

MONTAGE

NEWS FROM THE CAMPUSES OF MONASH UNIVERSITY

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November 1992

SAVANT

The ethics
of organ
transplants



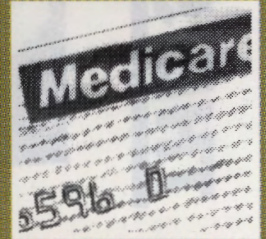
RESEARCH

Warfare
out in the
wilderness



FEATURE

How sick is
the health
system?



Downunder dinosaurs spark debate

A few fossilised dinosaur bones unearthed at two Victorian digs seem set to turn a chapter of the earth's prehistory upside down.

The discoveries at Dinosaur Cove in the Otway Ranges and near Cape Paterson in coastal Gippsland strongly suggest that two dinosaur families common in the northern hemisphere may have evolved on the other side of the world in the supercontinent Gondwana, from which Australia and Antarctica were formed. One of the finds has led to the naming of a new dinosaur species.

A team led by dinosaur hunter Dr Pat Vickers Rich, of the Departments of Earth Sciences and Ecology and Evolutionary Biology, and her husband Dr Tom Rich, of the Museum of Victoria, found a leg bone from what appears to be a pint-sized version of a horned dinosaur of the ceratopsian group, as well as a vertebra and several leg bones from what seems to be an ornithomimosaur, an ostrich-like dinosaur.

Until now palaeontologists thought the ceratopsians, the family that includes the well known rhino-sized herbivore *Triceratops*, were restricted to younger rocks and had originated in the northern hemisphere. An article, in which the new dinosaur form will be formally announced, is nearly ready for submission to the international journal *Science*.

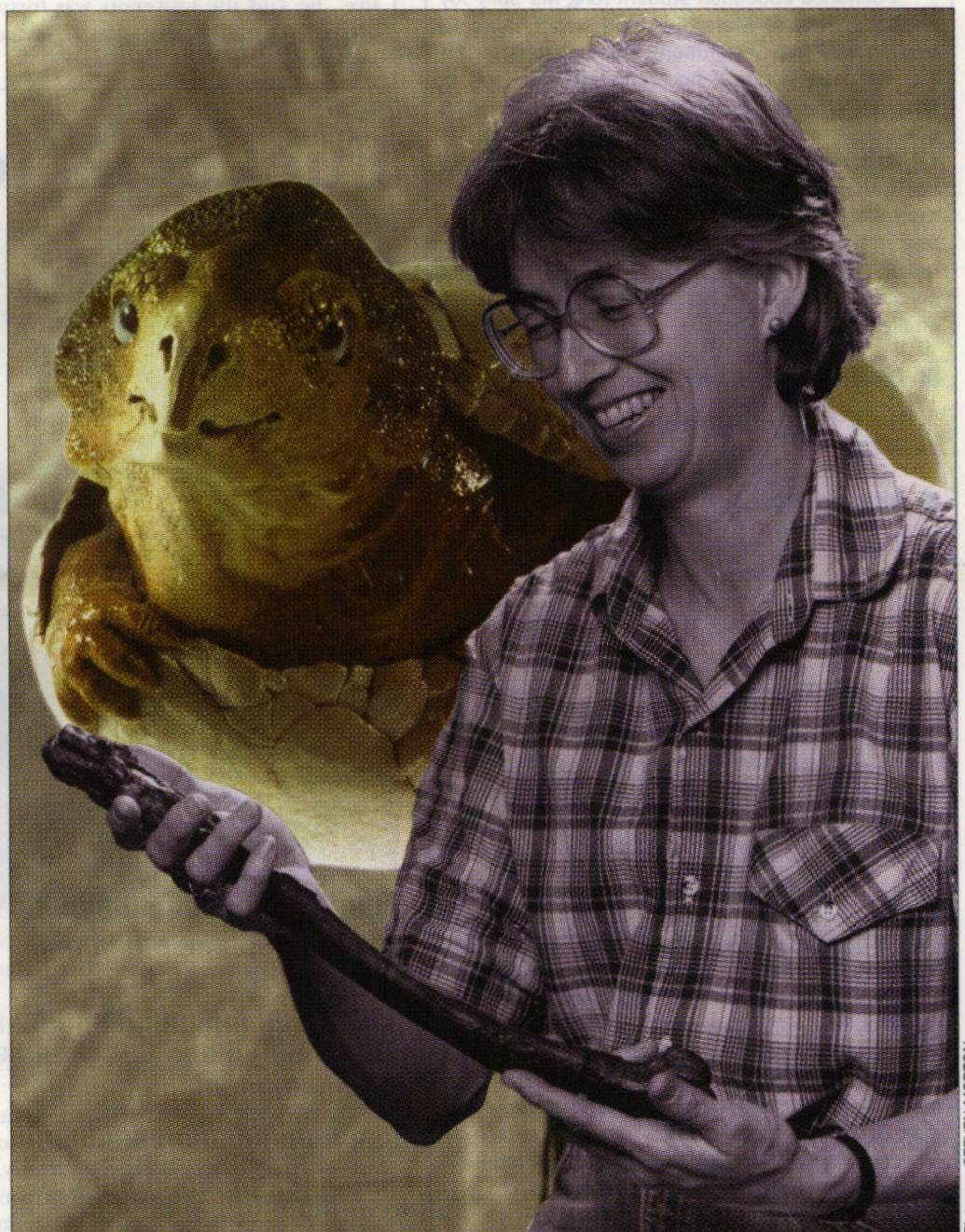
The discovery is likely to provoke lively scientific discussion when it is published, probably late this year or early next year. The reason for controversy is that the fossil not only seems to represent the first discovery of a ceratopsian in Australia, but also that its early Cretaceous age appears to predate the radiation of the ceratopsians in the northern hemisphere.

Dr Vickers Rich says this points to the possibility that this dinosaur family originated in the southern hemisphere, while parts of the supercontinent of Gondwana were still intact, and may have reached the north via a tenuous connection between the elongated 'tail' of west Antarctica and southern South America before the two continents drifted apart in the early Cretaceous era.

The bone found in Gippsland is an ulna, one of the major bones of the front leg. While the dig is yet to turn up any more bones of the sheep-sized creature, an extensive comparative search of North American collections found that the bone was very similar to that of a northern hemisphere genus called *Leptoceratops*, from the late Cretaceous period.

"Some experts we showed it to said it couldn't be a ceratopsian because it was in the wrong place, both geographically and chronologically," Dr Vickers Rich said. But the tentative identification received support when Dr Tom Rich showed the bone to Canadian dinosaur expert Dr Dale Russell, of the National Museum of Canada, who commented excitedly: "We are in violent agreement: it looks like a ceratopsian!"

The ornithomimosaur ('bird mimic') bones found by volunteer excavator Mr Nick van Clavern at Dinosaur Cove lend weight to this account. The creature, which was about the height of a human, is



Dr Pat Vickers Rich holds a leg bone from what she suspects is the first dinosaur of the ceratopsian group found in the southern hemisphere. Looking on is one of its distant northern relatives, *Proceratops*.

older and more primitive than the ornithomimosaur that were widespread and abundant in the northern hemisphere in the late Cretaceous period. "Only one species - from the late Jurassic deposits in Tendagaru, in Africa - is older, and this is the only other known southern hemisphere form," Dr Pat Rich said.

"We compared ours with ornithomimosaur fossils at the Tyrrell Museum in

Drumheller, Alberta, and the American Museum and Yale University, which have good collections. Ours looks extremely primitive and is certainly the second oldest.

Together with the even older material from Africa, this indicates that the ornithomimosaur is another group that might have had Gondwanan origins.

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The ornithomimosaur, an ostrich-like dinosaur, may also have originated in the southern hemisphere.

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THE SPIKE



■ A likely story

Over the years, students have gone to exceptional lengths to explain why their assignments have been late. This is one of the best.

A distance education student rang Ms Sally Joy of the School of Marketing and was unable to explain why his assignment had not arrived. "It was definitely posted," he protested. The reply, a sceptical: "Please send it again". Soon after, the student arrived in person to deliver the goods.

He came bearing a replacement copy of the assignment and the original, which had been returned to him by Australia Post in a 'mortality bag'; the document within burnt and in poor repair. Apparently, the student had entrusted his precious parcel to a post box which had been set on fire by vandals.

■ Divine intervention?

The principal of Mazenod College is one Father Kevin Davine.

■ Bite the other one

It wasn't all swaying palm trees, golden sand and a deep blue sea that greeted School of Marketing head, Professor Gary Harris, as he stepped out for an early morning stroll during a recent Sri Lankan trip.

Ready so soak up some relaxing tropical atmosphere, he swung open his beachside resort apartment's front door to be confronted by a 1.5 metre alligator with something else in mind. Reptile wrestling not being one of his strong suits, Professor Harris slammed the door on the toothy interloper and retreated to the balcony.

■ Sexual arousal

Retiring Deputy Registrar Mr Jim Leicester will be fondly remembered for many things – although his presentation concerning a sexual assault alarm at a recent Academic Board meeting is not likely to be one of them.

He was waxing lyrical to the board about how students have invented the hand-held alarm when, without warning, he set it off. The alarm, which by all accounts can be heard in Perth, left its mark on the nerves of some university notables.

■ Numbers up

The latest enrolment figures for Australian universities have just been released by the Department of Employment Education and Training. The big 10 are:

Monash	35,384	Sydney	30,451
Melbourne	29,700	NSW	26,006
Queensland	24,743	Deakin	23,543
QUT	23,189	RMIT	22,776
La Trobe	20,917	SA	20,454

MONTAGE

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NOW & THEN

25 YEARS AGO

To cope with an expected shortage of places in the Halls of Residence, the Student Housing Office appealed to members of staff "to ask any of their friends who may have a spare room to offer accommodation to students next year." Guidelines were provided on suitable charges and conditions. Full board – at \$13 to \$14 per week – would provide a student with breakfast and dinner each week day and three meals a day at weekends. Personal laundry and/or a cut lunch may or may not be provided.

15 YEARS AGO

While universities were going through a time of economic restraint, there was no cause for deep pessimism, the Vice Chancellor, Professor R. L. Martin, said. Noting that Monash was now one of the 'big five', he said the university was fortunate to have grown up in the "balmy days of tertiary education" beginning in the 1960s.

5 YEARS AGO

The Monash Medical Centre was officially opened by the Victorian Premier, Mr John Cain. The 436-bed hospital cost \$132 million to build and was the first new teaching hospital in Victoria since 1963.

The Vice-Chancellor, Professor Mal Logan, announced *The Monash plan: a strategy for the future*, saying that universities had traditionally been reactive but now needed to embrace "taking risks and marketing ourselves".

THIS MONTH LAST YEAR

The university adopted a smoke-free policy, with a total ban on smoking in all university buildings and vehicles. University Council approved the new policy after consulting staff and considering recent court rulings on the effects of passive smoking.

A Monash researcher has produced a radical – perhaps definitive – explanation of the design and purpose of Stonehenge and other prehistoric circles in Europe and Ireland.

Fuel cells to generate exports



Holding fuel cell components are (from left) SEC Chief General Manager Mr George Bates, CFCL Chairman Mr Peter Coats and Pro Vice-Chancellor Professor Tom Kennedy.

A major new hi-tech energy research and development project is soon to be established at the Gippsland campus.

The five-year project to develop ceramic fuel cells on a commercial basis involves a consortium of key players in the Australian energy industry.

Fuel cells have the potential to become a major source of energy by the turn of the century. The consortium partners believe a \$150–200 million industry could be established in Australia by the late 1990s with a potential export market of more than \$1 billion annually.

The consortium – Ceramic Fuel Cells Limited (CFCL) – includes the CSIRO, BHP, Pacific Power, the Victorian Government's Strategic Research Foundation and the Federal Government's Energy Research and Development Corporation.

A \$1.9 million laboratory and administration complex to house the project will be built at the campus, adjacent to the existing engineering and science laboratories. The campus is providing the site and contributing to the cost.

The consortium will begin operations at Monash's Technology Park, Clayton, in January while the new research facility at Gippsland – due to be completed late next year – is being built.

Fuel cells are devices for producing electricity through chemical processes. They directly convert fuel and an oxidant – in the form of air – into chemical energy without intermediate conversion to heat, as in conventional power plants.

They have many advantages over conventional facilities. They have high conversion efficiency, lower noxious emissions, high power density and can use fuels including natural gas, coal gas, methanol and hydrocarbons.

CFCL Chairman, Mr Peter Coats, said the project would employ 38 people during the five-year development phase, with 30 of these located at Gippsland campus.

"The Latrobe region, with its extensive brown coal power generation and natural gas operations, has clearly established itself as Australia's foremost energy centre," Mr Coats said.

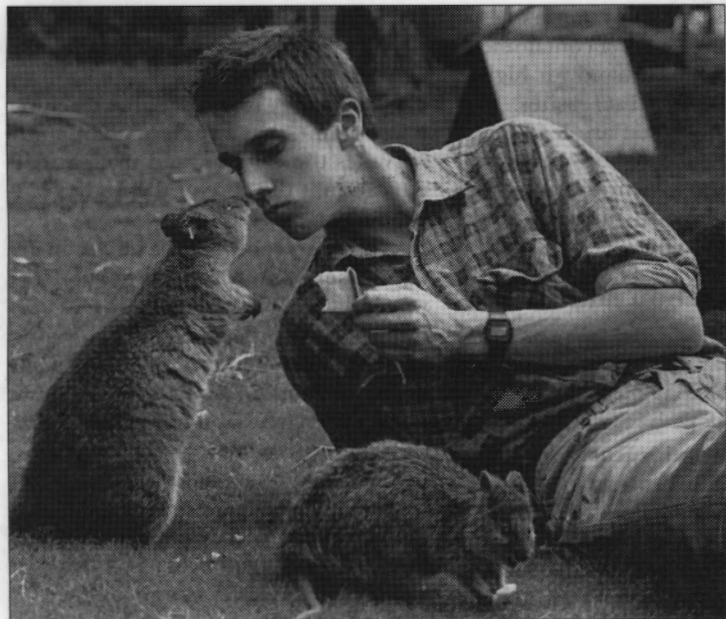
"We are absolutely confident that fuel cells have the potential to be a major energy source of the future. The region has the technical expertise and the facilities, along with the community support that would be required for subsequent manufacturing stages of the project."

The Vice-Chancellor, Professor Mal Logan, said the project was a reflection of the increasing level of interaction in hi-tech developments between the nation's major universities and the private sector.

Scientists at the CFCL research laboratory will be given access to university facilities including laboratories, library and computer resources.

Pro Vice-Chancellor Professor Tom Kennedy said the project would provide the opportunity for significant collaboration between research scientists of the two institutions, as well as new opportunities for graduates undertaking higher degrees through research.

Selling up for an amazing Amazon adventure



Wallaby keeper Mr Antony Taggart tending some of his quokkas.

A chance meeting has led to a "one in a million" job for a Monash animal keeper establishing an animal rehabilitation centre in the heart of Peru's Amazon Rainforest.

By Christmas, the keeper of Monash's wallaby enclosure, Mr Antony Taggart, hopes to be tending animals such as jaguars, toucans and monkeys confiscated from poachers or rejected by zoos.

The path that led to his new job began at a Monash lecture where underwater marine naturalist Neville Coleman told Mr Taggart about the California-based International Society for the Preservation of the Tropical Rainforest (ISPTR).

Inspired by the society's work, Mr Taggart was determined to become involved. The ISPTR receives hundreds of calls daily from volunteers, but he just kept on ringing and eventually his long-distance persistence was rewarded.

In addition to setting up the rehabilitation centre, the society will be sending him to

Brazil to work with one of only five species of fresh-water dolphin in the world, the Amazonian pink river dolphin.

Mr Taggart is selling all his possessions, including a house and car, to finance the trip.

"This job is the chance of a lifetime," he said. "I probably won't get paid for the first 12 months, but my highest priority is to be active in what I want most in life - to conserve the world's natural environment and wildlife."

Conservation work is not a new interest for Mr Taggart, who has studied horticulture and animal technology, and worked at the Healesville Sanctuary, the Melbourne Zoo and the Phillip Island Wildlife Park.

"The work that I have done with animals in the past helped me get the job, but I haven't ever worked with animals native to Peru," he said. "It will be very difficult to begin with, especially as the centre is only accessible with a team of local guides."

Mr Taggart's venture has attracted media interest, but he is still seeking sponsorship.

New faculty to be biggest in business

Monash will create Australia's largest centre for the study of economics and business by merging its Faculty of Economics Commerce and Management and the David Syme Faculty of Business.

The new faculty - the Faculty of Business and Economics - will have more than 6000 students and 300 academic staff. The merger will formally take place on 1 July next year.

It will be responsible for all undergraduate and graduate teaching in business and economics on four of the university's campuses and by distance education.

It will consist of six schools: David Syme School of Business, School of Economics, Syme School of Business - Gippsland, Syme School of Business - Frankston, David Syme Graduate School of Business, Graduate School of Economics.

The two largest schools - the David Syme School of Business on Caulfield campus and the School of Economics on Clayton campus - will be made up of six cross-campus departments: Accounting, Banking and Finance, Economics, Econometrics, Management, and Marketing.

Some of the graduate teaching will be offered through the faculty's two

graduate schools. The David Syme Graduate School of Business will offer a range of graduate courses developed from the present graduate program of the David Syme Faculty of Business.

The Graduate School of Economics will offer a range of graduate courses, including those arising from the present courses of the Graduate School of Management in the Faculty of Economics Commerce and Management. Both graduate schools will be involved in the faculty's MBA program.

The Syme School of Business - Gippsland will offer business courses on the university's Gippsland campus and by distance education. The Syme School of Business - Frankston will offer business courses on the Frankston campus.

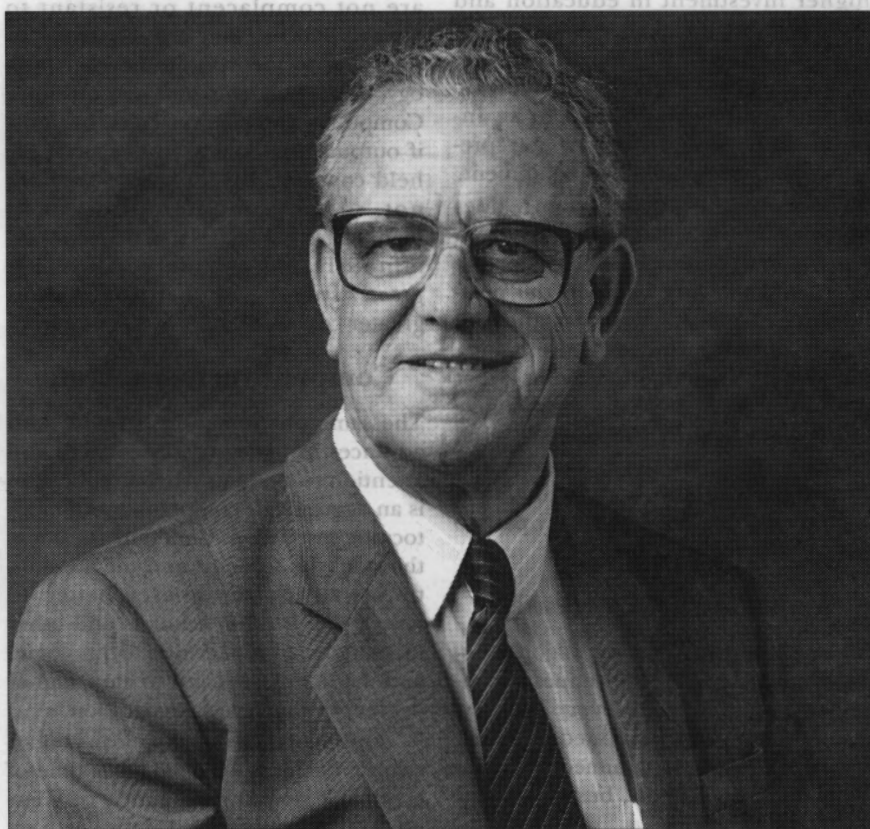
At the undergraduate level, the faculty will offer three generic degrees: the Bachelor of Business (BBus) with various specialisations on Caulfield, Frankston and Gippsland campuses and by distance education; the Bachelor of Commerce (BCom) and the Bachelor of Economics (BEc) on Clayton campus.

The Bachelor of Business is also available in double degree programs with arts, computing and law. The Bachelor of Commerce is offered in double degree programs with arts, law and engineering.

Students enrolling, or planning to enrol, in courses next year will enter the existing programs of the current faculties.

The Vice-Chancellor, Professor Mal Logan, said the amalgamation would create an environment in which the faculties' separate teaching, research and policy strengths would be reinforced, and in which vigorous interaction between two cultures would promote a new distinction.

The position of foundation dean for the new faculty will soon be advertised world wide.



Retiring Deputy Registrar Mr Jim Leicester.

Jim rings the changes

Christmas Eve will be Deputy Registrar Jim Leicester's last working day at Monash.

At 65, after 28 years with the university, he says he is now at the age when he is supposed to retire. Mr Leicester joined the fledgling university in December 1964 as examinations officer. From there he was promoted to assistant registrar student admissions and to deputy registrar, a position he has held for 18 years.

"In its younger years, Monash was smaller, staff knew each other and even knew students," he said. "Since its growth, Monash has become so much larger and wide-flung."

"People lose contact with each other. Things move upwards. Instead of talking to lecturers and senior lecturers, we now talk to chairmen and deans. Suddenly we do not talk to people at all levels of the university for there isn't the time."

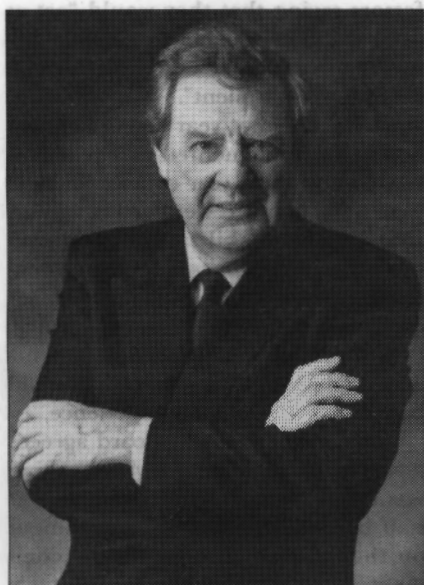
"My job has changed dramatically too. The registrar's responsibilities are now more complex. While my job has not always been enjoyable, it has always been interesting."

"I have watched thousands of students each year graduating. I have known many staff come and go. I have seen the changes in students' attitudes, staff concerns and the progression of Monash from its beginnings until now."

"Monash is at a turning point. I think Monash will be heavily affected by the TV Open Learning program and hope that the program gets the university's and the public's support to allow it to develop to its full potential."

"I also believe it would be a shame to let the internationalisation of the university decline. Accepting students on academic merit rather than nationality, making ties with other countries through joint research, staff exchanges, projects, and linking educational institutions is the way of the future."

"I hope that Monash does not become a specialist institution. By encouraging a broad range of studies, research, and academic teaching, the university is always accessible and is in demand by students, employers, and the general public." And what of his retirement plans? "I won't be altogether unemployed," he replies.



Professor Mal Logan: the new faculty will reinforce separate strengths and promote interaction between disciplines.

World focus on funding and teaching

The Vice-Chancellor, Professor Mal Logan, recently participated in the Sixth International Conference on Higher Education in Washington. It was attended by about 100 presidents, rectors and vice-chancellors, mostly from universities in the US and continental Europe. The main theme was the funding of higher education, but discussion extended over many issues. He reports here on the central points of discussion, on which there was broad agreement.

Investment in education

There is debate in US education circles that in a world of mobile capital, government can best promote higher living standards by focusing on production factors that are relatively fixed.

The two factors that cannot move at all easily are people and infrastructure. The argument runs that through higher investment in education and training there is a chance of increasing the productivity (and wages) of workers. Likewise, investing in public infrastructure should lead to an increase in the return to private entrepreneurs by locating plant and equipment.

Academic research certainly does suggest that the economic return from extra years of education has steadily risen; and the link between the profitability of private business and the quality of public infrastructure is long established. The important point is that investment in higher education is now much more in the public debate in all countries. If institutions can demonstrate accountability and quality, they should be able to constructively participate in this debate.

Managing cost increases

All universities are facing major problems in matching their revenues to constantly rising costs. In every country, revenues are being generated by a varying mix of instruments aimed at all citizens, students, parents, businesses and philanthropists.

The Australian HECS arrangement is being considered with real interest by quite a number of countries. The very real difficulty faced by universities is the way their costs increase at a higher rate than for most other enterprises.

This is because of the very nature of universities – where a new piece of equipment does not lead to a substitution of capital for labour (by a long-term lowering of costs) – but quite often to an increase in costs because of the new research opportunities that are opened up and the need for more skilled labour and so on.

Contrary to some views, universities are not complacent or resistant to change. Rather, they are constantly attempting to incorporate new technology, new scholarship and new missions. Computers can save on costs, but only if outputs and quality and capacity are held constant. But of course they are not, so the computer allows us to manage more effectively, write more voluminously and calculate with vastly greater speed – and, in the end, at greater cost.

Competitive, meritocratic

The same phenomenon is found with advances in pedagogy, assessment and attention to students. Higher education is an aggressively competitive and meritocratic institution. Generally speaking, the staff, the students and the administrators all want to do even better: to keep up with other scholars and other institutions, to master new technologies and methodologies and to earn higher degrees or more peer recognition.

And 'better' generally means 'more costly'. All this is occurring at a time of economic slowdown in much of Western Europe and North America with resultant lower tax revenues, demand for safety nets of various kinds and a diminished ability of students and families to afford whatever shares of the cost of construction and living must be borne by them.

The increasing cost of universities is leading to attempts at cost containment at a time when the demand for higher education is rapidly increasing. The policies being followed are leading to an expansion of the non-university higher education system – community colleges, TAFE-type institutions, open universities, and so on.

Democratisation and access

In the US, in particular, there is widespread acceptance that in the university system as a whole, democratisation and access are here to stay. There is now great differentiation inside what is known as the university. As the Chancellor of the SUNY system stated: "The university contains a wide spectrum of contributors, ranging from the highest level of medical research to carpentry". Staff have different but equally honourable tasks.

We are vulnerable if there is but one model of the professoriate; i.e. once someone enters the professoriate he or she is expected to produce the highest level research throughout their entire working life. The Americans argue we need more than one 'professorial lifestyle' to avoid the constant attacks based on the notion of a non-productive professoriate.

The search for non-tax revenue, especially for research purposes, is in danger of creating a conflict of loyalties between the university and the source of revenue. This trend has gone much further in North America and Europe than in Australia, but the Cooperative Research Centres (CRCs) were mentioned as an example of a form of funding which has the potential to conflict with institutional loyalties. Where the research contracts have been large as at Stanford and Yale universities, for example, there have been some major internal difficulties.

Quality of teaching

The most significant debate occurred on the matter of teaching. It appears that all the American research universities, both public and private, are agonising over the quality of teaching, despite the fact that they have had student evaluation of teachers for decades.

As Ernest Boyer, director of the Carnegie Foundation, says: "In the cur-

rent climate, students are all too often the losers. Today, undergraduates are aggressively recruited. In glossy brochures they're assured that teaching is important, that a spirit of community pervades the campus, and that general education is the core of the undergraduate experience.

"But the reality is that, on too many campuses, teaching is not well rewarded, and faculty who spend too much time counselling and advising students may diminish their prospects for tenure and promotion ... Thus, the most important obligation now confronting the nation's colleges and universities is to break out of the tired old teaching versus research debate and define, in more creative ways, what it means to be a scholar. It's time to recognise the full range of faculty talent and the great diversity of functions higher education must perform."

Scholarship redefined

Boyer went on to identify the work of the professoriate as having four separate, yet overlapping functions:

- the scholarship of discovery which comes closest to what is meant when academics speak of 'research'. No tenets in the academy are held in higher regard than the commitment to knowledge for its own sake, to freedom of inquiry;
- the scholarship of integration – making connections across the disciplines, placing the specialties in larger context, illuminating data etc.;
- the scholarship of application, which means the responsible application of knowledge to problems;
- the scholarship of teaching. The work of a professor becomes consequential only as it is understood by others. Teaching builds bridges between the teacher's understanding and the students' learning.

There have been numerous attempts in US research universities to emphasise the importance of teaching and to make a commitment to it a part of the culture of the institutions. By and large these have failed. The outstanding example is at Stanford where the President launched such a campaign three years ago, but the staff had no ownership of it. His efforts created nothing but problems at Stanford, culminating in his resignation.

Professor Pilbrow endorsed the recommendation to appoint two new professors saying that they would "act as catalysts to bring about new links between theoreticians and experimentalists in the department".

A revised first year physics course had been implemented this year and second and third year courses for next year were being reviewed. He agreed that teaching skills should be improved, and collaborative research ventures continually sought.

The Dean of the Faculty of Science, Professor Ian Rae, said departments would be reviewed regularly and would benefit from the physics experience.

The Science Faculty Board agreed, however, that a one-day review meeting was insufficient. Despite the fact that staff had the opportunity to comment on their review, and that these comments accompanied the committee's report to the board, more scope for the recording of views will be provided in any future reviews.

Physics changes matter

A landmark review of the Department of Physics has recommended broad-ranging changes affecting its structure, teaching practice and curriculum.

Although recognising the department's achievements in implementing the merger between Caulfield and Clayton, the review found that reform was still needed to address the drop in physics enrolments this year and the budget cuts that are likely to result from this fall.

Head of the Department of Physics, Professor John Pilbrow, has tabled a response to the recommendations that – while accepting the value of a review and the majority of points put forward – defends the activities already being undertaken by the department.

The Physics Review Committee recommended that:

- two new professors, one of theoretical and the other of experimental

physics, be appointed to the department as soon as possible;

- subject matter of courses should reflect the discipline of physics as it is today and not only the research interests of the department or individual academics;
- undergraduate education should be strengthened by increasing the number of lectures taken by students;
- a broad undergraduate curriculum should be taught with research concentrated in a few areas so as to maximise grants from the Australian Research Council (ARC);
- teaching skills of staff be improved;
- new links be established between the theoretical and experimental work of the department;

- research collaborations with other departments, such as chemistry and materials engineering, be increased;
- student research be linked with grant-funded projects;
- academic and non-academic staff numbers be reduced; and
- short fee-paying courses should be developed.

Professor Pilbrow's response to the recommendations said the department was looking for other funding sources, such as short courses and expanded contract work. He said that since 1991 the department's agenda had included concentrating on research where funding was available.

"With applied physics being 'marketed' more vigorously, with the prospect of an honours stream in this subject in 1995, and with increasing interest in courses such as computer imaging at Clayton, we expect to go some way towards recovering some of the EFTSU (Equivalent Full-Time Student Units) lost this year," he said.

'Tis the season to be building

Spring has heralded a flurry of building activity on all university campuses. Construction of nine major building projects – worth more than \$70 million – is now under way.

These large scale building projects at Clayton, Caulfield, Frankston and Gippsland will give Monash a face-lift over the next few years.

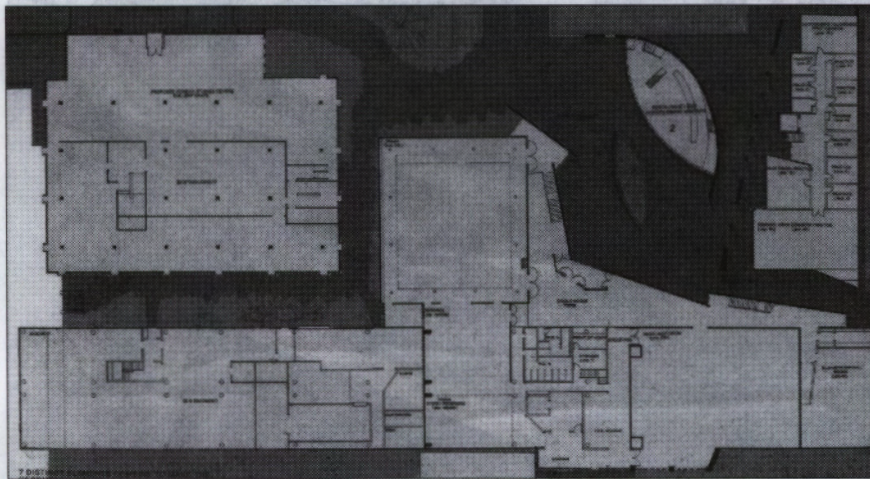
The first stage of the \$18 million General Teaching and Business School building at Caulfield, jointly funded by the student union and Federal Government, is the first large scale expansion on that campus for 15 years.

The first stage, expected to be completed by July 1993, is being built at a cost of \$9.4 million on open space between the campus's Phillip Law building to the east and the Technology tower to the west. The new three-storey building will create seven computer laboratories, 14 classrooms, two lecture theatres and provide the student union with a bistro and book store.

Building project coordinator, Mr Roland Black, said the General Teaching and Business School development would be created in two distinct stages, with each having specific but complementary facilities. The building would form the southern boundary of a large central green space intended to become the heart of future developments.

"The expansion at Caulfield ensures the campus provides suitable university facilities," Mr Black said. "The new construction affects the whole campus and allows for rationalisation of existing buildings on campus; for example, the relocation of the bookshop makes extra room for the library."

The building design also allows for the interconnection of existing buildings and the future creation of other points of access. Stage two is a \$9.4 million investment and includes the construction of a five-story tower to house the David Syme



Faculty of Business. It will allow the relocation of the Computing Faculty into other buildings on campus.

The Performing Arts and Information Services buildings on the Clayton campus will create a new look for the south-eastern part of the campus. A feature of the new development (above) will be the creation of a ceremonial courtyard and arts precinct. An artist's impression of the southern aspect is shown at left.

The \$5.76 million Information Services Building, which is located to the south of the Main Library, will house the music library, AV microfilm storage, rare books, technical services, administration, postgraduate students and staff. The four-level building will be connected with a catalogue hall to the Main Library.

The Performing Arts building will accommodate staff of Music, Drama, Australian Studies and Asian Studies, as well as providing performing space, a theatre, offices, and teaching, performance and practice areas.

Plans are also under way for the future construction of a restaurant and coffee shop in the courtyard and a verandah and entrance terrace for Robert Blackwood Hall, based on Sir Roy Grounds' original design.

Gippsland will replace the visual arts building at a cost of \$1.25 million. The Federal Government capital funding for universities in 1993 and 1994, provided \$625,000 for this project, with the university providing the balance of funds.

Current major capital developments

CLAYTON CAMPUS

■ Engineering 7 (\$7.2 million)

Now completed and occupied. Landscaping will continue as weather permits.

■ Computing & General Teaching (\$10.1 million)

First stages at both sites will be completed early in December to enable occupation of offices before Christmas. The balance will be completed by commencement of teaching in 1993.

■ Law extensions (\$3.1 million)

Construction is proceeding satisfactorily with completion due in March 1993.

■ Performing Arts-Information Services (\$13.2 million)

Plans have been approved by relevant committees and documentation is proceeding. It is expected tenders will be received in about April 1993 and construction completed late in 1994.

CAULFIELD CAMPUS

■ General Teaching – Stage 1 (\$9.4 million)

Construction is proceeding satisfactorily and is expected to be completed for teaching in second semester 1993.

■ General Teaching – Stage 2 (\$9.4 million approx.)

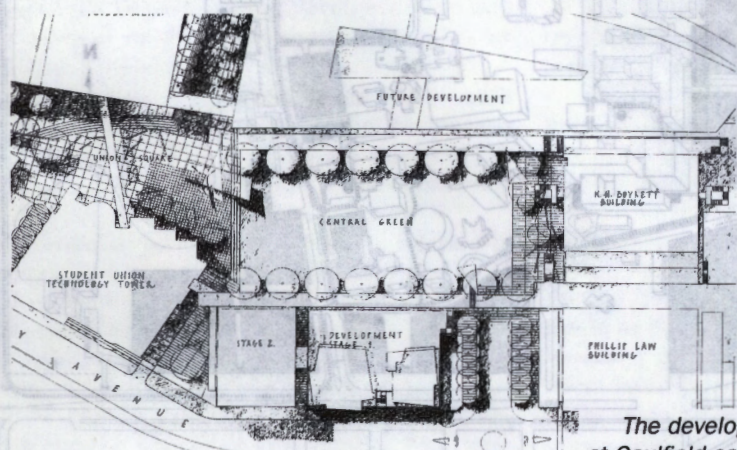
Planning will commence when it is determined how it fits into the capital program for 1994 onwards.

■ Coffee Shop (\$0.4 million)

Construction is expected to be completed by April 1993.

■ Landscaping

A master plan for redevelopment of the landscaping has been approved and significant works are expected to commence from the end of this year.



The development at Caulfield campus.

FRANKSTON CAMPUS

■ Technology (\$6.6 million)

Now completed and handed over.

■ Community Centre – Stage 1 (\$1.8 million)

Plans have now been approved by relevant committees and documentation is proceeding. It is expected construction will be completed by the end of 1993 (Note: this project is funded by the Student Union).

■ Community Centre – Stage 2 (\$2 million approx.)

The draft non-operating budget for 1993 includes an allocation to enable planning to proceed in 1993. It is hoped an allocation for construction in 1994 will be made available in the non-operating budget for that year. The project will enable rationalisation of space in existing buildings, particularly A building.

GIPPSLAND CAMPUS

■ General Teaching and Distance Education Centre (\$7.7 million)

Construction will be completed by the end of this year.

■ Visual Arts (\$1.25 million)

Replacement of the dilapidated existing buildings will proceed in three stages during 1993–4.

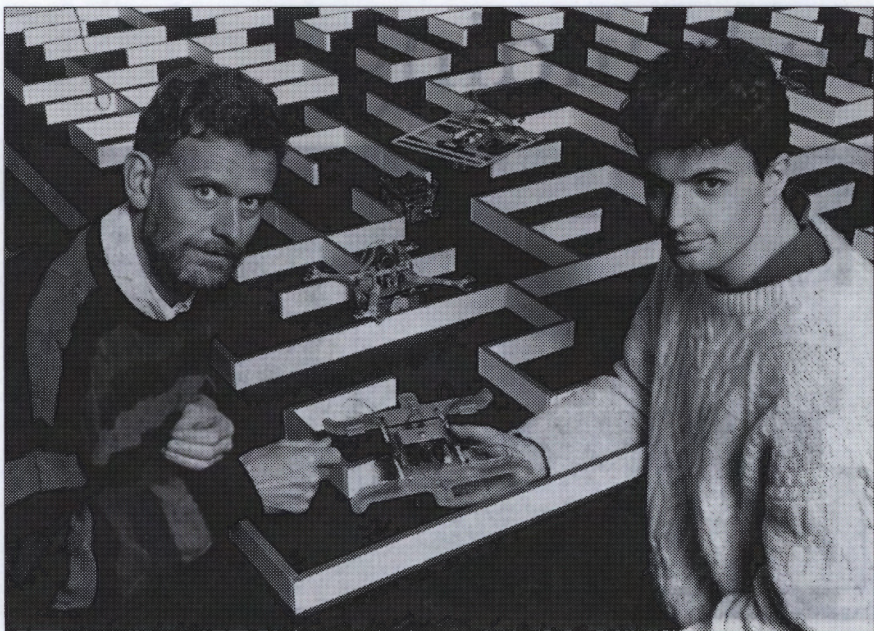
■ Ceramic Fuel Cells Laboratory (\$2 million approx.)

Architects have been appointed and planning and construction is expected to be completed by the end of 1994.

PHARMACY COLLEGE

■ Teaching laboratories refurbishment (\$0.5 million)

Work will be completed for commencement of teaching next year.



Lecturer Dr Simon Hill (left) and third year digital technology student Mr Brendan Simon with the maze and a few electronic 'mice'.

Reinventing the mouse

Digital technology students have been up until all hours lately, perfecting ways of running mice through a maze.

They're not reinventing the behavioural wheel, but redefining the mouse. The third year students in the Robotics and Digital Technology department are taking part in a project - known as RoDenT - to develop and program computer circuitry.

The 1992 class in the Bachelor of Computing (Digital Technology) at Caulfield campus are developing entrants for OzMouse, the Australian section of the worldwide biennial IEEE Micromouse competition. To take part they must design electro-mechanical robot mice capable of navigating through an intricate maze covering nine square metres.

The maze itself has been put together in the department's robotics laboratory. It will be moved to the World Trade Centre this month for the competition proper, cosponsored by the department.

OzMouse competition mice must be self-contained, self-powered devices which measure no more than 25 centimetres square. The mice must find their own way from a starting point at one corner of the maze to the goal in the centre, return to the start, and then attempt a speed run to the goal.

Apart from the size limits, mice can be of any technology. However, the rules do exclude mice with "an energy source which employs a combustion source" and require that mice "shall not jump over, climb, scratch, damage or destroy maze walls", nor "leave any part of its body behind during a run".

Fifteen mice have been developed by student teams using a standard chassis and motor system developed in the

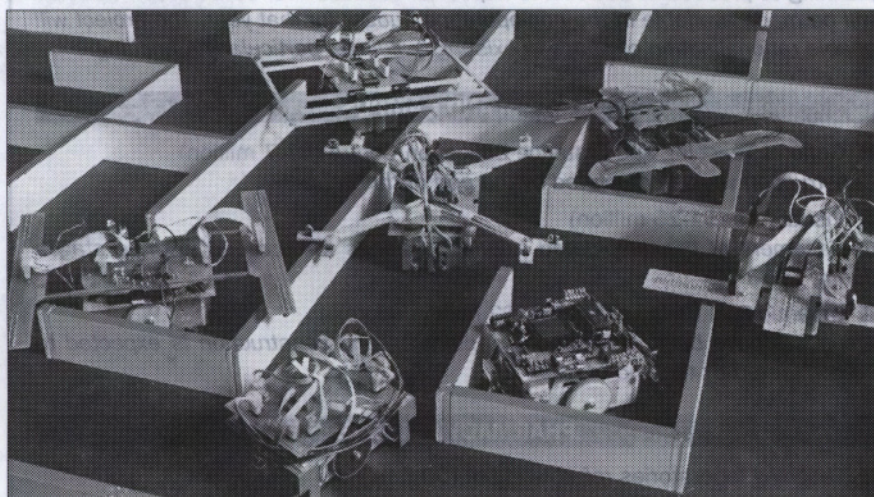
department by Dr Peter Atkinson and Mr Gordon Lowe. The chassis has two independent (CD player) motors used for drive and steering, with castors fore and aft for balance. Most teams are using a standard processor card designed by Mr Gary Evans.

Students have designed and built the sensor systems, interfaced the sensors with the processor and programmed the mouse to map and solve the maze. "The Micromouse competitions are more than an academic exercise," head of the department, Professor Jim Breen said.

"It's an entertaining learning experience in the development of an integrated hardware and software solution. Mouse programming is far removed from what most people associate with software development, as there is no input and output in the traditional sense. This is, however, typical of processors controlling devices in industrial situations.

"Student teams have had to write every instruction of software for the mouse. It is an epic in real-time programming, as the mice need to continually detect the wall locations and steer accordingly, as well as building a map of the maze and seeking an optimal solution. The typical mouse software is several thousand lines of C and Assembler programming language."

In their assessment trial, most of the mice solved the maze, with several performing as well as the place-getters in the 1991 Hong Kong competition, in which two Australian entrants competed. Eight of the 15 teams competed in the OzMouse competition on 11 and 12 November against experienced teams from Macquarie University and the University of Queensland.



A selection of Monash entrants in the OzMouse competition.

Parties agree on new parking plan

A comprehensive parking plan endorsed by major staff and student bodies will be put in place on Clayton campus next year.

The plan, proposed by the Comptroller's Working Group on Parking, was approved by Academic Board last month. Its key features include:

- changing gravelled areas, which are currently free, to permit parking;
- reducing the overall number of permits issued; and
- providing 1200 new free spaces on a site adjacent to the campus.

The number of permits issued for each space on campus will be reduced to 1.3. The new free spaces will be provided at the corner of Blackburn and Wellington roads, a former drive-in site, between 7.30 am and 6.30 pm weekdays.

With the increase of cross-campus teaching, the working group recommended that the number of Designated Vehicle Only (DVO) parking spaces be increased from 120 to 210, and that these permits be issued as required by faculty deans.

Up to 2000 people visit Clayton campus daily. In order to keep visitor numbers to a minimum during term, conferences, theatrical performances, graduations and other large functions will now - where possible - be scheduled during semester breaks or in the evenings.

Forty spaces are to be reserved for car pooling in the main south car park. The system will be operated by the Monash Association of Students and monitored to see whether it should be extended or discontinued. Alternative forms of transport will continue to be supported and promoted.

The working party said that because future space requirements for parking will only increase, a building reserve fund - receiving revenue from parking fines and ticket machines - will be es-

tablished to finance the construction of future car parks.

It was agreed that additional on-campus car parking should take the form of above- or underground facilities and that the cost of operating, maintaining and constructing them should be reflected in the price of a permit. Permits for 1993 will cost \$45.

Chairman of the group, Mr Brian O'Mara, believes that the new arrangements address most of the issues raised this year and will make life easier for staff and students in 1993.

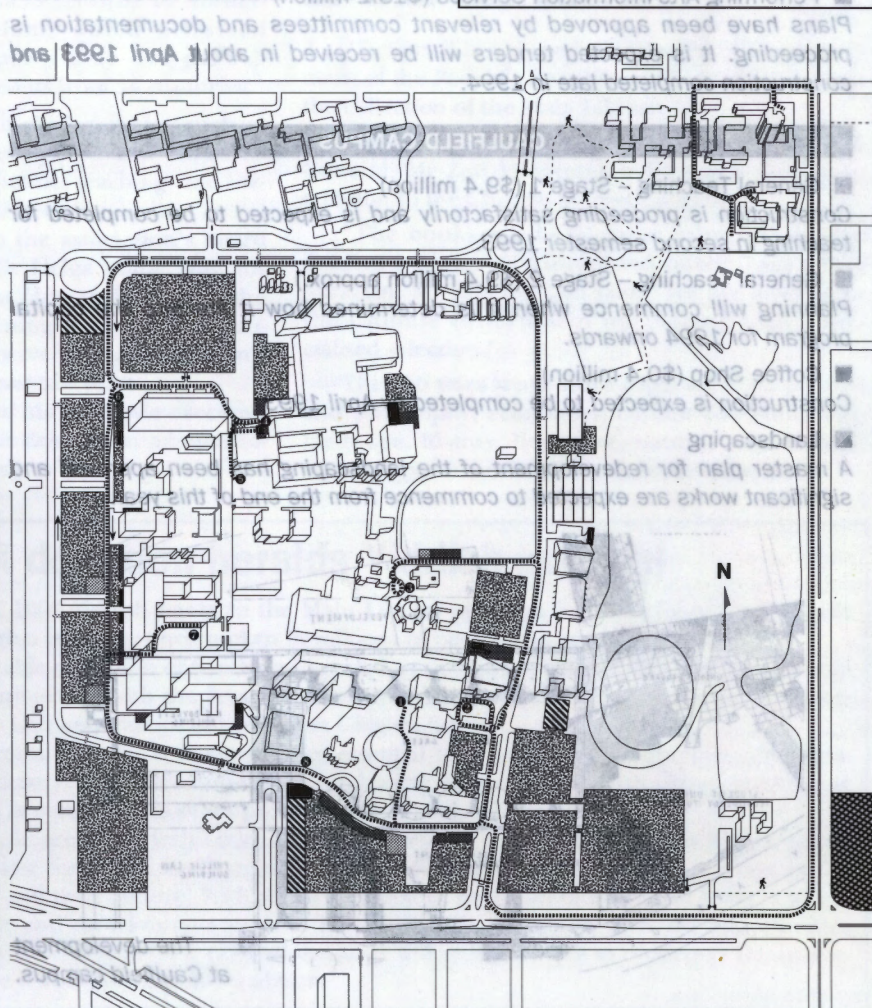
The Australian Colleges and Universities Staff Association (ACUSA) representative on the working group, Dr Paul Rodan, supports the new system, saying "staff with a permit in 1993 will have a better chance of getting a parking space than this year".

Chairperson of Monash Association of Students (MAS), Ms Kerry Barker, says the changes will also benefit the student group. "MAS is pleased with the recommendations of the group because of the focus on promoting alternative forms of transport," she said. "Car pooling should be supported by all university groups."

A parking group, with similar membership to the working group, will meet quarterly to monitor and report on the operation of the new parking system.

New parking areas

	Current Permit		Designated Vehicles Only
	2 Hour Visitor Parking		Free Parking
	Motorcycles		Disabled Parking



Porter takes on research post

The Dean of Medicine at Monash, Professor Robert Porter, has been appointed Deputy Vice-Chancellor – Research.

Professor Porter (below), dean of medicine since 1989, has been acting in the newly-created position for most of the year. Before joining Monash in 1989, he was director of the John Curtin School of Medical Research at the Australian National University.

His appointment was confirmed by Council last week. The position was one of the main recommendations of the university's Research Review Committee, set up earlier this year in response to academic staff concerns about research management, and departmental and research funding.

Professor Ian Chubb will join Monash in March as senior deputy vice-chancellor. The third deputy V-C position – academic projects – has been advertised.



Kennedy retires

The Pro Vice-Chancellor and Chief Executive of Gippsland campus, Professor Tom Kennedy, is to retire at the end of this year.

Professor Kennedy (below) was appointed director of the Gippsland Institute of Advanced Education in 1984, and played a major role in its amalgamation with Monash.

During his period of office, student numbers on the Gippsland campus grew from about 2500 to more than 6000. In addition, the campus changed from being a regional provider of education to assuming a state, national and international role.

Professor Kennedy is responsible for the university's National Distance Education Centre, which now services about 1000 students off-shore.

Before his Monash appointment, Professor Kennedy was deputy director of Chisholm Institute of Technology, and assistant director of the former Western Australian Institute of Technology.



Toasting success: the winners of the Vice-Chancellor's Awards for Distinguished Teaching (from left) Ms Joyce Tooher, Mr Rob Hagan and Dr Anne McDougall.

More than talking shop...

When the winners of Monash's new teaching awards got together last week, they had plenty to discuss without resorting to talking shop.

The three academic staff members, each from different faculties on different campuses, already had much in common.

Mr Rob Hagan, of the Faculty of Computing and Information Technology at Caulfield campus, already knew Dr Anne McDougall, of the Faculty of Education at Clayton campus, through a mutual interest in educational computing.

It turns out that Rob and Ms Joyce Tooher, of the Faculty of Law at Clayton campus, had noticed one another at teaching workshops over the years. But to top that, both Anne and Joyce have children attending the same school.

The Vice-Chancellor's Awards for Distinguished Teaching – each worth \$5000 – have been introduced as part of a set of initiatives to improve the quality and status of university teaching.

Each winner will receive a grant to further their teaching interests, a commemorative award presented at the final graduation ceremony this year and a permanent citation in the university Calendar.

Next year, the recipients will conduct workshops on teaching and record an interview of their teaching techniques to be used in future staff development.

The three winners are planning a joint presentation on student assessment and its role in good teaching for a conference later this month. The chairman of the selection committee, Dean of Engineering,

Professor Peter Darvall, said the process of choosing only three recipients was not easy, given the high quality of the applications.

"Excellence in teaching is one of Monash's major objectives," The Vice-Chancellor, Professor Mal Logan, said.

"We have instituted evaluations of teaching practices and are looking to change promotion procedures to encourage and reward distinguished teaching.

"We want to enhance distinctive teaching strengths, especially those that emphasise the unique character of Monash graduate and undergraduate courses."

Nominees were required to provide a teaching dossier, which included a statement on their attitude towards teaching responsibilities and their main strengths as a teacher, as well as information about courses and supervision, current teaching practices, student achievement, scholarship in teaching, evidence of student reaction and peer evaluation.

They were judged on their command of the subject, continuing professional development, organisational and communication skills, enthusiasm, ability to arouse curiosity, and concern for the student as a learner.

"It's good to see a public acknowledgement of the work we've all put into teaching," Dr McDougall said.

"Hopefully, this recognition will promote development of better teaching skills and contribute to the standing of the profession in tertiary education."

Eureka tells the research story

Eureka, a full colour, glossy magazine about the diversity and innovation of research at Monash has just been published.

The magazine – aimed primarily at the commercial and industrial world – presents a snapshot of current projects, covered throughout the year in the pages of *Research Monash*. It has been produced by the Office for University Development.

Eureka aims to demonstrate to the corporate community the fundamental role of research in today's society and the quality of research at Monash. Articles have been written for the layman with an emphasis on the potential of the projects to change the way we live and work.

In the magazine's foreword, the Vice-Chancellor, Professor Mal Logan, examines the challenges facing the university as a result of rapid changes in the economy and society. "The maintenance and enhancement of the quality of our research demands that the institution manages change in a positive and constructive way," he writes.

"All indications suggest that far more autonomy and deregulation will characterise the higher education industry in the future." Predicting greater competition between institutions, he says the more diverse, more distinctive and more flexible ones will benefit. "There will be less cooperation, more competition, and stronger pressure to recruit outstanding academic staff. Cooperation between institutions will be replaced by strategic alliances."

The magazine is suitable for presentation to visitors, to include in information kits, or for staff to take on overseas trips. *Eureka* is available from the Public Affairs Office, Gallery building, Clayton campus. Contact the Editor, Greg Williams, on extn 75 2085.

Teamwork cuts the queues down to size

Long queues, which have become a familiar part of the campus scenery this time of year, may now be a thing of the past. This year re-enrolment lines are expected to be much shorter, thanks to a computerised student information system.

A diverse group of Monash people are proving once again the value of teamwork and persistence.

More than 80 staff from Administration and Management Information Systems (AMIS), Student Administration, the Computer Centre, Finance Branch, the Centre for International Students, and all faculties have been involved in developing the new Monash University Student Information System (MUSIS).

According to manager of AMIS, Mr Max Robinson, this joint effort is the most inspiring instance of teamwork he has encountered in 25 years at Monash.

"Building this system has been a catalyst for togetherness," he said.

"Faculties and central administration have joined forces to define the nature of the service we needed to deliver. We haven't always been able to deliver that service, and it hasn't always been easy, but even when there were disagreements everyone involved showed a huge commitment to the project, putting in extra time to get the job done."

"We had people asking for access to the computer system from 8 am to 7 pm weekdays and 10 am to 4 pm on weekends. That's the kind of hours people were putting in." Although Mr Robinson admits he "wouldn't want to do it again", he believes the process of creating MUSIS has been valuable for the university.

Deputy Head of Student Administration, Mr Phil Irvine, has also been closely involved in the project. He believes that effective application and implementation of computer technology will relieve people of repetitious tasks and enable them to enjoy more challenging and fulfilling work.

His vision for the future is of a paperless office where most administrative tasks will be achieved by scanning a document or keying in decisions as they are made. He believes Monash is well on its way to achieving this kind of administration.

In fact, many of the processes are already in place and he says it will only be a matter of time before the university is employing the latest technology to improve the efficiency of its service to its most important clients: students.

Mr Irvine is well aware that there may be doubters. The introduction of MUSIS has attracted criticism and he is the first to admit the system needs further development and refinement. "MUSIS is not simply a rewrite or a combination of the old systems employed at Monash and Chisholm," he said.

"One of the basic tenets was that the system be devolved to users whether they be in faculties or the service areas. MUSIS represents a significant change in management practice as many tasks shifted and responsibilities changed."

"With this simple arrangement we have reduced re-enrolment queues by up to 70 per cent."

"Due to the need to update our administration system quickly after the amalgamation, the decision was taken to introduce rapid prototyping technology, but insufficient time allowed provision of only the most basic elements to allow enrolment in 1992. It is a pity that they the system had to 'go live' before it was ready."

"MUSIS is much more than an enrolment system. It is an instrument for collecting and disseminating information for many kinds of purposes, from determining quotas to calculating fees. We also use MUSIS to prepare reports for DEET and provide statistical information to Planning and Analysis."

"With MUSIS we can also provide information for collating child care requirements and information relating to the university's Equal Opportunity

policies. It is not just that MUSIS can enrol 30,000 students in more than 300 courses, it is the flexibility built into the system to cope with the demands of university users that makes MUSIS unique."

More than 550 people are registered MUSIS users. The system aims to reduce job drudgery and eradicate student queues; a tall order given that Monash's enrolment is now larger than the population of many Australian towns. The first step towards cutting queues is a new pre-enrolment system, effective this year.

"We have analysed peak activity times, such as re-enrolment, and devel-

oped new, more effective methods for coping with demand," Mr Irvine said.

"For example, instead of asking all students to come in over an eight day period to enrol in their courses for next year, we are spreading the load over a four week period during October, November and December."

"In October, students register their preferred subjects with their faculty. If they pass their final exams in December, they are automatically re-enrolled in the courses they have nominated. In January, Student Administration will send them an invoice for fees, which they can pay directly into any bank."

"Only students who fail will need to come onto the campus in December to discuss re-enrolment with their faculties. With this simple arrangement we have reduced re-enrolment queues by up to 70 per cent."

Next year it is planned to further improve the service with the addition of a telephone information system that will enable students to check their results without coming into campus. With the present system the onus is on students to check their exam results when they are displayed on each campus.

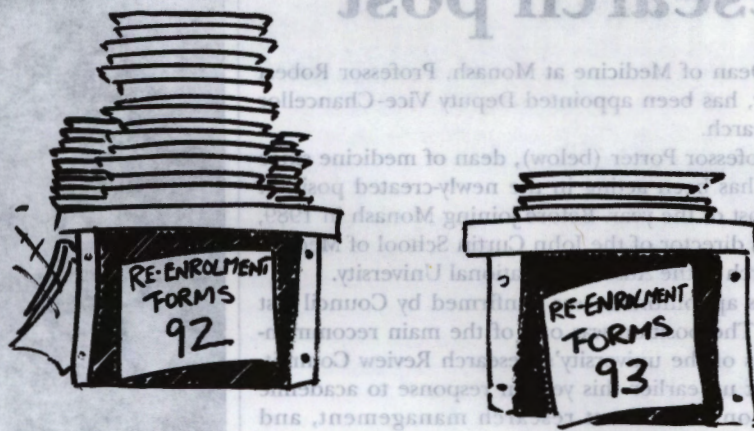
However, Mr Irvine believes improvements are already evident. For example, this year's exam timetable took only 20 minutes to create, thanks to a computer program developed by staff from AMIS and the Computer Centre. Previously, it has taken up to 12 weeks to develop an exam timetable for a single campus.

With the new program, once users had keyed their requirements, the task was completed in a matter of minutes with no consecutive subject exams and only three clashes. Other universities have now approached Monash with a view to purchasing the program.

Phil believes this is an example of the sort of rewards to be gained from thinking laterally and being open to change. Another example is the new digital imaging system for student cards. This technology allows the image to be stored on computer and transferred for use in faculties.

Students seeking a replacement card will not be required to wait for a second photograph to be processed as their old image can be used. In the future it is planned to use the imaging for a variety of uses, such as class lists with students' images.

MUSIS will never be a closed book. Mr Robinson and Mr Irvine agree that the system will be an ongoing task with scope for additions and improvements.



Boxer enters the educational ring

Educational research has been boosted by the installation of a new computing environment, known as 'Boxer', in the Faculty of Education.

The program was installed by Professor Andy diSessa, director of the Boxer development project at the University of California.

Boxer is an integrated computing environment with functions including programming, text editing, database design, file manipulation, graphics and animation.

Every part of the system is visible on screen; making changes on screen modifies the system. A text-based environment, it uses a box metaphor to describe ideas.

In any box, the user may add text or more boxes in arbitrary combinations. The spatial relationships on the screen are interpreted by Boxer in terms of computational ideas.

Boxer was first designed at the Massachusetts Institute of Technology as a successor to the educational computing language Logo. The project moved with Professor diSessa to Berkeley in 1986.

He anticipates the first commercial release of the program for Sun computers will become available before the end of the year, with a Macintosh version to follow soon after.

The School of Graduate Studies has ordered two XWindows terminals and, with the support of the Computer Science department, will run the Sun version of Boxer.

PhD student Ms Elizabeth Vincent, whose previous music learning research was done in Logo, will be the first at Monash to use the program on a Macintosh computer. Other projects will examine questions on learning in areas of science, mathematics and computing.



Professor diSessa installs the Mac development version of Boxer, watched by members of the Monash research group (from left) Ms Elizabeth Vincent, Mr Frederick Robilliard, Mr Paul Nicholson and Dr Anne McDougall.

RESEARCH

MONASH

Fighting for forest survival

Down through the millennia, Victoria's forests have been engaged in a never-ending battle for territory. Rainforest and eucalypt forest have waxed and waned, but the impact of people – particularly logging – now seems to be tipping the scales against the rainforests.

Out in the forests of east Gippsland and the Otways, the plants of two very different communities are playing their own ancient version of the old oriental game of rock-scissors-paper.

Victoria's cool temperate and warm temperate rainforests are constantly contending for territory with the eucalypt-dominated sclerophyll forests.

The eucalypt forests intermittently employ fire to repel the advancing rainforests, and to push into rainforest territory. The green, humid rainforests suppress fire and push their own boundaries outwards.

They come to dominate because eucalypts cannot regenerate under a dense rainforest canopy. In the absence of fire, eucalypt forest senesces at around 350 years; rainforest species can live twice as long.

The fronts between the two vegetation types have advanced and receded in resonance with climate change, with rainforest reaching its greatest extent towards the ends of the warm wet periods between glacials.

Relatively recently, a third force entered this ancient theatre of war: human beings. Aborigines began firing the forests and, in doing so, helped the eucalypts confine Victoria's rainforests to fire-protected pockets. Lastly, came the Europeans, who logged the eucalypt forests and sought to suppress fire.

Frequent burning soon after the arrival of Europeans reduced the wet rainforest elements and increased the flammability of the forests, perhaps increasing the likelihood of extensive wildfire. The Ash Wednesday firestorms of 1983 destroyed the largest remaining tract of warm temperate rainforest in Victoria – in Coopracambra National Park in the Cann River region of east Gippsland.

Concerned for the future of this rare vegetation type, Mr Peter Gell of the Department of Geography and En-

vironmental Science, convened a symposium last November to consider the conservation status of Victoria's remaining rainforest. The scientific papers from the symposium, co-edited by Dr David Mercer, have now been published in a new publication, *Victoria's rainforests: perspectives on definition, classification and management*.

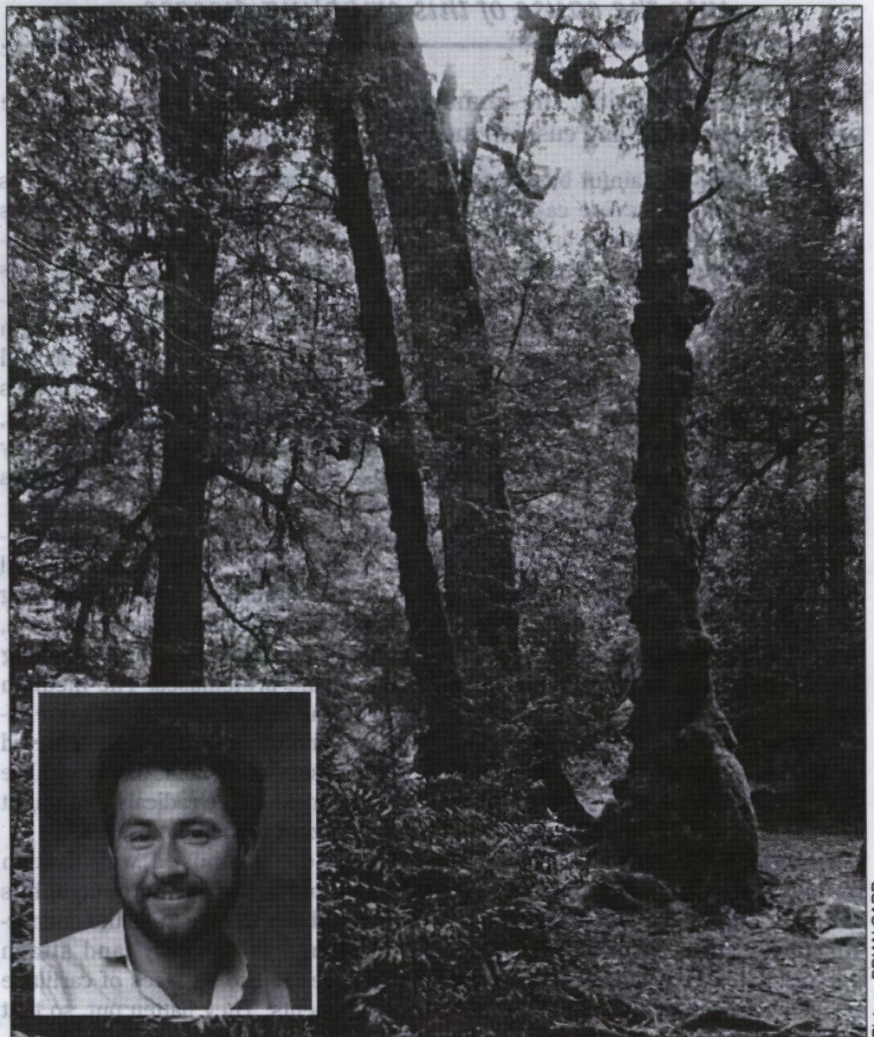
Mr Gell describes the book as a definitive work on the subject. He says not the least threat to the rainforests is a sort of death by definition. Depending on how broadly or narrowly rainforest is defined, Victoria has either 16,000 or about 35,000 ha of rainforest.

The larger figure applies if mixed eucalypt-rainforest communities are included in the definition of rainforest; the opinion of scientists at the symposium was that they should be. The forestry industry has favoured the exclusion of mixed communities from the definition; this view has held sway in official conservation practice.

Rainforest is characterised by broad-leaved species, which have grown in Victoria for perhaps 80 million years. They are not, as some have suggested, relics hanging on after climate change has passed them by, but communities well adapted to their present circumstances.

Dr John Busby, a researcher with the Australian National Parks and Wildlife Service in Canberra, told the symposium last year that a computer-based projection had shown that Victoria's rainforests occupy only 20 per cent of the area that is environmentally suitable for them.

Antarctic Beech (*Nothofagus cunninghamii*) and Sassafras dominate in the cool temperate rainforests of the



Rainforest in Victoria takes up less than one-fifth of one per cent of the state's total area, and even that is under threat. Inset: Mr Peter Gell.

Otways and central Victorian highlands. In East Gippsland, cool temperate rainforest is dominated by Sassafras and olive berry (*Elaeocarpus holopetalus*), while warm-temperate rainforest dominants are another species of olive berry, (*Elaeocarpus reticulatus*) and Lilly-pilly (*Acmena smithii*). Warm temperate rainforest, like its sub-tropical and tropical counterparts, also has lianes and epiphytes, including orchids.

The rainforests expand by infiltrating the eucalypt forests with an advance guard of relatively short-lived, fire-suppressing species including ferns, the tree daisy or blanket-leaf (*Bedfordia*), Banyalla (*Pittosporum bicolor*), and waratah (*Telopea oreades*). There is no sharply defined boundary, but a continuum terminating with eucalypts at one end and rainforest species at the other. In the absence of fire, within its climatic limits, rainforest will eventually invade and shade out the sclerophyll forest.

In the past, mixed communities have been excluded from the narrow definition of rainforest. Logging operations in eucalypt forest have been permitted right up to the boundary of pure rainforest and fires, set to burn off the trash in clear-felled areas to promote regeneration of eucalypts, prevent rainforest expanding and have selected for fire promoting species and against those that suppress fire.

Mr Gell says that the present area of rainforest of all types in Victoria represents less than one-fifth of one per

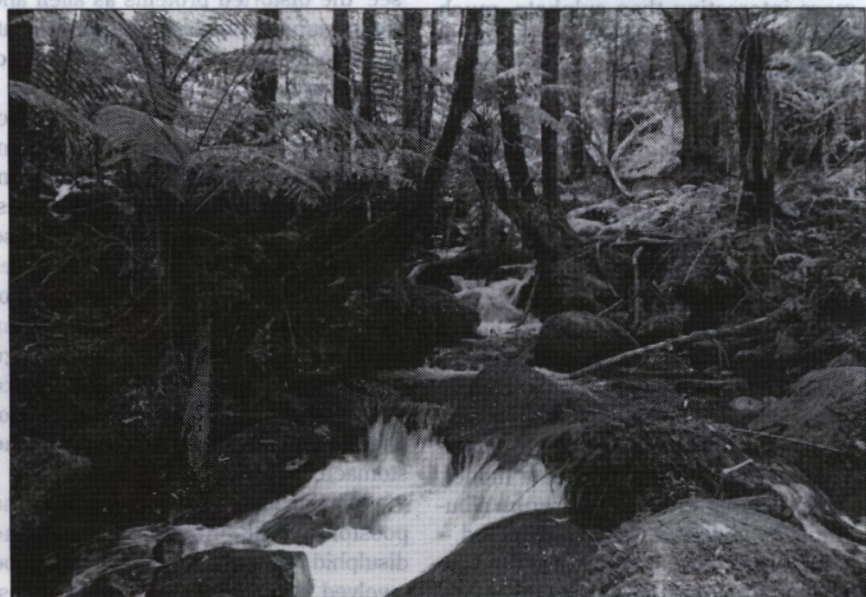
cent of the State's area. And even that small area is under threat – at a time when climatic conditions actually favour the expansion of rainforest.

Rainforest presents problems for conservation, because it tends to cling to protected gullies and to follow rivers and creeks. It thus forms linear strips that are not easy to protect in reserves or national parks. The way in which rainforest is defined is of crucial importance to the conservation of rainforest communities which lie outside of the national parks.

"Recent government research has shown that, in eucalypt forest, there is a shift from wet or moist sclerophyll towards drier community types after logging," Mr Gell said. "If logging practice favours the regeneration of drier sclerophyll forests immediately adjacent to rainforest, it increases the ability of intense fires to penetrate into the rainforest core areas."

"Logging of moist eucalypt forest containing secondary rainforest elements tends to shift the species balance away from rainforest, particularly where regeneration burns are employed. If the intensity of these regeneration burns is too great, rainforest will not regenerate."

"So there needs to be careful control of regeneration burning, as well as the controlled burns used to reduce fuel loads. The issue of protecting catchments is central to the issue of protecting rainforests."



One pocket of Victoria's remaining rainforest is in the central highlands.

Continued on Research Monash 8

Unravelling a crippling disease

Rheumatoid arthritis causes acute pain and debilitation that can only be controlled with large doses of anti-inflammatory drugs like aspirin. Such treatments are a double-edged sword, but a new study has yielded a potentially crucial insight into the cause of this crippling disease.

In rheumatoid arthritis, the immune system mounts an attack on the tissues that stabilise and cushion the joints: the cartilage and ligaments.

This results in painful bouts of inflammation and, in severe cases, crippling erosion of the joints as even the bone itself comes under attack. In the Connective Tissue Group in Biochemistry, research student Ms Elizabeth Gardiner has been examining the biochemistry of rheumatoid arthritis.

Ms Gardiner became interested in biochemistry as a third year undergraduate and, encouraged by Professor Dennis Lowther, undertook an Honours study. Then, in a joint PhD study with Drs Chris Handley and Clem Robinson, she investigated how white blood cells – the front-line troops of the immune system – begin attacking connective tissue when they have somehow been freed of the normal checks and balances operating in the synovial region, the fluid-filled environment of the joints.

The onset of rheumatoid arthritis is marked by an inflammatory response, which brings white blood cells swarming into the synovial region: mast cells, basophils and, particularly, specialised microbe-eating (phagocytic) neutrophils. The initial inflammation may, in fact, be caused by an infection, so the immune system's response in sending in neutrophils is quite normal.

But in some people, what happens next is not normal. "All hell breaks loose," Ms Gardiner said. The neutrophils and other immune-system cells begin releasing cytokines (cell-activating signalling compounds), along with highly reactive free-oxygen radicals and a cocktail of protein-digesting enzymes called proteinases. Normally, she says, these compounds work harmlessly within the security of the neutrophil's inner environment.

When the cell encounters a microbe, it engulfs it by folding its cell membrane around it and then pinching it off to form a cavity called a vacuole, into which it releases microbe-busting radicals and proteinases. The medium outside the cell contains proteinase inhibitors and other compounds secreted by the tissues of the joint that neutralise any enzymes or free radicals that might pose a hazard to the joint tissues.

The idea proposed was that in rheumatoid arthritis the neutrophils lose the ability to recognise the connective tissues as 'friendly' and attach themselves to the surfaces of cartilage and ligaments. They flatten out, so that one side of cell makes such close contact with the connective tissue that the



Ms Elizabeth Gardiner with her research collaborators (from left) Drs John Underwood, Clem Robinson and Chris Handley.

inhibitory substances in the synovial fluid cannot penetrate into the contact region.

In *in vitro* tests, pieces of cartilage were exposed to neutrophils and, subsequently, a protein-digesting enzyme called elastase was detected on the surface of cartilage, along with fragments of proteoglycan – one of the main structural proteins of the cartilage. Electron micrographs of the samples revealed tiny pits, suggesting that the neutrophils are actively deploying their lethal chemical weapons through their membranes and digesting the proteins of the connective tissues.

Neutrophils also release sulphated proteins into the synovial fluid. Drs Handley and Robinson hoped these might serve as a useful biochemical marker for the early diagnosis of rheumatoid arthritis. Any dramatic increase of a marker like a sulphated protein would indicate that the neutrophils had been activated.

During her Honours year, Ms Gardiner conducted experiments into the dynamics of sulphates in the synovial fluid and obtained some odd results. By incubating neutrophils with a mildly radioactive isotope of sulphur, she was able to track what happened to the sulphur as the neutrophils were activated.

"It seemed that the neutrophils were secreting lots of sulphur as sulphite (SO₃), rather than sulphate (SO₄)," she said. "Sulphite is much more interesting than sulphate, much more reactive, and it has antibacterial properties." (The food industry commonly uses calcium or sodium metabisulphite as sterilants and antibacterial agents. Interestingly, sulphites are known to trigger asthma attacks; asthma is now considered to be another form of auto-immune disease.)

This new finding will be published in the *Biochemistry Journal* later this year. Subsequently, Ms Gardiner began looking at the possible consequences of sulphite release by neutrophils into the synovial fluid.

In a collaboration with Dr John Underwood using the mouse as a model, she found that when mouse serum albumin – an abundant protein in blood – was treated with sulphite and then injected into healthy mice, the mice mounted an immune response against the modified protein. The immune

system treated the modified protein as 'foreign'. But the more provocative result was that the mice also mounted an immune response against their own, unmodified serum albumin.

Ms Gardiner says that she was so excited by the result that she was "bouncing off the ceiling. It was terrific. My PhD will have this terrific sting in the last chapter. I hope others will pick it up and do further research." So what role might sulphite play in an inappropriate immune response? Another Honours student in the department, Ms Zheng Yang, has shown that sulphite may be incorporated into disulphide bonds on 'friendly' proteins.

One of the most important discoveries in immunology is that the immune system distinguishes between friendly and foreign proteins more on the basis of their tertiary (three-dimensional) structure than their specific chemistry. Proteins consist of linear chains of amino acids that spontaneously fold up into their final, active three-dimensional shape, secured by a system of chemical bonds, including disulphide bonds.

It is possible, she says, that the large quantities of sulphite that neutrophils release into the synovial fluid would react with disulphide bonds on proteins, distorting their normal tertiary structure. Other immune-system cells involved in the crucial process of recognising any alien proteins in the body 'see' the distorted proteins as alien and the immune system mounts episodic attacks on them, resulting in the destruction of cartilage and ligaments.

Ms Gardiner is motivated by the fact that one of her friends suffers from rheumatoid arthritis. Quite apart from the acute pain and debilitation it causes, the disease flares up unpredictably so that sufferers cannot plan their lives more than a day or so ahead and cannot keep regular jobs. The pain and inflammation can be controlled with large doses of anti-inflammatory drugs like aspirin, but aspirin causes other biochemical changes in the lining of the stomach, leading to stomach ulcers.

Ms Gardiner's finding points to the possibility that sulphites, through the disulphide bonding mechanism, may be involved in other auto-immune diseases. It could stimulate a whole new field of research.

RESEARCH MONASH

We want to hear about research at Monash for next year's scientific publications.

Some articles featured in *Research Monash* and *Montage* will also appear in the university's annual research review *Eureka*.

If you believe your work would interest readers within the university and in the wider community, complete the coupon below and send it to:

The Editor, *Research Monash*
Public Affairs Office, Gallery Building, Clayton campus

Name

Department

Synopsis of topic

Briefly describe the work's potential applications:

Decaying cities of our making

Australia's urban infrastructure – its bridges, roads, buildings, power plants, water and gas-reticulation systems – is decaying. Just repairing the decline will soon consume the entire infrastructure budget of some cities. A Monash engineer believes the causes of this malaise have been built into the system.

The causes of infrastructure decay lie much deeper than the recession or inadequate maintenance, according to Professor Brian Cherry, Associate Dean for Research and Development in the Faculty of Engineering.

It is a problem that feeds upon itself, with its roots in the public tender system, inadequate training of construction workers, and the inexperience of some supervising engineers. He says by the second decade of next century, some of Australia's cities face the prospect of having to devote their infrastructure budgets to maintenance, leaving no capital funding for new works.

"I believe we are rapidly approaching a state of being the last generation of Australians to enjoy the full amenities of a city," Professor Cherry said. "The development of the public tender system has been bad news for the durability of infrastructure."

He likes to illustrate his argument with an anecdote about an American astronaut, who when asked by a television interviewer whether he was ever scared during a space mission, answered: "Ma'm, when I thought about that capsule consisting of 14,728 items, each of which had been bought on the basis of lowest possible tender, I was scared."

"Government authorities are normally required to get the lowest possible tender," Professor Cherry said. "Durability and the long term cost of maintenance usually have little place in their calculations. And for our entrepreneurs and developers – the people we are supposed to worship because they get big projects going – the major objective must be to minimise their costs. They have a greater moral obligation to their shareholders to maximise short term profits than they have to maximise durability."

On the rare occasion when an instrumentality does not accept the lowest tender, the engineer must justify his decision to non-engineers. Professor Cherry says he has had personal experience of this situation on a major construction project, in which he recommended one system against another –

supposedly cheaper – system because it was inherently more durable.

"In the end, we managed to get the price of the more durable system down to less than the scheme originally proposed," he says "But I think it was purely because of the way that we fought that the authority eventually allowed two tenders on both schemes, and I recognise that if the less durable scheme had come in cheaper we would probably never have succeeded."

Professor Cherry suggests that sociological considerations have an insidious influence on the quality and durability of infrastructure. "If you take a 22-year-old civil engineering graduate, lacking in experience, and make him a site engineer in charge of a project where there is a 55-year-old shop steward who has been dealing with young sprogins like him for more than 30 years, how likely is it that the young engineer will receive the respect he needs to control the quality of construction?" he asks.

"When money is scarce the reality is that if a young, inexperienced engineer costs \$26,000, and a senior engineer costs \$50,000, the young engineer will get the job. It's a sociological problem, not a technological problem. Inevitably, corners get cut, and it's not primarily a matter of budget."

"In the field of civil engineering we know that 75 mm of cover of a 0.45 water:cement ratio concrete will stand up to seawater for 50 years because this specification was incorporated in our construction standards by the late 1960s. Yet things are still not being built to these standards today."

"The community expects its roads, bridges and hospitals to last. But at the trades level I think there is a profound lack of knowledge about why specifications are written the way they are. It's a training problem: if the builder was aware of the reasons for a specification,



Professor Brian Cherry: "I believe we are rapidly approaching a state of being the last generation of Australians to enjoy the full amenities of a city."

then it is much more likely that it would be adhered to. I believe that this is very much a consequence of the 'us and them' attitude.

"The workers can come on site, pour the concrete and go home and forget about it. If the managers were more willing to train the operatives and give them more interest in the job, they would know how what they are doing affects what they are creating and the work would be done much more closely to specification. Even for quite basic jobs you need some fundamental knowledge; the 55-year-old shop steward who is trying to win more from the management on behalf of his workers can, with technological training, achieve more for both workers and the management."

Professor Cherry says the rate of development of infrastructure in Australian cities must inevitably slow down as more and more funds are transferred to maintenance. Politicians had to share the blame because while they were prepared to splurge periodically on new capital works to gain political kudos, there was no political capital in the large budgets needed to maintain those works a decade later.

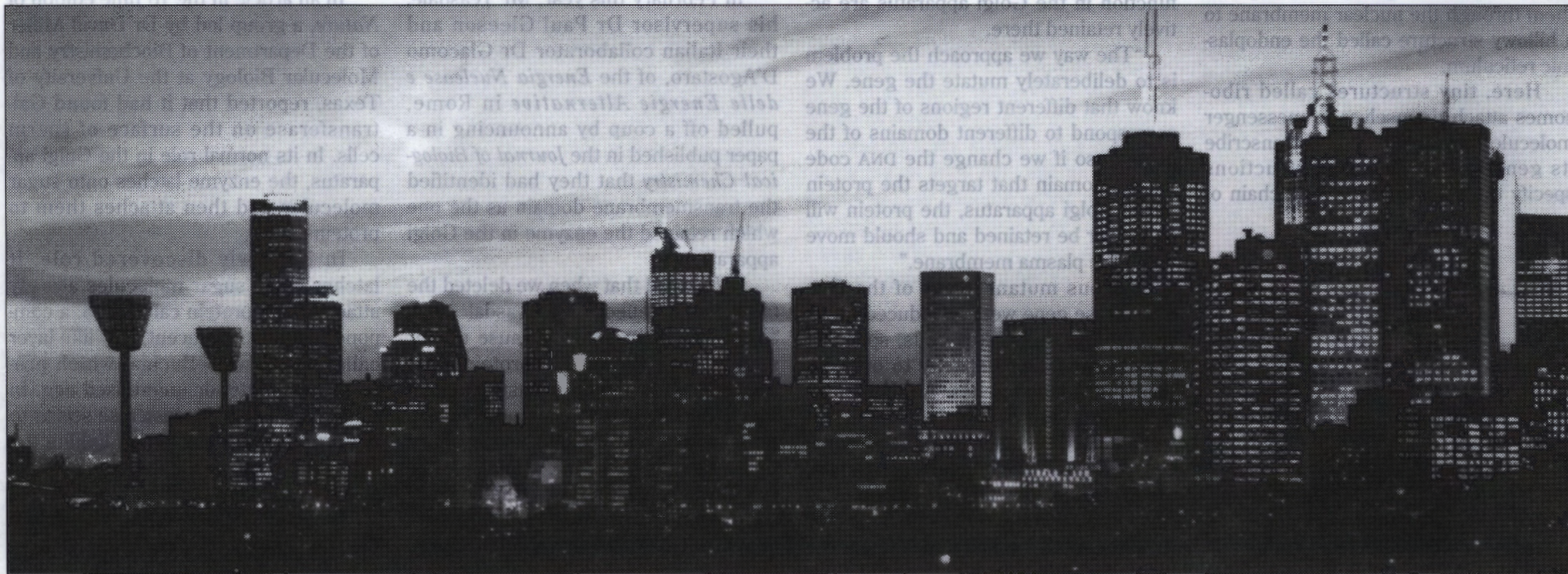
Scrimping on maintenance did not save money. Professor Cherry says Australia's failure to pursue the best possible corrosion-mitigation practices in

maintaining its urban infrastructure was costing some \$750 million a year.

The causes of Australia's infrastructure decay were institutionalised, but were common to most cities of the world. "In most European cities, if you take a cab from the station to your hotel, you look at the refurbishment taking place en route and think: 'Won't it be nice to come back in 10 years when all the maintenance will have been completed and we can see the city as it was built'. But of course it won't – it will probably be worse."

Part of the problem may be that engineers now understand the behaviour of their materials much better than they did a few decades ago, and were building much closer to the limits of their materials. "That's good engineering, but the capacity to build closer to the limits means that the margin for error during construction is much less," Professor Cherry said.

"In the past, we over-engineered to minimise the risk of failure to the extent that durability was much less of a problem. Today, our knowledge of structural performance has outpaced our knowledge of lifetime performance. When they were building Salisbury Cathedral in England in the 14th century, they were more worried about making it stand up rather than about how long it would last."



Some of Australia's cities may have to devote their infrastructure budgets to maintenance, leaving no capital funding for new works.

Targeting enzyme behaviour

The human body is assembled from several hundred billion cells, each with its own specialised function and structure. How do the individual enzymes and proteins that make up a cell 'know' their place in this elaborate system? The answer is embedded in DNA's blueprint.

Like many other young scientists working on biology's frontier, Rohan Teasdale dreads the inevitable "And what do you do?" question that serves as a pipe-opener for polite conversation at social gatherings.

"I just tell them I'm a cell biologist and hope that's enough," said Mr Teasdale, a PhD student in the Department of Immunology and Pathology at the Monash Medical School in Prahran.

Describing one's research on intracellular targeting of an enzyme called beta-1,4-galactosyltransferase (Gal-transferase, for short) may cause the inquirer's eyes to glaze over and to divert the conversation to the weather or last night's TV movie. But if this enzyme and others like it did not perform their specialised functions in precisely the right location, a human being might be no more than an amorphous collection of several hundred billion cells.

In a PhD project supervised by Dr Paul Gleeson, Mr Teasdale is studying one of biology's deeper mysteries: how the myriad proteins and enzymes that organise the structure and function of living tissues manage to find their way to the right place in the body. Some form of targeting is involved: a molecule of protein or an enzyme must carry somewhere within its structure a message that directs it to the right site within the cell, or beyond it, where it is to perform its specialised task.

Since each individual protein or enzyme is assembled according to the precise instructions of the gene that specifies it, the DNA code of the gene itself must have this information embedded in it. What is the nature of these instructions, and how do they specify the destination of the protein molecule? Mr Teasdale has been seeking to throw light on these questions, using the Gal-transferase gene as a model.

A mammalian cell in cross-section bears some resemblance to a walled mediaeval city (see figure 1). A series of concentric walls protect the city's residential core; the walls are represented by specialised membranes. The centre of the cell, the nucleus, houses some 100,000 genes and is surrounded by a nuclear membrane. Enzymes within the nucleus synthesise copies of the DNA code of an active gene, and despatch them through the nuclear membrane to a billowy structure called the endoplasmic reticulum.

Here, tiny structures called ribosomes attach themselves to messenger molecule from the gene and transcribe its genetic code. These instructions specify the assembly of a long chain of

amino acids that fold spontaneously into the final three-dimensional shape of the protein.

Tiny bubble-like structures called vesicles fill up with the protein, and bud off the endoplasmic reticulum, then move to another cellular organelle called the Golgi (pronounced *gol-gee*) apparatus. The Golgi apparatus, a series of folded membranes, houses an array of enzymes that modify the newly synthesised protein molecules into their fully functional form.

Not all proteins are modified; some may actually remain in the Golgi apparatus if they are directly involved in the process of modifying other protein molecules. If not, they may migrate up through the layers of the Golgi apparatus to the outer region of the cell to embed themselves in the plasma membrane – the outer 'skin' of the cell.

Some do not even stop there; they ghost through the outermost membrane and into the intracellular medium, perhaps to be transported elsewhere in the body where they may help construct new tissues or carry out important biochemical reactions.

Mr Teasdale focused on Gal-transferase because it travels only as far as the Golgi apparatus. The enzyme is involved in a process called glycosylation, in which molecules of a natural sugar called galactose are attached to a range of proteins before they are exported to the plasma membrane.

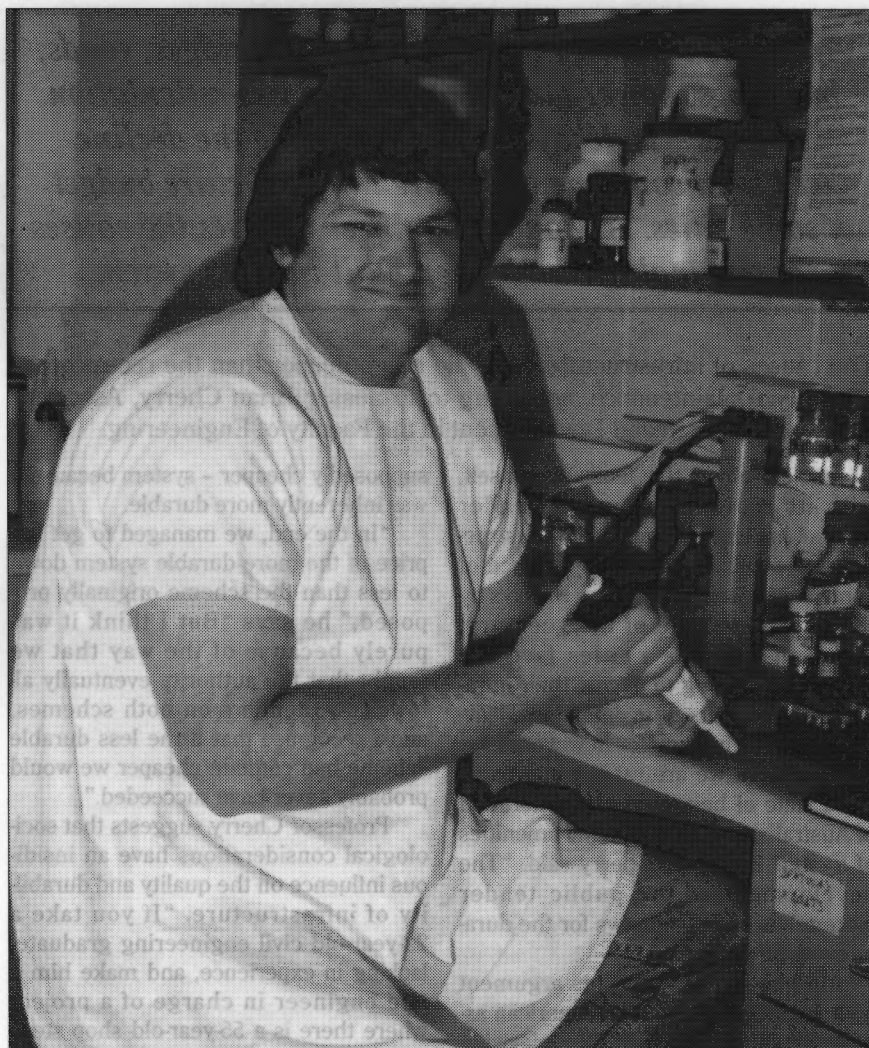
These sticky sugar-swathed proteins are the body's natural glues, serving to stick cells together into the elaborate communities of the body's organs and specialised tissues. Without them, these tissues might fall apart.

How does Gal-transferase 'know' how to go only as far as its workplace in the layers of the Golgi apparatus, and not all the way to the plasma membrane? "The current thinking is that plasma membrane proteins end up there by default," Mr Teasdale said. "This implies that proteins that live and function in the Golgi apparatus are actively retained there."

"The way we approach the problem is to deliberately mutate the gene. We know that different regions of the gene correspond to different domains of the protein, so if we change the DNA code for the domain that targets the protein in the Golgi apparatus, the protein will no longer be retained and should move out to the plasma membrane."

Various mutant forms of the Gal-transferase gene were introduced into a special line of monkey cells, specially selected for their capacity to over-express introduced genes. Antibodies labelled with fluorescent dye sought out and attached themselves to the enzyme. Under a powerful optical microscope, the dye revealed where the enzyme was concentrated in the cell.

If the mutation had knocked out the targeting signal, the cell would fluoresce on its margins, indicating that the enzyme had gone right through to the



Mr Rohan Teasdale: throwing light on one of biology's deeper mysteries.

plasma membrane. If not, it should concentrate in its normal home in the Golgi apparatus, lighting up the region around the nucleus.

Mr Teasdale says molecules of Gal-transferase consist of three domains: a catalytic domain, a transmembrane and a tail. The catalytic domain – the business end of the molecule – is cleaved from the molecule and floats off into the intra-cellular medium, where it performs its appointed task of attaching galactose molecules to proteins.

The fact that it is cleaved off naturally exempts it from containing the targeting information. The transmembrane domain sits within the phospholipid membrane of the Golgi apparatus, while the tail projects from the membrane's underside into the cell's fluid interior, pointing back towards the nucleus.

In scientific parlance, this research field is 'hot': half a dozen other research teams around the world are competing to identify the enzyme's anchor.

In February this year, Mr Teasdale, his supervisor Dr Paul Gleeson and their Italian collaborator Dr Giacomo D'Agostaro, of the *Energia Nucleare e delle Energie Alternative* in Rome, pulled off a coup by announcing in a paper published in the *Journal of Biological Chemistry* that they had identified the transmembrane domain as the one which retained the enzyme in the Golgi apparatus.

"We found that when we deleted the tail it had no effect," Mr Teasdale said. "That was interesting, because earlier studies have shown that proteins that are retained in the endoplasmic reticulum (the innermost organelle where proteins are synthesised) usually have their retention signal in the tail."

"It was quite unexpected to find it in the transmembrane domain of this enzyme. If you think about the ways that a protein might be retained in a membrane, a good guess would be that it caught by the tail by some other

receptor protein already present in the membrane. It seems that in this case the transmembrane region may interact directly with the phospholipids of the Golgi membrane, although we can't be certain." He says studies like his own are primarily aimed at gaining a better understanding of the way cells work, but in the case of the Gal-transferase gene, there has recently been an interesting sequel.

Beta-1,4-galactosyltransferase, which normally works in cell interiors, has also been found in the medium between cells, suggesting that it may have other roles in the body. But how it manages to escape from the cell interior is a mystery. If natural leakage is not responsible, it is possible there is another form of the enzyme which has a modified transmembrane domain – or which lacks the domain completely – so that the enzyme makes it all the way to the plasma membrane, and then into the intracellular medium.

In an article in the 18 June edition of *Nature*, a group led by Dr David Miller of the Department of Biochemistry and Molecular Biology at the University of Texas, reported that it had found Gal-transferase on the surface of sperm cells. In its normal role in the Golgi apparatus, the enzyme latches onto sugar molecules and then attaches them to proteins.

In its newly discovered role, it latches on to sugar molecules already attached to a protein called ZP3, a component of the translucent, jelly-like layer called the zona pellucida, which protects the oocyte, or unfertilised egg. In this novel role, Gal-transferase seems to perform the vital function of linking the ovum with the one successful sperm among hundreds of millions.

In short, Gal-transferase supervises the magic moment of conception. Here, at least, is a discovery that could enliven discussion at the next social gathering that Rohan Teasdale attends.

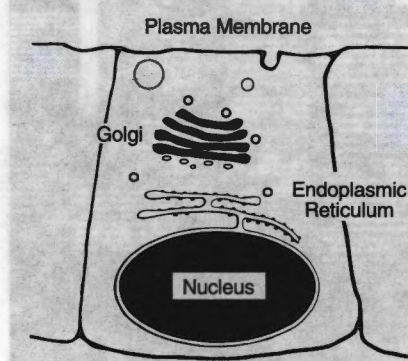


Figure 1.

Bearing up under the strain

Bearings are the most common components in modern machines, and the most critical. The failure of a single bearing in one machine can bring an entire production line grinding to a halt, resulting in significant revenue loss. A PhD project at Monash is taking the guesswork out of bearing maintenance.

A bearing usually gives some warning of its failing health, but in a modern industrial plant there may be few people who can speak its language.

In the past, maintenance staff became familiar with machines through long experience and could judge whether to replace a noisy bearing immediately or let it run until regularly scheduled maintenance was due. However, such seat-of-the-pants experts are dwindling in number.

Efficiency demands some way of monitoring the condition of bearings objectively, so that problems can be anticipated. A bearing must be able to be repaired or replaced with minimal disruption to production.

PhD student Mr Chris Mechefske, of the Department of Mechanical Engineering, has been studying the cryptic language of healthy and ailing bearings and analysing their complaints using advanced mathematical techniques. He has used his findings to develop computer software that will translate the information into a form that can be readily understood.

His PhD project has been supervised by Dr Joseph Mathew, of the Centre for Machine Condition Monitoring, and the research itself has been sponsored by the aluminium company Comalco. The company was interested in finding a more effective way to monitor the condition of low-speed, high-load bearings on conveyor belts used at smelters to transport raw materials.

All bearings, even those in mint condition, emit a characteristic pattern of vibrations or 'noise'. Only in the terminal stages does the frequency of these noises spill into the spectrum spanned by human ears. The tell-tale early signs of trouble may be inaudible, and can only be detected by electronic transducers mounted on the bearing.

The pattern of vibration potentially contains valuable information, but it must first be analysed and then interpreted. "It comes down to a way of automatically classifying a frequency spectrum as normal, or as representing some fault condition, or anywhere in between," Mr Mechefske said.

"It's also important to distinguish between different categories of faults. For example, if you have a flaw on the outer bearing race of a very expensive bearing but the bearing is loaded in such a way that all the load is on the bottom of the race, then the race can be rotated to place the fault at the top where it is not under load. But if the rollers are damaged, it would mean replacing the whole bearing because the position of the race is irrelevant."

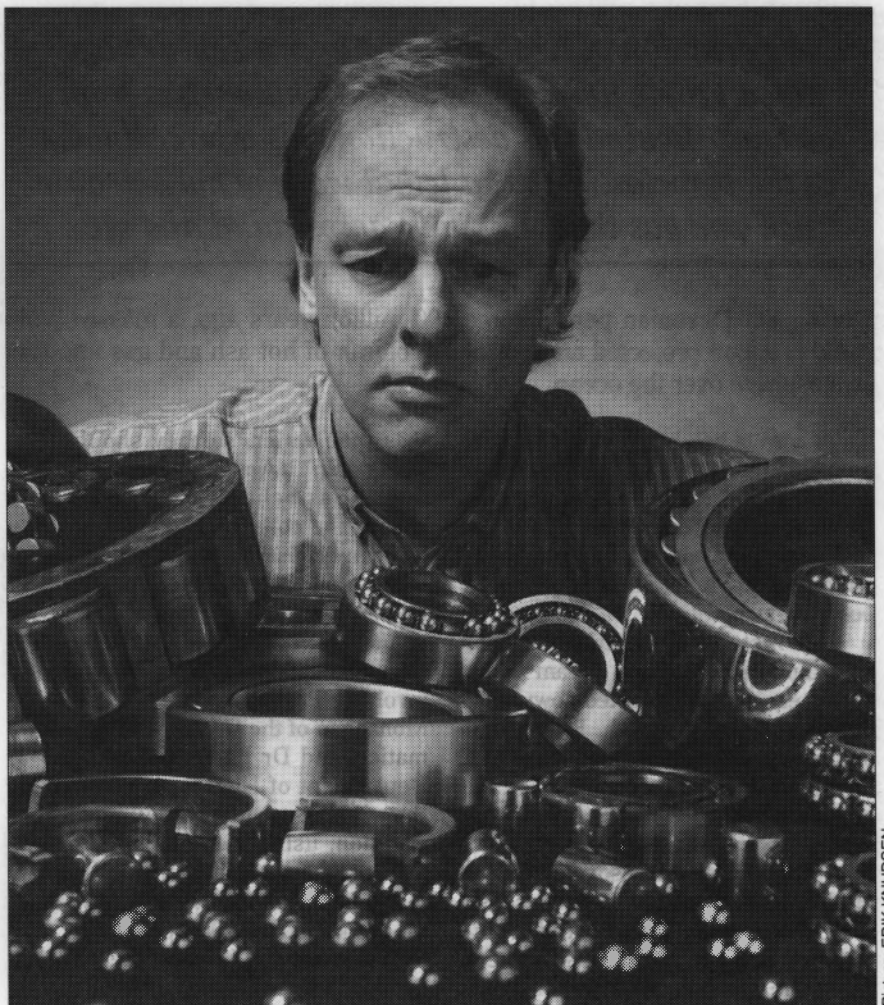
A neural network – a computer programmed to learn in a quasi-human way – could be taught how to recognise particular faults. But teaching a neural network to recognise various problems in different bearings under a range of operating conditions would be very time-consuming.

Mr Mechefske has developed a technique based on extracting information from a bearing's frequency spectrum, potentially a shorter route to diagnosing a problem. Against the routine noise of a normal bearing – its normal frequency spectrum – any unusual vibration signals an abnormality, and its characteristic frequency offers clues to its source and nature.

The various components of a bearing (the outer race, inner race and the rollers that separate them) do different jobs, but interact with each other. In a healthy bearing, each component emits vibrations at its own characteristic frequency and energy; the frequency will vary according to how fast the bearing is working as a unit. The rollers, for example, rotate faster than the inner race because of their smaller diameter.

If one of the rollers develops a small flat spot due to wear or overloading, it may 'click' rapidly as it makes contact with both the inner and outer race. If a flaw develops on the outer race, all of the rollers will click as they pass it. In each case, the fault changes the bearing's frequency spectrum.

Mr Mechefske compares the bearing's frequency spectrum against the



Picture: ERIK KNUDSEN

PhD student Mr Chris Mechefske ponders wear and tear on bearings.

spectrum of a healthy bearing working at the same speed, using a computer-based mathematical model of the vibration signal generating process. The degree to which the measured spectrum departs from the healthy bearing spectrum is represented as a number from 0 to 100, known as the probability of fault existence, with low numbers indicating normality and high numbers indicating a fault.

The computer program he has developed contains a library of signals of known faults; the software finds the nearest match. Even if the computer cannot identify the fault – it may be of a new type not yet represented in its library – it will still pick it out as an abnormality.

The advantage of his technique is that it can detect a fault within a matter of seconds, where other techniques may need to monitor a bearing for 10 minutes or so before the abnormal signal emerges from the background noise. By monitoring the bearing at regular intervals the computer can look at the trend of the fault and predict how long it will be before the bearing fails. The plant manager can choose a convenient time before the predicted date of failure to repair or replace the bearing.

Bearings are subject to a range of problems as they age: the surfaces of the races may become pitted by fatigue spalling or components may corrode. If a large bearing is transported by road in a vertical position, a bumpy ride can cause very high static pressures on one part of the race, causing it to harden. Abnormal patterns of wear can occur when it is put into service.

Mr Mechefske's software can detect these types of faults, but has not yet been extended to detect faults that result from mismatched components or faulty installation of bearings. He has also been experimenting with an analytical technique for identifying different types of faults based on the computer program SNOB, written by Professor

Chris Wallace of the Department of Computing Science.

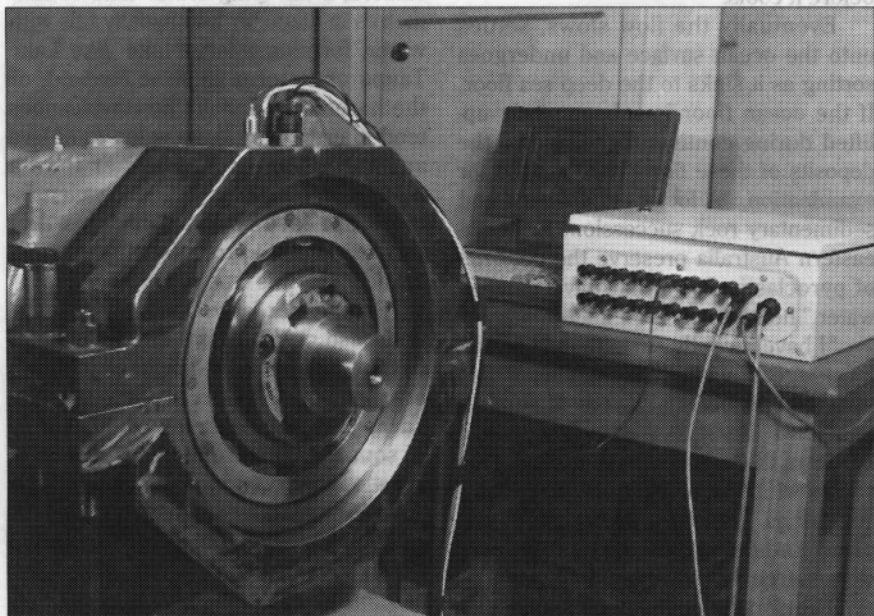
Professor Wallace has developed a technique that estimates the length of computer code needed to describe a group of similar phenomena: in the case of bearings, their frequency spectra. In essence, the computer estimates the minimum amount of code needed to describe a group of spectra; the shorter the code, the greater the similarity, and the greater the likelihood that they represent the same type of problem.

Mr Mechefske says the technique does a very good job of matching and classifying various types of frequency-spectrum data. Written to run on a moderately powerful VAX computer, it is fairly demanding on computer power. He would like to convert it to run on one of the popular class of PCs with a 386 chip.

"Apart from all the technical work I have done, the thing I am proudest of is that it looks like my software can solve a problem that continues to exist in industry, leading to considerable cost savings," he said. "At the moment, there is no accurate way to predict when low-speed, heavily loaded bearings are going to fail."

The results of the research have been distributed by the Centre for Machine Condition Monitoring to companies that contribute to the centre's running costs and research programs. BHP Steel and Alcoa have both expressed interest and have agreed to sponsor further research aimed at producing a PC-based software package for monitoring low-speed bearing condition.

Mr Mechefske says the software could be installed as part of a permanent monitoring system, in which a PC would be used to monitor a network of transducers mounted on machines throughout a plant. "Companies are now tending to lean towards on-line monitoring of critical equipment so that they can anticipate problems and carry out maintenance before something fails," he said.



Measuring the frequency spectrum of an ailing bearing.

Flowing waves of destruction

The eruption of Krakatoa just over a century ago killed people living on islands 45 kilometres from the blast. Behind this destruction was a force known as the pyroclastic flow, a lethal wave of hot volcanic ash and gas that can move across land and sea.

During the Devonian period some 400 million years ago, a massive volcanic eruption projected an enormous column of hot ash and gas into the stratosphere over the ocean.

At a great height – perhaps as much as 50 km – it lost momentum and cooled sufficiently to lose buoyancy in the thin atmosphere. Then it collapsed under its own weight. Gathering speed under gravity, it splashed down on the ocean surface.

But instead of sinking it began spreading radially, like a stream from a high-pressure hose directed downwards onto a concrete footpath. Riding on a bed of vapourised sea water, the 700°C pyroclastic flow raced outwards at speeds of up to 700 km/h before it slowed, cooled, and then began to sink.

Volcanologist Professor Ray Cas, of the Department of Earth Sciences, estimates the volcano erupted some 2000 km³ of ash and lava, which carpeted the sea floor over an area of at least several thousand square kilometres. Over time – during mountain building crustal events – the sea floor became dry land, preserving an extensive sedimentary basin in what is today inland NSW.

The original volcanic deposit was weathered, dissected and reworked by other geological processes over the past 400 million years, but Professor Cas says it is clear that it formed a contiguous deposit that could only have been deposited by massive eruptions.

"One of the least well understood phenomena in volcanism is what happens when a gas-rich flow of ash comes in contact with a significant body of water," Professor Cas said. "Some would have it that such a large volume of solids would enter the ocean and continue to flow underwater as a gas-supported flow."

"Others argue that if you look at the flow's physical characteristics, it should actually flow over the water. Firstly, the significant temperature differences between the flow and the water mass would set off sustained phreatic explosions, caused by the sudden vapourisation of water."

"Secondly, many pyroclastic flows also carry low-density particles of pumice, so their bulk density is actually

less than water, so they should flow over water." It was this type of flow, Professor Cas believes, that could have caused the collapse of the Bronze Age Minoan civilisation when the Santorini volcano on the Aegean island of Thera erupted around 1620 BC.

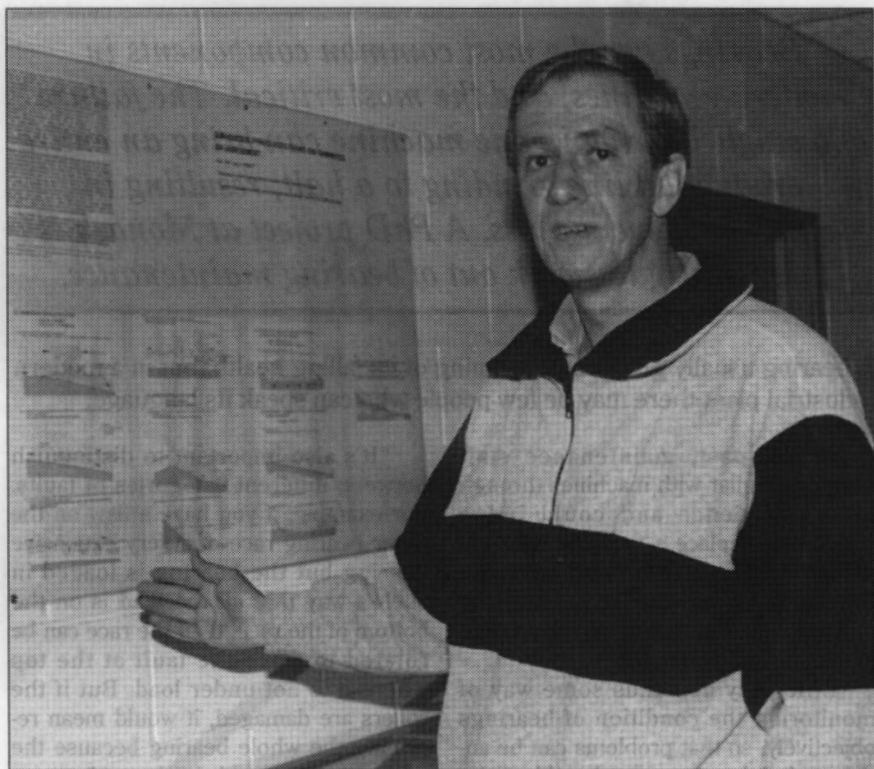
Research Monash reported earlier this year on a multidisciplinary project involving Professor Cas, Professor Joe Monaghan of the Department of Mathematics, and Dr Peter Bicknell, of the Department of History, to reconstruct the violent events surrounding this eruption, using a combination of historic accounts and mathematical models of the behaviour of the tidal waves and the associated pyroclastic flow.

Professor Cas believes the pyroclastic flow may even have reached the shores of Crete, 140 km away, setting fire to houses inland, beyond the reach of the tidal waves that followed. "There are documented cases of pyroclastic flows over land that travelled more than 100 km," he said. "The deposit from the Lake Taupo pyroclastic eruption in New Zealand in AD 183 reached the outskirts of present-day Auckland."

"These flows are very mobile. The Taupo pyroclastic flow, to travel such a distance, and to flow over the high intervening topography, must have been travelling at 600 m/s. The main force driving such flows is gravity, and to get a dispersal of the fallout ash over large distances, the column of ash and gas from the eruption might have been as much as 50 km in height."

Professor Cas says that in a major eruption, the gas and ash column is impelled by the force of the explosion to great heights. When that momentum begins to wane, the column continues to rise from convection as it entrains air from the atmosphere around it, heating it up to 600°C.

Finally, it reaches a height where the bulk density of the column is the same as that of the surrounding atmosphere; it spreads laterally and begins to drop its ash, although some of the finer ash at altitudes above 25 km can be



Vulcanologist Professor Ray Cas: "If one of the very large scale eruptions occurred today, there would be enormous loss of life."

transported all the way around the globe. If the column becomes overloaded with solids and is denser than the atmosphere, it collapses, producing pyroclastic flows.

"Once the collapsing column hits the ground it acquires enormous kinetic energy," he said. "It also acquires mobility from the continued expulsion of gas from the ash particles. And, if the landscape has abundant vegetation – as it did in New Zealand – it is instantly volatilised and the released steam serves to support the flow as it streams through it."

Pyroclastic flows have caused huge loss of life down through history: some 20,000 died in St Pierre when the Mt Pelee volcano erupted on the Caribbean island of Martinique early this century, and thousands died in the Krakatoa eruption of 1882 when a pyroclastic flow swept over the ocean, burning people on beaches up to 45 km away. The populations of the ancient Roman towns of Pompeii and Herculaneum were wiped out by pyroclastic flows from Vesuvius.

Professor Cas says that in a major eruption like Krakatoa, the volcano may already have covered the surrounding ocean with floating pumice. This floating carpet of light material may insulate the pyroclastic flow from direct contact with the surface of the sea, so that it projects to much greater distances before it cools.

Eventually the flow slows, settles onto the ocean surface and undergoes sorting as it sinks to the deep sea floor. If the ocean floor is subsequently uplifted during continental collisions, the deposits of these flows are exposed for examination. "A lot of old volcanic and sedimentary rock successions in south-eastern Australia preserve the deposits of pyroclastic flows that have entered water," he said.

"I have recently studied one of Cambrian age in western Tasmania which consists of individual layers of pumice, ash and crystal fragments some 70–80 m thick. It occurs in black pyritic shales which indicate quiet, deepwater conditions. (Pyritic shales contain sulphur, indicating they formed in an oxygen-free deepwater environment.)

The sorting of the particles by size is the most distinctive aspect of these deepwater deposits. Professor Cas says

this suggests an intimate interaction between the flow and the water as it sinks. The textural characteristics point to very efficient mixing of water with enormous volumes of ash, which also can be seen in the Devonian deposits in NSW, near Bathurst, where the ash volume of individual deposits was up to 150 km³.

"It's fairly clear that eruptions recorded in historical times were relatively small in scale and intensity compared with some of those represented in the geological record," he said. "If one of the very large scale eruptions occurred today, there would be enormous loss of life."

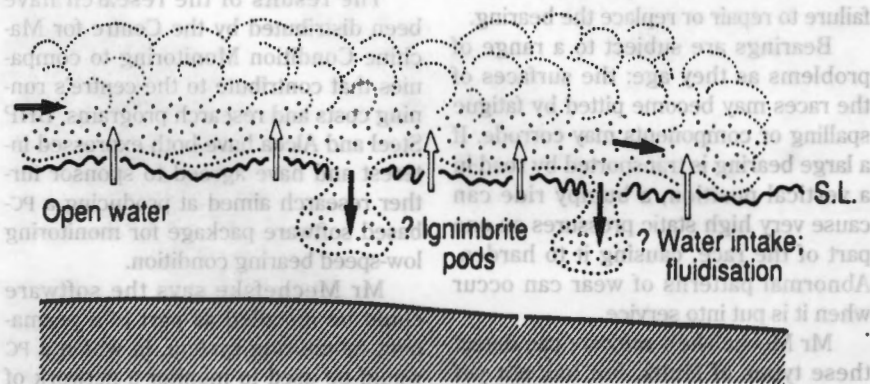
"There is a lot of speculation that the Earth goes through cycles of volcanic flare-ups, with numerous eruptions. I don't think historic records extend long enough to say the Earth is in a quiescent phase today."

Two potential sites for catastrophic modern-day super-eruptions – much larger than the Mt Pinatubo eruption in the Philippines last year – are at Rabaul in New Britain, and Lake Taupo in New Zealand. The characteristic of such sites is that the volcano does not form a cone, unlike stratovolcanoes such as Mt Fuji in Japan or Mt St Helens in the US. Stratovolcanoes tend not to produce violent eruptions because the cone itself would be destroyed.

The biggest eruptions form a caldera, a low-lying crater tens of kilometres in diameter that usually fills with water, forming a large lake, like Lake Taupo or Rotorua in New Zealand, or the harbour in Rabaul. Stratovolcanoes tend to erupt very large volumes of lava and form large cones rather than a caldera-type volcano. The Hawaiian Islands are lava shield volcanoes that were formed – and continue to be formed – by this type of eruption.

Spectacular large volume lava eruptions also occur during the break-up of continents. A good example of this type of eruption is the Deccan Traps in India. Lavas covered hundreds of thousands of square kilometres during sustained eruptions by scores of volcanoes some 65 million years ago. The flows are typically of low-silica, basaltic magmas, in which the eruption rates can be as high as 1 million m³/s.

Continued on Research Monash 8



Like skipping stones across a pond, the pyroclastic flow will continue to travel over the water. As in the Krakatoa eruption, it may flow considerable distances given the low coefficient of friction due to its high velocity, a low angle of incidence and the surface tension of the water.

Bridging the age gap

The discovery of cracks in the supporting steel framework of the West Gate Bridge two years ago prompted a detailed study of the daily stresses and strains that it endures. Monash engineers found a flaw, overlooked by the original designers, that is actually helping the bridge to age safely.

In 1970, the collapse of one of the West Gate Bridge's spans during construction killed 35 construction workers and engineers. In the light of the bridge's ill-starred history, finding fatigue cracks in unexpected places caused some disquiet.

But the cracks are of no immediate concern, according to Associate Professor Paul Grundy, of the Department of Civil Engineering, who has been investigating the small fatigue cracks since they were first detected about two years ago. "There's nothing remarkable happening," Dr Grundy said.

"Fatigue cracking is a recurrent problem with modern cable-stayed box-girder bridges. It is the box girders that are part of the problem here, not the cable stays," Dr Grundy describes some of the problems experienced with some box-girder bridges in Europe as quite frightening, but says the West Gate Bridge had many good features engineered into it to minimise the fatigue experienced in bridges of this type.

The bridge's specifications included a regular maintenance and inspection program, designed with the expectation that the first fatigue cracking would show up after about 10 years of service. That expectation was fulfilled early with the discovery of some minor cracking in areas where they had been predicted.

The cracks found two years ago, however, were of a different type. "They were not found in locations predicted in the manual," Dr Grundy said. "But this is inevitable because all bridges are unique, and have their own idiosyncrasies."

Dr Grundy has considerable experience in studying metal fatigue in large steel structures, particularly railway bridges in Victoria and offshore structures like oil and gas production platforms, where the consequences of metal fatigue and corrosion can be very serious.

The West Gate Bridge is in a coastal environment where salt in the air can rapidly attack and corrode any unprotected metal exposed by cracking. So Victoria's Road Construction Authority engaged Dr Grundy's research group to

investigate the nature of the cracks, and the factors that produced them.

"When you're confronted with something like this, you have to conduct a very detailed and thorough investigation of what is going on," Dr Grundy said. "The secret to structural reliability is knowledge; you have to be able to explain what you see, and what it is happening, before you can do anything about it."

The 'what' was easy: the unexpected cracks had occurred around openings cut in steel plate forming the vertical web of the cantilevers that run across below the decking supporting the roadway, at right angles to the direction of traffic flow (see figure overleaf).

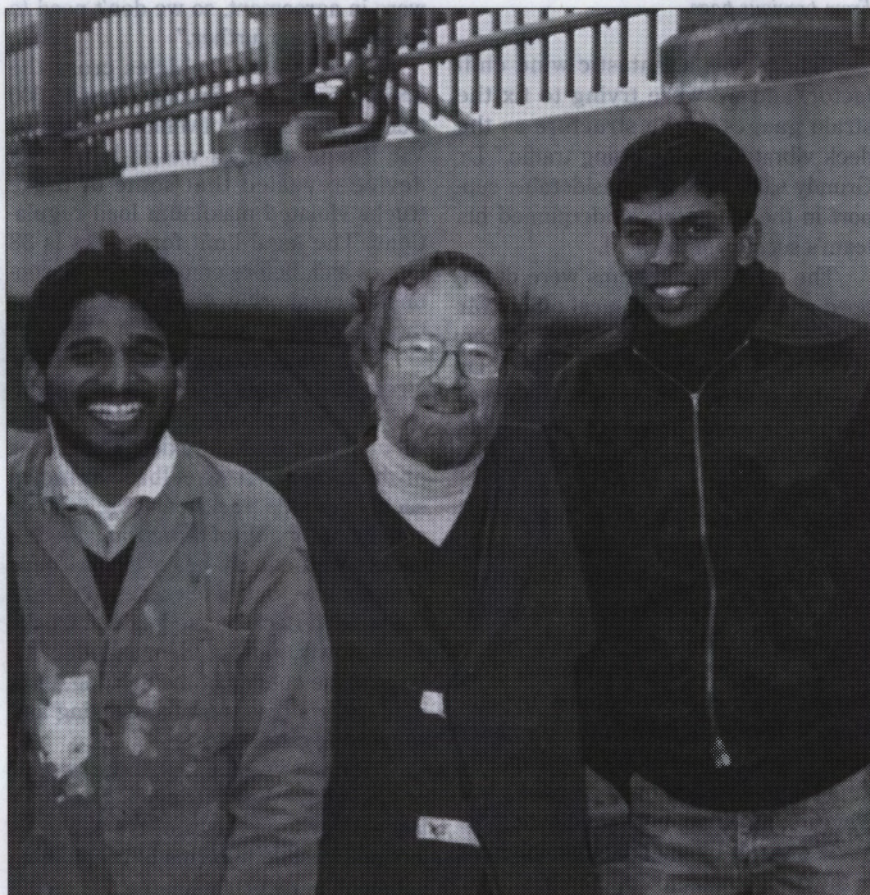
The cantilevers, which impart lateral rigidity to the bridge, flex slightly under load. Roughly resembling inverted coat-hangers, the cantilevers are bolted to the sides of the box girder, and the steel deck plate is then welded in place.

However, at regular intervals there are gaps in the steel cantilever web plate to accommodate a series of parallel, trough-shaped members that run longitudinally under the deck in the direction of traffic, providing stiffening.

Dr Grundy says every passing vehicle puts an independent load on each cantilever; this sets up a load cycle in which the cantilevers are repeatedly stressed. The greater the weight of the passing vehicle, the greater the load.

"You need two things to cause fatigue damage," he said. "You need stress to be applied repeatedly, and a notch somewhere in a structure where the stress is focused. Most structures have notches. It costs money to eliminate them from the design, and some are unavoidable."

The West Gate investigation divided into two phases; the first, a field study in which the stresses applied to the bridge by daily traffic flow were measured and monitored. In the second



Mr Thiru, Dr Grundy and Mr Gerard Chitty on the bridge's access gantry.

phase, a research group at Melbourne University, led by Emeritus Professor Len Stevens, confirmed by analysis the behaviour observed by the Monash researchers, using a computer-based mathematical model that employs a technique called the finite element method.

In essence, the model takes real-world data and applies it to the model in an attempt to reproduce the type of damage observed in the real structure. Once the behaviour of the model has been reliably correlated with that of the real structure, it can be used to predict the future behaviour of any cracking, and its effect on the bridge's structural integrity and working life.

Dr Grundy says most modern structures have very large margins for safety designed into them. Safety margins, he says, are normally expressed in terms of loads applied to the structure. For example, an engineer or architect might include a capability to resist loads much greater than would be encountered in normal service.

"But safety margins are a bit old hat," he continued. "Designers know much more about the limits of the materials they are using, so there is now more emphasis on reliability."

"All materials respond elastically to stress, meaning that they return to their original shape when the stress is removed. There is a maximum stress, called the yield stress, beyond which elastic recovery does not occur. In the old days when less was known about materials, you might have used a safety factor of 1.5 or 2 from permitted stress to yield stress to ensure the structure never reached the limit of its capacity."

"But safety margins don't have much relevance to fatigue. You are likely to get fatigue cracking in any steel structure; it's not a question of safety, but of knowing how long it will last, because you know that eventually it will fail."

Knowing how a structure will behave under stress, and being able to simulate it using a computer, the engineer can then use the model to simulate the effect of modifying that structure. Dr Grundy says: "You can ask 'what if

type questions of the model: what happens if you add more steel, or even take some away?"

"The interesting thing about the West Gate Bridge, from my viewpoint, was that something was happening that had been overlooked by its designers. The effect of the cantilevers distorting under repeated cycles of load was unlikely to have been taken into account in the original design. It would have taken rare insight to have anticipated this problem."

"The trouble occurred because the web of the cantilever was distorting. All the cracks ran parallel to the direction of the traffic, so they would not compromise the integrity of the bridge for a long time. It now becomes a management problem, as to how we manage the cracks."

"We need to know whether, as they become larger, they grow faster. Cracks tend to grow exponentially, but in the case of the West Gate Bridge, the opposite appears to be happening. Because the cracks result from the distortion of the structure, they are actually relieving the stresses induced by that distortion."

Once the stresses have been relieved by the cracking, the forces involved will find a different path through the structure. The weakness, in effect, redistributes the stresses until the structure reaches a new equilibrium.

Dr Grundy says he was unable to find any description of this type of cracking in the codes relating to the remediation of fatigue in bridges, but did find one in a code of practice for offshore structures. The cracks are unlikely to shorten the bridge's life. With the problems clearly identified inspection and maintenance will ensure that the cracks will not get out of hand.

Setting up the instruments to monitor the loads imposed on the bridge by passing vehicles tested the mettle of the Monash team. They had to go over the side to set up on an open-grid gantry slung from the underside of the deck, with the water far below.



Mr Gerard Chitty (left) and Mr Thiru logging data under the bridge's deck, 55 metres above the water level.

Cracks redistribute the stresses

From previous page

"There was a fantastic wind chill factor, and we were trying to fix the strain gauges to the structure as the deck vibrated from passing traffic," Dr Grundy said. He says considerable support in the laboratory underpinned his team's success in the field.

The electronic systems were developed and tested by technical officer Mr Greg Stroot. Another technical officer, Mr Peter Dunbar assisted two of Dr Grundy's research students, Mr Gerard Chitty (on secondment from BHP Research's Melbourne Laboratories) and Mr Kanethapillai Thirugananasundralingam ("Thiru") with the installation of the strain gauges and data-logging equipment. Mr Chitty had developed considerable expertise in previous research on Victorian railway bridges.

After four weeks of continuous monitoring, the data obtained by the Monash team was fed into the computer model, which predicted a median lifetime for the bridge of between 40 and 80 years; more accurate predictions are made difficult by uncertainties inherent in the design of large structures.

"The remarkable result that we had before us was a scattering of cracks around the structure, which had appeared at around 11 years, in line with design-life predictions. Theory and test

were in agreement, so we don't need to investigate any further."

About 100,000 vehicles cross the bridge each day, including about 15,000 trucks. Monitoring of vehicle masses by Vic Roads using a weigh-in-motion device revealed that some of these trucks violated maximum load regulations. The legal limit for trucks is 38 tonnes and, before enforcement by continuous monitoring, about 12 per cent of the trucks were over this limit.

Such loads do not necessarily overstress the bridge because with semitrailers and tankers, the weight is distributed over multiple axles. The bigger problem is short-wheelbase vehicles such as quarry trucks carrying sand or aggregate, many of which are towing trailers with equally heavy loads. These vehicles have only a few axles to spread the weight. Because the heaviest trucks move slowly, most of them use the slow lane on the outside of the decking, placing higher stresses on the decking and supporting cantilevers.

"Some experts have suggested putting all the heavy traffic in the inner lanes, away from the cantilevers, but it's just not feasible in terms of traffic management, particularly if a truck is trying to get from Williamstown Road up the steep approach to the bridge," Dr Grundy said, "and it would simply transfer the damage problem from the left hand lane to other lanes."

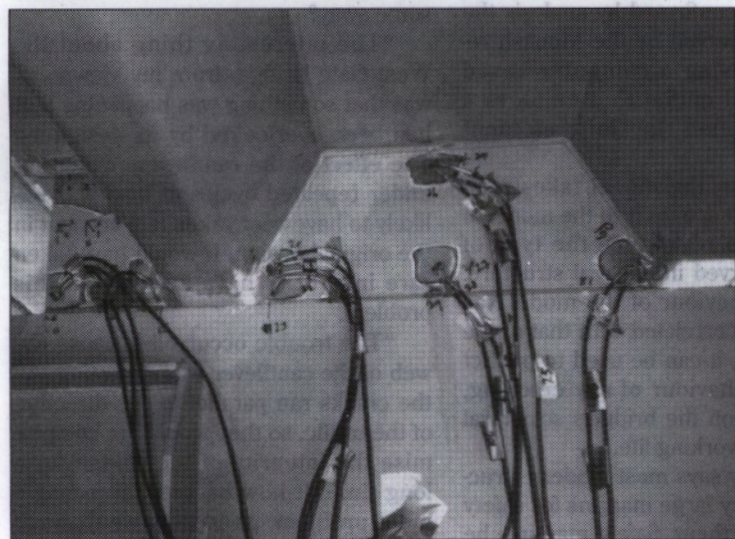


A heavily laden test semitrailer passes over a strain gauge marker.

"As far as the cracks were concerned, one option was to remove material which was making the deck too stiff, which would actually add to its strength. Finite element analysis revealed that there would be a significant reduction in stress in key locations. Vic Roads made this type of cutout at several locations, and monitored it before and after with loaded test trucks. They verified what theory had predicted."

Since it costs relatively little to make this modification it is likely that it will be done to all the cantilevers.

"The cracks in the trough stiffeners are small enough to be left alone, because they are growing quite slowly, and the rate of the growth is actually slowing down. But now we have a reliable way of predicting what might happen in future, and a method for taking action."



Strain gauge instrumentation under the slow lane.

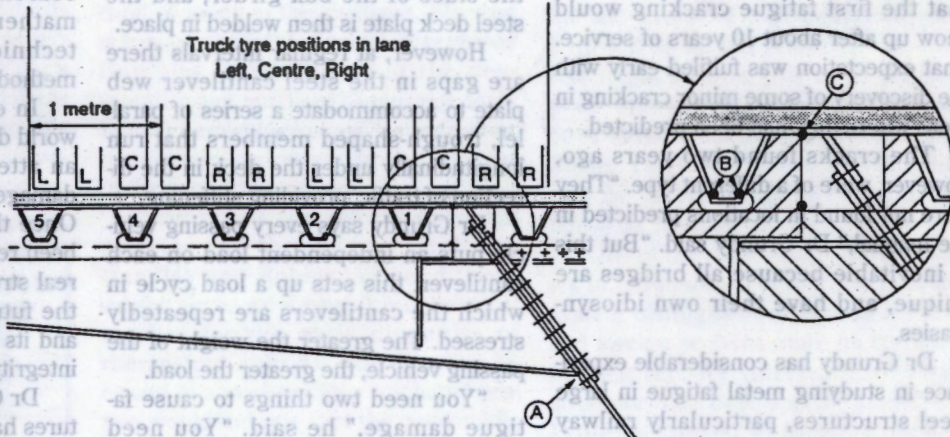


Figure 1: detail of cantilever showing locations of cracks A, B and C.

Rainforest threatened

From Research Monash 1

"After forest fires there is an incredible burst of regeneration in which the vigorous growth of young eucalypts reduces water yields. It takes a long time to get back to pre-burn yields. In supply catchments, it's a case of timber economics versus water economics. You don't want fires in catchment areas. If you can suppress fires for long enough, allowing the rainforest to expand, you can get fire suppression for nothing, as well as an increase in water yields."

Mr Gell says the rainforest symposium decided that mixed rainforest should now be included in the broad definition of rainforest. In the case of the state forests in the Otways in southern Victoria, this would effectively increase the area of rainforest by fivefold, from 800 to 4000 ha.

Victoria's Labor Government undertook in its State Conservation Strategy to preserve rainforest. Cool temperate

rainforest has recently been listed as a threatened community; conservationists and scientists have been seeking to have the definition extended to warm temperate rainforest.

Former Conservation and Environment Minister Mr Barry Pullen ordered a halt on logging in mixed rainforests earlier this year. He also halted logging in catchments of a number of sites that rainforest expert Mr David Cameron had defined as being of special significance: sites containing a core of rainforest, surrounded by mixed and sclerophyll communities. With the change of State government, there is apprehension among rainforest researchers and conservationists about whether the undertakings will be honoured.

Victoria's rainforests: perspectives on definition, classification and management is available from the Geography and Environmental Science department for \$25 plus postage. To order, phone Mr Gary Swinton on extn 75 2922.

Victorian fields 'active'

From Research Monash 6

Professor Cas says there is a very small volcanic province in western Victoria that is probably a relic of the mantle activity associated with the break-up of Gondwana. Western Victoria is probably passing over a deep-seated hot spot caused by a rising plume of magma in the mantle.

The western Victorian field has been active for the past 6 million years and there is no indication that the field is extinct. The last eruption was at Mt Gambier some 4500 years ago and others could follow "tomorrow, next year or several thousand years in the future."

The small magmatic volcanoes, which created the basalt plains west of Melbourne, can erupt quite violently at times as molten magma rises through the ground water aquifers, setting off a series of phreatic blasts. They can also

produce small pyroclastic flows, called surges. "If we had another eruption from Tower Hill or nearby, Warrnambool would probably be inundated with ash and the city would be severely affected," Professor Cas said.

Finally, for those who wonder why physical volcanology should be an important research field for Australia, when active eruptions represent a relatively minor risk factor, Professor Cas points out that much of Australia's mineral wealth is locked up in ancient volcanic successions. These records cover repeated volcanic activity for the past 4000 million years.

Professor Cas annually teaches a week-long professional course on volcanology to more than 40 industry, government and research geologists from all over Australia and overseas. As a result, these professionals are better equipped to assess the mineral potential of Australia's volcanic past.

Media reports about long waiting queues for surgery, spiralling health costs and the rising cost of medical insurance suggest that Australia's health and health-insurance systems are sick and in need of major surgery. But by world standards, we're not too badly off.

Just how sick is the health system?

Professor Jeffrey Richardson reports on the way ahead

The problems with Australia's health system are generally exaggerated. Consider these points:

- compared with the average OECD country, Australia is fairly well provided with medical and hospital services, and Australians make above average use of doctors and hospitals;
- since 1975, Australia has maintained a constant level of expenditure on health, as a percentage of Gross Domestic Product (GDP), indicating a greater degree of cost control than in most other OECD nations;
- Australia's health costs are almost exactly in line with what would be predicted from our national income – neither too much, nor too little (there is a strong relationship between GDP and personal expenditure on health).

Critics who describe Medicare as a disaster obscure the fact that our health system could be dramatically worse. We could have a scheme like the US, where individual health costs are 40 per cent higher than the next highest OECD nation, Canada, and 109 per cent higher than in Australia.

It is not surprising that American commentators repeatedly tell us that we are lucky. In addition to its high cost, American insurance leaves 35 million citizens without cover and about the same number with very inadequate coverage of expenses. To qualify for the Medicaid scheme, families must generally be well below the poverty line. The near poor have no assistance.

Dubious distinctions

Despite having the highest health expenditures in the world, the US also has one of the highest infant mortality rates among OECD nations and amongst the lowest life expectancy. Australia ranks near the top on both counts. Ten years ago the US did not enjoy these dubious distinctions; the figures have been worsening progressively. The reason appears to be associated with their free market health and health insurance schemes. In contrast, Australia's Medicare may be ragged at some important edges, but by international standards it works well.

The issues that get the greatest political and media publicity are the small ones. For example, there is the issue of co-payments – the amount patients pay directly out of pocket when they visit the doctor.

Co-payments are almost irrelevant to the costs or the benefits of the health scheme. The evidence is very clear that co-payments are quite incapable of explaining increases in health costs and, given the US experience, increases in these fees cannot contain the sorts of cost pressures that have driven the US system. Their chief function is to give doctors greater control over their incomes.

It is not surprising that when the Federal Government attempted to increase co-payments last year, its chief support came from the medical profession. Many health economists and consumer groups were highly critical of the proposal. But the effect of co-payments on demand is comparatively modest, and doesn't go anywhere near explaining the differences between US and Australia. The US has tried to use co-payments to constrain costs; but in-

creasing co-payments has not held down the use of services, nor the cost.

In contrast with Australia, the US has never had a schedule as the basis for medical fees. Insurance rebates depend on the average fee in each geographic area ("usual customary and reasonable fees"). As doctors increase their fees, rebates rise, driving the fees even higher into an inflationary spiral.

The second much-publicised but relative insignificant issue is: should our hospitals be publicly or privately owned?

There is no good evidence in Australia that private hospitals are more or less efficient than private hospitals. American studies do not show significant differences either. A decade ago private hospitals in Australia were essentially cottage industries with little sophisticated technology.

In the past decade, however, this has changed and there is no reason why private hospitals should not provide services of equal technological sophistication as the public hospitals. They were less efficient a decade ago, but have improved dramatically since then, especially in their use of medical technology.

One of the really big issues in our health system is: what controls costs? The evidence seems unambiguous that the higher the percentage of the bill paid by government, the lower the national health cost. There have been four studies demonstrating this in the past six years. The OECD's own analysis shows that for every 10 per cent increase in the share of the bill paid by government, there is about a 4.2 per cent reduction in the proportion of the GDP spent on health.

This does not specifically reflect the influence of government, but the need for a countervailing influence to the inflationary forces that exist on the provider side. At almost every point there is an incentive to increase costs. This applies to those who develop the new technology, to doctors, to insurance funds and to hospitals. For the medical profession the incentive is financial and professional; the providers of health care are amongst the most influential groups in the community.

The individual simply cannot match this power and influence in the way that simple economic models envisage. The countervailing power can only be provided by a well-organised group

or public authority. Governments can carry out this function and, in principle, so could other organisations. But the incentive to carry out this difficult task only exists where health costs are funded from a single, concentrated budget.

The US experience shows that the key factor in rising expenditures is multiple sources of finance; there is no incentive for cost control, only for cost shifting. If the Federal Government can shift costs to the state, the state can shift it to insurers, insurers can shift it to the employer, and everybody can shift it back to the patient through higher co-payments.

The great attraction of co-payments to governments and insurance companies is that they shift the cost and burden of cost control away from them to the individual – but they don't control costs. The key to controlling costs is to provide an incentive to the government of insurance company, rather than literally to pass the buck.

Medical 'uncertainty'

The second big issue – and a longer-term problem – is establishing best medical practice. The evidence here is startling: not only can the consumer not decide what is best practice, the doctors themselves cannot. There is extensive research on the variation in practices carried out by doctors in treating essentially the same medical conditions.

The differences do not necessarily reflect financial incentives; rather, they reflect the uncertainty of medical outcome itself and the lack of good information about optimal practice. US doctors perform four times as many tonsillectomies as Swiss doctors, and six times as many hysterectomies as Japanese doctors (twice as many as Australian doctors).

These differences are apparent within small geographic areas. A study of 15 different surgical procedures carried out in 30 US hospitals found that the rate for certain procedures varied by as much as 750 per cent. The implication of such variation is that some problems either receive far too many or far too few services. Either way, it represents a serious reduction in the cost effectiveness of the system.

Medicare, in its various versions under both Labor and Coalition administrations, has been effective in cap-

ping costs during the past 10 to 15 years.

Hospitals have been progressively forced by restricted budgets to improve their efficiency over the past decade, but the result has been to increase the waiting lists for surgery. The real challenge is to continue improving efficiency and to reduce queues, without pouring new money in and letting hospitals 'off the hook'. We don't want to go back to where we were.

There is a strong move under way in Medicare – fully endorsed by the Coalition – to introduce information systems between and within hospitals so that health departments can distinguish between efficient and inefficient hospitals. Such systems mean the hospitals themselves can know what is happening within each of its own departments and carry out measures to improve efficiency.

Within any hospital there are likely to be efficient and inefficient departments. Blunt instruments, such as the budget caps that have been used in the past to obtain efficiency, squeeze both the efficient and the inefficient.

Efficient information systems are a prerequisite for efficient management of our hospitals. The time is passing when money came in and simply went out again without anybody really knowing what was happening in between.

Having said all this there are, of course, serious problems with our medical system.

As a result of the removal of government subsidies to private hospitals in 1986 Medicare now has a structural imbalance. Private health insurance, which has to cover the cost of private hospital care, has become increasingly expensive, with the result that the healthy people who use medical insurance least – but who cross-subsidise those who use it frequently – are opting out.

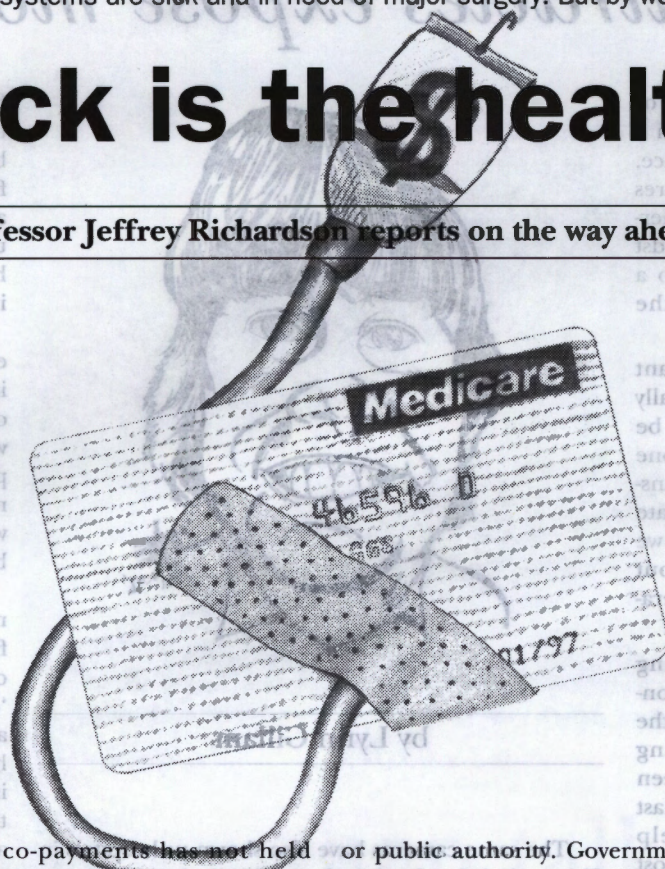
This creates a positive feedback loop: the healthy people leave, premiums go up, fewer people can afford them, and the next stratum of healthy people leave, driving up premiums... Unless something is done to end this downward spiral the health system will look very different in five years time.

Between 1983 and 1992, the number of Australians in private health insurance schemes declined from 60 per cent to 40 per cent, and the trend is accelerating. In the past 12 months membership of private funds has decreased by three percentage points across Australia and in Victoria by an astonishing six percentage points.

Private health insurance has traditionally maintained an equilibrium between the public and private sector. It is the lifeblood of the private hospitals, but it also allows private patients to pay fees in public hospitals, providing public hospitals with added revenue.

In the longer term, the disintegration of private health insurance will mean the disintegration of private hospitals and greater pressure on public hospitals. Paradoxically, the trend away from private health insurance has not yet had severe repercussions for private hospitals.

Continued overleaf



Transplant miracles expose moral grey areas

TRANSPLANTATION is one of the miracles of modern medicine but it is a miracle with a dark side that most of us prefer not to notice. The media presents us with warm and fuzzy pictures of the wonders of transplantation: young lives, otherwise doomed, dramatically saved; families in the midst of their own tragedy giving the gift of life to a stranger, thereby winning some victory over the powers of death.

And yet, for one person to receive a transplant and a chance at life someone else must die, usually suddenly and violently, in the prime of life. To be waiting for a transplant is to be waiting for someone to be killed; a realisation not lost on potential transplant recipients, but not often allowed to infiltrate the popular image of transplantation. As a society we seem to accept the benefits of transplant without being prepared to acknowledge and give consideration to the truly tough questions involved in it.

Some of the ethical ambivalence surrounding transplantation can be seen by considering its connection with the road toll. It is an ironic fact that the more successful we are as a society in preventing death on the roads – and we in Victoria have been proud of our considerable success in this over the last few years – the less people we are able to help through transplant. Road trauma victims are the most common source of organs for transplant; if less people die in road accidents, there will simply be less organs for transplant.

No-one in Australia has actually been as forthright (or as tasteless, as some would put it) about this equation as the Canadian transplant service director who questioned the introduction of compulsory seat belt legislation, because of the detrimental effect it would have on the transplant service. Nevertheless, it is probably true that transplant programs would be better off if we stopped trying to prevent deaths on the road.

This is not to suggest that we should, in fact, cease our efforts to reduce the road toll, but rather to demonstrate that transplantation occupies a morally ambiguous place in our society. And it is because we will quite rightly continue to try to prevent road deaths, accidents, murders and suicides that those involved in transplantation are forced to look for ways of increasing the numbers of available organs, despite the falling death toll.

Some potential sources of extra organs for transplant look relatively acceptable but others are very controversial. Media attention has recently been focused on the commercial trade in organs, involving both living and dead donors. Television cameras have brought us interviews with desperately poor slum dwellers in India, who have sold their kidneys for a few hundred or thousand dollars. Some are happy with the exchange and have reaped some tangible benefit; for others, the money has disappeared and all they are left with is poor health.

From previous page

In fact, the reverse has happened: there has been a significant shift of patients from public to private hospitals. The reason private hospitals have been complaining of financial problems is that in the same period there was a very rapid increase in the number of private hospital beds, resulting in intense competition. Fees have been constrained and hospital occupancy rates have been low despite increased patient numbers.

The shift away from public hospitals has been driven in part by the long queues for some surgical procedures, partly because of the influence of private doctors, and partly because private hospitals have made legitimate deals with insurers so that the full cost of private hospitalisation has been met by the insurance rebate. But the long-term scenario is that this trend cannot continue and there almost certainly will be a decline in private hospital use if its fi-

nancial base – private health insurance – deteriorates further.

The options are to put a patch on Medicare so that it subsidises private health insurance and private hospitals, or use the same funds to expand public hospital capacity so that the public sector grows at the private sector's expense. This is a social judgement politicians must make on our behalf.

Monopolisation

In terms of economic efficiency, there are no grounds for making all hospitals private or all public. Our mixed system can be maintained by putting hospitals on equal footings, and ensuring their efficiency via global budgeting, plus payments to hospitals based upon their output, known as 'case payment'.

Competition could result in significant advantages. Private sector innovation could occur while the public sector acts as a check against monopolisation by de facto collusion.



by Lynn Gillam

The same cameras have also shown us hospitals in China admitting foreign, fee-paying patients for heart transplants, using the hearts of prisoners executed in Chinese jails. The prisoners may have been sentenced to death or murder or rape, criticising the government or stealing a bicycle. The date of their execution is set by the arrival of a patient of the same tissue type and their family receives a bill for the cost of the bullet.

It is not hard to criticise the abuses going on in these instances; the wrongness seems very apparent, even if it cannot readily be put into words. And yet patients travel from many parts of the world, including Australia, to receive these 'morally tainted' transplants. The reason is not far to seek: if they stay home, they may very well die waiting. But are there any morally more acceptable ways to help these people without exploiting the poor, the ignorant and the powerless?

One possibility is to look closer to home for more organs. Kidney transplants using organs from live donors do occur in this country with very good results – both for the donor and recipient – but are limited to family members donating for each other. A person who walks in off the street and offers to donate a kidney to a complete stranger will get very short shrift. Certainly there is good reason to be cautious in response to such an offer but why it should be rejected out of hand?

We accept that a person can make a free, informed and considered choice to donate blood or bone marrow to stranger, indeed we encourage people to make such a choice. We also accept that a person can legitimately decide to donate a kidney to a

family member; the risks, though significant, are not too great and undue influence will not be brought to bear. Why should people wanting to accept these risks for the sake of strangers be thwarted? Perhaps they are more altruistic than most, perhaps we are made uncomfortable by this degree of self-sacrifice, but this hardly seems to be a morally sound reason to prevent it, especially when someone's life is at stake.

Anonymous living donors look to be one of the ethically acceptable sources of extra organs but utilising this resource would not have a very great impact on the organ shortage in this country. Living donors would probably be few and, in any case, could only provide kidneys (and perhaps parts of their livers, if recent advances in this field prove successful). Those waiting for heart and lung transplants would be no better off.

Increasing the availability of hearts and lungs means increasing the numbers of organs retrieved from cadavers. A method more palatable than buying organs from the Chinese government is the so-called 'opt-out' or presumed consent system, under which all adults are deemed to be organ donors unless they have taken specific steps to register their refusal. This is in contrast to the totally voluntary 'opt-in' system that we have in Australia, where no-one is regarded as an organ donor unless they have specifically indicated a wish to be one.

A presumed consent system clearly has the potential to improve organ retrieval rates, provided that hospital staff are willing to cooperate with it, but it is not without ethical problems. The role of consent and altruistic gift-giving – the features which were widely held to make organ donation acceptable when transplant programs first began – is watered down in a presumed consent arrangement. Organs are not taken on the basis that this was what the deceased really wanted, but rather on the basis that there is no evidence to show that he or she had any strong feelings against it.

Thus, gaining consent appears to be a matter of avoiding an obstacle rather than seeking a positive warrant to proceed. Moreover, organ donation under this system is no longer a special gift, given out of concern for others, but a routine and expected procedure, done perhaps reluctantly, perhaps without thought, perhaps with a sense of obligation. These factors do not condemn presumed consent systems outright but they should make us wary of blithely following the lead of countries like Singapore and France without thinking carefully about the moral basis of the policy.

Whilst it might be more comfortable in the short term not to inquire too deeply into transplantation, it is only by asking the tough questions now that we have any chance of dealing with morally questionable developments. Present discomfort may prevent future angst.

Ms Lynn Gillam is resources officer in the Centre for Human Bioethics.

Such competition between the public and private hospitals would be a step in the direction of a third option for the Australian health system, known as managed competition. This is already being trialled by such countries as the UK, the Netherlands, Israel and New Zealand. It is a system that appears to be attractive to the new Victorian government and is not inconsistent with the philosophical basis of the Coalition's Fightback policy.

The risk with a free market scheme is that it would pump money back into the health system with little thought about the regulations appropriate for containing inflationary pressures. Hospitals could return to the easy life, largely free of budget caps, resulting in loss of efficiency.

The idea of managed competition is to have an agent manage health care on behalf of the individual. Depending upon the model, the agent could be a regional health authority, an employer

or a health fund. These agents would be expected to manage all of a person's services – hospitals, medical services, auxiliary care and nursing homes. A government-subsidised premium would be paid to the agent, considering the person's age, sex and risk, and health care would be bought from the most cost-effective provider by the agent.

In summary, the coherent options are: patch up Medicare, expand the public sector until a new equilibrium is reached, or go to a system of managed competition. Going back to a fantasised free market is a recipe for what has already happened in the US.

The free market works when there is readily available information and an ability to assess the product. Without this consumers (patients) cannot exercise any countervailing power against supply side inflation.

Jeffrey Richardson is Professor of Health Economics and codirector of the National Centre for Health Program Evaluation.

Tacked on, out back intellectuals

How a cosy conference was disrupted by a concerted attack on Australia's silent intellectuals. Diana Bagnall reports.

Few among the audience of mainly European specialists seemed to expect the attack, coming as it did at the end of a cosy enough academic conference on 'Intellectuals in Europe today'.

Outside, Victoria was in a frenzy, engaging in the intellectual blood sport of the nation – politics. But inside, there was an implicit assumption that matters of the mind would hardly rate a mention on a dull day, let alone the day before the state election.

Maybe the topic of the final panel discussion should have warned them: it was entitled 'Intellectual life in Australia'. Barry Jones, president of the Australian Labor Party, began the assault.

"Intellectuals in Australia largely talk to each other," he said. "Why is there this reluctance to engage in public debate? Why are professional political scientists always on sabbatical leave when elections come around?"

Robert Manne, a lecturer in politics at La Trobe University and ousted editor of the right-wing magazine *Quadrant* was bemused to find himself arguing in support of, rather than against, Jones on this occasion. He pursued Jones's line by citing George Orwell as the exemplary intellectual.

Orwell, he said, displayed outstanding moral courage, a genuine engagement with the large political questions of his time and the capacity to combine complexity of thought with simplicity of expression. Australian intellectuals, on the other hand, were characterised by their conformity, and their virtual abandonment of serious engagement with the public realm.

Jenny Lee, editor of the left-wing magazine *Meanjin*, astounded the audience by suggesting that for her generation of intellectuals (that is, those whose attitudes were shaped by the student revolts of 1968), academia was largely irrelevant. "We retain a certain modesty about our skills," she said, "and at some level is sufficient for us to act as mere technicians on behalf of other interests."

It was not Lee's shirt-sleeve intellectuals, then, to whom Manne and Jones addressed their comments. Or was it? Manne came up with a sketch of the so-called chattering classes which was damning in its scope.

"Most intellectuals maintain the fiction that they are individualists and mavericks," Manne said. The reality was less flattering. Most Australian intellectuals belonged to cliques and engaged, in general, in "rather unthreatening dialogues with those who agree about fundamentals".

"Generally speaking, it is not intellectual magazines or books but newspapers, radio and television which carry public debate forward in Australia," Manne added. "Inevitably what this means is that our public realm is impoverished, for there is a certain level of complexity which is, necessarily,



Broinowski, Victorian regional director of the Department of Foreign Affairs and Trade, and an expert on Asia.

She identified the focus on Europe as a problem in itself, perpetuating old notions of European superiority and antipodean inferiority. Broinowski seemed to suggest that only when intellectuals shifted their allegiance to Asia would they move out of the shadows.

The stronger implication from both Manne and Jones, however, was that Australian intellectuals and academics had been frozen into silence through fear. Fear of what? Fear of disturbing their own comfort zones.

Perhaps one key to understanding the ferocity of the conference skirmish (which raised much dust and drew blood, metaphorically speaking), lay in a comment from Alastair Davidson, professor of political theory in the department of government at the University of Sydney. "An intellectual, he said, was one 'whose ideas have mass effect'."

Although that probably let many of those listening off the hook, it also left Australia with barely an intellectual to its name – unless the politicians outside could be counted.

● This article originally appeared in *The Bulletin*. Reprinted with the author's permission.

"Most Australian intellectuals hunted in packs, sharing roughly the same world view ..."

Most Australian intellectuals hunted in packs, sharing roughly the same world view, he said. This encompassed such 'isms' as egalitarianism, moral individualism, feminism, sentimental multiculturalism, and so on. "It is rare for an intellectual to show signs of dissent," Manne said.

When someone did break ranks, such as Geoffrey Blainey on the question of Asian immigration, Fred Hollows on AIDS or Richard Neville on pornography, they risked being marginalised (if they were strong-minded) or silenced (if they were weak).

beyond the capacity of the mass media to bear."

Even when their own interests were under scrutiny, Australian intellectuals refused to come out and fight, maintained Jones. "This is the age of specialisation and [academics] are nervous of contributing with generalisations to the big picture," he said. "It is no longer regarded as intellectually respectable ..."

Such nervousness, however, served only to reinforce popular perceptions of intellectuals being extra to Australian society – "tacked on like a dunny out the back", to quote Alison

Who are Australia's allies in the world trading wars?

If the current round of world trade negotiations breaks down, Australia may become caught in the crossfire between the major trading blocs. Researchers at Monash are looking at the alternatives.

Australia's future trading policy is at the crossroads. Its traditional markets are being threatened by subsidised exports while the world's trading alliances jockey for position.

A team of three economists in the Department of Economics have been commissioned by the Federal Government's Department of Foreign Affairs and Trade to report on the implications and options for Australia of regional trade agreements.

Led by Professor Richard Snape, the team's task is to provide an independent insight into the growing regionalism of world trade. The final report of the Monash group has been submitted to the department and is expected to be released later this year.

A two-volume preliminary report was released in September. Part two, entitled 'Options for Australia', painted a bleak picture for Australia's international trading relations if the current Uruguay Round of GATT negotiations failed. "If the Uruguay Round does not end with at least moderate success, subsidy and other trade wars between the US and Europe may grow, as may the aggression towards East Asia, inviting retaliation," it says.

"Inevitably peripheral countries will seek to avoid being hurt as bystanders in such battles and defensively will seek trade agreements among themselves or with the principals. This would be a bleak scenario for Australia and for other countries which depend on an efficiently trading world economy."

The Uruguay Round negotiations seem to be back on track after many months of disagreement. Talks resume in Washington this month.

The report concludes that ASEAN countries were unlikely to welcome Australia into their proposed free trade agreement. In any case, the economic benefits for Australia of participation in the ASEAN Free Trade Area would be relatively small because current plans excluded most resource-based exports.

Whatever prospects Australia might have of joining the North America Free Trade Agreement would be diminished by the fact that the US would be unwilling to dismantle the main trade barriers that affect Australian exports – meat, sugar and steel.

From an American perspective, Australia does not offer a large market, does not have serious trade barriers to US exports and does not have a trade surplus

with the US. The report notes that so far Australia has not been subjected to harsh direct US harassment, but a failure of the Round, or even a slow collapse, may "remove the brake".

If regionalism comes to dominate world trade, the report says that Australia may be forced to seek trade agreements with key trading partners.

"The most likely candidate is Japan, given its prominence as a market for Australian exports (nearly 28 per cent of total exports in 1991) but other possibilities include the Republic of Korea, Taiwan and, with a view to the very long term, China," it says.

"Such agreements may be necessary to protect our market access if these countries were to respond to the collapse of the multilateral system and an increase in aggressive unilateralism by concluding defensive trade agreements with the US. However, an important factor influencing the development of such agreements will be the relative bargaining power of the US and Australia."

"Not only does Australia not have the clout of the US, it also lacks its market size as an attraction to enter into bilateral agreements. And it is access to this market which is likely to drive the Asian countries to seek bilateral agreements with the US."

The Monash paper, written by Professor Snape, Ms Jan Adams and Mr David Morgan, argued that as a relatively small trading nation Australia had far more to gain from a global liberalisation of trade. Other countries had little reason to see free trade agreements with Australia, given that it was already opening its markets.

It says existing developments in North America and Europe did not pose serious problems for Australia, but warns that if the GATT round was not concluded with at least some success there was a real risk that the resulting trade wars would undermine the multilateral system.

■ Coal drying award

Emeritus Professor Owen Potter from the Department of Chemical Engineering has won an international award for his coal drying process.

The ICI Award for Innovation in Drying, presented at the eighth International Drying Symposium, in Montreal, Canada, recognises Professor Potter's development of steam-fluidised bed drying.

Both electricity costs and 'greenhouse' carbon dioxide emissions from brown coal power stations are expected to be reduced if plants using this process are successful. The first demonstration plant using this process has just begun operation at Loy Yang in the Latrobe Valley.

Pictured at the award ceremony are Mr Stuart Gardiner, of ICI Polymers, Runcorn, England; chairman of the awards committee Professor Jud King, Provost, University of California, Berkeley; and Emeritus Professor Owen Potter.



▲ Bioethics comes of age

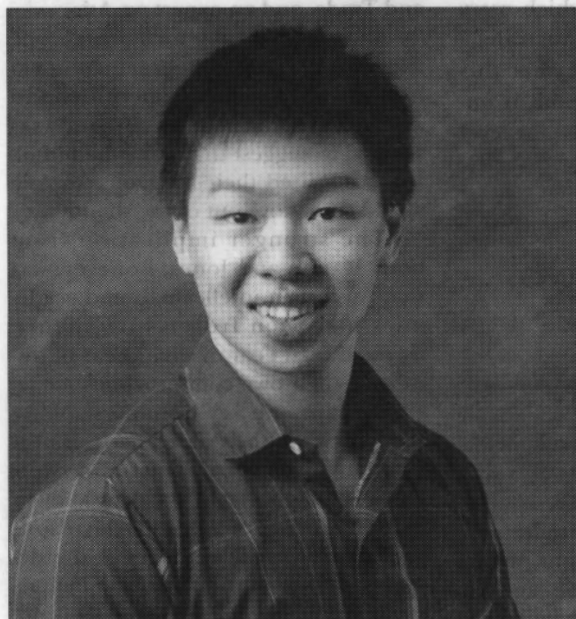
The growing awareness of health care ethics in Australia has been marked by the graduation of this country's first bioethics master's students.

Pictured above with course coordinator, Dr Justin Oakley (centre back), they come from the medical, nursing and legal professions. They are (from left) Surgeon Dr David MacIntosh, lawyer Mr John O'Sullivan and nurse Mrs Beverley Touzel. The three graduates received their degrees at a graduation ceremony in Robert Blackwood Hall last month.

According to Dr Oakley, the graduates represent an emerging trend in the way health care professionals, particularly, are dealing with ethical issues.

He said such courses had been running in the US for the past 10 years, with Monash in 1989 becoming the first Australian institution to establish a Master of Bioethics. Now other universities, including the University of Technology Sydney, Newcastle University and Wollongong University, were getting similar courses up and running.

The first graduates represented the three main professional groups among the 50 students undertaking the course. However, the course now seemed to be attracting a wider range of people, including social workers, occupational therapists, secondary school teachers and philosophy graduates.



▲ Glass industry solution

Mr Boon Yuen Jching, a PhD student in the Department of Econometrics, has solved a problem that has been puzzling the glass industry for the past 20 years.

At the recent student conference of the Australian Society for Operations Research, he won a prize for best paper for his work on 'Sequencing cutting patterns in glass cutting'.

Cutting problems occur when large rectangles of glass stock plates need to be cut into smaller rectangles to comply with customer requirements. The trick, he says, is not only to come up with a cutting pattern that minimises waste, but also to complete one order before moving on to the next.

Mr Yuen built his own computer software to develop optimal, computer driven sequencing patterns. Pilkington (Glass) Limited is now considering how to incorporate the results of Mr Yuen's research, which could save the glass industry hundreds and thousands of dollars.

■ Banking law prize

Law student Mr David Charles Russell has won the Australian Banking Law Prize.

The award acknowledges excellence for assignments in the Banking Law subject and on his results at the final examination. The head of the National Australia Bank, Mr Don Argus, presented the award at a Monash Law Foundation function held at the Melbourne law firm Minter Ellison.

▼ International honour



Monash bioethicist Professor Peter Singer has been elected president of the new International Association of Bioethicists.

The association was formed at an inaugural congress of bioethicists held recently in Amsterdam, which attracted more than 310 participants from 34 countries.

Its scientific program included issues such as embryo research, prenatal diagnosis and sex selection, resource allocation, bioethics teaching, and life-and-death decisions at the end of life.

Among those elected to the association's board were Professor Singer and Dr Helga Kuhse, director of the university's Centre for Human Bioethics, who were instrumental in convening the inaugural congress. The centre will also serve as the association's administrative office for at least two years.

The board also appointed Ms Kay Boyle executive officer of the association. Ms Boyle is an administrative officer at the Monash centre.

■ Swedish exchange

Awarded an exchange scholarship to Uppsala University, Sweden, third year Economics/Law student Ms Jane Laity is all set for a white Christmas.

Ms Laity, 22, will undertake the university's International Business course, where classes are conducted in English to prepare students for dealings in world business affairs.

"I will really be studying some interesting subjects, especially some of the law ones," she said. "One title is 'Legal Aspects of Investment in Russia'. With the trade doors slowly re-opening, I believe this subject will hold me in good stead for the future."

"I'm not repeating any of economics or law that I have already studied and will do more marketing and business subjects. Any law subjects that I do over there will be credited to my degree here."

The scholarship is for six months but Ms Laity can opt to stay on for the full year, if finances allow. "In second semester I will be able to take up more arts subjects and learn more about Swedish language and culture."



▲ Computer design winner

Monash Gippsland design studio staff member Ms Sharon Shaw has won the national Macworld magazine cover competition.

The winning entry, which was produced on a Macintosh II computer using the Aldus Freehand program, appeared on the September issue of Macworld. Ms Shaw received a cash prize and Aldus software worth \$2500.

■ Chinese books

A collection of books specially selected by the government of the People's Republic of China will soon join the collection of the Main Library.

The collection, presented by the Chinese Consul-General, Mr Zou Mingrong, is seen as a significant addition to the Chinese Studies Collection.

"The books will be of great value to Chinese Studies students and interested public," university librarian, Mr Edward Lim said. "We are grateful to the Chinese Government for making such a specialised selection."

The 450 titles range from social sciences, politics, and philosophy, economics, culture and education, language, history, literature, natural sciences and technology, classical works and reference texts.

■ Book donation heralds Yiddish survival

A donation of 1000 Yiddish books to the Main Library will assist in the rediscovery of Jewish culture through a language once spoken by millions of people in Europe.

The invaluable collection of books was donated by the Joseph Giligich Foundation and is to be used in conjunction with the Jewish Studies program taught. Pictured at the presentation last month are four generations of the Joseph Giligich family.

The collection includes reference works, essential texts in history, biographies, ethnographies, social theory and other non-fiction, and some of the best Yiddish prose, poetry and drama, as well as memoirs and other primary sources of the Holocaust.

"These books are a wonderful resource for our centre," said Professor Louis Waller, of the Australian Centre for Jewish Civilisation. "These Yiddish books are part of the heritage of the Jewish people and their culture. With the destruction of nearly all of European Jewry, a whole creative culture and consciousness was lost. The accessibility to Yiddish texts, the opportunities to read the classic writers in their original language will enable people to rediscover this important part of the Jewish heritage and tradition."



A sporting pioneer retires

The Director of Sport and Recreation at Monash, Mr Doug Ellis, will retire at the end of this year after 32 years with the university.

The driving force behind development of sport at Monash, he played a major role in forming the national tertiary sporting federation and has been labelled the 'Godfather of child care'.

Mr Ellis joined the university as laboratory manager in the Department of Chemistry in 1960. In response to the Vice-Chancellor's request in 1961 to initiate student activities, he and other staff helped develop the Sports Association and affiliated clubs.

Since 1965, when he was appointed Deputy Warden of the Union (Sports Administrator), the association has grown substantially. It employs 16 full-time and more than 100 part-time staff, and its facilities and services are considered among the best of any Australian university.

"The most exciting thing about my time at Monash is that I have always been involved in new developments, and with local and overseas students from all faculties," he says.

Mr Ellis has also played a key role in the national sporting arena. In 1962 he served as the Monash delegate to the Australian Universities Sports Association. He was assistant manager of the first Australian team to compete in the World University Games in Tokyo in 1967 and also attended the 1983 games in Edmonton, Canada.

More recently, he has been a leader in the move to amalgamate the universities and tertiary colleges sports organisations, which culminated in the formation of the Australian Universities Sports Federation (AUSF) in February this year. He has been elected a foundation director of the federation, which represents about 400,000 tertiary students.

"The existence of a national body combining the two organisations will mean more sporting opportunities for students while increasing the standard of the inter-university competitions", Mr Ellis said.

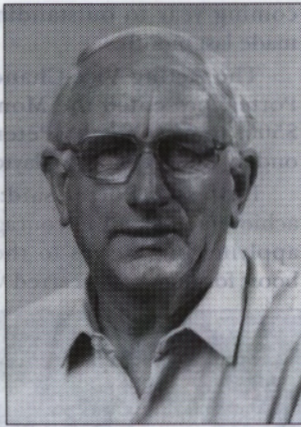
In addition to his sporting achievements, in his time at Monash he has contributed to the amalgamation process, initiated many student and staff support systems, participated in the debate about crime and sexual harassment on campus, and was instrumental in the development of the first sports medicine centre in an Australian university. In the 1970s, he earned the tag 'Godfather of child care' because of his assistance in the development of the Monash Child Minding Centre.

One career highlight, he says, was the period from 1966 to 1976 when students, actively opposed to Australia's involvement in the Vietnam War, were requesting a greater say in university affairs and questioning the contents of courses and the nature of assessments.

Since then, because both the economic and employment conditions have changed and no particular catalyst such as the Vietnam issue has existed, the whole nature of student activities has changed.

On the eve of his retirement, Mr Ellis sees the university going through enormous and exciting changes over the next decade. He believes some aspects of the university will change as students become more mobile and technology takes university to the students.

Given this, he says: "As with any large organisation, one of the greatest challenges of today, and even more so in the future, is to help students feel they really belong to the university community".



Mr Doug Ellis.

New Open Learning director appointed

Interim changes have been implemented in the management of the Registrar's Division following Monash's successful bid to manage the national Open Learning initiative.

The Vice-Chancellor, Professor Mal Logan, has appointed Mr Tony Pritchard as Director of the Open Learning Agency of Australia on a full-time basis until the project's management structure becomes formalised and permanent appointments are made.

Mr Pritchard has spearheaded Monash's involvement in open learning and his continued involvement in the program is seen as crucial to its success. He will continue to report directly to the Vice-Chancellor. Three other senior officers – Mr John Julian, Mr Gavin Moodie, and Mr John Evans – have also been seconded to the Open Learning Agency on a full-time basis to assist Mr Pritchard in getting the new project off the ground.

Acting Vice-Chancellor, Professor Robert Porter, said the Deputy Registrar, Mr Jim Leicester would be retiring soon after Mr Pritchard's secondment. Although not officially retiring until the end of the year, Mr Leicester's leave and travel plans effectively preclude his involvement in the day-to-day administration of the registrar's division.

"In view of this situation, I have, after consultation with Deputy Vice-Chancellor, Professor Robert Pargetter, Mr Pritchard and senior members of his staff, approved arrangements for management of the registrar's division on an interim basis until March 1993," Professor Porter said. "These arrangements follow closely recommendations made to me by Mr Pritchard, who has indicated that the structural arrangement proposed is consistent with plans discussed with his senior staff over recent times."

"They are being set in place to deal with current realities and to ensure that proper lines of responsibility and accountability are in place to help the university through a busy period. I stress that they are interim arrangements, and in no way impinge on the proceedings or the outcome of the Vice-Chancellor's review of senior administrative structures."

It is proposed to divide the responsibilities of the registrar's division into three areas:

University Administration: Director, Mr Michael Watson; Deputy Director, Mrs Janice Dunn.

Student /Academic Administration: Director, Mr Karl Huss; Deputy Director, Mr Ivan Gregory.

Human Resource Management: Director, Ms Susan Harrison; Deputy Director, Ms Ann Boyle (Ms Boyle will continue as Director of Industrial Relations).

Mr Watson has been appointed Acting Registrar until March 1993.

Asian languages expanded

Monash will offer four new Asian languages next year after receiving a grant from the Monash Development Fund.

The fund has provided more than \$300,000 over three years to establish Cambodian (Khmer), Hindi, Malaysian and Lao language courses.

The courses, offered by the Department of Asian Languages and Studies, will cover many aspects of the languages, including gaining an understanding of the country's culture and society.

Head of the Department of Asian Languages and Studies, Professor Bruce Jacobs, said the introduction of new languages meant Monash now offered more Asian Languages at tertiary level than any other Australian institution.

He said the department already offered Chinese, Korean, Indonesian, Thai, Sanskrit and Vietnamese. "We now offer 11 Asian languages, including Japanese," he said.

"We already have strong links to Asia and the new languages are part of Monash's commitment to the region. Monash is also a contact point, linking Melbourne's substantial Asian communities with the wider Australian community."

More dinosaur discoveries

From page 1

"Here we have two dinosaur groups which we had no idea were in Australia prior to last year's digs at Dinosaur Cove and in Gippsland. It's intriguing: we now have the barest inkling of a number of groups that may have had Gondwanan origins but which then became extremely successful in the northern hemisphere. The fossil record is not good enough to tell us what happened to them here yet."

The Riches' sites in Gippsland's Strzelecki Ranges also provided other new discoveries last year.

Retired teacher and amateur fossil hunter par excellence Mr Mike Clelland found an armoured dinosaur from the ankylosaur (pictured) group, previously known only from Queensland, and more bones of a large crocodile-like amphibian called a labyrinthodont.

The Strzelecki fossil deposit is of early Cretaceous age, somewhat older

than the Dinosaur Cove deposit – about 125 to 115 million years old. What is intriguing about the amphibian fossils found there in recent years is that labyrinthodonts seem to have persisted in southern Australia long after they were extinct anywhere else.



The Riches suspect that the explanation for this may lie in the fact that southern Victoria lay inside the Antarctic Circle during the early Cretaceous, and while the world was much warmer than it is today, the intense winter cold near the south pole may have been enough to exclude the crocodiles that superseded the labyrinthodonts in

warmer latitudes elsewhere in the world. That begs the question of how Victoria's dinosaurs were also able to survive the bitter winters they experienced at high southern latitudes. Did they hibernate, or migrate northwards to more temperate latitudes?

The Riches lean towards the idea that the dinosaurs represented at Dinosaur Cove and in Gippsland rode out the winter without migrating or hibernating. Both herbivorous and carnivorous species were generally much smaller than their northern hemisphere counterparts, so that they could not have exploited gigantothermy to stay warm.

Gigantothermy amongst reptiles is found today in the largest of the modern sea turtles, the leatherback, whose sheer bulk in relation to its body surface area enables it to stay warm in the frigid depths where it hunts jellyfish. Smaller animals, especially cold-blooded reptiles, lose body heat much faster because they have a larger body surface area in relation to their volume.

One of the Dinosaur Cove species, chicken-sized *Leaellynasaura*, had large eyes and very large optic lobes in the brain, suggesting that it was adapted to forage in the gloom of the three- to five-month long Antarctic night.

If the small Victorian dinosaurs remained at home and active in the sub-zero temperatures of a south polar winter, it implies that they were either warm-blooded or may have had an insulating cover of fur, or even feather-like scales, or perhaps they had a thick layer of body fat.



The jawbone of a large crocodile-like amphibian, the labyrinthodont.

Arts & Minds

■ Australian Centre for Contemporary Art

An exhibition of photo-based works investigating the idea of place is soon to open at the Australian Centre for Contemporary Art (ACCA).

Titled *Location*, the exhibition investigates the ways in which 12 Australian artists have turned the photograph into an object, rather than a picture of their sense of place or location.

From the majestic black and white, romantic works of Hobart artist David Stephenson to the airport inspired back-lit transparencies of Anne Zahalka, *Location* is a journey of discovery in and around the photographic media, the landscape and the city.

Contributing artists include Linda Marie Walker and Paul Hewson, Graeme Hare, Kevin Todd, Ian North, Anna Zahalka, Robyn Stacey, Rozalind Drummond, Ewen McDonald, Ed Burton, Geoff Kleem, David Stephenson and John Dunkly Smith.

Curator Ms Juliana Engberg said: "This exhibition is the first major survey of photo-based works to address the issues of photographic media within the context of the art 'object' and the traditional depiction of place in Australian contemporary art."

Location will tour Australia before heading to South-East Asia. With the assistance of Asialink, the exhibition will visit Jakarta, Manila, Kuala Lumpur, Bangkok, Singapore and Japan. The tour, scheduled for early 1993, will further the exchange of art, artists and ideas in the region.

The exhibition opens at ACCA, Dallas Brooks Drive, South Yarra on 12 November and runs until late December. It is open from 11 am to 5 pm Tuesdays to Fridays and from 2 to 5 pm Saturdays and Sundays.



■ Monash University Gallery

Tracey Moffat's *Untitled* (above), bought earlier this year by the Friends of the Monash University Gallery, will be shown next month in an exhibition from the gallery's collection.

The work by the Sydney-based Aboriginal film maker and photographer from her 1989 *Something More* series, examines issues of racial integration, Australia's place within its Asian region, and tensions between dissimilar partners.

She ignores the approach of using photography as a tool of accurate and true recording. Rather, she utilises the extent to which the camera can and does lie, alter and transform fact into fiction. The photograph has been shown in New York and also appeared on the cover of the prestigious art journal *Art and Text*.

The Friends of the University Gallery was launched in 1987 with the opening of the new gallery premises. Other works the Friends have provided for the university's collection include *God and Country* by Juan Davila, *Untitled* by Marianne Baillieu, *Drawing I Landscape at T* by Bernard Sachs, *Tree and Wall (Italy)* by Rosslyn Piggott and *Port Melbourne* by Jan Sensbergs. For more information, phone extn 75 4217.

● This month, the Monash University Gallery presents *The Angelic Space*, an exhibition celebrating the works of Piero della Francesca.

Twenty artists feature in the exhibition, which looks at their own personal interpretations of della Francesca's works. These range from contemporary paintings, sculptures, and mixed media. The exhibition will run until 24 November.

New student prize

The first of 60 awards to be presented over the coming year to outstanding Year 11 students was made last month.

The Acting Vice-Chancellor Professor Robert Porter, presented the Monash Prize, a cheque for \$500, to Mr Quynh (Peter) Vien, of Westall Secondary College, South Clayton.

Professor Porter said: "It rewards academic achievements and encourages students to continue applying themselves to their studies. It is a great boost for our battle-scarred VCE students."



Disabled access ramp

The opening of a ramp at Robert Blackwood Hall is the most recent of several projects on Monash campuses to improve access for people with disabilities.

The ramp provides access to the stage area of the hall for disabled graduates, musicians and performers. Previously, wheelchair users needed to be lifted up steps to the stage entrance.

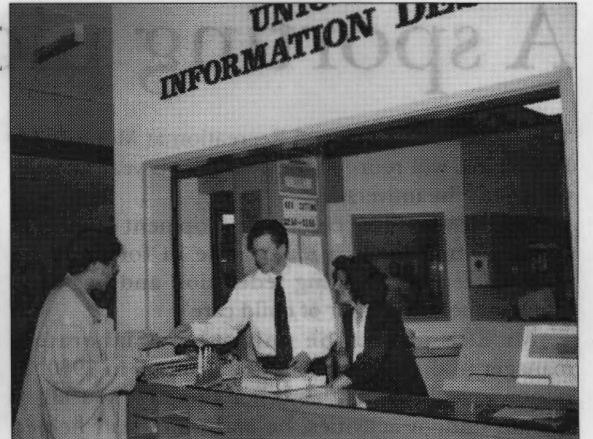
The construction of the ramp, at a total cost of \$7000, is part of a program to ensure that Monash students with disabilities have ready access to campus facilities, lecture theatres, and administration areas. Projects include the installation of automatic doors and communications equipment on all campuses.

Based on US and UK trends, Monash can expect to have more than 300 students with disabilities studying here within about 5 years. "Our vision for Monash is that access will be no big deal for anyone, including students with disabilities," Disabilities Liaison Officer, Ms Gillian McConnell, said. "We want to make sure that these students have the same access to facilities and systems as everyone else, with the same dignity and independence."

The Disabilities Liaison Office is responsible for the coordination of existing services for people with disabilities and to develop new integrated services and facilities that ensure access and equity for disabled students, members of staff and visitors. An advisory committee reports to the vice-chancellor on these matters.

The Vice-Chancellor, Professor Mal Logan, said the new ramp was a valuable contribution to the function of Robert Blackwood Hall and the life of the university. The ramp was funded by the Disability Pension Fund and the vice-chancellor's private fund on a dollar for dollar basis.

Ms Linda Smith, a fourth year honours student in psychology, tested the ramp for the first time. "We have worked so hard to get changes and facilities established for students with disabilities," she said.



Information facelift

The Union inquiry desk at Clayton has undergone a facelift and change of name to provide better service for staff, students and the wider community.

Staff at the new-look Information Desk (above) handle more than 1000 telephone or personal inquiries a day, with requests for assistance ranging from public transport information to car pooling details and directional maps. Other services offered by the desk include thesis and resume typing, book-binding, key cutting, *Daily News*, *Monads*, room bookings, faxing, image scanning and lost property.

The refurbishment, the desk's first structural change for 15 years, was the initiative of Acting Union Warden, Mr Joe Curtis, and was planned by his assistant, Ms Jenny Smyth, and supervising draftsman in the Buildings and Development Branch, Mr Ron Too. "The changes have created more working space as well as given the whole office a boost," Ms Smyth said.

"The Information Desk is the hub of the university. The most commonly requested information is directional. We are also constantly asked to help find someone who is somewhere at Monash - kind of like finding a needle in a haystack."

The Union Information Desk is open from 8.40 am to 10 pm Mondays to Thursdays and 8.40 am to 8 pm Fridays. For inquiries, phone extn 75 3106.



Community caring

A community nursing program - the first of its kind in Australia - is encouraging independence and self-esteem in disabled adults and providing caring experience for students.

Last month, 16 developmentally disabled adults were accompanied on a four-day holiday to Bright by first year student nurses from the Caroline Chisholm School of Nursing. The trip included visits to the snow fields, tours of horse ranches, picnic lunches and gold panning.

The program, which was piloted last year, gives developmentally disabled adults the chance to experience different activities. For the 30 student nurses and medical students, it represents practical experience in caring for people on a full-time basis.

"It is important for our students to recognise the developmentally disabled as normal people with needs," head of the School of Nursing, Professor Dot Angell said. "The program goes a long way in helping to break down the social stigma." She said the School of Nursing funded the program through student activities, support from local businesses, and a grant from the Sidney Myer Fund.

Lecturer and program organiser Ms Sue Elsom said students were matched with a developmentally disabled person, and were responsible for caring for them throughout the trip. "We had 70 student volunteers for the 30 positions available, and the whole school has supported the program. We also have people with disabilities waiting for next year's program."

Royalty, treason and murder

The cast and storyline of *The Popish Plot* makes the tabloid marital intrigues of the present day British royal family seem just a little tame.

A blockbuster novel would even find it hard to compete with the array of plotters, rumour-mongers and villains portrayed in the latest exhibition from the university's Rare Book Room. The exhibition, now on show at the Main Library, Clayton campus, highlights the substantial resources available in the library for the study of 17th century culture.

The Popish Plot refers to a political crisis that developed in late September 1678 when King Charles II and the Privy Council were informed of a plot by Jesuits to murder the King and install his Catholic brother on the throne. Charles II, with his well-known inclinations to a life of pleasure and no legitimate heir, was in debt and dependent upon Parliament to vote him funds. The opposition was at the time trying to impeach Charles' Treasurer.

Britons were very apprehensive at the prospect of the re-establishment of a Catholic monarchy; with James on the throne and the possibility of a son to succeed him, Britain could be brought back under Papal control.

Into this political cauldron stepped the informers Titus Oates and Israel Tonge. "Tonge, a Church of England

parson was a well-known anti-Catholic obsessive, having lost his church in the Great Fire of London, for which Catholics were made scapegoats," said Rare Books librarian, Mr Richard Overell.

"Oates was a particularly unsavoury individual, an Anglican minister whose career had already encompassed perjury, sodomy and apostasy. However, there was nothing inherently improbable in the plot as such and Charles and his government had to consider the matter seriously.

"But Oates was caught out on various details in his story and it looked as though any credibility the two men may have had was waning, when on 17 October Sir Edmund Berry Godfrey, the Justice before whom Oates had his statement, was found dead, impaled on his own sword."

The opposition quickly made this into a hue and cry against the Papists and the "horrid Popish Plot" became a public obsession. About 30 people were eventually executed for their alleged involvement in the plot.

Mr Overell said the other informers were also of questionable backgrounds. "Captain William Bedloe was an experienced confidence trickster, who in the

course of his avocation had come into contact with many Catholics. Miles Prance was a Catholic who was accused of involvement in the death of Godfrey and to clear himself turned informer.

"Stephen Dugdale was the manager on the estate of the Catholic Lord Aston. He was a gambler and had fallen into financial difficulties. As a means of covering his dishonesty, he decided to inform on his master and his master's Catholic friends."

The 17th century political pamphlets that form the basis of the exhibition were just a handful of the many thousands of volumes in the rare books section of the library, Mr Overell said. "The value of the collection is obvious to historians, but it is also an important resource for students from all disciplines," he said.

Books, encyclopedia, magazines, dictionaries, maps and comics are all part of the collection which ranges from a 1476 commentary on the Old Testament to gangster novels of the 1930s, 40s, and 50s. Other subjects include ogres of the 17th century, an 18th century book on divorce and several editions of the Vatican's index of prohibited books.

There is a large collection of 18th and 19th century cookery books including an early edition of *Mrs Beeton's Book*



The Popish Plot's cast of informers.

of *Household Management*. "Old cookery books are quite rare," Mr Overell said.

"They were general household items which were used and thrown away, not ending up, as many of the more treasured books did, on a gentleman's library shelf. We have been very lucky to have acquired them. A generous donation by a student at Monash has formed the basis of our collection. We are looking to add to it as opportunities arise."

An illustrated catalogue for the current exhibition, which runs until 4 December, is available free of charge from the Rare Books Room.

A weekend reverie wins poetry prize

Ms Mollie Nettleton has won the Monash University Prize for Poetry for her poem *On a Sunday morning when ...*

A total of 86 entries were received, with honourable mentions awarded to Ms Vivien Vasic and Ms Hasannah Briedis.

On a Sunday morning when ...

On a Sunday morning, when
The toilet needs cleaning, and
Several days' newspapers
Are spread across the floor,
I settle into my pillow
Propped against the wall,
My husband, a dog, and two cats
Sharing the comfort of my bed.
I am reading Proust
Talking about the perfect writer,
The "Bergotte" of his fancy,
That bit about "making beauty
Explode and drench me with its essence".

I stop and read it again
Rolling the words between
My tongue and teeth like a sherbet.
Is it positive luxuriating
Or negative indolence
To be thus occupied
Or unoccupied
On a Sunday morning?

I wake my husband
And read aloud to him the words
Which made my hair rise and my skin
creep:
"Beauty explode and drench me
With its essence".
He only says, and for the hundredth time,
"You should write".
I am angry. Why should I write?
I should also clean the toilet.
There is no more obligation
To do one than the other
Thus, deadly indecision
Takes my hand leading towards guilt
And making this bed my tether,
Weights me once more towards sleep.



A visit to Melbourne's beaches may hold few surprises for the intrepid explorer, but lovers of flora and fauna will find much of interest in a new guide written by a Monash lecturer.

The pocket size guide, *Life on the Rocky Shores of South Eastern Australia*, published by the Victorian National Parks Association, is co-written by Dr Gerry Quinn, of the Ecology and Evolutionary Biology department, Dr Geoff Wescott and Dr Russell Synnot.

More than 72 plants and animals are described in this, the second edition of the 96-page guide. It devotes a page to each species found on our beaches, complete with a photograph or sketch, scientific name and classification, appearance description, and details about habitat and ecology.

The guide was first published in 1980, with the revised edition launched by the Minister for Conservation and Environment, Mr Barry Pullen in July.

Dr Quinn believes the guide is a valuable reference for schools and universities, as well as beachgoers. "It is a

Life on the rocky shores

simple, concise guide which identifies living animal and plants along Melbourne's beaches and can be used by everyone," Dr Quinn said.

The guide also highlights the effects of human activity on marine environments. "Many plants and animals found on beaches in south-eastern Australia are threatened by human activity," Dr Quinn said.

"Sewage pollutants, industrial wastes, tourist development and recreation all have diverse impacts on the intertidal shores. There is now considerable proof this activity depletes populations of animals and plants, as well as changing the structure of intertidal communities.

"The guide encourages visitors to look and learn about the intertidal animals, but to leave the shores as they find them." Dr Quinn, who serves on the Ministerial Advisory Group of the Scallop Dredging Trials Committee and is a technical expert on the Ninety Mile Beach Environmental Consultative Committee, is researching human



impact on the marine environment. He believes the opening of the Queenscliff Marine Station in 1990 was a huge boost for research projects and has helped to raise awareness and education of marine environments.

The station - established with a \$500,000 grant from Monash, the University of Melbourne, RMIT and the Victorian Institute of Marine Sciences - is now a regular venue for student field trips.

"The facilities are among the best in Australia: plenty of laboratory space, high quality aquaria and access to the field," Dr Quinn said. "It has become an essential part of Monash's marine biology course and is widely used by students and researchers alike."

Life on the Rocky Shores is available at leading bookshops and the Monash bookshop for \$7.95, with discounts for school orders.

Tracing nursing history

Sister Elizabeth Burchill may still be nursing a few dreams but her latest book on Australian nursing is a revelation of history and anecdotes.

Australian nurses since Nightingale: 1860-1990 traces the origins of modern nursing from the days of Florence Nightingale to the present time. Sister Burchill, a well-known and respected Victorian nurse and author, has pursued her calling around the world.

The book contains remarkable anecdotes of Australian nurses, including 'nurses on wheels', 'nurses on horseback', 'male nurses', 'army nurses', and concludes with her own story, spanning achievements in the nursing, literary and academic fields.

Sister Burchill, who graduates next year from Monash with a masters degree, was honoured by the university in 1986 with the establishment of the Elizabeth Burchill Room

in the Main library at Clayton. Her five previously published works, written over 45 years, include the popular *Innaminka*, and *The paths I've trod*.

A nurse since the early 1930s, she served with an ambulance unit during the Spanish civil war in 1937, the Second World War theatres in Egypt and Palestine, the rugged north coast of Canada and has nursed in outback Australia. After the war, she had a brief stint as a radio announcer in Shepparton before returning to nursing. In 1950, she established the first full-time infant welfare clinic in Darwin since the war.

In an extract from the Royal Flying Doctor Service's John Flynn Memorial Address delivered by the Duchess of York in 1990, bush nurses were described as "resourceful, self-reliant, compassionate, understanding and above all, to possess a sense of humour".

Australian nurses since Nightingale: 1860-1990, is available from the Australian Studies Centre at Monash, extn 75 5241, for \$18.95 including postage.

Modelling the landscapes of the mind



Trike by Ray Lee

These fanciful constructions, made possible by the latest in computer animation, show the way ahead in the field of product modelling.

Students from the Department of Industrial Design, with the aid of the advanced computer graphics laboratory on Caulfield campus, are producing product models among the most complex ever made by Australian design students.

Senior lecturer in 3-D modelling, Mr Michael Kitson, said the skills students were gaining by using the facilities of the laboratory gave them a distinct advantage in a profession in which computer applications were being constantly updated.

"Because they will have already encountered most of the concepts in computer graphics, students are well placed to move from one specialised computer modelling package to another," he said.

The world-class laboratory comprises twelve networked Silicon Graphics Iris workstations. Each workstation, which outputs to video for animation and to a high-resolution colour printer, runs the professional standard Alias 3.1 software.

The models pictured on this page are single frames from short pieces of animation and were built, lit, coloured and textured using Alias.

The program is capable of 'natural phenomena' procedures. These allow solid textures such as wood, varieties of rock, water and clouds to be mapped onto or through objects using fractal mathematics.



Robot insect by Tim Umney