



THE FIFTH QUARTER

Meat Industry Biologicals Workshop

Meat and Livestock Australia (MLA) facilitated a Meat Industry Biologicals Workshop in early November 2001 that was run in parallel with the ClubBio Symposium.

The ClubBio Symposium was hosted by AustBio, the peak industry representative body for the Australian Biotechnology Industry. The programs were run consecutively to allow for interaction between delegates from the meat and biotech industries.

Approximately 40 meat industry participants attended the workshop which focused upon achieving three key outcomes;

- To demonstrate a continuity of activity within various meat industry and science based organizations.
- To enhance the connectivity between various links in the supply chain for high value meat industry biologicals including; producers, abattoirs, intermediate crude processors, and technical companies in the biotech/ pharma industries.
- To better understand the key drivers, barriers, and accelerants for change in the industry.

The workshop participants and a select group of industry experts jointly developed the outline of a program strategy for enhancing meat industry income from harvesting high value biologicals including:

- Promoting the current status of various high value co-products initiatives.
- Building awareness of available resources and QA initiatives across the entire supply chain.
- Supporting existing champions in advanced processing companies through partnership programs and actively seeking-out other product champions.
- Exploring and exploiting opportunities for "knowledge partnerships".
- Promoting MLA's role as a catalyst for innovation in this area.

International Developments

The EU scientific committee on BSE recently announced that biological materials sourced from BSE risk Level 1 (highly unlikely) countries, such as Australia, are safe for the manufacture of medical devices and products. This decision was given on the basis that precautions, including ante and post-mortem inspection at slaughter, animal identification, and traceability rules are adhered to.

This provides a fabulous opportunity to differentiate Australian -sourced biologicals, but a number of challenges still exist before we can take full commercial advantage of our unique animal health status.

MLA will continue to work with the industry and individual supply chain partners to exploit opportunities as they arise. The following brief synopses outline the presentations made at the workshop.

Protein products from the meat industry

Mike Boland, New Zealand Dairy Research Institute

Proteins of value from animal tissue include:

- Enzymes - for use as food processing aids, cleaning aids, surgical use and biotransformations.
- Hormones such as insulin, animal hormonal treatments (eg for fertility control, growth stimulation) and growth factors.
- Functional proteins such as gelatin and albumin - for commercial purposes, these proteins are usually fractionated to a semi-purified form. As well as the need to get the protein in a clean soluble form, proteins are fractionated to:
 - give increased specific activity (enzymes – lower addition level in applications), for functionality unavailable or impaired in mixtures;

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- to separate two or more products, each with added value, because of a need for purity to avoid other adverse effects;
- and to meet regulatory requirements.

Aqueous two-phase systems (APS) are a potentially valuable way of extracting and purifying proteins from meat by-products. They occur as a separation of the water into two phases when a polymer and a salt, or two polymers are dissolved. Typical systems use: PEG (polyethylene glycol)-salt, PEG-dextran, other polymers and/or affinity media. The phases separate well and can typically be processed in equipment similar to a dairy cream separator, with high throughputs and very clean separation of the phases. Separation of the desired protein into one phase or the other is achieved by choosing the right phase-forming materials (eg grade of PEG), and manipulating simple variables such as pH.

The big advantage of APS is the separation of the desired protein from bulk insoluble material, as well as purification in one or two steps. The separation steps are simple and continuous operation is the norm, making best use of plant. Use of affinity media, though expensive, can give high purifications if needed.

The separating materials usually used in APS separations are generally accepted as food grade materials, so the method can be used for manufacture of process aids and ingredients for the food industry. The cost of purchase (and sometimes disposal) of phase-forming chemicals is larger than the consumables cost for most other unit operations, however this can be minimised by simple cleaning and recycle.

Australia’s relative disease-free status means unique opportunities. Questions to be considered are: What are the target products? What is their value? Where, how big and how accessible is the market? How much raw material is available? How accessible is the source tissue? Are there species, seasonal or breed differences in the levels of component in the raw material? Are other environmental factors important?



Caption to go here

Table 1: Examples of use of APS to prepare proteins from animal

Protein	Tissue	Notes
Alkaline phosphatase	Bovine	Lab scale
d-Aminoacid oxidase	Porcine kidney	Lab scale
Catalase	Bovine liver	Lab scale
Insulin	Porcine pancreas	Lab scale
Lactated dehydrogenase	Rabbit muscle Porcine muscle Bovine liver	Affinity method, lab scale and pilot scale
Malate dehydrogenase	Porcine muscle	
Myokinase	Porcine muscle	
Pyruvate kinase	Porcine muscle	
Protein C	Porcine milk	Recombinant human protein
Alpha-1-antitrypsin	Sheep milk	
Prion Proteins	Bovine brain	Infected with BSE
Superoxide dismutase	Bovine liver	Lab scale and pilot scale

Meat bioactives – pathway to innovation

Dr George Slim, Industrial Research Ltd New Zealand

In the healthfood supplements market, meat co-products are just another raw material for biologically active products. They have many advantages over other raw materials such as wild plants or marine organisms, because the collection infrastructure is already in place, costs are lower, harvest is sustainable and regulatory barriers to market are lower for a material already recognised as safe food.

There are also many bioactive components in meat that are not available from other sources, such as chondroitin sulphate, a popular joint-health product. However, the market generally perceives meat as food, not as a source of health food supplements.

Finding a market is the key to successful bioactive meat products; if the market wants the product, the processing technology is always available. To find the markets, meat producers need to join with other producers of bioactive natural products and not stand-alone.

Functional dairy ingredients – How Australian dairy companies are moving up the value chain

Geoffrey Smithers, Food Science Australia

Food Science Australia (FSA) has extensive pilot scale equipment and technical expertise in areas related to food and food processing. FSA has a centre of expertise in

bioprocess technology with capabilities in the separation and recovery of valuable components from food and food waste streams. The aim is to invent and develop more efficient processes with an emphasis on production of value added functional and/or nutraceutical products from low value by-product streams. This has resulted in the development of scale-able processes for the recovery of bioactive compounds from the dairy, meat and fruit by-product streams. Examples include;

- Development of a commercial process for isolating a whey growth factor extract.
- Commercial scale process development based on two continuous chromatographic plants using CSEP technology to manufacture a whey protein isolate and a bioactive fraction for Murray Goulburn cooperative co. Ltd. The ingredients are exported as unique functional food ingredients.
- Process development for the manufacture of a casein phosphopeptide product, Recaldent™, which is manufactured and exported by Bonlac Foods Ltd. Enzyme modulated processes were also developed to add value to the by-products of the Recaldent™ process.
- Development of commercially viable processes for value addition to meat waste. This is in the process of being commercialised.

The organisation has successfully transferred CSEP technology, which is a continuous chromatography technology used in the chemical industry to the food industry. This has enabled the cost effective manufacture of value added food ingredients for export.

In recognition of the experience of FSA in implementing the CSEP technology into the food industry in Australia, Calgon Carbon of USA has the intention of installing a pilot scale CSEP continuous chromatographic system at FSA for use in research and development (R&D) projects. It is expected that the pilot CSEP plant will be installed and commissioned by June 2002.

We plan to transfer the expertise we developed in commercialising innovative dairy processing technologies to the large-scale fractionation of blood.

Adding value to co-products

Rob Stevenson, Gateway Products

A significant increase in value of co-products can be achieved by understanding the range and volume of raw materials you have available and the potential markets you can service when the raw materials are modified to suite key functions and applications for customer needs. Technology for adding value is also fundamental to prepare the desired functional characteristics and product form for that market.

Market assessment will help identify target industries, volumes and the technical requirements of the product, which in turn determines the technology and manufacturing needs required to modify, add value to the raw material, and present the finished product in the appropriate form for the market. The essential component for success is having access to the market

or access to a distribution network for sales, marketing and distribution of the value added products. The sales team must have a solid understanding of the market you are entering, a customer network, technical knowledge and the ability to position the new product to present well in the market. Many market barriers need to be addressed upfront to give the product the best chance for immediate sales and future growth.

There are a large number of potential value added co-products that can be manufactured to meet market needs. Once all factors have been defined, the market clearly mapped out, technologies developed and product optimised for greatest possible success; the required technology can be installed to produce the value added co-product to launch into its market. Diversifying markets is essential for future growth and to address the diminishing profits of products that have reached the end of their life cycle.

Australia is well positioned to take advantage of a range of global market areas like the Pet Food, Meat, Food, Flavour, Nutraceutical, Pharmaceutical and other markets with Australia adding value in the form of our image - clean, green, BSE free and GMO free to help boost our market approach.

The message is - know your raw materials and know your market in areas of incorporating latest technologies, developing your distribution network and reducing market barriers to achieve success.

Maintaining Australia's favourable animal disease status

Lex Carroll, Animal Health Australia

Animal Health Australia facilitates a national approach to enhancing Australia's animal health status through utilising effective partnerships between government and industry. It fosters an integrated national animal health system that meets current and future challenges, advances Australia's economic and trade interests, promotes international and domestic confidence and provides effective risk management of animal health issues.

New Sanitary PhytoSanitary, (SPS) arrangements applying to world trade in animal and animal products increasingly require substantiation of claims of disease freedom. Trading partners and consumers now demand accurate and timely information on our animal disease status that can be substantiated.

Services delivered by the Commonwealth, States and the private sector include maintaining an effective quarantine barrier, ensuring early diagnosis and control of serious diseases, ensuring product is free from harmful residues and safeguarding the welfare of animals involved.

Animal Health Australia manages the National Animal Health Information System, (NAHIS) which it produces quarterly reports and an annual Animal Health in Australia Report. Up to date information is available on the website: www.aahc.com.au/nahis

Cost and Availability of Raw Material

Bill Spooner, Food Science Australia

About 40% of the live weight of cattle is boneless meat and the remaining 60% is co-products. The hide and edible offal are worth about 9% of the total value of products from an animal. Most of the remaining material is rendered to make tallow and meat meal. The rendered products contribute about 4% of the value of products from the animal although the raw material for rendering is about 40% of the live weight. Some co-products such as foetal blood are valuable and profitable to collect. Others, such as pituitary glands appear to be valuable at \$126 per kg but high collection costs may make it unprofitable to collect these items.

Figure 2: Breakdown of Livestock

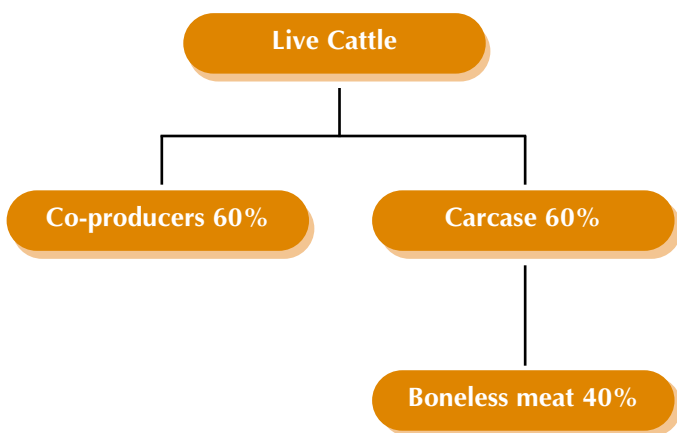


Table 2: Value of Co-products from 275 kg steer

Product	Quantity (kg)	Value (\$ per head) Sept 2001 prices
Boneless meat	187	1300
Co-products		
Hide	29	86
Edible offals	15	54
Pet food	5.5	2.5
Tallow	56	34
Meat meal	51	26
Blood meal	2.5	2.25
Total co-products		205

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Table 3: Co-products for biologicals

Foetal blood high volume producer	93 – 103 \$/kg
Foetal blood low volume producer	79 – 88 \$/kg
Ox gall concentrated to 75% solids	7.2 – 8.0 \$/kg
Beef adrenal glands	12 – 15.2 \$/kg
Beef pituitary gland	122 – 130 \$/kg
Pig pituitary gland	544 – 697 \$/kg
Beef ovaries	13 \$/kg
Beef trachea (trimmed)	2.8 \$/kg

Table 4: Availability of materials

Source of material	Whole blood (tonnes)	Bones (tonnes)	Pituitary gland (tonnes)
Australia	90,000	315,000	15
South east Queensland/ North East NSW	30,000	105,000	5
Abattoir with kill of 700 per day	2,100	7,350	0.35

Bioactives from animal cartilage

Gregory S. Harper and Peter G. Allingham - CSIRO Livestock Industries

Graham Pegg and Xiaoyi Qiu - School of Biological and Chemical Sciences, Central Queensland University

This group has worked over the last five years, to support manufacturers of ethical food supplements with a view to providing them with information about biological efficacy, product consistency and raw material sourcing. Animal cartilage products have been of particular interest. Anti-cancer activities and analgesic activities for arthritis are amongst many therapeutic claims attached to cartilage products. Our role has been to investigate the basis of these claims and to assist product development where the claims can be supported.

In the case of cartilage extracts, we have found solid evidence for biological activity in cartilage that works against development of new blood vessels: antiangiogenic activity. The activity varies widely between samples taken from



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products in the market place, though some manufacturers can achieve consistently active product. The activity can be enriched from extracts of shark cartilage (suggesting it is a single molecular species), and our group has achieved partial purification. Molecules of the glycosaminoglycan class seem to be involved in antiangiogenic activity.

It is important to realise that identification of a biological activity within a tissue extract, does not amount to proof of clinical or health efficacy of that extract: it is merely a suggestion. Justifiably, health authorities are becoming more focussed on the voracity of health claims attached to natural product preparations.

Table 5: Species exhibiting activity table

Species (cartilage)	AA Activity
Shark (skeleton)	Yes
Bovine (scapula)	Yes
Crocodile (ischium)	Yes
Emu, ostrich	No
Kangaroo, camel, sheep	Yes