

Cooperative Research Centres Association

# SCIENCE IN *ACTION*

Achievements, action and activities in Australia's  
Cooperative Research Centres  
2003

*Julian Cribb & Associates*

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# Introduction:

*Science in Action* is based on material developed for the CRC National Communication Project of 2003. This was a joint project between the Cooperative Research Centres Association and the Department of Education, Science & Training. Julian Cribb of Julian Cribb & Associates was engaged to carry out the project.

The CRC National Communication Project 2003 aimed to highlight the value of the CRC Program to Australia through focussing on the achievements, actions and activities of many of the Cooperative Research Centres via a targetted media campaign through out 2003. The full media releases can be found at the CRC Association's Web site (<http://www.crca.asn.au> Press Releases 2003)

The CRC Program covers six Industry Sectors –

- Manufacturing Technology,
- Information & Communication Technology,
- Mining & Energy,
- Agriculture & Rural based Manufacturing,
- Environment,
- Medical Science & Technology

In several cases, where the story better illustrates a particular industry activity, it has been grouped in that sector even though the CRC is in another sector.

A full contact list of the CRC Association members (19<sup>th</sup> January 2004) by industry sector is provided at the end, together with an index listing the stories by participating CRCs and the media releases from which they were sourced.

# Manufacturing technology

## Disappearing ink

Generations of ink makers have exerted all their skills to make ink stick better to paper: today Australian scientists are close to a breakthrough that achieves the exact opposite.

In a bid to make the millions of tonnes of newspapers generated for the consumer society more recyclable and the printing industry more sustainable, researchers at the CRC Smartprint are devising ways to detach ink more easily, cheaply and effectively from the cellulose fibres of paper.

“Traditionally, ink has been removed by pulping, washing and aerating (or bubbling) the ink off the paper so it can be recycled,” says CRC Smartprint CEO Mr Rod Urquhart. “But the better the inks became, the harder it was to remove them – and more energy and larger plants were needed to do it.”

“Our team is investigating how the ink layer wets its cellulose substrate, and whether modifying the paper fibres by grafting on to them hydrophilic (water attracting) chemical groups will enable the water to get under the ink and so “float” it off during the washing phase.”

A major investigation is also in progress to redesign the equipment used to separate the detached ink particles. This includes studying the efficiency of aeration, and how ink particles are picked up by the bubbles and carried to the surface of the tank.

The third element of the work is development of a test to show accurately how much ink has been removed – and how much is left adhering to the paper fibres. Without this, it will be difficult to fine-tune the de-inking process.

“The results of this final step could change forever the thinking of ink chemists worldwide. Balancing ink application properties with ink removability may become the new yardstick of printing success,” Mr Urquhart says.

Contact: 03 9905 3456

CRC Smartprint is CRC for Functional Communication Surfaces

## Better bottles

An Australian technology for recycling plastic drink bottles is going global through an international licensing agreement between Ciba Specialty Chemicals (Ciba) and the CRC for Polymers (CRC-P).

Using this technology, PET (polyethylene terephthalate) from soft drink bottles can be re-used to produce new bottles.

The technology increases the melt strength of molten PET and improves its processing properties. With the licensing agreement, the technology could provide a competitive edge in the global packaging industry.

It also opens up wider applications. For example, the PET used to make bottles has limited processing properties, which restrict or preclude its use in operations such as film blowing, thermoforming and foam extrusion, where good melt strength is required. The CRC-P technology provides a solution to this problem, opening the way to improved PET-based products including packaging films, food trays and containers.

The patented technology was developed within the Centre over six years in a collaborative project involving researchers from CSIRO Molecular Science, Monash University and VisyPak.

The research team developed the technology using a state-of-the-art reactive processing facility within the CRC-P. This includes a laboratory extruder modified so that researchers can precisely monitor the processing properties of polymers and study the effects of varying parameters that change them. Initially the process was optimised in the laboratory, and then an extensive series of production trials followed, resulting in refinements that made the technology suitable for use in large-scale production.

VisyPak then took an exclusive licence for the use of the technology in Australia and New Zealand, and are using it in the commercial production of packaging trays.

Contact: 03 9558 8111

## **Hot alert**

Early warning of fire, explosion, melt-down or system failure is vital to the safe operation of many industrial and communication processes.

A revolutionary system for measuring temperature along the length of an optic fibre has been developed by the CRC for Intelligent Manufacturing Systems and Technologies (CRCIMST) and the Tyree Group.

Their Sentor 101 technology can be used to monitor a wide range of thermally critical situations, including underground power cables, petrochemicals plants, concrete curing, fire detection in cable ducts, transformer windings, furnace jackets and many other applications where real-time knowledge of distributed temperature conditions is vital for safe and efficient operation.

The fibre-optic sensor can operate in severe, high-temperature and electrically noisy environments. It works by measuring temperature-dependent Raman back-scattering from laser light pulses that are launched into an optical fibre. The intensity of the scattering signal reveals the temperature.

Light particles scattered from different positions along the cable arrive at a light detector at different times, so indicating the temperature at various places along the length of the cable. Data is processed and stored locally and/or relayed to a remote control centre. Alarms and trips can be preset based on absolute temperature or rate-of-rise.

Contact: 03 9480 0400

## **Fast timber**

A world-first technique for drying timber with microwaves has been developed by the CRC for Wood Innovations (CRC WI).

The technology reduces the time needed to dry hardwood from Australian eucalypts from around one year to one day, promising potentially huge savings to the industry.

It also opens the way for timber worth only \$70-80 a tonne as woodchips, to be used as high quality furniture sawn wood, worth \$2000-3000 a tonne.

CRC director Professor Peter Vinden and his team conceived and developed the microwave system – a piece of equipment 300 times larger than a domestic microwave oven – for drying timber rapidly and without warping, on a conveyor belt system.

“We’ve tested the concept in 60kW devices, and it works beautifully. Now we’re building a full-scale pilot plant with a 300kW microwave to test it under commercial conditions at Creswick in Victoria,” he explains.

“The problem with many plantation hardwoods today is that growth is so fast it sets up stresses in the timber which can deform it when it dries, making it unsuitable for quality end-uses. This technology overcomes that problem, leading to a much higher quality product, in a far shorter time.”

Prof. Vinden says the microwaves heat the timber to around 160 degrees, drying it in a matter of hours. This process creates microscopic channels in the wood radiating from the centre which allow the moisture out, but also allow the timber to be impregnated with preservatives and other treatments.

Recent trials have confirmed that the CRC’s microwave drying system works equally well for both soft woods and hard woods.

Contact: 03 8344 5250

## **Personal locator**

Finding your way round a huge sporting event, public exhibition or even a giant shopping mall is likely to be far easier in future with the development of a way-finding tool by the CRC for Construction Innovation.

The way-finder is scheduled for its first outing at the Melbourne Commonwealth Games in 2006, helping visitors to locate the right event, the toilets, the bar or any other facility they need, says CEO Dr Keith Hampson.

Its development is likely to be a great boon, not only to visitors to large events or sites, but also to those with disabilities, sensory impairment or the elderly.

“It will be as simple as a mobile phone or hand-help device which locates you and then gives you simple directions, either on a map, as text or voice, to the place you want to get to,” he says.

In addition the device may provide the user with hazard warnings or emergency advice.

The locators may be issued at the entry gate, or may even be accessible via your mobile phone or palm pilot.

“At the moment we’re assessing what’s going on around the world in mobile locators, to make absolutely sure our concept is cutting edge or beyond,” Dr Hampson explains. “Phase two is to build our preferred system, and phase three is to install and trial it at the upcoming Commonwealth Games.”

Down the track the uses for such devices are limited only by the imagination, with self-guided tourism, big shopping centres and expos being major potential markets.

Contact: 07 3864 1393

## **Fewer fumes**

Arc welding fume can have serious effects on the health and safety of welders – and one young CRC scientist is determined to see what can be done about it.

Owen Lucas, a postgraduate researcher with the CRC for Welded Structures, is investigating the fume of gases and vaporized metal given off during welding to see whether there is scope to reduce it and make welding safer.

“It’s long been recognized that welders suffer a higher rate of lung disease than other occupations – but it isn’t clear how much of this is due to the welding process itself, to other chemicals in the workplace or to personal habits like smoking,” Owen says.

“Conditions like metal fume fever, siderosis and zinc poisoning that are almost certainly linked to the welding process.

“The fume consists of gases like the nitrogen oxides and ozone, as well as vaporized metals including some – like chromium, zinc and lead – which are toxic.”

Present safety measures call for fume removal or breathing apparatus, but Owen considers there may be scope to modify the welding process itself to reduce the emissions, making it safer and less injurious to health.

Using laser spectroscopy he is attempting the extremely difficult task of analyzing the dazzling 10,000 degree welding arc in action, to diagnose the composition of fume under varying conditions and materials.

Owen Lucas is used to challenges – a broken spine resulting a cycling collision with a car has left him in a wheelchair – but, with the aid of some specially adapted lab equipment in the CRC, it hasn’t slowed his scientific career one bit.

Contact: 02 4252 8889

## **Plant drugs**

Researchers at the CRC for Bioproducts are using the natural ability of plants to produce anti-cancer drugs, using a technique known as plant cell culture.

Because some cancer treatments are based on substances from rare or endangered plants, the CRC team decided to use plant cell culture – the growing of plant cells in a nutrient medium – as a low-cost way to convert plant compounds into valuable pharmaceuticals.

“Our research has demonstrated there is a significant potential for using this technology as an alternative for making pharmaceuticals on a large scale,” says Chief Executive of the Bioproducts CRC, Dr Doug Hawley.

Contact: 03 9706 9730

## **Plane sense**

The cost of a passenger aircraft could fall by as much as \$US100,000 thanks to a breakthrough in aircraft construction pioneered by the CRC for Advanced Composite Structures (CRC-ACS), with a new way to heat-bond high-performance carbon fibre.

“We’ve come up with a way to put a thermoplastic layer between sheets of high-strength thermosetting materials, which enables us to weld them together

at fairly low temperatures,” explains CRC-ACS Chief Executive Officer Professor Murray Scott.

“It’s the first really cost-effective way to bond high-performance aircraft skin materials, and is perfectly suitable for subsonic passenger aircraft. It offers a big advantage in an industry where margins are very tight.”

Contact: 03 9646 6544

### **Mag motor**

A revolutionary magnesium engine block that weighs 25 per cent less than its aluminium competitors has been installed in a Volkswagen Lupo motorcar and road-tested in Austria. The new alloy was developed by the CRC for Cast Metals Manufacturing (CAST).

The block was designed by AVL, one of Europe’s leading engine design firms, to handle the high pressures and performance demanded of modern engines, and makes use of the mechanical and acoustic advantages of magnesium. It is being tested in the AVL Genios LE engine.

The 14-kilo motor is expected to pave the way for general use of cast magnesium in car engine components, reducing greenhouse emissions and creating global demand for metal from Australia’s magnesium industry.

Contact: 07 3365 3574

### **Smarter trains**

Intelligent trains will soon set their own speed limits for each individual journey, allowing for differences in track, load and vehicle safety.

A train in which all the wagons ‘talk’ to one another and to the locomotive, which also communicates with track managers and following trains is under development at the CRC for Railway Engineering and Technology (CRC RET).

The world-first approach started with a technology originally developed for sheep – smart ear-tags – but has been radically redesigned and upgraded it for rail use.

“A locomotive in-cabin computer system collaborates with electronic ‘health cards’ on each wagon in the train,” explains CRC RET chief executive Dudley Roach.

“These are self-powered microprocessors that contain communication systems, simulation ability, identifiers for the wagon, micro-machine accelerometers and an impact classification system.

“When the train marshals, it automatically assembles its communication network, creates a picture of its own ‘health’ and uses an on-board track database to set speed limits for the coming journey,” he says.

“While travelling, impacts and other ride disturbances are classified into track defect types and stored on a time-and-location track data base for consideration by rail maintenance staff. It also sends an automatic warning to following trains.”

By understanding both its own ‘health’ as well as that of the track the train can set optimal speeds for itself which prevent unnecessary speeding up and slowing down – and so lead to significant energy savings.

The technology is being developed after a global search revealed little work was going on in intelligent systems for highly cost-sensitive rail operations like freight.

Contact: 07 4930 9597

### **Wiser welding**

A new metal welding technology developed by the CRC for Welded Structures can boost the productivity of existing welding equipment by up to 40 per cent. The system reduces the distortion caused by welding and cuts fume and spatter by up to 80 per cent.

CEO Dr Colin Chipperfield says the new technology offers very significant reductions in the cost of welded construction, improved surface quality, and major reductions in the fumes to which operators are exposed. The technology is market-ready and is being commercialised.

Contact: 02 4252 8889

### **Hull saver**

THE US Navy has sought Australian expertise to help prevent ships made from super-light advanced plastics from breaking up.

Scientists from the CRC for Advanced Composite Structures (CRC ACS) are working to develop smart systems embedded in the ship’s hull that report its state of health.

“Polymer composite materials are becoming very popular for civilian and naval vessels, due to their low weight, high corrosion resistance and low radar and magnetic signatures,” says CRC-ACS’s Dr Ian Crouch.

“However they are susceptible to impact damage and can delaminate or come apart in layers – with results like those witnessed in one famous America’s Cup challenge.

“This means higher safety has to be built into both the design and the repair of any damage that occurs, irrespective of whether it is critical or not.”

CRC-ACS has been asked by the US Office of Naval Research to help devise better composite design methods and more selective repair procedures.

The Australian team is also working on Structural Health Monitoring (SHM) systems that can be embedded into the actual structure of the vessel, especially around joints.

“For example, optical fibres with Bragg Gratings etched into them, can be used to continuously monitor changes in strain,” Dr Crouch says. “The theory is that if a crack develops in the structure, the strain field increases around the crack, the sensor detects the change in strain and continuously monitors the changes as the crack develops.

“The challenge is to be able to monitor crack growth, using sensitive SHM systems, and predict how large a crack can grow before it “goes critical” and leads to catastrophic failure.”

The two-year program will involve investigating a number of smart technologies and ways to build them into composite structures as well as using computer modelling tools to improve understanding of repairability.

Contact: 03 9646 6544

## **Tougher alloys**

Australia's CRC for Cast Metals Manufacturing (CAST) is helping to forge the next generation of tough, light and versatile metal alloys.

Researcher Mark Easton aims to improve the performance and strength of aluminium alloys by reducing the size of the metal grains within their structure.

When molten metal cools, it can develop large ‘grains’ which result in poor mechanical characteristics. Reducing grain size leads to a tougher alloy, enabling it to withstand fatigue, corrosion, tearing during solidification or cracking during welding or flame cutting. Smaller grains can also make an alloy easier to work and shape via extrusion, rolling and forging.

Smaller grain size is achieved by adding foreign particles to molten metal which cause multiple grains to form when the alloy solidifies. However, only certain kinds of particles are suitable and much research has gone into finding the best grain refining compounds for different alloys.

Mark's research found that differences between cast and wrought aluminium alloys in response to the addition of particles were due to their differing composition and the particles' effect on solidification.

His work is now being applied to the manufacturing problem of hot tearing – one of the most serious defects that affect casting and a major reason for rejection of ingots.

Mark developed a model to predict the grain size for a particular alloy composition and has identified a way to reduce the cost of grain refiner additions whilst retaining grain size improvements. A plan to introduce his findings into industry is being developed with Comalco Aluminium.

Mark is also working with Comalco Aluminium to reduce the cost of aluminium-silicon alloys that require the addition of titanium. He is also investigating the advantages of magnesium alloys over steel in automotive crash structures.

Contact: 07 3365 3574

## **Tape solution**

The tapeworm *Taenia solium* kills 50,000 people a year in Central America, sub-Saharan Africa, India, China and SE Asia – and the main cause of its spread is the domestic pig.

Simone Poznanski of the CRC for Bioproducts aims to break the tapeworm's life cycle by developing a simple, robust way to immunise the pigs against them, so worm eggs are no longer passed to humans in the meat.

Conventional vaccines are too costly and difficult to administer to every pig in the developing world, so Simone has adopted a novel approach of developing a plant-based feed that will immunize the pigs against *Taenia* eggs.

To do this she has inserted a gene which codes for a protein from the surface of a tapeworm egg into a laboratory plant called *Arabidopsis* and shown that the plant can produce the protein to prime the pigs' immune systems against tapeworm eggs.

The advantage of her approach is that plant-based vaccines are cheap to produce, easily delivered to pigs in their feed, and do not require refrigeration, careful handling or skilled injection like normal vaccines.

"It's a promising and unique approach to a dreadful problem," she says. "There are currently about 50 million people infected by *Taenia* worldwide, and 50,000 estimated deaths a year".

“Half the victims will suffer late onset epilepsy as a result of the parasite cysts in their brain. The current drugs used against tapeworms are really potent and have serious side-effects”.

“The best solution is to prevent the pig meat from becoming infected, and passing the parasite to humans. This approach offers a real chance of breaking the tapeworm cycle, and potentially eradicating it from the food chain.”

Contact: 03 9706 9730

## **Smash absorber**

A new, lifesaving technology for motor vehicles is being tested by researchers at the CRC for Cast Metals Manufacturing (CRC CAST).

The CAST team is investigating the potential of magnesium as an alternative to aluminium and steel for use in crash structures in motor vehicles.

As magnesium has very low density it is very light, which means that you can use more magnesium to make thicker, stronger crash components than you can with either aluminium or steel, says CAST’s Dr Trevor Abbott.

“A unique property of magnesium is its ability to distribute deformation throughout its volume, allowing the metal to withstand high loads without fracturing. This property is enhanced when thicker sections of magnesium are used, suggesting that there is great potential for magnesium components in both structural and energy absorbing applications.”

“The thicker you can make a metal component, the more energy it can absorb during a car crash – and the less the impact on the passengers.

Research by CAST has found that magnesium becomes extra-absorbent when subjected to high speed deformation like that in car crashes.

This property of magnesium is known as strain rate dependence, and its extent depends on the aluminium content of the magnesium alloy.

“Car manufacturers can develop components with higher energy absorption by applying this knowledge to innovative crash structure designs using new Mg-Al alloys.

“This will potentially improve the crash performance of our cars and save lives,” Dr Abbott says.

Magnesium is a quarter the weight of steel and two thirds the weight of aluminium. It is the lightest of the commonly used metals and has the highest strength-to-weight ratio. Magnesium is being used increasingly by world car

makers in instrument panels, interior structural supports and may soon appear in engines.

Contact: 07 3365 3574

## **Red health**

Foods that help save lives are on the way thanks to a special natural substance, extracted from tomatoes with a process developed by the CRC for Bioproducts.

The CRC team has developed a new product to increase the content of the naturally occurring compound lycopene, a carotenoid that endows tomatoes with their rich, red colour, in foods.

International research has shown that a diet rich in lycopene reduces the risk of certain killer diseases, including prostate and gastrointestinal cancers and coronary heart disease, says the CRC's Technology Transfer Manager Jane Evans.

"The problem is you need the equivalent of 10 serves of tomatoes a week to reduce disease risk – and that's more than most people consume. So, we've come up with a way to help them get the right amount of lycopene without having to change their diet."

The CRC's process can be used to enrich a wide range of tomato-based products, including tomato paste, pasta sauces, soups and meals.

"Lycopene is very red, so you'd add it wherever you'd normally use tomatoes."

Ms Evans says the lycopene technology is well advanced and should shortly be available for commercial use, where it can be used to create premium lines of health-protecting foods based on tomatoes.

Contact: 03 9706 9730

## **Safer travel**

Melbourne aerospace researcher Dr Minh Nguyen is part of a global effort to improve the performance and safety of passenger aircraft.

Minh works in the CRC for Advanced Composite Structures (CRC-ACS) in its major research program with Airbus Deutschland GmbH in Hamburg, Germany. The philosophy at Airbus is that the next generation of aircraft needs a new generation of design tools, to reduce the number of tests for certification and reduce development costs.

During 2002, Minh was seconded to Airbus in Germany. His specific research is the development of software modelling tools to predict the onset and extent of defects in different composite structures under impact conditions.

A key aim is to understand the failure mechanisms that occur after impact, so that the design of the composite can be improved for both performance and safety.

The software tool automates the creation and modelling of composite materials and applies impact scenarios to analyse their structural response.

Airbus are interested in developing this tool in order to evaluate the suitability of certain materials for future aerospace applications.

Contact: 03 9646 6544

### **Terrorproofing**

Terrorist attacks on buildings like the Twin Towers in New York and Bali nightclubs have highlighted issues of building safety and the challenge of safely evacuating large numbers of people in an emergency.

The CRC for Construction Innovation has tasked its researchers to explore large building designs that anticipate a crisis.

The CRC is working with leading building designers and surveyors on ways to make large buildings such as tower blocks and shopping centres, safer.

These include: vulnerability of buildings to progressive collapse, fire protection, means of escape, general security, security of building services like power and water, safety of cladding and glazing, and prevention of unauthorised entry.

Contact: 07 3864 2288/1393

### **Trays smart**

Stronger, greener and more versatile plastic trays for frozen food have been developed in a breakthrough process by Australia's CRC for Polymers and VisyPak Pty Ltd.

The development, which offers a fresh competitive edge to Australia's growing processed food industry, is based on a new form of high melt strength polymer, says CRC director Dr Ian Dagley.

The technology was developed over several years by a team from Monash University and CSIRO and has recently been commercialized by VisyPak following extensive customer trials.

Visy Industries project leader Mr Kelvin Davies says the technology represents a significant technological breakthrough.

“This novel material and process offers significant technical and performance advantages over existing alternatives.

“It is much more flexible, and can be tailored for everything from premium products to budget lines and a variety of colours – a complete suite of packaging solutions.”

Mr Davies adds the process is far more energy efficient than conventional polyethylene (PET) fabrication, and at the same time extends the scope for recycling. “This makes it a lot greener, in keeping with modern industry and consumer demand.”

Contact: 03 9558 8111

### **Weather eye**

Higher yields in the vineyard, orchard or cropping paddock are on the cards with a remarkable new sensor being developed by the CRC for MicroTechnology for US communications firm Motorola.

The device is an “environmental sensor” - an integrated chip acts like a tiny weather station, monitoring temperature, moisture, light and wind-speed around individual vines or trees, and reports back to base. A network of chips can give the grower a complete picture of conditions in the field.

Part of the revolution in precision agriculture, the device will enable farmers to fine-tune growing conditions around the crop to achieve optimum yield along with top quality, says CRC MicroTechnology CEO Clive Davenport.

“The sensor is designed to be low cost - you could have one on every tree or every couple of vines. They are also made of harmless materials which break down in the environment,” he says.

The device could also find a use on golf courses, sporting ovals, greenhouses, parks and private gardens – anywhere ideal growing conditions for crops, plants, pasture, turf or trees are required.

Contact: 03 9214 8557

### **Curing buildings**

Healthy buildings and sustainable workplaces which could spare the nation much sickness and achieve massive healthcare savings are the goal of a new research project at the CRC for Construction Innovation (CRC CI).

CRC CI Chief Executive Officer Dr Keith Hampson says the cost of 'sick buildings' runs into tens of billions of dollars a year – and is liable to rise with time unless buildings are better designed and operated.

"Our research aims to develop the smart technologies that will ensure a healthier indoor working environment and more sustainable buildings," he says.

Dr Hampson says the first stage of the project is a scoping study of the technology available to measure the health of buildings based on economic, environmental and social performance.

"A building can be 'sick' when there is a presence, or high concentration, of a number of physical, chemical and biological agents, which can be emitted from flooring, paints and coatings, furniture and cabinets, walls and ceilings, and equipment such as stoves, heaters, copiers, and printers," says Dr Hampson.

Dr Hampson says the CRC CI project is looking at a whole suite of performance issues, indoor air quality being just one of many.

The research team is working on evaluating sensors and technologies which will make buildings more sustainable and develop prototype hardware and software system for smart indoor environment control.

"The project will identify the areas where investments in technological research can bring maximum benefits to building users, occupants and owners," he says.

The project will also seek to reduce the cost of building services design and component selection, and achieve more efficient building operation and maintenance.

Contact: 07 3864 2288 /1393

## **Sporting sense**

Australia's sporting coaches are hatching a big shock for the competition at the 2004 Athens Olympics, with the aid of what is already being hailed as a revolution in coaching technology.

Devised by the CRC for Microtechnology (CRCM) in conjunction with the Australian Institute of Sport (AIS) a new unobtrusive sensing system provides comprehensive feedback on athlete's actions and performance, enabling the coach to spot flaws and fine-tune as never before.

A range of prototypes have been used in rowing, rugby, swimming, running and kayaking, with the most advanced version undergoing its first big field trial at the World Rowing Championships in 2003. The success of the new technology even had to withstand a protest from the German Rowing team.

"The rowing device provides on-water analysis and vision to the coach covering all the key movements like speed, strength, stroke length, effort, boat depth etc. It lets you micro-manage the entire performance of the athlete" says CRCM Commercial Director Damian Lismore.

Similar technology has also been stitched into the shorts of Rugby Union players, to help the coach gauge levels and patterns of activity and tiredness, and tune training regimes to match conditions.

"Using feedback provided by the system, we can now calibrate the performance of an athlete in several dimensions and measure against the requirement to win that elusive gold medal. We are adjusting our training regime accordingly," Professor Allan Hahn of AIS says.

The device has widespread application for all sports and recreational users and may also herald a new era for sports fans worldwide. Linked to TV, it can provide a host of detail on an athlete's action, energy levels, performance and style, updated every second.

Commercial interest in the device is fierce from both Australian and overseas companies - as well as coaches, many of whom view it as the next big secret weapon in international sporting competition.

Contact: 03 9214 4414 (03 9214 8557 for CRC CEO)

## **Hot wheels**

A revolutionary Australian bike frame that lets the rider put an extra 200 watts of energy directly onto the road could be the sensation of the Athens Olympics cycling events.

Developed by Bike Technologies Australia with the help of the CRC for Advanced Composite Structures (CRC-ACS), the secret of success, in this case, is stiffness, says Sal Sansonetti, general manager of Bike Technologies Australia.

"It's a one-piece frame, which is so stiff that it doesn't waste the rider's energy by bending - but instead transfers more of it to forward momentum.

"We tested it on four different athletes, and found they were averaging an extra 200 watts of energy each on the road."

Dr Ian Crouch of CRC ACS says the secret also lies in applying state-of-the-art aerospace technology to the design and manufacture of competition bikes.

"We looked at each element of the frame and modelled the stresses and loads applied to it. We then chose the best combination of carbon fibre grades and fibre orientation, for each individual element - the same basic approach as in the aviation industry," he explains.

The CRC team opted for an optimal combination of high modulus, unidirectional, carbon fabrics, pre-impregnated with epoxy resin, to achieve an overall 50 per cent increase in stiffness in the frame.

Mr Sansonetti says that although the revolutionary frame is available commercially, and has been purchased by athletes from the Netherlands and New Zealand, Australian cyclists have a head start in adapting their training regimes to it.

Contact: 03 9646 6544

# Information and Communication Technology

## Massive messaging

A communications technology that can sort and deliver millions of messages per second is poised to revolutionise the way people receive and use information across the internet.

Known as Elvin, the technology is the focus of a spin-off venture from the CRC for Enterprise Distributed Systems Technology (DSTC), called Advanced Messaging Technologies PL.

“Elvin is a radical shift in network communications because it allows messages to be received and sent by content – rather than predetermined addresses or channels,” says DSTC chief executive officer Mark Gibson.

“This unique routing technology vastly improves the scope of network communications, and will provide huge savings in both time and money in the transfer of information.”

Elvin is a universal internet technology capable of operating at massive scale, collecting ‘events’ across the internet and filtering them at lightning speed to deliver to a network of users only those items which are of direct interest.

Elvin is a generic technology that can be used for almost any information gathering application. Developer Bill Segall says the first major commercial application will be in securities trading – where time, speed and performance are money.

“Using Elvin we can deliver tens of thousands of messages to hundreds of individual desks in just a few milliseconds. Those are the sorts of volumes and speeds you need nowadays to operate on global financial markets. That adds up to a serious competitive edge,” Mr Segall says.

The technology has also been trialled in telecommunications network management, network security and in defence applications in both Australia and the United States.

Contact: 07 3365 4310

## Better brokers

Investors large and small can select the best broker anywhere in the world based on performance, using a revolutionary rating service developed by the Capital Markets CRC (CMCRC).

Combining the capacity to analyse vast amounts of market data from round the world with advanced mathematical modelling, the CRChas developed a rating service that tells investors just how well their chosen broker is performing compared with others, in research, sales and trading. Brokers are assessed stock-by-stock, and the ratings can be updated monthly.

“It’s a quantum leap in sophistication over the present annual, labour-intensive survey system. It offers institutional investors a real opportunity to make sounder decisions and reduce their transaction costs,” says CMCRC chief executive Professor Mike Aitken.

“At the same time it is cheap enough to help the mums-and-dads investors, and will help reduce the cost of capital to Australia overall.”

The broker rating service is one of a series of advances in financial tools and technologies, ranging from investment advice to market surveillance and scam detection, that are positioning Australia to be a leader in they supply of intelligent technology to world capital markets within 3-5 years, he says.

Contact: 02 9233 7999

### **Instant info**

Employees, managers and customers moving around a large workplace need never be out of touch, thanks to technology developed by the Australian Telecommunications CRC (ATCRC).

Offices, factories and shopping centres will soon offer instant contact with information, email, the web, phone calls and other services no matter where you are in the building.

The system uses low-cost Bluetooth radio technology to link devices like mobile phones, laptops, personal digital assistants, digital cameras and other roaming equipment to the central information and communications hub.

“Mobility means people will have access anywhere, anytime, anyhow,” says CEO Dr Leith Campbell.

Typical uses range from helping shoppers to find a particular store or item, being in constant touch when roving the building, downloading the budget on the spot, or searching for information on the net – without a desktop PC.

“The advantage to Australian industry is that this is an exceptionally low-cost technology to instal and use – user devices like phones, PDAs and laptops already exist, so its just a case of installing the Bluetooth network and controllers,” Dr Campbell explains.

Contact: 08 9266 3432

## **Online health**

Huge savings to the healthcare system, more timely and better quality patient information for doctors, and greater access by patients to their own medical records are the promise of a new electronic health records (EHR) system.

Developed by the Distributed Systems Technology Centre CRC (DSTC) in conjunction with the openEHR founders, Ocean Informatics, openEHR is the world's first system for accessing all of a patient's electronic health records across the health system, regardless of how they are created or stored.

openEHR has been adopted as the underpinning model for the new European EHR standard which is likely to also become the Australian and international (ISO) EHR standard.

"No matter what form a patient's health records take or what computer system is used, we've developed an architecture that can handle them all," says program leader Geoff Marshall.

openEHR could help save Australia up to \$300 million a year in unnecessary tests on patients, and give patients access to all their own medical, dental, pharmaceutical and other health record for the first time. It will enable doctors and other health professionals to provide better-coordinated patient care. It will also help reduce the current high rate of medical errors and improve health outcomes.

"The architecture will be publicly available anywhere in the world to assist with improved health record keeping, but we anticipate a range of commercial products which will help GPs, specialists, hospitals, and national healthcare systems keep better records," Mr Marshall says. "No-one has managed to achieve this anywhere else in the world, and we are now developing commercial products."

Contact: 07 3365 4310

## **Optical breakthrough**

A major obstacle to future high-capacity telecommunications has been overcome with the commercial launch of an Australian breakthrough designed to reduce signal loss in optic fibres.

Developed by the Australian Photonics CRC and Redfern Optical Components (ROC), the Direct Rite TM process cuts costs and gives enhanced performance over longer distances in optic fibre telecommunications systems.

Signal dispersion in multi-channel systems has plagued optic fibre systems for years, says ROC CEO Mark Englund. Previous attempts to overcome the problem were expensive and created technical problems of their own.

“We’ve developed a dispersion compensator – a sort of cattle grid for photons - which addresses all channels and overcomes other limitations to achieve superior performance at a reasonable cost.

“It means purer signals can now travel longer distances – up to 120 kms – without requiring amplification and are virtually rippleless, which reduces error rates. No other competing technology has achieved this.

“This puts Australia right at the front edge in the international telecommunications technology race.”

The Direct Rite TM process is expected to substantially reduce the costs of upgrading national and international telecommunications networks from their current capacity of around 2.4 Gbps to 10 Gbps, and will be essential for future 40 Gbps systems. It has been released to the global market.

Contact: 02 9209 4148 (CRC CEO 02 9209 4790)

### **Jam preventer**

Thousands of lives, entire industries and livelihoods depend on the precision, speed and freedom from interference of global positioning systems (GPS). From air, sea and land travel to industrial applications, exploration and defence, the 24 GPS satellites provide vital navigational and positional information to tens of thousands of users worldwide.

A reliable and cost-effective answer to the universal problem of jamming and interference in GPS signals is under development by Australia’s CRC for Sensor Signal and Information Processing (CSSIP).

The technology involves the use of adaptive filters whose characteristics change continuously to suit the radio environment in which they are operating. An anti-jam device is inserted between the GPS antenna and receiver, to filter out unwanted interference and protect the integrity of the signal.

Various digital signal processing chips and antenna arrays have been designed and tested against all kinds of interference – including deliberate jamming. Work is now proceeding on ways to pinpoint and block the source of interference.

Extensive trials at Woomera followed by detailed analysis of the signal data have demonstrated the effectiveness of the Australian solution. CSSIP is exploring the scope to commercialise the technology.

Contact: 08 8302 3477/3942

## **Human web**

The mouse, the keyboard, even the dreaded PIN, are heading towards the technological scrapheap as a revolution in user-friendly internet technologies takes hold.

Conversing with the internet, touching the internet, even grimacing or gesturing at the internet are all on the cards as replacements for clunky keystrokes, point-and-click, and cumbersome password ID systems.

At the forefront is Australia's Smart Internet CRC with a major research effort into what's known as the "natural adaptive user interface" – or, simply, making computers more "human" to deal with.

Listening to your email while you're driving to work, surfing the web by audio and being able to move smoothly from home to car to office without a break in transmission are among some of the technologies now being developed, says Smart Internet CEO Professor Darrell Williamson

"There are plenty of systems nowadays that do word recognition, but they are still awkward to deal with. You can't have a conversation with them.

"So we're adding in a bit of artificial intelligence that allows a conversation to take place. This allows the system to learn and adapt to your needs while you're conversing."

Other ways of contacting the internet include touching the screen or even, with the increasing use of tiny video cameras, using facial expressions and gestures combined with speech to communicate – as we do with people, Professor Williamson says. "Of course, keyboards and mice would remain for appropriate uses," he adds.

The advent of biometrics – recognition of your physical characteristics – is likely to end forever the tyranny of the lost or forgotten password, or the mass of different passwords and PINs we all have to remember. Far easier for your home or car to recognise you, he says.

To test some of the new technology combinations the CRC is working on a single portable device to assist blind users do all they require, in one voice-activated platform.

"I expect we'll see a lot of these new voice-activated devices appearing in cars first, before homes or offices.

Contact: 02 8374 5080

## **Crash cure**

Computer crashes are irksome enough – but when the computers control air liners, spacecraft, traffic or rail networks, software disasters can spell real disasters.

One man with a mission to stamp out the bugs that cause crashes – at least of the digital kind – is Tom Tilley of the CRC for Enterprise Distributed Systems Technology (DSTC).

“Formal methods are way of describing what a piece of software should do – but not necessarily how to do it. I’m working with a formal method called Z, for specifying software.

“As Z is maths-based, you can use it to produce a mathematical proof that the software is bug-free. If the programmer writes their software to match the Z description, it too will be bug-free.

The problem, says Mr Tilley, is that the maths involved is pretty high-powered. “You may need to be literally a rocket scientist to understand it,” he adds.

So, to spare computer programmers the necessity of becoming mathematical whizzes, while still turning out bug-free software, he has developed a visual system that converts the maths into line diagrams. These visual aids help the programmer understand whether their software is matching its specifications correctly.

The diagrams – known as formal concept lattices - allow Z users to navigate and query a specification. They can combine the various diagrams to summarise the properties of the specification they are interested in.

Contact: 07 3365 4310

## **Faster fibre**

A breakthrough in optical filters by a team from the Australian Photonics CRC has opened the way for IT companies to get far more out of their fibre – without having to lay thousands of kilometres of new cable.

“The global telecoms market is poised for further growth – not by deploying more fibre, but by increasing capacity in existing networks through low-cost high-performance devices,” says Don Hewitt.

“One promising way to do this is to use optical filters to suppress a redundant sideband. This approach has been around in electronics for decades – but it has proved extraordinarily hard to do with light, which is much more complex.”

Mr Hewitt tackled the problem by designing an ideal filter – and the CRC then assembled a team from across Australia’s research institutions to build real devices that would match its parameters as closely as possible.

Capitalising on the early C20th discoveries of two Australian Nobel laureates, Lawrence and William Bragg, the team designed a number of optic fibre Bragg gratings to screen out the unneeded side bands. These proved to have properties very close to the ideal VSB (vestigial side-band) filter designed by Mr Hewitt.

This breakthrough was possible because of unique optical design and fabrication technology developed by the AP CRC’s spin-off company, Redfern Optical Components (ROC) Pty Ltd.

It has since been followed by another world-first - the building-in of fibre dispersion compensation into the VSB filter.

The advances promise significant improvements in both high-speed and existing optic fibre networks, Mr Hewitt says.

“For the 40GB very high speed technology, the narrowing of transmission bandwidth with the VSB filter means there will be more channels on a single optic fibre – and hence a higher volume of traffic.

“On existing systems, the filter can either increase the traffic or cause the whole system to disperse less, leading to the signal being carried long distances without correction.”

Contact: 02 9209 4148 (CRC CEO 02 9209 4790)

## **Healing satellites**

Australian researchers have taught a computer soaring in a satellite 800 kms above the Earth to “heal itself” after being disrupted by a blast of space radiation.

The experiment aboard FedSat – Australia’s first home-grown satellite to fly in 30 years – is a world first and considered a major advance for the communication revolution, which depends heavily on satellite networks and their ability to keep functioning under all conditions.

Though Australia lost three decades in the space-race, Dr Andrew Parfitt, the CEO of the CRC for Satellite Systems, says we are catching up with a rush. The six experiments aboard FedSat are attracting worldwide interest from other space scientists and engineers.

In May FedSat recorded a bombardment of fast-moving charged atomic particles from the Van Allen radiation belts that sometimes disable satellites at higher altitudes. These magnetic storms also cause spectacular auroras near

the Poles and can disrupt electric power supplies and radio communications on earth.

Dr Parfitt said the magnetic storm proved a perfect opportunity to test a new high-performance computer which has been equipped with the logic to reconfigure and restart itself after an accidental shut-down. The experiment proved a major success.

Another experiment attracting global attention is the on-board magnetometer, which is measuring “space weather” – the stream of charged particles that pours from the sun, and magnetic storms like the one encountered.

“This is the environment in which modern communications and energy systems both in space and on Earth must operate reliably, and we are gathering important new data to help us understand how to design equipment that is disruption-proof,” Dr Parfitt says.

A third experiment involves super-accurate navigation using FedSat’s global positioning system, which at the same time is being used to check the electron content of the Earth’s upper atmosphere – another source of disruption to communications and navigation.

FedSat is also the first small satellite to operate in the Ka band frequency range – the coming thing in satellite communications. When the world finally switches over to more complex multi-band communication, Australian science and industry will be well-positioned to provide expertise and technology, Dr Parfitt says.

Contact: 02 6281 8529

## **Wall watcher**

Open cut coal mines will become safer and more productive thanks to a breakthrough in monitoring the stability of walls and slopes.

The CRC for Sensor Signal and Information Processing (CSSIP) has developed a Slope Stability Radar (SSR) able to detect minute movements or deformations of the cut wall – of less than one millimetre or less.

The technology promises to supplant less reliable, costlier and more labour-intensive techniques. It is reliable in all weather conditions, easy to set up and can scan large open cut walls ranges up to 450 metres from the face, and provides anew data scan at the radar and in the mine office every 15 minutes.

In trials the (SSR) has consistently detected wall movements and on several occasions accurately predicted a collapse.

“The radar has major prospects for reducing losses in productivity and equipment, and could certainly save lives and help prevent injuries,” says

CRC CEO Professor Matthew Cuthbertson. The radar is being commercialised by CSSIP's spinoff company GroundProbe Pty Ltd.

Contact: 08 8302 3477 /3942

# Mining & Energy

## Drill power

A new drilling system could unlock vast new energy resources for Australia, while creating scope to slash greenhouse emissions from power generation.

Tight-radius drilling (TRD) will enable us to tap centuries-worth of natural gas reserves currently locked in unmineable coal beds, says Professor Michael Hood of the CRC for Mining Technology and Equipment (CMTE) (Now CRCMining).

“TRD is the perfect way to drain methane out of otherwise inaccessible coal seams. At the same time we’re exploring the possibility it can also be used to re-inject CO<sub>2</sub> into the coal seam where it will be locked away.”

The technology consists of a high-pressure water-powered drilling bit that rotates like a fierce garden sprinkler, is driven forward by water jets and carries an on-board navigation package so the operator can guide it.

“Using this you drill a fan of holes into unmineable coal seams to extract the natural gas. Potentially, also, you could pump carbon dioxide back into the coal where it will be absorbed and locked up,” Professor Hood explains.

Contact: 07 3365 5640

## Energy bonanza

Australia has over 500 years’ supply of energy which can be converted to clean hydrogen for electricity or liquid fuels for transport in the State of Victoria alone.

“Lignite - or brown coal - has a number of advantages over other energy sources, in that it is easy to mine and highly reactive, which means it is cheaper to extract the energy,” says Dr David Brockway, Chief Executive of the CRC for Clean Power from Lignite. (Note: Dr Peter Jackson new CEO)

“The technology we’re working on will enable us to extract the energy without emitting greenhouse gases or other pollutants, by converting the coal to hydrogen and then sequestering – or storing – the CO<sub>2</sub>.”

The work combines two cutting edge technologies: mechanical thermal expression (MTE) to de-water the brown coal by heat and compression, and then gasification to make syngas, a blend of hydrogen and carbon monoxide. The syngas is then reacted with steam to create pure streams of hydrogen, for power generation, and CO<sub>2</sub> which can be locked away.

“The Gippsland Basin is a potential repository for CO<sub>2</sub>. The brown coal energy resource is vast. It is several times the scale of oil and gas resources of Bass Strait and even dwarfs those of the Northwest shelf. It has the added advantage of being close to major centres of industry and population.”

“The Gippsland Basin is a premium repository for CO<sub>2</sub>. For instance in Bass strait, we could replace the carbon we have extracted as oil or gas with CO<sub>2</sub>,” he says.

“The brown coal energy resource is vast. It is several times the scale of Bass Strait and even dwarfs the Northwest shelf. It has the added advantage of being close to major centres of industry and population.”

Dr Brockway says his CRC estimates MTE-IGCC (integrated gasification combined cycle) technology could produce electricity at \$31-32 a megawatt hour – lower than current technologies – and even with the cost of sequestration, the objective is to achieve an all-up cost of clean energy that is below \$80/MW-hour, below wind or and significantly below solar energy.

“An added bonus is the potential to make clean diesel fuel to keep our transport fleet running when domestic oil reserves run low, and avoid Australia being dependent on the Middle East.”

Contact: 03 8542 0800

## **Longlife power**

Eleven ageing power stations in South Australia, Queensland, NSW, Victoria and the Northern Territory are receiving a fresh lease on life under a \$3m joint industry research program.

Developed by the CRC for Welded Structures (CRC-WS), the program is prolonging the efficient working life of power stations and assisting the commercial uptake of the next generation of power technologies

“Australia’s power stations are ageing, and no-one is building new ones,” says CRC-WS chief executive Dr Colin Chipperfield. “Our aim is to extend their useful working life and keep them generating the megawatts that are so vital to industry and the community. The potential benefits run into tens of millions of dollars a year.

In one project a robot and laser welder are being developed to repair turbine blades without extracting individual, worn blades from their assemblies. “It’s literally cutting edge stuff, which no-one has done before – and could save a week in downtime.”

The power station program is based on a template developed by the CRC WS for industry-science joint ventures which ensures rapid transfer and

commercial uptake of new technologies, while the research is going on. It also gives industry a share in any intellectual property generated.

The same template has already yielded major research alliances in the alumina and pipeline industries, and may shortly be used in Australia's defence industries, Dr Chipperfield says.

Contact: 02 4252 8889

## **Missing bullion**

A huge gold anomaly that never yielded an ounce of gold is providing exploration scientists with fresh clues about where to look – and where not to look – in the hunt for the elusive precious metal.

In the 1990s, the discovery of a giant anomaly in the Gawler craton of South Australia sent a pulse of excitement through the gold industry. But extensive exploration failed to unearth what many hoped would be the next Golden Mile.

The explanation, say researchers at the CRC for Landscape Environments and Mineral Exploration (CRC LEME), lies in the tantalising ability of gold to smear itself across the landscape through groundwater movement, creating false leads that emulate the traces of rich deposits.

“The good news is that it looks as if we’ve found a new technique to identify such large-scale gold redistribution which will help us to pinpoint the source better in future – and to understand when we’re looking at false clues,” explains CRC LEME chief executive Dr Dennis Gee.

The technique is based on an airborne aeromagnetic platform called TEMPEST developed in a previous CRC (Australian Mineral Exploration Technology).

The Gawler anomaly consisted of calcrete – carbonate-based minerals originally deposited over eons from the sea by wind and which are sometimes linked to ancient drainage channels where rich deposits of gold can collect. In this case, however, the telltale gold had simply trickled from several lesser sources in the vicinity, perhaps too small to be worth mining.

“It’s taught us something else about how gold behaves in the Australian environment. This is knowledge that will help make future mineral exploration a lot more discerning,” says Dr Gee.

Contact: 08 6436 8786

## **Beating blowouts**

Reading the earth's warning signals more accurately may save life, limb and hundred of millions of dollars in the petroleum industry.

A team from the Australian Petroleum CRC has made an important advance in predicting the risk of a blowout during oil exploration and development.

Blowouts occur when fluid and gas pressures trapped in pores in the rock exceed those normal for its depth – and the drill-bit breaks into this region of high pressure unexpectedly. These pressure sometimes reach millions of atmospheres and consequences can be disastrous, both financially and for operator safety.

Oil drillers rely extensively on practical experience to anticipate and forestall blowouts. Now a CRC team led by CSIRO's Kevin Dodds has devised a new way to interpret signals from seismic exploration for clues which indicate pore pressures and consequently reduce the risk of surprise by predicting and planning for these 'overpressures'.

Tested against laboratory experiments, theory and field observations, the method promises a much more reliable way to assess overpressures in advance and so avoid blowouts with all the attendant cost and physical danger – or the opposite trap, taking needlessly costly precautions.

Overpressure problems occur in Australia's Barrow Basin and Carnarvon oilfields, off PNG and in many other locations round the world. An industry consortium is currently working with the CRC.

"Till now, dealing with overpressure has been something of a black art," Kevin says. "This technique promises to add more certainty to prediction, especially when combined with other indicators currently used by the industry"

Contact: 02 6200 3366

Note: This CRC has developed into a new CRC – CRC for Greenhouse Gas Technologies.

## **Seethrough success**

Broken Hill has a fresh break for new mineral discoveries, with images from the first major airborne gravity gradiometry survey publicly released by the CRC for Predictive Mineral Discovery (**pmd** CRC) and the Department of Mineral Resources NSW.

The data represents the best hope in years for discovering major satellite orebodies to revive the fortunes of what has been one of Australia's most productive mining towns since 1883.

The high resolution gravity data penetrates the earth to a depth of some 300-500 metres. Coupled with 3-dimensional visualization, other prospecting

technologies and a geological modeling system developed by the CRC it offers a powerful new way to identify otherwise hidden orebodies.

These may form part of the same vast silver/lead/zinc complex that formed the Broken Hill orebody more than a billion years ago.

“We’ve acquired some wonderful data which we’re processing into visual images right now, in the first survey of its kind every to be publicly released in Australia,” says **pmd** CRC chief executive Dr Bob Haydon.

“Airborne gravity is so detailed – it gives us a completely new way to visualize what is beneath the earth’s surface, especially in areas like Broken Hill where much of the surrounding terrain is covered by soil and sandy sediments.”

The project focuses on an area of 1000 square kilometers – far too great to prospect easily in such detail by ground based methods – along the main Broken Hill line of lode.

The survey was carried out with the unique Falcon™ gravity gradiometer developed in Australia by BHP Billiton for detection of ore deposits and mapping structures covered by surface rubble and sediments up to 500m deep. The data are available for use by anyone wishing to explore for minerals in the area.

Contact: 03 8344 6514

## **Capturing carbon**

A critical step in Australia becoming a hydrogen economy is to find reliable and economical ways to lock up carbon dioxide underground says CO<sub>2</sub>CRC chief executive Dr Peter Cook.

“Australia is richly endowed with the sort of rocks that naturally trap carbon dioxide, in our coal, oil and gas basins. If we can demonstrate this can be done at a reasonable cost, it will mean we can go on using our fossil energy reserves for centuries to come without adding to greenhouse or air pollution.”

Dr Cook says that Australia faces a multi-billion dollar cost for renewing its energy infrastructure. We should plan to include the elimination greenhouse and other emissions in this renewal.

Geo-sequestration involves compressing CO<sub>2</sub> until it becomes liquid and then injecting it into suitable rock strata at depths of about a kilometre or more underground.

“The CO<sub>2</sub> is then trapped in the subsurface for thousands of years and longer. Australia has natural accumulations of CO<sub>2</sub> that have been safely stored below the surface for millennia, which prove this is feasible.”

To test the idea CO2CRC researchers are working closely with the gas, coal and power generation industries.

Dr Cook says that studies undertaken by the CRC indicate that excluding the cost of CO<sub>2</sub> capture it may be possible to store carbon dioxide for around \$10 or less a tonne depending on how far the CO<sub>2</sub> has to be piped to a suitable location. The search is now on to find suitable locations for geosequestration around the continent.

Another challenge the CRC is investigating is how to retrofit our aging power stations with systems to separate CO<sub>2</sub> from other gases vented in exhaust stacks, so it can be sequestered. This could be an important interim step on the road to modern gas-fired plants.

Contact: 02 6200 3366

## **Cool coal**

Sunlight and black coal, two of Australia's most abundant energy resources, could be combined to provide clean energy to power the economy for centuries into the future.

That's one of the conclusions of a study on the hydrogen economy by the CRC for Coal in Sustainable Development.

The report "Hydrogen from Coal: a pathway for the future" points out that Australia has 250-500 years worth of black coal in known reserves.

"Hydrogen can be produced from coal by two main methods - gasification, and use of coal-generated electricity to electrolyse water. Gasification offers the greater potential for CO<sub>2</sub> capture and storage, as well as the reduction of other pollutants," the study says

"With gasification however, there is the possibility of achieving very high purity hydrogen due to the ease of separation of CO<sub>2</sub>, which is found in high concentrations in the product stream.

"By sequestering CO<sub>2</sub>, hydrogen produced from coal gasification has the potential to be a very low CO<sub>2</sub> emissions fuel on a life cycle basis."

The coal industry already has an established infrastructure, is located conveniently close to major cities and industrial centres, and the cost of coal is highly competitive. The major challenges lie in supplementing Australia's existing coal-fired electricity system with hydrogen – using fuel cells together with steam turbines - and in demonstrating that the CO<sub>2</sub> can be safely and economically captured and stored.

"The report also suggests we may take full advantage of Australia's natural abundance of sunlight by continuing to explore the potential for solar thermal

systems to gasify coal into hydrogen,” says CCSD Chief Executive Mr Frank van Schagen.

“That way we would be combining two of our outstanding natural assets in a truly Australian energy solution.”

The report calls for a major national investigation of the future role of hydrogen as an energy carrier in the Australian economy, and modeling of the various technological pathways to see which offer the best energy, greenhouse and economic prospects.

Contact: 07 3871 4400

### **Nickel win**

An unexpected discovery by an Australian scientist at the AJ Parker CRC for Hydrometallurgy has opened the way for a major enhancement in the processing of Australia’s \$2.8 billion nickel production.

Nickel forming on an electrode during the extraction process can be contaminated by other metals, sometimes with disastrous consequences for the electrowinning plant - and added costs for industry.

Electrowinning is used to recover nickel metal from a solution containing nickel atoms. An electric current is applied to the solution and nickel metal forms in sheets on the sides of the negatively-charged electrode.

Dr Daniel Kittelty of the Parker Centre was investigating the role of aluminium, copper and other contaminants in the nickel solution. He knew that tiny amounts of aluminium caused the nickel to stress and peel away from the electrode – but curiosity prompted him to find out what larger amounts would do.

Contrary to all expectation, he found that increasing the level of aluminium actually resulted in a smoother, stronger nickel sheet being deposited.

His discovery – on which a provisional patent has been lodged - has given Australia’s growing nickel industry a new way to control and optimise its electrowinning process.

“This indicates that nickel plants can reduce strain buildup in nickel deposits by maintaining tight control over the conditions in the solution, and by replacing the normal boric acid additive with small concentrations of aluminium.”

Although he has not yet had a chance to explore the consequences downstream to metal products, Daniel considers it likely that a higher quality nickel sheet will also result in superior quality and stronger fabricated nickel

products, giving Australian nickel a further competitive edge in the global market as well as sparing industry the cost of downtime in the plant.

Contact: 08 9360 6361 (CRC CEO 08 9360 2552)

## **Dragline care**

Protecting and enhancing investments in mining equipment worth tens of millions of dollars is the benefit from a smart new sensor system developed by Australia's CRCMining.

Draglines – the giants of the mining industry – can cost up to \$100 million a piece. A typical mining company spends 30-50 per cent of its operating budget maintaining such machines and systems, and the cost to Australia alone exceeds \$10 billion a year.

The CRCMining Dragline Dutymeter can help raise the operational capacity of a dragline by up to 25 per cent, without significant loss in reliability or availability.

The Dutymeter acts as an early warning system to alert dragline operators in real time to actions which can rapidly degrade the machine's reliability. It also continuously monitors and logs the cumulative wear and tear on the machine.

It not only provides a tool for enhancing operator performance but also gives managers a new way to assess, compare and control the effects of bucket loads on dragline life and provides maintenance staff with information on the specific duty experienced by different components. It also enables comparisons to be made between different draglines and minesites.

The Dragline Dutymeter has been licensed to Tritronics Pty Ltd as a component of the company's new Series 3 Dragline Monitoring System, and has recently undergone successful trials in the Bowen Basin. Operators of Dragline 18 at BHP Billiton Mitsubishi Alliance's Saraji mine now know in real time how their operating practices are affecting machine duty.

CRCMining's Professor Hal Gurgenci and Dr Paul Meehan estimated that Dutymeter use can improve operator practices to such a degree as to enable an increase in suspended load capacity of up to 25 per cent, without a noticeable degradation in machine reliability and availability.

CRCMining hopes to apply the dutymeter concept to shovels and trucks, and has been conducting research in these areas. The CRC has analysed operational practices on hydraulic excavators over a number of shifts and developed a prototype tool to detect practices that cause the most duty.

Researchers have also been working on a technology to enable trucks to monitor the quality of the road they are travelling on in real time to enable the driver to make adjustments to increase tyre and truck life.

Contact: 07 3365 5640

## **Dry history**

The first 'history' of Australian aridity and salinity is being painstakingly pieced together by researchers from the CRC for Landscape Environments and Mineral Exploration (CRC LEME).

Around 80 per cent of Australia is scarred by the fossil remnants of the extreme aridity which occurred in stages during the last ice age – vast sheets of sand, dunes, wind-blown dust and gibber plains.

This environment, say Dr John Magee and Professor John Chappell, has been relatively static since the end of the last glacial period around 10,000 years ago – until recently, when human activity wrought massive change.

“By clearing vegetation, changing water tables, altering flood and fire patterns and remobilising salt we’re recreating earlier, more volatile conditions – but in a far different climatic setting,” Prof. Chappell says. “This makes it very hard to predict the consequences – but an obvious one is the loss of species.”

Dr Magee’s research indicates there are ‘thresholds’ in the evolution of our environment, where the gradual buildup of interacting forces leads suddenly to precipitous change.

An example is the gradual drying of the great inland lakes, leading to ‘deflation’ in the sediments as they become playas, or salt pans. This leads to rapid mobilisation of huge amounts of sediment and salt, sandblasting the region, killing off vegetation and building vast, active dunefields.

The mobilisation of salt by human activity bears similarities to its liberation in extreme dry periods at the peaks of the ice age, and gives us a window for understanding the long-term consequences of our actions – the Australia we are making.

Unclear, as yet, is whether such events happen at the same time across the continent, whether they radiate from its centre, or occur in different regions independently.

The picture of Australia’s development under these conditions is far more complex than hitherto imagined – with soils, surface water, groundwater, salts, fire and vegetation interacting to reshape the landscape – and makes it all the more imperative for us to understand just how this happens. One of the obvious impacts is that we are losing soil at far faster rates than it is being formed.

Dr Magee and Prof Chappell are compiling the first chronology of the onset of aridity in Australia during the last 350,000 years – the period that mainly

shaped the landscape as we know it today – and opening in new chapter in our understanding of what it means to be Australian.

Contact: 02 6125 2761 (CRC CEO 08 6436 8786)

### **Transparently Tasmania**

Tasmania went transparent in 2003 when the first-ever see-through map of the State revealed its geological features several kilometres underground, paving the way for major new mineral finds

Combining vast amounts of geological data with state-of-the-art visualisation technology, a team from the Predictive Mineral Discovery CRC has created a visual guide which industry can use to pinpoint the potential mines of the future - and boost the State's mineral economy.

"It incorporates seismic, gravity, magnetic, geochemical, topographical and other data in an easy-to-interpret visual form, which will be up on the web in September for all to see," says **pmd**\*CRC chief executive Dr Bob Haydon.

"One of the most impressive things is the way many mining companies have contributed their private information to this, to make a C21st map to guide future mineral exploration."

The CRC consortium has also recently completed the first-ever airborne gravity survey of the Broken Hill region, to help miners locate associated ore bodies and keep the town in prosperity as known resources dwindle.

Contact: 03 8344 6514

### **Diggers delight**

Australian technology is poised to revolutionise coal mining world wide, with the introduction of a system that boosts dragline productivity by more than 25 per cent.

Three of the world's largest coal miners have expressed interest in fitting a number of their draglines with the Universal Dig & Dump (UDD) system developed by the CRCMining. This follows a successful full-scale trial at BHP Billiton Mitsubishi Alliance's Peak Downs mine in Queensland.

Conventional draglines use antiquated rigging that limits where they can dig and dump. On a UDD dragline, the new rigging configuration and the control system give the operator precise control over the angle of the dragline's bucket, and hence the ability to dig and dump anywhere under the boom. This improves cycle time. A UDD dragline also uses less rigging, so it can lift more payload without imposing extra stress on its components.

“There are 400 large electric draglines worldwide which could be retrofitted with this technology - and we’re hoping to fit up to half of them over the next 10 years. This could yield a benefit to Australia of more than \$200m,” CRCMining CEO Professor Michael Hood says.

“This technology is also going to revolutionise the design of coal mines for efficient operation – so it will also position Australia as the primary global source of mine planning advice.”

Contact: 07 3365 5640

### **Lower emissions**

Australia can more accurately predict and deal with power station emissions following research by the CRC for Coal in Sustainable Development, CCSD.

The research has provided an important input into a revision of National Pollution Index reporting procedures for the Australian electricity industry commissioned by the Electricity Supply Association of Australia (ESAA).

The CCSD study provided greater confidence in the reporting procedures for emissions of trace species from power production. Power producers, along with other industries, are required to report such emissions through the National Pollutants Inventory (NPI), set up by Environment Australia (EA) for the Federal Government.

All coal-fired power stations in New South Wales and Queensland participated in the work.

The power producers had initially been using emission factors largely based on data originating from the USA. Local power producers saw the need for local data, and commissioned a number of research organisations, to sample and analyse for trace metals and organic species.

Measurements related to black coal generation were made from the stack emissions at nine NSW and Qld power plants. CCSD researchers supported the industry through the ESAA in critically reviewing the NPI methodology, notably emission factors, identifying the need for additional measurements and making recommendations on reporting procedures.

Contact: 07 3871 4400

### **Carbon burial**

Up to one million tonnes of CO<sub>2</sub> could be buried in a saline reservoir deep underground, as part of a national experiment to demonstrate that it is possible to largely eliminate Australia’s industrial greenhouse emissions.

The new CRC for Greenhouse Gas Technologies (CO<sub>2</sub>CRC) is planning a major demonstration of the large-scale disposal of CO<sub>2</sub>, to see if it is possible to 'lock up' greenhouse gases in the sub-surface and keep an eye on them, says Executive Director Dr Peter Cook.

"Australia has sufficient underground capacity to potentially store our total emissions for the next 2000 years. We want to be sure it is safe, secure, practical and economic to do so," he says.

The CO<sub>2</sub>CRC is working with partners in North America, Europe and Japan on extraction technologies and advanced power systems that allow CO<sub>2</sub> to be extracted cost effectively from power plant and factory flues, so it can then be stored geologically.

Storage options being examined include saline reservoir rocks, coal seams and depleted oil and gas fields.

Contact: 02 6200 3366

## **Brown power**

Technologies to reduce greenhouse emissions from power generation using southern Australia's vast reserves of brown coal – or lignite – are under development at CRC for Clean Power from Lignite.

"Contrary to what many people imagine, brown coal is a very clean fuel. The problem is that it contains 60-70 per cent water – and dealing with that requires a lot of extra energy," CRC CEO Dr David Brockway explains. (Note: Dr Peter Jackson is the new CRC CEO)

The CRC is developing a technology for heating and squeezing the coal which will cut the need for extra energy to evaporate the water content by up to 90 per cent. This in turn will substantially lower greenhouse emissions.

"The treated coal can then be used in existing power stations, protecting Australia's competitive advantage in low-cost energy while addressing our greenhouse commitments," Dr Brockway says.

"Treated coal can also be used as a feedstock for IGCC (integrated gasification combined cycle) which is the power generation system of the future. This will give substantial increases in both efficiency and cuts in greenhouse gases."

The technology can also yield concentrated CO<sub>2</sub> in the waste stream – enabling it to be buried, or sequestered.

"This work perfectly complements the research of the CO<sub>2</sub>CRC, and puts Australia squarely on the route to zero greenhouse emissions from power generation," Dr Brockway says.

Contact: 03 8542 0800

## **Bushlight**

Remote indigenous communities will manage their own power supplies under the Australian Centre for Renewable Energy's *Bushlight* Program.

*Bushlight* is delivering tailored renewable energy – mainly solar and some wind power – to up to 200 small communities living in remote areas.

"We're using energy as a driver for other community goals, such as improved health or job opportunities," says ACRE managing director Dr Frank Reid. "We help communities to plan and manage their own energy needs, to have control over the power supply and usage patterns. The social side is as important as the technology,"

The technology too is world class, having been vetted in ACRE-Lab, Australia's only facility for testing renewable energy equipment to world standards.

A recent study shows that Australia's sustainable energy industry now comprises more than 2,100 companies earning \$3.4 billion a year, making an overall economic contribution of \$10 billion and creating 58,000 Australian jobs. Direct employment by the industry is estimated at 17,000.

Contact: 08 9360 6620

Note: This CRC has finished; RESLab Manager, Renewable Energy Systems Test Centre, Australian Sustainable Energy Centre, Murdoch University, WA 08 9360 7214

## **Plastic power**

A solution to one of the nation's worst environmental headaches – the large volumes of plastic waste – is being explored by researchers from the CRC for Coal in Sustainable Development (CCSD)

The team is investigating the scope to use waste plastics as part of a combined fuel with coal in blast furnace processes.

"If waste plastic injection proves to be feasible in iron making it will provide an environmentally sound option for disposal as well as lowering GHG emissions because plastic is carbon-lean compared with coal," says CCSD chief executive officer Mr Frank van Schagen .

Co-firing of blast furnaces with coal and plastics has been pioneered in Japan. CCSD researchers led by Prof Veena Sahajwalla are collaborating with the

Australian coal and iron industries to explore the impact of waste plastics when used as a co-injectant with coal.

“The use of plastics as a fuel supplement not only has the potential to reduce the carbon intensity of the ironmaking process, but also usefully reduce large quantities of troublesome waste” she said

Contact: 07 3871 4400

# **Agriculture & rural based manufacturing**

## **Electronic sheep**

Electronics are poised to transform the sheep industry, enabling graziers to move from manual, whole-flock management to precision management at the level of the individual sheep.

The result will be sharp increases in productivity – more wool, meat and fewer parasite and disease problems per sheep, says Professor James Rowe, CEO of the CRC for the Australian Sheep Industry.

“Starting with radio ear tags, and linking them with race-side diagnostics, a central flock database and automated drafting, we’ve got the sheep management system of the future under development right now,” he says.

The diagnostics could range from simple measures such as bodyweight, to on-the-spot fleece tests and parasite counts. Individual sheep can then be classified and drafted as required.

Beyond the farm, the new data gives the grazier the ability to sell forward over the internet based on detailed information about his stock, their genetic background and individual histories.

“Productivity gain in the sheep industry is currently less than 0.5 a per cent, compared with 2.2 for cattle and 3.5 for broadacre agriculture. Electronics can unlock precision sheep production,” Professor Rowe says.

Contact: 02 6776 1465

## **Clever crops**

Drought resistance and superior quality are just two of the traits being rapidly transferred to Australia’s next generation of cereal crops through the use of molecular markers.

To put Australia into the world lead for malt quality, the CRC for Molecular Plant Breeding (CRCPMB) in partnership with ABB Grains has developed new lines of barley which have just completed their first field trials.

“With traditional plant breeding it takes 12-14 years to develop a new wheat or barley cultivar. Using molecular techniques we’ve been able to cut that time in half,” says CRCMPB chief executive Dr Bryan Whan.

“Like DNA fingerprinting of humans, this powerful technology enables us to pick out the cereal strains which have the precise genes for the characteristics we’re looking at, then breed them conventionally”

Working with germplasm from the International Wheat and Maize Centre (CIMMYT), the CRC team has also been selecting wheat varieties with genes for longer roots and other drought-tolerance features, to help Australian farmers better withstand future dry years.

In the longer term, Dr Whan says, a gene from the laboratory plant *Arabidopsis* appears to significantly enhance drought tolerance in wheat – a clear pointer to the future potential of gene transfer.

Contact: 08 8303 6539

### **Banana saver**

Pre-emptive strikes against two banana diseases which entered Australia have spared the nation tens of millions of dollars in losses.

Sophisticated diagnostic tools developed by the CRC for Tropical Plant Protection enabled researchers to identify the invaders - Black Sigatoka and Tropical Race 4 Panama - in the early stages, leading to their successful quarantine and eradication.

“Many of these diseases occur in neighbouring countries in our region and can get into Australia quite easily, potentially causing havoc in crops such as tropical fruit, sugarcane and grains,” says CRC TPP chief executive Professor John Irwin. “In any year about \$2-3 billion worth of tropical crops is at risk.”

“One answer is to develop the molecular diagnostic tools that enable us to identify an invader as soon as a new disease is detected – and deal with it.”

The Centre is developing diagnostics for the leading disease threats - bacterial, viral and fungal - to Australia's main tropical and temperate crops, such as bananas, mangoes, sugarcane, tomatoes, pastures and wheat.

Besides providing early identification of an invader, the work also enables the development of resistant strains of crops or new protective strategies – before the enemy arrives, Prof. Irwin says.

Contact: 07 3365 2790

### **Super wheat**

The world's most powerful and cost-effective plant breeding technology is poised to give Australia a leading edge in a critical area of global biotech – the breeding of superior wheats and other food crops.

A joint venture company, Tritcarte PL, has been launched by the Value Added Wheat CRC and Diversity Arrays Technology Pty Limited, with backing from

the Grains R&D Corporation, to commercialise novel genotyping technology for barley and wheat.

The technology dramatically accelerates the process of selecting desirable genes for novel food crops using conventional breeding, says VAWCRC chief executive Dr William Rathmell.

“Plant breeding can be a bit like playing the pokies, where you may have to pull the lever 1000 times to win. But with the Triticarte approach, you can select the precise genes you want to include in your new wheat variety,” Dr Rathmell says.

“It’s all-Australian technology. It costs around ten cents to flag a key gene that you’re after – which is a fraction of the cost of comparable technologies.

“And it’s very fast. It took us just two days to compile a genetic family tree of Australia’s main wheat varieties which otherwise would have taken four years.”

The technology will enable plant breeders using conventional breeding to create designer wheats which combine features desired by consumers, food makers and farmers. These could include improved nutrition and shelf-life, better baking quality and resistance to pests or drought.

Contact: 02 9490 8488

### **Fatal attractant**

Pesticide use in the Australian cotton industry is set to fall with the commercialisation of a new product with a fatal attraction to insects pests.

The Australian Cotton CRC has signed a commercial agreement with Ag Biotech Australia to develop, manufacture and market Australia’s first adult moth attractant for the voracious cotton pest, the cotton bollworm.

Appropriately named MAGNET, the lure is based on smells identical to ones emitted by plants which affect insect behaviour.

Associate Professor Peter Gregg from The University of New England, who led the attractant project, says trial results indicate great potential for reducing pest numbers – with little effect on friendly insects.

“MAGNET provides a new tool for managing cotton bollworm, allowing growers to reduce use of insecticides, and providing significant advantage to their integrated pest management programs,” he says.

In the trial, in which 1.5 per cent of the cotton field was sprayed with the attractant mixed with an insecticide, the researchers estimated they had killed

28,500 moths – reducing the number of caterpillars that would potentially hatch to eat the crop by around 13 million.

“The number of moths killed will depend on the numbers which are present. Timing of attractant applications, in relation to the local ecology of cotton bollworm species, is likely to be a critical factor in their effectiveness,” Dr. Gregg said.

Another experiment using attractants without insecticide added found the material had some weak attraction to ladybirds, but none to lacewings, wasps, spiders and other beneficial groups.

The detection of both local and district impacts on bollworm pressure suggests that if larger areas were treated, the attractant might be able to substantially reduce pest pressure – and pesticide use – over a wide area and for a long period.

The Cotton CRC and Ag Biotech are jointly seeking registration of the new attractant, which will undergo evaluation trials over 10,000 hectares of cotton this summer, subject to approval by government regulatory authorities.

Contact: 02 6799 1500

## **Parasite peril**

Australia's sheep industry faces a \$700m parasite bill by 2010 as drench resistance rises and production losses escalate.

Researchers at the Sheep CRC are working against the clock to build an armoury of new techniques to keep the threat at bay. Spearheading the new approach are practical ways to measure the level of parasite infestation in a sheep flock, so producers can treat only those sheep that need it – not the whole flock, says CEO Professor James Rowe.

“We’re finding the problem sheep are only about 10-20 per cent of the flock – yet up till now we’ve had to drench the lot, which has cost plenty and brought on the present problems of parasite resistance.”

The CRC is trialling three techniques for a possible race-side test for parasite levels, to help the grazier cull animals which consistently show high worm burdens. This could be coupled with e-sheep bodyweight recording technology to pick out potential problem animals for worm tests.

“Parasites are such a huge problem that one approach alone is not sufficient. We’re aiming for a total package which covers breeding, pasture and parasite management, matching the right chemicals to specific parasites, and strategic feeding to bolster immunity to parasites in lambing ewes and weaners.”

Another promising technology is the use of natural fungi which attack and strangle the parasitic worms. The CRC will shortly begin field trials using these fungi as part of an integrated pest management program, and as an important option for organic growers.

“The cost of parasites to the livestock industries is one thing – but the real fear is losing our drenches to resistance, which would be a catastrophe.

“The situation is urgent, but equally, it’s now starting to look like it is soluble provided we use a combination of approaches to manage the problem,” Prof. Rowe says.

Contact: 02 6776 1465

### **Beating wilt**

A ban on \$100m in Australian cottonseed exports to the US was averted thanks to a crash research effort by scientists in the CRC for Tropical Plant Protection.

US authorities feared the cottonseed might contain Australian strains of the fusarium wilt fungus which could potentially devastate the US cotton crop.

Several shiploads of Australian cottonseed were already off the California coast or en route when huge pressure from local cotton growers came on US quarantine authorities to ban its import – while equally firm pressure was applied by the Californian dairy lobby to allow it in.

With \$6m in exports already on the high seas, a team led by Dr Suzy Bentley worked round the clock and weekends to solve the problem, by demonstrating that current, pre-export, pest treatments of cottonseed in Australia were effective in controlling local strains of the fusarium wilt fungus.

It is routine practice to treat all cottonseed exports with methyl bromide to control any insect pests – and a preliminary study revealed that this was also effective against the fusarium wilt fungus. The question was: would it control the two native Australian strains of the fungus which the Americans had declared as prohibited imports under their Quarantine regulations.

The CRC TPP team used a sophisticated DNA-based diagnostic test to determine whether or not the local strains were present in samples taken from the treated cargoes. The two strains of the fungus were not detected, confirming the current methyl bromide treatment is satisfactory against the fusarium wilt fungus. These data were used by US authorities to allow the lucrative cottonseed trade to continue.

Using Australian research results US researchers have carried out investigations into the strains of the fungus in the US, discovering at least 3 additional strains not previously identified in the US.

Contact: 07 3365 4776 (CRC CEO 07 3365 2790)

## **Tuna trackers**

Australian fresh farmed tuna's position as a premium product in one of the world's choosiest markets has been assured by an exhaustive probe into the total chain from the tuna fish farms of South Australia to the customer in Japan.

In one of the most intensive investigations of a food chain ever undertaken, researchers from the Aquafin CRC accompanied individual fish on every stage of their journey from water to platter.

"It was a huge logistic challenge – we ended up exhausted, but very satisfied with our achievements. We spent ten frantic days on farms, in plants, planes and markets in Japan chasing fish and people, sampling and testing every step of the way," says Dr Phil Thomas.

Results from the study are expected to reveal exactly what goes on in tuna meat on its way to the consumer.

"Our goal is to have Australian farmed tuna recognized as second to none – and to do that we need to find out everything that can happen to it en route, from harvest to restaurant," Dr Thomas explains.

"The high price of tuna – around \$A35-40 a kilo fresh at auction in Japan – is what justifies such an extensive and detailed study. Like our best wine, tuna is an elite product and we are undertaking research to support South Australian producers to keep it that way."

Key to the process is the 'bloom', the rich red colour which fresh tuna meat turns when it is cut. This visual appeal is critical to creating high demand.

Also important are achieving the right fat content of the fish and extending shelf life. In a recent advance, the Aquafin CRC team has found that correct vitamin balance in the fish's diet can significantly improve the keeping quality of its meat. They are also investigating the effects of providing optimal growing and harvesting conditions on the eating quality of farmed fish.

The results of the research will give tuna farmers new ways to assess their husbandry, feeding, slaughter and post-harvest techniques in order to ensure Australia's tuna industry, worth about \$440 million and employing 1750 people, continue to command premium prices in the world's most discerning fish market.

Contact: 08 8290 2302

## **Gentle reward**

Gentle handling of cattle makes a big difference to the eating quality of the meat.

Research at the Cattle and Beef Quality CRC led by Dr Robyn Warner (Vic. Dept of Primary Industries) and Dr Drewe Ferguson (CSIRO) has found the treatment of animals during lairage – when they are held at the abattoir prior to slaughter – can have a large impact on consumer acceptability of the meat.

This follows earlier work by the CRC which examined the impact of mixing unfamiliar cattle prior to slaughter.

The new research shows that use of electric cattle prods just prior to slaughter can cause a significant stress and a decrease in eating quality and the water-holding properties of the meat.

“When we compared consumer reaction to meat from animals that had been subjected to cattle prods with those that had not, there was quite a surprising difference,” says Dr Robyn Warner.

“The Meat Standards Australia (MSA) consumer panel definitely found the meat from stressed animals to be tougher and less palatable.”

“These results indicate that the industry may have underestimated the impact that even mild levels of pre-slaughter stress on the animal can have on meat toughness. They tell us we need to take greater care in all aspects of how animals are treated and handled between farm and abattoir.”

To complicate the picture, the effect of stress on eating quality does not seem to be directly linked to known mechanisms associated with toughness rather there appears to be other biochemical factors at play.

However the conclusion is clear - that gentler handling of animals pays off in the form of better beef quality, and consumers can tell the difference, Dr Ferguson says.

The Beef CRC has created a technology transfer package to advise producers, processors, transporters and other in the industry of the latest findings, with the ultimate goal of delivering even better Australian beef to domestic and export consumers.

Contact: 02 6776 1354 (CRC CEO 02 6773 3501)

## **Rot stopper**

Avocado lovers can look forward to fruit without those nasty little rots on the inside of the skin, thanks to research by the CRC for Tropical Plant Protection (CRC TPP) now being adopted across the industry.

The rots are caused by a fungal disease called anthracnose, which inflicts around \$15m in damage and losses on the nation's \$70m avocado industry – and also harms mangoes and lychees.

Research in the CRC has come up with a couple of strategies now being widely adopted in the industry to combat the disease – the use of a Guatemalan rootstock called Velvick which induces resistance to the disease, and a management strategy for altering the chemical balance in the fruit's skin, which discourages it.

Researcher Dr Lindy Coates says that most nurseries in eastern Australia are now selling avocados on resistant Velvick rootstock and the growing industry is progressively converting its trees. The next step, she says, is the development of clonal rootstocks which will provide higher and more consistent disease resistance.

Growers have also widely adopted a management approach recommended by the CRC to lower the nitrogen and increase calcium content in the fruit skin, as both of these limit the damage caused by the anthracnose fungus.

The CRC is currently exploring the promising potential of the Velvick rootstock to resist another devastating disease of avocados – the root-destroying fungus *Phytophthora*.

Contact: 07 3896 9468 (CRC CEO 07 3365 2790)

## **Wine saver**

The Australian wine industry faced a hammering as the impact of drought menaced the nation's 2004 vintage through reduced water availability in grapegrowing regions across southern Australia.

Researchers from the CRC for Viticulture (CRCV) hastened to the rescue with the early release of a package to help grape growers make the very best use of scarce water.

The CRCV's VineLOGIC program is a computer simulation that allows users to create various vineyard scenarios based on different soil types, irrigation methods, water availability, climate, salinity, vine canopy management etc. The simulation then predicts the likely grape yield and total water use for different scenarios – so the grower can select the best outcome.

The VineLOGIC education package was released to universities, TAFEs and schools in May 2003 and was being taken up.

However, in view of widespread water restrictions across southern Australia and great uncertainty in the industry, the CRCV decided to make the grapegrower version of VineLOGIC available early, through workshops across the main growing areas of the Murray / Murrumbidgee region.

“VineLOGIC allows growers to compare different scenarios in their own vineyards – for example what will be the likely impact on yield and vine stress if they use 30 per cent less water, and apply it in different strategies during the season,” says CRCV project co-ordinator Max Tolson.

“This package can also show the impact on yield of irrigating with saline water. This is an incredibly important issue, especially the Riverland, and we can look at strategies that reduce soil salinity and the uptake of salt into the vine.

“It shows growers that there are lots of options in regards to their irrigation practices and explores the outcomes of changes to their strategies. It provides a sound scientific starting point for looking at the best irrigation practices for what is shaping up to be a difficult season.”

Contact: 08 8363 6811 (CRC CEO 08 8303 9405)

## **Salt assault**

Cotton growers have a new tool for defeating salinity before it strikes, thanks to the work of Dr John Triantafyllis, a researcher in the Australian Cotton CRC.

Salinity does not yet pose a widespread threat to the cotton fields of NSW and Queensland - and John is keen to keep it that way, providing farmers with early warning of potentially saline soils and aquifers needing to be carefully monitored and managed.

“We’re using ground-based electromagnetic (EM) induction, a well tried and cost-effective technique for revealing the presence of salt in the top metre or so of the soil,” he explains.

“The signal received is a function of salinity, moisture, the mineralogy and clay content of the soil. If you know the soil’s moisture, mineral and clay content, you can then map the presence of salt stored across a landscape.”

EM surveys can be performed at field or district levels, depending on the information required. At the field level the instruments are mounted on a small tractor and coupled to a GPS provide information very quickly. At the multiple-farm or even across a whole district, the instruments are used on grids of 0.5-1 kms.

The spatial variation of the measurements is used to identify soil sampling locations. If laboratory analysis confirms that salinity is causing these differences, a map can be

produced from which the cause and appropriate best management can be determined.

“Salinisation in cotton growing can arise in two ways – either by applying salty water from the river or groundwater, or through inefficient irrigation practices which recharge saline groundwater and bring it to the surface,” says Dr Triantafilis.

“In the Namoi, Gwydir and MacIntyre valleys there is a lot of dryland salinity in the upper catchments which is entering the rivers. At present the levels of salts in these rivers is still low. However these need to be monitored as most cotton growers in these valleys rely on this water for irrigation.”

As a general rule, the cotton areas in the east have much less salt stored naturally in the soil, but levels increase further west in older soils, and this has to be carefully watched. So too does the siting of water storages on farms, to avoid leakage into groundwater.

Dr Triantafilis says the techniques being developed in Australia to combat salinity offer potentially global benefits, wherever salt threatens irrigation agriculture. This includes countries such as Pakistan, India, Iran and Iraq.

Contact: 02 6799 1522 (CRC CEO 02 6799 1500)

## **Rural regeneration**

New industries based on perennial native plants will provide jobs, profits and fresh way to tackle both greenhouse and salinity across rural Australia.

The 'Florasearch' project is searching out native trees to identify species suitable for large-scale commercial revegetation. The project is a collaboration between the CRC for Plant-based Management of Dryland Salinity (CRC Salinity) and the Joint Venture Agroforestry Program (JVAP).

New farming systems which integrate short-rotation tree crops with traditional cereal crops and perennial pasture can be profitable for farmers as well as environmentally friendly, says CRC chief executive Professor Philip Cocks.

New industries across southern Australia will focus around regional integrated processing plants. A feasibility study shows that producing several commercial products and keeping transport distances down is the key to profitability.

A range of innovative new products is on offer, from composite wood products, fodder and food ingredients, oils, gums, resins, bio-fuels, herbicides and anti-fouling agents, degreasers and preservatives, pharmaceuticals and activated carbon, through to pulp and paper products.

Leftover materials can be used for biomass energy generation - powering the plant and providing electricity to surrounding towns from a renewable source.

"When we harvest trees like oil mallees they are coppiced at ground level, leaving the roots in the ground. There they continue to act as carbon sinks and keep down the water table as the tree re-sprouts from the stump," Prof. Cocks says.

"The aim is to create a profitable new farming system based on native perennial plants to deliver multiple environmental benefits - reduced salinity, enhanced conservation, reduced greenhouse gases and renewable energy.

"At the same time they will help support rural communities, provide jobs and growth and limit the economic impact of drought."

Contact: 08 9380 2555

### **Quality red**

Researchers at the CRC for Viticulture have developed a rapid measurement system to assess the colour of grapes being delivered at harvest. Using near-infrared spectroscopy to measure the intensity of malvidin, a red grape pigment, they can now more readily predict which grapes will make the best quality wines.

"The intensity of the malvidin gives a remarkable clue as to the ultimate appeal of the wine – up to a point, the stronger the colour, the better the quality. We don't know why this is, because malvidin doesn't have much taste itself – but it obviously correlates with things that do," says CRC CEO Dr Jim Hardie.

The test is applied when the grapes are delivered, but work is afoot to design a hand-held "gun" to provide an instant read-out of potential wine quality while they grapes are still on the vine.

Contact: 08 8303 9405

### **Tender test**

The secret of tender, tasty beef lies in a world-first Australian test to help cattle producers consistently select the tenderest animals to breed from.

Developed by the CRC for Cattle and Beef Quality and Brisbane firm Genetic Solutions, the GeneSTAR tenderness test was based on one of the world's largest scientific experiments in livestock, involving over 5000 animals and costing \$32 million.

"It was only by combining the resources of the Commonwealth – through the CRC program – the universities, CSIRO, the agriculture departments and livestock breeders, that Australia has been able to snatch a world lead in this field," says CRC CEO Dr Bernie Bindon. "Our competitors in the US and elsewhere are too fragmented."

“Tenderness is far and away the most important quality attribute as far as beef consumers are concerned – we’re seeing consumption of beef in Australia on the increase for the first time in years because we’ve been able to combine taste with tenderness. As the world’s largest beef export nation it has also given us a fresh market edge.”

Contact: 02 6773 3501

### **Perfect noodles**

Research at the CRC for Value Added Wheat has yielded a test that rapidly identifies which kinds of wheat make the perfect noodle.

“The most affluent Asian consumers are very fastidious about how their *udon* noodles should feel in the mouth – and we know that this special ‘feel’ occurs when a particular gene is absent from the wheat plant,” explains CRC CEO Dr Bill Rathmell.

“We’ve come up with a totally reliable test which enables plant breeders to spot which types of wheat have this quality, and combine it with other desirable features to create a wheat that grows well here and commands premium prices in the Asian market.”

Dr Rathmell says it’s a good example of the use of molecular genetics to identify desirable natural traits in plants, without need for genetic engineering.

Contact: 02 9490 8488

### **Healthy milk**

Australian dairy researchers are working on a revolutionary series of foods designed to boost human immunity to disease.

The research is focussing on a natural compound, normally in minute amounts in milk, which has strong potential as an immune booster and an anti-inflammatory, says Dr Paul Donnelly, CEO of the CRC for Innovative Dairy Products.

“We think this substance could be the basis for a whole range of health-giving dairy products, suitable for children and mature adults, or specially-tailored products for people with low immunity,” he says. “These could be a normal part of a healthy diet, or taken as a special supplement. We’re looking at traditional dairy products incorporating this, as well as completely new ones.”

Contact: 03 9607 8607

## **Night light**

Researchers at the Aquafin CRC have discovered a new way to boost productivity in the nation's salmon farms: turn on the lights at night.

“Conditions in Australia are ideal for salmon farming – especially the high water temperature and light intensity, which causes the fish to grow far more quickly than in Scotland or Norway,” explains project leader Dr Mark Porter.

“This is because of the effect of light on the fish’s melatonin system, which influences the timing of reproduction and whether it puts its energy into gaining weight, or into maturing and breeding.

“Normally, sexual maturity is triggered by decreasing day length, which is the fish’s natural autumn signal to start breeding.

“By providing artificial light at night from midsummer on we’ve been able to delay maturity in the fish for several months. This keeps them growing, to provide consumers with fresh salmon from March to May when it is normally unavailable.”

The team has also successfully shown that light can be used to recondition salmon after the spawning period and improve table quality. They are currently running a major trial to see if it is possible to use light to prevent fish from maturing sexually altogether. Dr Porter says that so far, results look highly promising, with fish under lights growing around 25 per cent faster than ones in normal conditions.

Contact: 08 8200 2481 (CRC CEO 08 8290 2302)

## **Bollworm bane**

Researchers at the Cotton CRC have devised a super-bait of volatile compounds from native plants that Australia’s worst crop insect pest, the cotton bollworm, finds irresistible.

Using a device known as an “olfactometer”, Dr Alice Del Socorro tested more than 40 different plants to identify the compounds most attractive to female bollworm moths. These plants included crops, weeds, native trees and ornamentals.

“Even though the caterpillars mostly attack crops, it was interesting to find out that certain eucalypts were highly attractive to the adult female moths,” she says.

Dr Del Socorro explains that the “super-blend” of attractant volatiles consisted of compounds that were identified as common in the most attractive plants, rather than mimics of compounds found in a single attractive plant. The synthetic versions of these attractive compounds were combined in a canola

oil-based formulation with emulsifiers, thickeners, anti-oxidants, feeding stimulants and a small amount of insecticide, to create a deadly attract-and-kill spray for crops.

By treating less than a tenth of the field a few times a season, the technique will help to dramatically reduce the amount of pesticide sprays needed by farmers to protect their crops. It will also limit the scope for pesticide resistance to build up in the pest population.

In a recent trial, the number of caterpillars that would normally have munched their way through the crop in one paddock was cut by around 13 million after the first spray.

Most important of all, the plant-based attractants are attractive to both female and male moths. Sex pheromone attractants which mimic the female's scent are commercially available for males – but this technique does not work for the females that cause all the damage, laying up to 1500 eggs each.

The plant-based attractants offer a new way to safely control *H. armigera* pests which would otherwise inflict tens of millions of dollars worth of damage to Australian crops each year and require extensive use of chemical sprays.

Contact: 02 6799 1500

### **Greener sugar**

Sugarcane production will be more environmentally sustainable and, potentially, more profitable as a result of research into one cause of fish kills in Australia's northern rivers.

Measurements by the CRC for Sustainable Sugar Production (CRC SSP) of water draining off cane fields into rivers found there is significant oxygen depletion, caused by microbial action on sugar spilt during the harvest.

"Fish kills occur in catchments where there is cane growing and catchments where there isn't, so there are clearly several different causes," explains program leader George Rayment.

"Our work shows that, in certain conditions, water from sugar farms can contribute to this – and there are a number of things that can be done to prevent it, including holding back the first irrigation after harvest so the drainage doesn't run straight into the waterway."

Down the track, he says, there is scope to develop new harvesting methods that minimize the loss of sugar juice in the paddock – reducing environmental impact and increasing returns to the cane grower and sugar mill.

The CRC SSP has produced an information kit and provided technical training to help farmers understand and manage runoff from their land to avoid oxygen depletion and its effects on river life.

Contact: 07 4781 5763 (Note: The CRC *per se* has closed; contact is for the previous CEO Professor Robert Lawn)

### **Dry logic**

Lessons from the 2003 drought will help Australia's cotton growers make better use of limited water in future years.

The Australian Cotton CRC and CSIRO have developed HydroLOGIC, an irrigation management decision support system to make cotton crop water management decisions easier, especially in dry seasons.

"HydroLOGIC is an interactive software system that not only advises growers when a field should be irrigated, but also lets them explore the consequences – in terms of water use and yield – of irrigating more or less frequently, under differing in-season weather scenarios," explains Dirk Richards.

"By adding information as the season progresses, on soil moisture deficit (collected from any existing soil monitoring equipment), fruit load, and leaf area, and combining this with historical weather data, HydroLOGIC can be used to fine-tune water use and forecast final yield potential.

"Importantly, it is designed to complement not to replace continuous soil moisture monitoring systems."

"At least two or three months before harvest, HydroLOGIC can predict the number of total irrigations, timing of the next irrigation, total water use, water use efficiency and estimated yield," Mr Richards says.

Trials of HydroLOGIC were carried out at Narrabri and Gunnedah in 2002-03, providing valuable feedback on the software and comparisons with standard commercial management. The software package has now been released on the market.

Contact: 02 6799 1500

### **Smarter gums**

Advanced breeding techniques are helping Australia's plantation forestry industry catch up with competitor countries which have stolen a march on us in eucalyptus development.

"South Africa and Brazil now have around six generations of eucalypts specially bred for timber quality, growth rate and performance – whereas Australia is only on its second generation of improved stock," explains

Professor Rod Griffin, director of the CRC for Sustainable Production Forestry (CRCSPF).

"We have access to the world's best eucalyptus genes, and there's every reason why we should be the world leader. But they've been at it for over 25 years and are currently the star performers at breeding our native trees."

It takes ten years to produce one eucalypt generation by conventional means, but using advanced breeding, molecular markers and wood quality prediction in young trees, the CRC and its partners are rapidly speeding up the process.

A study by the Centre for International Economics says the payoff to Australia is potentially huge – an investment of just \$2.8m in research is likely to yield \$193.7 million in benefits, a return of nearly 70-fold achieved largely through improvement to the genetic potential of eucalypts for hardwood plantations.

"The profitability of plantations is heavily determined by annual tree growth rate. With the rapid expansion in the plantation estate it is critical for future industry profitability that the genetic capability of new tree plantings be continually enhanced," the study says.

Combined with research into the pests and ecology of Australian eucalypts this research will contribute to the sustainability of both the native landscape and the forest industries, Prof. Griffin says.

Contact: 03 6226 7947

# Environment

## Flush success

Victoria's famous Flemington racecourse is the test site for a revolutionary water purification technology developed by the CRC for Waste Management and Pollution Control (CRC WMPC).

The Multiple Water Reuse (MWR) technology taps into the urban waste system to extract high quality water which can then be safely re-used on parks, ovals, farms and for domestic uses like toilets, gardens and washing machines.

MWR uses microfiltration and reverse osmosis to remove impurities from raw sewage and produce "grade A" clean water. No chemicals or biological processes are used to treat the water.

The trial plant draws water from one of Melbourne's main sewers and yields up to 100,000 litres of clean water a day for Flemington, at a cost similar to water supplied by Melbourne Water.

CRC Executive Director Dr David Garman says that most water used by Australian cities is flushed out to sea after being used only once – a colossal waste in a nation that is starting to face critical water shortages.

"Many major cities re-use their water and Singapore has plans to re-use it several times. The MWR approach means we can extract clean water from the waste system right where it is needed – instead of pumping water back uphill from the sewage treatment works."

Dr Garman says that with the addition of a minor further treatment it is possible to produce drinking-quality water from wastewater, though this is not proposed in this particular experiment.

Contact: 02 9385 4886

Note: CRC for Waste Management & Pollution Control has finished and a new CRC based on it has started viz CRC for Environmental Biotechnology; Dr Garman is CEO of the new CRC

## Fertile solutions

Farmers could save tens of millions of dollars while slashing greenhouse emissions in a new win-win approach to fertiliser use.

A consortium of CRCs is exploring scope to change the management of nitrogen fertilisers to limit leakage into the atmosphere, soil and water.

"We estimate that the application of improved management techniques could reduce greenhouse emissions in the grains, dairying and cotton industries by

the equivalent of 1.2 million tonnes of CO<sub>2</sub> a year,” says CRC for Greenhouse Accounting chief executive Dr Chris Mitchell.

“These three industries account for 40 per cent of Australia’s agriculture and deliver \$12 billion in export earnings a year.

“The new fertiliser management technologies – which we will develop over the next three years – could save farmers around 120,000 tonnes of nitrogen and cut production costs by \$116 million. At the same time it could earn up to \$30m in greenhouse credits.”

Contact: 02 6125 4020

### **Space scrutiny**

Vast stretches of Australia's rivers, estuaries and coastline are under scrutiny from space in a major leap forward for surveillance of water quality.

Australian researchers in three CRCs – Coastal Zone, Rainforest and Tropical Savannas – have teamed up with NASA scientists in a project to keep an eye on troubled waters and forests.

Information from satellites and airborne sensors is being used to monitor the condition of Queensland’s coastal waters and tropical forests for adverse signs, like outbreaks of blue-green algae, loss of riparian vegetation or areas of vegetation clearing. A number of the sensors being used in this project have been launched within the last two years and this project is providing information on how effectively they are working

“Traditional boat or ground-based techniques for monitoring coastal environments can only cover small areas in detail or large areas very sparsely,” says Dr Stuart Phinn of the Coastal and Rainforest CRCs. “By combining them with data from satellites and aircraft we can significantly improve our ability to watch what’s going on in our waters, rivers and forests over much larger areas.”

The technique uses both colour imagery from satellites and advanced radar that can see through cloud and vegetation. It can observe things like the amount of sediments carried in water bodies, algal blooms, seagrass beds, mangroves, forest clearings and individual trees adjacent to streams and track their change over time.

The data is being used by natural resource management agencies to monitor the condition of the waters of Moreton Bay and forests in the wet tropics, and will shortly be applied to Port Curtis and the Fitzroy regions.

The technique gives Australia’s water managers a powerful new way to observe the health of coastal water systems, allowing them to spot trouble and plan corrective action.

Contact: 07 3365 6526 (Coastal CRC CEO 07 3362 9398)

### **Water threat**

Weeds are emerging as a significant threat to the quality of Australia's drinking water, according CRC for Australian Weed Management CEO Dr Rachel McFadyen.

"Invading water weeds like lippia, alligator weed and willows are starting to have a serious impact on our drinking water, and on the cost of keeping it clean and healthy," Dr McFadyen says.

"By choking oxygen out of the water, by adding different nutrients, by changing the natural flow patterns, weeds can cause our fresh water to smell and taste bad.

"There can also be an increase in disease causing organisms in stagnant water, which then require extra treatment."

The Weeds CRC is encouraging helping communities to get to know more about weeds in their local waterways, to be on the lookout for invaders and to form groups to deal with them.

Among its advice: don't wash your car or boat down near a waterway. Don't tip aquarium plants down the drain, and don't dump garden waste near a waterway.

Contact: 08 8303 6590

### **River Recovery Plan**

The CRC for Freshwater Ecology is developing a River Recovery Plan to help protect Australia's inland rivers, creeks and wetlands following the drought.

"In a healthy Australian river, drought is part of the natural cycle. Drying out is important to our wetlands and rivers. However, when they are stressed due to over-removal of water and have lost their natural resilience it may be much harder for them to recover," says CRC CEO Prof. Gary Jones.

To avoid inflicting further – possibly permanent – harm on the nation's waterways, the CRC has three urgent pieces of advice:

- Protect water holes and billabongs, which are the refuges river life retreats to in dry times. Minimise water pumping from them
- Don't catch the big fish or kill wildlife which retreat to deep waterholes. They are the breeders which will be needed to replenish the stock after the drought breaks.
- Restrict livestock access to waterholes and wetlands, to avoid pollution and damaging plants and habitat.

Prof. Jones says the drought brings with it a major risk of toxic blue-green algal blooms like the 1000km event on the Darling River, and fish kills as water levels fall and oxygen becomes depleted.

“When the drought breaks, and there are big flows or floods, there may also be a pulse of dirty, poor quality water – and drinking water managers need to be on alert to manage this,” he adds.

Contact: 02 6201 5168

### **Learning fear**

For Australia’s small marsupials, the gravest danger is ignorance. Lack of fear has led many a wallaby, numbat, potoroo or bettong into the jaws of an introduced predator like a fox, dog or cat.

Attempts by wildlife scientists to reintroduce native species are being stymied by the fact that captive-reared animals don’t know what to be afraid of, says Professor John Rodger, CEO of the Marsupial CRC.

However CRC research student Andrea Griffin is having success in teaching captive tammar wallabies to adopt anti-predator behaviour, so they stand a fighting chance when released into the wild.

Using classical psychology, Ms Griffin exposed the tammars to a number of frightening experiences using model foxes and then cats, so they could learn the correct response.

The technique was then tested with goats, and the tammars correctly showed they did not fear the goats but only the carnivores. Better still, the tammars were then able to “train” other tammars to adopt the same response to predators.

“This research shows that marsupials have a sophisticated anti-predator system which can be developed. It holds exciting potential to apply simple behavioural techniques to pre-release training of small marsupials, prof. Rodger says.

Contact: 02 4921 7784 (for previous CRC CEO; Marsupial CRC has finished)

### **Treetop test-bed**

Forest canopies are poised to become the world’s most sensitive indicators of global change and environmental health.

The forest canopy is the place where 90 per cent of the earth’s biomass comes into contact with the atmosphere, says Professor Nigel Stork, CEO of the Rainforest Co-operative Research Centre.

Professor Stork is a member of an international team of scientists who published a paper in the journal *Science* arguing that the forest canopy is a prime location for predicting future risks associated with global change.

“Trees respond as individual species to higher levels of CO<sub>2</sub> and this will cause forest composition to alter.

“Changing climate affects the relationship between trees and their pollinators – insects, birds and animals,” he says.

“Trees produce important processes and chemical substances that cause clouds to form and affect the composition of the atmosphere.

“All this tell us that the world’s forest canopies will be one of the first places we will observe the impacts of global change, and be able to measure them.”

Despite 20 years of research effort round the world, the forest canopy – the leafy zone – remains one of the least known and understood biological systems. As a result it is hard to predict the impact of global change on the world’s great forests – tropical, temperate and boreal – and the knock-on effect this has on the global environment, Prof Stork says.

The team argues there is an urgent need for more integrated study of the combined forest system, from soil to canopy to atmosphere, and this has to take place worldwide.

At the forefront of this study will be giant equipment like Australia’s 50m Rainforest Canopy Crane, which enables researchers to investigate the canopy of soaring trees close-up. A network of similar cranes has been set up round the world as scientists seek to discern the real impacts and risks of man-made global change.

Contact: 07 4042 1246

## **Stink preventer**

Sewage spills occur in most suburbs every year, especially in older cities, polluting local waterways, creating bad smells, health hazards and eco-risks.

Now a team from Australia’s Coastal CRC led by Dr Peter Pollard has come up with a way to prevent the mess of toilet paper, condoms and domestic waste fouling the local creek.

“All sewage systems have emergency release valves that open when there is a lot of rain, or the pump blocks or power fails – and these pour raw sewage into the local waterway,” he explains.

“Every suburb in the country has these valves – and some can open two or three times a year. Knowing exactly when, where and how much sewage spills is critical to the management of overflow events.

Working with Brisbane City Council, Dr Pollard’s team has devised a remote monitoring system that keeps continual watch on the valves, as well as other things – rainfall, creek levels, sewage flows etc – and sends an immediate alert when a valve opens.

The team also samples the sewage and the creek to determine the nature and level of contamination with disease-causing organisms and toxic substances in domestic waste such as endocrine disruptors that affect the reproductive systems of humans and wildlife.

“We found we had to know exactly when and where overflows were occurring, how much raw sewage was escaping and what its likely impact would be.”

The result is a system of sensors, samplers, data loggers and telemetry developed for research, but which could potentially give water managers instant information and fingertip control over the urban waste system.

“Sewage spills are a universal problem, affecting virtually all of the world’s cities, especially the older ones – so the potential market for solutions is huge,” he says.

The Coastal CRC technology has recently won acclaim in the form of the Healthy Waterways Award from the Moreton bay Waterways and Catchments Partnership.

Contact: 07 3362 9373 (CRC CEO 07 3362 9398)

### **Saline solution**

A new way to tackle salinity - inter cropping or companion cropping - is being tested by the CRC for Plant-based Management of Dryland Salinity (CRC Salinity).

The idea is to grow a deep-rooted perennial crop - typically lucerne - along with an annual crop, in order to mop up surplus rainfall and stop it adding to saline groundwater.

One option being explored by the CRC researchers, particularly for higher rainfall regions, involves direct drilling annual crops into existing lucerne (or other perennial pasture) stands. This takes advantage of the perennial’s ability to use out-of-season water, but without the costs and technical risks associated with removal and re-establishment of the perennial species.

“This is still pioneering research for Australian conditions,” says project leader Roy Latta. “But already there are signs that inter-cropping could provide

farmers with a tool for controlling leakage during the cropping phase, while at the same time offering the flexibility to move in or out of cropping or pasture.

“The key challenge is how to manage simultaneously two competing demands – the moisture needs of the crop to ensure maximum yield and that of the perennial species, to ensure its survival.”

Research so far has revealed:

- Competition for water is significant, with wheat reaching up to 65 per cent of potential monoculture yield in wetter areas.
- Annual lucerne production in inter-cropping varies between 65 and 80 per cent across sites
- Together, the wheat and lucerne can result in an overall productivity gain.
- There appears to be value in suppression of lucerne to reduce its use of soil water before planting wheat.
- Higher rates of nitrogen application in wetter regions increase the wheat yield.
- It is important to capitalise on the ‘break of season’, as delays in sowing result in considerable wheat yield penalties.

More information: 08 8538 7070 (CRC CEO 08 9380 2555)

## **Toxic hazards**

The ending of a drought can bring a toxic shock to for many of Australia’s fragile coastal ecosystems, warns Dr Roger Shaw, CEO of the Coastal CRC. Note: Dr Rob Fearon is new CEO

Major rivers close to cities can accumulate high levels of effluent, organic wastes, viruses, bacteria, drugs, chemical pollutants and hormones during dry times.

“When the drought breaks these rivers flush themselves into the sea, and a large slug of accumulated contaminants goes with them, which are diluted to varying degrees,” he says.

Nutrients and sediment can smother seagrasses, killing the meadows which serve as nurseries for fish and other marine life. Human and animal pathogens also build up in the rivers, as do hormones from contraceptives – known as endocrine disruptors – and drugs from human waste.

The impact of many of these on marine life is still unknown, Dr Shaw cautions. The answer lies in a far more stringent approach to the way we manage our estuaries – and what we allow to go into them

Contact: 07 3362 9398

## **Outback greening**

Amid the wide outback landscapes of the Northern Territory savannas new management techniques are emerging which combine conservation of native wildlife with cattle production in pastoral country .

Project leader with the Tropical Savannas CRC Alaric Fisher considers that if we can devise ways to manage this landscape for biodiversity as well as cattle, there are potential benefits for vast areas.

Much of the continent is used for cattle grazing. This area also contains a rich biodiversity - numerous species of animals and plants that are native to the tropical rangelands of the north. Alaric's research focused on the endless grasslands of the Barkly Tablelands in the Northern Territory. Through the CRC, this work has now extended to many regions of northern Australia, including the Kimberley and north Queensland.

Understanding the ecology of these landscapes is important, Alaric says. But a key to success of the project has also been getting out and working with pastoralists to see how they can modify the way they graze stock to better protect the native animals and plants on cattle stations.

“For example, this may involve leaving some parts of a paddock remote from any waterpoints, around which cattle grazing concentrates. The ungrazed country remote from water can be a haven for native species that are sensitive to heavy grazing. This is just one voluntary way pastoralists are able to manage for biodiversity. In these scases we can also analyse the balance between economic cost and biodiversity benefits to help us find the most efficient approach. ”

The approach promises not only to benefit the native plants and animals of the north, it is also building bridges between two groups that have sometimes had an acrimonious relationship in the past - pastoralists and conservationists.

Contact: 08 8946 6285 (CRC CEO 08 8946 6834)

## **Polar power**

Antarctica could become the delivery suite for the clean, green energy revolution following research by David Pointing into renewable energy systems for the frozen continent.

In keeping with Antarctica's pristine character David believes the people who live and work there should be among the first to move away from using the most expensive fossil fuels on Earth, towards clean, renewable and economic energy.

Working in the Antarctic CRC, David is exploring ways to turn the continent's natural energy resources - including its furious gales - into energy for habitation, for research and for land transport.

"Among the most promising routes is to convert wind energy into electricity and use that for domestic uses, but also to melt ice into water and extract hydrogen from the water for fuel," he explains

"Antarctica has the costliest energy on Earth – every drum of imported fuel costs a small fortune and poses an environmental risk. So it could be the first place where renewable hydrogen power is economic and this could pave the way for its wider adoption in the energy systems of Australia and other continents."

One aspect of David's work is to identify the opportunities that the two large 300 kilowatt wind turbines now installed at Australia's Mawson Station may provide for hydrogen energy production. The renewable hydrogen fuel could replace or supplement conventional energy supply systems that use fossil fuels. The 300 kilowatt turbines will produce a sufficient power surplus – especially in winter – for the generation of hydrogen for a variety of applications.

"We're also currently investigating the conversion of a quad bike to run on hydrogen, so the original wind energy may even end up as a transport fuel or to power scientific experiments far from base."

One advantage of the system is that both water and hydrogen can be stored for relatively long periods of time, meaning that surplus power can be generated during the period of fierce winter gales, and used to run the Station when the wind resources drop, such as during summer.

This may entail using a fuel cell or a common combustion engine to convert the hydrogen gas back into electricity to light and warm accommodation. While Antarctica is the test-bed, Mr Pointing is convinced that if the technology pathways prove viable there, they can be enhanced and adapted for use in Australia and round the world.

"However aiming for a hydrogen economy is the second step we must take. The first is to curb our energy hungriness," he cautions.

Contact: 03 6226 2265 (CRC CEO 03 6226 7888)

## **Alien watchers**

Kerry Neil is in the frontline of the battle against the invading marine pests which threaten Australia's coral reefs, marine ecosystems and fisheries.

Kerry leads CRC Reef's Introduced Marine Pest Species (IMPS) program, whose task is to help protect the tropical waters of Queensland, the Great

Barrier Reef and the north against the alien creatures which occasionally slip in on shipping.

Kerry's research – the first study of its kind – has thrown new light on the impact that chronic, small scale, disturbances and catastrophic, irregular disturbances have on tropical marine ecosystems.

Her team is running a baseline survey of ports, marinas, shipping channels and high-traffic areas to see what's there – and what should not be. The work has achieved international scientific recognition.

"We've gone far and wide," she explains. "Our survey work ranged from Ashmore Reef off WA, to Gove in the NT, through the Gulf of Carpentaria to Cairns, Townsville and the main ports of Queensland.

In Cairns, the survey pinpointed two new invaders - a pest called the Asian green mussel which grows to a whopping 16cm, and a Caribbean tube worm.

With ships now banned from discharging ballast water in Australian coastal waters, Kerry believes the war on marine invaders must focus on hull fouling of all vessels, including recreational vessels, fishing boats and illegal vessels – many of which carry growths of alien marine organisms on their hulls.

"Introduction of marine pests is a global problem, and in places it can cause devastation to an environment or industry. By being vigilant and knowing what to look for we aim to keep Australia's tropical waters as pristine as possible, to prevent or at least limit the impact of any invaders that sneak in," she says.

Contact: 07 4729 8400

## **Pollution solution**

Iron nano-particles may hold the answer to the clean-up of thousands of sites contaminated by solvents and pesticides, thanks to a breakthrough by Australian researchers.

Scientists at the Cooperative Research Centre for Waste Management and Pollution Control (CRCWMPC) in Sydney have discovered a new way to produce iron nano-particles that makes the clean-up technology affordable.

The new method has been patented and the CRC is soon likely to seek a commercial partner to produce the particles on an industrial scale.

Project manager Dr Andrew Feitz says the particles are 10 times cheaper to produce than other methods of producing iron nano-particles, and work faster than conventional shredded iron which has also been used in remediation.

The new process is simpler and cheaper as it is carried out at room temperature and produces no hydrogen gas. The particles are actually tiny plates measuring about 50 by 100 nanometers and are less than one nanometer thick. (1 nanometer = a billionth of a metre)

Chlorine-based chemicals are common in solvents, such as paint stripper, dry cleaning fluid, and pesticides and have contaminated thousands of sites where these chemicals are used or manufactured, both in Australia and worldwide.

Iron particles have been trialled for the treatment of contaminated groundwater in both the US and Australia. At Port Botany in Sydney a large iron particle barrier has been installed to destroy trichloroethylene and hexachlorobenzene.

"The iron particles chemically modify polluting compounds by removing chlorine atoms and replacing them with hydrogen atoms. This makes the target compounds less toxic and easier for natural microbes to break down," Dr Feitz says.

Provided that the low manufacturing costs of the process developed by the CRC are confirmed, these tiny specks of iron could be used to clean up contaminated sites nationwide and overseas.

Contact: 02 9385 5008

Note: This CRC has finished and a new CRC for Environmental Biotechnology has started; CRC CEO for former and current CRC is Dr David Garman 02 9385 4886

## **Crypto cleanser**

Residents of Australia's major cities and towns are likely to experience fewer costly public health scares in future thanks to a breakthrough in the war against the waterborne parasite *Cryptosporidium*.

Secrets of the elusive *Crypto* which open the way for its ultimate defeat have been unlocked by Dr Rob Considine, working with the CRC for Water Quality and Treatment (CRC WQT).

The problem is that the tiny *Crypto* spores can slip through the sand filters commonly use to cleanse drinking water - so Dr Considine decided to investigate the beast in the most microscopic detail to see if he could find its Achilles' heel.

In world-first work using an atomic force microscope capable of imaging individual molecules and even atoms, he discovered a natural repulsion between the *Crypto* spore and sand grains, which makes it very hard to remove the parasite with a normal sand filter.

“This was partly due to the fact that both the spore and sand grain were negatively charged, but also because the surface of the *Crypto* was covered with molecular hairs that act like springs and cause it to bounce off the sand grains and not stick to them.”

Dr Considine’s solution is to fine-tune the flocculation process which takes place just before filtration – whereby unwanted contaminants in water are chemically clumped together so they can be removed by the filter.

He found that by altering the chemistry of the flocculation process just slightly, he could collapse the protective ‘hairs’ on the *Crypto* spores and enable them to be swept up in the flocs which are then removed by the sand filter.

However Dr Considine says that to be sure of clean water, it is also important to continue to reduce the chance of *Crypto* entering the supply in the first place – if possible by excluding cattle from the catchment or, if there are cattle or dairies, to prevent their effluent from reaching the water supply.

Contact: 08 8259 0351

### **Traditional answer**

Fire has become a vital tool in restoring the Northern Australian landscape, building new hope for Indigenous youth and curbing the greenhouse effect.

In a trail-blazing experiment, young Aboriginal people, under the guidance of senior elders, are helping to bring under control the savage wildfires that regularly devastate up to two thirds of the west Arnhem plateau.

The approach is a unique combination of an ancient technology – aboriginal fire management – and space-age technology in the form of state-of-the-art satellite imaging and global positioning systems (GPS).

“Huge areas in western and central Arnhem Land are now largely depopulated, and massive wildfires pose a real threat to sensitive vegetation like rainforest, heathlands and other elements of the biodiversity,” explains Professor Gordon Duff, CEO of the CRC for Tropical Savannas Management.

“Our research shows that by strategic burning around the edges of the plateau you can cut the burnt area from over 60 per cent to less than 25 per cent.”

As well as senior land owners the project involves the Northern Land Council, the Bushfires Council of the NT and the CSIRO. Using young volunteers from local communities and careful planning with satellite imagery and GPS, the team is developing a pattern of low intensity burns that tames the wildfires and gives the landscape the mottled mosaic of vegetation that favours the survival of Australian native plants and animals.

“These are kids who might otherwise get themselves in trouble – but now they are learning all about their land and how to manage it. They’re living in it, understanding it, caring for it and being paid for it – instead of just living in their communities,” Prof. Duff says.

In another major benefit, the reintroduction of fire management also encourages vegetation that locks up more greenhouse gas. Professor Duff says there is a real possibility major overseas companies may invest in the program to earn carbon credits – and at the same time benefit Australia’s landscape and Indigenous people.

Contact: 08 8946 6834

### **Rainforest guardians**

Responsibility for managing tropical rainforests, one of Australia’s most precious environments, is increasingly being shared by indigenous communities.

A partnership between scientists, environmental management authorities and Aboriginal communities has been formed to look after rainforests from a combined ecological, cultural and economic perspective.

Under the ‘Bama’ Plan, indigenous communities can now put forward their own proposals for taking care of their landscape and receive funding to do so, says Dr Sandra Pannell of the Rainforest CRC.

“It’s fair to say the Wet Tropics are leading the way in engaging indigenous Australians in active natural resource management and planning. And they are adding a great deal.

“We are starting to see the Australian landscape in different ways – not just as an ecological landscape, but also as a cultural landscape and a source of income or sustenance.

“This contrasts with the longstanding view that national parks and reserves should be locked up and left alone.”

In one case, indigenous communities are helping with the Queensland National Parks’ cassowary recovery program. As a totemic symbol for some, they have a strong obligation to protect not only the bird itself, but also its cultural significance. The cassowary, in turn, helps spread tree seeds around the rainforest and renew it.

In another program the Jumbun community has proposed integrating an indigenous approach to managing landscape with the western scientific approach currently used in the Murray Falls State Forest, she says.

“It’s changing the meaning of ‘parks’ to embrace cultural and even economic values, as well as ecological ones.

“It’s also combining two forms of knowledge – modern science and a traditional understanding of landscape and its meaning.

“We know there will be a challenge in having this new approach publicly accepted because it’s very different to what we’re used to. But in the end, we feel it will be taken up all over Australia,” Dr Pannell says.

Contact: 07 4042 1253 (CRC CEO 07 4042 1246)

### **Bellyache battle**

New biological weapons are under development by researchers in the Australian Weed Management CRC against the four “Bs” – bellyache bush, blackberry, bitou bush and bridal creeper – four of our worst weeds.

Blackberry infests 9 million hectares nationwide and costs over \$40m a year. Scientists were recently astonished by DNA fingerprint results showing there may be as many as 14 different kinds of blackberry in Australia. This may explain why control with a single rust fungus has been patchy – and further biocontrol agents may be needed .

A new biocontrol agent, a jewel beetle, has just been released against bellyache bush, a major problem weed in pastoral areas of Queensland and the Northern Territory.

Bridal creeper infests southern Australia from WA to northern NSW, and with the cost of control by conventional methods estimated at over \$30,000/ha a year, a new type of biocontrol was the only real option. Researchers have high hopes for a combined assault on the creeper using a rust fungus and a leaf hopper insect.

Progress is being made in biocontrol of bitou bush, which infests coastal dune areas from NSW to South Australia. A recent study estimates effective control could deliver a national benefit of \$45m a year for a cost of just \$2.2m.

“Weeds cost the economy \$4 billion every year, not to mention the damage they do the environment,” says Peter Martin of the Australian Weed Management CRC. “Biocontrol is, in many cases, the only cost-effective answer.”

Contacts: 08 8303 6590

## **Saving snakes**

Once shunned by visitors to the Great Barrier Reef, sea snakes have become a major attraction for divers – and are now an important focus for conservation.

Researchers at the Reef CRC are investigating the breeding habits of sea snakes, with a view to understanding how much pressure different sea snake populations may be facing, so as to better manage their conservation.

Sea snakes evolved from land snakes, and there are 14 species in the waters off Australia. Key to their survival is the extent to which different populations are able to interbreed – or may be geographically isolated from one another, says researcher Ms Vimoksalehi Lukoschek.

Mr Lukoschek is using molecular genetic methods to identify different populations of two species – the olive sea snake *Aipysurus laevis* and the spine-bellied sea snake *Lapemis harwickii*.

“So far, we’ve established that the olive sea snakes of the Great Barrier Reef are genetically distinct from those of northern and western Australia – which means they must be more carefully managed, as they don’t interbreed as a single large population.”

With fine-tuning, Ms Lukoschek hopes to further pinpoint the geographic centres of different sea snake populations, and the extent to which they travel to breed with other groups in the same species. This will assist in the protection as a species listed under the Environment Protection and Biodiversity Conservation Act, and will provide vital information for recovery plans should any particular group ever become threatened.

Contact: 07 4729 8404 (CRC CEO 07 4729 8400)

## **Carpless water**

Carp are blamed for contributing to the decline in native fish and water plant populations, degradation of freshwater ecosystems and water quality.

The CRC for Biological Control of Pest Animals is working on a “daughterless carp” – fish whose genes have been modified so they have only male offspring, leading to gradual population decline as fewer and fewer females are bred.

The modification consists of a promoter that activates a gene in female fish, which inhibits production of a key enzyme required for fish to produce female offspring. As a result, all offspring default to males.

The concept, developed by Dr Ron Thresher of CSIRO, has been tested with encouraging results in zebra fish and is poised to begin full-scale laboratory trials in gambusia (mosquito fish).

CRC director Dr Tony Peacock says there will be strict adherence to all legal and regulatory requirements and very extensive public discussion and debate before any testing of daughterless carp in the wild is contemplated.

“The beauty of this technology is that it is exclusive to carp and will have no effect on any native fish. In effect, it will enable the carp population to breed itself into decline.”

Although the technique involves modifying the carp by including the promoter, there is doubt as to whether it actually constitutes genetic engineering, as it simply triggers a normal gene already present in carp.

Dr Peacock says that overseas countries are already watching the work with great interest and two may join the project in the hope of controlling their own pest fish populations.

Contact: 02 6242 1768

## **Reef care**

Better ways to care for Australia's coral reefs under global warming are being hammered out by researchers in the Reef CRC.

In 2002 a major coral bleaching episode occurred on 60 per cent of 600 reefs surveyed, with varying degrees of severity.

Findings from research will be used to identify more and less vulnerable reefs as the seas warm in coming decades, and provide advice to help reef managers manage coral in ways that minimise the added stress of global warming.

Risks to the reef from bleaching, runoff, pollution and other sources are being monitored in a major program in the CRC and AIMS at 200 sites along the Reef. This includes permanent transects at 48 reefs where regular video surveys of coral, and fish counts are carried out.

Contact: 07 4729 8400

## **Forest and sea**

Protecting Australia's coral reefs begins on land, at the top of the catchments, says Professor Richard Pearson of the Rainforest-Reef CRC joint research program.

The program is developing tools to understand how the land, rivers and sea are linked, to help resolve debates about human impacts on river water quality and the coastal reef. They will also tell land and water managers whether their strategies to improve the environment are working or not.

“We’re looking at indicators of water quality such as nutrient levels, signs of stress in river fish or sea corals, how much sediment is moving and so on,” Prof. Pearson explains. “These not only tell us what’s going on, but they’ll help us target landcare activities to the areas which most need it.”

Contact: 07 4042 1246 (Rainforest CRC)

### **Safer sealions**

Protecting sea lions from tourists and tourists from sea lions is the aim of research by Dr David Newsome and Dr Jean-Paul Orsini of the CRC for Sustainable Tourism.

“Male sea lions haul out on a number of small offshore islands near Perth, and are a big attraction to visitors. But they may also be a threat – the bulls can weigh upward of 300 kilos, have impressive teeth and can outrun a human on a beach. At the same time we want to be sure that tourists aren’t unduly disturbing the sea lions.

“Off Carnac Island in summer there may be up to 150 boats anchored and many people competing for space on the beach with the sea lions. Humans and animals are both interested in using these small islands and we want to understand what effect human competition has on the animals and whether it is causing them stress,” they say.

Dr Newsome and Dr Orsini are studying the behaviour of both species – humans and sea lions – to understand the impact tourism has on the animals, and what level of visiting and contact is advisable for the good of both.

Contact: 07 5552 8172 (CRC CEO 07 5552 8114)

### **Friendlier fish farms**

DNA extracted from organisms in the seabed near fish farms is providing an instant readout on the health of the marine environment, in research by the Aquafin CRC.

Derived from a technique devised to monitor risks from plant diseases in farm lands, the team are developing special DNA probes to quantitatively measure the abundance of key marine organisms in the sediment near fish cages. Measures of relative abundance allow researchers to assess whether the fish farm is adversely affecting its environment or not.

“Round the world, many aquaculture industries have got into trouble due to self-pollution, resulting in substantial production losses and higher incidence of diseases in fish stocks. We’re creating a powerful tool to help make sure that doesn’t happen in Australia, where aquaculture is already worth \$600m a year – and a healthy marine environment is precious to all of us,” Prof. Anthony Cheshire says.

“This tool not only has commercial potential, it will also be used by Government authorities for compliance based environmental monitoring of the industry and facilitate regulation of existing and new industries.” The technology was developed for tuna farms and is being tested for salmon farms.

Contact: 08 8290 2302

## **Global green**

Tourism destinations round the world are now being certified for sustainability through Australia’s unique Green Globe 21 program.

Hotels, resorts, tours and even cities from China to the Caribbean, Egypt to Port Douglas, and Bali to New Zealand are lining up to benchmark themselves for sustainability, using the Green Globe system developed in Australia by the CRC for Sustainable Tourism.

Green Globe allows tourism enterprises – resorts, hotels, tours, cruises, airlines, airports, adventures etc – to measure their sustainability in terms of water use, energy use, greenhouse emissions, local employment, waste disposal, chemical use, landscape care, waterway quality, customer satisfaction etc.

Enterprises can then compare themselves with others in similar locations worldwide, and receive annually-audited certification if they are in the top 40 per cent, says CRC chief executive Professor Terry de Lacy.

“The original idea came from the World Travel & Tourism Association, but we’ve developed the standards and system and we’ve commercialized it through our spinoff company Global Green Asia-Pacific Pty Ltd – so now anyone can use it.”

Prominent among the early users of the technology is New Zealand, where sustainability is a core value for tourism, he says.

“The Kiwis are right into sustainability – more so than Australians, perhaps. But we’re getting strong interest locally as well.”

Prominent customers certified by Green Globe include Bali’s Intercontinental Resort, the Douglas Shire Council, Jiuzhaigou scenic area in China, resorts on Egypt’s Red Sea coast and in Tasmania and Kaikoura in NZ’s South Island.

In a major new development Green Globe now offers sustainability benchmarking and certification for total destinations – not just enterprises.

“Recognising that people travel for a destination more than a particular resort, we can now rate the total community for sustainability, using similar criteria – and help it assess itself against comparable destinations worldwide,” he says.

Contact: 07 5552 8114

## **Canopy craning**

Visitors to Australia’s tropical rainforest can now get to the heart of it through one of the nation’s largest scientific instruments – the 50-metre Australian Rainforest Canopy Crane.

Situated in the World Heritage area at Cape Tribulation, Qld, the crane towers over the rainforest canopy, allowing visitors in the gondola a close-up view of the trees and the rich bird, animal and insect life they support.

Developed for international scientific research into rainforest canopy dynamics, the canopy crane is opening up a new world for visitors as strange and unfamiliar as a ride into the deep oceans, says Rainforest CRC CEO Professor Nigel Stork.

While the crane is mainly for science, a handful of visitors can take the ride into the forest canopy each day, guided by a researcher who is also a world authority on what they are seeing.

The crane is a fusion of science and tourism that is unique in the world, and allows visitors to experience the rainforest in quite a different way to walking through or riding above it.

“When I took my first ride into the canopy, I was literally gob-smacked at how rare and different it was,” Professor Stork recounts. “The birds are so unused to people they don’t fly away, and the insect life is simply stunning.”

In his own research, which uses the crane, Prof Stork has collected an estimated 15,000 insect specimens from the canopy in the past three years representing over a thousand species.

“Many of these are likely to be completely new to science, so visitors to the crane can actually partake in the excitement and wonder of scientific discovery, in a world we still know relatively little about.”

Contact: 07 4042 1246

## **Gentle tourism**

Tourism can play a central role in protecting the environment, research by the CRC Reef has found.

Its study of the impacts of tourism on the Great Barrier Reef indicates that - contrary to the public impression that tourism damages the environment - in many cases it is helping safeguard it.

Half of Australians responding to a 1997 survey said they thought tourism development had a very large and negative impact on the Great Barrier Reef. But CRC Reef research doesn't support such a view, especially where the tourism industry is using scientific advice to care for its natural assets.

“While the GBR has about 1.6 million visitors a year, and about 335,000 dives, we need to bear in mind that, compared with other reef systems round the world it is very large, and the human pressure is thinly spread,” CRC Reef CEO Professor Russell Reichelt says.

“Secondly, thanks to industry stewardship and management by Marine Park authorities, there's a strong and growing ethic to protect the reef.”

Better mooring systems are being introduced for pontoons on the Reef to prevent damage to corals and the reef. Fish feeding can only be done using special food under permit by operators to ensure that fish populations are not affected.

Pressure from boats is being reduced by installing moorings, many installed by the operators themselves, as well as having 'no anchoring' zones in particularly sensitive areas, accompanied by an education campaign for owners.

Coral damage is also being reduced by developing eco-trails, educating divers and keeping inexperienced divers and large groups away from sensitive areas.

Major scientific effort is being put into ensuring that tourism does not impact on populations of whales, turtles and birds – and many tour operators are involved in developing codes of practice to ensure that encounters do not disturb the wildlife or endanger visitors.

New tourism developments on the coast and islands are subject to increasingly tough controls over design, construction, environmental impact, energy and water use and especially waste disposal, to prevent nutrient runoff to the sea.

“While the record isn't perfect, it is good and it is improving – contrary to the impression held by many Australians. At the same time it's generating \$1.5 billion in annual income plus extensive overseas investment.

“Tour operators, more and more, are acting as “reef watchdogs”, and are often first to spot something that may be going wrong – such as outbreaks of crown-of-thorns starfish.”

Contact: 07 4729 8400

### **Scat success**

Rare marsupials can now be easily and reliably monitored without having to catch them – by sampling the DNA in their droppings.

Optimised for Australian mammals by Dr Peter Spencer in the Marsupial CRC, the technology has the potential to revolutionise the care of rare and endangered small animal populations in Australia and worldwide, says CRC director Professor John Rodger.

“This approach can indicate both abundance and genetic diversity without having to catch and stress the animals. This is particularly valuable if they are small, very rare, elusive or nocturnal,” he explains.

“Populations of small animals fluctuate wildly, and it can be extremely hard to monitor what’s going on by trapping. Analysing scats allows us to do this, far more efficiently and easily.

Analysing the DNA from gut cells in scats, or animal droppings, not only identifies the exact species which left them, but also gives a read-out on its genetic diversity – the population’s resilience to external pressures, says Dr Spencer.

“For example, although there are about 10,000 quokkas in WA, there are only about 80 individual genetic types in the whole population. This tells us they need very careful management to protect that diversity.”

The technique also allows individual animals and their offspring to be monitored – their influence on a breeding population, how far they roam, whether they interbreed with other groups or not – giving a much fuller picture of the dynamics of an endangered population

Contact: 02 4921 7784

Note: This CRC has closed; the contact given is for the previous CEO (Professor John Rodger)

### **Frozen flips**

Antarctica may hold the clues to early warning of major climate change in places as distant as Europe and America.

Research by a team of scientists at the Antarctic CRC has uncovered evidence that climatic flips in Antarctica may be forerunners of big changes in the northern hemisphere, with potential to affect billions of people.

Ice cores from Law Dome in Antarctica are revealing a pattern of climate 'flips' preceding by several centuries events recorded in ice cores from Greenland.

"The Greenland record shows a very abrupt climate warming about 14,500 years ago that was widely thought to be triggered by changes in North Atlantic ocean circulation. The conventional view was that this then led to a cooling in the Southern Hemisphere," says researcher Dr Tas van Ommen.

"Comparisons with the Law Dome record were a surprise, however, because they show that cooling occurred in the south around 15,000 years ago - about 500 years ahead. This was one of several such changes during the last ice age."

Dr van Ommen said it is not yet certain whether the changes in the north were driven by the south – but this is a strong possibility.

The importance of the discovery lies in its scope for refining current computer models for predicting global climate. If the computer models can reproduce the pattern of climate changes shown in the ice record from both south and north, they will provide a more reliable estimate of climate changes to come.

The ice core also holds a warning, Dr van Ommen says – that the global climate may not be as stable as we have assumed on the basis of human experience over the last few thousand years and may be subject to sharp warmings and coolings far more commonly than supposed.

This not only confronts civilization with the prospect of quite sudden climatic shifts – but also makes it more difficult to discern what is the result of human activity and what is natural variation.

Contact: 03 6226 7867 (CRC CEO 03 6226 7888)

# Medical Science & Technology

## Younger eyes

A cure for ageing eyesight is on the way, with the development by an Australian team of a permanent lens and gel that can replace the normal lens of the eye.

Scientists at the Vision CRC are well advanced in their quest to develop an implant that overcomes both loss of focus in aging eyes – or presbyopia – and other vision problems such as short sightedness.

Its developers believe that if successful in human trials - due to begin in 2004/05 - the technique will also overcome cataracts.

Tests found that the implantable gel lens has around four times the focal power of a pair of reading glasses – significantly better than the researchers' had aimed for, says team leader Dr Arthur Ho. "However we have yet to test it in human patients, so we won't know for sure till then," he adds.

Work on the implantable gel lens began in the CRC for Eye Research and Technology and is being carried on in the new Vision CRC. "Our initial aim was to overcome the inability of the aging eye to focus close-up, caused by the gradual hardening of the lens," Dr Ho explains.

"This affects almost everyone aged 45 or more. In Australia, that's about 6.7 million people now – and around 9.9 million by the end of this decade, or 44 per cent of the population."

However the team also wanted to combine the ability to focus close-up with other forms of vision correction, such as distance refractive error – to provide total correct vision, short and long, for the ageing eye.

Besides inserting the soft gel lens, they also propose to insert a novel 'mini-lens' to correct other aspects of vision. This 'mini-lens' will be embedded in the gel within the human lens itself, giving both distance and close-up vision and, potentially, good vision at all distances that will last many years - maybe even a lifetime.

Contact: 02 9385 7406

Note: CRC for Eye Research & Technology has finished and Vision CRC has begun (Vision CRC CEO 02 9385 7409)

## **Arthritis hope**

A new arthritis drug with global market potential is being developed based on a breakthrough discovery within the CRC for Cellular Growth Factors (CRC CGF) of a receptor for one of the main causes of the painful inflammation of the joints caused by arthritis.

“One of our partners - the Walter and Eliza Hall Institute for Medical Research - discovered the receptor for GM-CSF, a cytokine (or protein) that is released into the joints and causes inflammation, and it was patented,” explains CRC Director Dr John Flack.

“Our industry partner, Australian drug discovery firm Amrad, is collaborating with the UK-based Cambridge Antibody Technologies Ltd, who have proprietary enabling technologies needed to develop a new drug, to form a strong international partnership.

Dr Flack says “the partnership is developing an antibody to the receptor that will block binding of the cytokine and so prevent its harmful inflammatory effects which lead to damaged joints”.

“Although we know antibodies may block binding of the offending cytokine, we still have to do the clinical trials to determine how safe and effective this new treatment will be. This will take several years,” he says.

However with the global market for arthritis treatments running into \$A billions, Dr Flack believes there is substantial potential for Australia to reap the financial rewards for having made the key discovery – and for Australian arthritis sufferers to be among the first to benefit from the new treatment.

Contact: 03 9345 2332

## **Mobile ear test**

A hearing lab no larger than a briefcase is poised to help people all round the world to hear better - especially very young children.

Developed by the CRC for Cochlear Implant and Hearing Aid Innovation (CRC HEAR) and the National Acoustic Laboratories (NAL), HearLab is the world’s most compact and powerful way to carry out the latest auditory and hearing aid testing, whether in the clinic or the field.

The technology will be commercialized worldwide through the CRC’s company HearWorks Pty Ltd, in partnership with leading international auditory equipment firms.

HearLab opens new frontiers in auditory testing by having one piece of hardware that can perform a wide range of tests, each backed by its own unique analysis software, says CRC deputy director Dr Harvey Dillon.

“Our prototype will have four hearing tests in a single unit, replacing the four separate pieces of often very cumbersome and expensive test equipment audiologists currently need.

"There is capacity to easily add further existing tests, or a range of entirely new ones that CRC HEAR and NAL are currently developing into a comprehensive range of tests in a single kit.

“It is highly portable – ideal for both the major hearing markets in Europe and North America, but also because of its comparatively low cost and mobility, for use in rural areas and in countries with developing demand for audiological services such as China ,” he explains.

HearLab will enable:

- A speech test to efficiently analyse how much speech people can understand in noisy environments
- A brainwave test that shows immediately whether a person is hearing and differentiating sounds – particularly valuable for infants who cannot respond
- A test of auditory processing ability for people whose hearing is rated ‘normal’ by conventional tests, but who still have difficulty in understanding speech
- An audiometer for testing children’s behavioural response to a novel set of sound stimuli, and which can be operated by a single audiologist instead of the usual team of two.

"Two previous CRC/NAL technologies are widely used and trusted in auditory clinics round the world, and we’re hoping our reputation for quality technology will generate early market demand for HearLab,” Dr Dillon says.

“The real value-add, so far as Australia is concerned, is in the software that drives each test. We aim to pioneer a whole suite of powerful new hearing tests and deliver them to the world market.”

Contact: 02 9412 6820 (CRC CEO 03 9667 7539)

## **CMV vaccine**

Progress towards a vaccine for cytomegalovirus (CMV), a cause of crippling birth defects, has been made at the CRC for Vaccine Technology (CRC-VT).

CRC-VT chief executive Professor Anne Kelso says her CMV team has identified a range of promising components of the virus which may be used to make a vaccine capable of protecting most people.

CMV can be spread through childcare centres. A primary infection during pregnancy can cause multiple birth defects, which can seriously disable the

victim for life. As well as the human cost, the resulting healthcare is estimated to cost Australia over \$60M a year.

“Our view is that it is possible to develop a vaccine to protect young women against CMV infection when pregnant, and to run a national vaccination campaign similar to rubella. This would be justified by the high human and national cost of the disease,” Prof. Kelso says.

The team’s strategy is to develop a vaccine made from a string of viral peptides – the building blocks of proteins – capable of priming the immune systems of different people, whatever their genetic background.

“We’ve identified about 200 different peptides in CMV proteins which could do this, and we’re screening them for effectiveness. Our plan is to string 20 or so of these peptides together using our really neat Polytope™ technology, and couple them with an adjuvant to help the immune system recognize it.”

Contact: 07 3362 0430

### **Inflammatory answers**

Advances towards reducing the enormous impact of inflammatory diseases in Australia has been made by researchers working for the CRC for Chronic Inflammatory Diseases (CRC CID).

One Australian in three suffers from a chronic inflammatory disease such as rheumatoid arthritis, chronic lung disease (COPD), atherosclerosis, psoriasis or inflammatory bowel disease. The cost to national healthcare of the first two alone is over \$2.5 billion per annum.

Figures suggest that almost 15% of the Australian population suffers from some form of arthritis, with at least 60% of these being female. The cost to the community of this painful and debilitating disease is estimated at around 1 billion dollars.

By 2010 the WHO projects that COPD (chronic obstructive pulmonary disease - a terminal group of disorders that includes emphysema and chronic bronchitis) is tipped to become the world's no 3 killer. This disturbing epidemic is largely due to the worldwide increase in cigarette smoking. COPD costs the global economy billions of dollars in premature deaths and lost productivity as well as hospitalisations and palliative care. Currently there are no effective treatments.

The CRC has made significant strides in understanding the processes of these diseases - which are based on the body’s self-defence mechanisms – focusing on a novel approach involving a particular type of white blood cell.

The CRC is using two powerful and sophisticated discovery technologies: gene chips and proteomics. Gene chips monitor simultaneous changes in tens

of thousands of genes simultaneously allowing key molecules in complex disease processes to be identified. Proteomics measures minute changes in the expression patterns of proteins in cells and tissues and can also help to understand how disease alters the regulation of cellular biochemistry.

The CRC team has already identified a range of promising molecules associated with particular inflammatory diseases. These molecules are both signals that something is going wrong, and may also be targets for therapy, says CRC chief executive Professor John Hamilton.

“With an aging population, the world market for anti-inflammatory drugs is now worth over \$50 billion a year. Our projects are structured to cover the whole drug discovery cycle, from primary target identification and validation through to the development and delivery of drugs which target the white blood cells,” he says.

Contact: 03 8344 6252

### **Kidney target**

Kidney disease, one of the most devastating of health problems facing Australia’s indigenous population, is a primary target for the CRC for Aboriginal and Tropical Health (CRC ATH).

“Rates of kidney disease in Outback communities are running at 16 times the national average, and it is clear from our research so far that there are multiple causes,” says CRC director Professor Tony Barnes.

Causative factors include low birth weights, untreated skin infections, high blood pressure, diabetes, smoking and poor water quality.

“It is now clear that Indigenous Australians do not have a particular genetic disposition to renal disease. There is a complex of social and medical factors which need to be addressed if we are to get on top of this problem,” he says.

One of the problems is communication. Knowledge about the origins and cause of renal disease is scant in most communities.

“Also, many Aboriginal people do not know that when they need dialysis it usually means leaving their community to go and live in a health centre for the rest of their life,” he explains.

“Some cannot face this, and are choosing to die at home instead. There are also deeply-held beliefs and concerns around kidney transplants – apart from a lack of suitable organs.”

As a result, less than a quarter of Aboriginal people who qualify for a transplant actually receive one, compared with other Australians. Mortality

from kidney disease is 5 times higher and only one aboriginal person has been on dialysis for more than three years.

“From this we are seeing that renal disease is far more than simply a medical problem in Indigenous communities, and the approach needs to begin with community awareness, communication and education to prevent the disease in the first place,” Prof. Barnes says.

Contact: 08 8922 8473

### **Tick success**

The days of tick fever causing havoc in the world’s cattle industries may be numbered thanks to an Australian vaccine breakthrough.

The Cooperative Research Centre for Vaccine Technology is working to develop a new recombinant vaccine for anaplasmosis – or tick fever – that promises a spectacular improvement in control of the disease.

The tick-borne parasite *Anaplasma marginale* invades and destroys the red blood cells of cattle leading to anaemia, fever and respiratory distress. If not treated, severely-affected animals die.

Tick fever is a major problem in Northern Australia as well as other tropical and sub-tropical regions of the world including North, Central and South America, Asia and Africa, where it is estimated to cost the global cattle industry over \$500 million a year.

The CRC team has identified four new antigens in the parasite, two of which were found to give significant protection of cattle in vaccine trials, reducing the number of parasites in their blood and the severity of the disease.

“Conventional live attenuated vaccines give some protection, but have a number of downsides including cost, instability, side-effects and limited range. Worldwide there is no truly effective vaccine against tick fever,” CRC director Professor Anne Kelso says.

“Our recombinant vaccine is expected to overcome these problems, providing better protection against a wider range of disease strains.”

Besides Australia’s northern cattle herd, the CRC says the market for the vaccine in North, Central and South America is potentially huge, with US producers alone losing \$100m a year to the disease.

Contact: 07 3362 0249 (CRC CEO 07 3362 0430)

## **Gene caution**

Powerful new gene tests confront society with one of its most agonizing dilemmas: should young people be tested for deadly diseases they may develop later in life?

No-one knows the answer, but one person keen to find out is gene ethics researcher Rony Duncan, who works for the CRC for Discovery of Genes for Common Human Diseases (Gene CRC) and the Murdoch Childrens Research Institute.

“There are more genes discovered every day and sometimes this leads to tests that can predict future disease in people. These predictions can be made long before symptoms ever begin – even while the person is still an infant.

“The big question is: what effect would testing have on them, growing up in the knowledge that they may develop an incurable, potentially lethal or disabling condition? And is it fair to tell them?”

Examples of diseases which can now be tested for in advance include Huntington’s disease – which generally does not strike its victims till their late 30s, various cancers, familial motor neurone disease and cerebro-spinal ataxia.

At present, Rony says, Australian doctors observe guidelines which discourage early genetic testing – but we face the potentially global availability of commercial gene tests sold over the internet

“How widely early gene testing is being used in western medicine is one unknown. Another is how young people might react to the news they may develop an incurable or disabling condition,” she says.

Rony Duncan is exploring the extent of gene testing, in Australia, New Zealand, Canada, the United States and Britain.

She also plans to work with teenagers in Melbourne to explore their reactions to the fast-arriving technology – whether or not they would wish learn of test results and how they might handle it.

“It may be there is no easy answer. Some people may be depressed by the knowledge they carry a disease gene, while others may find it a challenge and a motive to plan their lives and achieve what they can before the disease onset.”

Contact: 03 9208 4444

## **Cancer contact**

Researchers from the CRC for Cellular Growth Factors have won a global race to determine the structure of a key molecule on the surface of cancer cells.

Known as the EGF (epidermal growth factor) receptor, the molecule is seen by medical researchers as an ideal target for the development of new classes of anti-cancer drugs. The detailed structural information obtained by the CRC researchers now enables such approaches to drug development to be initiated.

“These drugs will bind to the receptor and inhibit the cancer cell’s growth by preventing the effects of several of the EGF family of growth factors known to be important in causing cancers to grow,” says CRC Director Dr John Flack. “It’s a landmark discovery, made amid strong international competition.”

Contact: 03 9345 2332

## **Sister search**

Researchers at the Gene CRC are close to pinpointing the key genes behind the disease endometriosis, which affects one in ten women and causes up to 40 per cent of cases of infertility.

The Gene CRC and its UK partners are conducting a huge international study involving approximately 5000 women – mainly sisters – and their family members. It has compiled the most comprehensive body of information on the disease yet.

By comparing sisters and close relatives with and without the disease, the researchers hope to pinpoint the genes responsible, as a basis for developing effective treatments.

“Projects of this size and complexity can only be run through a structure like a CRC, a multi-skilled research consortium with the critical mass for such a large undertaking,” explains Gene CRC CEO Dr Andrea Douglas.

Contact: 03 9208 4444

## **HUGO help**

Data from the Human Genome Project - known as HUGO - has given researchers from the CRC for Asthma Ltd a flying start in identifying genes linked to various forms of asthma.

Asthma has proved a particularly challenging disease to link with particular genes, especially in Australia where much is caused by environmental factors, says CRC CEO Philip Bert.

The CRC's research is a nationwide collaboration involving three states. Promising genes selected from the Human Genome Project are matched against cell types at the Garvan Institute in Sydney to see if they are linked to asthma. Interesting 'targets' are then matched against a large DNA database of asthmatics and non-asthmatics held at the University of WA in Perth and the results sent for further tests at the Australian Genome Research Facility in Brisbane.

The CRC team is now exploring the most promising 'hot genes' identified by this process to determine their role in the causes and possible treatment of asthma.

Contact: 02 9036 3130

### **Microbe magic**

Dangerous microbes will be diagnosed quickly and tracked to their source using a powerful new technology developed by the CRC for Diagnostics.

The technique of SNPs has the scope to revolutionise public healthcare microbiology, says CRC chief executive Professor Ian Gardner.

SNPs – single nucleotide polymorphisms – provide a fast, reliable, low-cost way to identify strains of disease-causing bacteria and viruses so they can be safely controlled.

"Some strains of the same microbe are quite innocent – others are killers. When faced with an infection, healthcare workers need to know as soon as possible what they are dealing with, so they can take appropriate action," Prof. Gardner explains.

"SNP detection can dramatically shorten the very lengthy and expensive process of sequencing large sections of the genome of the microbe, by focusing on a few key loci – places on its genome – that will tell us straight away."

The technique combines cutting edge gene science with advanced maths to find the minimum number of loci that can give a reliable diagnosis with around 95 or 98 per cent certainty.

It cuts the cost of identifying the bug by up to 90 per cent, and delivers an answer in less than three hours, instead of days.

Contact: 07 3864 4015

## Debugged lenses

Contact lenses generally bring a welcome improvement in vision – but when toxic bacteria use them as an invasion beachhead, the result can be blindness.

“Bacterial contamination of contact lenses is a major problem, affecting from 10-25 per cent of wearers,” says Professor Mark Willcox of the Vision CRC.

“It can lead to conditions like microbial keratitis, which can scar the cornea so badly as to blind the patient, and acute red eye or ulceration associated with contact lens wear. These are linked with common microbes such as *Pseudomonas*, golden staph and *Streptococcus*.”

The Vision CRC’s answer is to design an anti-bacterial contact lens which discourages bacteria from sticking to it, and sends out chemical signals that curb their virulence.

Marine organisms like seaweeds have natural repellents which prevent their surfaces being colonized by bacteria. The Vision CRC team in collaboration with Biosignal Pty Ltd have developed a range of bacteria-repellent compounds, known as furanones, from the byproducts of seaweed, and succeeded in incorporating them into contact lenses.

In trials these have reduced adhesion by golden staph by 90-100 per cent, while another class of furanones appears to disrupt the bacteria’s inner workings, so making them less virulent and less likely to form colonies.

On the basis of work so far, the team is optimistic they can produce a safer, healthier contact lens that will do its own bacterial control, rather than rely on external drugs or treatments.

Contact: 02 9385 7406 (CRC CEO 02 9385 7409)

## Ear leaders

Aboriginal communities across Australia are pioneering a healthcare approach that may one day help indigenous communities world wide combat a universal problem - middle ear infection in children.

Australia’s remote communities have the worst rates of Otitis media (middle ear infection) in the world, with almost every child suffering an average of 32 weeks of infection between 2 and 20 years, compared with 2 weeks for non-indigenous Australians. The condition causes deafness, often with significant loss of education and social consequences.

Working with Indigenous communities, researchers from the CRC for Aboriginal and Tropical Health (CRC ATH) have developed a training package that helps Aboriginal nurses, doctors and healthcare workers diagnose the

four kinds of Otitis media, apply the right treatment, and also helps parents to understand what is happening to their kids.

“The real challenge was lack of awareness. Many children suffer from this condition, both Indigenous and non-indigenous, but it is frequently overlooked and can have a devastating effect on the child’s development,” explains CRC acting director Ms Terry Dunbar.

A CRC technology breakthrough – use of a video camera coupled with an otoscope (ear microscope) – enabled the team to get shots of the different forms of the disease which are used to train healthcare workers what to look for, and parents to understand what is going on in their children’s heads.

The training package, including a video, was developed with advice from Indigenous communities, and is now being offered to communities across the nation, to see if they can reduce their incidence of the disease – and so give their children better prospects at school and in the community.

“Otitis media affects youngsters all over the world, and is particularly bad in many indigenous communities. There has already been real interest in this project from North American indigenous healthcare workers, so we’re hoping that this package, developed through our Aboriginal people, will bring global benefits,” Ms Dunbar says.

Contact: 08 8922 8841 (CRC CEO 08 8922 8473)

### **Shriek excluder**

The risk of acoustic shock injury while using a telephone headset has been significantly reduced thanks to SoundShield, an intelligent acoustic protection device using software developed by the CRC for Cochlear Implant and Hearing Aid Innovation.

SoundShield intercepts “acoustic shrieks” on the phone in hundredths of a second and blocks them before they can damage the hearing of call centre operators – without blocking the voice of the person they’re talking to.

The technology has been licensed to Telstra and Polaris Communications of Victoria, and is expected to attract a large export market in the booming global call centre business, as well as in other occupations that depend on phones.

Contact: 03 9667 7539

### **Vision implant**

Permanent, invisible vision correction may soon be a reality with a fully-implantable contact lens being developed by the Vision CRC.

This new lens is designed to slip under the outer layer of the eye to provide a permanent, comfortable and safe alternative to spectacles, ordinary contact lenses or laser surgery.

The process is less invasive than current surgical or laser treatments, and is easily reversible. It is designed to correct problems such as short-sightedness (myopia) and aphakia (loss of the eye lens surface).

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Note: CRC for Eye Research & Technology has finished and Vision CRC has begun (Vision CRC CEO 02 9385 7409)

### **Dog control**

A safe, humane to control Australia's domestic dog population is on the way with the development of a promising new sterilization vaccine by the CRC for Vaccine Technology CRC VT.

Delivering what is known as immunocastration or immunospeying, the vaccine immunizes dogs against the key hormone that controls their reproductive system, explains CRC VT chief executive Professor Anne Kelso. With final trials in dogs now under way, the ultimate goal is a commercial vaccine that only requires a 6-monthly booster.

"The vaccine primes the immune system to make antibodies against a hormone called LHRH (lutenising hormone releasing hormone). This effectively blocks the hormonal cascade that makes the animal fertile," she explains.

The neat trick incorporated in the CRC's trial vaccine is to use a synthetic peptide – essentially a fragment of protein – which stimulates the immune system into making antibodies that block LHRH.

Though developed specifically as an injectable vaccine for dogs, the broad technique applies to most mammals – and could potentially be used to develop immunocastration vaccines for other domestic animals. A further advantage is the way it modifies the animal's behaviour.

The injectable dog immunocastration vaccine is a world-first using this approach, with potential markets wherever dogs are kept as pets, Prof. Kelso says.

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## Appendix A: Index of Stories by Participating CRCs

CRC	Media release title	Media release date	Science in Action Title	Science In Action Page #
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	Future Makers	29 <sup>th</sup> April 2003	Safer Travel	12
	On track for smarter, safer transport	23 <sup>rd</sup> Sept 2003	Hull saver	8
	Gold Edge for Aussie Athlete	3 <sup>rd</sup> Dec 2003	Hot wheels	16
<b>CRC for Bioproducts</b>	Gene weapons for the war on disease	4 <sup>th</sup> Feb 2003	Plant drugs	6
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<b>CRC for CAST Metals Manufacturing</b>	Revolutionising planes, welds and automobiles	28 <sup>th</sup> Jan 2003	Mag Motor	7
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<b>CRC for Construction Innovation</b>	Building a safer Australia	11 <sup>th</sup> Feb 2003	Terror proofing	13
	CRCs Safeguard Australia - Healthier Air, Water, Buildings	20 <sup>th</sup> May 200	Curing Buildings	14
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<b>CRC for Functional Communication Surfaces</b>	New Weapons for the Innovation War	18 <sup>th</sup> Nov 2003	Disappearing Ink	2
<b>CRC for Intelligent Manufacturing Systems and Technologies Ltd</b>	Australia Reshapes the Communications World	8 <sup>th</sup> April 2003	Hot Alert	3
<b>CRC for Microtechnology</b>	Eyecatching, ear-saving, palate p-leasing technologies	12 <sup>th</sup> Dec 2002	Weather eye	14
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<b>CRC for Polymers</b>	Quality Wood, Healthier Food & Versatile Packs	17 <sup>th</sup> June 2003	Trays Smart	13
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<b>CRC for Railway Engineering &amp; Technologies</b>	On track for smarter, safer transport	23 <sup>rd</sup> Sept 2003	Smarter trains	7
<b>CRC for Welded Structures</b>	Revolutionising planes, welds and automobiles	28 <sup>th</sup> Jan 2003	Wiser welding	8
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<b>CRC for Wood Innovations</b>	Quality Wood, Healthier Food & Versatile Packs	17 <sup>th</sup> June 2003	Fast Timber	4
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<b>CRC for Enterprise Distributed Systems Technology</b>	Enabling Australian Business	4 <sup>th</sup> March 2003	Online health	20
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<b>Australian Photonics CRC</b>	Australia Reshapes the Communications World	8 <sup>th</sup> April 2003	Optical breakthrough	20
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<b>CRC for Satellite Systems</b>	Australian Science at the Cutting Edge	15 <sup>th</sup> July 2003	Healing satellites	24
<b>CRC for Sensor Signal and Information Processing</b>	Mining Magic	18 <sup>th</sup> March 2003	Wall Watcher	25
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<b>CRC for Smart Internet Technology</b>	ICT Revolution 2: Heading your way at lightspeed	26 <sup>th</sup> August 2003	Human web	22
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CRC for Molecular Plant Breeding	The Next Farming Revolution	25 <sup>th</sup> March 2003	Clever crops	41
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CRC for Sustainable Sugar Production	Sustainable Production Pays Off	15 <sup>th</sup> April 2003	Greener sugar	54
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CRC for Tropical Rainforest Ecology & Management	Safeguarding the Seas Indigenous Science Shows a Lead Science Gives Tourism a Lift Australian Science at the Cutting Edge	25 <sup>th</sup> Feb 2003 10 <sup>th</sup> June 2003 8 <sup>th</sup> July 2003 15 <sup>th</sup> July 2003	Forest and Sea Rainforest guardians Canopy craning Treetop testbed	72 69 75 60
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CRC for Cellular Growth Factors	Gene weapons for the war on disease Commercial Success from Co-operative Research	4 <sup>th</sup> Feb 2003 24 <sup>th</sup> June 2003	Cancer contact Arthritis hope	86 80
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