Dianne Glenn, Principal, Corelli Consulting
10.30am	Morning Tea
10.45am	**Technology Three: Powdered Meat/Bone/Blood and Desiccated Liver**
	Presenter: Chris Dahm, R&D Consultant, THRICOR Pty Ltd
11.15am	**Technology Four: Chondroitin Sulphate**
	Presenter: Dr Dianne Glenn, Principal, Corelli Consulting
11.45am	MLA Donor Company Model
12pm	Discussion
12.15pm	Lunch

For further information, please contact:

E: valuechaininnovation@mla.com.au
P: 02 9463 9115
W: www.mla.com.au/off-farm/Value-adding/Co-products

{The presenters slides will be available here following today's workshop}

The Technologies

Blood Products

There is great potential for commercial opportunities to be derived from the utilisation of blood-based bioactive ingredients such as BSA, immunoglobulins and haemoglobin in the key sectors of pig and poultry feed ingredients, in fish and shrimp feeds, and in pet foods, based on the acceptance and uptake of comparable ingredients. This is driven by market demand for bioactive ingredients to improve animal health and growth performance. A recent review of the competitive landscape and interview with industry respondents suggest that the best opportunity for volumetric consumption of blood products from the Australian red meat industry is in the context of commercial application within the key sectors of animal feeds and pet foods and supplements.

Bioplastics

Blood is an undervalued co-product of bovine and ovine slaughter that is currently sold as a commodity has an opportunity to be value-added to as a major feedstock for the manufacture of a bio-polymer. This bio- polymer can be sold as a master-batch material, with mechanical properties similar to low density polyethylene (LDPE) making it suitable for injection moulding applications. An cost benefit analysis conducted by MLA validated the business opportunity for the meat processor and indicated a Discounted Payback Period of 0.81 years and NPV of $2.51/ head based on a total capital investment of $2M.

Powdered meat/bone/blood and desiccated liver

Red meat coproducts have had many opportunities identified for adding value, most require considerable risks, be it market, investment or logistical. Powdering is an option that aims to enable a stepping stone to a number of these added value opportunities, by stabilising coproducts while maintaining functionality and food grade status. Powdered meat coproducts can be achieved a number of ways, familiar ones being spray or freeze drying with some commercial operators already providing this service, but they tend to be very expensive. Initial trials evaluated lungs, blood, bones, trim and hide on a small prototype unit, successfully drying each in under one second. Larger sized trials on trim and bone also were successful again with drying times around one second.

Chondroitin Sulphate

Chondroitin sulphate has an established global market as a nutraceutical . This market as a nutraceutical for use in joint health for humans and companion animals is substantial, global and growing. Previous value chain studies have shown the potential to significantly add to the net value of a carcase by producing the product in Australia.

A recently project has detailed the opportunity to capture a portion of the growing CS market by manufacturing this product in Australia.