final report

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MINTRAC

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MINTRAC scholarship program

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2 Background

The MINTRAC scholarship program began in 2001 and since that time more than 70 employees and students have participated in the original four categories of scholarships that MINTRAC offers. The MINTRAC scholarship program has had a close association with the MLA undergraduate program, with MINTRAC scholarship students undertaking workshops and projects at MLA.

The original four categories of scholarships were: Postgraduate research; the small projects grants; employee upskilling; MINTRAC undergraduate. This was changed to incorporate the outcomes of the 2006/7 review conducted by the scholarship committee which voted to replace the small projects grant with an international research grant pilot. Changes have also been made to the employee upskilling scholarship, lowering the requirement for employees to have worked in the industry for five years or longer to a minimum two years work experience in the industry. Also, the companies who employ recipients of the upskilling scholarship will now have to pay for 30% of the course fees, with MINTRAC funding the remaining 70%.
The four categories of scholarships in 2007/8 are:

2.1 Postgraduate research

This scholarship is for participants undertaking a Doctorate, Masters or Honours qualification in a discipline that is relevant to the meat industry. Applications that fit within one of the following MLA/AMPC programs are given priority over other proposals:

- The Red Meat Innovation R&D Program
- Co-Products R&D Program
- Meat Safety Issues Management
- Environment R&D – Resource Management
- Improving Productivity R&D – (Processing Technology Processing Occupational Health & Safety and Alternative Stunning Research)
- Adoption & Capacity
- Strategic Research and Development Program - Meat Quality Science and Technology
- Domestic marketing – Beef/Sheepmeat (Nutrition R&D)
- Market access (R&D)

The conditions of the postgraduate research scholarship include the submission of a summary report on the progress of their work to MINTRAC at six monthly intervals by both the students and their supervisor, presentation of ongoing and developing research to representatives of the meat industry once a year; a bound copy of the student's thesis; at the conclusion of the research, a short overview of their research in a format specified by MINTRAC which is distributed to the red meat processing industry; appropriate acknowledgement to MINTRAC, Meat and Livestock Australia (MLA) and Australian Meat Processor Corporation (AMPC) in the publication any manuscript embodying results of research undertaken during their studies; and a non-exclusive

perpetual, royalty-free licence for MINTRAC to use the project results and project intellectual property.

2.2 International research grant pilot

This is a sum of $5,000 to be matched by the applicant's employer, which will go towards the costs for one person employed in the Australian Meat Industry to travel overseas to research an area of interest to them and their company. Applicants must provide a comprehensive research proposal which indicates their reasons for applying for the grant, what they will be researching, how they will conduct the research, who they will be meeting with on their tour and what outcomes/knowledge they anticipate on bringing back to their plant.

On completion of the study the recipient will provide MINTRAC with a detailed research report in a format that can be easily disseminated to industry. They will also be required to present their report at the MINTRAC conference.

This is a new category offered by MINTRAC, and 2007/8 will be the trial period. If the grant should prove to be unsuccessful it will not be offered in 2008/9.

2.3 Employee upskilling

These scholarships are available for meat industry employees who are working in the meat processing industry and undertaking tertiary studies at Diploma level or higher. The company the student is working for must be a member of AMPC and the type of qualification must be relevant to the meat processing industry. Scholarships are only available for qualifications where no other source of funding is available. A limited number of Certificate IV applications are considered in exceptional circumstances.

The conditions of this scholarship include submission to MINTRAC of two progress reports in the first year of studies and one per year for the remainder of the course; provision of a written case study and completed evaluation questionnaire to MINTRAC within one month of achieving the qualification detailing the benefits to the student, sponsoring company, and the meat industry; participation in marketing activities from time to time (eg attend a conference, have a story written about them, have their photos in promotional material); applicants are to maintain employment in the meat processing industry at the meat processing plant that supported them through their studies or at another meat processing plant.

2.4 Undergraduate

MINTRAC offers scholarships to people of all ages interested in a career in meat processing, to attend a university or other tertiary institution for full-time study to gain a qualification relevant to the meat processing industry. The purpose of the scholarship is to encourage people to join the meat industry and undertake qualifications which will benefit the meat processing industry in the future.

In order to be eligible for this scholarship, students must be undertaking full-time tertiary studies for the first time; be studying for a qualification which is relevant to the meat processing industry; agree to work in a meat processing plant for six weeks per annum for the duration of the qualification with the intent to continue employment with the plant on completion of the qualification; and have written support from a meat processing plant which is a member of AMPC.

3 Scholarship evaluations

Scholarship applications are evaluated by a selection committee and students notified of the decision of the committee. Decisions are partly based on the relevance of the research to the industry and other research already in progress, and are subject to availability of funding.

3.1 Milestone requirement 1

– status of all scholarships reported to include completed in financial year, withdrawn, continuing from the previous financial year, and new

New Scholarships

Name	Category	Company/University	Qualification / Project title
[redacted]	Upskilling	CRF (Colac Otway) Pty Ltd	Graduate Diploma in Ergonomics
[redacted]	Upskilling	Australian Country Choice	Diploma of Business Management
[redacted]	Upskilling	Monbeef Pty Ltd	Master of Human Resource Management
[redacted]	Upskilling	Shark Lake Meat Works	Certificate IV Quality Assurance
[redacted]	Upskilling	Teys Bros (Holdings) Pty Ltd	Graduate Certificate in Business Administration
[redacted]	Upskilling	Stanbroke Beef Pty Ltd	Bachelor of Business Studies (Accounting & Management)
[redacted]	Upskilling	Harvey Industries Group Pty Ltd	Bachelor of Business (Marketing)
[redacted]	Upskilling	Australian Country Choice	Diploma of Business Management
[redacted]	Upskilling	CRF (Colac Otway) Pty Ltd	Diploma of Business Marketing
[redacted]	Undergraduate	University of New England	Bachelor of Science (Molecular Biotechnology)
[redacted]	PhD	University of Wollongong	Health Benefits of Docosapentaenoic Acid (DPA)

Continuing scholarships

Name	Category	Company	Qualification / Project title	Status/Comments
[redacted]	PhD	University of Sydney	Previous - Effects of Omega-3 Fatty acid deficiency on rat intestinal Structure and microbiology. New - Comparison of higher protein, red meat based diet versus higher carbohydrate, white meat based diet on weight loss, satiety, metabolic parameteres, iron status and immune function in young, obese women.	Reports up to date. Awarded an extension to scholarship funding. *([redacted] was awarded a MINTRAC scholarship in 2005 with the expected completion date of 30/01/2008. Factors beyond [redacted]s control have caused the delays in the project and therefore [redacted] has been awarded a new MINTRAC Scholarship to complete her research)* New completion date February 2009.
[redacted]	PhD	Deakin University	Investigation into the effects of dietary meat consumption, in conjunction with resistance training on muscular growth and strength in elderly population.	Currently preparing reports and thesis for examination.
[redacted]	PhD	University of Queensland	Development of a generic polymerase chain reaction (PCR) test for detection on carcases of microbial genes associated with human health and trade risks	Hoped to be complete by end of 2007.
[redacted]	PhD	University of Tasmania	Development and characterisation of genetic mutations in L. monocytogenes	Has again suspended enrolment due to illness. Supervisor keeps in contact with MINTRAC to alert us of enrolment updates.

[redacted]	PhD	La Trobe University	Disability prevention and effective disability management in the Australian Red Meat Industry	Was due to complete in December 2008, however still continuing research. Was a speaker at the MINTRAC Conference.
[redacted]	Undergraduate	Fletcher International Exports	Bachelor of Veterinary Science	Satisfactory progress. Due to complete in December 2008
[redacted]	Undergraduate	Hardwicks Meat Works Pty Ltd	Bachelor of Occupational Therapy	Satisfactory progress. Due to complete in December 2008
[redacted]	Undergraduate	Harvey Industries Group Pty Ltd	Bachelor of Commerce - Agriculture	Satisfactory progress. Due to complete in December 2008
[redacted]	Undergraduate	Harvey Industries Group Pty Ltd	Bachelor of Exercise and Health Science (Rehabilitation)	Due to have completed in December 2007. Awaiting final report, results and photo.
[redacted]	Undergraduate	Burrangong Meat Processors	Bachelor of Science (Resource & Environmental Management)	Satisfactory progress. Due to complete in December 2008.
[redacted]	Undergraduate	Primo Australia	Bachelor of Veterinary Science	Satisfactory progress. Due to complete in December 2009.
[redacted]	Undergraduate	CRF (Colac Otway) Pty Ltd	Bachelor of Biological Sciences	Satisfactory progress. Due to complete in June 2008.
[redacted]	Undergraduate	Monbeef Pty Ltd	Bachelor of Nursing	Satisfactory progress. Due to complete in December 2009.
[redacted]	Undergraduate	Fletcher International Exports WA Pty Ltd)	Advanced Diploma Accounting (18 months) then Bachelor of Commerce (Marketing) at UWA (from 01/7/04)	Awaiting final report, photo, results and letter from workplace mentor.
[redacted]	Upskilling	Teys Bros (Holdings) Pty Ltd	Masters in HR Management	Satisfactory progress. Due to complete in June 2009.

[redacted]	Upskilling	Fletcher International Exports	Bachelor of Business (Accounting)	Resumed study. Due to complete in December 2010.
[redacted]	Upskilling	Fletcher International Exports	Masters of Agribusiness	Satisfactory progress. Due to complete in June 2008.
[redacted]	Upskilling	Peel Valley Exporters Pty Ltd	Diploma in Occupational Health and Safety	Satisfactory progress. Due to complete in June 2008.
[redacted]	Upskilling	Peel Valley Exporters Pty Ltd	Diploma in Occupational Health and Safety	Satisfactory progress. Due to complete in June 2008.
[redacted]	Upskilling	Cargill Beef Australia	Masters of Business Administration	Satisfactory progress. Due to complete in January 2012.
[redacted]	Upskilling	CRF (Colac Otway) Pty Ltd	Bachelor of Applied Science (Food Science)	Satisfactory progress. Due to complete in December 2012.
[redacted]	Upskilling	H W Greenham & Sons Pty Ltd	Master Human Resource Management	Satisfactory progress. Due to complete in December 2008.
[redacted]	Upskilling	G & K O'Connor Pty Ltd	Master of Agribusiness, Graduate Certificate in Agribusiness	Satisfactory progress. Due to complete in December 2009. Received the International Stockmen's Educational Foundation Travel Fellowship to the 2008 International Livestock Congress. Article published in MINTRACker.
[redacted]	Upskilling	John Dee Warwick Pty Ltd	Bachelor of Science/Bachelor of OH&S	Satisfactory progress. Due to complete in December 2012.

Completed Scholarships

Name	Category	Company	Qualification / Project title	Status/Comments
[redacted]	Honours	Deakin University	Does red meat help young males recovery after strength exercise?	Completed in December 2007, Thesis and précis received.
[redacted]	Honours	University of Tasmania	Proteomic signatures of stress resistant Listeria monocytogenes to identify strains of greater resistance and determine whether stress (notes)	Thesis received, awaiting précis
[redacted]	Honours	Deakin University	Does red meat after exercise activate muscle synthesis in older women?	Completed in December 2007, thesis and précis received.
[redacted]	Honours	University of Adelaide	Maximising lamb feedlot performance and improving carcass sensory attributes by dietary means.	Completed in December 2007, awaiting thesis and précis.
[redacted]	PhD	University of Queensland	The role of habitat structure and competition in the ecology of Listeria species in food related and other environments.	Awaiting thesis and précis, thesis currently being examined.
Sweet, Timothy	PhD	University of Queensland	High frequency ultrasound in meat quality analysis	Has submitted first draft of thesis to supervisor. Awaiting final thesis, précis and photo.
[redacted]	Undergraduate	Fletcher International Exports	Bachelor of Business converted to double degree Bachelor of Business/Economics	Completed in December 2007. Received final report, results and photo. March MINTRACker article student.

[redacted]	Undergraduate	Bindaree Beef	Bachelor of Science	Completed in December 2007. Received final report, results awaiting photo.
[redacted]	Upskilling	International Exporters	Diploma of Maintenance Management	Completed December 2007. Received final report, results awaiting photo.
[redacted]	Masters	Swinburne University of Technology	Automated Meat Cutting using Abrasive water jets.	Withdrawn. No contact with supervisor or MINTRAC.
[redacted]	PhD	University of Tasmania	Investigation of Physiological Mechanisms of Microorganisms associated with Fresh Foods	Completed April 2008. Thesis and précis received. 2008 MINTRAC National Conference speaker
Smith, Robyn	PhD	RMIT	The effect of a low carbohydrate high protein meat based diet on incidence and severity of acne vulgaris	Completed March 2008. Electronic version of thesis received.
[redacted]	Upskilling	Fletcher International Exports	Graduate Certificate in Marketing	Completed September 2007. Received final report and photo.

3.2 Milestone requirement 2

Dissemination of outcomes of research to date

During this financial year, the MINTRAC Scholarship program has received four theses. They were received from:

- Emma Renehan - Honours – Effects of lean red meat on skeletal muscle stress signalling pathways following resistance exercise
- Tahlia Laffey - Honours – Effects of lean red meat on skeletal muscle hypertrophic signalling mechanisms
- Terry Pinfold - Honours – Lmo2821 a newly identified molecular marker of virulence in Listeria monocytogenes
- Heather Haines - PhD – Acid stress responses in Enterohaemorrhagic E. coli O111:H-
- Robyn Smith - PhD – The role of diet in clinical and endocrine manifestations of *acne vulgaris*

3.3 Milestone requirement 3

Collation of reports and dissemination to plants of scholarship outcomes from completed scholarships

Over the last 12 months the MINTRAC Scholarship program has received numerous final reports from scholarship holders. These reports are disseminated to industry in the form of an outcomes brochure. Anthony Hall, an Upskilling scholarship holder from Fletcher International Exports, completed his scholarship in September 2007. His final report has been printed and distributed to the industry. This report can be seen in attachment one.

The following students have also submitted their final reports and are ready to be sent to the graphic designer Paul Watson to prepare them for the MINTRAC Scholarship program outcomes folder:

- Ashley Strike, MINTRAC Undergraduate scholarship holder, completed a Bachelor of Engineering.
- Joshua MacLean, MINTRAC Undergraduate scholarship holder, completed a Bachelor of Science.
- Craig Spradbrow, MINTRAC Undergraduate scholarship holder, completed a Bachelor of business and economics.
- Terry Pinfold, MINTRAC Postgraduate scholarship holder, completed research project as described above.
- Heather Haines, MINTRAC Postgraduate scholarship holder, completed research project as described above.
- Jonathan Potter, MINTRAC Upskilling scholarship holder, completed his Diploma of Maintenance Management.

These reports can be seen in attachment two.

3.4 Milestone requirement 4

Presentations from scholarship holders at MINTRAC National Conference

At the 2008 MINTRAC National Conference held in Melbourne in March this year, the MINTRAC Scholarship program was represented by five scholarship holders. The attendance at last year's conference was minimal, so to alleviate this happening at the MINTRAC Conference in 2008, the scholarship holders presented in a plenary session with all delegates present.

The speakers included:

- Heather Haines, PhD: Investigation of the molecular and physiological basis of acid stress responses in Enterohaemorrhagic *E. coli* 0111:H-
- Timothy Sweet, PhD: High frequency ultrasound in meat quality analysis
- Lara Wallis, PhD: Disability management in the Australian Red Meat Industry
- Michael Healey, Undergraduate: Bachelor of Veterinary Science
- Mark Sansom, Upskilling: Master of Agribusiness, Graduate Certificate in Agribusiness

The conference presentations can be seen in attachment three. Feedback from the conference showed that the delegates felt the scholarships were "interesting, as expected" with 40% commenting it was "above expectations".

3.5 Milestone requirement 5

Annual evaluation of scholarship program

Over the last twelve months, the MINTRAC Scholarship program has had eleven new successful applicants. Of the new scholarship holders, nine are upskilling, with only one for undergraduate and postgraduate. With the upskilling scholarship operating successfully, emphasis should be focused on increasing the awareness of the undergraduate, postgraduate and overseas research scholarship. There have been no applications for the overseas research scholarship. From the new applications the prominent ways the students found out about the scholarship were:

- company personnel
- MINTRAC website and *MINTRACker*
- talk by MINTRAC representative, Kate Christensen at the MLA Undergraduate program.

At the December scholarship committee meeting, it was decided to remove the scholarship application date to encourage more applications throughout the year. This has proven to be a successful move as the numbers of applications have increased from previous years. The committee has agreed that once MINTRAC has received a few applications they are sent via email to the committee for review and a follow up teleconference is held to make the final decisions.

Undergraduate scholarships have been advertised in the Australian Farm Journal and Queensland Country Life newspaper.

3.6 Milestone requirement 6

Recommendations for the coming year

MINTRAC is going to have to concentrate on a range of initiatives to further promote the MINTRAC Scholarship program and its relationship with the scholarship holders. This will be done through:

1. continuing with the open application period with no closing date to further encourage applications
2. promoting the scholarship program through the MINTRAC newsletter, *MINTRACker*, the Training Manager and QA Manager Networks, MLA publications and the MINTRAC national conference
3. engaging the MLA Undergraduate program and liaising with the MLA projects officer about specific promotional activities

4. arranging a study skills workshop with an industry networking session, with representatives from the industry discussing their role and possible alternative career paths.

4 Attachments

Attachment 1. Anthony Hall

National Meat Industry
Training Advisory Council Limited
MINTRAC Scholarship Program
EMPLOYEE UPSKILLING SCHOLARSHIP

Anthony Hall

Export Manager, Fletcher International Exports

MINTRAC Upskilling Scholarship 2004-2007
Qualification: Graduate Certificate in Marketing
Tertiary Institution: Charles Sturt University

How I came to tertiary study

I left school in 1994 and all I wanted to do was get out into the work force and start earning some money. At that stage in life, I really had no intentions to further my education. I didn't believe I had the skills to take on a university degree. I never thought twice about this until 2003 when I learnt about the scholarship program that MINTRAC was offering to employees in the meat industry. By that time I had matured and could see I was in need of further personal development. I could see that taking on the Graduate Certificate in Marketing would further enhance my career and be of great benefit to Fletcher International Exports.

The scholarship

Money certainly plays a major role in our day to day lives, especially with a young family to support. Looking at the costs involved in studying a university course, I would have had to think twice about taking on something like this, if it wasn't for the grants MINTRAC were offering. Looking into the scholarship I could see two other major benefits in taking this on through MINTRAC. Firstly I could see I was going to get the support I needed to complete a Graduate Certificate. Studying externally was always going to be a big change and I knew that if I needed support, MINTRAC would be there to help. As it turned out, this was the case. On a few occasions, I was completely stuck and had no one to turn to for a suggestion on a question in one of my assignments. I spoke to the staff at MINTRAC and they immediately put me in touch with someone who was able to give me the guidance to work through the problem. Secondly I knew if someone was generous enough to pay for me to do a course, there was no way I was going to let them down. So, I worked especially hard to make sure that I completed the assignments.

Personal benefits of the study

Personally, I am a better person for completing this Graduate Certificate. There is a real sense of achievement in knowing that all of that hard work and those sleepless nights have been rewarded in the end. I did not initially have the confidence in my skill level to study at post-graduate level. With the support from MINTRAC and Fletcher International, this was not the case. My working environment became easier and I was happier in knowing what I was doing was a good job. By the time I had completed the certificate I had put in place a number of changes that benefited not only the company, but myself as well.

Benefits to the company and industry

The way I believe I have helped both Fletcher and the meat industry comes under the one banner. I was operating as a marketing/sales manager the way I was taught through my predecessor and through things I picked up from the people around me. This, in a way, was narrowing my vision as a marketing/sales manager. With my new marketing skills I have now developed new markets to take more products at a higher value.

This has helped increase revenue, but also allowed Fletcher International to be more flexible in what they are able to pay for the raw materials.

Future plans

At the moment, with two young children, I don't have any immediate plans to start a Masters, however I will reassess the situation in another year or so.

Suggestions

The support from MINTRAC was second to none. If I can make one suggestion, it would be to broaden your scope to allow more people to get in and study. Our industry can't have too many university qualified people.

Anthony (left) graduates with Fletcher International Exports' Managing Director, Roger Fletcher

MINTRAC

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Attachment 2. Final reports and précis

- Ashley Strike
- Joshua MacLean
- Craig Spradbrow
- Terry Pinfold
- Heather Haines
- Jonathan Potter

Ashley Strike
MINTRAC Undergraduate scholarship 2003–2007
Sponsor: Australian Meat Holdings
Qualification: Bachelor of Engineering
Tertiary Institution: University of Queensland

The scholarship

In 2003 I commenced the MINTRAC undergraduate/families scholarship. I completed my studies in 2006 but will return to university to further my studies in 2008.

In relation to undertaking and participating in my studies, the MINTRAC scholarship helped me immensely. Firstly, the scholarship was a great financial benefit for me while undertaking my studies. Secondly, the scholarship provided an introduction to the meat industry and although I have chosen not to work in this industry, I have been able to work alongside professional engineers and have had a valuable insight into the lifestyle and type of work I could expect, were I to go into this industry. It was a great advantage working alongside engineers while studying, as I was able to see the practical applications of the study.

Personal benefits of the study

Some of the personal benefits gained in relation to my studies include:

- professional experience from working in an engineering team
- exposure to many problems associated with a large plant such as AMH
- ability to liaise with superior engineers
- exposure to engineering projects and participation in various ways with many projects at AMH.

Benefits to the company and industry

Over the three and a half years I worked at AMH I compiled a large amount of documentation in regards to the electrical maintenance of the Dinmore plant. I also designed, with Michael Gugle, a standard labelling system for all the electrical switchboards, which had to comply with the SCADA labelling system. The largest project I completed while at AMH was updating the web pages for the SCADA for the Colby conveyor system. AMH benefited a lot from the work that I completed although the real benefit for the company would have been were I to stay after my degree had finished.

My studies complimented the work I was doing at AMH. The benefits that AMH gained in relation to my studies were that I was able to apply my knowledge to improve many of the existing systems that were already in place.

In my time at AMH I did not focus upon innovation and introducing new systems or technology as I was an undergraduate, however I did help to improve the existing systems. A lot of my work at AMH consisted of updating and restoring many things that had been neglected within the Engineering department due to lack of engineering staff.

Future plans

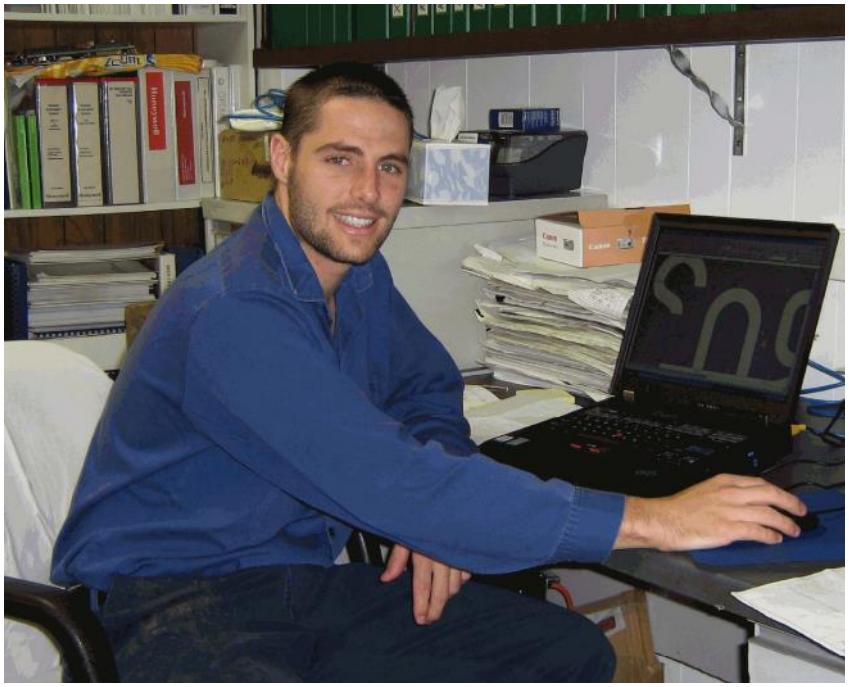
My future plans in relations to my career are not decided at this point. I have worked in the meat industry and can see there are many applications of my degree, in power, control and telecommunications. I will more than likely pursue a career in Power Engineering within Origin.

Suggestions

I think that the scholarship is a worthwhile venture for MINTRAC as it provides two things, an opportunity for students to gain an insight into this industry; and an opportunity for the sponsor company to gain a potential employee with site based knowledge.

I entered into this program not knowing in which direction I wished to pursue a career, and after my final years of study I am more inclined to look outside the meat industry. I believe, however, there will be many students who will continue to work with their sponsor company or in another company within the meat industry.

The one thing that I think could be improved in the scholarship program would be mentoring or meetings with the students as a compulsory part of the scholarship; otherwise this scholarship is a very worthwhile venture for MINTRAC.



Joshua MacLean
MINTRAC Undergraduate scholarship 2005–2007
Laboratory Technician
Sponsor: Bindaree Beef
Qualification: Bachelor of Science
Tertiary Institution: University of New England

The scholarship

The MINTRAC Scholarship that I have obtained over the last three years has allowed me to excel in my studies through giving me financial security to pay for accommodation and texts. This has allowed my studies to progress easily.

The work component of the scholarship has also given me important workplace skills.

During my work component I was employed as a Laboratory Technician in the microbiological lab of Bindaree Beef. The scholarship has allowed me to enter into a field of study that I both enjoy and is of benefit to the meat industry. My studies into Microbial disease and the passage of infection has allowed me to take modern laboratory practices to the processing plant I have completed my work requirements with, Bindaree Beef.

Workplace employment

Employment in the laboratory allowed me to gain and practice the skills I learnt during my degree in an industrial setting including the testing of meat products for bacterial pathogens, this work also gave me an important insight into the way bacterial pathogens are controlled and tested for on an industrial scale, this understanding of how these pathogens are transported has also allowed me to excel in units dealing with the clinical setting.

Personal benefits of the study

During my time of work within the microbiological laboratory of Bindaree I gained important work place skills and the ability to communicate with a wide range of people and levels of management to ensure product safety within the plant.

My studies while focused on the clinical settings can also be used in the food safety area. The knowledge and understanding I have gained of the passage of pathogens within the human body and how a pathogen can infect an individual can also be extended to the area of food safety. The food safety aspect is that the understanding of how a pathogen will affect a human host and what conditions the pathogens requires to survive will allow more effective quality control measures to be put into place to ensure product safety.

Future plans

My future plans are to enter the health system in the pathology sector however other positions with the meat industry would be seriously considered. Plans for undertaking an honours degree in the near future are also being made.

Suggestions

I have no recommendations for the improvement of the scholarship program and am quite happy with how the program has helped me through my degree.

Craig Spradbrow
MINTRAC Undergraduate scholarship 2004–2007
Sponsor: Fletcher International Exports
Qualification: Bachelor of Business and Economics
Tertiary Institution: University of Newcastle

The scholarship

The MINTRAC grant helped me to successfully complete my studies over the course of 4 years and receive excellent marks. The Scholarship I received allowed me to be financially independent from my parents this combined with regular work throughout the year with my sponsor company Fletcher International Exports, took the financial stresses out of university which many of my peers endured. The scholarship program also allowed me to gain invaluable industry experience which is highly sought after by employers.

My studies have given me the required theory to operate in the often high pressure and strategically important areas of Management, Human Resources and Economics. Without the underlying theory gained through my studies it would be difficult to effectively practice in my chosen areas of work. My studies also gave me a greater idea of my desired career path.

Workplace employment

Through my work with Fletcher International Exports i was able to implement my learning into practice which in turn helped F.I.E to achieve its goals while also providing me with hands on experience. I worked mainly within the human resources department which is has turned out to be my chosen career path. During my time I undertook various projects all of which provided mutual benefit to myself and F.I.E

Business and Economics are areas that affect every party in the meat industry. From Human resources and Industrial Relation to the economics of foreign currency exchange the meat industry is involved in a global market place and faces the same and sometimes extra challenges that every other industry faces. Understanding of Business and Economics is vital for the industry to remain competitive and operate efficiently and effectively.

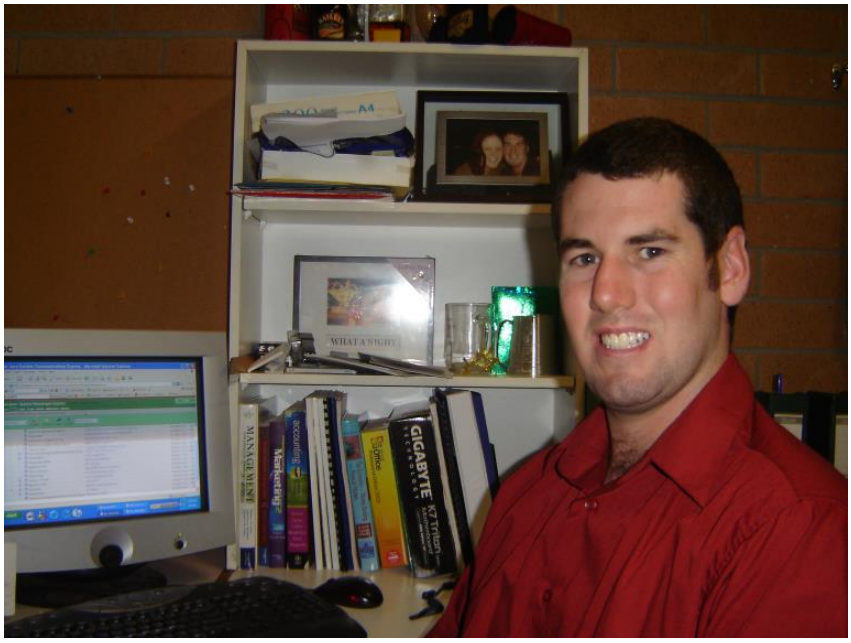
Future plans

Unfortunately at this stage I will not be undertaking a role within the meat industry. I have been offered a role in the banking industry which meets my career path aspirations and provides me with greater diversity of experience on top of what i have gained from the meat industry. This is not to say that my career will not lead me towards the meat industry in the future. I have gained much from my time working in the industry and have enjoyed it thoroughly.

Suggestions

The Scholarship scheme is a wonderful resource. It has helped me immensely and allowed me to achieve many goals that i may not have been able to achieve otherwise. My suggestions for improving the scheme would be to increase the awareness of the scholarships. Many would be students cannot afford the cost of university and many brilliant minds are never fully utilised. I suggest that sponsor companies should advertise the program at career days and in School newsletters etc.

Finally, thankyou to MINTRAC, AMPC and Fletcher International Exports for providing me with the opportunity to participate in the scholarship program.


GIGABYTE

Lmo2821 a newly identified molecular marker of virulence in *Listeria monocytogenes*

The problem and aim

Listeria monocytogenes is a rare but severe foodborne pathogen primarily affecting pregnant women, newborns, and adults with weakened immune systems. Not all strains of *Listeria monocytogenes* present the same level of virulence and associated risk to public health. The initial aim of this project was to investigate if the food processing environment was favouring the survival and proliferation of the more virulent strains of *Listeria monocytogenes*.

Very early into the project it was recognised that a suitable marker of virulence for individual isolates of *Listeria monocytogenes* was lacking. To date, the best methods available involved infection of animals followed by subsequent observations and autopsy. However, despite the resources invested into such procedures the results were questionable since *Listeria monocytogenes* demonstrates species specific host responses. This means that virulence potential and lethal dosage could not be reliably determined by current techniques.

As a consequence of these difficulties the current project then redirected its resources to the problem of identifying a distinct marker of virulence in *Listeria monocytogenes* isolates. A collection of more than 120 isolates of *Listeria monocytogenes* were screened for high pH tolerance, serotype, haemolysin expression, and finally the presence of the *lmo2821* gene in the isolates genome.

Lmo2821 gene identified as a potential marker of virulence in Listeria monocytogenes

The presence or absence of the *lmo2821* gene identified two distinct populations of *Listeria monocytogenes* from the collection of 126 isolates obtained from Dr John Bowman (UTAS). Of the few strains within the collection that were known to be virulent or avirulent the presence of the gene in the genome identified the virulent isolates and the absence of the gene identified the avirulent strains. This promising result then required further validation to test the hypothesis that the *lmo2821* gene would be a reliable marker of virulence.

As it was impractical to test the virulence potential of the current isolates being used in the project it was decided to obtain isolates of known virulence. Royal Hobart Hospital (RHH) supported this project by providing 15 isolates obtained from patients with invasive listeriosis. These isolates therefore had all demonstrated human virulence potential. The hypothesis being tested required that a screening of the genome for these clinical isolates must all contain the *lmo2821* gene if it would be an acceptable marker of virulence. All 15 isolates contained the gene thus supporting the hypothesis.

The next stage of the project was supported by Dr Agnes Tan of Melbourne University who subjected the project to a blind trial. This involved supplying 50 isolates of *Listeria monocytogenes* from the MDU collection for screening. All 50 strains however proved positive for the gene. Initially this was seen as a disappointing result because the screening of the MDU collection had failed to differentiate two distinct populations. However, re-examination of the source and serotypes of isolates for the UTAS, RHH, and MDU collections would reveal a significant pattern.

Lmo2821 gene identifies a subpopulation of Listeria

Re-examinations of the data collected during this project identified a correlation of serotype in Dr Bowman's collection and the *lmo2821* gene. Serotypes 4a and 4c correlated to an absence of the *lmo2821* gene. It therefore appeared that the *lmo2821* gene could successfully identify a subpopulation of *Listeria monocytogenes*. Subsequent search of the literature suggested that

these serotypes are rarely if ever associated with human listeriosis but are a common cause of animal listeriosis.

Based upon the new hypothesis that the *lmo2821* gene was fundamental to human virulence and absent in the serotype 4a and 4c lineage of *Listeria monocytogenes* the RHH clinical collection was serotyped and found not to contain serotypes 4a or 4c. Subsequent serotyping of the MDU collection also failed to contain serotypes 4a or 4c. The previously disappointing results of the screening of the MDU strains were now viewed in a more favourable light.

The MDU strains had been collected by a public health laboratory and involved environmental samplings of food processing plants and products. All the clinical isolates from RHH had been obtained from patients. In contrast, over 80% of Dr Bowman's collection had been sourced from animals and about 20% of the strains were serotype 4a or 4c and lacked the *lmo2821* gene.

Lmo2821 gene expresses inlJ

Independent and parallel studies being conducted in France, by Sabet *et al.* [1], identified that the *lmo2821* gene is responsible for the expression of inlJ, a species-specific virulence factor essential in human listeriosis. This therefore provided a molecular explanation for the absence of lineage III strains, serotype 4a and 4c, from clinical isolates. At the same time the suspected role of *inlJ* in biofilm formation and adhesion to abiotic surfaces may provide a biological explanation for the apparently poor adaptation of this lineage to the food-processing environment.

Conclusion and recommendations

Significance to industry

Risk associated with *Listeria monocytogenes* in food products should not only be evaluated based on contamination levels but also the virulence potential of the individual strains. This would facilitate a more realistic risk assessment and in consequence, more efficient and cost effective control measures.

Existing surveillance schemes regard all recovered *Listeria monocytogenes* strains as equally pathogenic, since reliable phenotypic and genotypic markers for assessing virulence are lacking. The results of this study suggests the presence or absence of the *lmo2821* gene in the genome of *Listeria* species is one such factor that can be exploited to differentiate the virulence potential of *Listeria monocytogenes* isolates.

Future research

The initial focus of this project was to test the hypothesis that sub-lethal exposure to alkali cleaners and sanitisers in the food-processing environment selects for more pathogenic strains of *Listeria monocytogenes*. The results of this project suggest that the food-processing environment is selecting for more virulent and persistent strains at the exclusion of avirulent lineage III strains. Therefore, the function of inlJ in biofilm activity, adherence to abiotic surfaces, and the correlation to effectiveness of disinfectants and sanitisers upon *Listeria monocytogenes* needs to be investigated.

Need for a comprehensive collection of clinical and food isolates for future research

This study has demonstrated the significance of ancestral lineage to the adaptation of *Listeria monocytogenes* to the various environmental niches including food, as well as animal and human hosts. Lineage, serotype, and source of isolation proved critical to understanding of observations in this current project. For this reason, it would be of immense value to compile a collection of *Listeria* isolates of known source, virulence, serotype, and lineage for future research.

Three distinct lineages have been identified within the *Listeria monocytogenes* species and there appears to be heterogeneity in the virulence, environmental reservoir, and niche adaptations

based upon this lineage. Researchers must recognise the significance of this diversity of *Listeria monocytogenes* to their projects. A researcher may compromise their experiments by working with strains that are not adapted to the environmental niche that they are studying. Alternatively, a researcher may want to select a wide representation of genotypes and phenotypes for their experimental work and a well-documented collection would facilitate efficient selection of suitable strains.

Too often researchers are working with a small set of isolates that do not adequately represent the diversity of *Listeria monocytogenes*. For example, much research is focused on the EGD-e strain, which was isolated from an animal in 1924, and therefore this may not be the best representative of serotype 1/2a strains that are linked to human listeriosis. A collection of isolates from human, animal and food sources is required for reliable estimation of evolutionary and population genetics parameters for *Listeria monocytogenes* associated with transmission via the food supply.

Acknowledgements and references

This project was indebted to the work of Liu *et al.* that provided evidence that virulent *Listeria monocytogenes* isolates contained unique genes not present in avirulent strains [2]. In effect, this project independently extended and validated the preliminary observations made by Liu *et al.* after reviewing the limitations of the original study. The work by Sabet *et al.* validated the presumption of this current project that the gene *lmo2821* was fundamental to virulence.

1. Sabet, C., et al., *LPXTG Protein InlJ, a Newly Identified Internalin Involved in Listeria monocytogenes Virulence.* Infection and Immunity, 2005. 73(10): p. 6912-6922.

2. Liu, D., et al., *Characterisation of virulent and avirulent Listeria monocytogenes strains by PCR amplification of putative transcriptional regulator and internalin genes.* Journal of Medical Microbiology, 2003. 52: p. 1065-1070.

Terry Pinfold
Bachelor of Science (Honours) *University of Tasmania*
MINTRAC Honours Scholarship

Acid Stress Responses in Enterohaemorrhagic E.coli O111:H-
Heather Haines, University of Tasmania

The serious illnesses attributable to Enterohaemorrhagic strains of *E. coli* have prompted considerable change in production and processing practices for the red meat industry. Organic acids, as interventions in processing, have been widely suggested to provide a suitable method for reducing the incidence of this pathogen on carcass meats, despite research evidence that such methods can, in fact, induce resistance in potential pathogens on the meat and in the meat processing environment. Moreover, whilst the O157 strains are more commonly associated with disease, the non-O157 serotypes are increasingly identified as important pathogens and there is a paucity of information regarding the stress responses of these pathogens.

The organism investigated in this thesis was implicated in an outbreak of foodborne disease in South Australia in 1995, in which the food vector was identified as an uncooked fermented, comminuted meat product. The objective of this thesis was to increase understanding of the organism's response to acid stress.

Prior research has shown that EHEC O157 strains that are acid habituated are better able to survive carcass sprays with 2% acetic acid; it was also noted that the acetic acid spray reduced the pH of the carcasses only to pH 4.61 and the pH of the carcasses rose during refrigerated storage. In this study it has been shown that the EHEC O111 can survive acetic acid stress at pH 3 and pH 3.5 if previously exposed (habituated) to acid stress at pH 4.69, a pH only slightly higher than that obtained when carcasses were treated under USDA-accepted industry practices. Thus, spraying carcass sides with acetic acid can induce an acid resistance which promotes survival of the organism on red meat.

Bacterial response to acid stress requires the maintenance of the internal pH (pH_i), and fundamental to this homeostasis is management of hydrogen ions external to the cell and those released in the cytoplasm through the dissociation of organic acids. This work sought to investigate the effect of acid habituation on net hydrogen ion movements when exposed to solutions of pH 3.5 – 5. These experiments demonstrated that prior acid habituation does affect the bacteria's response to the presence of hydrogen ions. The work showed that acid habituated EHEC O111 could resist influx of hydrogen ions at pH 3.5, whilst non-habituated cultures could not. This finding was supported by standard cultural studies which showed that acid habituation improved survival of the organisms at pH 3 and 3.5.

The arginine and glutamate decarboxylase acid resistance (AR) systems have been reported as important in acid stress responses of *E. coli*, but the mechanisms of these systems are still being elucidated. In order to assess any involvement of these systems in acid habituation, and specifically in hydrogen ion flux, in EHEC O111 the amino acids were introduced into the MIFE system at pH 3.5 and 4. Non-habituated cells at pH 4 did not show any improved ability to resist the influx of hydrogen ions when supplemented with either amino acid, but both amino acids reduced the extent of the hydrogen ion influx at pH 3.5. Acid-habituated cells showed a different response: at pH 4 arginine supplementation was effective in reversing flux, leading to a net efflux of hydrogen ions. However, glutamate supplementation significantly increased efflux from the cells at pH 3.5, where acid habituated cells without amino acid supplementation had been shown to effectively manage pH_i.

The role of the amino acids in the altered ability of cells to resist hydrogen ion ingress is interesting, and the varying effects of amino acid supplementation across acid- and non-habituated cells suggest a more complex situation than the simple release of hydrogen from reactive groups of the decarboxylation end product. It appears feasible that the amino acid decarboxylation supplies CO_2 for biosynthetic reactions, diverting energy to stress responses, and the differing flux responses reflect the availability of energy to respond to the stress. These

results suggest that responses in the acid-habituated cells are different, and for this reason, the transcription profile of EHEC O111 under acid habituation conditions was investigated.

Unfortunately EHEC O111 and other non-O157 serotypes have not been fully sequenced, so transcription profiling of EHEC O111 was conducted using an Affymetrix product that contains not only probes for the two sequenced O157 strains but also *E. coli* K12 and a uropathogenic strain of *E. coli.* There is likely to be some variation between the genomes of the O111 and these sequenced species. The hypothesis that acid stress necessitates the diversion of energy to biosynthesis of acid stress response proteins is supported by the results of transcriptomic analysis. A number of recognised acid and general stress response genes were up-regulated under acid habituation. Genes for metabolic functions were also affected: there was up-regulation of genes responsible for nucleotide synthesis and down-regulation of the some of the virulence genes.

The metabolic processes of the bacterial lag phase are not well understood, and this work sought to clarify the sequence of events in acid- and non-stressed lag phase using a proteomic approach. The acid stress pH again reflects the lowest pH obtained during studies of acetic acid carcass washes. Although a large number of proteins were identified as significantly different at different stages of the lag phase, and between acid- and non-habituated cells at the same stage, only a proportion of these proteins were identified and this reflects a limitation of a two-dimensional electrophoresis (2-DE) approach. Proteins that were identified reinforce the traditional view of the lag phase as a period during which cells adjust to different metabolic conditions. Initial proteins expressed were involved in transcription and translation of proteins, with increasing expression of new structural and metabolic proteins as the lag phase resolved. These studies also indicated that protein expression was delayed in cells subjected to acid stress during the lag phase, with early expression of the stress proteins and a range of proteins of unknown function.

The production of red meat will always involve a risk of contamination of the final product, but minimising this contamination is important for both the safety and the quality of the product. Any number of strategies may be used to reduce contamination during processing, including management practices and physical decontamination methods, however organic acids are frequently used to reduce bacterial contamination. This work has shown that acetic acid stress as applied during red meat processing can enhance the survival of the potential pathogen EHEC O111; and that acetic acid application during lag phase induces the expression of stress proteins which contribute to survival of the pathogen when subjected to later acid challenge. Thus, the use of organic acid washes, such as acetic acid, in red meat processing should be re-examined, and more strategic approaches to interventions employed. Such interventions should be required to reduce the risk of microbial contamination without inducing resistance in surviving cells, and an understanding of the impact of current and future interventions on bacterial physiology is essential. The techniques used in this work have great potential applications for such studies.

Upskilling scholarship
Final report
Name: Jonathan Potter
Date of report: 28/2/08
Qualification: Diploma of Maintenance Management
Institution: APMM Group
Date of completion of studies: 31/12/2007

Provide a 400 word report addressing the following questions:

1. How has the MINTRAC grant helped you to undertake and participate in your studies?

The MINTRAC scholarship grant gave myself the opportunity to be able to participate in up skilling myself further. I would not have considered the training without the grant.

2. What personal benefit have you gained from your studies?

This qualification has enabled me to understand the maintenance system better. How as a Plant Manager I may be able to utilise it to the full advantage of the company and those for those involved within the maintenance system.

3. What benefits has your company gained from your studies?

International Exporters has gained a number of benefits as a direct result of me undertaking the qualification. Benefits include:

a. Review of current system in detail.
b. Documenting procedures for maintenance in line with best practice.
c. Creating maintenance schedules and planning guidelines
d. Creating an action plan to improve the maintenance system for the company
e. Generating data / plans for preventive action programs
f. Cost benefit analysis
g. Research into maintenance programs

4. What are the benefits of your study to the meat industry?

It has enabled me to be able to pass on to others in management teams a unique appreciation of what the maintenance department does, how things work, how maintenance can be managed effectively, usefulness in reporting and analysing data, cost benefit analysis and preventative maintenance.
As I currently mentor, coach and train a number of people in industry I can pass this information on for them to utilise.

5. What are your future plans – how do you intend to use your qualification?

My short term future plan to utilise the knowledge I have obtained to further improve the plant maintenance system at International Exporters.
Already the things I have learnt have helped me put together some maintenance planning forms and reports which are being utilised by the maintenance supervisor.
As time permits I would like to break down collected data for the preventative maintenance system.
Longer term I would like to look at possibly undertaking a training qualification following on from my certificate 4 in training and assessment. For now though I just want a break from the books!!!!

6. Do you have any suggestions to help MINTRAC improve the scholarship scheme?

The scholarship program is a fantastic program for the meat industry which a lot of people and companies involved in the meat industry have gained a lot of skills and knowledge from it.
I know a lot of hard work goes into the scholarship program from the MINTRAC team already but feel it could possibly be improved though some of the examples provided below:

Promotional material

- Posters for training rooms
- CD's / overviews on scholarships and past holders (other than current mail outs).
- How to make the most of your scholarship with the assistance of MINTRAC
- Help that's available to you from MINTRAC
- Include something about the training provider utilised in the fliers currently circulated.

7. Training Provider / Recommendations

Asset Project Maintenance and Management Group (APMM) provided the training for the diploma of maintenance management. It was offered either unit by unit in house or through distance learning.

I found APMM Group to be extremely helpful and as their company deals with a wide range of industries they have a wealth of knowledge that they can match to you and your business.

I recommend the course to all maintenance personnel and senior management teams wanting to get the most out of their maintenance system.