



Techwatch

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Mobile phone drop-out research wins coveted scholarship for JCU student

Research to eliminate those annoying signal drop-outs during mobile phone conversations has earned James Cook University PhD student Dimitri Ledenyov a coveted international scholarship.

The Ukrainian-born student is one of six researchers world-wide to receive a Microwave Theory and Technique Society Graduate Fellowship from the Institute of Electrical and Electronic Engineers (IEEE).

His research with JCU's Microwave Superconductivity Group has significant applications in the rapidly expanding field of wireless communication and, in particular, for improving the sound quality of mobile phones.

Mr Ledenyov is investigating the use of superconductive materials in filters for mobile phone base stations with the aim of boosting reception and reliability.

"It will be possible to receive calls from people who are far away from telephone towers and more people will be able to use the same frequency bandwidth without disturbing each other's calls," he told the *JCU Outlook*.

The IEEE fellowship carries a grant worth nearly \$12,000, plus a \$1000 travel allocation to attend the world's largest microwave conference, *The International Microwave Symposium*, held annually in the United States. Through its members – there are more than 377,000 in 150 countries – the IEEE is a leading international authority in technical fields ranging from computer engineering to biomedical technology, aerospace research and telecommunications.

Using emerging microwave technologies, researchers all over the world are searching for ways to improve wireless communication for both industrial and personal applications.

At James Cook University, Mr Ledenyov is looking at the use of superconductors – materials that can conduct electricity with minimal losses – to enhance performance of filters on mobile phone base stations.

And he is in good company !

His research supervisor and head of JCU's Microwave Superconductivity Group, Associate Professor Janina Mazierska, has been nominated to become an IEEE Fellow – a title which if conferred would acknowledge an extraordinary contribution to IEEE activities. Australia at present has only a small handful of IEEE Fellows.

An explosion in the use of mobile phones has seen the frequency spectrum allocated to mobile phone communication become overcrowded, according to Mr Ledenyov.



"And it will become even more crowded with the imminent introduction of more advanced applications, like imaging and streaming video," he said. "One solution is to develop highly selective frequency filters with advanced microwave properties that are much better at selecting the wanted calls and filtering out the unwanted calls. This will reduce interference and decrease the number of calls where voices drop in and out.

"Specifically, my work is related to investigation of non-linear effects in superconducting materials that may deteriorate superconducting filter properties," he said. "More simply, I am looking at factors which can improve performance of superconducting materials in filters."

Associate Professor Mazierska says she is thrilled at her nomination for IEEE Fellow.

"This is a tremendous achievement for Dimitri and a glowing endorsement for James Cook University, because independent reference letters were required to confirm the strength and viability of the research PhD program," she told the *JCU Outlook*.

Her research at JCU has been with measuring precisely the microwave properties of materials used for wireless communication, particularly superconductors and low-loss dielectrics.

She explained: "We need to know exact parameters of materials when we design mobile phones or satellite receivers, because just one per cent error in value of relative permittivity of a dielectric can result in a shift of the frequency of a filter by 20MHz.

"That means you will not be able to hear your calls, but someone else's."

Associate Professor Mazierska said demand for new or optimised materials to improve the quality wireless communication had prompted a surge in interest in the field of superconductivity and JCU research was at the cutting edge.

"Here at JCU, we have come up with precise data on superconductors and several new and old dielectrics at cryogenic temperatures and have developed a measurement system equal or better than any other in the world," Associate Professor Mazierska said.

ANU's plasma thrusters could be ticket to Mars

An Australian invention using Australian National University research may one day propel a spacecraft to Mars.

Professor Rod Boswell and his SpacePlasma and Plasma Processing Group in the Research School of Physical Sciences and Engineering have identified a way to make a 'plasma thruster' for use in space exploration.

"It is still early days and the thruster is still only a laboratory experiment on a bench, but it works - it's simpler than any other thrusters presently available and it's ours," Professor Boswell told the *ANU Reporter*.

The Group uses plasma processing to change the surface of semiconductors.

"When we were looking at the basic properties of the plasma, we realised the ions were coming out very quickly under certain conditions," he said.

His Group made the link between their processing of plasma conductors and the need for a thruster to propel a NASA mission to the Red Planet

"It's quite strange doing experimental physics; you have to go into the experiment, talk to lots of people and then bang, sometimes, something really important happens," Professor Boswell said.

Plasma is a state of matter where high-density gas is heated and ionised. This plasma can be placed in a magnetic field that then pushes the plasma out as it expands. This creates a thrusting force in the opposite direction and, in theory, could be used to propel a craft through the distances of space that separate the Earth from planetary neighbours.

"A typical scenario for a Mars mission would involve basically two steps," Professor Boswell said. "The first would be to ferry all the parts for the spaceship to a holding orbit at a few hundred kilometres above the Earth and the second would be the long flight to Mars."

The plasma thruster would be used for the second step. It throws out material from the rear of the spacecraft, which thrusts the craft forward and can do this ten times faster than the rockets on Saturn or the space shuttle. This means it needs only one-tenth of the amount of propellant and brings down the overall cost of the mission.

The launch of the craft from a holding orbit would need to be carefully timed to coincide with when Earth and Mars are closest to each other – once every 11 years.

However, before this technology can be used on a Mars mission, it needs to be tested in space.

Professor Boswell has approached AUSPACE, the company building much of the Fedstar satellite for the Australian Government, to collaborate on this process.

Vetting phone system – the latest in wireless technology

UQ Veterinary Science School is trialling a revolutionary new technology

It looks like a mobile phone, it sounds and feels like one, but actually it is the latest - the Personal Handyphone System (PHS) has the potential to wipe out prohibitive intra-office mobile telephone bills in many organisations, with The University of Queensland leading the way in wireless technology.

Fortunately for many of UQ's faculties, schools and centres, the technology is now available on campus.

"The distinct advantage of this system over 'carrier-based' mobiles is that calls between individual handsets and campus telephones cost absolutely nothing," said UQ's Director of Information Technology Services, Mr Nick Tate. "Strategically placed cells, like miniature mobile phone towers, will pick up the signal throughout a school or faculty, automatically passing the call from cell to cell as the user moves about.

"Essentially, the user gets the portability of a mobile with the cost-effectiveness of a cordless telephone," Mr Tate said.

UQ's School of Veterinary Science is the first to take up the revolutionary new technology.

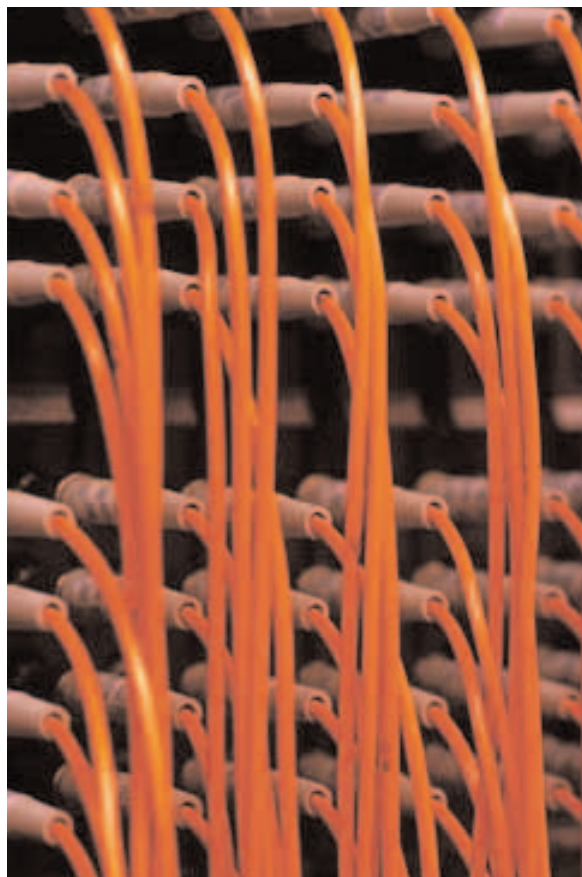
Veterinary School Head Professor Neil McMeniman said the technology had proved invaluable.

"Mobile communications are essential for students and staff in the Clinic and the Handyphone system is exactly what's required," he said. "We've been able to do away with paging devices and supply people working in the Clinic with more than 20 Handyphones.

"It's light, portable, easy to use and importantly, it will save time and money."

The PHS initiative is a *cellular phone* platform fully integrated into the UQ telephone system with comprehensive call-accounting capability for external calls as well as headset, voice-mail, and auto-answer functionality.

- The Federal Government has announced that Optus has been chosen to establish state-of-the-art communications systems to regional and remote students in NSW and the Northern Territory. The venture is the result of Optus' successful bid to receive National Communication Funding from the Federal Government to establish shared broadband interactive distance learning (IDL) communications infrastructure. Optus, in collaboration with the NSW Department of Education and Training and the Northern Territory Department of Employment, Education and Training, will establish IDL infrastructure for small rural communities and isolated homesteads in the Clarence, Murray-Darling and Dubbo areas of NSW and the whole of the Northern Territory. The technology includes real-time streaming video, high-resolution graphics, full duplex audio, two-way data interaction and application sharing capabilities. School courses offered will cover primary, secondary and vocational, including those that are currently difficult to offer in remote and rural settings, such as courses in small business skills. TAFE programs will be specific to each local community and a number of courses will be offered for indigenous education.



Company could produce new therapeutic drugs

CSIRO Entomology has established a company, *Entocosm Pty Ltd*, dedicated to producing a wide range of therapeutic drugs from a virtually untapped source – insects.

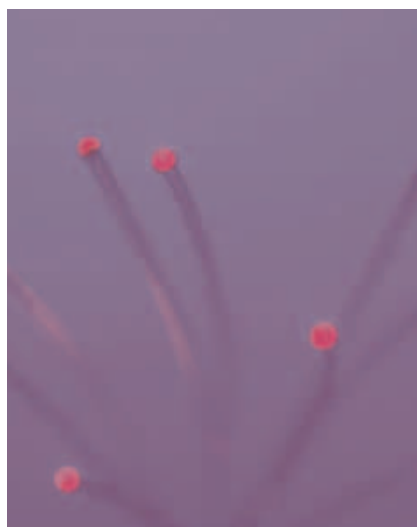
Entocosm's Chief Scientific Officer, Dr Stephen Trowell (a CSIRO scientist for the past 13 years), will work with Emeritus Professor Rod Rickards, from the Australian National University, and Clinical Associate Professor at the Canberra Hospital, Peter Collignon, to identify novel drug candidates from insects.

Due to the urgent demand for new agents to treat drug-resistant pathogens, the team will initially focus on discovering new antibiotics.

There are more than 250,000 plant species on Earth, but there are more than four million insect species. Microbial diversity is also huge, although 99 per cent of bacteria cannot be cultured in the laboratory.

Insects utilise an unparalleled array of biologically active substances. These include molecules that kill cancer cells; proteins that prevent blood from clotting; enzymes that degrade pesticides; proteins that glow in the dark; and, anti-microbial peptides and toxins.

Australia, with its mega-diverse biota and advanced scientific infrastructure, offers unique potential for discovery.



The company has appointed the New York-based firm, Malcolm Binks Associates LLC, as its investment bankers to raise capital from US and Australian investors.

The info-medicine superhighway

Prescribing medicines has become a lot safer because of information technology advances in general practices, according to doctors who participated in an AMA Telstra Family Doctor Week survey.

An on-line survey of 700 doctors has revealed what some doctors see as the major benefits of information technology in general practice.

Eighty-four per cent of doctors surveyed listed fewer drug interactions as one of the biggest improvements for patients. AMA Vice-president Dr Trevor Mudge said clinical software packages could now identify drugs that should not be prescribed together.

Eighty-per cent of respondents believe IT is important in improving patient care. Sixty per cent rely on their computers to communicate with other doctors. Around 50 per cent said

their patients frequently present them with health information obtained from the Internet. This may explain why doctors, too, are using the Internet and e-mail to keep up with international medical news and to compare notes with their medical colleagues.

Australian first in ultra clean coal production

Australia has reached a milestone in the development of ultra clean coal with the first bulk sample undergoing combustion tests in Japan.

The Ultra Clean Coal pilot plant at Cessnock in the Hunter Valley, which produced the coal samples, had set a world first for Australia, according to the Minister for Industry, Mr Ian Macfarlane.

"The impurities or ash in the bulk sample are less than 0.2 per cent, compared with ash levels typically exceeding 10 per cent in normal export coals," he said. "I am not aware of coal with such purity being produced outside of a laboratory."

The Federal Government has committed almost \$15 million to the construction and operation of the UCC Energy Research Centre and the pilot plant at Cessnock. This is in addition to the \$25 million already spent on UCC technology, including \$19.5 million by Whites and the CSIRO's Division of Energy Technology. The Government has also worked closely with the Japanese Government and industry to establish a program in Japan to trial UCC.

The main application for UCC is a cost competitive for natural gas in gas turbine power stations. It is estimated that greenhouse gas emissions can be cut by a quarter for a combined cycle gas turbine power plant running on UCC, compared with normal coal in a coal combustion plant. Over the whole UCC lifecycle, greenhouse gas emissions can be reduced by 10 per cent.

Territory Sunrise gas facing problems

Northern Territory Chief Minister Clare Martin has met representatives from peak industry groups in Canberra to discuss her Government's campaign to bring Sunrise gas onshore from the Timor Sea.

The industry groups included the Australian Industry Group, the Australian Gas Association, the Australian Pipeline Industry Association, and, the Minerals Council of Australia, among others.

Joint developers of the 8.4 trillion cubic feet Sunrise gas field, Shell, Woodside and Phillips Petroleum, are currently re-examining the case for bringing the gas onshore to Darwin via pipeline. It could then be used to fuel industrial expansion in the Territory and be piped elsewhere in Australia to meet domestic customers' needs.

The Territory Government is opposed to the so-called Floating LNG option – one that Shell and Woodside have indicated they prefer.

The FLNG option has never been tried before, but proposes that Sunrise gas would be loaded onto a floating barge to convert the gas to liquid on site. The resource would then be exported directly to North American markets.

"Sunrise gas onshore will create thousands of extra jobs for Australians and will increase GDP by \$15 billion," Ms Martin said.

In general terms, the meeting agreed that what was needed in Australia was a more competitive energy market, better diversity of supply and more affordable costs.

Ms Martin later met the Deputy Prime Minister, Mr John Anderson.



New hope for diabetics in treating blindness

Australian research has led to clinical trials of a drug that could provide a painless and non-destructive way to treat blindness in diabetics.

The University of Melbourne-led pre-clinical research prompted the world-wide, multi-centre clinical trial following the announcement of their results at an international conference last year. The drug blocks a crucial pathway whose end products cause blindness and eye damage in diabetics, the leading cause of new blindness in adults around the world. The trial will begin later this year.

The research team's success also caught the attention of funding agencies. The US-based Juvenile Diabetes Research Foundation (JDRF), the world's leading non-profit, non-governmental funder of diabetes research and the National Health and Medical Research Council (NHMRC) have granted the University of Melbourne team \$4.7 million in funding over five years. The funds will help refine their understanding of the chemical pathways that lead to blindness (diabetic retinopathy) and kidney failure (diabetic nephropathy) in diabetics and to find new drugs to combat the disease.

"A vital clue to our breakthrough came unexpectedly when treating diabetics for high blood pressure, another consequence of the disease," says Dr Jennifer Wilkinson-Berka, Head of Diabetes and Vascular Biology Laboratory, University of Melbourne.

Dr Wilkinson-Berka's team and other researchers working in this area found that common drugs used to treat high blood pressure also improved kidney problems. The chemical system in the body that caused high blood pressure in diabetics

was found to be the same culprit behind kidney failure. The system, called Renin-Angiotensin System (RAS) is triggered by high blood glucose levels and its end product is a protein called angiotensin that causes cells to grow.

Drugs used to treat high blood pressure block the chemical pathway in RAS that produces angiotensin.

"Diabetic patients now take these drugs to treat kidney damage, but nobody had thought to look if RAS also operated in the eye," Dr Wilkinson-Berka said.

Using a diabetic rat model with an enhanced RAS that the team developed specifically for their diabetic research, they quickly discovered that RAS was present and active in the eye when blood glucose reached high levels.

"The diabetic rats also allowed us to test various drugs that attack the pathways affected by or involving glucose, including two angiotensin blocking drugs similar to the new drug to be used in the clinical trial," Dr Wilkinson-Berka said. "We found that these drugs successfully prevented the growth of blood vessels in the eye and kidney. It was this success that led to the funding for, and approval of the clinical trial."

Diabetic retinopathy occurs when the tiny blood vessels of the retina are damaged. The retina is a thin light-sensitive tissue at the back of the eye that transmits visual images to our brain. The eye's vessels are extremely delicate. Angiotensin may cause the blood vessels to grow too fast and they fail to form properly. This causes the vessels to bleed and gradual detachment of the retina to occur. Similar damage occurs to the blood vessels in the kidney, eventually leading to kidney failure. Current treatment for retinopathy is to burn hundreds of tiny holes into the retina with a laser to burn away damaged blood vessels. While effective, it is a damaging procedure causing loss of peripheral vision and it fails to prevent the problem re-occurring.

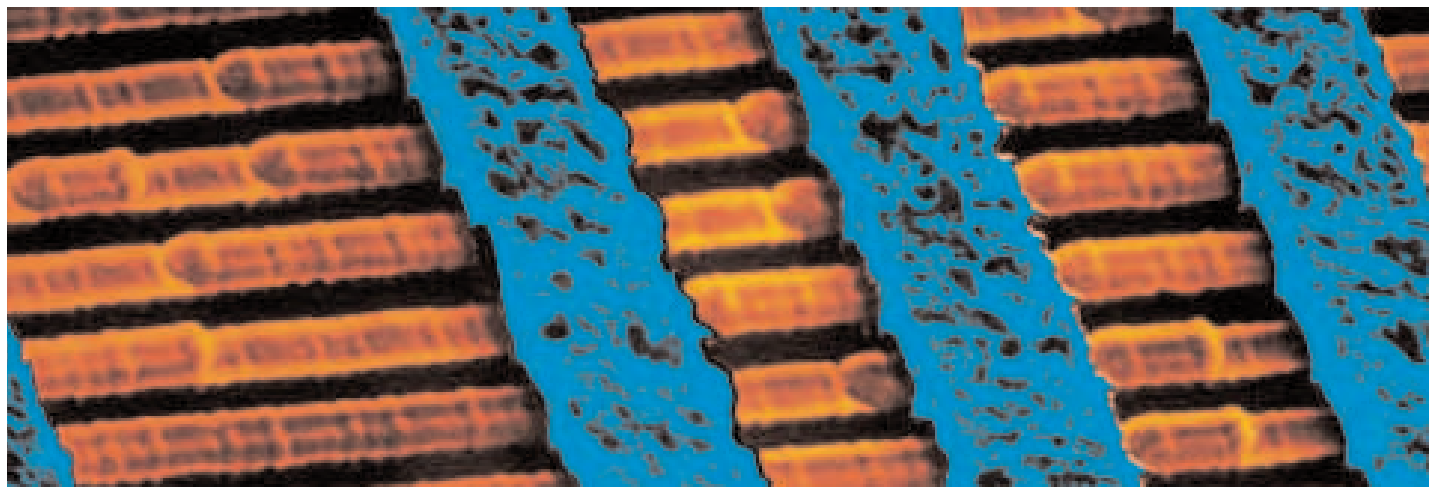
"We are aiming for a non-destructive, preventative treatment that doesn't involve destroying retina or requiring a kidney transplant," Dr Wilkinson-Berka said.

The JDRF and NHMRC grant will enable Dr Wilkinson-Berka's team to find other pathways and hormonal systems involved in nephropathy and retinopathy, and potential drugs to block these pathways.

The research team includes Associate Professor Richard Gilbert and Dr Darren Kelly, Medicine, St Vincent's Hospital; Associate Professor Rik Thomson and Dr Mark Waltham, St Vincent's Institute; Professor George Werther and Dr Chris Wraight, Murdoch Children's Research Institute and Royal Children's Hospital; Professor Carol Pollock and Dr Philip Poronik, University of Sydney, Royal North Shore Hospital; Associate Professor Silviu Itescu, Columbia University, New York.

More information: Dr Jennifer Wilkinson-Berka, University of Melbourne, Dept of Physiology (03) 8344 5849; or 0409 516 753. Email: j.berka@physiology.unimelb.edu.au





Monash shares in infrastructure grants worth \$40m

Monash University is a partner in 10 of the 16 consortia that were awarded Science, Technology and Innovation Infrastructure Grants by Victoria's minister for Innovation, Mr John Brumby, last week.

The grants will be used to build world-class facilities that will enhance Victoria's involvement in nanotechnology, materials handling, drug and vaccine development, oral health and mathematical sciences.

Monash University will share in \$42.55 million of the \$59 million the State Government made available for Round Two of the Infrastructure Grants.

The University will lead two of the consortia – Nanotechnology Victoria, which received funding of \$12 million, and the Centre for Pre-Clinical Drug Candidate Optimisation, which received \$4 million, and will be a partner in eight others.

The Director of Nanotechnology Victoria, Professor Barry Muddle from Monash's School of Physics and Materials Engineering, said the project would consolidate and grow the research base for nanotechnology in Victoria, particularly its interface with the biotechnology community.

"The three areas where Nanotechnology Victoria will contribute most are materials and sensing devices for biodiagnostics, drug delivery and tissue therapy," Professor Muddle said. "For tissue therapy, there will be a lot of emphasis on the development of substrates and scaffolding for tissue engineering."

The Centre for Pre-clinical Drug Candidate Optimisation would fill the critical gap that falls between drug discovery and drug development, said the Centre's Associate Professor, Dr Susan Charman, from the University's Department of Pharmaceutics.

"Pre-clinical optimisation is really about identifying compounds that have the proper characteristics and that can be used to go on and develop better drugs," Dr Charman said.

Mr Brumby said the facilities would plug a gap in the State's research capabilities, helping Victoria break into the \$US36 billion world-wide market for pharmaceutical research and development.

The Australian Sustainable Industry Research Centre received a grant of \$2.4 million and will be established at the Gippsland campus of Monash University. The ASIRC will provide Victorian industry and communities with solutions to the management of waste products. ASIRC will develop ways to implement cleaner production technologies; improve waste treatment technologies; and, develop more effective recycling techniques.

Monash University researchers are also partners in: > Clinical Trials Victoria, which received a grant of \$8 million; > Victorian Centre for Advanced Materials Manufacturing, \$5 million; > Victorian Institute of Chemical Science, \$5 million; > Victorian Centre for Oral Health Science, \$3.5 million; > The Virtual Reality Observatory of Melbourne, \$1.3 million; > Australian Mathematical Sciences Institute, \$1 million; > Centre for Education and Research in Environmental Strategies, \$350,000.

• A grant of \$439,315 to the Monash University's Gippsland School of Computing to establish a Technology Diffusion Gateway Network project has been announced by Federal Industry Minister Ian Macfarlane.

INVETECH makes move on USA

Invetech, a contract R&D service and the innovation engine room of publicly-listed Vision Systems Limited, is opening an office in California.

"More than 60% of our business is with overseas clients driven by the explosive growth in the North American medical instrument sector," Mr Paul Wright, Invetech's Chief Executive, said. Biomedical clients include Abbott Laboratories, Bayer, Leica, Applied Imaging Corporation and Ambri.

The Company will take up residence at the newly-opened Victorian Government Business Office in the heart of San Francisco – one of the major centres for medical instrumentation and biotechnology companies in North America. This sales/marketing office will enable Invetech's instrument design and development team to say close to existing and potential US clients. The office will be staffed by two long term Invetech bio-medical instrument development specialists; Dr Ian Macfarlane, VP for Invetech-USA and Jari Palander, VP business development.

Invetech has provided leading-edge, technology-based products ranging from early warning smoke detectors to world-class biomedical equipment for market leaders in the US and Europe for more than 25 years.

Invetech's world-class 'Idea-to-Market' service is well known among many industry leading companies, including Ansell, NEC, Shell, CSL, Telstra, Cochlear Ltd and The Woolmark Corporation, to name a few.

"Our integrated 'Idea to Market' capability to develop new products and manufacturing processes has enabled us to penetrate the highly competitive international medical instrumentation market where we provide world-class capability and an extensive track record at 30-50% lower cost," Mr Wright said.

More information: Mark Kestigian, Invetech Communications Consultant on (03) 9755 2540 or via email: mkkestigian@beyondtech.net. **INNOVATION:** A Commonwealth funding offer of \$1.4 million under the Government's Innovation Access Program to help with the establishment of an Australian Industry Innovation Exchange would considerably enhance the nation's innovation capabilities, the Industry Minister, Mr Ian Macfarlane, said in a recent announcement. InnovationXchange will connect the major stakeholders – industry, government and research institutions – to provide access to the best and most applicable technologies. It will become an important mechanism for increasing competitiveness and achieving greater industry efficiencies.



PLANTS: Genetic Technologies Limited and Agriculture Victoria Services Pty Ltd have created a new company, AgGenomics Pty Ltd to enhance conventional plant breeding through the application of genomics – the study of genes and their function. Initially, the new company will provide plant genomics services in collaboration with the Plant Biotechnology Centre, an Institute of the Victorian Department of Natural Resources and Environment, based at La Trobe University. Director of Agriculture Victoria's Plant Biotechnology Centre at La Trobe University, Professor German Spanenberg, has been appointed Managing Director (Research and Development) of the new company. Dr Glenn Tong, of Genetics Technologies, is Managing Director (Commercial). Professor Spangenberg said AgGenomics would assist plant breeders identify genetic markers linked to commercially important traits so that they can improve production efficiencies and quality.

RADIOACTIVE: Public comment is invited on the release of a draft Environmental Impact Statement (EIS) for the establishment of national repository for the disposal of Australia's low level radioactive waste. The draft EIS, issued by the Federal Science Minister, Mr Peter McGauran, describes the national repository and the environment at the preferred site, and two alternative sites which are all located near Woomera in South Australia. Public comment is invited from July 29 to September 20 this year. More information: Darren Chester (02) 62777 440 or Virginia Cock (DEST) (02) 6240 9518.

GENETIC: The first purpose-built facility to meet the strict containment standards for genetically modified plants has been opened by the Minister for Education, Dr Brendan Nelson at the Australian National University. The pioneering building meets all the requirements, according to the ANU Reporter, set by the Gene Technology Regulator and the Australian Quarantine Service for plant research. The facility has two major components – housing facilities for soil mixing, sterilisation, potting, washing and laboratory analysis; and, growth cabinets and 20 specially designed growth rooms in which temperature, light, humidity and carbon dioxide levels can all be controlled.

DISH: Staff at CSIRO's Parkes Observatory – home of 'the Dish' – have made a special delivery to the Urumqi Astronomical Observatory in far western China. It's a new 'receiver' for the 25-metre diameter Urumqi radio telescope to be used for studying pulsars – small, spinning stars that emit beams of radio waves – a kind of cosmic hearing aid. It amplifies weak radio signals from space to the point where they can be analysed. The receiver is a sophisticated system, cooled to -253°C to improve its performance. It replaces a simpler, room-temperature instrument. Urumqi commissioned it from CSIRO's Australian Telescope National Facility in late 2000.



SUCCESS: University of Queensland researchers say the launch of the HyShot experiment at the Woomera Prohibited Range yesterday was successful. The launch was a success, says the Hyshot program team leader, Dr Allan Paull, and we received data for the duration of the flight. The aim of the experiment is to achieve the world's first flight test of air-breathing supersonic ramjet engines, also known as scramjets. These engines could revolutionise the launch of small space payloads, such as communications satellites, by substantially lowering costs.



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