

Water usage needs urgent review

Decisions need to be made immediately on the use of groundwater in inland NSW, as current usage appears to be unsupportable, says an ANU scientist.

PhD student Carolann Wolfgang of the Centre for Resources and Environmental Studies (CRES) has found the amount of water flowing into the artesian basins is lower than figures currently quoted.

"Previous estimates on recharge rates appear optimistic and current usage may be unsustainable," she said.

"This will have major implications for those living and working in central western NSW."

Groundwater in this region supports pastoral and irrigation industries, towns, homesteads and has potential for use in mining.

"Current enterprises in the area are worth \$1 billion dollars annually," Ms Wolfgang said.

Her study encompassed the Coonamble Embayment, part of the Great Artesian Basin that covers an area of 90,000 square kilometres and includes the Bogan, Macquarie and Castlereagh Rivers catchments.

The Great Artesian Basin is the lifeblood in these areas and was believed to be unlimited. Recently, however, people have realised that this resource is not infinite and free-flowing bores were capped and quotas imposed.

Current groundwater consumption too high, says ANU researcher

"In some cases so much water was flowing from uncapped bores that it had the potential to threaten livelihoods and ecology across state boundaries," Ms Wolfgang said.

Until her study, it was believed that the Great Artesian Basin — spanning four states — was one large underground store of water and that everybody was tapping into the one "bucket".

After analysing drillers' logs, bore samples, flow rates and other geochemical data, Ms Wolfgang has found that the Coonamble Embayment is poorly connected to the rest of the Great Artesian Basin.

"This means that effects are localised in this region and water loss will directly affect those who are using it," Ms Wolfgang said.

"It should therefore be managed separately from the other parts of the Great Artesian Basin in a way suitable to its particular characteristics."

She also found that the area available to recharge the underground waters is dramatically smaller than previously thought.

"Recharge only occurs in the Warrumbungle

region and along the Castlereagh River. Contrary to accepted opinion, there is no evidence for major recharge from the southern portion of the Embayment," Ms Wolfgang said.

This resulted in the total area available to recharge the aquifer dropping from 35,000 square kilometres to 1,600 square kilometres.

Ms Wolfgang said it was fortunate that the Warrumbungles was a national park as this limited pollution and further extraction in this critical recharge zone.

However, she said she was concerned that pumping was allowed in areas close to the recharge zone just east of the national park boundary.

"Permits have been allocated without suitable regard to the importance of this area," Ms Wolfgang said.

Her research also found faults in the aquifer that allow water to seep up into the water underlying the Macquarie Marshes.

This may provide an important clue as to how the marshes remain moist while the surrounding land becomes parched during a drought.

While some stakeholders argue that water

quotas and bore capping are unnecessary or unreasonable, the importance of the marshes has been recognised in their listing as an internationally important wetland.

"The environment has a legitimate claim on water which maintains ecosystems and has enormous benefits to farmers," Ms Wolfgang said. "The water certainly does not go to waste."

As a result of her study, Ms Wolfgang believes that groundwater needs to be managed more effectively at the Federal level to allow coordinated action.

"Capping should be targeted to bores that will provide maximum long-term benefit and these can only be identified by having central access to data from each State," she said.

Ms Wolfgang argues that a national database of information should be established to help manage the country's water resources.

"The Great Artesian Basin is Australia's most important groundwater basin. It contains water up to 1 million years old and should be scientifically evaluated within the social and ecological context of the region," Ms Wolfgang said.

Her study was funded by the NSW Department of Land and Water Conservation and the Water Research Foundation of Australia.

JULIAN LEE

Most air crashes due to 'human error'

According to an ANU researcher, human error is a factor in two-thirds of all airline accidents, and poor communication with and between pilots is a major contributor to this.

PhD student, Maurice Nevile from the School of Language Studies said airline accidents were rarely caused by pilots' individual incompetence or lack of technical knowledge.

Problems more often stemmed from the way pilots assessed situations, performed tasks, made decisions and communicated in specific circumstances as a team.

Mr Nevile said he studied routine cockpit talk to analyse "the talk that gets things done". He found that successful airline flights relied upon good communication between pilots to ensure the pilots were constantly aware of the plane's mechanics, the crew and their environment.

He said that, despite a communications-training program for pilots, there was still room for improvement.

"During their training, pilots are told to speak clearly and accurately, but the meanings of those words aren't clarified or defined for them," he said.

To analyse pilots' communication, Mr Nevile sat in on 18 Qantas and Skywest flights around Australia and observed and videotaped the pilots during flight.

His research analyses the communication between pilots for the duration of a trip. Until now, detailed analysis of cockpit communication has generally only occurred after an accident by listening to the cockpit "black box" voice recorder. But, he said, this method was limited, because the voice recording held as little as half an hour of tape before an accident. Furthermore, when the tape was analysed, mood indicators such as pitch and silence were not considered.

"The transcriptions of cockpit voice recordings fail to note things like the pilots talking over each other, or the loudness of their voices. Even in America which has the most planes and the

highest number of accidents, the black box transcriptions are really basic, and hide a lot of information about what is going on," he said.

The importance of communication in an aircraft does not stop with pilots, Mr Nevile said. Cabin-crew had often contributed to tragic accidents by neglecting to inform the pilots of dangers such as ice on the wings or an engine fire.

"There have been many accidents which could have been prevented if the cabin crew had spoken up. For example, one major accident occurred when the cabin-crew saw ice on the wings, and assumed the pilots were aware of it. As it happened, the pilots were not aware of the ice, and the plane crashed."

Mr Nevile said another factor that had contributed to mis-communication in the past was that airline pilots were often former air force officers, and that the civil aviation industry had borrowed much from military research, training and practice. He said the airline industry had only recently realised that the skills required of fighter pilots flying solo differed greatly to those of modern airline pilots.

By analysing communication between pilots for entire flights, Mr Nevile has identified improvements he believes could prevent future accidents.

"Just small things, like acknowledging that the preflight checklist has been completed, are necessary communication tools. Currently, when the list has been completed, one pilot is told to say 'checklist completed', but the other pilot is not required to verbally acknowledge this. Acknowledging this is a basic necessity as it ensures both pilots know the checklist has been completed before they take off."

Mr Nevile's research has already been picked up by the Air Accident Investigators in Australia, who are keen to develop methods to accurately analyse conversation from cockpit voice recorders.

LEIGH BAKER

Sweet sounds for music school



Photo: Stuart Hay, ANU Photography

The three tuners: Canberra School of Music students (from left) John Ma, Douglas Macnicol and Tim Wickham, play the newly-acquired violins for Ruth Llewellyn at the official presentation.

The Canberra School of Music recently took possession of three violins with a significant historical connection to the School.

The violins were made for the School's founding Director, Mr Earnest Llewellyn, in the 1960s by his father-in-law, Arthur E. Smith.

Mr Smith was one of Australia's finest craftsmen of violins, often referred to as "the Australian Stradivarius", and his instruments still command a high price. Prof Llewellyn's widow, Ruth

Llewellyn, offered to sell two of the violins to the School at a discount price and the "Friends of the School of Music" helped raise a substantial portion of the \$20,000 needed, which was then matched by the University.

Mrs Llewellyn later decided to give the third instrument as a gift and presented all three to CSM Director, Prof Nicolette Fraillon, late last month.

The School said the violins would be used by the students for teaching and concerts.

Star students take to astronomy school

Over the summer holidays, 15 star students were selected in a national competition to attend an ANU astronomy school.

The students were given the opportunity to learn from leading academics in the Research School of Astronomy and Astrophysics (RSAA) and visited Tidbinbilla Deep Space Communications Centre and the Molonglo Synthesis Telescope.

"The summer school enabled the students to appreciate firsthand the workings of astronomical research facilities," school convener, Dr Geoff Bicknell of RSAA said.

"A highlight of the program was the opportunity to use Mt Stromlo's 74-inch telescope to explore the universe and learn about colour imaging," he said.

In a project led by Doctors Paul Francis and Ralph Sutherland of RSAA, the students photographed various night-sky objects with filters and were shown how to create a combined colour image.

Some of the objects included star-forming nebulae, elliptical galaxies and other objects typically studied by astronomers.

Dr Francis also led role-playing exercises in which the students were presented with a hypothetical discovery and were challenged to work together to determine what type of

object the discovery might represent.

"It was an interactive exercise that taught the students some of the sociological and astronomical skills required to do well in astronomy," Dr Bicknell said.

He believes that another benefit of the school was the chance for the students to interact with other like-minded people.

"In most cases the students were the only ones in their school with an interest in astronomy," Dr Bicknell said. "Each year the students set up an email network and keep in touch enabling them to continue their interest jointly."

As a result of attending the school, Dr Bicknell believes that most of the students will continue their education in science and would be surprised if at least half did not end up in astronomy.

"It must be a real inspiration to the students to receive lectures given by ANU astronomers that are at the cutting edge of their particular field," he said.

This will hopefully result in future talent to further Australia's excellence in the field, he said.

The summer school is an annual event financed by a grant from Perpetual Trustees. In 2000 it was supplemented by a scholarship from *Newton* magazine.

JULIAN LEE



Photo: Dr Geoff Bicknell

Watch this space: Star astronomy students from throughout Australia at the ANU's summer school.

Report criticises private health insurance subsidy

A discussion paper from the ANU's Centre for Economic Policy Research (CAEPR) argues the cost of encouraging private health insurance has been too high.

Dr Rhema Vaithianathan said that, while almost 3 million extra Australians obtained private insurance between 1998 and 2000, the cost of the subsidy may outweigh the benefits.

"In the long run, it is possible that

the overall health system will cost more as a result of encouraging private health insurance," she said.

The total subsidy is expected to cost more than \$2 billion per annum, but public hospitals are saving less than half that amount, the report claims.

Dr Vaithianathan's report concludes that subsidising private hospitals would be a more effective method of easing the pressure on public hospitals.

LETTERS

Coombs' shady tree's time had come

In response to a letter in the *ANU Reporter* of Friday 2 March entitled "Stumped over loss of Coombs shady trees", this is an issue close to my heart as it is my job to monitor and maintain all of the 14,000 plus mature trees on campus.

The tree in question was a *Eucalyptus nickolii* and yes it was at least 20 years old and no doubt offered good shade to this area. Unfortunately the tree was in very poor health and, after monitoring its health over the past couple of years, it was decided that the tree would be sacrificed in the interest of public safety.

The tree in question was suffering from an advanced infestation of longicorn beetle, which had killed 80 per cent of the tree's cambium (evidence of this could be seen not at

ground level, rather at about 1 metre above the ground where the live bark had died and was peeling away). The net affect of this infestation saw the death of several large limbs in the upper canopy, one of which had already fallen.

The danger with retaining a tree in such condition is not so much failure of the main trunk where the infestation had occurred, rather in the upper canopy where large branches can be shed as a reaction to the stress the tree is suffering.

I would like to assure readers that any decision to remove a tree on campus is not taken lightly and is usually a last resort.

I am ever aware of the negative impact that tree removal has on the local environment and I apologise

for that, however I would rather apologise for this than to have to apologise after someone has been injured or even killed by a falling branch.

On the issue of why this work was undertaken during a weekday, well we have to do it sometime! Regular weekend work does occur, however it is more expensive and it is reserved for tree work around roads, carparks and lecture theatres. The local business manager was notified that this particular tree was to be removed on this particular day and that person indicated that it would not be a problem.

Jeffrey Albrecht
Arborist/Horticulturist, Gardens and Grounds, Facilities and Services

Climbing in a group is the safest choice

In the 2 March *ANU Reporter*, Aat Vervoorn espouses the virtues of solo mountaineering and its links to Taoist philosophy. Having enjoyed similar climbing experiences in New Zealand and other parts of the world, I agree with him wholeheartedly when it comes to the safety and enjoyment of climbing, that "an important part of all this is being in tune [with] your environment".

However, I can't agree with his premise that you need to be alone in order to achieve this. Quite the opposite: climbing experiences can not only be more enjoyable in the company of others, but in dicey situations can be infinitely safer with other climbers to watch out or assist. In this sense, climbing together (in contradiction to the article) is less "thrill seeking" than climbing solo.

Of most concern is the message that the article gives aspiring climbers, in particular the misleading directive that "you should be in complete control, so nothing should go wrong".

This ignores the fact that mountaineers face two types of risks: those under their control, and those that are not. The latter (objective) dangers include hold breaking, avalanches, crevasse falls etc. They can be ameliorated by experience and mountaineering risk management (including being in tune with your environment), but not eliminated.

As an illustration, the photograph accompanying the article shows Aat alone on an open snowfield. In similar innocuous looking terrain many of my climbing colleagues and I have been forever grateful for the climb-

ing companion on the other end of their rope, who has held them safely when a hidden crevasse has opened up into a gaping chasm beneath. Some of the best climbers in the world have died this way while soloing, and no amount of Taoist tuning in to their environment would have prevented such disasters.

Every year the ANU Mountaineering Club (AMUMC), whose members number in the hundreds, produces a fresh crop of new climbers who set forth into the mountains of New Zealand and beyond. It would be a great pity if any of them were to fall victim to the perils of solo mountaineering in the pursuit of some philosophical construct.

Ken Baldwin
RSPHysSE and former ANUMC President

LETTERS TO THE EDITOR

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VC's plan to freeze debts wins approval

The ANU Council has approved a proposal by Vice-Chancellor Professor Ian Chubb to freeze the \$2.8 million debt of The Faculties and the Institute of Advanced Studies (IAS).

Prof Chubb made the proposal at a meeting of the Finance Committee late last month and told the Boards of The Faculties and the IAS earlier this month.

Chair of the Board of The Faculties, Professor Ric Pashley, said the move meant the debt, of which The Faculties' share is about \$2 million, would be deferred.

"Under this arrangement we are not asked to pay it back in the short-term. Neither are we asked to pay interest," he said.

However, The Faculties could be asked in the future to repay the money if they failed to operate within a balanced budget.

Prof Pashley said the freeze would bring relief to The Faculties that had struggled with a 6 per cent cut in its operating grant and rising debts. He said that about 15 per cent of The Faculties' academic staff had been cut in recent years.

Prof Pashley said the freeze would have a very positive effect on staff morale, as it was a demonstration by the new Vice-Chancellor of his very strong confidence in The Faculties. The Board of The Faculties formally applauded the Vice-Chancellor's announcement of his intentions earlier this month.

Last year the Council agreed to write off \$5 million of The Faculties' debt under a plan produced by Deputy Vice-Chancellor Professor John Richards. His plan, devised following the Review of The Faculties, also called for improved budgeting controls and the appointment of Deans based on them meeting selection criteria that included financial management. Several Deans have already been appointed under this process.

SEAN DALY

Census to determine level of harassment

The ANU will this month conduct a university-wide Census on harassment and discrimination, in what is believed to be a first in the higher-education sector.

The Census to determine the extent and nature of harassment and discrimination at the University has been commissioned by the Deputy Vice-Chancellor, Professor John Richards, as part of his plans to enhance the University's equity and diversity operations and grievance procedures.

Prof Richards stressed his total support for the Census and said he believed it was vital that as many people as possible responded. The planned exercise has also won widespread support from students, staff and academics across the campus.

It will take place from Monday 26 March and will be flagged by an email to all staff and students from the Vice-Chancellor, Professor Ian Chubb, encouraging everyone to respond by filling out the online or

Portals expand art of learning

The Institute of the Arts (ITA) has launched two new electronic information "portals" to expand students' access to research information and databases.

The portals were officially launched by the Vice-Chancellor Ian Chubb, who said the new technology brought key research resources to the fingertips of students, lecturers and researchers.

"As a scholarly institution, the ANU needs access to the very best information," Prof Chubb said. "These portals are gateways to specific areas of study, and really contribute to this being a great place to study or work."

ITA librarian Ms Joye Volker said the portals would provide access to a total of six new databases and four previously available databases. The databases allow access to art, opera and music dictionaries, periodical articles, books and museum catalogues.

"The music portal will provide access to sound files and scholarly music resources through an integrated Web gateway and the art portal will provide access to artistic images and scholarly art resources.

"We are delighted that this University initiative has come to fruition as it provides the Institute and the wider University with one of the largest ranges of full-text, web-based electronic resources for music and

University 'gateway' proposed

The ACT Government will this month host two public meetings to discuss the creation of a recognisable campus entrance at the end of University Avenue.

The "University Gateway" project is aimed at enhancing the approach to the campus.

Susan Conroy, a planning consultant with the Department of Urban Services, said the government had already begun discussions with the ANU's Facilities and Services Division and other parties in the Marcus Clarke, Childers Street and University Avenue areas.

"What we are asking people to do is think about how to improve the safety and amenity and create a sense of arrival for all the people moving between the campus and the city," she said.

"hard copy" questionnaire. Those responding will be asked to give their University identifier number and anyone who has not filled out the questionnaire after a set period will receive a reminder email.

The Census was developed by a group led by Professor Peter Bailey from the Faculty of Law and has been approved by the University's Ethics Committee. The web-based questionnaire includes up to 50 questions and will take respondents between three and 12 minutes, depending on their experiences.

Prof Bailey, a human rights lawyer who has twice served as Convener of the University's Council Committee Against Sexual Harassment (in 1989-95 and 1997) and was formerly Deputy Chair and Chief Executive of the Human Rights Commission, said it was important that as many people as possible responded.

He said the committee had worked to ensure the responses would be anonymous, with the University identifier



Photo: Stuart Hay, ANU Photography

Find art: Vice-Chancellor Professor Ian Chubb launches the new art "portals" with the Institute of the Arts Director, Professor David Williams and Librarian, Joye Volker.

the visual arts in Australia," she said.

Ms Volker said purchasing journals and publications on the visual arts and music had often proved difficult, making the portals a convenient and innovative alternative.

The portals are part of the ANU's Scholarly Information Portals Program, a joint venture funded by the University's IT Systems Management Plan, the University Library and the ITA Library and Resource Centre. Over the next three years, \$90,000 will be invested into the ITA Library for the program.

Early discussion with both city and University representatives had highlighted the desire for a recognisable feature, such as a large public artwork, as a way of defining the University boundary, Ms Conroy said.

She said that, although various interested parties had ideas on what they would like to see in the redevelopment, there were no formal drawings or plans at this stage.

"We find that it is more productive to give people a very rough idea of what we want to do and let them comment and make suggestions, rather than present them with some drawings and asking them what they think," Ms Conroy said.

She hoped the two public meetings, in the Manning Clark Lecture Theatre 5 on Friday 23 March from

12.30-1.30pm and in the PAP Moran Building, Room G008 on Thursday 29 March from 6-8pm, would produce ideas from which initial plans and drawings could be made.

Ms Conroy said the government was hoping drawings could be produced by July in time for incorporation into the ACT Budget bids for the 2002 financial year, with construction not expected to start until 2003-04.

ANU Facilities and Services Planner, Chris Coughlan, said the University would be putting together a small group to represent its interests in the project. He said the University was keen for a redevelopment of the area to go ahead and recognised the need for a formal entrance.

SEAN DALY

SEAN DALY

IN BRIEF

The Australian Vice-Chancellors' Committee (AVCC) will consolidate and, where appropriate, update its various codes and guidelines relating to entry and assessment standards. The President of the AVCC and ANU Vice-Chancellor, Professor Ian Chubb said the intention was to publicise the codes throughout the university community so that no one could be in any doubt of the rights and protection afforded to them.

The ANU and the Canberra Business Council hosted the second in a series of luncheons titled 'Outlook 2020' at the National Press Club on 8 March. Guest speakers were David Chessell, Director of Access Economics, and the ANU's Prof Tim Brailsford. Mr Chessell spoke on the changes predicted for Canberra's economy in the year 2020. The event was sponsored by TransACT Communications.

A book about a pioneer Australian accountant, co-authored by the Faculty of Economic and Commerce's Professor Russell Craig, has been mentioned in the 2000 National Literary Awards. The book, *John Croaker, Convict Embezzler* was 'highly commended' in the Christina Stead Award for biography, autobiography or memoir.

PEOPLE

Dr Patricia Eastale from the Law Faculty was one of five women to receive an 'ACT Women's Award' from Chief Minister Gary Humphries on 8 March — International Women's Day. Dr Eastale has made a significant contribution to the ACT community through her academic and community work in the area of domestic violence, sexual assault, battered woman's syndrome and gender issues in the law. She has contributed through primary research, speaking in university and continuing education programs.

Ken Grime has accepted an appointment as Head of the Legal Office and University Solicitor. Mr Grime has extensive legal experience in public and private practices and will leave a partnership in a Canberra legal practice to join the ANU. His career has included periods as a Senior Legal Officer with the Pitjantjatjara Council and the Central Australian Aboriginal Legal Aid Service. Mr Grime will take up duty with the University on 2 April.

Zoe Greenwood, an honours graduate from the ANU is helping to organise a musical evening in London on 16 March to raise funds for CARE International's work in developing countries.

The Board of Directors of The Australian Vice-Chancellors' Committee (AVCC), last month appointed Mr John Mullarvey as the AVCC's new Chief Executive Officer. Mr Mullarvey has been the Deputy Executive Director of the AVCC since 1990.

Professor Sir Rutherford Robertson, Director of the Research School of Biological Sciences 1973-78, died on 5 March. He was 87.

SEAN DALY

RSES celebrates four journeys

EVENTS

A conference titled "Exploring the Earth: a Celebration of Four Journeys" was held last month to mark major milestones in the careers of four distinguished scientists from the ANU's Research School of Earth Sciences (RSES).

Foundation Director, Emeritus Professor Anton Hales, celebrated his 90th birthday, Professor Bill Compston's 70th birthday, Professor Ian McDougall's retirement and Professor David Green's imminent retirement as Director.

The scientific program, consisting of four day-long symposia each built around the research interests of one of the four principals, addressed themes ranging from seismology and geodynamics to petrology, geochronology and isotope geochemistry. The intention was to reflect on the careers of these internationally renowned researchers by reviewing progress in their chosen fields and assessing the prospects for future advances.

Highlights of the week included the 2001 Jaeger-Hales lecture delivered by Professor Philip England of Oxford University who examined the systematic spatial distribution of volcanoes in island arcs above the steeply dipping (Benioff) zones of deep seismicity worldwide.

He advanced a simple explanation, based on the computed thermal structure of the wedge of mantle material overlying the Benioff zone.

In petrology and geochemistry, highlights included Dr Andrew Berry's (RSES) in-situ determination of the oxidation state of transition metals in silicate melts by synchrotron x-ray spectroscopy and Dr Ulrich Faul (RSES) on emerging constraints on the grain-scale melt distribution and melt migration within the Earth's upper mantle. Prof Gerhard Brey from Frankfurt showed how the chemical composition of the lower mantle might



Photo: Stuart Hay, ANU Photography

RSES foundation Director, Emeritus Professor Anton Hales with Professor Philip England of Oxford University, who delivered this year's Jaeger-Hales lecture.

be constrained by the chemical compositions of mineral inclusions of very deep-seated origin transported to the Earth's surface in diamonds.

Quantification of the processes of mountain building, erosion, landscape evolution and soil formation was a major theme addressed by a number of speakers. Prof Mark Harrison (UCLA and Director-elect RSES) spoke of the importance of high-resolution profiles of the concentrations of radioactive parent and daughter isotopes in constraining uplift histories. Prof Andrew Gleadow (Melbourne University) showed how fission-track ages from sites Australia-wide can be used to infer denudation rates and thus to estimate palaeotopography. Dr Paulo Vasconcelos (University of Queensland) demonstrated the use of isotopic methods to date the formation by rock weathering of the regolith with its built-in history of past climatic variations. Dr Jean Braun demonstrated the use of

elegant computational methods in the modelling of crustal deformation and the related processes of erosion and landscape evolution.

New techniques employing scattered seismic waves to image structures in the deep crust and upper mantle were described by Dr Michael Bostock (University of British Columbia). The lectures by Profs Brian Kennett (RSES) and David James (Carnegie Institution of Washington) provided an interesting comparison of the deep structures of regions of Australia and Southern Africa that were close neighbours in the ancient supercontinent of Gondwanaland. Prof Yoshio Fukao (University of Tokyo) showed images of descending lithospheric plates and rising mantle plumes substantially improved through selected expansion of the seismic traveltime dataset.

Prospects for improved performance of the School's new SHRIMP ion microprobe were outlined by co-

designer with Prof Bill Compston, Dr Steve Clement, whereas Prof Don de Paolo (UC Berkeley) demonstrated the potential of calcium isotope geochemistry especially in the fields of palaeontology, palaeoceanography and biochemistry. Jan Veizer (Ruhr University and University of Ottawa) summarised palaeoclimatological research based on stable isotope geochemical techniques, emphasising that water vapour rather than CO₂ may be the greenhouse gas that most strongly influences climate change.

The remarkable accomplishments of the four honourees, all Fellows of the Australian Academy of Science and two (Compston and Green) Fellows of the Royal Society, highlight the special opportunities available for earth sciences research within the block-funded Institute of Advanced Studies at the ANU.

The founding fathers, Jaeger, Ringwood and Hales, cultivated an environment conducive to the development of quantitative methods of mathematics, physics and chemistry for application to major geological problems. Their leadership and the quality of the academic staff they recruited were the main ingredients in the early success of the School and its predecessor department within the Research School of Physical Sciences.

"Exploring the Earth" provided an opportunity for RSES staff and students to join many renowned overseas, interstate and local participants in celebrating the milestones in the careers of the honourees, and to wish them well in their future endeavours.

In doing so, the RSES community also reaffirmed its commitment to further enhancing the role of the School within the Australian and international scientific community.

Dr Ian Jackson
Research School of Earth Sciences

The Economics Program in RSSS and the Graduate Program in Public Policy will hold a public lecture series, "Welfare and the Labour Market: A New Frontier for Reform?" on 14-16 May. The lectures are in honour of the late Professor Fred Gruen, Head of the Economics Program from 1972-1986 and inaugural Director of the Centre for Economic Policy Research, 1980-1986. Lectures will be presented for the Economics Program by F.H. Gruen Distinguished and Visiting Fellows on Wednesdays between 5-6:30pm in the GPPP Lecture Theatre, Sir Roland Wilson Building.

Dr Brendan Mackey, chair of the Australian Earth Charter Committee will give a public lecture on "The Earth Charter" on Wednesday 21 March. Dr Mackey will discuss the drafting and global consultation process, provide an interpretation of the document's principles and examine how the Earth Charter can assist in the promotion of a more environmentally secure world. The lecture will be held at 8pm in the Reception Room, Legislative Assembly Building, Civic Square. Contact the Nature and Society Forum on 6288 0760 or <natsoc@natsoc.aust.com>.

The School of Music and the National Multicultural Festival Canberra will present an evening of music and merriment at the Llewellyn Hall to celebrate the Centenary of Federation on Saturday 18 March. The works are drawn from those performed at the opening of the first Parliament of the Commonwealth of Australia in 1901 and include everything from Gilbert and Sullivan to Verdi. The soloists, who will be appearing under the stage names of the artists who performed in the 1901 concert, will be in full Federation costume. Members of the audience are encouraged to do likewise. For further information contact the Canberra School of Music Concerts Manager, Katie Woods on 6125 5771.

Professor Peter Little, recently appointed Professor of Medical Biochemistry, University of NSW will lead a provocative discussion on the human genome. His speech titled "After the Genome" will be held at the John Curtin School of Medical Research on March 28. For more information contact Dr Peter Jeffrey: 6125 3652 or <peter.jeffrey@anu.edu.au>.

Meeting hopes National Council may fill sustainability niche

On Friday 2 March, University House hosted a meeting to discuss a proposal to establish a National Council for Sustainable Development (NCSD).

Among those at the meeting were the ACT Deputy-Chief Minister Brendan Smyth, Virginia Young (The Wilderness Society), Ella Antonio (Earth Council), Mike Williamson (Environment Business Australia), Stephen Macready (Interface Carpets), John Pritchard (Australian Local Government Association) and

Professor Ian Lowe (Griffith University).

The establishment of NCSDs was a key recommendation that came out of the Rio Earth Summit in 1992, and they exist in more than 70 countries around the world.

The main focus of NCSDs is to bring together civil society, industry and government to work towards sustainability in a collaborative and participatory manner. The integration of economic, social and environmental

action, and localising global agreements such as Agenda 21 are some of the other functions an NCSD serves.

The structure of NCSDs vary widely in the countries where they have been established, so the form an Australian NCSD should take was one of the main topics discussed at the meeting.

It was decided that an Australian NCSD could fill a niche not already covered by other bodies in Australia. Suggestions that the NCSD promote

education and understanding of sustainability issues, facilitate new partnerships and mediate sustainability issues, were widely supported.

In the coming months a business plan for an Australian NCSD will be developed and taken to Federal and state governments and key national organisations for consideration. An Asia-Pacific NCSD meeting will be held in Brisbane in November, and it is hoped that an Australian NCSD will be planned, if not operating, by then.

Dr Brendan Mackey and Sonya Duus

UPCOMING CONFERENCES

The Research School of Social Sciences' Law Program will hold a two-day conference titled, "Towards a History of the Australian Administrative Law System" on 31 March-1 April. It will explore the legal, political and administrative background to the system of law, and will be of interest to lawyers, political scientists, historians and any observer of the Australian government. Experts will speak on the early days of the system, its present state and future directions. The venue is the Law Faculty's Lecture Theatre. For further details contact Professor Peter Cane on tel: 6125 4162; fax: 6125 4933; email: <Peter.Cane@anu.edu.au>.

The 11th David Nichol Smith Conference titled "The Exotic During the Long Eighteenth Century (1660-1830)" will be held at the National Library in Canberra between 26-28 March. This will be the first in a sequence of conferences and events organised throughout 2001 as part of the Humanities Research Centre's theme of 'Enlightenment'. For further information contact Dr Christa Knellwolf on 6125 8963 or email: <Christa.Knellwolf@anu.edu.au>; website: <http://www.anu.edu.au/hrc/activities/conferences_2001/knellwolf.html>.

The seventh biennial national confer-

ence of the Australian Society for the Study of Labour History will be held at ANU from 19-21 April. For further details contact 6125 2347, email <l a b h i s t @ c o o m b s . a n u . e d u . a u > or visit the conference website at <http://histrss.anu.edu.au/lhconf.html>.

The ANU's Research School of Physical Sciences and Engineering (RSPHSE) will host the Australian Workshop on Nanotubes and Fullerenes 2001 on 3-4 May. Registration and abstract forms can be downloaded at <http://rsphysse.anu.edu.au/nanotube/awnf2001/>.

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Comprehensive history of rural agents

By JOHN MERRITT*

In recent years Australian historians have been accused of writing more and more about less and less. Simon Ville is an honourable exception. His study of stock and station agents covers both Australia and New Zealand and extends from the 1840s to the 1990s.

With an undertaking of such scope and span the historian is in danger of being overwhelmed by his/her material. Ville's book is full of information, but he is in control throughout.

The stock and station agents he writes about were once household names in Australasia, especially Dalgety, Elder Smith, Goldsborough Mort and the New Zealand Loan and Mercantile Agency.

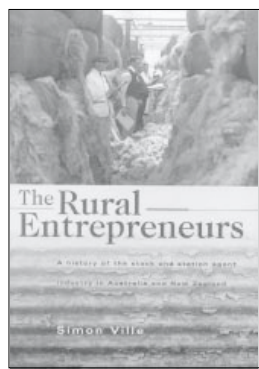
Ville argues that they and other like firms filled an "entrepreneurial gap" in Australasian farming, overcoming the problems of international and local isolation and making the sustained growth of rural production possible.

This central theme is developed in a succession of chapters that deal with aspects of the growth, structure and policies of the agents.

The subject matter of each chapter is different but they all proceed through the same chronology, an approach that in less skilful hands could lead to excessive overlap.

Ville never falters as he shows how the agents established networks in farming communities and how they developed financing, marketing and advisory services and, in the case of the remarkable Australian Estates, a scientific research service.

The parts of the whole fit together well and the reader not only sees the "entrepreneurial gap" filled, but learns how the agents



The Rural Entrepreneurs:
A history of the stock and station agent industry in Australia and New Zealand

Simon Ville

CUP, 2000, \$49.95.

expanded their businesses, dealt with competition and changed with the times.

In Australia, the stock and station agents were more closely involved with wool than with wheat, the latter being subject to more government direction and regulation.

From the outset their ties to the pastoral industry were social and political as well as economic. Their representatives were members of pastoralists' clubs and of pastoralists' unions.

They involved themselves fully in the strikes of the 1890s, backing the militant pastoralists in 1890 and 1891, although in 1894 their desire "to get the wool off" created a debilitating split in pastoralists' ranks.

Ville does not deal with these social and political ties in any detail although he is fully aware of their economic significance.

The original networks, through which the agents built their businesses, relied heavily on former pastoralists whose judgment was sometimes warped by old associations or a few too many whiskies in the Warrigal Club.

The financial collapse of the

early 1890s had this mateship dimension to it.

Some of the agents went out of business as wool prices fell and the depression worsened. Others were forced to reconstruct. All of them were stuck with stations acquired after they had been forced to foreclose on delinquent borrowers.

They were still in serious difficulties when the 1894 shearers strike took place and they chose not to resist the demands of the Australian Workers' Union so that they could market their wool as soon as possible.

Recovery had barely begun before the drought of 1895-1903 brought more trouble. In 1902 a new man at Elders derisively referred to colleagues "whose only office was under their hat". But the necessary lessons were learnt from the traumas of those years.

When the good seasons returned most of the surviving agents sold off their stations and honed their administrative and accounting skills.

They remained active in industrial relations, however, and were influential political lobbyists for the pastoral industry for much of the 20th century.

In the Perth of my youth, four significant buildings stood on the corners of the intersection of William Street and St Georges Terrace. The Bank of New South Wales was on one corner, an insurance company on another. Elder Smith was on the third corner and there was a pub on the fourth.

It was said that Western Australian farmers, whenever they visited "the big smoke", did all

their business at that intersection. Ville makes that claim less fanciful than I had imagined.

Should future Australians ever wonder how their country was once able to dominate international wool markets, his book will prove their most useful guide.

*John Merritt taught history at ANU for several years and is the author of *The Making of the AWU and That Voluminous Squatter*.

Purves Smith at DHG



Image: Peter Purves Smith, *New York*, 1936, oil on canvas, Art Gallery of New South Wales

A touring exhibition, Peter Purves Smith (1912-1949), opened in the ANU's Drill Hall Gallery (DHG) last week.

In the early 1940s Peter Purves Smith was considered one of Australia's most promising young artists along with his friend Russell Drysdale, and the Sydney painter William Dobell.

By 1942 his paintings had received accolades from a number of art reviewers outside Australia, and one of his paintings had been acquired by the Museum of Modern Art (New York). But Purves Smith died in 1949, too soon to make an indelible stamp on the consciousness of later generations of Australians. It was left to Drysdale to carry forward the outback subjects and the surrealist note of 'unquiet' that had been Purves Smith's special contribution to Australian art in the years immediately before the war.

The paintings and drawings open up various perspectives on people and places. They speak for the artist's life; Parisian streets and cafés, London in the blackout, outback New South Wales (where he was a jackaroo in the early 1930s). The notes he strikes are those of fashion, frivolity, love, war and suffering.

Through the sequence of works, one sees that events in Peter Purves Smith's life changed him. If the pre-war paintings are those of a young man participating in but also standing aside from the deceptions of modern life, the postwar paintings and drawings are eloquent of a personal engagement with life and death.

The exhibition Peter Purves Smith (1912-1949) (and its tour to the Lawrence Wilson Gallery in Perth, the Museum of Modern Art at Heide in the artist's hometown, Melbourne, and Benalla Art Gallery in regional Victoria), has been made possible by the Federal Government's national touring exhibitions grant program, Visions of Australia.

The exhibition is the second survey of Purves Smith's work, the first being in 1976 at Joseph Brown Gallery in Melbourne.

Last Friday, Daniel Thomas officially opened the Drill Hall exhibition and launched a book, *Peter Purves Smith: a painter in peace and war*, by Mary Eagle. The exhibition continues until the 15 April 2001. Curator of the exhibition, Mary Eagle, will give a floor talk next Friday at 12.30pm.

Tony Oates
DHG Exhibitions Officer

WHO WROTE IT?

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Now, it is clear that the decline of a language must ultimately have political and economic causes: it is not due simply to the bad influence of this or that individual writer. But an effect can become a cause, reinforcing the original cause and producing the same effect in an intensified form, and so on indefinitely. A man may take to drink because he feels himself to be a failure, and then fail all the more completely because he drinks. It is rather the same thing that is happening to the English language. It becomes ugly and inaccurate because our thoughts are foolish, but the slovenliness of our language makes it easier for us to have foolish thoughts. The point is that the process is reversible. Modern English, especially written English, is full of bad habits which spread by imitation and which can be avoided if one is willing to take the necessary trouble. If one gets rid of these habits one can think more clearly, and to think clearly is a necessary first step towards political regeneration.

The first entry to identify the above piece and its author, drawn after the close of entries on Wednesday 7 March, will receive a \$30 voucher from University House. Entries should be emailed or sent to the Editor (see page 2 for contact details).

Jan Lloyd Jones won the Who Wrote It? of 16 February, correctly identifying the piece from Milton's *Areopagitica*.

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Genome 'disappointment' brings proteomics to fore

Only five years have passed since the publication of the first complete genome sequence of the bacterium *Haemophilus influenzae*.

Since then, the genomes of 30 bacterial and multicellular organisms, including the plant *Arabidopsis thaliana* and a draft version of the human genome have been completed.

Up to 200 other genomes will be completed in the near future.

One clear message emerging from this deluge of genomic data is that the functions for up to 40 per cent of the theoretical gene products of these genes remain unknown in each organism, and about one quarter of these are completely novel.

In addition, due to such processes as alternative splicing, RNA editing and modification of proteins by a wide range of chemical additions, one gene can give rise to many protein products.

A major challenge of the post-genomic era will be to address the functional complexity of an organism at the protein level.

The "disappointing" finding that there are comparatively few human genes—about 30,000—has caused a major realignment in thinking that brings proteins firmly to centre stage.

However, proteins contain much more biochemical diversity than the

nucleic acids that comprise genes, and the task of addressing the protein "output" of a genome is a challenging task.

One high throughput technology that has emerged to address this challenge is "proteomics".

The term "proteome" was coined by the Australian researcher Mark Wilkins in 1995 to describe the PROTEin complement of the genome.

Proteomics involves combining techniques from a broad range of disciplines: biochemical techniques to isolate, separate and resolve the proteins present in complex mixtures, imaging techniques to detect, visualise, record and compare the patterns of the separated proteins, robotics for high speed handling of large numbers of proteins, mass spectrometry for accurate determination of the mass or sequence of the proteins (or peptides derived from them) and, finally, bioinformatics to interpret the huge data sets.

Proteomics allows the researcher to confirm that the predicted product of a gene is really made into a protein.

Up to this point, many genes identified from genome sequencing projects encode for a theoretical protein product. In addition, many chemical modifications (e.g. addition of phosphate or a sugar molecule or the trimming of a small

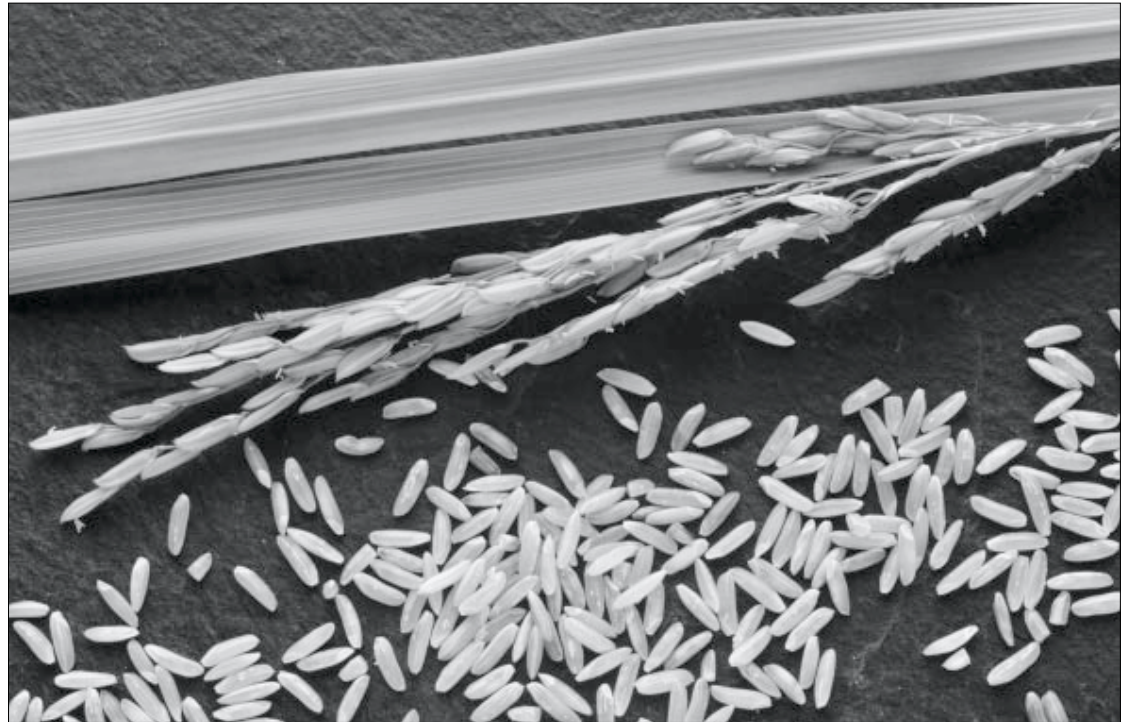


Photo: Jeff Wilson, RSBS

World food: Proteomics may lead to substantially increased yields in the world's vital food crops, such as rice.

part of the end of a protein) are known to occur to proteins after they are made.

These modifications are critical for proper protein functioning or for switching a protein's activity on or off. These modifications cannot be determined by looking at the

DNA sequence alone. In a high-throughput proteomics laboratory, hundreds of proteins can be analysed and identified in a day.

In a sense, both genomics and proteomics are "bottom up" approaches to scientific discovery, yielding fundamental information

about a large number of components that each make up the jigsaw puzzle of life. This represents a fundamental paradigm shift in the way we approach complex biological questions.

Dr Michael Djordjevic
Genomic Interactions Group

Self-fertilising rice is genetic engineering's new 'unicorn'

How do we know that the Genomic Interactions Group hugs the cutting edge of genetics? How do we know what that edge is? Frontiers are obvious when science plods steadily along, however, genetics has been wrenched by revolutions every 50 years.

The 1900 Mendelian revolution erected two new quests for genetics. One was to relate all biological traits to "genes". The other was to find the material basis for the gene, which was detectable only by its consequences, able to reproduce and dictated the most intimate details of organisms and mutate.

The discovery of the DNA double helix in 1953 concluded this quest and ushered in a molecular revolution.

Molecular geneticists first sought universal principles of gene structure, gene expression, gene control and the universal genetic code. Chasing idiosyncrasies of a particular trait or genes was "stamp collecting".

Recently, molecular "stamp collectors" discovered the extraordinary repertoire of enzymes that cells use to manipulate the structure and information of their genes.

Their followers realised that these gene-processing enzymes—transposases, restriction endonucleases, ligases, polymerases and so on—can be used to artificially work almost any conceivable change to genes in the test tube.

The human genome is the first awesome demonstration of this newfound prowess. It heralds the new unnamed post-molecular genetics, again, with two tracks.

One is systems genetics. How our tens of thousands of catalogued

genes cooperate to produce the countless wonders of the human body.

The "big labs" are surveying what subsets are activated together in particular situations. Geneticists monitor the activity of genes from the presence of their RNA expression products.

Scanning each gene in the entire genome for RNA production is called genomics. More recently, geneticists have acknowledged that the real measure of gene involvement must be their protein products instead of the RNA intermediates. This vastly more difficult survey has been coined "proteomics".

Genetic engineers find unicorns perfectly acceptable. If you want one badly enough to pay for it they (eventually) will engineer a horn on your horse ...

The ANU's Genomic Interactions Group (GIG) is arguably the most technically proficient proteomics laboratory in the world. But, post-molecular genetics has a second arm, even more visionary than systems genomics, genetic engineering.

Everyone is disturbingly aware of its promise to reshape our agriculture, medicine and ourselves. Ten years ago I wrote, and I still predict: "In a dozen generations people well may advance [through genetic engineering] as far above our contemporary form as we sur-

pass the apes. Descendants of another dozen generations may regard our mental capacities as we do the mind of a mole.

"When they have progressed as far beyond us as you and I have over a mushroom surely our descendants will match more closely our images of minor gods, if not Jupiter Himself, than humans."

Any politician, venture capitalist or patent attorney will point unhesitatingly to genetic engineering as the cutting edge of genetics. Yet, genetic engineering is so brashly radical that many geneticists deny that it is genetics at all—or even science.

Its DNA jockeys craft instead of create, imagine instead of experiment, boast of patent applications instead of publications and, worst of all, are concerned with what can be in biology instead of what is.

Genetic engineers find unicorns perfectly acceptable. If you want one badly enough to pay for it they (eventually) will engineer a horn on your horse, and then patent the result. Demand remains low for these toys but not for cheaper pharmaceuticals, genetically modified foods and recombinant vaccines.

One of the most ambitious unicorns that genetic engineers are working on now is rice plants that fix nitrogen. GIG is in this fray and I will bet that if anyone can pull it off this decade it will be this group.

Just before my first visit to the Research School of Biological Sciences (RSBS) in 1973, the group announced that they had inserted the first functional foreign gene into plant and animal cells. Their audacity stirred the scientific community in Canberra into an uproar.

The derision over a genetic breakthrough too far ahead of its time has long since died. The incident is all but forgotten but I remember that the GIG group was the pioneer into 21st century genetics.

If anyone is going to command rice to fix nitrogen it will be GIG. Keep watching for unicorns in the rice paddocks of RSBS and for the jockeys at GIG riding them.

John Campbell
Visiting Fellow



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Protein analysis may improve disease diagnoses

Biologists at the ANU have refined a protein characterisation process that may have a crucial role in diagnosing diseases and developing drugs.

The technique, called proteomics, can be used to rapidly compare proteins present between healthy and diseased cells.

"It is very fast and internationally the technique is being used to develop markers that will play a role in early diagnosis of cancer," Dr Jeremy Weinman of the Genomics Interaction Group (GIG) said.

Proteomics is a relatively new field that examines the range of proteins in a given cell or tissue type at any particular time.

"Proteins, as well as the metabolites, represent the working parts of a cell and, therefore, studying them is a powerful way of understanding what is happening.

"By looking at the same types of cells in different conditions, we are able to see the types of proteins present at different stages of development or disease," Dr Weinman said.

Because the types and concentration of proteins found depend on conditions at any one time, Dr Weinman believes proteomics will be particularly valuable in determining gene function.

"The proteins expressed in a cell are a reflection of the stage of development and environment, both of which can be manipulated experimentally," he said.

The first step, however, is to extract most of the several thousand proteins present in a cell at any one time.

This is done by a chemical process that dissolves the water-soluble components, then the non-water soluble components from cell membranes.

Dr Charles Hocart, also of GIG, said this step was critical to the success of the whole method.

"Unless you extract the full set of cellular proteins, the analyses will be potentially limited," he said. "It is also vital that the process is reproducible, and we've gone to a lot of trouble to achieve this."

Once the proteins are extracted, they are separated using a process that distinguishes them by mass and charge.

"Scientists have been using this technique for 10–15 years now, but we have developed it to a point where the reproducibility of the process enables small differences in protein amount to be determined," Dr Hocart said.

Once separated the proteins are chopped into smaller fragments using an enzyme and analysed in a mass spectrometer.

The mass spectrometer can very accurately determine the mass of the fragments, which provides the scientists with a "fingerprint" to be

compared to a list on a database.

"The fingerprint method enables us to identify proteins at a rate of several hundred a day," Dr Hocart said.

An alternative technique puts the fragments through a second mass spectrometer and allows the amino-acid sequence of the protein to be determined.

"This is amazingly powerful as, knowing the amino-acid sequence, we can find the DNA sequence that makes the protein and can often identify the function by matching it with similar proteins in other species," Dr Hocart said.

He said that the Australian Proteome Analysis Facility in Sydney, which they use for their mass spectral analyses, has allowed labs like theirs to pursue cutting-edge international research.

"It used to take us a year to characterise one protein. Now we can

start to understand the hundreds of protein changes that can be necessary, for example, to adapt a plant to environmental stresses such as drought and salinity.

"The use of proteomics represents a paradigm shift in terms of the biological complexity that can be analysed. We have demonstrated that it is a reliable technique and can be used by scientists with confidence," Dr Hocart said.

The scientists believe that proteomics will be beneficial to plant and animal breeders and in many areas of health.

"Proteomics will not only provide the basis for understanding complex systems, but will create protein markers that can be used, such as genetic markers are now used for identifying disease susceptibility," Dr Weinman said.

JULIAN LEE



Photo: Jeff Wilson, RSBS

Flower power: PhD student Nijat Imin dissects rice flowers to extract the protein.

Answers to questions not even thought of

An ANU biologist is developing a flexible database system with the ability to answer questions its designer has not even thought of.

"The proteomics database will allow scientists to ask questions that were never anticipated in its design," Dr Georg Weiller head of the Bioinformatics Lab in the Genomic Interactions Group (GIG) said.

He said that in basic science it was often the questions that changed, and the answers that followed were used to construct new questions.

"It will be quite unlike an ATM machine which can only answer the same questions over and over. For example: 'How much money is in my account?'" Dr Weiller said.

The database is being developed to analyse information on *Sinorhizobium meliloti*, a bacterium that is able to convert nitrogen in the atmosphere into

a form that plants can use for growth.

Scientists in the GIG group are trying to understand how some plants can work with nitrogen-fixing bacteria. They hope to produce a nitrogen-fixing, or self-fertilising, version of rice.

"The challenge to link nitrogen-fixing bacteria with some of the world's staple crops such as rice is a long-term goal of the GIG," Dr Weiller said.

The GIG scientists are analysing the proteins within the bacteria, grown in different conditions, to help understand this process.

Dr Weiller said that this produces an enormous array of complex data that must be managed, compared and analysed.

"The Bioinformatics Lab has a long history in the development of state-of-the-art software for such genetic analysis. The lab is currently developing a revolutionary approach for handling and interpreting the huge data

sets resulting from research within the group," Dr Weiller said.

He said that around the world, there are several approaches to database design underway to handle this type of data. However, many of these approaches have their disadvantages, including the reliance on specific equipment and a lack of flexibility.

"Traditional database design focuses on specific ways of managing volumes of diverse data, for instance an accounting system will be able to perform a specific type of transaction (query) for different customers or amounts of money.

"However the flexibility required in science can hardly be achieved with a central database system that attempts to provide a one size fits all solution," Dr Weiller said.

Instead, he believes a series of interconnected smaller and more specialised databases, able to work un-

der a coordinating system, will better meet the needs of basic science.

"Our proteomics database system is much more flexible and allows scientists to ask questions that were not anticipated in the original design. The smaller databases are specialised for only a small set of tasks and do not rely on specific equipment," Dr Weiller said. "They are self-contained and relatively simple."

He said that the simplicity of the individual databases provides the key to modification as the need arises. Initially the proteomics database system will assist in protein identification in *S. meliloti*, however, it will have applications to all future organisms as they are sequenced, including legumes and rice.

"It will take scientists to a whole new level as they are able to efficiently analyse whole networks of protein and gene interactions," Dr Weiller said.

JULIAN LEE

How plants 'talk' may open new chapter in the book of life

Scientists at the ANU are taking a radical new approach to understanding the book of life in the hope of providing more food to the world's population.

"We are moving beyond looking at the genome — the genetic make-up — to exploring the proteome, which is defined as the protein complement of the genome," Dr Michael Djordjevic of the Genomic Interactions Group (GIG) said.

The scientists aim to use proteome analysis to fast-track their understanding of symbiotic nitrogen fixation, which Dr Djordjevic describes as one of the most important processes for supporting life. For a growing number of scientists, the proteome is the frontier as it provides an insight into the processes of life not available by looking at genes alone.

"Proteomics allows scientists to better understand complex systems because you do not look at that system one gene at a time," Dr Djordjevic said.

After completing the Human Genome Project, scientists believe there are only about 30,000 human genes, far fewer than previously thought.

However, according to Dr Ulrike

Mathesius also of GIG, each gene can result in several related proteins with different functions.

"While 30,000 genes may not be very many, the diversity possible from the resulting number of proteins is very exciting. The protein level is clearly where the action is," Dr Mathesius said.

By looking at the proteome, she said, we can more rapidly unravel the multitude of biochemical pathways in organisms.

The researchers are using the proteomic approach to understand the symbiosis between the plant *Medicago truncatula* and the nitrogen-fixing bacterium *Sinorhizobium meliloti*.

By forming a symbiosis with nitrogen-fixing bacteria, legume plants, such as beans, are able to provide some of their own fertiliser and are therefore an important part of enriching the soil.

By studying the relationship between these two organisms, the researchers aim to create a nitrogen-fixing version of rice.

"Rice production can be increased by the application of a nitrogen-based fertiliser, however to meet future food needs would require an enormous in-

crease in fertiliser," Professor Barry Rolfe of GIG said.

"If we can come up with an alternative nitrogen supply, such as the use of nitrogen-fixing bacteria, we may be able to create more sustainable rice production," he said.

By using proteomics, Dr Djordjevic believes they will be able to understand the subtle communication occurring between legume plants and nitrogen-fixing bacteria.

"We can determine the flow of signals between the bacteria and leguminous plants, and we can compare this with what happens when the bacteria attempt to 'talk' to rice," Prof Rolfe said.

By determining where in the "conversation" the bacteria stop signalling the rice plant, the scientists hope to explore ways for establishing successful communication. This could be the beginning of creating a nitrogen-fixing rice plant and increasing yields.

"Proteomics promises to change the way we do things," Dr Djordjevic said. "In a few months we have been able to discover what in the past would have taken 25 years."

JULIAN LEE

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Soviet science then, Russian ruin now

The sole difference in the structure of the Academy of Sciences in the Soviet Union and now is that the Academy of Sciences in the former republics are now independent.

The Academy is a Society with rules of operation set up by its founder, Catherine the Great, 280 years ago. It comprises about 1,500 academicians who elect new members every four to five years. In order to attract eminent scientists from abroad, Catherine had to provide some heavy financial inducements. To this day if a scientist becomes a member they automatically receive substantial financial rewards and privileges for life.

As a rule all Directors of Academy Research Institutes — which are a giant CSIRO-ANU IAS — have to be academicians.

The Academy has accumulated vast property holdings including the Research Institutes, mechanical plants — factories, agricultural holdings, museums, hospitals, medical services, hotels, rest homes and so on.

Not surprisingly there is a massive bureaucratic machine. The Academy receives a block grant from the national budget. The bureaucracy distributes this (principal) financial support among the different research organisations that carry the burden of practically all Russian science. It is important to understand how the system worked previously in order to understand what happened after “perestroika”.

In Soviet times the Academy of Sciences Institutes were the Mecca for young people.

Under the Soviets, the Academy of Sciences was able to attract and retain the very best distinguished scientists and young people. They had enough money, excellent conditions and good equipment. Importantly too, many people

Professor Vadim Ogarev from the Russian Academy of Sciences, Institute for Physical Chemistry visited the Department of Applied Mathematics recently. He gave a brief talk to the Emeritus Faculty on the catastrophe facing Russian science following the collapse of the Soviet Union and its economy. He is a long-time colleague and friend of **Professor Barry Ninham** of the Research School of Physical Sciences and Engineering. Prof Ninham has visited the Soviet Union, Russia and Uzbekistan on a number of occasions. Below is Prof Ninham's summary of Prof Ogarev's address, which has lessons for Australia.

genuinely believed that life would improve, that they could contribute to the advancement of Russia. Morale was good because, as you know, Russia has good people, immense space and unimaginable natural resources.

At the same time, of course, many intelligent people understood that the Soviet Union was a closed society under the strong Communist ideology. The Communist ideology was bad for economic development. Everybody knew this. The government spent a lot of money on the military, assisted Vietnam, Cuba, Angola and other countries and made war in Afghanistan. The consequent drain on resources diminished the available resources for fundamental science, public services, agriculture and so on.

The point is that the general situation in the Soviet Union had taken a downturn much earlier than “perestroika”.

Mikhail Gorbachev was the first leader of the Communist Party who

took real steps to redress the declining situation. He opened society, partly; and initiated a primitive market system.

It was a crucial period in Russia for everyone, especially for scientists. The brain drain began. At that time the more active and clever young scientists were able to leave for different countries. They did. None returned. Other scientists took advantage of the situation and moved to “business”.

Over the past 10 years a great deal of industrial agricultural products have come to Russia from different countries using the now “free” market. At the same time Russian industry, including the military, declined very rapidly. The cost of living increased dramatically. My own salary as a supposedly senior professor is \$US40 per month, about 1/50 that of an Australian professor after tax. Admittedly the price of the cheapest car made in Russia is about \$5,000, but the price of apartments is as high as in Sydney for something

you would regard as a dog box.

The Russian Government has tried to support the Academy of Science throughout, but invested far less money than before. Any attempts have been frustrated by the bureaucratic machine. Its own preservation was obviously first priority. It reduced the money for the Research Institutes and discouraged those few remaining scientists by diminishing salaries in real terms. Hardly encouraging for those young scientists because the price of living increased almost without bound. Again the Institutes have practically lost relations with industry, an area which is still on a rapidly declining slope. Hardly any industry is left. This meant that the Institutes have not been able to acquire any scientific equipment essential to retain young scientists. Simultaneously the bureaucracy provides support to Academicians, invests money in hotels, rest homes etc, that provide good investment returns. You call it, I suppose, foundations and

infrastructural investment but there is nothing left for fundamental research — for ANY research.

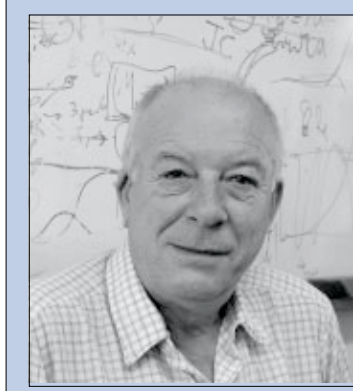
To summarise, what we have in the Russian Academy of Sciences at this time is very low salaries, very old equipment and no possibility of replacement, a median age for scientists of around 55 and the Institutes with a great deal of space that nobody wants to use.

We have some few young committed scientists and are trying to find some additional financial support. University education is, in principle, free and Moscow State University still attracts good students. (Children of the favoured few go to Oxford, Cambridge, Harvard and such places).

But the situation is very unstable. A research grant deposited in a bank for safe keeping can and has often disappeared, along with the bank. If there is any chance for students to move from Russia for research training, they do so every time, promising faithfully to come back. But, as I said before, nobody has ever returned! The situation is much worse in the republics of the former Soviet Union.

I am an optimist, and believe in my country. (All pessimists have left Russia). The country is incomparably rich in natural resources. Siberia, a rich area much bigger than Australia, is still virtually unexplored. But we have dismissed the best of socialist ideals and ethical behaviour; adopted the worst of the new nirvana, capitalism and the “magic market” of rational economics; but failed to harness its good qualities, not knowing what they are. This dark age for Russian science will continue until such time that Russian industry will improve. This will not take place in my lifetime.

I hope you can learn from our experience in your Australian paradise.



Professor Vadim Ogarev graduated with a PhD from Moscow State University in 1958 and worked continuously in Moscow and held distinguished positions of leadership from the time that Soviet science, the universities and academy had a privileged position in Soviet society until the present. He has travelled and worked widely within and without the Soviet Union, and even spent a year in the USA in 1971 during the Cold War. His fields of research are polymers and surface science, corrosion and colloids, in which areas he has published more than 200 papers. His Institute was, for more than half a century, the world centre in colloid and surface chemistry, key to most industrial processing, soil science, modern biology and other fields. It made major contributions to the war effort. His father developed the enabling separation technologies that underpinned the Soviet nuclear industry, and his great-grandfather led the first Russian Revolution in 1850.

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62927470 home.
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SOFA BED 2-1/2 seater dark blue veg,

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