



Recent highlights of the Cooperative Research Centres Program 2003



*Established and supported under
the Australian Government's
Cooperative Research Centres Program*

Foreword

Australia's Cooperative Research Centres (CRCs) are the basis of an innovative Australia through transforming research into products and services.

Many of the success stories are highlighted in this booklet, creating an informative snapshot of some of the best lab-to-marketplace transitions across Australia's research sector.

The centres featured here were all applicants for the CRC Association's Awards for Excellence in Innovation, with three winners receiving awards from the Prime Minister at the Association's annual conference in May this year.

CRCs are crucial in drawing together universities, research organisations, government agencies and industry to collaborate in research and development.

This booklet highlights the importance of partnerships and cooperation to successfully carry out research and development. It showcases CRCs that have been energetic in commercialising their research and establishing education programs that will deliver world-class researchers.

Our capacity to compete in the global economy increasingly depends on our ability to produce and support innovation. Hence the significance of our \$3 billion, five-year national innovation action plan *Backing Australia's Ability* (BAA).

There will be a record 71 CRCs this year, sharing about \$200 million of CRC Program funding. This figure includes a recent Budget boost from the Australian Government, highlighting its faith in the CRC community to deliver both innovative research and commercial applications of that research.

CRCs operate in a dynamic environment. There are several challenges they face across different sectors. The agricultural industry is impacted by drought, and the information and communications industry has been enduring a significant downturn. Therefore, it was very pleasing to see how these two sectors in particular were recognised in the Awards.

The qualities of the CRCs featured here — entrepreneurship, leadership, commitment, vision and an ability to communicate and champion ideas — are absolutely vital in advancing Australia's technological and competitive edge.

I warmly congratulate the CRCs on their achievements over the last year.



Peter McGauran
Minister for Science
October 2003

Winners



Photo: Irene Dowdy

CRC for Cochlear Implant & Hearing Aid Innovation

(left to right) Hon Tony Staley, CRCA Chairman; Associate Professor Jim Patrick, Cochlear Ltd; the Prime Minister, the Hon John Howard, MP; Dr Elaine Saunders, Dynamic Hearing; Dr Robert Cowan, CEO, CRC for Cochlear Implant & Hearing Aid Innovation; Dr Peter Blamey, Dynamic Hearing.



Photo: Irene Dowdy

CRC for Sensor Signal & Information Processing

(left to right) Hon Tony Staley, CRCA Chairman; Mr Maurice Hermann, Assistant Secretary, Science Industry & External Relations, DSTO; the Prime Minister, the Hon John Howard, MP; Professor Mathew Cuthbertson, CEO, CRC for Sensor Signal & Information Processing.



Photo: Irene Dowdy

CRC for Cattle & Beef Quality

(left to right) Mr Peter Frawley, Chairman, CRC for Cattle & Beef Quality; Hon Tony Staley, CRCA Chairman; Mr Arthur Rickards, Managing Director of Agricultural Business Research Institute; the Prime Minister, the Hon John Howard, MP; Dr Gerard Davis, Managing Director of Genetic Solutions P/L; Professor Bernie Bindon, CEO, CRC for Cattle & Beef Quality.

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Introduction

Since its inception in 1990, the CRC Program has backed a diverse array of innovative research programs that benefit from the intrinsic essence of the Program — cooperation between a wide range of participants from both the public and private sectors, through bringing together researchers and research users. The CRCs cover six sectors: Manufacturing Technology; Information and Communication Technology; Mining and Energy; Agriculture and Rural Based Manufacturing; Environment; and Medical Science and Technology. CRC participants come from universities and other educational and research facilities, CSIRO, industry, government departments and private businesses. As participants include both researchers and users of their results, research can be tailored appropriately and uptake is maximised; and importantly, CRCs have a bridging role in linking a range of communities, both national and international.

Here we provide just a taste of this research, through stories based on entries in the Awards for Excellence in Innovation, announced at the CRC Association's annual conference in May 2003. The Awards recognise outstanding examples of the transfer of CRC research results, knowledge and technologies that have been developed for a wide range of users. The winners of this year's Awards closely reflect the emphasis on connecting communities through cooperative research. The CRC for Cattle and Beef Quality's project will benefit beef farmers throughout Australia by improving the international market for Australian beef as the research — mainly focusing on genetic factors — makes it possible to guarantee the characteristics of the meat; primarily its tenderness. The CRC for Cochlear Implant and Hearing Aid Innovation has developed a signal processing software system for 'personalising' hearing aids to adapt the

quality and level of sound to suit the individual — this has the potential to benefit the millions of people worldwide who rely on such devices, and significantly reduce healthcare costs wherever it is used.

This year we introduced an award specifically recognising innovation in education — its inaugural winner was the CRC for Sensor Signal and Information Processing which is delivering an on-line Master's program in Mathematical Sciences which draws on experts from five Australian universities plus visiting international lecturers — a huge achievement in cooperation which allows people to undertake the course wherever they are located and helps to build and retain expertise in Australia.

We also continued our tradition of showcasing the work of PhD students working in the CRCs — we are grateful to CSIRO for their ongoing sponsorship of this initiative. The student stories in this booklet highlight the tremendous standard being achieved by our postgraduate students. In the competition, selected students are judged on their ability to convey their research to a non-specialist audience through either a 10-minute (finalists) or 3-minute (runners up) presentation. We congratulate Simone Poznanski from the CRC for Bioproducts on being this year's winner.

CRCs have many links with many communities of a diverse nature — for example, business, rural, government, higher education, national, and international. So, welcome to CRCs — Connecting Communities: we hope you enjoy reading about just some of the projects that are doing us proud. Contact details for current CRC Association members, including all the CRCs featured here, are given at the back of the booklet, or visit our website at <<http://www.crca.asn.au>>.

ADVANCED MATHEMATICS FROM A DISTANCE

CRC for Sensor Signal and Information Processing



When people want to study postgraduate mathematics in a specialised area, it is often difficult for them to find the exact university courses they need. In response to this problem, the CRC for Sensor Signal and Information Processing has devised a program that provides first-rate training for engineers and scientists and is available online.

The program draws on a variety of expert teachers and researchers from five Australian universities, as well as visiting international lecturers, who cooperate to deliver 14 courses to some 40 students across Australia and in countries such as Singapore, Malaysia, Greece, the USA and Canada. The program is the Master of Mathematical Sciences (Signal and Information Processing) and seems to be the only course of its type in Australia that can be studied by distance education. In 2003, the program is incorporating short courses and face-to-face teaching in various locations across Australia so as to provide students with the highest possible quality of teaching. In addition, a short course in radar fundamentals has been presented in Kuala Lumpur, Malaysia.

People already in employment find distance study an enormous advantage, and the fact that the whole program is managed by the CRC is of great importance. For a start, no single university department could put together enough teaching staff to design and deliver such a range of specialist courses. And the CRC is uniquely placed to match student and employer demand with appropriate and expertly developed courses in the field of signal processing.

As well as meeting an industry need, this initiative is helping to establish Australia internationally as a source of high-quality training in this field, and playing a significant role in retaining and attracting talented students and staff—it is helping to preserve a capability and to grow it as well as to anchor it in Australia.



Paul Piperias from the Defence Science and Technology Organisation taking part in one of the short courses.



US radar expert, Mr Robert Hill, presenting Colonel Kamarul Azhan Bin Nordin with his certificate at the Malaysian short course.



Successful student, Matthew Dragovic, graduating from the Masters course.



*Connecting postgraduate mathematics students in Australia and overseas
with expert teachers and researchers from five universities*

INFORMATION FOR THE TOURISM INDUSTRY

CRC for Sustainable Tourism



Decipher® can quickly be accessed by more than 100,000 Australian tourism enterprises.



Decipher® accesses vast amounts of information and processes it into customised business reports.



Decipher® delivers vital business information to regional and rural tourism businesses.

Tourism is one of Australia's largest and most rapidly expanding industries. The diversity of the enterprises engaged in tourism and the large number of them (around 120,000 small to medium-sized businesses) make communication of business information unusually difficult. For this reason, the CRC for Sustainable Tourism set out to produce software that could provide all tourism sectors with the information they need in a form that they can instantly use.

Named Decipher®, an initial feasibility study led to the formation of a subsidiary company called Decipher Technologies Pty Ltd to take the technology from the prototype stage to implementation across Australia. As all the state and tourism organisations are involved in the project, adoption is expected to be extremely high.

Training packages to help the industry use Decipher® effectively as a business planning tool are being developed by the North Sydney Institute of TAFE and will be delivered at the end of 2003.

When Decipher® is launched, users will be able to pose questions in plain English and then refine the data into a report that specifically meets their needs. The main advantage of Decipher® is that it can be flexibly adapted to an almost unlimited range of requests through its unique data dictionary and knowledge base. These inquiries are supported by a highly versatile retrieval system engineered to accept and work with a variety of supplier formats.

Information that will be available to tourism operators and planners includes the latest arrivals, detailed breakdowns of tourist origins and length of stay, tourism business best practice, business-planning tools, forward indicators and regional profiles. Decipher® has been identified by the Australian Government in the recent Green Paper on tourism as one of the key mechanisms for fast and efficient distribution of business information to the Australian travel and tourism industry.

*Connecting tourism operators, planners and tourist organisations
with specialists in information delivery*

A SWEET SOLUTION IN HARD TIMES

CRC for Sustainable Sugar Production



For well over a century, the sugar industry has been of great importance to the Australian economy. In recent years, the country's GDP has benefited annually by some \$4.7 billion as a result of the industry's activities. But times are changing. There is increasing international competition, costs are rising, and the widespread drought has had severe effects. The CRC for Sustainable Sugar Production (CRC Sugar) has long been aware that drastic changes to the industry are needed if it is to survive and remain competitive.

But where is the reform to start? Because of the industry's long history, practices have become so entrenched that any attempt to change them can expect to meet stiff opposition. Moreover, with so many different individuals and institutions engaged in the growing, processing, transport and sale of sugar, it is inevitable that interests will compete and sometimes contradict each other — so what is a step forward for one is seen as an attack by another.

CRC Sugar seized the bull by the horns and decided that the only way forward was to try to engage all interested parties — researchers, growers, millers, processors and so on — in redesigning the way sugarcane is supplied from individual farms to the mill and to reshape the system of 'equity' that was established nearly 100 years ago to protect growers from disadvantages arising from the cane harvesting arrangements.

The seemingly impossible is now being achieved. Through research followed up by intensive consultation with full representation, much of the opposition to change is being overcome. In commercial-scale evaluations in several regions, all sectors of the industry have pooled their knowledge and expertise to modify such practices as cane supply and harvest scheduling so as to ensure that most farmers' cane is harvested at the highest sugar concentration, and thus to create a potential gain of \$63 million a year for the industry from Australia's 400,000 hectares of sugar.



Harvesting sugarcane.



Industry representatives meeting to discuss cane supply options.



Researchers Dr Russell Muchow (left) and Dr Andrew Higgins (right) studying cane supply options.

Connecting sugar growers, harvesters, millers, marketers and researchers

THE THREAT OF BLUE–GREEN ALGAE

CRC for Water Quality and Treatment



Potentially toxic blue–green algae can cause serious problems for drinking water supplies.



Recreational waters can also be affected by blue–green algae.



The Alert Levels Framework is helping water managers respond more effectively to blue–green algal blooms.

Most bodies of water naturally contain blue–green algae (cyanobacteria), but when they multiply and form surface blooms, they can become a serious problem. The look and smell of the blooms make the water unattractive for recreation and can also make it unsuitable for agriculture. And when they invade the drinking water supply, serious trouble can ensue, as water managers grapple to identify the species involved and assess the level of risk posed by it.

To tackle this problem, the CRC for Water Quality and Treatment brought researchers together with water managers who have to deal with the problem. A practical framework was developed which operators and managers can use to manage algal blooms effectively. The ‘Alert Levels Framework’ enables them to assess a bloom as it develops and take appropriate action as it passes through four ‘threshold’ stages.

The first level is the Detection Level, when blue–green algae first become apparent; at Level One (moderate cell numbers), it may be necessary to consult algal experts and assess the toxicity of the algae. If the algae multiply, the managers should move to Level Two: at this stage, health authorities may issue a warning and water managers may consider the type of treatment required. At and above Level Three, the risks become serious if treatment is unavailable or ineffective.

Because it is based upon new knowledge from drinking water guidelines for toxicity, the Alert Levels Framework allows for sound and defensible assessment of hazards to public health and water quality. This in turn allows for informed judgement of when to communicate to other groups and when to act to manage these algal problems. The Framework has become a standard tool for use throughout the world and has been incorporated into the World Health Organization’s recommended approach to managing these problems in drinking water.

Connecting water managers with environmental researchers

PACKING A PUNCH AGAINST WEEDS

Australian Cotton CRC



Cotton growers spend a great deal of money on fighting weeds — in fact about 20% of their total production costs. In the 2001–2002 season that amounted to some \$110 million.

To bring down these huge costs to the producer, the Australian Cotton CRC has published a package which provides cotton producers with effective guides to identifying and managing the more than 200 weeds which may affect their crops. The major aim is to reduce the use of herbicides through a better understanding of the biology of weeds and how the main ones interact with the production system.

WEEDpak, as it's called, was developed under the CRC banner by research and extension staff from NSW Agriculture, the University of New England, CSIRO Division of Plant Industry and Queensland Department of Primary Industries. Its full-colour guide helps producers to identify the weeds they are dealing with at any growth stage. Then they can study the biology of the species, work out the best management option for dealing with it, and select the best approach according to their situation and the range of weeds they have on their land.

WEEDpak comes in a printed version which features a folder format to allow for the easy addition of new information, and since the 'pak' was launched at the Australian Cotton Conference in 2002, more than 500 copies have been distributed to the industry. In addition, since many cotton growers already have access to the Internet (and their number is growing), WEEDpak has also been made available through the Cotton CRC website.

The reduction in the costs of weed control from the use of the WEEDpak, and the increase in yield that can be expected to result, are estimated to deliver a total return of over \$100 million in a normal cotton season.



WEEDpak display at the Australian Cotton Conference 2002.



Seedheads of velvet leaf (*Abutilon theophrasti*) within a cotton crop in north-eastern NSW.



Defoliated cotton crop infested with wide-leaf bladder ketmia (*Hibiscus trionum*), with nutgrass (*Cyperus rotundus*) between rows.

*Connecting cotton producers with weed specialists
in agriculture departments, universities and CSIRO*

SOUNDS FOR LIVING

CRC for Cochlear Implant and Hearing Aid Innovation



Fitting ADRO™ in a digital hearing aid.



ADRO™ is available in the Nucleus 24 Cochlear Implant System.



An engineer prototyping software on a development board at Dynamic Hearing.

Most Australians know of the success of cochlear implants (sometimes called 'bionic ears') and modern hearing aids in restoring communication to adults and children who have a hearing loss. But until now, delivering the range of sounds that surrounds us in daily life has been problematic, as these devices are generally programmed in quiet surroundings, and have relied on limiting systems to try to ensure that the user doesn't find the louder noises intolerably loud or the quieter ones inaudible, especially in noisy environments.

After seven years of research, the CRC for Cochlear Implant and Hearing Aid Innovation (CRC HEAR) has developed an innovative solution to this problem. ADRO™ is a signal processing software system that adapts the output of the hearing device to suit the individual user, adjusting the 'gain' or amount of amplification in each of 64 frequency bands to ensure that sounds remain audible and clear in quality.

ADRO™ was first developed for the cochlear implant and licensed to Cochlear Limited. To facilitate the widespread application of ADRO™ in hearing aids, CRC HEAR established a spin-off company—Dynamic Hearing Pty Ltd—through funding from GBS Ventures and Nanyang Ventures. Staffed by key ex-CRC scientists and audiologists, Dynamic Hearing has already had its first commercial ADRO™ hearing aid product released by Intrason, one of France's leading hearing aid manufacturers. Dynamic Hearing is also exploring the application of ADRO™ in headsets, headphones and mobile phones.

The ADRO™ technology promises improved hearing and quality of life for many of the 300,000 people in Australia (and millions worldwide) who receive hearing aids each year. Moreover, the use of ADRO-fit promises to reduce healthcare costs wherever it is used—a matter of great importance in the developed world where an increasingly aging society is creating greater demand for hearing aids of every kind.

*Connecting scientists, audiologists and specialist manufacturers
to serve the hearing impaired*

TO DAM OR NOT TO DAM?

CRC for Sustainable Sugar Production



In this dry continent, the biggest user of water is the irrigated agriculture sector, and farmers have to take particular care if they are to maintain productivity without overtaxing water supplies and harming the environment. They could construct dams on their properties, but that is very expensive and may not be either economical or effective.

Aware of this dilemma, scientists at the CRC for Sustainable Sugar Production initiated a comprehensive and systematic process of consultation, research and development to enable sugar farmers to assess the likely costs and benefits of storing water on their properties.

The consultation involved not only growers and scientists but also a wide range of institutional participants, so that scientific and technical knowledge combined with practical farming experience produced a workable and user-friendly solution.

The result was a software package called Dam Ea\$y. In using Dam Ea\$y, the grower works with a trained operator to load into the software a wide range of very precise data. These focus closely on the individual property and include such factors as rainfall history, the specifics of the sugarcane grown on the farm, type of irrigation, farm income and many others. Then a set of scenarios is generated on the basis of a range of options and dam sizes. This enables the growers to decide whether to construct an on-farm water storage and if they do, what management procedures will best integrate the new dam into the farm enterprise.

Dam Ea\$y has made it possible for cane growers to make well-based decisions on a vital question which previously could only proceed from guesswork — and it has also been a striking example of the effectiveness of cooperation in practical research. And for an industry that contributes \$5 billion to the Australian economy each year, the impact will be immense.



An on-farm dam used to irrigate a crop of sugarcane.



Collecting data to enter into the Dam Ea\$y program.



A new dam built after exploring the options using Dam Ea\$y.

Connecting sugar growers with scientists, industry and government representatives, computer modellers and experts in water storage assessments

BETTER SIGHT FOR THOUSANDS

CRC for Eye Research and Technology



Aboriginal communities have been the focus of ICEE work in Australia.



ICEE is also active in many other countries.



Conducting an eye test with an East Timorese group.

Throughout the world, preventable blindness blights individuals and communities. In developed countries, most people assume that there will be ophthalmologists and appropriate treatment for such ailments as glaucoma or cataracts, and that relatively minor vision impairment can be rectified by a visit to the optometrist and the provision of a pair of spectacles.

However, in many parts of the world and even in parts of Australia, the infrastructure and trained experts are not available or not affordable, so that the eye condition known as refractive error — easily fixed with spectacles — leads to severely impaired vision or even blindness.

To deal with this, researchers and educators from the CRC for Eye Research and Technology got together with colleagues from India and Canada to establish the International Centre for Eyecare Education (ICEE) with the aim of helping to prevent the consequences of refractive error. The ICEE uses a three-pronged approach: providing examinations and spectacles to those in need; training and equipping optometrists, eyecare personnel and educators; and supporting and developing eye clinics, schools of optometry and centres of excellence.

Since 1998, ICEE has provided 32,449 people with refractive services; trained 27 trainers, 191 refractionists, 17 eye health coordinators and assistants, 89 school teachers and 24 nurses; supplied 48,142 spectacles; helped to establish 50 eye clinics, 2 optical workshops and 3 optometry schools; and provided professional education to 4365 practitioners and 697 educators. These figures include work in many countries and in Australia where much of the emphasis has been on aid to Aboriginal communities.

As the only organisation specifically dedicated to tackling the problem of blindness and impaired vision from refractive error, ICEE is rapidly gaining international recognition as a collaborative operation which is filling a major gap in basic healthcare and delivering large numbers of people from the fear and incapacity of blindness.

Connecting communities afflicted with preventable blindness with eyecare providers, educators and researchers in Australia and overseas

THE TOOLS YOU NEED IN THE PALM OF YOUR HAND

Australian Cotton CRC



How would you handle a complex decision about how to manage a range of insect pests attacking your \$1 million cotton crop, while standing in the field in the mud with the temperature at 36° in the shade? An innovative new tool, CottonLOGIC on the Palm Pilot, now assists cotton producers handle this situation — optimising their pest management, minimising the use of pesticides and generating real environmental benefits, all while standing out in the field.

CottonLOGIC is a computerised decision-support tool developed by the CSIRO that has been available since 1998, and is used by over 90% of Australian cotton growers. It assists producers and their consultants to achieve maximum benefits from the latest cotton research in a way that supports the industry's best management practices program. However, many crop managers have sought to have the full power of CottonLOGIC with them in the field to assist with pest management decisions. Thus, the Australian Cotton CRC's task was to take CottonLOGIC off the office desk and 'into the mud'.

The result is CottonLOGIC running on the Palm operating system (Palm OS®) — a world first in the integration of handheld technology with complex biological models used in real-time management. This development allows pest managers to utilise data collected in the field, in conjunction with pest models, to make more informed decisions on the spot. Later, a simple push of a button downloads all the data to a desktop computer for safe storage and more complete analysis.

Since its launch in August 2002, around 1300 copies of CottonLOGIC for the Palm OS® have been distributed free to cotton growers. It is having a major impact in two ways — speeding up the adoption of integrated pest management (IPM), and contributing to the increasing efficiency of the Australian cotton industry, which is valued at some \$1.5 billion.



Grower downloading data from CottonLOGIC running on Palm OS® to his office computer.



CottonLOGIC display at the Australian Cotton Conference 2002.



Darren Linsley demonstrating the package to Senator Judith Troeth at the CottonLOGIC launch.

*Connecting cotton growers and crop managers
with computer and pest management experts*

TO KEEP OUR WATERWAYS CLEAN

CRC for Catchment Hydrology



MUSIC has been used to design stormwater treatment systems for a range of new developments around Australia.



MUSIC was used to design this wetland treatment system in Coopers, Brisbane.



MUSIC is being used to design integrated stormwater treatment measures that also provide communities with landscape, aesthetic and recreation values.

Town-dwellers love to see the rain washing their streets clean — but where does the water go and what does it take with it? Usually the water ends up in waterways and bays, along with huge quantities of rubbish, chemicals and soil. The result is pollution which would destroy our streams and coastal bays if it were not removed. And that is very expensive. For example, Port Phillip Bay in Victoria was shown to need the removal of more than 500 tonnes of nitrogen every year — at a cost of \$500 million in capital works.

To tackle this problem, the CRC for Catchment Hydrology has researched ways of using natural processes to remove pollutants from stormwater near their source, especially in new urban developments. This has long been an aim of urban planning but the CRC's research has given planners and engineers a valuable tool to make the dream a reality by enabling them to predict the performance of a whole range of environmentally friendly methods of removing pollutants from urban stormwater.

The CRC's Model for Urban Stormwater Improvement Conceptualisation (MUSIC) brings together the latest in stormwater management technology and the best available data to provide engineers, planners and developers with the planning framework and computer tools that they need to get rid of pollutants before they reach the waterways. With MUSIC, they can confidently predict the effectiveness of such measures as wetlands, buffer strips, vegetated swales, sedimentation basins, pollutant traps, filters, ponds and many others; and this improved confidence and reliability can not only save the public purse large sums of money but can also reduce the time-lag in development approvals, thus improving the industry's cost-effectiveness.

Already, MUSIC has revolutionised the implementation of stormwater management plans and is helping to secure cleaner bays and waterways at a much lower cost.

*Connecting planners, engineers and developers in the stormwater industry
with researchers and computer scientists*

THE TENDER TOUCH

CRC for Cattle and Beef Quality



Beef is widely enjoyed in most parts of the world, and when it's as good as Australian beef, there is an eager market in many countries. Until about 1990, that seemed to be all exporters needed to know. But then they realised that different markets preferred different kinds of meat: lean, marbled and so on. To meet the highest expectations of buyers, the CRC for Cattle and Beef Quality has engaged scientists to discover ways of selectively improving quality — with remarkable results. In particular, four novel approaches have been developed, all directed at improved tenderness, the most important consumer trait.

1. Investigation of the genetic and non-genetic factors that contribute to tenderness has shown that certain breeds of cattle produce more-tender meat in the right circumstances. Now growers can use BREEDPLAN, the national beef genetic evaluation scheme, to buy cattle that will produce beef with best overall eating quality.

2. Cattle with best temperament produce the best beef — new technology to measure the temperament of cattle 'on-farm' allows identification of sires whose progeny will have more tender beef.

3. Comparison of grain-fed and pasture-fed beef cattle has shown that the former produces more-tender beef. Grain-feeding also has the advantage that it can be done all year round, regardless of factors such as drought.

4. A gene marker test for tenderness has been developed and patented. The marker makes it possible to identify which animals have a particular 'tenderness gene'. This allows growers to breed selectively for the characteristics they desire in their beef.

These new ways of ensuring tenderness and the right characteristics for export are helping to maintain Australia's position as the world's No. 1 beef exporter. We have 110 customer countries. They yield earnings of \$6 billion annually to an industry which in total earns more than \$9.6 billion annually.



Mustering cattle using a chopper on a remote property in Queensland.



Grain-feeding allows for consistent results all year round.



Australian beef is highly prized in many countries.



*Connecting cattle producers with scientists and beef consumers
in Australia and overseas*

TOWARDS INFORMED GENETIC DEBATE

CRC for Discovery of Genes for Common Human Diseases



Information on the CRC's education program can be accessed through its website.



Senator Natasha Stott-Despoja presenting awards to the winners of the Victorian finals of the 2003 *genETHICS* Competition.



The *geneISSUES* CD-ROM includes a teaching module on embryonic stem cell research.

One of Australia's greatest scientific advances of recent years lies in the field of human genetic research. As a result of this work, there is increasing hope of successful treatments for a wide range of diseases, including relatively rare ailments such as cystic fibrosis as well as commoner conditions like type II diabetes and skin cancer. But that hope rests on the outcome of informed debate about the ethical, social and legal questions that the new advances raise.

The CRC for Discovery of Genes for Common Human Diseases (Gene CRC) aims to foster that debate in a way that will create a more informed community and is implementing several substantial efforts towards achieving this goal through its *geneEDUCATION* program.

Central to *geneEDUCATION* is *genETHICS* — an annual, national competition in which students make a presentation based on a genetic scenario; addressing all the issues arising from it. Teachers have enthusiastically adopted *genETHICS*, extolling its value in engaging, empowering and motivating their students, as well as the CRC's other secondary school products, such as *geneTHINK* (a worksheet kit) and *geneISSUES* (an interactive CD-ROM). Both are designed to facilitate delivery of a meaningful genetics unit in the classroom.

These activities provide a bridge with the Undergraduate Research Opportunities Program (UROP), developed by the Gene CRC with the CRC for Cellular Growth Factors. UROP gives university students a unique opportunity to undertake research within a CRC research team while they study. This program has been embraced by the Universities of Melbourne and Queensland, and more than 75 undergraduates have now been involved. An independent assessment deemed that "UROP is having a significant impact on producing industry-ready graduates".

The Gene CRC hopes that by means of these programs, links will be forged which will facilitate the growth of a vigorous genetics–biotechnology industry, working within an ethical framework which has been endorsed by the Australian community.

Connecting high school and university students with genetic researchers

MARK FELTHAM

*CRC for Eye Research and
Technology*

MEDICAL SCIENCE AND TECHNOLOGY



Photo: Irene Dowdy

Finalist

Cutting Edge Doubts

Many short-sighted people are attracted by what is claimed to be a permanent, safe and fuss-free means of correcting their eye problems: laser surgery.

Unfortunately, it's not quite so straightforward. The success rate of the most popular form of this surgery ranges anywhere between 37% and 94% because of the large range of variables which mean that the surgeon isn't dealing with identical cases.

These factors include the speed of the surgery, the humidity of the operating room, the differences in the corneal tissue of the patients and even the scent or aftershave the patient is wearing, which may affect the highly reactive halide gas that is used in laser refractive surgery.

Mark Feltham is working with a team that hopes to analyse these and other factors, assess how important they are, and minimise the variability of laser eye surgery so that patients get the treatment they had hoped for.

CHAMINI MENDIS

CRC for Cast Metal Manufacturing

MANUFACTURING TECHNOLOGY



Photo: Irene Dowdy

Finalist

Making Cars Lighter

Greenhouse gas emissions from the transport sector account for 12.9% of Australia's total emissions. We can reduce these emissions and help protect the environment by manufacturing lighter cars. Substituting lighter components for aluminium and steel can reduce car weights. One potential candidate for substitution is the light metal magnesium, which weighs 80% less than cast iron and 25% less than aluminium.

The heaviest component of a modern car is the engine, so the greatest weight savings can be made by substitutions in this area. The material substituted must be able to withstand the changing temperature and pressure conditions found in modern car engines. Chamini Mendis's research is looking at how to design a specific magnesium alloy composition that will perform well in an engine. Her studies have shown that the addition of small amounts of zinc, aluminium and calcium can be beneficial.



SIMONE POZNANSKI

CRC for Bioproducts

MANUFACTURING TECHNOLOGY



Winner

Vaccine in a Biscuit?

Tapeworm infection is widespread in many developing nations. The tapeworm is transferred to people when eating undercooked, infected pig meat; this in turn is transferred back to the pigs from human faeces. Treatment of patients involves expensive drugs that have many side effects.

Simone Poznanski's research aims to break the life cycle of the tapeworm by vaccinating pigs against it. Pig-owners in poor countries can't afford to vaccinate their animals by the usual means, so Simone's research is looking at a different approach.

The first step has been to express the vaccine in plants and see whether this can produce an immune response when fed to pigs. The vaccine will also be made in plant cell suspension culture. The hope is that the most promising plant line can then be fed to pigs (e.g. as a biscuit or feed supplement), thus reducing the threat of acquiring tapeworm from eating pork.

MICHAEL STOREY

CRC for Water Quality and Treatment

ENVIRONMENT



Finalist

Safeguarding Public Health Against Viruses

Scientists have known for some time that 'biofilms' — the slimes that form on the inside of our water pipes — can accumulate bacteria.

Recent work by a team of scientists from the CRC for Water Quality and Treatment has revealed that the biofilms can also accumulate another group of potentially harmful microorganisms — enteric viruses — which can cause gastroenteritis.

By developing unique fluorescent molecules, Michael Storey, a PhD student at the University of New South Wales, was able to pinpoint the exact location of the viruses in the slime. The ability to trace these and other waterborne pathogens (including *Cryptosporidium* and *Giardia*) makes it possible to investigate the health risks present in water supplies and could lead to better methods of disinfection.

Modelling showed that while this phenomenon was unlikely to provide a cause for concern in drinking water, there could be potential risks in recycled water systems.

ANDREW CHANNON

CRC for Cattle and Beef Quality

AGRICULTURE AND RURAL BASED
MANUFACTURING



Runner up

Starch and Cattle

Over 700,000 head of cattle are currently being grain-fed in Australian feedlots. The major ingredient in feedlot diets is cereal grain and efficient beef production depends on the optimal utilisation of the starch within this grain.

Grain processing can be used to increase starch digestibility but gross inefficiencies in starch digestion and animal health problems continue to occur.

Research has indicated that cattle differ genetically in their ability to digest starch efficiently and safely in the rumen and small intestine. Andrew Channon is part of a team investigating the possibility of utilising these between-animal differences to improve starch digestion.

The major implication of this work is that there may be an opportunity to identify and select cattle that are more efficient at digesting starch. If successfully implemented, profitability would be increased while feedlot waste and animal health problems would be reduced.

BRIANA DALY

CRC for Cattle and Beef Quality

AGRICULTURE AND RURAL BASED
MANUFACTURING



Runner up

Tender, Juicy Beef!

Many factors determine whether the steak you buy is going to be tender and juicy or as tough as boots. One important determinant is the rate of pH decline in the carcass after slaughter.

If the rate of decline is too fast, the result is what is called 'heat shortening', which reduces the tenderisation by enzymes. If it is too slow, then 'cold shortening' causes massive muscle contraction — and very tough meat.

Briana Daly is taking part in research that seeks to discover the causes of these phenomena and find ways of regulating the factors that produce variations in the rate of pH decline.

Changes have been made to electrical devices used during carcass processing in an attempt to achieve consistency from one carcass to the next, and this will result in maximum beef tenderness every time.

PETER OLIVER

*CRC for Coastal Zone, Estuary and
Waterway Management*

ENVIRONMENT



Photo: Irene Dowdy

Runner up

Do Partnerships Really Work?

To say that everyone should cooperate in partnership with everyone else to achieve common goals sounds rather like a 'motherhood statement'. But Peter Oliver's research shows that sometimes partnerships are not all they are cracked up to be.

When the partnerships dealing with natural resource management were examined, it became apparent that organisations often differ greatly in their ability to tolerate and work successfully in partnership with others to achieve common goals, especially when the size, structure and vision of the partners is varied.

In particular, governments can find it difficult to see the advantages of partnership-generated solutions to issues, to maintain the supply of resources to partnerships, or to share and recognise the contributions of other bodies. Similar constraints can also affect communities and industries.

The research, based on comparing case studies, highlighted contemporary partnership practices in natural resource management and show how they may be improved.

THOMAS TILLEY

*CRC for Enterprise Distributed
Systems Technology*

INFORMATION AND COMMUNICATION
TECHNOLOGY



Photo: Irene Dowdy

Runner up

Don't Crash the Software!

It is annoying if the software crashes on your own computer, but if the software controlling a spacecraft crashes, the consequences can be disastrous.

A group of techniques known as 'formal methods' allow computer experts to describe what a piece of software should do. One of these techniques is called 'Z'. Since the Z specification language is based on mathematics, it can be used to describe a piece of software and then produce a mathematical proof that the software will be free from certain problems. Programmers can then write problem-free software by matching the Z description.

It sounds straightforward, but Z is actually extremely hard to read and write. The research that Thomas Tilley is engaged in has devised a prototype software tool that makes it easier for users. It does this by creating diagrams to augment the Z description — as diagrams can often make clear what would otherwise be obscure.

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