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UNSW

SPECIAL WATER ISSUE

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Five minutes with ...

An early career in film brought **Brigid Costello** into contact with some famous faces - including Cate Blanchett and Hugo Weaving. Her work in film now influences her academic work in the Faculty of Arts and Social Science.



Susan Trent, Gasbag Studios

What is one of the films you have worked on?

People always want to know about my involvement in *Bad Boy Bubby*, a Rolf de Heer film from the early 1990s. I was a cinematographer for one of the scenes in that film. The film is about a man who was brought up, by his mother, locked in a room. At a certain point in the film, he escapes. He's a grown man, but essentially he's like a child being in the world for the first time. To express that, ten different cinematographers - including sculptors and other artists - were used. Mine was one of those scenes. The idea behind it was that Rolf wanted to have a sense of seeing the world for the first time with new eyes.

You studied cinematography at the Australian Film Television and Radio School. What do you remember of that time?

It was quite hard to get into and it was a great course. I got the chance to work with some famous actors including Matt Dillon, Phil Collins and Hugo Weaving. One of the three other people in my year of cinematography was Dion Beebe, who won an Oscar for cinematography for his work in *Memoirs of a Geisha*.

I remember working on an exercise at film school which had Cate Blanchett in it - way before she was well known. I remember setting up the lights and thinking "Gee, that girl is really good." It was not her presence, it was her acting. She had a kind of containment and focus which was really unusual.

Is there something about some actors which makes us want to watch them?

People in the industry say that big stars have faces that are brighter than everyone else's. Their faces are luminous and they reflect the light. Good actors also know how to angle their faces, so they can capture the light. Hugo Weaving is a case in point. He's got a brighter face and he's very good at catching the light with it.

What prompted you to leave the film world?

One of the reasons I left cinematography is that you can't 'dip into' it. Plus, I fell into the academic world and then realised that I loved it! When I started teaching, I was doing a few jobs for people every now and again. I felt like it was something that I was not doing a good job at. It is something that you devote your life to, it's not something that you can keep on the backburner. It's like being a concert violinist and only playing twice a year.

That's why smaller art projects work for me. You can tie them to research interests within a university structure. You can be more innovative and original by forging new ground. Interestingly, now I can see animation and cinematic themes coming back in my work.

Brigid works in the School of English, Media and Performing Arts where she teaches interaction design.

Deputy Prime Minister at CSI

Deputy Prime Minister Julia Gillard called for more ambitious partnerships to generate social innovation when she spoke at the new Centre for Social Impact on 28 February.

Ms Gillard, addressing an audience of 500, outlined the Federal Government's commitment to a social inclusion agenda and to reshaping the health, education and community sectors through collaborative national reform.

The event, hosted by the chief executive of the Centre, Professor Peter Shergold, brought together a number of leading social innovation thinkers and practitioners.



For the second year in a row a graduate from COFA has won the Archibald Prize. Del Kathryn Barton, who has a Bachelor of Fine Art from COFA, where she also taught for three years, won the 2008 Archibald Prize for her painting *You are what is most beautiful about me, a self portrait with Kell and Arella*.

Largest Australian grant

UNSW has been awarded the largest Australian grant in its history, receiving \$17.7 million in funding to advance understanding of HIV and hepatitis C.

The funding, from the National Health and Medical Research Council, was one of four program grants announced by the Minister for Health and Ageing, Nicola Roxon.

Professor David Cooper from the National Centre in HIV Epidemiology and Clinical Research will lead a nine-person team combining researchers with skills in virology and immunology with those who have expertise in translating findings in the laboratory into human clinical trials.

In the same funding announcement UNSW also received \$5.5 million to help further the careers of 28 researchers.

Australia 2020

Thirteen staff members and affiliates from UNSW helped shape Australia's future when they took part in the Australia 2020 summit in Canberra.

Prime Minister Kevin Rudd described the summit as "an important initiative to harness the best ideas for building a modern Australia that is ready for the challenges of the 21st century".

The UNSW representatives were: David Gonski, Chancellor; Professor Fred Hilmer, Vice-Chancellor; Professor Deb Brennan, Social Policy Research Centre, Faculty of Arts and Social Sciences; Associate Professor Kate Crawford, Faculty of Arts and Social Sciences; Ms Megan Davis, Indigenous Law Centre in the Faculty of Law; Professor Julian Disney, Social Justice Project in the Faculty of Law; Professor Michelle Haber, Children's Cancer Institute Australia for Medical Research; Dr Sarah Maddison, Faculty of Arts and Social Sciences; Louisa Minney, Manager of International Programs and Policy in the National Centre for HIV Social Research; Associate Professor Alison Ritter, National Drug and Alcohol Research Centre in the Faculty of Medicine; Professor Peter Shergold, Centre for Social Impact in the Australian School of Business; Dr Rosemary Stanton, Visiting Fellow in the Faculty of Medicine; Professor George Williams, Gilbert + Tobin Centre of Public Law, Faculty of Law.

How to ... Refurbish your home

Ever wondered why some people's homes look effortlessly chic, while others are a messy collection of pieces that don't quite work? FBE's Rina Bernabei, and her design partner Kelly Freeman, have some tips.

- 1** Remember that it is your home. You must feel safe, comfortable, relaxed and confident, but most importantly it must feel like you.
- 2** Don't purchase the whole interior from one shop, it will tend to look sterile and a bit like a showroom not a lived-in home.
- 3** If you already have a few pieces, decide which ones you really love or which hold special memories, and work your new furniture around these.
- 4** Don't rush, much of the pleasure of putting a room together is in finding that right piece.
- 5** Get rid of anything that you really don't like, even though these pieces may be in good condition, you will never be happy with them.
- 6** When buying big-dollar items like lounges and dining tables, it really is best to buy the best quality you can.
- 7** Lighting is one area that it really pays to invest in, good subtle lighting can really make a space feel relaxing and warm.

For the record

"I don't think the Taliban reads *New Idea*." Journalism and Media Research Centre Associate Professor David McKnight, on why reporting Prince Harry's tour of duty in Afghanistan raised few real ethical dilemmas - SBS News.

"The focus in Australia is on 'Thank God I've found somewhere'." Professor Deb Brennan on why Australians put up with often sub-standard child care - Daily Telegraph.

"Their doctors should be guiding their choices based on the realistic outcomes - which are terrible." Fertility expert Professor Michael Chapman on why doctors, not governments, should determine whether women over 45 have access to IVF - Australian.

"It's all about the mortgage, I'd say." COFA artist Del Kathryn Barton when asked what she might do with the \$50,000 Archibald Prize she had just won - The Age.

"Senior citizens are by far our most interesting visitors because not only can we actually show them the diseases but a lot of the time they've got firsthand experience of the symptoms." Museum of Human Diseases curator Robert Lansdown - Sydney Morning Herald.

Foundation for Success



Foundation Studies, the early years.

Photo courtesy of Peter Coody

This year UNSW's Foundation Studies program celebrates 20 years of helping international students prepare for university in Australia. Created in 1988, UNSW Foundation Studies is the longest running and most successful foundation program in Australia and is often used as a model by other institutions developing university preparation programs.

"Our emphasis is to teach for understanding, not just knowledge," says Jon Ireland, the Director of Foundation Studies.

Enrolling students from over 35 countries, Foundation Studies provides a smooth transition into the many challenges of university life and also of living abroad. Over 12,000 students have graduated from the program and annually, 80 percent of all graduates are offered places in degree courses at UNSW or other Australian universities.

“Our emphasis is to teach understanding, not just knowledge.”

Enoch Chi Tak So, a former Foundation student and UNSW University medallist graduating in Engineering in Bioinformatics says, "I believe that Foundation students have the edge compared with other international students coming directly into first-year university."

Graham Ware, Head of UNSW Foundation Studies Science and one of the original teachers agrees. "We try to cultivate and foster a teaching style that encourages students to develop analytical and problem-solving skills, not just write answers."

The UNSW Foundation Studies program, which is part of UNSW Global, now has 10 external partners and campuses, as well as its award-winning facilities in Kensington.

A graduate of the art strand of Foundation Studies and the UNSW Commerce degree, Mitchell Kwong now works in the finance section of UNSW Global, where she is the Group Reporting Manager.

"When I arrived in Australia, Foundation Studies not only helped me adjust to the required academic study, but also encouraged me socially. It was like a miniature United Nations," Mitchell says.

"When I look back now, choosing to do Foundation Studies was one of the best decisions I ever made. From the frantic pace of education in Hong Kong, doing Foundation Studies in Sydney settled me into a study routine, supported my academic goals and helped me achieve what I really wanted." ■

Recognition of excellence

UNSW's international leadership in areas as diverse as dementia research, architecture and risk management have been acknowledged with a recent spate of awards.

A Faculty of the Built Environment (FBE) research team headed by Professor Martin Loosemore and Associate Professor Dr Patrick Zou won the International Construction Project Management Award in the Chartered Institute of Building's Innovation and Research Awards for their development of a risk and opportunity management system for the construction of the Beijing Olympic Games facilities.

Professor Deo Prasad, also from the FBE, was named as the Chair of the United Nations Environment Program's (UNEP) Global Civil Society Forum for the Asia-Pacific region. As part of the two-year role Professor Prasad will host an International Environmental Governance workshop at UNSW later this year.

At home FBE Adjunct Professor and UNSW Alumnus, Richard Johnson, was awarded the prestigious Royal Australian Institute of Architects 2008 Gold Medal for his work on some of Sydney's greatest buildings.

UNSW won four of the 15 grants offered by the National Health and Medical Research Council in a special round of dementia funding. Over \$900,000 was given to the team, led by Senior Research Fellow Dr Julian Trollor from the School of Psychiatry, for an investigation into the role of metabolic and inflammatory factors in cognitive decline. Professor of Psychogeriatrics, Henry Brodaty, was appointed to the national advisory group on dementia.

UNSW won an Employer of Choice for Women citation from the the Equal Opportunity for Women in the Workplace Agency (EOWA) - the fourth year the University has received the citation.

In other honours, the University featured twice in the finalists list of the prestigious DuPont Australia & New Zealand Innovation Awards for work with big benefits for the environment. Researcher David Tolmie, from UNSW's Water Research Laboratory, was named as a finalist in the Sustainable Services category of the awards and PhD student, Renuka Karuppuswamy, is also in the running in the Tertiary Student category.

In Accounting Dr Elizabeth Carson from the School of Accounting has received the American Accounting Association Auditing Section Outstanding Dissertation Award for 2008. ■

- Steve Offner

It's in the family

Dr Helen Pringle from the School of Social Sciences and International Studies has been appointed Presiding Member of the Faculty of Arts and Social Sciences and awarded her second Vice-Chancellor's Award for Teaching Excellence.

By **Susi Hamilton.**

While teaching runs in the family, it didn't come easily at first to Helen Pringle. While she was a young doctoral researcher at Princeton, she was told that research - not teaching - would be her forte.

"When I first taught, I got really bad student reviews," says Dr Pringle. "I realised that one thing I needed to do was take a much more forward role in lectures and tutorials. I started shaping the discussion and learning more. It's a more respectful thing to do - rather than just sitting back and saying: 'What do you think?'"

Dr Pringle muses about whether her skills as a teacher weren't just waiting to come out - as her father was one and a beloved great-aunt was a popular teacher at a primary school in Ipswich.

"Students often get excited about the subject through your passion for it," she observes. "I also look at politicians. What successful ones like Obama do is persuade people about something. That is part of teaching as well."

Storytelling is also entwined in Dr Pringle's teaching - most often through real-life examples. Audiovisual material is used - for example, parts of the film *The Accused* illustrate the course of a rape trial and those from *Witness* illustrate the virtues and costs of non-liberal societies.

"Stories are really important," she enthuses. "They help people remember. The story is like a picture, it helps bring the important points to mind."

Human rights is an area which Dr Pringle teaches - and one which she uses to illustrate the relevance of her work.



Susan Trent, Gasbag Studios

“Students often get excited about the subject through your passion for it.”

"When we talk about abortion, I say that the law changed when there were raids on the streets in Bondi," she says. "That makes it so that you understand that human rights are about all of us and they are not only in some faraway place, such as Bosnia or Darfur."

And the approach clearly works. One student describes a "spine-tingling, breathtaking, often moving, session".

Another says: "I learned about life, about speaking, about who I am, making me a more comfortable public speaker, not afraid to speak my thoughts and opinions to others in an academic environment."

Dr Pringle believes that this will help students well beyond the classroom.

"You hope that students have a voice and can stand for things. In a democracy, being able to talk and to talk well is such an important thing," she says. "It's not an empty thing because you can't talk well unless you know what you are talking about, and are learned and cultivated."

Dr Pringle nominates having a command of your field as being of utmost importance, but does not make a distinction between her publications and teaching.

"I think they are both part of research.

It is the one vocation," she says. "It is part of getting your work out there and making a contribution. Teaching is not a disembodied skill."

Dr Pringle has supervised nearly 40 Honours and postgraduate students since being appointed to UNSW in 1990. Fourteen of them gained first-class Honours and three were awarded the University Medal. She has an ongoing relationship with many of them.

"When Facebook came in, I got many former students looking me up," she says. "Teaching is very rewarding. It reminds me of my great-aunt. People always remembered Miss Pringle." ■

LIGHT RELIEF



Water (re)cycle

UNSW academics are researching every step of the hydrologic cycle.

Down came the rain? Why we have a water shortage



Purification, that's the name of the game: water recycling and re-use



Tossed upon stormy seas: the role of our oceans



Essential for existence: the impact on flora and fauna



Ownership, control and use: water policy and law



The integrated research of our University provides us with knowledge that is vital to our ability to understand water on our arid continent and to adapt to the climate changes that are confronting us," says Professor Andy Pitman, co-director of the UNSW Climate Change Research Centre.

In recent years water has come to the forefront of our collective consciousness. Our changing weather patterns and emptying dams have created an awareness of our most precious resource that didn't exist a decade ago.

But why is water so important, how varied are its uses and what can be done to improve the situation?

UNSW's researchers are at the cutting edge of global research into water. Their work covers areas as varied as water recycling, beach erosion, bottled water consumption and groundwater subsidence.

In this special water issue of *Uniken* we outline just some of the amazing research that is taking place on campus, as well as look at some of the practical steps UNSW is taking to minimise our water usage.



Down came the rain?

Changing weather patterns mean we can no longer assume that we will have enough water to meet our needs. But how extensive is the problem? What caused it? And is groundwater the solution?

Hotter and drier

The populated southern coastline of Australia will likely suffer from heatwaves and drought as a result of global warming, according to research undertaken by Professor Andy Pitman, co-director of the UNSW Climate Change Research Centre.

“We have modelled future rainfall patterns, using projections based on both low and high rates of emissions, to the years 2050 and 2100,” he explains.

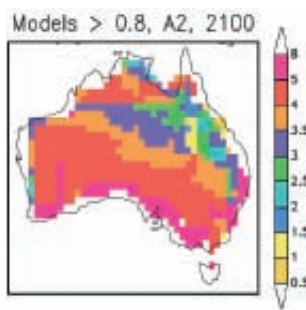
“Earlier assessments that climate change will cause major changes in rainfall in Australia are probably wrong. Our research has found that global warming will cause a small increase in the average rainfall over most of Australia, but that will decrease further into the future.

“What is extremely concerning is that the models show a drying of the highly populated areas of the southern coast of Australia.”

Global warming will also cause an increase in the average temperature according to Professor Pitman. However, this increase will counteract the increased rainfall with increased evaporation resulting in a net decrease in the amount of water available.

“Our research also shows that, although the average temperature increase will be least in southern Australia, the decreased rainfall in that area means it will suffer a particularly large increase, by up to six degrees, in the hottest temperatures. So, hotter, drier and longer heatwaves and droughts along the southern coast and into the Murray-Darling Basin,” he explains.

- Victoria Brown



Models > 0.8, A2, 2100
Change in the annual maximum temperature by 2100 under high greenhouse emissions.

Flood, fire and famine?

In future our rainfall will come in different patterns, mostly in shorter and more intense bursts, according to research by Ashish Sharma and his hydrology group in the School of Civil and Environmental Engineering. The change, due to increased carbon dioxide emissions, will bring greater risk of flood, increased erosion, and altered pressures on reservoir capacity.

Professor Sharma and research fellow Dr Raj Mehrotra have developed sophisticated software which allows them to use the data from the General Circulation Models (large-scale rainfall, temperature and other atmospheric circulation variables) using inputs such as the projected rates of slow-down in emissions, adoption of alternative fuel sources, rates and patterns of industrialisation and other factors which affect atmospheric CO₂.

Sharma and Mehrotra translate the information into a catchment-size scale and are able to present the likely rainfall outcomes and water supply risks for up to seven or eight plausible emission scenarios. Much of their present work addresses the future capacity of Warragamba Dam and its catchment area to supply Sydney's needs up to 2070.

- Louisa Wright

Role of the ocean

Rainfall over Western Australia is controlled by sea surface temperatures in the Indian Ocean, new research has shown.

“The annual rainfall variations in WA are huge; as much as 70 percent variation from one year to the next,” says Professor Matthew England, co-director of the UNSW Climate Change Research Centre.

Looking at the rainfall cycles, Professor England discovered that Indian Ocean temperatures seesaw between WA's dry and wet years and that the pattern involved two massive patches of cold and warm water sitting next to each other off the WA coast. Farmers can benefit from the findings if they plan their cropping accordingly.

“During dry years the ocean forces a southward shift of the rain-bearing fronts that normally hit the southern fringe of the Australian continent. As the fronts drift south, so too does the rainfall normally destined for WA, leaving the region dry,” he says.

“Rainy years see the same process only in reverse: the ocean temperature pattern seesaws, the rain-bearing fronts move closer to the continent, and WA gets a much deserved break from the dry spell.”

- Victoria Brown

What lies beneath

Less than one percent of terrestrial rainfall percolates through surface soil to recharge groundwater lying in underground aquifers.

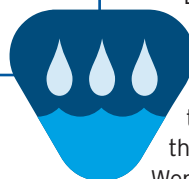
“One doesn't need to be an Einstein to appreciate that these aquifers will run dry if we keep plundering them at a greater rate than natural recharge,” says Wendy Timms, a Senior Engineer-Scientist with UNSW's Water Research Laboratory (WRL).

Dr Timms says there is immense variability in the proportion of rainfall that recharges local groundwater supplies, for example computer modelling suggests that between six and 90 percent of rainfall percolates into Sydney's Botany Sands aquifer.

The WRL has built a mobile rainfall simulator which has been designed to rapidly and accurately measure surface run-off and soil infiltration processes under field conditions.

The brainchild of WRL's Director Dr Bill Peirson, the simulator can be set up at any location and calibrated to mimic local rainfall conditions, including parameters such as at-surface droplet size, distribution and velocity. Probes can be inserted into soil and groundwater to provide accurate measurements over an area of 36 square metres.

- Peter Trute





Purification, that's the name of the game

As freshwater sources become scarce we need to be smarter about how we use and care for our existing water supplies. UNSW scientists are leading the way.

Waste not

India may be swamped by the refuse and discarded consumer packaging of its recent economic success, but one of UNSW's newly appointed Visiting Research Fellows plans to use that waste to clean up the nation's tainted water systems.

Dr Malini Balakrishnan, of the Delhi-based Energy and Resources Institute (TERI) is turning the fly ash waste from rice husks and sugar-cane processing into an effective, low-cost filter for contaminated water. When converted into a



Dr Malini Balakrishnan

membrane filter for use in waste treatment systems, the fly ash looks much like a large ceramic tile and TERI is working with an Indian tile manufacturer to begin commercial-scale production.

fly ash is what is left behind after incineration and if it is not re-used, it is a major source of air pollution. The fly ash filter is designed to be fitted to small municipal or household water systems, to provide a local solution which can be run and monitored by local communities.

Dr Malini's position at UNSW will allow her, and the TERI team, to collaborate with Australian researchers specialising in wastewater treatment, especially membrane bioreactors which clean up contaminated water for re-use.

- Louise Williams

Brackish water comes clean

When the freshwater dries up farmers have had little choice but to stand by and watch their crops wither and die. Now, a new crop watering system can save farmers from ruin by turning previously useless brackish groundwater into high-quality water for irrigation.

The water system also promises to extend agricultural land into regions with brackish water supplies, and to assist struggling farmers in areas where decades of poor water management has caused salt to leach into the water table, such as has happened in the Murray-Darling Basin.

The new system, developed by Associate Professor Greg Leslie and the UNSW Centre for Membrane Science and Technology, and the University of Sydney's, Professor Bruce Sutton, has been provisionally patented by NewSouth Innovations, UNSW's commercial arm.

The subsurface drip irrigation system relies on the basic principles of membrane desalination. To strip brackish water of salt a pressure gradient must be created to draw the clean water through a reverse osmosis membrane. Professor Leslie and Professor Sutton's system lets the crops do the work. They've demonstrated that by running irrigation lines under the ground beneath the plants, the root systems provide a sufficient pressure gradient to draw freshwater through the desalination membranes.

- Louise Williams

Oil and water don't mix

One of the most basic rules taught in science classrooms is that water and oil don't mix. It's a truth too often tragically illustrated when oil spills into waterways and wetlands.

But, UNSW technologist, David Tomlie, from the Water Research Laboratory, has set a new world standard in cleaning up oil spills.

Three years after his separation system was launched, it is now installed at 70 locations around Australia including the Caltex Kurnell Oil Refinery, where it helps protect Botany's wetlands.

Using his "Extended Gravity Oil Water Separation" (EGOWS) concept, Mr Tomlie's device can clean water to within 10 parts of oil per million - the strict limit set by many environmental authorities around the world for returning water to the natural environment.

EGOWS works on the principle that oil and water do not mix. Because oil is less dense than water it rises to the surface and can be skimmed off in a separator tank. The environmentally acceptable results were achieved by extending the time effluent water remains in a separator tank, and redesigning previous tank inflow and outputs.

Mr Tomlie is in the running for a DuPont Australia and New Zealand Innovation Award in the Sustainable Services category.

- Louise Williams





Tossed upon stormy seas

Oceans cover 71 percent of the Earth's surface and contain 97 percent of our water. A playground, place of industry, food provider and a source of great beauty; storms, erosion and loss of life mean our seas can also be a formidable foe.

The secrets of the beach

Preliminary research results from the windswept coast of southern France suggest an extraordinary but little understood mathematical equilibrium has been keeping the world's coastlines largely intact, despite the vagaries of the weather.

The urgent question is whether even small changes in sea levels due to climate change will wreck this natural balance and trigger devastating coastal erosion.

The key measurements are being recorded on equipment constructed by a joint University of New South Wales and University of Plymouth (UK) team, in what is believed to be the single largest array of scientific instruments ever deployed in experimental coastal research. On the remote beach at "Le Tru Vert", literally "the green thing", in Bordeaux, a group of 90 international researchers is hoping to unlock the secrets of coastal seabed movement, and in doing so map the likely impact of climate change on coastlines.

UNSW's Dr Ian Turner says preliminary results show a single wave can shift the seabed by up to two centimetres and move large amounts of sand. Over a three-week period total movements of 100 metres have been recorded, he said by phone from France.

But, nature is constantly seeking equilibrium, and no matter how extreme the short-term movements, over a tidal cycle the actual change in the beach is very small.

"The beach is constantly changing over short time periods, but over weeks nature rights itself and we have no idea why," he said.

"We need to understand the fundamental science behind this balance between the erosion and deposition of sand."

Dr Turner, who is in France until mid-year with his colleague from UNSW's Water Research Laboratory, Dr Chris Blenkinsop, says the research confirms that the world's beaches are very sensitive environments. In Sydney, the research will be especially relevant to UNSW's work on the exposed Collaroy Beach coastline, which is vulnerable to erosion and could be devastated by rising sea levels.

"Relatively small changes in the wave climate could cause relatively large impacts on beaches, in the same ways small temperature changes can disrupt natural ecosystems," said Dr Turner.

"But, it is also possible our research could show that because beaches have this ability to find a natural equilibrium they may have the ability to adjust to rising sea levels."

The first step, he said, is to model this extraordinary natural equation once tests are completed in Bordeaux. The international research team is being hosted by Bordeaux University and the French Navy.



Testing waves in southern France.

Photo courtesy of Ian Turner



Science of the surf

More than 60 people die in Australia's surf every year, many as a result of the powerful rips along our beaches and coastline. UNSW's Rob Brander is bringing science to the study of surf to help reduce the number of drownings.

A scientist in the School of Biological, Earth and Environmental Sciences, Dr Brander has been studying rips for 15 years and believes he may have found the cause and timing of 'rip pulsing' - when the speed of water flowing offshore in an ocean rip current increases, suddenly dragging swimmers hundreds of metres offshore.

"This is when most swimmers get into trouble - there is just no way you can swim against the speed of the rip, let alone a rip pulse," he says.

During a rip pulse, the current can double in speed for anywhere between 30 seconds and a few minutes.

"Rips tend to pulse once every five to 30 minutes," he says. "The fact that we can't be any more specific than that is because we still don't understand what causes them. It's often been thought that the pulse is related to wave groups, or sets, which arrive at the shore at approximately the same time intervals."

In particular, Dr Brander wants to understand why rips pulse.

"There's still so much we don't understand about how rips form. They are such a ubiquitous hazard on Australian beaches and it's just crazy that we don't understand them."

Dr Brander uses electromagnetic current meters to gauge waves and releases dye into the water to trace the rip's movement.

"Watching the whole dye release, I can see where the rip is accelerating the most," he says.

- Louise Williams

- Dan Gaffney



Essential for existence

Water is vital to the world's flora and fauna. Changes to water availability, and the impact of development and climate change have potentially far-reaching ramifications.

Sydney Harbour's seaweed a deadly diet

Contaminated seaweeds in Sydney Harbour could be threatening the small animals that feed on them, according to a new study revealing that the harbour's seaweeds have the world's highest levels of copper and lead contamination.

Up to 75 percent of the offspring of small crustaceans that feed on a common brown seaweed, for example, are killed when they are exposed to copper at levels found in some parts of the harbour, UNSW experiments have shown.

The UNSW study sampled seaweed from 10 bays within the harbour and found concentrations of copper, lead and zinc in a species of brown seaweed that equal or exceed levels found in the Hong Kong Islands and Brazil's Sepetiba Bay, which are among the world's most heavy metal-contaminated waterways.

The study, completed by Dr David Roberts, Dr Alistair Poore and Dr Emma Johnston, reveals that high concentrations of copper in one seaweed species were associated with a low abundance of grazing amphipods that feed on algae.

- Dan Gaffney



A small crustacean feeds on seaweed in Sydney Harbour.

Photo courtesy of Dr David Roberts

Cracking good yarn

UNSW scientists are pioneering a new way to monitor water movement in "cracking soils" that support the bulk of Australia's irrigated cropping land.

Cracking soils offer favourable conditions for agriculture because of their high nutrient content and water-holding capacity. Their fine grain is believed to be a factor assisting water retention.

The drying of Australia's environment has seen farmers develop an increasing interest in crack dynamics because it may offer better strategies for sustainably managing crop irrigation.

Ian Acworth, Bryce Kelly and Anna Greve from UNSW's Water Research Laboratory are using time-lapse photography and electrical borehole tomography to estimate changes in soil moisture content that are associated with the opening and closing of cracking soils.

The team has successfully applied the technique in laboratory and field experiments based in Boggabri, a wheat, wool and cotton town situated on the banks of the Namoi River in north-western New South Wales.

- Dan Gaffney



Development threatens marshes

UNSW research has revealed that earthworks are having a devastating impact upon the lower Macquarie River and its flood plain.

The mapping and satellite-based study identified 338 kilometres of levees, 1,648 kilometres of channels, 54 off-river storages and 664 farm dams on the flood plain of about 4,300 square kilometres.

"This is the first time such an extensive study has been done for any river in the Murray-Darling Basin and the extent of development is surprising as it is making a significant impact on the river and its ecology," said UNSW's Professor Richard Kingsford, who co-authored the report with science honours student, Celine Steinfeld.

This flood plain contains flood-dependent vegetation, including river red gums and reed beds. The combination of reduced flows resulting from river regulation, and the cutting off of flows by channels and levees, has had considerable impact on flood plain trees, killing many hectares.

The study analysed how government policies and guidelines for flood plain works had been implemented and found that they had been breached.

- Dan Gaffney

Science taps into nature

The ability of water-borne bacteria to colonise surfaces and form "biofilms" is a source of infection and biofouling that claims millions of human lives and costs billions of dollars.

Biofilms form when free-roaming bacteria in water and other fluids adhere to a surface and then send signalling molecules into the immediate environment to communicate with nearby bacteria.

Bioscientists Peter Steinberg and Staffan Kjelleberg observed that the seaweed *Delisea pulchra* contained compounds known as furanones that inhibit the formation of biofilms by "jamming" their communication systems.

Working at UNSW's Centre for Marine Bio-Innovation, they successfully produced synthetic furanones that have potential application in the medical, retail, agricultural and industrial sectors. The synthetic furanones have an advantage over traditional antibacterials and biocides because they appear to avoid the problem of bacterial resistance.

In 1999 Kjelleberg and Steinberg established Biosignal Ltd to commercialise synthetic furanones. Today, NewSouth Innovations, UNSW's new commercialisation division, holds a 20 percent stake in the ASX-listed company.

- Dan Gaffney

Ownership, control and use

As water has become increasingly scarce and an issue of interest to the public, the policy and law makers have stepped up to protect it.

Nursing an ailing water system

Dr Keiko Hirota from the Centre for Health Assets Australasia (CHAA) in the Faculty of the Built Environment is looking at how a hospital's facility management strategies can impact on water use issues.

"It is important to understand how hospitals deal with water management within their facility, and as such this is one of the key research interests of CHAA and our key funder - the Health Capital and Asset Managers' Consortium of Australia and New Zealand," Keiko says.

Keiko sees this as a financial management issue for hospitals, as well as an opportunity to demonstrate responsibility in the area of managing resource utilisation and achieving efficiencies from being more environmentally aware.

"Many hospitals have funding issues and they can't recycle much of their water because of the nature of the facility," she says. "They feel that water harvesting is the way forward but this requires investment in technology to test its ongoing viability."

A hospital that Keiko has worked closely with has applied for a grant that would allow them to put in water harvesting infrastructure. If they are successful CHAA would be able to evaluate the implementation of this infrastructure and use this to build a systematic model for other hospitals.

- Victoria Brown

Effluent could mean affluence

Few people stop to ponder the question of who might "own" our sewage. We're perfectly happy to keep flushing it away.

But, there's a new group of entrepreneurs who want our effluent. "Sewer miners" want access to contaminated water to recycle it into a saleable commodity for irrigation and maybe even household use.

Senior Lecturer in the School of Law, Janice Gray, believes that legal frameworks can, and have in part, already been designed to deal with the challenges of a "third party" accessing public sewerage infrastructure. She also believes that the legal question of ownership of the raw resource can be resolved. Ms Gray has done extensive research, with Alex Gardner from the University of Western Australia, on Australia's current institutional framework for water and wastewater management.

However, Ms Gray argues that legal clarity may not be enough to open access smoothly to this potentially valuable new resource.

If sewage does appreciate in value, Ms Gray envisages problems ahead over access pricing as well as potential commercial conflicts between competitors who seek to harness the resource.

"Will governments and parliaments be forced, at some stage in the future, to legislate for a resource regulation regime based on public ownership of sewage and governmental allocation of this fantastic new resource?" Ms Gray asks. And, that could mean the answer lies in the political arena, not the courts.

- Louise Williams

Economics of salinity



Farmland irrigation has economic consequences.

Water is undervalued and misused, according to researchers analysing the environmental economics of water conservation.

"Salinity is uncertain, relying on many factors which are quite localised," explains Professor Kevin Fox, Director of the Centre for Applied Economic Research (CAER) at the Australian School of Business.

Professor Fox says a priority for CAER research is developing instruments and economic models that take the uncertainty of salinity into account.

Economics PhD student Amy Cheung is researching ways to find the lowest cost and highest efficiency value to salinity mitigation. Her preliminary findings indicate that this lies in tradeable permits, where companies monitor their own water use and pollution, are informed about consequences of overuse, and can sell leftover permits for cash.

However, balancing the needs of the environment with the bottom-line requirements of farmers is a delicate exercise.

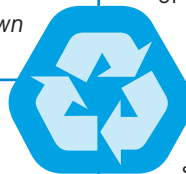
Dr Lisa Lee, a CAER post-doctorate fellow, uses Geographical Information Systems (GIS) to develop models in which regulators can meet better environmental targets at the least cost to producers and irrigators.

"Using GIS provides realistic data for economic management of natural resources, and enables us to use water in more environmentally, economically and socially sustainable ways," says Lisa.

Thomas Longden, PhD student in Environmental Economics, says that phasing out inefficient farming practices will also help increase water availability and quality.

Thomas argues that non-point sources, such as agricultural run-off, create problems for tradeable permit schemes. What one farmer does upstream may affect another downstream. He suggests that a scheme where monitoring of water trading occurs at the level where pollutants are measurable could provide a solution.

- Jared Reed



In the drink

If you believe bottled water is always the safer and healthier option, think again. By **Chris Sheedy**.

Whilst it seems an obvious conclusion to draw that bottled water should always win out when measured against tap water for its purity, Dr David Roser, from the Centre for Water and Waste Technology, School of Civil and Environmental Engineering, says the truth is not so clear-cut.

"With both tap and bottled water the quality depends on the water source that it's coming from, how well this source water has been treated, how it is transported to the consumer and how well the treatment and transport are managed and the sources protected," Dr Roser says. "In a wealthy country like Australia both water types should ideally be of a sufficiently high quality and the water quality and supply system should both satisfy health authorities in line with guidelines."

In regard to these factors different brands of bottled water vary just as much as tap water from different cities, Dr Roser explains. Melbourne's supply comes from the Upper Yarra Range Forests, for instance. Adelaide's water comes from the Murray River, and Perth's from the rainfall infiltrating the sand dunes of the WA coastal strip. Bottled water also comes from various sources.

Sometimes when bottled water comes from aquifers its proponents imply that it is somehow free of contaminants, but while sand aquifers are very good filters of micro-organisms groundwaters can still be contaminated. Indeed things can go wrong with any surface water or groundwater source, Dr Roser says, so it all can need testing and treating at times.

"The treatment processes also vary," he says. "Some tap water only gets a low dose of chlorine, other reticulated supplies are extensively filtered to control contaminants. Some bottled water is put straight in the bottle without any treatment, others are ozonated and tested and treated virtually like tap water, except they're delivered in small plastic bottles instead of via a pipe. Groundwater in Moree, I believe, supplies the local taps and is also bottled and shipped to Sydney."

In recent years there has been concern that treatment of tap or bottled water, especially disinfection using chlorine or ozone, can itself create by-products such as halomethanes and bromate. This is because at high concentrations these can be toxic or cause cancer.

At the very low concentrations which might be encountered in drinking, however, their effects are less clear and are currently being studied. Further these must be weighed up against the value of disinfectants which have negated many health threats posed by pathogens. Disinfectants, along with filtration and catchment protection, have meant food- and water-borne diseases such as typhoid and cholera are unheard of in Australia.

"Historically the experience of the introduction of chlorine and other water treatment processes and public health initiatives is that



Susan Trent, Gasbag Studios

“In a wealthy country like Australia both water types should ideally be of a high quality.”

they have led to an enormous increase in life expectancy. In the US between 1900 and 1999 there was a 30-year increase in life expectancy due to the control of infectious diseases, with sanitation and hygiene measures figuring as the most important factor," Dr Roser says.

"But this is no reason for complacency. For 10 years now health, food (bottled water is managed as a food) and water authorities, and supply companies have recognised that no water or food is absolutely lacking in contaminants. As a result they have developed systematically and continually undertake what is known as 'Risk Assessment and Management'. These days 'safe' means the achievement of a sufficiently good quality water that the remaining risks are very small at most and are as a result considered 'tolerable'."

"This leads to a public message that can be slightly confusing. On one hand whether you drink from the tap or regularly splurge on expensive bottled water, the quality is excellent and continually improving. But having a greater insight into risks from water and publicising this as happens these days can scare people who, for various reasons, understood that safe meant absolutely no contamination."

"I know I sound like the man from the ministry, but really they [water authorities] do a great job which is poorly recognised outside of the scientific and medical literature. Their near invisibility is a testament to their success. Sadly it means they are also a victim of this success, as are so many others. Like garbage men you only notice them when they're not around, unless they're noisy like ours!" ■

All in our mind?

Why do we buy bottled water when tap water is so readily available? By **Susi Hamilton**.

There might be one in your bag, on your colleague's desk, in your friend's car. Those clear plastic bottles filled with water are ubiquitous.

Bottled water sales have grown up to 500 percent* in Australia and Asia in recent years. While environmentalists have been critical of the environmental consequences of the production, transportation and disposal of the bottles, until now there has been no academic assessment of the phenomenon.

"Many people think it is just beverage companies selling snake oil, but I think it is more complicated than that," says Professor Gay Hawkins, the chief investigator on the world's first comparative study of bottled water marketing, consumption and disposal.

"You can't sell water to people unless they want it. There is a complex range of reasons why people might be buying it in Australia, when it's available very cheaply from taps," says Professor Hawkins from the School of English, Media and Performing Arts.

“You can't sell water to people unless they want it.”

"For a start, there have been scares around tap water, but that is only part of the story," she says. "A lot of companies market bottled water as a health-giving product essential to maintaining proper levels of hydration. However, a lot of the research which shows that we are supposedly dehydrated is funded by beverage companies."

The research, which will be carried out in Australia, the UK and Vietnam, will also look at the industry's claims to purity and portability, and what that means for tap water and the environment.

"It's partly a status thing amongst consumers, but it's also very deliberate positioning by the beverage companies. The bottles have pictures which evoke purity - a spring, or mountain - even though much of the water is just filtered tap water. This fetishisation implicitly devalues tap water, rendering it both ordinary and suspect," she says.

Professor Hawkins is currently in Vietnam, looking at the rapid growth of bottled water over the last four years. This growth is partly connected to the expansion of tourism but also to the growth in domestic incomes and householders, desire to purchase safe drinking water.

The business story in this research is not simply the profits being reaped by the big beverage companies. It extends to the price we are prepared to pay for our water bills too.

"Food and water are central to the security of populations," says Professor Hawkins. "Now water is entering the corporate realm. This will have serious implications for tap water, how much we are prepared to pay for it and the way it is delivered."

Dr Kane Race from the University of Sydney and Dr Emily Potter from the University of Melbourne are also involved in the three-year Australian Research Council funded project. ■

* Sustain - the alliance for better food and farming in the UK.



Bottled water is seen as a "health-giving product".

Handbook help reaps rewards

Dr Stuart Khan, a Research Fellow in the Centre for Water and Waste Technology, has been awarded a National Water Commission Fellowship to assist in his practical contribution to the knowledge of and capacity to support improvements in Australia's water management and use.

Dr Khan received \$136,000 to produce a handbook setting out practical methods for the quantitative assessment of exposure to chemical and microbial contaminants from recycled water systems.

The project will improve capacity for comprehensive risk assessment of proposed and existing recycled water schemes, as well as play a significant role in protecting public health and the environment from the risks associated with hazardous agents in recycled water.

How should we then live?

UNSW is walking the water savings talk and major changes have been made across campus to restrict our usage. By **Victoria Brown**.

Not only are UNSW's academics leading the world in water research, our Facilities Management team are making sure that our campuses are as water efficient as possible. The changes to water usage and conservation on the Kensington campus over the past seven years have seen a 30 percent drop in consumption of potable water (supplied by Sydney Water), despite a 25 percent building growth on the site. Last year UNSW used just over 240 megalitres (ML) of potable water.

As well as an active maintenance program of early detection and repair of faulty fixtures, the change reflects two major initiatives across the campus.

Bore water substitution

About 35 percent of the University's total water demand is currently met with bore water from the Botany Sands aquifer. The water is delivered into a campus-wide pipe network capable of delivering just over 1 ML/day.

UNSW has constructed a percolation pit just inside the perimeter of the Village Green which allows our storm water run-off to be fed back into the aquifer. This is a more effective alternative to constructing rainwater tanks and meets Randwick City Council and State requirements for new construction, particularly the North Mall development.

The pit, which is Sydney's largest, receives stormwater from 70 percent of the campus. The pit's chamber is 1.6 metres deep and half the oval's circumference. A milk-crate-like structure has been used to create an empty space where rainwater is collected. The water is then allowed to percolate slowly through the sandy soil and into the aquifer.

The University extracted just over 130 ML of water from the aquifer last year but using our percolation pit we are able to put 160 ML back in each year. This, in addition to the natural infiltration that takes place through the grassed and garden areas on campus, means that we are replenishing the aquifer at an equal or greater rate than we are using its water.

According to UNSW's Energy Manager, Chris Collins the high rate of water return to the aquifer means that "we essentially use the aquifer as a giant rainwater tank".

The aquifer's water is put to good use around campus.

"It's ridiculous that we use drinking water to flush our toilets," says UNSW Environment Unit Manager Paul Osmond. "We have made moves to substitute bore water in as many contexts as possible, including the University pool which is 100 percent bore water, toilets and all irrigation."

The use of bore water will be further extended with the opening of the lower campus bore water treatment plant later this month. This development will allow bore water to be used in airconditioning cooling towers and in laboratories.

"The treatment will allow us to increase the PH of the water," Paul explains. "Bore water is slightly more acidic than tap water, which makes it inappropriate for some uses. The plant is a significant development because our cooling towers use a lot of water."

Chris agrees. "This will save us money, but it will also mean more potable water is freed up for other uses."

Chris agrees. "This will save us money, but it will also mean more potable water is freed up for other uses."

Installation of water-saving devices

Across the campus water-saving devices have been installed to reduce our water consumption. These include waterless urinals and dual flush cisterns, as well as numerous changes to our taps.

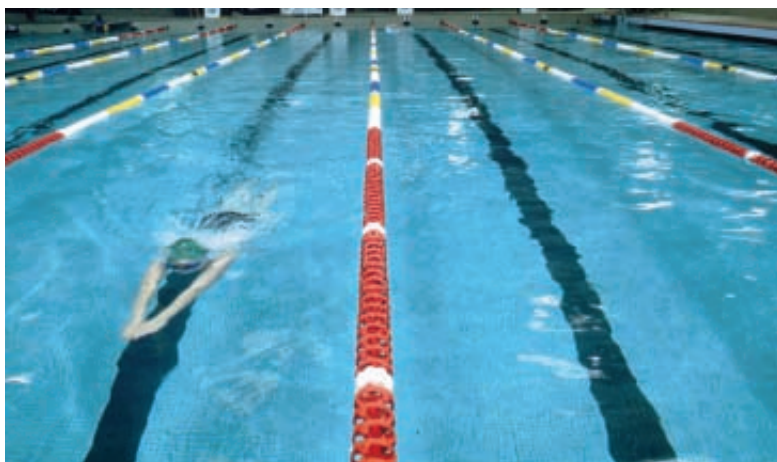
"We have removed hot water taps in a number of locations to save both water and energy," Chris explains.

Facilities Management also employed a group of students to do an audit of the flow of water



Water flooding the Village Green drains down through the percolation pit to replenish the Botany Sands aquifer.

It's ridiculous that we use drinking water to flush our toilets.



The UniGym pool: 100 percent bore water

coming out of the taps around campus. This was then used to prioritise places to put flow restrictors into the plumbing below the tap to decrease the pressure.

"Most taps give you much more water than you need. Changing taps to restrict flow is very expensive but putting flow restrictors into the pipes is much cheaper and has made a big difference to our water usage," Chris says.

In high traffic areas timed taps which turn off automatically have been installed and more are planned.

Chris says: "Although the more expensive option, this is particularly effective in places like the UniGym where there are a large number of different people using the facilities, including children."

The University aims to have a five-star green rating on each of our new buildings and refurbishments. The assessment process is a rigorous one and part of it involves our water conservation, so continued efforts are required to ensure our water usage is minimised.

Future projects that Facilities Management are investigating include a cover for the UniGym pool to stop evaporation.

"The pool is already filled with bore water but we don't want to waste that resource either," Chris says. ■



Constructing the University's percolation pit.

Courtesy of Facilities Management

The new Environment@UNSW website was launched at the Vice-Chancellor's Forum on Climate Change in April. To learn more about UNSW's water initiatives or to make a comment go to www.environment.unsw.edu.au

Botany Bay bound by toxins

Tucked away in part of Sydney's historic Botany Bay is a shed - the size of a football field - filled to the brim with barrels of toxic waste.

60,000 barrels of hexochlorobenzene (HCB) - the largest stockpile of its kind in the world - are stored at the bay. The chemical, which was derived from the manufacture of solvents and other chlorinated compounds from the 1940s, has been linked to cancer.

The shed is just 700 metres from residents, and additional barrels are kept in an underground car park by the Eastlakes Shopping Centre. There are fears this is leaching into the groundwater.

Both sites are at risk of a terrorist attack. If that occurred, the air and waterways would both be affected.

This is the subject of a documentary film, *60,000 Barrels*, which was aired on SBS Television in 2003 and produced by the head of the School of History of Philosophy, Dr Paul Brown, with community members.

This is just one of the ways that UNSW is studying the bay's multitude of environmental problems - including a plume of water with chemical concentrations substantially higher than safe drinking levels, and erosion due to the container terminal expansion.

"What we have been doing across the years with Botany Bay is one of the best examples of engagement with community, industry and academics," says Dr Brown, whose area of research focuses on toxic waste, and who is one of a number of academics who have served as Chairs on community committees.

Botany Bay is the focus of research for students enrolled in the Environmental Studies Major in the Faculty of Arts and Social Sciences.

"Our students look at the political, social and environmental aspects of what is happening at the bay," said Dr Stephen Healy, who runs the program with Dr Brown. "They look at the roles of the media, advocacy groups and the process of public participation more broadly."

While working with the community is key, the research is scholarly in nature. This year, academics and residents will contribute papers to a special issue of the *Journal of Environmental Management*.

And there has been some progress on the ground as a result of the work the University has been involved with for over a decade.

"I would say that the University's community engagement fed into dramatic changes in the way the company responsible for cleaning up the pollution, Orica, relates to the community," said Dr Brown. "In the late 1980s the relationship was inherently adversarial. While they are still fighting down there, the processes are much more sophisticated. We can't say we've saved the bay, but we have helped build up more trust. I'm optimistic about an era of even greater co-operation."

- Susi Hamilton

Sinking cities

Our use of groundwater as a substitute for rainwater may be causing our towns to subside into the ground. By **Peter Trute**.

Large-scale groundwater extraction may have caused parts of the city of Perth to sink at an average rate of more than two centimetres a year, while parts of Sydney where groundwater is being used have also suffered subsidence, UNSW research has found.

Highly accurate new satellite-based radar surveying technology has identified much greater subsidence in the Western Australian capital than has been found with previous land-based methods, with the research, funded by the Cooperative Research Centre for Spatial Information (CRCSI) indicating average ground deformation of 24 mm per year, reaching up to 50 mm a year in the worst-affected areas.

Associate Professor Linlin Ge, from the School of Surveying and Spatial Information Systems and CRCSI Project Leader, and PhD student Alex Ng used a satellite-based radar remote-sensing technique called Persistent Scatterer InSAR (Synthetic Aperture Radar Interferometry) to identify previously undetected subsidence in Perth.

The research has also revealed that parts of Sydney, where much less groundwater extraction takes place, have subsided at an average rate of 5mm a year - with the key sinking points concentrated around bore water use areas in the city's south-east.

Satellite images of Sydney, Canberra and Newcastle - cities where groundwater is not over-extracted - were compared with images from

“... large and uneven areas of subsidence can lead to cracking of masonry in buildings ...”

the same period of time in Perth and a city in China where groundwater extraction was considered in excess of sustainable yields.

The surveying method showed that parts of Perth sank up to 50 mm between 1992 and 1996. The subsidence corresponded to areas where the groundwater level has fallen due to extraction from the underground aquifer which supplies much of Perth's water.

The largest subsidence was in the suburbs of Balga, Nollamara, Stirling and Balcatta.

Results for Sydney showed subsidence in areas south-east of the city, where water is drawn from the Botany Aquifer, although in much smaller volumes than in Perth.

The largest subsidence was in the suburbs of Kingsford, Kensington, Clovelly and South Coogee.

Professor Ge said the research used images taken between 1992 and 1996 because records from this period had the type of tandem images, taken by twin European Space Agency satellites, needed to use the PSInSAR technique. He said it was hard to say what has happened since 1996 but drought may have worsened the subsidence. He is now gathering current data on Sydney to compare with the earlier results.

Professor Mark Bradford, Director of the Centre for Infrastructure Engineering and Safety in the School of Civil and Environmental



Cracks in walls are a visible side effect of subsidence.

Susan Trent, Gasbag Studios

Engineering, said subsidence was a known cause of problems for infrastructure such as excessive deformation of pavements, railway grades and bridges caused by underground coalmining.

“Under certain foundation conditions in urban areas, large and uneven levels of subsidence can lead to cracking of masonry in buildings and potential problems with old and brittle pipelines and concrete bridges and roadways,” Professor Bradford said.

By using radar measurements from a number of fixed points or “scatterers”, such as buildings, over a widespread area, engineers can use satellite data to form a much more complete picture of ground deformation over large areas.

The CRCSI is a joint venture of 70 Australian organisations. ■

Connected Waters

The UNSW Connected Waters Initiative investigates sustainable groundwater use under the directorship of the Gary Johnson Professor of Water Management, Professor Ian Acworth.

www.connectedwaters.unsw.edu.au provides a lively forum for ideas, information, articles, news and research about connected waters to promote better understanding of this vital issue for students, members of the public, researchers and water managers.

Sponsored by Jaycar Electronics, the site profiles UNSW's research into water issues, and has contacts and links to a wide range of water researchers and organisations.

Drugs in our drink

Unmonitored levels of pharmaceuticals in our water pose real health risks, according to Dr Francesco Pomati.

When we take prescription drugs or other pharmaceuticals we excrete over 80 percent of the dose in an unaltered chemical state. According to Dr Francesco Pomati from the Faculty of Science, this has introduced a new threat to Australian water management.

The ongoing water crisis across Australia has prompted authorities to look at alternative water management options such as recycling. However, if the proper checks are not put in place this could enhance the dangers posed by the problem of pharmaceuticals in our water.

"Thank God in Australia the problem isn't at the same level as it is in Europe or America," Dr Pomati says. "There are a few places trying to recycle or re-use wastewater, so there are just a few local concerns."

“Thank God in Australia the problem isn't at the same level as it is in Europe or America.”

"We naturally don't want to recycle water from industrial areas so we recycle water from cleaner areas where it has been used for human consumption. The belief is that the organic compounds will break down easily, but we haven't taken into account the fact that pharmaceuticals are very stable and could be recycled into the system."

Dr Pomati believes prolonged exposure to certain combinations of drugs in water could possibly induce diabetes or have other harmful side effects.

"Even if pharmaceuticals are present at low concentrations, if you mix them you'll get various biological effects," Dr Pomati explains. "If you digest them one by one they may not have any effect, but if you mix them up then you're challenging your body's cells from a lot of different angles at once."

The good news for Australians, Dr Pomati says, is that we're at the forefront of water management research and excellent work is being done in water assessment and management.

- Chris Sheedy

What's your poison?

Each day up to 70 million people in Bangladesh risk drinking water contaminated by arsenic.

As if devastating floods and grinding poverty are not bad enough, Bangladesh is struggling with an arsenic-contaminated water supply. Up to 70 million people are potentially drinking water contaminated by arsenic which occurs naturally in the regions underground water, according to Dr John Merson, Director of the Institute of Environmental Studies. While some of the shallow tube wells are marked with a red ribbon, signifying contaminated water, even wells which have previously been designated as "safe" can become contaminated.

"It's a slow poisoning," observes Dr Merson. "You can't taste it and you can't see it. As many as one in three shallow tube wells in rural areas could be contaminated, but it's hard to say for sure."



Photo courtesy of Crelis Rammelt

Villagers in Bangladesh are learning about the dangers of their water supply.

While there are no adequate health statistics on how this is affecting the population as a whole, there are many reported cases of people dying as a result of arsenic poisoning.

"What we do know is that it impacts heavily on the poor," says Crelis Rammelt, a Dutch PhD student at UNSW who is jointly supervised by Dr Merson and Dr Phillip Crisp from the School of Chemical Sciences and Engineering.

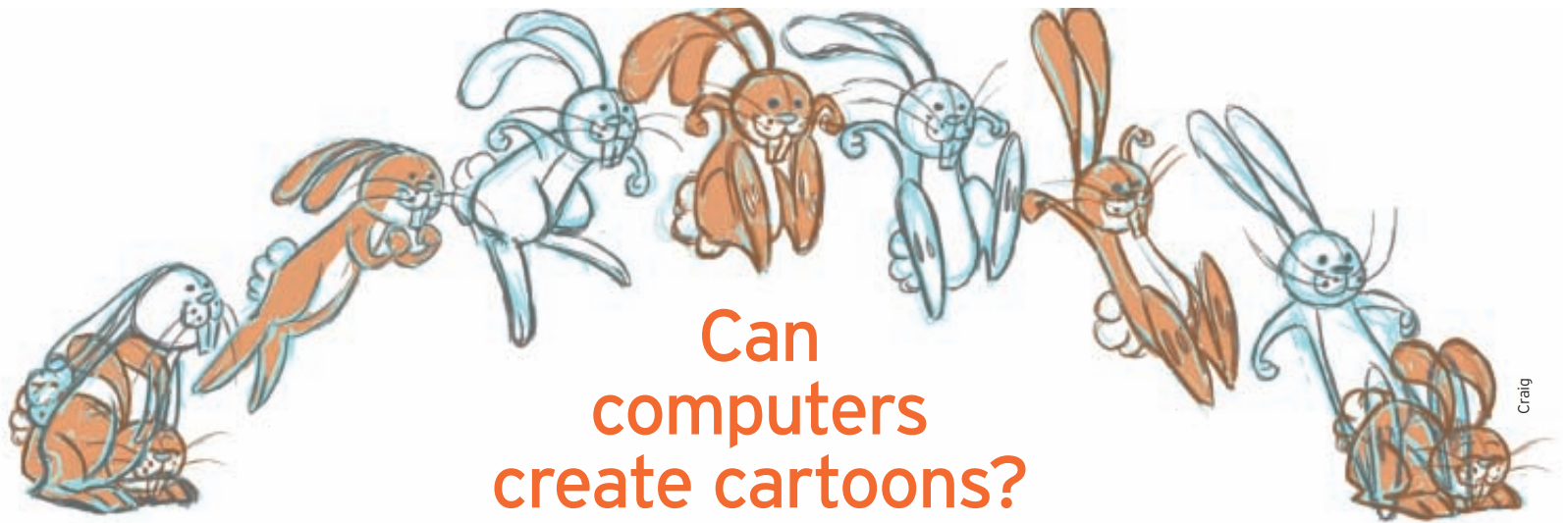
"One of the first visible symptoms are lesions on the skin, but by then there is often little doctors can do. The arsenic affects their liver and that makes the body more prone to other diseases."

As an engineer, Crelis started out looking at trying to supply clean water from a purely technical perspective, but quickly realised he needed to look at social, economic and environmental aspects of the problem.

"What is different about this project is that it is village-based," says Crelis. "Yes, we want to secure safe drinking water, but the community needs to be driving the change."

"In some villages, it is taking off fantastically. The local committees are functioning, they are maintaining the deep tube wells, which are free from arsenic. But in other villages it is not working so well. We need to take a long-term view."

- Susi Hamilton



Can computers create cartoons?

A program that can create animation offers a glimpse of the future of drawing. By **Louise Williams.**

Remember flip books and just how many individual drawings it took to make a stick figure move? To create animated cartoons, armies of artists painstakingly draw every single frame. For a 2D TV cartoon, like *The Simpsons*, a highly skilled commercial artist might be able to do 40 or 50 separate drawings a day. But, that's still less than two seconds of animation, and that's before the colouring is done.

A new computer program is promising to take the hard labour out of the art of animation. The program has succeeded in drawing the so-called "in between" frames, the millions of drawings which smooth out the gaps between the movements, to a professional standard. With colouring also automatic, the potential for the global animation industry is a 40 percent cut in production times, and commensurate cuts in budgets.

For consumers, there's the future possibility of home animation. Inventor Professor Seah Hock Soon believes anyone with a computer and the software will be able to create animation.

"The cost of computers has come down so much that an ordinary PC can now create animation. We are seeing more and more consumer-produced animation. Consumers will no longer be a passive audience, they will want to participate," he says.

Professor Seah Hock - Dean of the School of Computer Engineering at Singapore's Nanyang Technological University (NTU) - has recently been appointed as a Visiting International Research Fellow to UNSW.

His "cacani" animation software is undergoing testing in commercial studio conditions in Tokyo with Anime International.

Professor Seah Hock says computers can't replace artists, and that his team had to consider the reality that art and computer engineering isn't always an easy fit.

"When artists first saw our system they were quite concerned that machines would replace them. But, this is a tool to be used by artists to enhance their work. The artist

This is a tool to be used by artists to enhance their work.

will still do the key drawings but the tedious ones in between will be done by computers."

Sydney-based animation production consultant, Michael O'Brien, says: "It will allow productions to be done more quickly and will bring costs down to a more affordable level.

"Artists aren't naturally technology resistant, they just have to get a chance to use the technology and realise the benefits of it."

Professor Seah Hock says his team is also working on digital models for art styles which are difficult to keep consistent by hand, such as Chinese brush strokes.

Globally, he says, the animation industry

is expected to continue to boom. In the past animation was largely considered the stuff of Disney movies and Japanese TV cartoons. Nowadays there's a vast global games industry, billions of animated websites and animated digital education tools, as well as professional applications like medical, scientific, engineering and industrial visualisation.

Professor Seah Hock's NTU team is already collaborating with UNSW's iCinema project; the world's first 360 degree stereoscopic cinema which allows viewers' to create their own 3D cinematic experiences.

The iCinema Centre's executive director, Professor Jeffrey Shaw, says NTU's animation expertise would help in creating characters within the interactive 360 degree cinema experience. The iCinema's digital re-creation of the Indian temple heritage site at Hampi, for example, could be greatly enhanced with the addition of animated people and monkeys programmed to respond to the viewers gaze and movement.

Professor Shaw said the new Fellowship link to NTU was particularly important for UNSW, given the Singaporean government's recent decision to put substantial investment into the digital creative arts. Professor Shaw spoke at NTU in late April at a major conference on the convergence of art and technology.

Of the new computer animation software, he said: "In the world of new media all these different resources get mixed together and the range of applications is enormous from films and games to industry and science." ■

Good sax?

Professional saxophonists use their vocal tract to increase the range of their instrument, new research has found.
By **Dan Gaffney**.



Unlike amateurs, professional saxophone players can play notes in the very high *altissimo* sound register by tuning their vocal tract to assist the instrument, according to new UNSW research.

The finding, which has been published in the journal *Science*, resolves a 25-year-old debate among scientists and players of reed instruments, such as the saxophone and clarinet.

It means that a player's vocal tract is sometimes more important than the instrument itself.

The longevity of the debate is due to the technical difficulty of making non-perturbing, precise, acoustical measurements inside the mouth during playing - that is, in a variable, humid environment with very high sound levels.

Physicist Chen Jer-Ming solved the mystery by building a device that fits within the mouthpiece of the saxophone and detects the resonances of the musician's vocal tract. He and his colleagues compared the results of three amateur players and five professional jazz and classical saxophonists.

The research demonstrated that professional players achieve this effect by systematically tuning their vocal tracts to resonate at a frequency close to that of the desired note. This tuning adds the tract's resonance to that of the saxophone, which allows the instrument to play above its normal range.

The research reveals that amateur players, who were unable to play notes in the *altissimo* range, did not tune a strong vocal tract resonance.

The standard range of the saxophone that is taught in elementary and intermediate stages of learning is a little over two and a half octaves. The *altissimo* range, used by experienced players, extends another octave or two above this.

"Acousticians have long debated whether and how the resonances of the vocal tract are involved in the playing of clarinet and saxophone," says Chen.

"We measured the resonances of saxophonists' vocal tracts directly, while they played. Over the standard range of roughly two and a half octaves, there is no particular relationship between the vocal tract resonances and notes played.

"However, in the *altissimo* range, the second resonance of the tracts of professional saxophonists was systematically tuned slightly above the desired note. The players who couldn't achieve this effect were also those who couldn't play in the high range.

"Over the standard range, a resonance of the air within the saxophone determines the note played: you press the right keys and the right note (usually) comes out. But for the *altissimo* range, the sax's own resonances are weak, and to play up there you need to make the resonances of your own vocal tract stronger so they can assist those of the instrument to produce the desired note."

Although the effect was shown in the saxophone, similar effects are likely to be important in other single and double reed instruments, whose players also report the importance of the tract for special effects, including high register playing.

The professional musicians Chen tested all said that they had stumbled upon the technique by accident and kept practising.

"Once they learned how to do it, they had to hear the note in their head first, then the note will just naturally follow. I think it's a kind of muscle memory at work. Their throat just moves in the right places at the right time," he says.

"I believe it's something most people could learn if they were conscious of it and practise hard. It won't happen overnight." ■



To see more on this story go to UNSW TV - <http://www.youtube.com/watch?v=DaYMSAzfz5E>



Indigenous Australians' resilience to climate change

From the stone country of the Kimberley, to the sandstone escarpments of Arnhem Land, the rainforests of the Daintree and the sandy palm-fringed islands of the Torres Strait, archaeological records show Aborigines and Islanders have effectively adapted to environmental change for thousands of years. Given Indigenous Australians' past ability to respond to environmental change, it is reasonable to assume that they would be among the best-placed Australians to cope with environmental impacts caused by anthropogenic climate change. In fact the opposite is true, for two key reasons.

The first reason relates to the rate of environmental change. Projections of anthropogenic climate change indicate appreciable direct biophysical impacts occurring over decades. In contrast, prior environmental change occurred over millennia. The second factor relates to social and cultural resilience. Many of these communities are fighting a number of devastating social problems, the result of decades of profound government mismanagement and neglect.

In mid-2006, newspapers began to report on the plight of several low-lying Torres Strait Islands. Shortly after, the threat was officially acknowledged by the Australian government, which signed off on the Intergovernmental Panel on Climate Change's Fourth Assessment Report. For the first time, this report acknowledged the likelihood that around half of the 4,000 people living on the islands would have to relocate in the long term. Understandably, the Islanders see relocation as a last resort, and are already working on adaptation strategies to delay, and ideally avoid, having to leave their ancestral homelands.

How could action be taken to reduce this threat and promote resilience to climate impacts in these communities? I decided to see whether the traditional environmental knowledge passed down through oral history could guide region-specific and culturally appropriate climate adaptation strategies. After organising meetings with Traditional Owners from across northern Australia, a collective decision was made to begin this work in the Torres Strait.

Torres Strait Islanders are a traditional seafaring people, who pride themselves on their intimate understanding of the seasonal shifts in the ocean and weather. Islanders had noticed that in recent years the waves occurring in king tides seemed higher and more powerful. Consequently, on several of the islands, coastal tracks were being washed away



“Indigenous people have responded strongly and are keen to act.”

and long-established graveyards and houses inundated. In addition to the psychological distress caused by the flooding, their remoteness makes repairing this damage extremely expensive.

The Islanders understand that the problem extends further than the initial flooding. They are concerned about indirect impacts of climate change, seeing how, for example, inundations could jeopardise public health caused by contamination of freshwater supplies or from the flooding of their landfill rubbish tips. While a full suite of indirect impacts are harder to assess and quantify, they are crucial to consider in designing comprehensive adaptation strategies.

Many of these local adaptation strategies are being detailed on the new *Sharing Knowledge* website. The *Sharing Knowledge* project breaks new ground in Australia by being a source of both regional climate projections for northern Australia and local Indigenous observations of environment changes. Combining traditional knowledge with Western science will assist in the creation of strategies for adapting to climate change that are culturally and geographically relevant, and therefore far more

likely to be of practical use to the communities of northern Australia. As well as providing that information online, the project also strives to communicate locally relevant climate impact assessments to people who otherwise have limited access to accurate information through community outreach work.

Recent examples of this outreach work include talks with elders in the Torres Strait and workshops for schoolchildren in the Kimberley on the latest science on climate impacts for their regions, and how traditional knowledge could help in responding to those risks. Further workshops are planned across northern Australia. However, the remote locations of these communities and limited funding means that this crucial work of working directly with communities remains highly constrained.

My experience in working with Indigenous communities across northern Australia has demonstrated the importance of giving people reliable information on climate change, as well as paying them the respect of asking their views on how best to adapt to those likely changes. Once empowered with that information, Indigenous people have responded strongly and are keen to act. But the lack of government and private funding to assist them in doing so remains a major obstacle. ■

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