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Contents

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Thinking strategically about science

The level of collaboration between industry and academia in Australia has picked up a little. According to Chief Scientist Professor Ian Chubb, who took part in a science panel on the ABC's *Q&A* in mid-September, it sits at about 8% - about 4% of our large research-active businesses, and 4% of our small to mediums, collaborate with universities.

That's just behind Mexico, where cooperation between universities and businesses is about 10%. In the UK, it's about 40%.

The Chief Scientist has been in the media quite a bit lately. And it's not by accident. Chubb has made it his mission in the aftermath of the federal Budget to put science on the agenda.

One goal he has is to gather evidence to give to Industry Minister Ian Macfarlane to take to cabinet and impress upon the government the importance of supporting science and building capacity and capability for the future of the country.

The fact that Australia has a similar profile of researchers to Britain - about 60% of our researchers work in universities, about 10% work in publicly funded research agencies and the remainder are based in business - yet there is a much lower level of cooperation between universities and industry, is one piece of evidence Chubb is using to push for a national science strategy.

Britain has had a national strategy in place to encourage collaboration in research. They've put incentives in place and have taken a long-term view with funding.

The national science strategy Chubb has put to the government outlines recommendations for developing a coordinated long-term plan to match what higher education delivers with what industry demands.

Participation in science and mathematics, particularly at senior levels, has fallen. It should be heading the other way.

Chubb is calling for an increase in science, technology, engineering and maths skills at the education level to secure a research base so we have enough trained people coming through the pipeline to deliver on meeting needs - needs such as increased farming exports through trade agreements, healthcare demands and researchers to develop technology to boost yields and take new products to the global market.

Chubb has also called for the establishment of an Australian Innovation Board, based on a UK model, that would be run by industry collaborating with researchers and distributing finances.

Macfarlane and Chubb appear to be on the same page. The industry minister officially launched the Chief Scientist's strategy last month and agreed that science is essential to building the future of Australia. He also agreed that the level of collaboration between industry and academia in Australia is "atrocious".

It's true - we don't have a lot of cooperation between our researchers and our businesses. We need a paradigm shift to make this happen, which requires strategic investment supported by an attractive environment for doing research that has good planning and long-term commitment.

Susan Williamson

Janette Woodhouse

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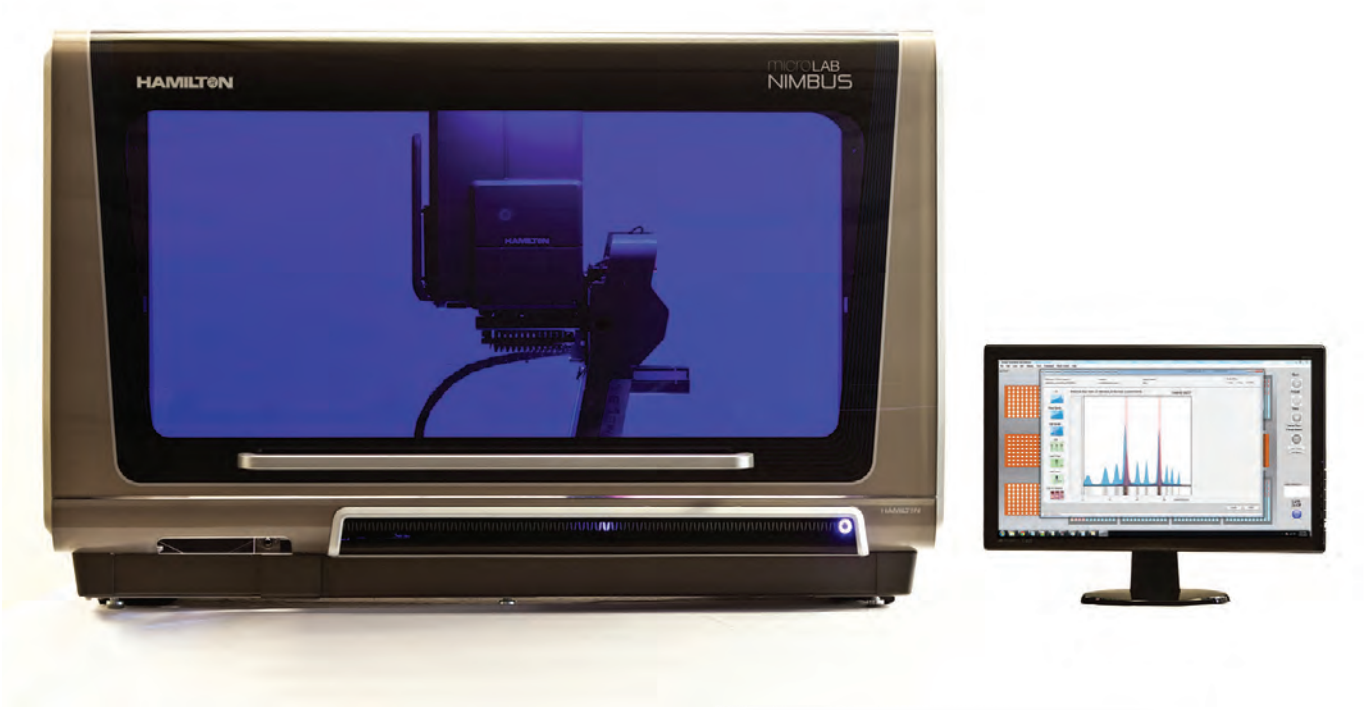

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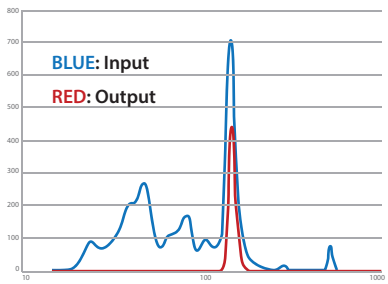

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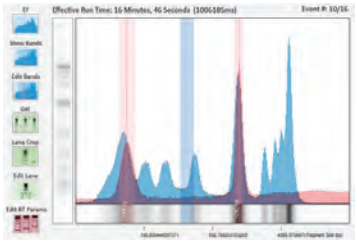

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Susan Williamson

The business of collaboration

Having developed an expertise in the social side of science, the CEO of the Cooperative Research Centre Association, Professor Tony Peacock, is putting his skills to the test in building collaborations between researchers, industry and the community.

Lab+Life Scientist: What led you to study agriculture?

Professor Tony Peacock: I grew up in Sydney and am the youngest of seven children. We owned a hobby farm of 250 acres in the Watagan Mountains north of Sydney and of the seven kids I was the only one who had an interest in agriculture so I spent a lot of time there.

The farm was quite well designed. My father was an engineer and was often trying to invent new ways to do things at the farm.

My mother was from the country and liked the idea of a few cows and a weekender, but my father didn't do anything by halves - what was meant to be a few cattle and horses became up to 80 cattle and 80 horses!

LLS: Can you explain how your PhD research led to changes in practice at piggeries?

TP: I was looking at what was called summer infertility in pigs for my PhD.

We expect pigs to reproduce year round, but in the wild pigs are a seasonal animal, their breeding is linked to day length. It's still a major problem for the industry.

My supervisors were Gareth Evans, at the vet school at Sydney University, and Bob Lovell. Bob and Gareth thought the pigs were responding to day length rather than the heat of the season. But when you've got fertility of about 85% dropping to about 75%, you can't do that sort of work on a 10-sow experimental piggery at a university - you've got to do it at the industry level.

We worked in a large commercial piggery of about 3000 sows at Menangle. Plus we had some controlled environment rooms at Camden.

We showed that pigs have a diurnal rhythm of melatonin, the same as other animals.

A series of PhDs were conducted after we established that pig infertility was largely because

> "The farmers generally respect the advice of the researchers and the researchers feel they are working to make money for the farmers."

of seasonal day length. We played around with melatonin implants and found there was an underlying likelihood that sows would become infertile during the early phase of the year but you could overcome it with nutrition, housing and good welfare at that time of the year.

That was the start of a type of movement that said you should have your sows 'fit but not fat'. The industry is now moving away from stalled housing, reportedly for welfare reasons. But the move to group housing of pigs traces back to research at Sydney University in the 1980s where we showed that farmers are probably better off to have their sows housed in groups.

Stalled housing has some advantages in that it stops animals fighting and you can feed them individually much more easily, but it has the disadvantage that consumers don't like to see dry sow stalls.

Group housing has basically become the norm. I think by about 2017 there'll be no dry sow stalls in the Australian industry.

LLS: And you continued working at a very pragmatic or applied level with the pig industry?

TP: Yes, I ended up with an industry-funded scholarship and worked for the pig industry for about 15 years. I just went to the launch of their strategic plan at Parliament House last month - I think I will always have an affiliation with them.

I came back from a research position at the University of Saskatchewan in Canada in 1993 and was research manager for the Pig R&D Corporation in Canberra.

In my first few years there we did a lot of work on welfare, stock handling and the industry standard, and supported a program called Prohand - the professional handling of pigs.

It came out of the Victorian Department of Agriculture and Melbourne University and really was ahead of its time. The Victorians showed that fear of humans can be measured in pig sheds and that professional handling of the pigs is really important.

For example, you might slap a pig on the bottom to move her along a laneway but she'll perceive that as aggression and develop a slightly higher level of stress.

I noticed this when I was working at the Pig R&D Corporation. In certain piggeries all the pigs would go to the back of the stall when I walked in, whereas in other piggeries they'd be snuggling up to you being really friendly. The attitude and culture of a place was important - it would only take one bad apple on the staff and the pigs would be scared of all humans.

We developed a multimedia program and showed people working in piggeries how to use a sow-moving board. Rather than hitting an animal you use a board and give her no alternative but the board and she will move forward. By using these tactics a shed's production will increase by about 7%. More importantly, it's safer and less stressful for the staff.

LLS: Can you explain how the R&D Corporation works?

TP: It's recognised around the world as one of the best ways of doing agricultural research.

Every time a pig was killed a levy went towards research. In those days it was 70 cents and the government matched that under the Rural R&D Corporation Levy. The legislation was brought in by John Kerin when he was Minister for Primary Industries.

It's a compulsory levy and makes it possible for relatively small groups of farmers to be involved in research. And because the farmers pay for it, they have a stake in it. Even though half of the money is from the government, the R&D Corporations really do work for the farmers.

The farmers generally respect the advice of the researchers and the researchers feel they are working to make money for the farmers.

Now the marketing and the R&D have largely joined up. It's basically still the same system. That's how we now have Australian Pork Ltd, which does the job the Pig R&D Corporation did and also represents the pig farmers.

They have to account to government for the levies they use on R&D and they also have a levy on marketing - the government collects that levy for them but doesn't match marketing money.

That's what pays for the pork advertising that you see. I think it's a good move - anything that

brings the research closer to the market and what consumers want.

LLS: What led you to work with the cooperative research centres?

TP: When I was leaving the pig industry, Bob Seamark, the head of the Pest Animal CRC, was retiring from the job as CEO - I knew Bob, he was a very good reproductive biologist.

The CRC was looking at changing the fertility of foxes, rabbits and mice, and because I'd done my PhD on fertility in pigs it was a natural fit and it was amazing science.

We were genetically engineering viruses to make the animals infertile. We could actually make 95% of mice infertile in a laboratory situation but we couldn't fulfil the requirement for spreading the virus outside of the laboratory. We were using a myxoma virus in rabbits but we were unable to identify a fox-specific virus.

We set up a series of milestones that dictated if we couldn't make it work over a couple of years we would need to look for other solutions.

In the meantime, two major events happened in the industry: zinc phosphate was registered for poisoning mice during mice plagues and rabbit haemorrhagic disease or calicivirus came along.

In addition, at the start of that CRC there was no Office of the Gene Technology Regulator overseeing genetic engineering. In the decade that the CRC was doing that work a set of rules for genetic engineering in Australia was developed.

The outcome of all that was that the work wasn't worth going on with.

LLS: Were you involved in the Gene Technology Regulator?

TP: Yes, I sat on the original interdepartmental committee - on behalf of the R&D corporations - that was involved in the development of the gene technology regulation legislation.

Back in the 1980s, the Pig R&D Corporation was slowly getting out of genetically engineering pigs when it had gone over to private industry.

There was the genetically engineered Australian super pig. That failed because to do the experiments at a big enough scale the companies had to start breeding hundreds of pigs, but the pigs weren't allowed into the food chain. The experiments were becoming unviable, plus there was a lack of regulation so the companies pulled out of that work.

It also came down to the time frame for doing those experiments and producing the pigs. The genetics of the pigs were improving by a percent or two a year anyway, so the genetics would eventually outstrip the work if there was 20 years of research to do.

The Governor General, Sir Peter Cosgrove, presenting Tony Peacock with his Churchill Fellowship earlier this year.

The committee developing the legislation for gene technology regulation was initially in the Department of Agriculture, but it got transferred to the Department of Health because of the perception that agriculture would push things through. And that is where the regulator continues to sit.

LLS: Do you think the super pig could have been accepted by the public?

TP: My predecessor at the CRC, Bob Seamark, actually started the work on the super pig at Adelaide University. It was curiosity-driven research. They thought it was a good idea and wanted to see whether the growth hormone gene could lead to pigs growing quicker.

Bob often said he wondered if they had picked another gene that gave better attributes to the meat or was green or clean technology then consumers may have been more accepting. But the Canadians did that 20 years later when they genetically engineered pigs to excrete less phosphorous and make more environmentally friendly pigs - they ran into the same problems that we did at the consumer end.

I think there's some real lessons there for scientists. Scientists used to go out and educate the public about what they were doing and then expect the public to agree with them.

Nowadays that's not the way you do research. Many people are offended by the idea of being educated - they want to be involved and talked to as equals. Scientists need to get out more and talk to people. They can't just assume they'll be given a social licence for their work.

That's one of the reasons I have such a strong philosophy that in applied research the end users, the people who use the end product and are most affected by it, have to be on board.

LLS: What are some of the highlights from your time at the CRC?

TP: Probably the biggest achievement was changing the Pest Animal Control CRC around from a single technology and seven partners to become the Invasive Animal CRC with 42 partners and a whole range of technologies.

That was a massive change of culture, although it's a hard thing to pinpoint. Changing from an elitist research group that might end up producing something of benefit to the industry to a much more people-focused, industry-based research group that was doing what the industry wanted.

It was really about trying to open the research up and get people more involved. There's some people around who are passionate about feral animals, and it's everyone's problem, but it's not the first problem for a lot of people.

LLS: Can you give an example of the CRC's feral animal work?

TP: The CRC pioneered what we call the nil tenure approach, which is managing things on a geographic scale for animals such as wild dogs. That's been a huge advance. It's not a silver bullet type of answer, but it involves the people in an area in the planning and execution of programs.

People used to laugh at us and say wild dogs were not a problem. But when you talk to people who are affected by wild dogs, it's like they are in a

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trauma situation. They are staying up at night, not sleeping; they feel like they are under attack and no-one is listening to them.

The dog control programs we developed bring all the people in an area together to look at what the dogs are doing in the whole area - whether it's a national park, a state forest, Aboriginal land, a family farm or a corporate farm.

If you've got wild dogs attacking your sheep, it's very likely they are coming from a neighbouring property or crossing four properties to get to your place. And they will be maintaining a pattern of activity that you can predict.

Trying to wipe out every dog is not a good strategy because they play a role - if they are in a national park they are top predator. If you shoot a few of the animals in an ad hoc fashion you might spark a lot of breeding and dispersement of the young animals. The best approach is to have area-wide management plans for controlling and managing the dogs.

A successful program will reduce sheep and goat losses to minimal amounts. But getting everyone to take responsibility is huge. It's completely different research, it's social science research.

LLS: Are you enjoying being chief executive of the CRC Association?

TP: It's very enjoyable. I never thought I'd be a lobbyist and I'm not officially a lobbyist, but I spend about half my time advocating for the CRCs. It's very easy to advocate for something you believe quite passionately in.

We're a tiny program - we make up about 1.5% of what the government spends on research - yet we tick so many boxes. The issue is always getting people to realise the CRCs exist - we're below the radar for a lot of people.

The CRCs bring together the elements. You can't steal the credit off the players who are actually doing the research, but the fact that they are doing it together means they are likely to produce an outcome. We fund the arrows between the boxes, if you like, in the research industry collaboration. People might think that would have happened anyway, but without the funding and the motivation to work together it never would have happened.

LLS: What do you think the future will bring from the federal government?

TP: I'm cautiously optimistic. We thought we'd done our heavy lifting, as the current Treasurer kept saying, before the Budget. We were already coming off the old Backing Australia's Ability Program that had boosted the CRCs for a number of years.

Throughout the entire Rudd-Gillard governments' terms we were coming down regarding the amount of money we got each year. And we were due to turn back up and start rising a bit but the current government found it necessary to make this $80 million cut.

> "We need to have an attractive total environment for doing research."

LLS: The CRC Association has a review coming up?

TP: Yes, it's about to start. We've just heard we will be reviewed by businessman David Miles, so any time now we will start the process.

The last review was done by NSW Chief Scientist Mary O'Kane in 2008. We've had a lot of reviews over the years and generally we do very well.

At the moment in Australia, I'd say people are more aware about the need for collaboration and more aware of the need for industry-research organisation interaction than ever before.

Industry Minister Ian MacFarlane keeps saying that collaboration is key - there's no doubt that he is really aware of it.

The Chief Scientist, Professor Ian Chubb, has released his plan for the future, which calls on greater collaboration and much greater industry involvement with public research.

We need a variety of collaboration mechanisms and the CRC is not for everyone. But the CRCs are regarded around the world as one of the really good mechanisms for doing that sort of research, so we hope to do quite well.

If we don't then hopefully they've found an even better way into it.

It depends whether the government wants to do a review of the whole innovation system or whether they just move to what Professor Chubb is recommending. I expect the government will do it in a staged approach by moving programs to be closer to addressing the issues Chubb is recommending.

LLS: What are your thoughts on Professor Chubb's statements like we "lack a science strategy" and we don't have a "national science policy"?

TP: I'm very supportive and think Chubb's absolutely right in saying we should have a more comprehensive strategy for science, and particularly in Australia where we have a federation. Some of the state governments have completely dropped the ball on research. Victoria is miles ahead on support of science at the moment than the other states in my view.

We should have a more coordinated plan in place but it's equally important to carry out that strategy and look at how you're going every now and then.

There's a Churchill quote on strategy: "However beautiful the strategy you should occasionally look at the results."

Australia is a federation, not just a single government, and yes, the national government is always going to be the biggest supplier of cash, but the states and business are vital as well. Business outspends government by 2 to 1 on research.

We need to have an attractive total environment for doing research. If we just yell at the federal government to put more money in that's not going to be enough.

LLS: Do you think the government is listening?

TP: I think Ian Macfarlane is listening.

If you look at this government they have made a big commitment to medical research with the MRFF - and that's become more complicated than it could have.

I expect that science, and particularly industrial-type science, will be one of the higher priorities if the government can get the Budget in order. They are very focused on that right now and Ian Chubb's been very careful not to go out calling for huge amounts of more money. When it's borrowed money people react to that.

The level of collaboration is picking up. It's gone up to about 10% of research-active businesses that are now collaborating with universities. That's really low - and Ian MacFarlane recently said it's atrocious - but it is improving.

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The first far ultraviolet spectra of a cometary surface

NASA's Alice ultraviolet (UV) spectrograph, located aboard the European Space Agency's Rosetta comet orbiter, has made the first far ultraviolet spectra of a cometary surface. The Rosetta is currently in orbit around comet 67P/Churyumov-Gerasimenko and is the first spacecraft to study a comet up close.

Developed by the Southwest Research Institute (SwRI), Alice has more than 1000 times the data-gathering capability of instruments flown a generation ago, yet it weighs less than 4 kg and draws just 4 W of power. It is probing the origin, composition and workings of the comet, gaining sensitive, high-resolution compositional insights that cannot be obtained by either ground-based or Earth-orbital observations.

The ultraviolet wavelengths Alice observes contain information about the composition of the comet's atmosphere and the properties of its surface. The comet is unusually dark at ultraviolet wavelengths, with a surface that has shown no large water-ice patches. Alice is also detecting both hydrogen and oxygen in the comet's coma, or atmosphere.

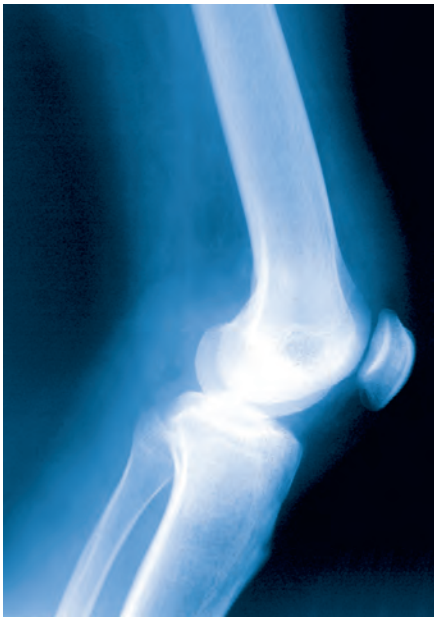
"We're a bit surprised at both just how very unreflective the comet's surface is, and what little evidence of exposed water ice it shows," said Dr Alan Stern, Alice principal investigator and associate vice president of the SwRI Space Science and Engineering Division.

To reach its comet target, the Rosetta spacecraft executed four gravity assists (three from Earth, one from Mars) and a nearly three-year period of deep space hibernation, waking up in January 2014 in time to prepare for its rendezvous with Churyumov-Gerasimenko. Rosetta also carries a lander, Philae, that will drop to the comet's surface in November 2014, attempting the first-ever direct observations of a comet surface.

"As the mission progresses, we will continue to search for surface ice patches and ultraviolet colour and composition variations across the surface of the comet," said Dr Lori Feaga, Alice co-investigator at the University of Maryland.

A sister Alice instrument was developed by SwRI and was launched aboard the New Horizons spacecraft to Pluto in January 2006 to study that distant world's atmosphere. It will reach Pluto in July 2015.

The shoebox-sized instrument is one-third to one-half the mass of comparable UV instruments, yet with more than 10,000 times as many imaging pixels as the spectrometer aboard Galileo. Image courtesy of Southwest Research Institute.



Bone engineers

Biomedical engineers are successfully engineering bone by making materials that mimic those naturally found in the body.

Professor Hala Zreiqat and her team at the University of Sydney have been working on their synthetic bone invention since 2011.

By learning from the properties of the skeleton, such as collagen and calcium, Zreiqat's team has developed a ceramic material that resembles natural bone in terms of architecture, strength and porosity.

"It is strong enough to withstand the loads that will be applied to it and also contains pores that allow blood and nutrients to penetrate it," explained Zreiqat. "It is designed to encourage normal bone growth and to eventually be replaced by natural bone in the body."

The non-toxic material acts as a scaffold on which new bone can be regenerated. Because it is bioactive and contains seed cells, the scaffold 'kick-starts' the process of bone regeneration, then gradually degrades and is resorbed as it is replaced by natural bone.

The team has recently adapted to using 3D printing to make the material. This enables surgeons to look at a defect and give the exact shape and size needed to the researchers, who then develop a 3D scaffold to give back to the surgeon for implanting.

"Smaller defects are far easier to repair," Zreiqat said. "The challenge is larger defects. We have experiments going on at the moment for maxillofacial regeneration, which is very difficult to regenerate."

Zreiqat, who presented her team's work at the Alliance for Design and Application in Tissue Engineering's recent Tissue Engineering Symposium, said they hope to see the material in clinical use within the next 10 years.

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Garvan and Roche to collaborate on epigenomic analysis

Roche Sequencing and the Garvan Institute of Medical Research have announced a collaboration to develop new technologies for targeted epigenomic analysis using DNA sequencing.

Genomics is focused on realising the potential use of sequencing information in patient diagnosis and treatment, while epigenetics - the heritable changes in gene expression that involve secondary chemical modifications of the DNA and the structural proteins in chromosomes - plays an important role in a host of biological processes. Due to the epigenomic events responsible for influencing expression of genes in chromosomes, more advanced methods are being sought to accurately analyse these changes.

Over two years, the Garvan Institute and Roche will collaborate to develop new methods to analyse regions of the epigenome, utilising the genomics expertise and infrastructure at Garvan and the products for target enrichment from Roche NimbleGen. Roche's SeqCap Target Enrichment System will be used by scientists at the Garvan Institute to further their research in epigenetic influences on human diseases.

"This collaboration with the Garvan Institute illustrates the potential of SeqCap Target Enrichment products in additional sequencing applications for epigenetic research," said Tom Albert, head of research at Roche's sequencing unit.

Professor John Mattick, executive director of the Garvan Institute, added that the collaboration "will empower more research into human biology and disease and lead to many translational opportunities".

Coffee genome sequenced

The draft genome of the coffee plant, *Coffea canephora*, has been sequenced by an international research effort including Australians.

Commonly known as Robusta coffee, *C. canephora* is the source of about 30% of the coffee produced worldwide.

The analysis sheds light on the evolution of caffeine in plants and shows that coffee plants evolved convergently with cacao and tea plants.

"Coffee, cacao and tea appear to share an ability to produce caffeine in their leaves, shoots or stems," said Professor Robert Henry from the University of Queensland's Queensland Alliance for Agriculture and Food Innovation (QAAFI). Henry contributed to the DNA sequence data used in assembling the coffee genome.

"Although such plants are not closely related, they all synthesise caffeine. It seems that during their evolution, each plant independently developed the ability to make caffeine," he added.

It is anticipated the genome sequence will accelerate the development of new coffee varieties, providing the ability to select and grow coffee with a pre-determined level of caffeine including premium-quality, zero-caffeine coffee, tea and cacao.

Because traditional methods of minimising caffeine often result in a corresponding loss of flavour, this will mean a less processed product with a more full-bodied flavour for the 12% of coffee drinkers who choose decaf. The results are also expected to lead to work on increasing the resistance of coffee plants to environmental stresses like climate change and pests.

"We think caffeine offers plants several advantages, including insecticidal properties and an inhibitory function that prevents seed germination in competing species," Henry said.

QAAFI, which is tasked with pursuing scientific methods to add value to Queensland produce, is also working with flavour scientists and industry partners to unpick the genomic component of premium coffee.

Australia currently produces a small fraction of the global coffee market, exporting a few hundred tonnes a year; it is estimated that 7.8 million tonnes of coffee was shipped globally in 2013.

"Potentially, Queensland could develop a multimillion-dollar market for high-quality, premium coffees, ranging from full strength to decaffeinated," Henry said.

The study has been published in *Science*.

Federal court upholds decision on Myriad patent

The full bench of the Federal Court of Australia has ruled that Myriad Genetics can patent isolated DNA sequences associated with mutations in the breast cancer gene BRCA1.

The decision upholds the ruling in February last year, in which the court reasoned that isolated nucleic acid sequences (including DNA and RNA) do not exist in a cell as distinct from naturally occurring genes and are therefore a patentable invention in Australia.

Cancer Voices Australia began legal action over patents associated with BRCA1 in 2010 and appealed against last year's decision, but the recent full sitting of judges has upheld the ruling.

Last year the US Supreme Court ruled that genomic DNA segments, whether or not they were isolated from their original environment, were not patentable subject matter. In a second ruling, the US court deemed that cDNA or DNA that has been chemically altered is patentable, and that genetic tests, methods of diagnosis, probes, primers used for amplifying DNA, etc, remained patentable.

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Laser beams to make microscopes more sensitive

Laser physicists from the Australian National University (ANU) have found a way to make atomic-force microscope probes 20 times more sensitive. Their research has been published in the journal *Nature Communications*.

Atomic-force microscopes are state-of-the-art tools for measuring nanoscopic structures and the tiny forces between molecules. They achieve extraordinarily sensitive measurements of microscopic features by scanning a wire probe over a surface; however, the probes, around 500 times finer than a human hair, are prone to vibration.

"At room temperature the probe vibrates, just because it is warm, and this can make your measurements noisy," said study co-author Dr Ben Buchler.

"We can stop this motion by shining lasers at the probe."

Researchers in the Quantum Optics Group at ANU's Research School of Physics and Engineering used laser beams to cool the nanowire probe to -265°C. The force sensor used by the team was a 200 nm-wide silver gallium nanowire coated with gold.

"The laser makes the probe warp and move due to heat," noted co-author Giovanni Guccione. "But we have learned to control this warping effect and were able to use the effect to counter the thermal vibration of the probe."

The probe cannot be used while the laser is on, as the laser effect overwhelms the sensitive probe. So the laser has to be turned off and any measurements quickly made before the probe heats up within a few milliseconds. By making measurements over a number of cycles of heating and cooling, an accurate value can be found.

"The level of sensitivity achieved after cooling is accurate enough for us to sense the weight of a large virus that is 100 billion times lighter than a mosquito," said co-author and leader of the Quantum Optics Group Professor Ping Koy Lam.

The researchers stated that their high prevision and fast force microscopy results "will potentially benefit applications in biosensing, molecular metrology, subsurface imaging and accelerometry". Co-author Harry Slatyer added, "With clever data processing we might be able to improve the sensitivity, and even eliminate the need for a cooling laser."

PhD students Giovanni Guccione and Harry Slatyer examine their gold-coated silver gallium nanowire. Image: Quantum Optics Group, ANU.

MS research alliance

MS Research Australia has joined the International Progressive MS Alliance, a global alliance formally established in 2013 to work towards ending progressive multiple sclerosis (MS).

Coordinated by the MS International Federation, the alliance includes organisations in the USA, UK, Italy, Denmark, Spain and Canada.

MS Research Australia has pledged $1.1 million over the next 3 years towards the collaborative project.

MS is a chronic, often disabling disease that affects the central nervous system. Fifty per cent of people with relapsing-remitting MS will develop progressive MS within 10 years, while 90% will develop progressive MS within 25 years.

Treatment options are limited for progressive MS and much less is known about this form of the condition. Around 10% of people are diagnosed with the primary progressive form of MS from the outset. Their neurologic functions steadily worsen and they typically experience only temporary or minor improvements, but for most, there are few remissions.

The alliance will fund projects that look at key challenges in progressive MS research, such as better understanding progression of the disease and trials to test new therapies, as well as support the formation of international collaborative research networks.

"Working in isolation on an issue such as progressive MS risks duplicating efforts or making only slow progress," said Dr Matthew Miles, CEO of MS Research Australia. "By enabling global collaboration, this alliance is dedicated to fast-tracking the type of discoveries that can truly change lives."

The first round of 22 research grants awarded to investigators in nine countries was recently announced. Australian MS researcher Dr Steven Petratos from Monash University obtained funding to support his research into preventing the degeneration of myelin and nerve fibres in MS, which aims to prevent illness progression and deterioration.

MS Research Australia joins the alliance as a managing member, with a key role in the executive committee and contributing technical advice and expertise. MS Research Australia will also continue to fund research into progressive MS in Australia.

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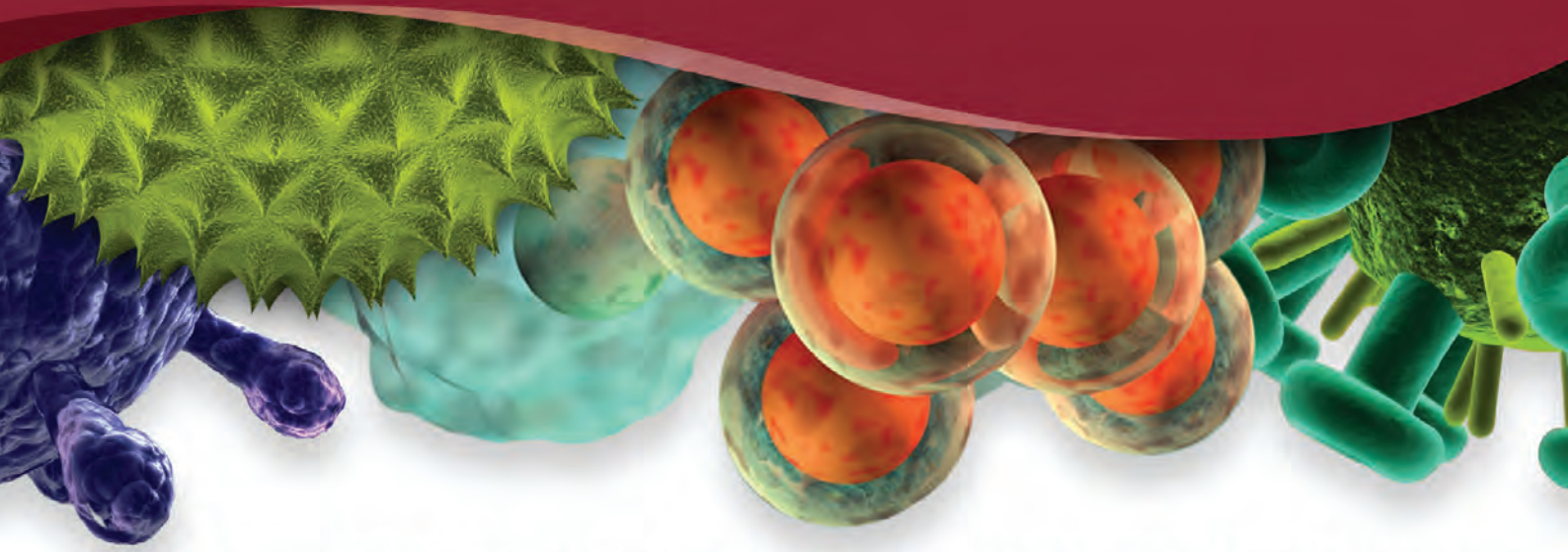

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Placental stem cells

The placenta and its resident stem cells are usually discarded after childbirth, but not any more.

Researchers from The University of Queensland have worked out how to extract the multitudes of endothelial stem cells from the life-giving organ that connects the developing foetus to the maternal uterine wall.

Endothelial stem cells are present in large quantities in the placenta, but until now isolating them in sufficient quantities for use in medicine has not been possible.

Each placenta reportedly contains enough stem cells to treat 100 patients, so the researchers are confident about developing treatments in which they can use the stem cells.

"One of the therapies we are exploring will benefit patients with any condition where blood supply to tissues is severely restricted, such as heart issues," said study leader Associate Professor Kiarash Khosrotehrani.

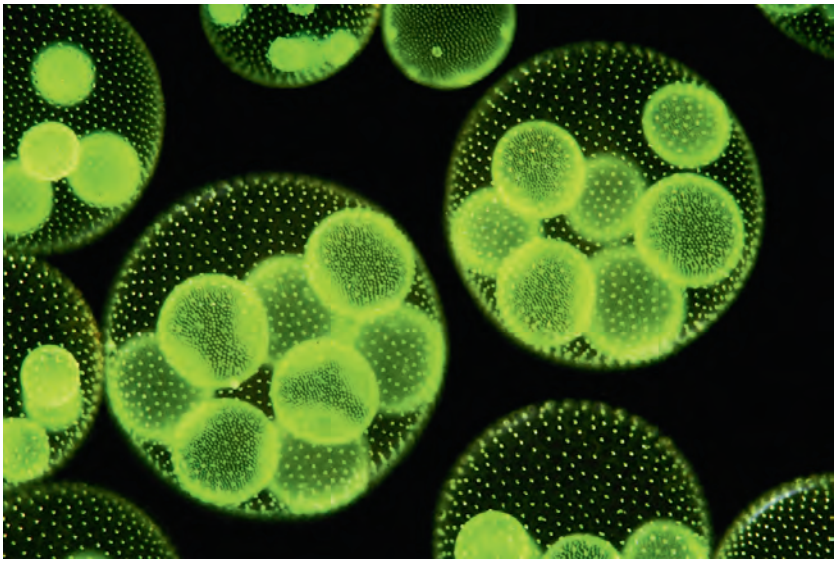
In the developing embryo, endothelial stem cells produce the endothelial cells that form the lining of the blood and lymphatic systems.

"We have recently discovered that endothelial stem cells form new blood vessels when injected into the body," said Khosrotehrani, adding that lab experiments were looking promising.

"We have conducted experiments in mice with restricted blood flow and this has revealed that injected endothelial stem cells spur blood vessel growth and improve blood flow by up to 30 to 40% in just two weeks," Associate Professor Khosrotehrani said.

"This therapy would be a real breakthrough for patients with conditions such as type 2 diabetes or ischaemia, where blood flow is restricted, resulting in intense pain, or wounds that won't heal."

The research is the subject of a patent application and the research team, with the support of UQ commercialisation company UniQuest, is seeking funding for clinical trials. The researchers hope to start clinical trials in humans in 2015.



Oceanographic research instrument arrives in Hobart

An oceanographic research instrument, which will be part of the onboard equipment on the research vessel *Investigator*, has arrived at CSIRO in Hobart.

The Triaxus, purchased from underwater technology company MacArtney Australia, is made from carbon fibre. It is hydrodynamically designed to be towed up to 3 km behind the ship and to collect data quickly, while 'flying' from the surface down to 350 m.

"The scientists on board *Investigator* will be able to control the flight path of the Triaxus to develop a 2D picture of the ocean across hundreds of kilometres," said Toni Moate, the executive director of the Future Research Vessel Project.

Biological oceanographers will use the device to determine the health of the ocean, collecting data on phytoplankton, salinity, temperature and light levels. Physical oceanographers will collect data about ocean currents descending undersea canyons, or when cooler waters are forced to the surface by ocean dynamics. Meteorologists will meanwhile improve weather and climate forecasting.

Dr Lindsay Pender from the Future Research Vessel Project Technical Team said it is critical to understand how the ocean interplays with the production of phytoplankton.

"The Triaxus will be used to estimate the amount of phytoplankton (small floating plants), which are the start of the food chain in the oceans," Dr Pender said.

"The equipment collects the data by shining a blue light onto the phytoplankton, which then emits a fluorescent signal.

"The returning fluorescent signal is measured by a fluorometer mounted on the Triaxus, and these data are used to determine where fish and other animals in the ocean start their lives, and the location of their food sources."

Vaxxas, WHO explore Nanopatch polio vaccines

Vaxxas has commenced a WHO-funded research project involving the use of its nanopatch technology to deliver vaccines for polio.

The project will cover pre-clinical studies and good manufacturing practices (GMP) research. The company and the WHO are evaluating whether nanopatch can contribute to the complete eradication of polio.

Incidents of the debilitating disease have been reduced by an estimated 99% since 1988, when more than 350,000 cases were being diagnosed every year. Vaxxas is now making a push to eradicate the remaining strains forever.

Vaxxas's nanopatch vaccine delivery technology has a nuymber of advantages over conventional syringes. For example, it is less invasive delivering a vaccine to immune cells via the skin , rather than into the blood.

Nanopatches prepared with vaccines also do not require refrigeration to maintain efficiency, which is important factor for the transportation and application of polio vaccine in the remote regions of the world.

Vaxxas plans to pursue licensing deals for the nanopatch technology as well as develop vaccine candidates of its own.

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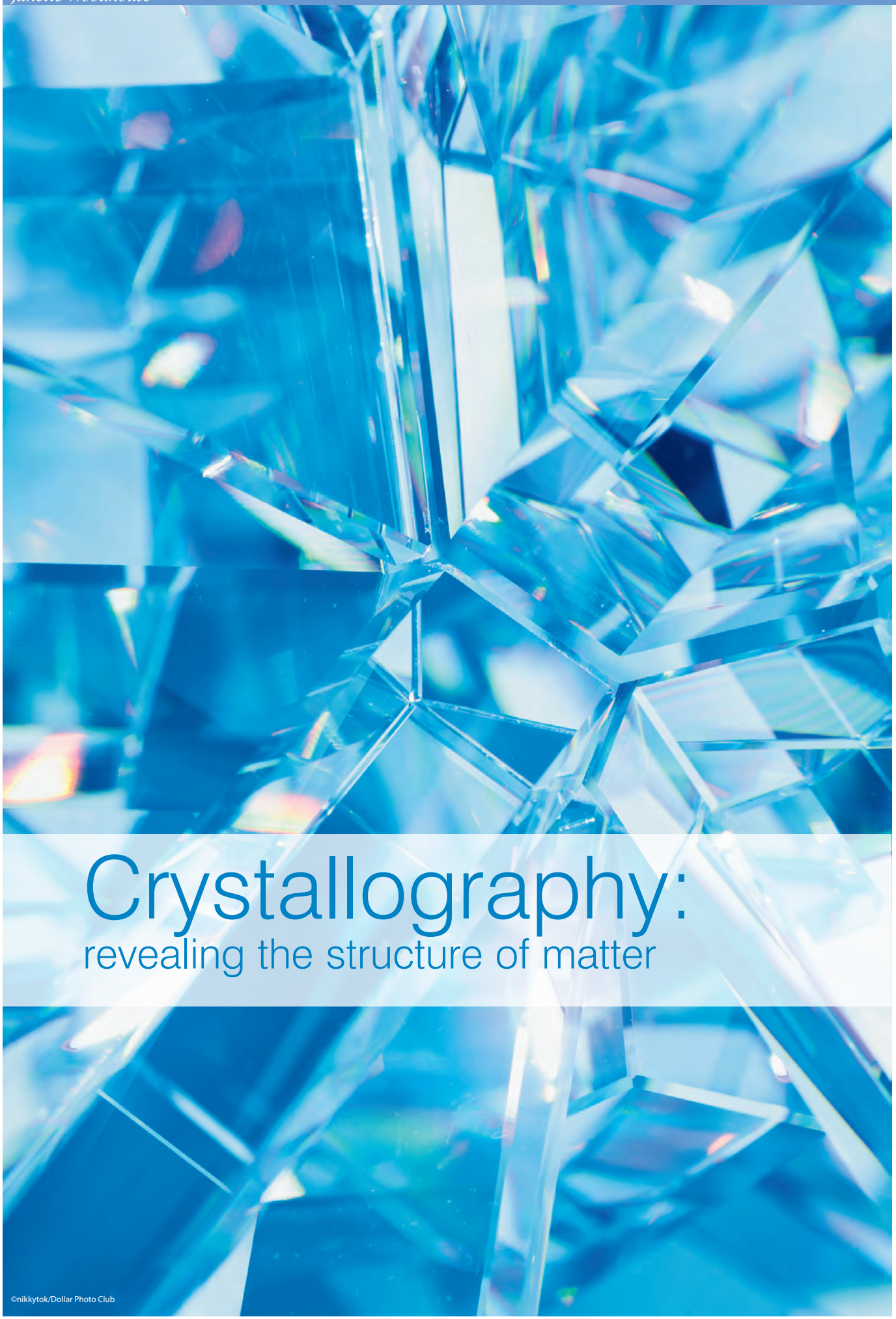
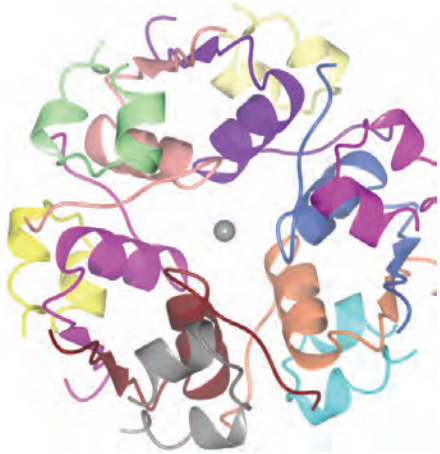
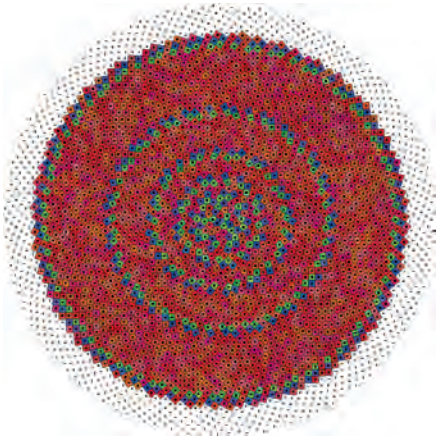
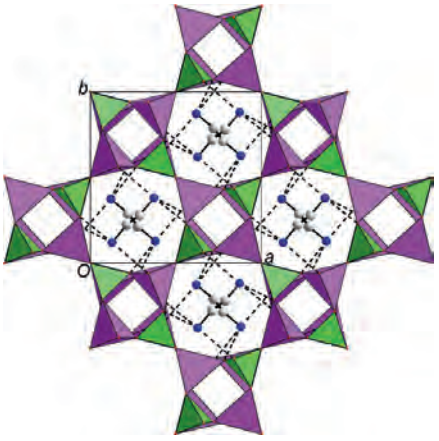


Crystallography:
revealing the structure of matter

For centuries, crystals have been desired for their alleged magical healing and mystical powers. While there is absolutely no scientific evidence that crystals can be used to predict the future or provide protection or healing, they play a critical role in establishing the structure of matter. Knowledge of the structure of matter underpins most science today, yet the majority of the general public is completely unaware of how scientists determine structure.







Top:Insulin.
Centre: Phyllotaxis.
Above: Zeolite lattice.
Images: © International Union of Crystallography (IUCr).

Modern techniques for determining structure were developed in the 20th century after it was discovered that X-rays could be used to 'see' the structure of matter in a non-intrusive manner and that, with their repeatable lattice structure, crystals made great candidates for investigation. Since this discovery, X-ray crystallography has become the leading technique for studying the structure of matter at the atomic or molecular level.

Crystallography permeates our daily lives and forms the backbone of industries which are increasingly reliant on knowledge generation to develop new products. The science has many applications in widely diverse fields such as agro-food, aeronautics, automobiles, cosmetics and computers, as well as the electromechanical, pharmaceutical and mining industries.

The importance of crystallography to scientific and technological progress, combined with the lack of community knowledge and understanding of the science, induced the United Nations General Assembly to proclaim 2014 as the International Year of Crystallography (IYCr2014).

So far, 29 Nobel Prizes for scientific achievements have related to, or involved the use of, crystallography. The first of these was 100 years ago with Max von Laue's discovery of the diffraction of X-rays by crystals.

The following year, father-and-son team William Henry and William Lawrence Bragg won the Nobel Prize for Physics for their work in determining the structure of sodium chloride using X-ray diffraction. Although the father and son went on to lead the Cavendish Laboratory team at Cambridge University, Sir William Bragg started his work on X-rays and crystal structure when he was Elder Professor of Mathematics and Physics at the University of Adelaide, and his Australian-born son Lawrence was a graduate of the university. Lawrence's equation to translate the diffraction into a structure, Bragg's Law, is still in use today.

The Bragg Institute at the Australian Nuclear Science and Technology Organisation (ANSTO) is named in tribute to the Nobel Prize winners. This institute leads Australia in the use of neutron scattering used in crystallography. At the centre of the research institute is the OPAL research reactor, along with state-of-the-art neutron beam instruments affectionately named Kowari, Wombat, Echidna and Koala, after Australian fauna.

How X-ray crystallography works

Modern crystallographic methods depend on analysis of the diffraction patterns of a sample targeted by a beam of some type. When a beam hits an object, the object's atoms scatter the beam. This is facilitated by the wave properties of the particles making up the beam. Crystallographers discovered that crystals, because of their regular arrangement of atoms, scatter the rays in just a few specific directions. By measuring these directions and the intensity of the scattered beams, scientists produce a three-dimensional picture of the crystal's atomic structure.

Beams of X-rays are most commonly used; other beams include electrons or neutrons. Crystallographers often explicitly state the type of beam used: X-ray diffraction, neutron diffraction or electron diffraction. These three types of radiation interact with the specimen in different ways.

X-rays interact with the spatial distribution of electrons in the sample, while electrons are charged particles and therefore feel the total charge distribution of both the atomic nuclei and electrons of the sample.

Neutrons are scattered by the atomic nuclei through the strong nuclear forces but, in addition, the magnetic moment of neutrons is non-zero. They are therefore also scattered by magnetic fields. When neutrons are scattered from hydrogen-containing materials, they produce diffraction patterns with high noise levels. However, the material can sometimes be treated to substitute deuterium for hydrogen. Because of these different forms of interaction, the three types of radiation are suitable for different crystallographic studies.

Crystallography and the life sciences

Most bio-macromolecules do not form crystals in their native environment, but by the middle of the

20th century, protein crystallisation techniques had evolved sufficiently to enable their analysis by X-ray crystallography. In 1964, Dorothy Crowfoot Hodgkin was awarded a Nobel Prize for her work on establishing the structure of vitamin B12 and penicillin.

Hodgkin was one of the first to use X-ray crystallography to look at biological molecules. Her first big breakthrough was with penicillin. Chemists didn't quite know what its structure was, but she solved that in 1945 and then she went on to solve the structure of the protein insulin.

Another female crystallographer, Rosalind Franklin, made a huge contribution to Francis Crick and James Watson's work in establishing the double helix structure of DNA.

Other notable crystallography-related Nobel prizes include Johan Deisenhofer, Robert Huber and Hartmut Michel - for revealing the structure of the first membrane-bound protein (1988); and Venkatraman Ramakrishnan, Thomas Steitz and Ada Yonath - solving the structure of the ribosome (2009).

In the past 50 years, the structures of more than 90,000 biological molecules have been revealed by crystallographers, with great ramifications for health care.

Crystallography is now commonly used in drug discovery. The detailed analysis of protein-ligand complexes allows scientists to design drugs to target certain molecules. The influenza drug, Relenza, is the first drug developed in Australia based on a protein crystal structure. The protease inhibitor that fights the Human Immunodeficiency Virus (HIV) is another significant finding, which was developed using diffraction. It is regarded as a major success of structure-based drug design.

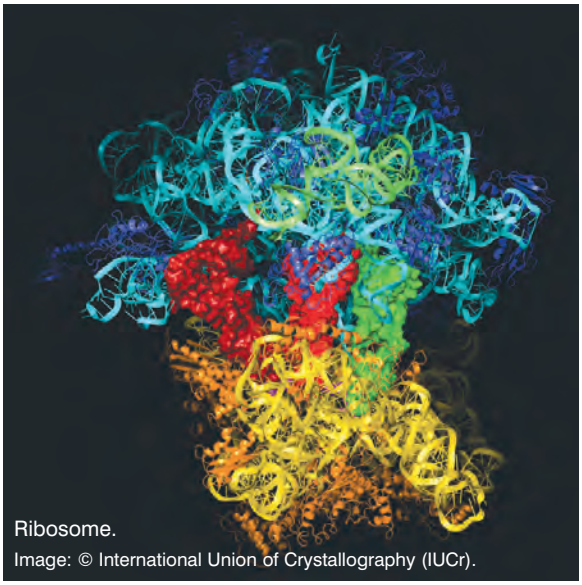
In exciting news, a new version of Relenza that could stop the flu virus in its tracks has been developed by Australian and international researchers at the Australian Synchrotron. The drug prevents flu virus particles from detaching themselves from the surface of a cell and spreading to infect other cells, buying time for vaccines to be developed. The team of researchers used the Australian Synchrotron to obtain finely detailed information about how the drug interacts with the virus and were then able to use the information to improve the drug's effectiveness.

In addition, ANSTO now operates the Australian Synchrotron, which produces extremely intense X-ray beams. Synchrotron light sources have revolutionised X-ray crystallography since the 1980s, and the Australian Synchrotron is now the centrepiece of crystallography in Australia, with five of its nine beamlines dedicated to crystallography and atomic structure determination.

The beauty of crystals

Crystals were found to be ideal subjects for studying the structure of matter at the atomic or molecular level, on account of three common characteristics: they are solids, three-dimensional and built from very regular and often highly symmetrical arrangements of atoms.

These crystals are often extremely beautiful and in some cases quite awe inspiring.



Ribosome.
Image: © International Union of Crystallography (IUCr).

In 2000, miners excavating a new tunnel for the Industrias Peñoles mining company were 300 metres below the surface at Naica, Chihuahua, Mexico when they discovered the Cueva de los Cristales (Cave of the Crystals) and in it some of the largest natural crystals ever found.

The giant selenite crystals (gypsum, $CaSO_4 \cdot 2H_2O$) are up to 12 m in length, 4 m diameter and weigh a massive 55 tons. The cave is usually flooded but the mining company had pumped out the water to facilitate their tunnelling.

Sadly, the cave is on private property and totally unsuitable for tourism as the air temperature reaches up to 58°C and the humidity is always 99-100%. Scientists working in the cave have to limit the time they spend in there to half-hour shifts and wear specially constructed refrigerated suits and cold-breathing systems.

The cave was explored in detail in 2006 by a scientific team coordinated by Paolo Forti. Forti is a cave minerals specialist and crystallographer at the University of Bologna (Italy). Besides mineralogical and crystallographic studies, biogeochemical and microbial characterisation of the gypsum giant crystals were also performed.

Stein-Erik Lauritzen from the University of Bergen, Norway performed uranium-thorium dating on the crystals. He determined that the maximum age of the giant crystals was about 500,000 years.

Crystallography without the crystals

University of Adelaide researchers Associate Professors Christian Doonan and Christopher Sumby and their team in the School of Chemistry and Physics, have developed a new material for examining structures using X-rays without first having to crystallise the substance.

"Today, crystallography is an area of science that's still providing new insights into the structures of materials - our new research is a prime example of that. It allows us to study chemical reactions that have just happened, or potentially even while they are still happening, which we can't do using normal crystallography," explained Associate Professor Sumby.

The researchers are using a new nanomaterial - called a metal-organic framework - to bind the metal complex catalyst and its chemical reactants in place.

"We can then examine the structures of the reaction products using X-rays without having to isolate the product or grow crystals," said Associate Professor Doonan.

"We are effectively taking snapshots of the chemistry, enabling us to study the reaction products in their native state. In this way we can provide structural evidence for the chemical transformations that are taking place."

The research, being undertaken in the Centre for Advanced Nanomaterials, is supported by the Australian Research Council and the Science and Industry Endowment Fund.

The work is being carried out in the Bragg Crystallography Facility at the university's North Terrace campus.

Conclusion

Today, crystallography underpins all the sciences. It forms the backbone of a wide range of industries, including pharmaceuticals, agri-foodstuffs, aeronautics, computing, mining and space sciences.

It is essential for the development of almost all new materials and deserves to be more understood and appreciated by the whole community.

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The Zeta Plus Encapsulated System is a single-use depth filtration system designed for the bioprocessing industry where upstream cell culture clarification or downstream impurity removal is required. The system consists of three product lines: a small system that is suitable for lab-scale production or scale-up studies; and two larger systems that are designed for production-scale biomanufacturing.

3M offers a complete range in various surface areas to ensure there is a solution for a variety of batch sizes. The capsules are available in 170, 340 and 1020 cm^2 surface areas and in a variety of grades. The single-use capsules reduce labour time and eliminate cleaning validation.

The depth filtration media has a high contaminant loading to ensure economical filtration and reliable particle reduction. The Zeta Plus EXT Series media is a dual zone depth media designed to provide optimal clarification of bioprocess and biological fluids and to remove contaminants such as host cell proteins (HCP), viruses, DNA, protein aggregates and endotoxins. The 60SP02A grade is said to excel at primary cell clarification, coping with the variation between harvest batches while providing clarified harvest fluid with low turbidity levels.

The products provide a simple solution for bioprocessing applications. 3M's technical support is available to assist in optimising the grade and product selection for the user's specific application.

3M Purification Pty Ltd
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Multiplexing system

PerkinElmer has launched AlphaPlex reagent technology. The product allows users to quantify multiple analytes in a single well for fast and accurate results, even with low sample volumes.

The homogeneous, all-in-one-well multiplexing reagent technology provides highly sensitive detection of a wide range of analytes in a simple, no-wash assay format. The system is said to enable a 5-20 times reduction in sample consumption compared to other multiplexing platforms and can be used with Alpha-enabled filter-based readers.

Based on the company's Alpha Technology, an alternative to enzyme-linked immunosorbent assays (ELISAs), AlphaPlex reagents are a homogeneous luminescent proximity technology. When the donor and acceptor beads are brought together, a cascade of chemical reactions is set in motion, causing a greatly amplified signal. By using multiple acceptor beads which emit different wavelengths, multiple analytes can be detected.

Researchers can use the reagents to quantify a broad range of analytes, from nucleotides to large proteins, and to immunophenotype various cell populations including immortalised, primary and stem cells. The reagents can be used to perform ratiometric signal measurement, allowing for higher reproducibility and a lower false-positive rate - an important feature in high-throughput screening.

PerkinElmer Pty Ltd
www.perkinelmer.com

UHPLC system

The Thermo Scientific Vanquish UHPLC looks different from standard UHPLC systems. The monolithic case contains an instrument that combines the ruggedness of an integrated system with the flexibility and serviceability of a modular system. The product stands about 25% lower than comparable modular stacks for safety and convenience.

Thermo Scientific Accucore Vanquish UHPLC columns are designed to optimise performance. The columns feature 1.5 μm solid core particles utilising Core Enhanced Technology to take advantage of the system's 1500 bar maximum pump pressure and flow rate up to 5 mL/min for ultrashort diffusion path lengths and highly efficient separations.

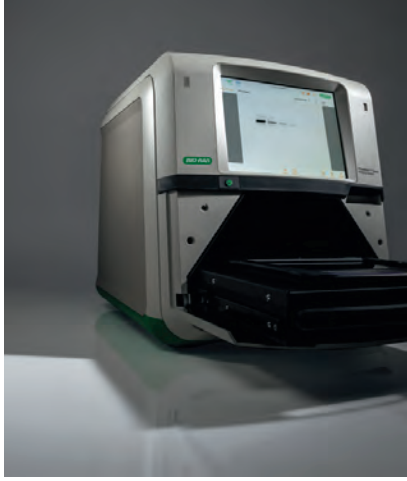
SmartFlow pumping technology is designed for reproducible retention times and low baseline noise to enhance detection sensitivity. Temperature control capabilities, including direct heating and forced air temperature control modules, enhance separation efficiency and selectivity as well as retention time reproducibility. An insulated autosampler compartment with air-to-air cooling protects vials from water condensation. The hard carbon-coated ceramic injection valve and pump pistons are designed to deliver consistent, reproducible performance for 200,000 injections.

The gold-standard Thermo Scientific Dionex Chromeleon Chromatography Data System can calibrate the system automatically and unattended. eWorkflow and Intelligent Run Control automation are designed to enhance data quality and instrument efficiency. Instant data reprocessing paired with Cobra Peak Detection and Smart Link can speed up data review significantly compared to manual procedures. Chromeleon software supports chromatography and mass spectrometry functions simultaneously.

The product's Diode Array Detector is designed to generate data over a wide linear range with high signal-to-noise performance. Low-dispersion 10 and 60 mm flow cells provide high sensitivity levels and wide linearity. Fused-silica LightPipe flow cells are designed to exploit low baseline drift for reproducible quantitation. Users can acquire up to 10 signal channels simultaneously and a spectrum 3D field at 200 Hz. Sensitivity, linearity and spectral resolution can be tailored to suit the application using four programmable optical slit widths from 1 to 8 nm.

Thermo Fisher Scientific
www.thermofisher.com.au

System for western blot imaging



The ChemiDoc Touch Imaging System from Bio-Rad is a complete solution for gel and western blot imaging. The system combines the sensitivity of film with advanced detection technology to determine the best exposure settings for publication-quality western blot images.

The intuitive touch-screen interface enables simple acquisition with features such as image preview, auto-focus and optional exposure modes. Images can be viewed, compared, pinched and zoomed into on the 12″ touch screen with Image Lab Touch Software and exported via USB or network connection.

In addition to chemiluminescent western blot detection, the product employs Smart Tray Technology for gel imaging. The system recognition of each tray automates the set-up of the chosen application, eg, UV transillumination or colorimetric stain detection.

The device also fully supports Bio-Rad's stain-free in-gel technology, allowing rapid fluorescent detection of protein gels and blots and giving multiple points at which to visualise, verify and validate results. This enables western blot loading control normalisation by using total protein concentration values, calculated by Image Lab Software, which eliminates the need for housekeeping proteins.

Bio-Rad Laboratories Pty Ltd
www.bio-rad.com

Integrated HPLC and UHPLC systems

Shimadzu has released its i-Series of integrated HPLC systems. The series promotes high efficiency and productivity with features including remote monitoring, graphical user interface touch screen and auto validation with self-diagnosis. The series consists of the Nexera-i, which supports ultrahigh-speed analysis; and the Prominence-i, which supports conventional to high-speed analysis. The integrated HPLC systems realise a PC-free laboratory by enabling control of the instrument from a smart device, such as a smartphone, and via an interactive communication mode (ICM).

The series offers an intuitive operating environment that allows anyone to analyse samples easily. Full automation from start-up to shutdown after analysis, and a direct access function that allows multiple operators to set samples at any time, provide for an efficient workflow. Method transfer from an existing HPLC system is seamless due in part to its architecture and ease of operation.

Shimadzu Scientific Instruments (Oceania) Pty Ltd
www.shimadzu.com.au

ICP-OES instrument

Analytik Jena has released the PlasmaQuant PQ 9000 high-resolution array ICP OES for multiple element analysis. ICP-OES is an analysis method in which very hot argon plasma is used to analyse the elements present in a sample using optical emission. The method is routinely used for determining smallest element concentrations especially in environmental analysis, material research, metal or pharmaceutical industries.

The product has been developed to master complicated analytical challenges in emission spectrometry with a high degree of precision, method flexibility and operating comfort. Technological advances include improved optical resolution, the plasma torch design and the generation and observation of the plasma. The product is especially suited to demanding samples and complicated matrices. It is high performing in identifying spectral interferences.

MEP Instruments Pty Limited
www.mep.net.au

Flash point instrument

PAC has announced the release of its next-generation flash point instrument, the Herzog OptiFlash Pensky-Martens. The product is simple to use, easy to clean and safe to operate. It detects flash points up to 400°C and complies to global standards such as ASTM D93, ISO 2719, EN ISO 2719, IP 34, JIS K2265 and GB/T 261.

With the product's intuitive user interface and built-in automation, users can easily start a test without having to spend time doing manual tasks like installing the flash point and temperature sensors, as well as installing the test cup for each test. Its innovative design also makes it easy to clean, allowing the user to not only disassemble the cup cover without any tools but also to clean highly viscous samples, like bitumen. This improves the reliability of the test results significantly since users can now run a quick clean before running any new sample.

With its ultrafast optical flame detector, the instrument can detect a fire or even small flames in an extended range around the test cup. It replaces the previously released PAC flash point instruments - the Herzog HFP 339, Herzog HFP 360 and ISL FP93 5G2.

AMS Instrumentation & Calibration Pty Ltd
www.ams-ic.com.au

Biobanking tubes

Biobanking tubes from Greiner Bio-One are designed to fit more samples in less space. With secure seals, robust walls and medical-grade polymers, the range protects samples from evaporation, leakage and the rigors of cold storage and thawing processes.

The company's 96-well, SBS footprint racks hold 250, 600 and 1000 µL working volume tubes with custom or pre-produced 2D coding. The tubes and racks will integrate easily with existing decappers, liquid handling systems, storage systems and scanners.

Interpath Services Pty Ltd
www.interpath.com.au

AppNotes

Automated purification of high-quality genomic DNA

The Eppendorf epMotion M5073 with MagSep Tissue gDNA kit is an efficient and effective way of isolating genomic DNA in an automated environment.

The MagSep Tissue gDNA Kit has been specifically developed to be used with the Eppendorf epMotion M5073 automated pipetting system. It provides a flexible, easy-to-use solution for magnetic bead-based automated purification from 1-24 samples of high-quality, ready-to-use genomic DNA from a broad variety of sample sources, such as tissue, mouse tails, cultured cells and bacteria.

In this study different mouse tissues were subjected to automated DNA purification using the MagSepTissue gDNA Kit. Genomic DNA purified in this manner showed yields and qualities that were comparable to manual methods and superior to silica column-based technologies. No cross-contamination was detectable and the genomic DNA was directly compatible with downstream real-time PCR amplification. Typical yields ranged from 13.5 µg (10 mg mouse tail material) to 33 µg (10 mg mouse liver).

With the introduction of the epMotion M5073 automated pipetting system with integrated Thermomixer (TMX) and Magnetic Finger Module, a powerful tool for the automation of magnetic bead-based applications became available. The MagSep Tissue gDNA Kit is a suitable addition that enables the user to easily perform hands-free, walk away automated genomic DNA purification. This combination of instrument and kit delivers ready-to-use, high-quality, high-yield genomic DNA that is directly compatible with downstream applications.

To show the effectiveness of the epMotion and MagSep Tissue gDNA kit, 10 mg of mouse tissue was processed for the isolation of genomic DNA. Tissue samples were processed with 25 µL Proteinase K solution and 200 µL lysis buffer, added manually. The lysis was performed overnight in a *Thermomixer comfort* at 56°C with shaking. After complete lysis, the DNA-containing supernatant was cleared by centrifugation and 225 µL tissue lysate were subsequently transferred into a fresh 2 mL Eppendorf DNA LoBind Tube for subsequent automated processing by the epMotion M5073. For 24 tissue samples the total processing time was approximately 2 hours excluding overnight lysis. The isolation performance of the individual purification methods was assessed by UV measurements of 3 µL and gel electrophoresis of the final eluates.

Depending on the type of tissue, typical DNA yields from 10 mg sample material were in the range of 13.5 to 33 µg for the automated method. DNA purity was good with A260/280 ratios between 1.67 to 1.89.

In a separate experiment, DNA isolated from 24 mouse tail clippings (10 mg each, combined in a master lysate) using the epMotion M5073 showed yields with an average yield of 17.3 µg and CV of 2.09%, giving evidence for a high consistency of the automated method.

The isolation performance of the automated MagSep Tissue gDNA Kit was compared to two widely used silica column-based kits and the manual method using the same reagents. Magnetic bead-based methods (both automated and manual) yielded up to twice as much DNA with purities comparable to the silica column methods, with higher reproducibility of the automated method.

The Eppendorf epMotion M5073 system in combination with the Eppendorf MagSep Tissue gDNA Kit allows the user to conveniently and efficiently purify genomic DNA from tissue and cell samples with minimum hands-on time and a maximum level of automation.

A broad range of sample material can be processed which reproducibly yields large amounts of high-quality, ready-to-use genomic DNA. The safety and reliability of this feature was proven by the fact that no cross-contamination was detectable by real-time PCR.

Visit www.eppendorf.com/epmotion for the full application details.

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AppNotes

DNA, RNA and protein extraction from skin tissue

Effective, efficient sample preparation is critical to successful downstream results. Now an effective method exists for the extraction of intact, biologically functional macromolecules from skin.

Animal and human tissues can be the toughest samples to isolate high-quality DNA, RNA and proteins. However, using the FastDNA Spin Kit and FastRNA Pro Green Kit in combination with the FastPrep instrument, full homogenisation of any sample including bone and tumours, and more elastic samples like skin, can be achieved within a few seconds. This method saves hours of work during sample preparation and provides high yields of DNA, RNA and proteins.

RNA and protein extraction from skin tissue

The FastPrep and associated matrices have demonstrated successful lysis and dual extraction of RNA and proteins from skin tissue in three runs of 40 seconds each.

Materials

- FastPrep instrument
- Lysing Matrix D tubes
- Sample: Human skin biopsies from a 3 mm punch (weighing 19 mg on average)

Protocol and parameters

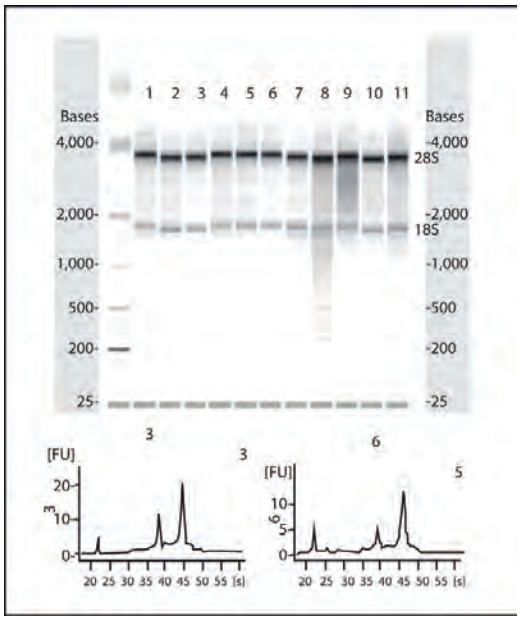
1. Add the skin sample to a Lysing Matrix D tube.
2. Add 1 mL of a guanidine thiocyanate lysis buffer (5.1 M guanidine thiocyanate, 50 mM sodium citrate, 50 mM EDTA, 0.5% ß-mercaptoethanol).
3. Homogenise in the FastPrep instrument for 3 x 40 seconds at a speed setting of 6.0. Place the tubes on ice for 5 minutes between each run.
4. Centrifuge at 14,000 x g for 5-10 minutes to pellet debris.
5. Proceed with the RNA and protein extraction protocol.

Results

The average yield of 1.4 µg RNA obtained with the FastPrep System was 57% higher than yields obtained with the Polytron, while the average yield of 170 µg protein obtained with the FastPrep System was 53% higher than yields obtained with the Polytron.

To verify the high-quality nature of the RNA, samples were analysed with the Agilent 2100 Bioanalyzer. Samples had ribosomal integrity number numbers of between 8.4 and 8.9, which is consistent with high-quality RNA (see figure).

The RNA was run on an Agilent 2100 Bioanalyzer (Agilent, Palo Alto, Calif.) using the RNA 6000 Pico LabChip kit to determine the quality of the samples. The 28S and 18S ribosomal bands show a greater than 2:1 ratio, and the calculated RNA ribosomal integrity numbers of the samples ranged from 8.4 to 8.9, verifying high-quality RNA.



Shown above are the gel images for 11 RNA samples and below are two representative electrophoretic graphs showing the RNA peaks.

The quality of extracted proteins was assessed by two-dimensional gel and Western blot analysis. There was distinct spot resolution and sufficient protein isolated from a single biopsy to produce five to six two-dimensional gels. For Western blotting, a primary antibody against GADD-45 was used to probe the membrane. GADD-45 antibody detects both the alpha and beta portions of the protein, although it is more sensitive for the alpha portion.

The FastDNA Spin Kit is used with the FastPrep instrument to lyse and subsequently isolate DNA from up to 200 mg of almost any sample in less than 30 minutes.

The FastRNA Pro Green Kit is designed to efficiently isolate total RNA from any type of plant and animal tissue or cultured cells.

Visit www.mpSamplePrep.com to access articles and other educational materials highlighting successful sample preparation using the MP Biomedicals product line.

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AusBiotech 2014

Australia's Life Sciences Conference

Life sciences = Future. Jobs. Exports.

29 – 31 October 2014

Gold Coast Convention & Exhibition Centre, QLD

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Life Sciences =

Future. Jobs. Exports.

Has the Australian biotech sector the potential to fill some of the gaps left by the demise of traditional manufacturing areas?

This question, and more, will be answered at Australia's premier biotech conference, AusBiotech 2014, which is being held at the Gold Coast Convention and Exhibition Centre from 29-31 October.

Australia's window of mining-driven prosperity is closing and the country must now look to other industries for sustainability and growth. High-tech, knowledge-based industries are a good match for Australia's skills in high-cost, low-volume manufacturing and the life sciences sector offers huge potential to fill the space left by the mining downturn. Australia already has existing prowess in the biotech and life sciences and now is the time to leverage this to our economy's advantage.

However, moving from research through development to commercialisation is not simple and companies need access to corporate and commercial expertise and insight. Technological innovation, knowledge and networking will be the the drivers of this evolution and all of these attributes will be found at AusBiotech 2014.

Held annually, AusBiotech informs and updates the biotechnology sector with current industry facts and knowledge. It provides key presentations and forums to help bring together representatives and professionals from across the biotechnology industry and the globe to experience a comprehensive conference program, extensive bio-industry exhibition, business matching program and associated events such as the AusFoodtech Symposium.

This year's AusBiotech conference theme - Life Sciences = Future. Jobs. Exports - brings focus to the developments in biotechnology and the life sciences industry that will significantly boost Australia's economic performance and help to build the nation.

Partnering program

AusBiotech's Business Matching Program will facilitate more than 2500 meeting requests between participants from the biotechnology, biopharmaceutical, life sciences, business, investment, research and health industries.

AusBiotech 2014
29-31 October 2014
Gold Coast Convention and Exhibition Centre
More information:ausbiotechnc.org/#
Registration: ausbiotechnc.org/registration

AusBiotech 2014 will be utilising a networking and partnering platform for all participants of the AusBiotech national conference. The powerful application is an integrated mobile event application and business partnering system all in one that will provide delegates with a one-stop shop for all conference information and networking aspects at the conference.

The 2014 AusBiotech platform features:

- Ability to request and schedule 30-minute meetings with other attendees through the AusPartnering system.
- Access to the full program and associated networking events.
- Ability to view the profiles for all attendees - including, speakers, sponsors, exhibitors and attendees.
- Manage a personalised calendar of sessions, meetings and networking events.
- Receive important updates and announcements in the lead-up to and during AusBiotech 2014.

The platform can be utilised via your desktop or mobile device, making it easy to continue to interact in real time as you keep updated with the latest information at the conference.

All full conference attendees have been able to gain access into the AusPartnering system since the end of September 2014.

Public forum - can we make brain diseases of ageing a thing of the past?

'Perspectives on dementia and Alzheimer's and biotechnology's role in treatments and prevention' is a free event for the public to join and hear from a number of experts who will present their vision on what the future of cognitive diseases like dementia and Alzheimer's looks like.

The forum will be held on Friday, 31 October from 9.45 am to noon. All attendees must have their AusBiotech 2014 conference registration, exhibitor pass or public forum pass to attend.

Concurrent agriculture and food biotechnology symposium

Where is Australia's global niche?

- Thursday 30 - Friday 31 October 2014 | 9 am - noon
- Room 8, Gold Coast Convention & Exhibition Centre
- More information and registration: ausbiotechnc.org/program14/AFBS

This two-day agriculture and food biotechnology symposium will highlight how Australian food and agricultural companies can capitalise on biotechnology innovations by exploring:

- Macroeconomics of influencing Australia's agri-bio industry.
- Technological advances that will transform livestock, horticulture and cropping industries.
- How to navigate regulatory and legal barriers.
- Emerging and enabling biotechnologies.

An outstanding line-up of international and national speakers from research and development, business, commercialisation, and legal and regulatory backgrounds will explain how Australia's food and agri-bio industry can secure its future as a niche provider of technology, services and products and how Australian food and agri-bio companies can position themselves as the preferred providers.

Some of the highlights in the AusBiotech 2014 program		
Opening address	Hon. Ian Walker MP	Minister for Science, Information Technology, Innovation and the Arts
Accessing innovation around the world	Dr Sue Dillon	Global Therapeutic Area Head for Immunology for Janssen
The challenges for pharma and biotech in emerging markets - Focus on China and India	Prof Ian Edvalson	Partner, Wilson Sonsini Goodrich Rosati
The connection between medical research and business	Prof Frank Gannon	Director and CEO, QIMR Berghofer Medical Research Institute
The use and future development of biomarkers	Professor Yongzhang Luo	Founder and Chief Scientist, Protgen Ltd
Bench marking biotech: Initiatives for the development of the biotechnology sector in Asia Pacific and their impact	Rhenu Bhuller	Senior Vice President, Healthcare, Frost & Sullivan
Investors unplugged	Chair: Lawrence Gozlan	Chief Executive Officer, Scientia Capital
Global regulatory issues	Chair: Bernard O'Shea	Partner Norton Rose Fulbright
New economy, new manufacturing	Chair: Julie Phillips	Chief Executive Officer, BioDiem
What does success look like?	Chair: Rob McInnes	Partner DibbsBarker
What are we doing for commercialisation in Australia?	Chair: Helen Fisher	Leader - Life Sciences, Deloitte Australia
Translation from innovation to the clinic and beyond	Chair: Dr Mark Ashton	Senior Director, Commercial Engagement, Health, UniQuest
Focus on China	Chair: Glenn Cross	Chief Operating Officer, AusBiotech
Converging the relationship between industry, investors and academia	Chair: Dr Anna Lavelle	Chief Executive Officer, AusBiotech
The changing face of big pharma	Chair: Glenn Cross	Chief Operating Officer, AusBiotech
Introduction of biosimilars into Australia	Chair: Dr Chris Holloway	Founder and Group Director of Regulatory Affairs, ERA Consulting Group

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Test tube racks

The Kartell range of plastic labware includes a variety of test tube racks, designed to fit test tubes in an extensive range of sizes from most manufacturers. Most of the racks are made from polypropylene, which features high resistance to most alcohols, alkalis and acids.

The company's universal test tube racks are large-capacity racks available in five sizes to store 24-90 test tubes. Supplied flat packed, they fold into three-tiered racks, with alphanumerical references on the top tier for easy identification. Available in four colours (white, blue, yellow and red) for easy identification and organisation, the racks can be used dry, wet or in waterbaths and will not float. The design allows all samples to be incubated at the same temperature. The racks can be used in freezers without deforming or becoming brittle and can also be autoclaved at 121°C for 20 min.

The company's test tube racks, specifically designed for titration work, feature an 'up-stand support' design which enables all the contents of the test tubes to be visible at all times. Three sizes are available to fit 16, 18 and 20 mm-diameter test tubes. An additional base plate is also available to hold two racks in the slots provided. The base is useful for colorimetric analysis.

The company's two/three-tier test tube racks are lightweight, unbreakable racks that are manufactured on a traditional pattern. They are available in a range of sizes to suit 10-24 test tubes and can be autoclaved for easy sterilisation.

The company's two-tier test tube racks are clear racks which come in three different sizes to hold 12 test tubes in sizes up to 40 mm diameter. Manufactured from 'glass clear' PMMA (Plexiglas), the reduced diameter holes in the lower tier of the racks hold the test tubes safely.

Sieper & Co Pty Ltd
www.sieper.com.au

Graeme O'Neill

Medical research

Seeking the right company

Australia excels in biomedical research but sucks at commercialisation. Professor Frank Gannon says that needs to change.

Prof Gannon is the director of the Berghofer Medical Research Institute in Brisbane, the translational arm of the Queensland Institute of Medical Research (QIMR). The institute is dedicated to doing well, what Australia has done so poorly: turning discoveries in cancer research, infectious diseases, complex medical disorders and mental health into new treatments, novel diagnostics and prevention strategies.

Gannon, who is from Ireland, retells an all-too-familiar tale: Australia ranks 11th in the world for generating new medical knowledge but languishes near the tail of the field in transferring that knowledge to industry and the clinic.

He will present the prestigious Millis Oration at the AusBiotech 2014 Conference on the Gold Coast this month - the oration honours the late Professor Emeritus Nancy Millis, one of Australia's greatest microbiologists, and former chancellor of Victoria's La Trobe University.

Gannon was recruited to head QIMR Berghofer in 2011 from his former post as director-general of the Science Foundation of Ireland, the dominant funding agency for all research in Ireland.

"Its motto is 'Research with Consequences' - it supports excellence, and expects consequences," he said. "When you normalise for differences in GDP, Ireland ranks close to Australia in the league table for research output but it does better than Australia in transferring research results to industry.

"When the foundation was established, there was an expectation that it would foster a culture in which scientists would work with industry to commercialise their discoveries. They have come to know each other very well."

Gannon says QIMR Berghofer is focused on producing an impact from excellent research. "In the past, we have tended to focus on the impact in the clinic," he said. "We now recognise that, to get to the clinic, we have to go through a commercial phase that may involve working with or licensing external companies, or setting up our own - it's a crucial part of what should be happening.

"The work we perform generally comes under the heading of translational research, but we prefer a more rigorous description: there are several lead-up phases that get bundled with translation, that we need to dissect out: the discovery of a target, its characterisation, developing molecules to interfere with the target, and then, translation."

"In the past, during the progression from discovery and translation, the enabling step of working with industry has tended to be omitted from the discourse."

Prof Gannon suggests that one reason why Australia has done so poorly at commercialising its medical discoveries is that Australian researchers are rewarded predominantly for publishing research papers - not for their efforts in commercialising their discoveries.

The process of research leading to publication becomes circular - an end in itself. "We need to break

out of the circle - not by stopping the cycle but by getting another plate spinning. We must look at the barriers to doing that," he said.

He suggests a major barrier is a funding system that fails to reward interactions between the discoverer and the deliverer, both at the clinical and company level. "We don't talk enough," he says. "As a result, researchers, clinicians and companies don't know enough about what each is doing."

Prof Gannon says exports from Australia's biotechnology sector are very high, but tend to be concentrated with a small number of companies. There haven't been enough successes to sustain a greater breadth of corporate activity.

The problem, he suggests, traces to the process of funding Australian start-ups: companies start with relatively modest start-up capital between $2 million and $4 million, and the founders exit and start over once the company's value reaches $20-odd million, and attracts takeover suitors.

Can Australia emulate Ireland's culture of communication between researchers and companies interested in commercialising their discoveries?

Prof Gannon doubts there is a simple remedy for the science-industry disconnect in Australia: "Culture is very hard to define, and harder to prescribe, but change must be encouraged, and we need examples of success to provide that encouragement."

He says when he became director-general of Ireland's Science Foundation, he conducted an annual census of foundation-funded research that asked how many researchers worked in each laboratory, how many publications they produced, whether they were working with companies to commercialise their discoveries, and how often they met for talks with company representatives and what they talked about.

"What the census showed was that there was healthy engagement with industry at the start, and at the end. Three-quarters of the researchers were actively collaborating in jointly funded projects with industry - by regularly asking each other questions, there was a much better transition from discovery to commercialisation.

Prof Gannon believes Australia's proposal to create a $20 billion Medical Research Future Fund, however it is funded, would not only boost the volume and quality of medical research in Australia but could catalyse the development of more commercially focused culture in research.

"Australia has a single funding agency for medical research - the National Health and Medical Research Council. It does an excellent job, but it creates a particular culture, and there are gaps in its coverage," he said.

"The success rate for grant applications is diminishing, which reduces the motivation to work hard.

"The projects that do win grants are often underfunded, which means the universities or research institutes that host the projects have to find extra money to support them.

"There's also a trend away from funding individuals, and the number of researchers on fellowships seems to be dwindling - fellowships are seen as just one phase of a career, rather than an opportunity to pursue an entire career in research.

"A Medical Research Future Fund would promote better connections between clinicians and researchers, by freeing up time for clinicians to do more research. It would provide more funds for translating research through industry and provide funding for clinical trials."

Prof Gannon said increased funding would reduce the time researchers currently spend writing grant applications or seeking funding. They would have more time to do high-quality research and become involved in commercialising their own discoveries.

Separation-electrospray ionisation system for mass spectrometry

AB Sciex has introduced technology called CESI-MS, enabling biopharmaceutical scientists to predict efficacy, reduce the time to market for therapeutics and detect potential issues before they lead to product recalls.

CESI marks a combination of capillary electrophoresis (CE) and electrospray ionisation (ESI) technologies. The workflow includes an ultralow-flow separation and ESI module for biologics, along with a high-performance, high-resolution, accurate mass instrument that is suitable for biopharmaceutical development.

The CESI 8000 System for Biologics Characterization is a separation-electrospray ionisation system for mass spectrometry (MS). The technology can be integrated with the AB Sciex TripleTOF 5600+ mass spectrometry system into a seamless solution.

The product is said to provide orthogonal and/or superior results compared to dual-method liquid chromatography/mass spectrometry-based approaches. From a single digest and run, users gain the following: identity and purity information with 100% coverage in a peptide map; heterogeneity information with ultrasensitive glycopeptide quantitation; stability information identifying, deamidation, cyclisation and oxidation.

The technical benefit delivered by the innovation is an improvement in biophysicochemical characterisation to guide the development of biologics-based therapeutics. CESI-MS serves to improve ionisation efficiency and reduce ion suppression.

AB SCIEX Australia Pty Ltd
www.absciex.com

Variable beam expanders

Edmund Optics Techspec Variable Beam Expanders offer continuous magnification for high-power laser applications where magnification changes may be required, including prototyping or research and development.

The product provides 1-3X and 2-8X continuous magnification. Design features include a 1/4λ transmitted wavefront, while its high laser damage threshold anti-reflective (AR) coatings ensure maximum transmittance while minimising ghost reflections.

The expander uses non-rotating internal translation and focusing mechanisms to continuously adjust magnification and laser divergence without any effect on the overall housing length. Its compact design eliminates the need to make system accommodations for changes in length and simplifies system integration. It easily adjusts for laser beam divergence.

The product is available in two different magnification ranges - from 1-3X or 2-8X - for 532 nm, 1064 nm or broadband visible wavelengths. Custom fixed magnification requirements can also be accommodated.

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When using generic labels, researchers run the risk of having ink dissolve, disappear or become illegible. Brady ensures sample integrity by offering identification labels that remain intact for life, ensuring traceability through the entire chain of custody.

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Brady understands it is imperative to be legislation and regulation compliant. The company's team of specialist lab chemists is dedicated to developing and testing solutions to enable users to comply with Good Lab Practice and the Human Tissue Directive.

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www.bradyaust.com.au

Graeme O'Neill

GM crops
New directions

It's 2014, and grain farmers in South Australia, Tasmania and the ACT are still forbidden to plant genetically modified, herbicide-tolerant (GMHT) canola.

Australia's GM crop revolution has stalled, after an auspicious debut in 1989 when South Australia became the first state in the world to release a genetically modified organism into the environment.

A quarter of a century later, only two GM crops are grown commercially in Australia: herbicide-tolerant canola and pest-resistant cotton. With such a modest record of uptake, whither GM crops in Australia?

Roger Hellens, Professor of Agricultural Biotechnology at the Queensland University of Technology, is an invited speaker at the Agriculture and Food Technology Symposium that forms part of this month's (29-31 October) AusBiotech 2014 Life Science Conference at the Gold Coast Convention and Exhibition Centre. He has titled his talk 'New emerging technologies - benefits and challenges'.

Hellens believes GM crops still have a bright future in Australia, but the next generation of GM crops will focus on traits providing health benefits to consumers, rather than agronomic benefits to farmers.

And they will be created with new molecular tools that permit molecular breeders to achieve big changes from minimal modifications to plant DNA, without disrupting crop genomes.

Hellens says the new tools and techniques are narrowing the gap between conventional and molecular plant breeding, so in theory, they should be an easier sell to consumers.

But he suggests it would be naive to believe the anti-GM movement will retreat from its implacable opposition to all GM crops, irrespective of how they are produced, or the efforts made to make very subtle changes to crop genomes, that merely replicate gene variants - alleles - that already occur in nature.

"They just don't like the technology," he said. "We can address most of their concerns, but they have an unfathomable opposition to all GM crops," he said.

Hellens says governments responded to the anti-GM paranoia of the past 25 years by creating complex regulatory schemes to reassure consumers that GM crops were no threat to human health or the environment.

And the first shall be last

In 1989, Australia became the first nation to release a genetically modified organism (GMO) into the environment with the historic release of a modified strain of the crown gall bacterium *Agrobacterium tumifaciens*.

Professor Alan Kerr's modified strainprev, marketed around the world as NoGall, suppresses pathogenic strains of the same microbe infecting young stone and pome fruit trees. It was released at a ceremony at the Waite Agricultural Research Institute in South Australia.

South Australia led the world into the age of GM agriculture, yet today is the only mainland state that maintains a moratorium on genetically modified canola, and all other GM crops - Tasmania and the ACT also maintain their bans on GM canola.

SA's moratorium has the support of all major and minor political parties in the state, and the current ALP government has no plans to lift it before 2019.

NSW and Victoria ended their four-year moratoria in 2008; WA followed suit, belatedly, after a change of government in 2010. GMHT canola is still banned in Tasmania and the ACT.

The only other GM crop commercialised in Australia is pest-resistant cotton, which is grown in NSW and southern Queensland, and accounts for 95% of Australia's cotton production.

Cotton was the first GM crop to be commercialised in Australia, in 1996. Today's varieties carry two transgenes for insecticidal toxins from the soil-dwelling bacterium *Bacillus thuringiensis*, which are highly lethal to destructive caterpillars of *Helicoverpa* moths. Some cotton varieties carry an additional gene that confers tolerance to the broad-spectrum herbicide glyphosate.

Many other GM crops or pasture species are in development, in field trials or are awaiting commercial release. They include the grain crops wheat, maize and barley; the oilseed crops canola, Indian mustard and safflower; pasture species like perennial ryegrass, tall fescue and white clover; sugarcane and horticultural crops including banana, papaya, pineapple and grapevines.

But some new molecular breeding techniques veer so close to conventional plant breeding that any attempt to bring them within current regulatory nets could end up entangling advanced conventional breeding techniques that have been in use for decades.

They could impede long-established breeding practices such as the use of 'wide crosses' to import germ plasm from distant wild relatives, or from natural field mutants that have arisen under selection pressure from herbicides or pathogens.

Hellens says that in some jurisdictions, existing regulatory regimes may not extend to novel techniques like in situ editing of genes to create useful new alleles.

Rapid, inexpensive next-generation sequencing has made these new approaches feasible, allowing researchers to zero in on single-nucleotide polymorphisms that give rise to useful developmental or metabolic traits.

Hellens said the use of *Arabidopsis* as a model for identifying genes that could be transferred in to crop plants was laborious. The simple *Arabidopsis* phenome - the sum total of all the species' phenotypic traits - was too small to represent the more complex phenomes of crop species, with their suites of genes.

"Next-generation sequencing makes it easy to relate traits to variations in sequence data from the transcriptomes of crop species," Hellens said. "It allows you to focus on traits of importance to particular crops.

"You can then look for production traits or consumer traits in a much more targeted way. It's been a real change, being able to offer traits that industry is more interested in.

"In the past, it was researchers trying to tell companies which traits they should commercialise."

Hellens says plant biotechnology is a "fascinating" field to work in. "What people care about is the product, but they tend to be hung up about the way the product is made.

"In just about every country except Canada, it's the technology that is regulated, not the trait. Most technologies can be used to advantage.

"The irony about regulating the trait is that the technology is generic.

"People are more comfortable with modern breeding techniques than they are with the GM approach, even though modern breeding is quite interventional.

"With the GM approach, there have been important developments in our ability to edit genomes in ways that were just not possible a few years ago. We can now go in and make precise changes to the DNA of a crop species, without affecting other parts of the genome.

"These changes are informed by new knowledge of the allelic diversity in already familiar germplasm.

"We now have the ability to change the DNA of a crop plant to replicate a desirable allele identified in a wild relative. With conventional breeding, it can take years of hybridisation and back-crossing to import an allele of interest, and it usually comes along with linked haplotypes that can be detrimental to what you're trying to achieve."

Hellens says the acetolactate synthase (ALS) gene from *Arabidopsis* is a case in point - a single point mutation in the ALS gene confers resistance to the herbicide chlorsulfuron urea. The gene is highly conserved across dicots and monocots, including rice.

'Tweaking' the wild-type gene in highly productive cultivars such as wheat or rice, to re-create the spontaneous mutation in *Arabidopsis*, would result in elite cultivars that could be sprayed with low concentrations of chlorsufuron urea to eliminate weeds.

"If an advantageous allele for a trait exists in nature, modern molecular breeding techniques like oligo-directed mutagenesis can now be used to

replicate it in commercial cultivars of crop species," Hellens said.

Hellens' own research in recent times has focused on the biosynthesis pathways in fruit that produce flavonoid compounds and vitamin C, both potent antioxidants with potential health benefits for humans.

But his team's work to increase vitamin C concentrations in fruit has a broader goal: dietary vitamin C is crucial to the body's ability to absorb iron. "Increasing vitamin C in plants doesn't affect the concentration of iron in the plant, but it does enhance the body's ability to absorb iron," Hellens said.

"Around 1.6 billion people around the globe are chronically anaemic because they don't absorb enough iron from their diet. Elevating vitamin C concentrations in the diet could help correct iron-deficiency anaemia."

Hellens says his team's research has determined not only how vitamin C is made in fruit, but how its production is regulated.

Hellens says his team's studies of kiwifruit, which has 50 times the vitamin C of oranges, and Australia's Kakadu plum, *Terminalia ferdinandiana*, which has the highest concentration of vitamin C of any fruit in the world - 200 times more than oranges - have revealed that a single nucleotide substitution in the regulatory region of an enzyme involved in vitamin C biosynthesis changes one peptide in the enzyme, resulting in a very large increase in vitamin C concentration.

Vitamin C from fruits is more readily absorbed by the human gut than vitamin C in the form of ascorbic acid tablets, sold by chemists.

"Although we're only at the preliminary stages of the project, because we now understand the mechanism involved, we have the tantalising prospect of elevating vitamin C concentrations in other plants in the human diet," Hellens said.

"We could prevent anaemia and keep people alive and healthy by editing the genomes of important commodity crops to replicate naturally occurring alleles in high-vitamin C species like kiwifruit, Kakadu plum, Amazonian fruits like acerola and camu camu, or the Indian gooseberry," Hellens said.

Targeted methylation or demethylation of genes, and homologous recombination, are among future tools for manipulating the activity of genes in situ in crop plants.

Hellens says it is already possible to demethylate genes, but selectively silencing genes by target methylation is not yet feasible - however, it may be possible, by demethylating repressor genes, to activate dormant downstream genes, to achieve gain-of-function traits, Hellens said.

Modifying genes in situ by homologous recombination has been used for years to create transgenic animals, but researchers have yet to find a way of making it work reliably in plants.

"I once drew an analogy between modern molecular genetics and toolmaking: all primitive tools were developed to join things, or separate them - the same is true of most of the power tools in a modern garage," Hellens said.

"Most of the things we do involve breaking or cutting DNA, and sticking it together again. Some of the emerging tools of molecular genetics are very good at making precise cuts, and excising DNA sequences with precision.

"But we're not particularly good at sticking things back together again. It's particularly true for plant DNA.

"I believe that, in the future, we will develop a better understanding of the mechanisms involved in homologous recombination.

"When conventional plant breeders introduce a gene into a crop, and back-cross, they are doing basically the same thing - double-strand breaks are required for the recombination events that lead to the hybrid progeny, so you're further blurring the differences between molecular genetics and conventional breeding."

Hellens says that for virtually every trait of importance in crop plants, there will be a pool of genetic diversity within the crop and its wild relatives to improve it. Rather than install the allele of interest, the preferred approach will be to use homologous recombination to 'overwrite' the gene in situ in the crop plant - the trait might affect yield, disease resistance, drought tolerance, dwarfing - "We know that lots of alleles exist in the wild, and we can use them," he said.

"Many traits are multigenic, but I don't believe any trait is so complex that it is not amenable to molecular dissection.

Corrosive storage cabinet range

The Polystore corrosive storage cabinet is suitable for containing corrosive chemicals and substances in the laboratory. Available in a wide range of sizes, the cabinet offers a safe, stylish storage option featuring no internal metal parts, fire-retardant polypropylene construction, self-closing, lockable doors and a liquid-tight sump.

The cabinet can be custom-made to the user's requirements and dimensions. It is available with adjustable and removable shelving. The corrosive storage cabinet has undergone many years of development and testing and is compliant to Australian Standard AS/NZS 3780 and AS/NZS 2243.10.

Additional sizes have been introduced into the range, including 150, 200 and 250 L, all with dividers to separate acids and bases under the one footprint. This adds to the existing range of 50 and 100 L, providing a complete storage range to suit all requirements.

Laboratory Systems Group
www.labsystemsgroup.com

DNA dye for live and fixed cells

DRAQ5 is a robust, far-red fluorescent dye that rapidly stains dsDNA and nuclei of live and fixed cells. The product is highly photo and chemically stable and easy to use, requiring no lyse, wash or RNase treatment. The dye is suitable for use in multicolour analysis and is compatible with a range of other dyes (eg, GFP and FITC) as it does not excite in the UV range, avoiding complications of autofluorescence.

The dye has many applications and is highly compatible with existing protocols across a wide range of instrumentation platforms. It is a suitable DNA stain in applications including IF nuclear counterstaining; HCS/IVT counterstaining; nucleated cell gating; DNA content/cell cycle analysis; in-cell Western assays.

Sapphire Bioscience
www.sapphirebioscience.com

Laboratory information management system

Lims1 is an easy and flexible laboratory information management system. The fully integrated system takes care of all data requirements including sample registration, allocation of testing, result entry, data acquisition from instruments and external sources, approvals and reporting.

The system combines ease of use with a high degree of flexibility. Productivity modules provide enhanced capabilities for specialised tasks and can be added to meet individual needs.

Version 9.3 was released earlier this year and users are said to be reporting enhanced productivity in the areas of sample registration, analysis and approval. Enhanced tracking of recurring samples has reduced data entry at registration, provided historical feedback at time of result entry and provided unlimited categories and filters for summary reporting.

Upgrades to Lims1 Script Server provide improved automation for routine data transfer tasks. Files can be dropped into defined directories and from then are automatically processed. Uses include importing of instrument data, external results and field results.

LTech Australia Pty Ltd
www.lims1.com

Purification system

WR Grace & Co has announced the release of the Reveleris Prep purification system - a dual-mode instrument that allows organic chemists, preparative chromatographers and other researchers to perform both flash and preparative liquid chromatography (LC) using a single unit.

Researchers can easily switch between flash and preparative chromatography modes with a simple touch of the screen, giving them complete control over the purification process and saving them time. The dual mode capability eliminates the need to change locations or departments when switching between flash and prep LC processes.

The instrument saves space in the laboratory and is said to reduce capital costs for equipment between 40 and 50%. The system incorporates Grace's Revealx detection technology which triggers fraction collection from multiple detector signals, yielding higher purity compounds in less time.

Grace Davison Discovery Sciences
www.discoverysciences.com/au

Top-loading autoclave

The Priorclave C60 top-loading autoclave is suitable for laboratories with limited floor space or a high-density load requirement. The product is equipped with castors, enabling it to be easily moved when required, and easily plugs into a 13 A socket to power up. It has a 60 L stainless steel chamber and requires just 472 x 620 mm of floor space.

Through the push-button Tactrol 2 microprocessor control system, users program the sterilising parameters of time and temperature as well as select special features such as free steaming and media warming. Free steaming can improve air removal in difficult loads and/or reduce temperature lag between the load and the autoclave, reducing process time at higher temperatures. Media warming cycles the temperature between 45°C and 55°C once the pre-set temperature of 45°C is reached, which is continuous until the door is opened. This allows nutrient media to be held as a liquid until it is needed.

Access to the sterilising chamber is gained through the Quickseal single-action door closure/opening mechanism, which is designed for one-handed operation and incorporates thermal and pressure locks that prevent opening at unsafe temperatures and pressure to prevent personal injury. Priorclave has incorporated Biomaster Protection into the exterior epoxy coating - an effective and permanent treatment for control of harmful bacteria providing durable protection against the threat of cross contamination.

Bio-Strategy Pty Ltd
www.bio-strategy.com

Kits for CRISPR/Cas9 genome editing

CRISPR/Cas9 technology offers an efficient, simple system for targeted genome editing. Guide-it products are said to improve the CRISPR/Cas9 workflow by providing a streamlined method.

The Guide-it sgRNA In Vitro Transcription Kit can produce high yields of sgRNA in vitro - over 4 μg of sgRNA can be transcribed per in vitro reaction. The Guide-it sgRNA Screening Kit provides an optimised in vitro assay to estimate sgRNA-directed Cas9 cleavage efficiency. The Guide-it Mutation Detection Kit contains all the reagents needed to quickly and easily confirm insertions or deletions generated using CRISPR/Cas9.

Scientifix Pty Ltd
www.scientifix.com.au

Rotary evaporators

Heidolph has released of the Hei-VAP Industrial series of rotary evaporators. The powerful glass-covered touch-screen controller design allows for easy and efficient control of standard and complex distillation processes.

Features include bumping protection as well as fully automated product boiling-point detection and tracking. In combination with Distimatic systems, the evaporators can perform automatic distillation in both batch and continuous processes, enabling processing of virtually unlimited batch sizes.

Focusing on operator safety, the series is equipped with illuminated on/off switches for heating functions to prevent accidental activation. Further safety features include two independent overheat protection circuits; an emergency cutoff switch which completely shuts down all evaporator functions; automatic vacuum-leak safety cutoffs; implosion-protection housings; and IP67 compliant electrical connections.

The easy-clip-flask connection system allows for ergonomic single-operator flask changes, providing user safety and reducing operator cost. A self-filling and level-maintaining bath eliminates the need for users to manually top up water before, during and after evaporation runs. The evaporators have a life expectancy of over 10 years, with minimal consumable cost.

Scitek Australia Pty Ltd
www.scitek.com.au

It is estimated that the average researcher reads about 23 scientific papers per month, which adds up to around 300 per year. At the same time, it is claimed that a new scientific research paper is published nearly every 30 seconds, which equals more than a million annually. This means that the average researcher is missing out on 999,700 papers each year.

So much information, so little time

© iStockphoto.com/Skip ODonnell

To be fair, researchers really only want to read papers specific to their particular field of interest, so the figure above is highly exaggerated. However, say you are interested in the protein p53, which is implicated in tumour suppression - so far about 70,000 scientific papers have been published about the protein. Even reading five of these papers each day, seven days a week, it will take you 38 years to catch up on all the published papers about p53.

The sciences are producing huge amounts of data and it is humanly impossible to keep up with this ever-growing body of scientific material. How can researchers deal with this volume of information? It seems the answer may be "Elementary, my dear Watson."

Elementary, my dear Watson

In truth, Sherlock Holmes and his mate Watson have absolutely nothing to do with IBM's Watson. However, researchers can uncover new relationships and recognise unexpected patterns among data that have the potential to significantly improve and accelerate the discovery process in research and science using Watson's computing power.

Named after IBM founder Thomas J Watson, IBM Watson uses natural language processing and analytics to process information akin to how people think. This represents a major shift in an organisation's ability to quickly analyse, understand and respond to big data. Watson's ability to answer complex questions posed in natural language with speed, accuracy and confidence is transforming decision-making across a variety of industries.

Available now as a cloud service, IBM's Watson Discovery Advisor is designed to scale and accelerate discoveries by research teams. It reduces the time needed to test hypotheses and formulate conclusions that can advance their work - from months to days and days to just hours - bringing new levels of speed and precision to research and development.

Building on Watson's ability to understand nuances in natural language, Watson Discovery Advisor can understand the language of science, such as how chemical compounds interact, making it a powerful tool for researchers in life sciences and other industries.

Researchers and scientists from leading academic, pharmaceutical and other commercial research centres have begun deploying IBM's new Watson Discovery Advisor to rapidly analyse and test hypotheses using data in millions of scientific papers available in public databases.

In 2013, the top 1000 research and development companies spent more than $600 billion annually on research alone. Progress can be slow, taking an average of 10 to 15 years for a promising pharmaceutical treatment to progress from the initial research stage into practice. Using Watson Discovery Advisor, researchers can uncover new relationships and recognise unexpected patterns among data that have the potential to significantly improve and accelerate the discovery process in research and science.

Drug targets

In a retrospective study Baylor College of Medicine and IBM scientists demonstrated a possible new path for generating scientific questions that may be helpful in the long-term development of new, effective treatments for disease.

In a matter of weeks, biologists and data scientists using the Baylor Knowledge Integration Toolkit (KnIT), based on Watson technology, accurately

identified proteins that modify p53, which can eventually lead to better efficacy of drugs and other treatments - a feat that would have taken researchers years to accomplish without Watson's cognitive capabilities. Watson analysed 70,000 scientific articles on p53 to predict proteins that turn on or off p53's activity.

This automated analysis led the Baylor cancer researchers to identify six potential proteins to target for new research. These results are notable, considering that over the last 30 years, scientists averaged one similar target protein discovery per year.

Drug re-purposing

Multinational pharmaceutical company Sanofi is exploring how working with Watson can speed up the discovery of alternate indications for existing drugs (drug re-purposing). Watson is able to understand and extract key information by reading millions of pages of scientific literature and then visualise relationships between drugs and other potential diseases they could target while providing supporting evidence each step of the way.

Drug safety and toxicity is a major driver of the high failure rate in clinical development and trials. Sanofi is exploring how Watson's ability to understand, extract and organise toxicological information can enable researchers to make better informed decisions with respect to candidate progression

Genomic medicine

Despite tremendous discoveries into the genetic drivers of diseases like cancer over the past decade, big data makes it difficult to translate DNA data into life-saving treatments. Based on results from the clinical study, IBM Watson could soon help scale up the availability of personalised treatment options.

IBM Watson will be supporting the analysis in New York Genome Center's clinical study to advance genomic medicine. The clinical study will initially focus on clinical application of genomics to help oncologists deliver DNA-based treatment for glioblastoma, an aggressive form of brain cancer.

Clinical trials

Johnson & Johnson is collaborating with the IBM Watson Discovery Advisor team to teach Watson to read and understand scientific papers that detail clinical trial outcomes used to develop and evaluate medications and other treatments. This collaboration hopes to accelerate comparative effectiveness studies of drugs, which help doctors match a drug with the right set of patients to maximise effectiveness and minimise side effects.

Typically, comparative effectiveness studies are done manually, requiring three people to spend an average of 10 months (2.5 man-years) just to collect the data and prepare them for use before they are able to start analysing, generating and validating a hypothesis.

In this research study, the team hopes to teach Watson to quickly synthesise the information directly from the medical literature, allowing researchers to start asking questions about the data immediately to determine the effectiveness of a treatment compared to other medications, as well as its side effects.

Mayo Clinic and IBM have announced plans to pilot Watson to match patients more quickly with appropriate clinical trials. A proof-of-concept phase is currently underway, with the intent to introduce it into clinical use in early 2015.

"In an area like cancer - where time is of the essence - the speed and accuracy that Watson offers will allow us to develop an individualised treatment plan more efficiently so we can deliver exactly the care

that the patient needs," says Steven Alberts, MD, the chair of medical oncology at Mayo Clinic.

Researchers hope the increased speed also will speed new discoveries.

Clinical trials provide patients with access to new and emerging treatments, yet enrolling participants in trials is one of the more difficult parts of clinical research. Currently it is done manually, with clinical coordinators sorting through patient records and conditions, trying to match them with the requirements of a given study protocol. At any given time, Mayo Clinic is conducting over 8000 human studies in addition to the 170,000 that are ongoing worldwide. Watson's cognitive computing ability will help sift through available Mayo clinical trials and ensure that more patients are accurately and consistently matched with promising clinical trial options.

"With shorter times from initiation to completion of trials, our research teams will have the capacity for deeper, more complete investigations," says Nicholas LaRusso, MD, a Mayo Clinic gastroenterologist and the project lead for the Mayo-IBM Watson collaboration. "Coupled with increased accuracy, we will be able to develop, refine and improve new and better techniques in medicine at a higher level."

A version of Watson will be specially designed for Mayo Clinic. As it progresses in its tasks and matures through this collaboration, it will learn more about the clinical trials matching process, becoming even more efficient and likely more generalisable. Watson also may help locate patients for hard-to-fill trials, such as those involving rare diseases.

Many clinical trials at Mayo Clinic and elsewhere are not completed due to lack of sufficient enrolment. Enrolment in general could be increased by the Watson project. In spite of well-organised efforts, even at Mayo Clinic, just 5% of patients take part in studies. Nationally, the rate is even lower, at 3%. Mayo hopes to raise clinical trial involvement to include up to 10% of its patients. Researchers say higher participation also should improve the quality of research outcomes.

To ensure Watson has the required expertise to assist with clinical trial matching, Mayo experts are working with IBM to expand Watson's corpus of knowledge to include all clinical trials at Mayo Clinic and in public databases, such as ClinicalTrials.gov. The new Watson system is being trained to analyse patient records and clinical trial criteria in order to determine appropriate matches for patients.

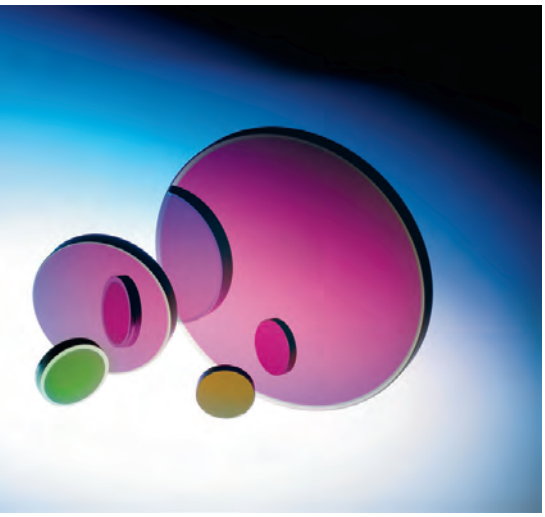
In the cloud

Last January, the IBM Watson Group introduced three new cloud-delivered services:

- IBM Watson Discovery Advisor aims to revolutionise how industries such as pharmaceutical and publishing conduct research.
- IBM Watson Analytics allows users to explore big data insights through visual representations, without the need for advanced analytics training.
- IBM Watson Explorer is designed to help users across the enterprise uncover and share data-driven insights more easily, while helping organisations launch big data initiatives more quickly.

All three of these new Watson services are fuelled by IBM Watson Foundations, a comprehensive, integrated set of big data and analytics capabilities that enable clients to find and capitalise on actionable insights.

IBM Australia Limited
www.ibm.com/au



IR optics featuring BBAR coatings

Edmund Optics introduces an expanded offering of off-the-shelf infrared (IR) optics featuring broadband antireflective (BBAR) coatings. These include 3-5 μm coating options on Silicon PCX Lenses and Silicon Windows and 8-12 μm coating options on Germanium PCX Lenses and Germanium Windows.

Techspec Silicon (Si) Windows and PCX Lenses are manufactured from optical-grade silicon, which is characterised by a low density of 2.329 g/cm^3, making it suitable for weight-sensitive applications. Techspec Silicon optics are available with a 3-5 μm BBAR coating in a range of sizes. The lenses and windows feature precision polished surfaces, suitable for a variety of IR applications including IR spectroscopy.

Techspec Germanium Windows and PCX Lenses are available with 3-12 and 8-12 μm BBAR coatings and are suitable for use in IR applications that require rugged optics. Germanium is a durable material which is inert to air, water, alkalis and most acids. Techspec Germanium Lenses offer minimal chromatic aberration due to low dispersion. The optics are suitable for a variety of IR applications, including thermal imaging, IR spectroscopy and remote sensing, and are available in a range of sizes.

The company offers over 650 stock IR optic designs on a range of substrates, including calcium fluoride (CaF_2), UV fused silica, germanium (Ge), sapphire, silicon (Si), zinc selenide (ZnSe) or zinc sulfide (ZnS). Additionally, Edmund Optics offers quick modifications to stock components to take the user's project from design to prototype to volume production.

Edmund Optics Singapore Pte Ltd
www.edmundoptics.com

Pipettes

HTL has launched the Discovery Pro pipette - a product with low mass and light piston actions. The body of the pipette is carefully engineered to comfortably accommodate those with large or small hand shapes and sizes.

The product's contoured shape eases the required grip strength, and is said to make pipetting motions effortless. The tip ejection force is said to have been reduced by more than 30% due to the push-button-lever system. All internal components are thermally insulated from the handle, eliminating heat transfer from the hand and ensuring accuracy and precision.

Equipped with a volume setting/locking mechanism, a 4-digit counter and a soft, thumb-friendly spring system, smooth pipetting is ensured for both 8- and 12-channel pipettes. The pipettes are fully autoclavable, can be user calibrated and come with a shelf- or wall-mountable storage hook.

The pipettes are compatible with tips from major manufacturers; Pacific Laboratory Products recommend using Axygen Maximum Recovery and Gentle Fit tips due to their good quality, accuracy and ergonomics. The single-channel pipettes can be purchased individually or in a four pack, which includes 10, 20, 200 and 1000 μL pipettes, a linear rack and tips.

Pacific Laboratory Products
www.pacificlab.com.au

Automated electrophoresis system

The Nimbus Workstation with Ranger Technology provides a fast and economical automated solution to agarose gel selection of DNA fragments, generating high-quality material for downstream use in next-generation sequencing (NGS), cloning and gene synthesis applications.

Agarose gel size selection is a key component in sample preparation and quality control used throughout the life sciences. By automating pipetting steps, the product eliminates the labour-intensive and error-prone step of manual gel preparation. In an average 2 h run, the workstation can accurately process up to 96 samples and then place the fragments in destination labware.

The unit offers numerous performance and quality-control benefits over manual processing and other automated platforms. As an open automation platform, the workstation can be used for many applications and works with multiple NGS instrument manufacturers. The instrument's 96-channel CO-RE head provides a pipetting dynamic range of 1 to 1000 μL.

Because sample processing does not always come in precise 96-sample batches, the workstation has the built-in flexibility to automate workflows from one to 96 samples at a time. Quality-control metrics, including individual gel images and electropherogram traces, are captured for each sample.

Bio-Strategy Pty Ltd
www.bio-strategy.com

Pipetting system

The Thermo Scientific ClipTip pipetting system features innovative interlocking technology that lets the user feel the tips lock firmly in place with just a light touch.

The product ensures no more banging tips on pipettes and no dropped tips that waste valuable samples. The seal on every channel delivers consistent, accurate volumes.

Thermo Fisher Scientific
www.thermofisher.com.au

Looking inside

a working lithium-ion battery

For the first time, researchers have been able to open a kind of window into the inner workings of a lithium-ion battery. Using a neutron beam, the researchers were able to track the flow of lithium atoms into and out of an electrode in real time as a battery charged and discharged.

It is hoped that neutron depth profiling (NDP) could one day help explain why rechargeable batteries lose capacity over time, or sometimes even catch fire.

Ohio State University researchers are using the technique to test new, high-capacity electrode materials, including ones containing tin, silicon, germanium and aluminium. These alternative electrodes could be capable of storing nearly three times as much energy as graphite, the material of choice in current lithium-ion batteries. They may also be less prone to overheating.

Marcello Canova, assistant professor of mechanical and aerospace engineering at Ohio State, explained that researchers could only measure a lithium-ion battery's output (in voltage and current) and then make computer models of what might be going on inside - a process that he likened to "trying to study the combustion processes in a car engine when all you can do is measure the torque and speed at the wheels".

"This is the first time that anyone has been able to directly verify how the lithium concentration evolves in space and time within the electrode of a live battery cell containing a typical wet electrolyte," he said. "We believe this will pave the way to an improved understanding of the material and chemical processes that power batteries."

NDP is a well-known technique in nuclear research. It's also used in the semiconductor industry, where it measures the concentration of dopants in silicon wafers. The Ohio State team is the first to further develop NDP into a tool to investigate lithium transport phenomena in normal, working batteries during charging and discharging.

For this study, the research team developed their methodology at The Ohio State University Research Reactor and acquired the final data at the National Institute of Standards and Technology's Center for Neutron Research where they were assisted by the facility scientist, R Gregory Downing.

NDP works in a way somewhat analogous to an MRI, in that it non-invasively captures images of an object's interior. In the same way an MRI can record

a series of image slices over time to capture changes in moving tissue, such as the inflation of a lung while a person is breathing, NDP can measure how the composition of a slice of material changes over time.

But whereas an MRI subjects materials to a magnetic field and measures how the polarity of the atoms in that material change, NDP hits materials with a low-energy neutron beam and counts the different kinds of charged particles that are created when an individual neutron happens to collide with one of the atoms in the test material and annihilates it.

"Just like an MRI is the best way of seeing inside the human body without cutting it open, we believe that NDP is the best - and one of only a few - techniques capable of taking a non-invasive look inside a lithium-ion battery," said Anne Co, assistant professor of chemistry and biochemistry and associate fellow at Ohio State's Center for Automotive Research. The images they've obtained thus far are two-dimensional, but with further development, 3D imaging might be possible, she added.

Lithium-ion batteries are popular in cars and handheld electronics because they are light and powerful, though their charge capacity still fades over time.

"One possible explanation for the fading is that lithium is becoming trapped inside the electrodes, and NDP would be an ideal method to see and quantify trapped lithium," Co said.

The researchers measured the concentration of lithium in the battery anode - the negative electrode where positively charged lithium flows in as the battery charges and out as the battery discharges. Normally, anodes in lithium-ion batteries are made of graphite, but for this experiment, the researchers replaced the graphite with a tin alloy.

Key to the experiment, said L Raymond Cao, assistant professor of nuclear engineering, is that it was non-invasive, so researchers could get a true picture of battery function. Though NDP's annihilation of lithium atoms doesn't sound very non-invasive, Cao explained that these low-energy neutron collisions very rarely happen and therefore couldn't interfere with the normal performance of the battery.

"We could hit it with a trillion neutrons per square centimetre and the beam would still only consume one in a billion lithium atoms inside the battery," Cao said. "However, it is the capture of that one-in-a-billion reaction that tells us where the lithium ions are and how many."

In a working lithium-ion battery, the lithium must flow through a liquid electrolyte that fills the space between the cathode and anode - and that fact alone created the experiment's main challenge. NDP only works inside a vacuum chamber, and vacuums vaporise liquids. That's why another group of researchers in a 2011 study used a solid-state battery - that is, one in which the electrolyte was made from solid material.

The researchers got around the problem by sealing their test battery in a special holding cell designed and tested by Danny Liu, a doctoral student in chemistry and biochemistry at Ohio State. That's how they were able to measure lithium concentration in a truly typical lithium-ion battery, containing electrolyte and all.

In the future, the team will try to identify the factors that cause lithium to become trapped in anodes and investigate new materials that might lessen the effect. Along the way, they hope to find ways to boost overall charge capacity. Aside from battery studies, the researchers say that NDP also holds promise for examining certain materials for solar cells and catalysts, including materials that are used to treat nuclear waste.

The research has been published in the journal *Angewandte Chemie International Edition*.

More funding for medical research

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Research into new treatments, improved research translation and Indigenous youth suicide are some of the areas that will benefit from the latest round of 95 NHMRC grants, totalling $71.2 million.

Announced by Health Minister Peter Dutton, funding of $54.6 million will support 74 NHMRC Research Fellowships and 28 current fellowship extensions. A further $8 million will go towards 17 Practitioner Fellowships and $4.5 million will support four grants that form part of the one-off Mental Health Targeted Call for Research (TCR) into Indigenous youth suicide.

Professor Anthony Jorm from the University of Melbourne and his team are one of the lucky four groups to receive a TCR grant. They will use the funding to develop new guidelines to support Indigenous communities to prevent suicide and self-injury amongst their young people. Community members will be trained to act as gatekeepers, identifying young people who are at risk and referring them to health workers with greater health expertise.

Senior researcher Associate Professor David Booth, from the University of Sydney, received an NHMRC Research Fellowship to build on his work into the causes of multiple sclerosis as well as test a number of therapies he has helped develop. He will apply similar 'omics'-based techniques to evaluate treatment for viral diseases such as HIV.

Further information can be found on the NHMRC website.

veski Innovation Fellowships

Applications are open for one of Victoria's leading research fellowships programs, the veski Innovation Fellowships.

Announced by the Victorian Minister for Innovation, Louise Asher, the veski Innovation Fellowships provide $150,000 over three years against matched and in-kind funding to support researchers working overseas in relocating their research activities to Victoria.

The fellowships are open to expatriate Australian and non-Australian researchers working in biotechnology, biomedical, advanced manufacturing - including food science and bioengineering, environmental technologies and enabling sciences.

The fellowships are managed by veski and funded by the Victorian Government. veski was established in 2003 with an endowment from the Victorian Treasury. The annual interest earned is used to help fund the fellowships.

Applications close on Friday, 14 November 2014.

Go to the veski website for more information and how to apply.

Call for ideas to partner with GSK

GSK is calling on scientists, researchers, innovators and start-up companies to submit ideas to the Open Innovation challenge. Ideas that match specific criteria will have the chance to partner with GSK and be developed through to commericalisation.

Ideas will need to be health-related and in the areas of nutrition, wellness, oral health or skin health. Successful entrants will be provided with resources and support to potentially turn their idea into a commercial reality.

GSK has a proven track record of turning inspired product ideas into household names. For example, Sensodyne Repair and Protect toothpaste began as an initiative by two Florida dentists, who adapted US military technology for mending bones into an oral health solution. This created NovaMin which, combined with saliva and water, crystallises to form a mineral similar to natural tooth mineral. GSK saw the potential in the innovation and built a partnership with the team. Together they developed the first daily toothpaste to repair sensitive teeth, which has helped millions of people with tooth sensitivity.

GSK Innovation healthcare spokesperson Montse Pena said that GSK is excited to be promoting this opportunity to innovators in Australia and New Zealand.

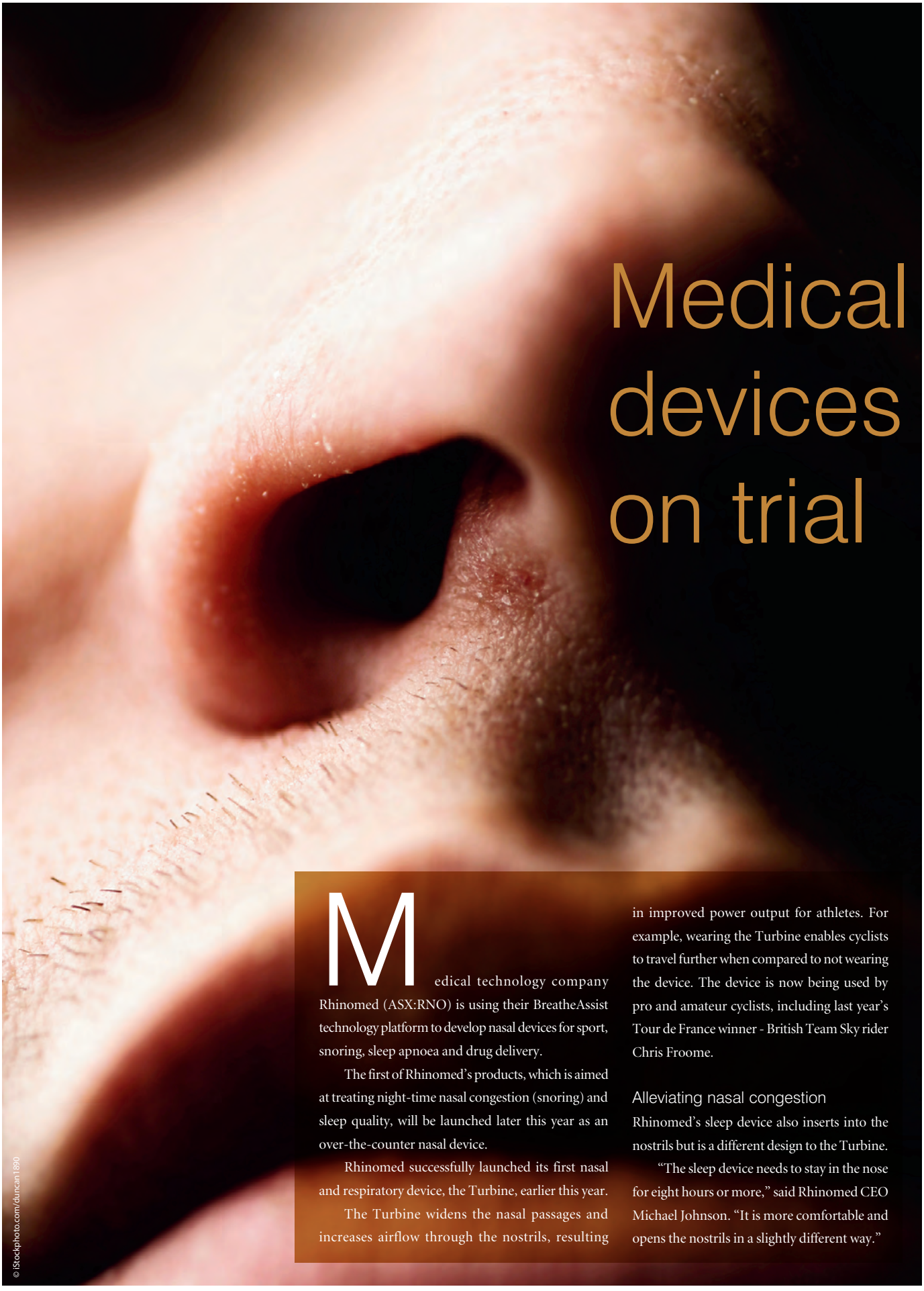
"We feel certain there are bright, new healthcare product ideas in this part of the world that just need support to progress to the next level. We offer Australian and New Zealand innovators the reach, resources, scientific development and world-class marketing to help their product ideas become a commercial success."

© iStockphoto.com/jgroup

Submissions can be made via the Open Innovation website.

Susan Williamson

Medical devices on trial



Medical technology company Rhinomed (ASX:RNO) is using their BreatheAssist technology platform to develop nasal devices for sport, snoring, sleep apnoea and drug delivery.

The first of Rhinomed's products, which is aimed at treating night-time nasal congestion (snoring) and sleep quality, will be launched later this year as an over-the-counter nasal device.

Rhinomed successfully launched its first nasal and respiratory device, the Turbine, earlier this year.

The Turbine widens the nasal passages and increases airflow through the nostrils, resulting in improved power output for athletes. For example, wearing the Turbine enables cyclists to travel further when compared to not wearing the device. The device is now being used by pro and amateur cyclists, including last year's Tour de France winner - British Team Sky rider Chris Froome.

Alleviating nasal congestion

Rhinomed's sleep device also inserts into the nostrils but is a different design to the Turbine.

"The sleep device needs to stay in the nose for eight hours or more," said Rhinomed CEO Michael Johnson. "It is more comfortable and opens the nostrils in a slightly different way."

Johnson said the company has gone through an extensive design phase before finalising version 1.0 of the sleep technology.

Early qualitative evidence showed that the device alleviates nasal congestion and appears to have an impact on snoring intensity - a hypothesis that is currently being tested in a user and partner trial.

Treating sleep apnoea

The company is also setting up a clinical trial program to look at how the technology can be adapted to help patients suffering from mild to moderate sleep apnoea.

The treatment of choice for people with sleep apnoea is continuous positive airway pressure (CPAP). This involves using a CPAP machine at night to maintain continuous pressure to the airway during sleep to prevent airway collapse and consequent blockage of the airway.

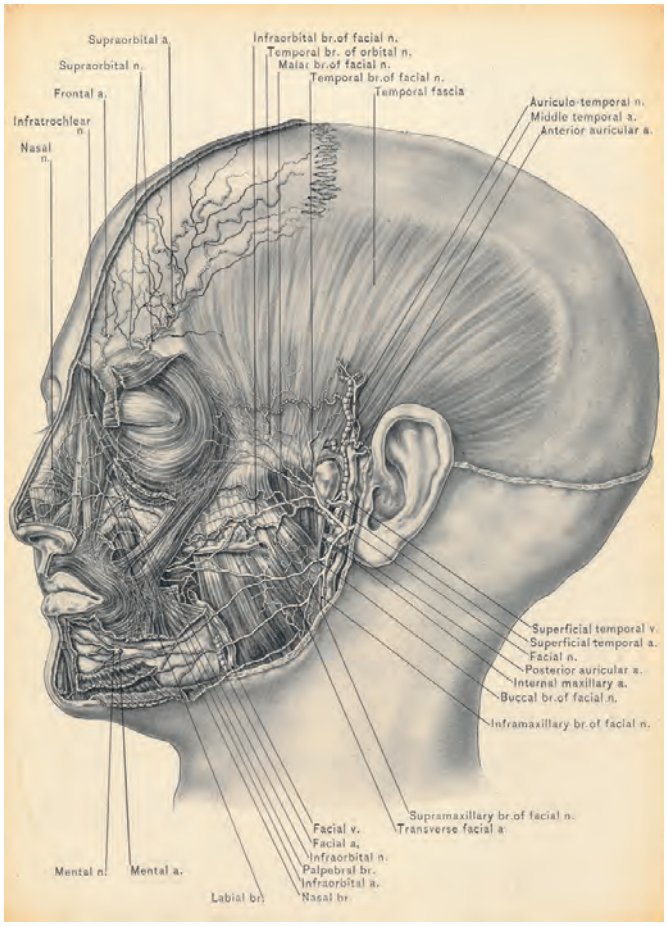
The Rhinomed device inserts into the nose, opening the nasal passages and regulating inhalation and exhalation.

"The aim is to impede exhalation," explained Johnson. "A CPAP device uses mild air pressure to maintain inflow and outflow of air. We want to maintain air pressure in the upper airways when people are exhaling - EPAP [expiratory positive airway pressure]. There are some existing EPAP therapies which are gaining traction due to their less-invasive nature. We believe there is a meaningful role for our technology in this setting."

The clinical trial program on patients with sleep apnoea will commence in early 2015 to assess how the technology could be used as a stand-alone therapy and as a companion therapy; for example, as a conjunct therapy which could improve the efficacy of a dental plate.

"Dental plates pull the jaw forward to avoid collapse of the palate," said Johnson, "so while they physically stop the jaw from collapsing the throat, we believe our device can assist with airflow into the upper airways.

"Most sleep apnoea patients report poor sleep quality. We are hopeful that our technology will not only be able to deliver some meaningful clinical end points but also improve a patient's all-important, but often neglected, sleep quality. If we can deliver this, we will have a significant impact on the level of adherence and compliance within this market."



"The nose as a site to deliver drugs is very effective."

Drug delivery through the nose

Another area Rhinomed is pursuing with its nasal device technology is the delivery of drugs for migraines and allergies. The first cab off the rank as a proof-of-concept or pilot study involves the migraine medicine sumatriptan.

"I was acutely aware of the value of novel delivery methods through my work with Melbourne-based advisory firm Cogentum," said Johnson. "When we looked at the challenges facing existing nasal sprays, of particular interest was the observation that the sprays often fall out - either through the nostrils or down the back of the throat. So we developed the concept of delivering drugs and keeping them in situ through our nasal devices."

The nose as a site to deliver drugs is very effective. It is safe, uptake is highly efficient and delivery into the blood is relatively direct - unlike taking a pill that can be inefficiently absorbed through the gut wall.

Nasal drug delivery also enables the dose of a medicine to be adjusted relatively quickly. The device can be removed and drug delivery stopped once enough has been taken up - unlike tablets, injections or the application of a cream where the dose is given whether it is needed or not.

"We are currently running a bio-equivalency trial," said Johnson. "In this way we can benchmark the ability of our technology to deliver the drug against delivery via a nasal spray. We need to determine efficacy within a relevant time frame and show equivalency to current modes of drug delivery."

The pathway to commercialisation

Johnson said the program has commenced with stability trials and a bio-equivalency trial will be conducted through local pharmaceutical manufacturing company IDT's CMAX subsidiary at the Royal Adelaide Hospital. Rhinomed anticipates reporting results in early to mid 2015.

"We have specifically chosen sumaptriptan because it's now a generic," said Johnson. "In addition, safety and efficacy within the nose has been established, the pathway is clear and our trial more easily managed and contained.

"Commercially, our focus has switched to creating differentiation within a competitive marketplace through novel delivery methods. If we can show that our delivery method works, and that it solves clear unmet patient and clinician needs, we believe we have a very attractive proposition to the current players in this market."

The potential applications and the range of drugs that could be delivered using this type of delivery method are significant, from acute rhinitis drugs through to more complex applications like pain management.

"In settings where getting a drug into someone quickly and where either oral or even injection delivery is problematic, the nose is a great site," said Johnson.

Another market with potential for the device is with people suffering from dysphagia. The number of people who have difficulty swallowing is growing - in large part due to the ageing population - so giving drugs via the nose instead of in tablet form provides a good option for these people.

Assuming positive outcomes from the trial program, the company plans to partner with a bigger company to take the drug-delivery program through to commercialisation.

3D conformational comparison of biosimilars

Enzo Life Sciences has introduced a novel line of conformational ELISA kits providing a sensitive, systematic and robust measurement of biosimilar conformation comparability at the molecular level.

The kit allows for 3D conformational comparison and higher-order structure (HOS) characterisation between biosimilars and marketed MAbs. The technology can be applied to many stages of biologics development. The assay uses more than 30 polyclonal antibodies to cover an entire Mab, thereby measuring its surface-epitope distribution systematically and sensitively.

The assay is in a sandwich ELISA format where the plate is coated with a panel of antibodies raised against peptides derived from the full length protein sequence of a biologic. Taken individually, each of these antibodies is strongly antigenic to the peptide sequence that was used in its production. However, when these peptides are incorporated into a full length correctly folded protein, the antigenicity of many of them is masked by the 3D structure of the protein and only a limited number of the antibodies respond. The result is a histogram which can be likened to a 'fingerprint' for a correctly folded biologic. The product detects small amounts of conformational impurity (≥0.1%) and correlates well with bioassays and glycosylation analysis.

United Bioresearch Products Pty Ltd
www.unitedbioresearch.com.au

Gas adsorption sample preparation device

The Micromeritics Smart VacPrep is a six-port system that utilises vacuum to prepare samples by heating and evacuation. Each of the ports may be operated independently. Samples may be added or removed from degas ports without disturbing the treatment of other samples undergoing preparation. Degassing automatically terminates when the samples have completed all programmed steps.

The software includes a set of default ramp and temperature parameters. Users also have the option of programming each port with a different set of parameters. A record of the sample preparation time and temperature can be recorded as part of the sample data file.

The de-gas program may be started or terminated by using software installed on the computer attached to the analysis instrument or with push-buttons on the front panel of the product. The time-saving 'Rapid-Start' mode on each port gives the user the ability to walk up to the instrument, attach the sample tube with heating mantle and immediately start degassing a sample.

Particle & Surface Sciences Pty Ltd
www.pss.aus.net

SEM with EDX for elemental analysis

Hitachi has released the latest model in its tabletop SEM range, the TM3030Plus. The SEM features an ultravariable-pressure detector (UVD) for low-vacuum SE imaging and a high-sensitivity, four-segment BSE detector for high-quality compositional imaging. The UVD has been adapted from the SU3500 premium VP SEM.

Low vacuum minimises moisture evaporation and subsequent shrinkage of samples, reducing the need for chemical processing and critical point drying (CPD) or freeze drying. Moisture evaporation can be further reduced by purchasing an optional -50°C cooling stage.

Low vacuum also reduces surface-charging effects on electrically non-conductive samples such as insects, microorganisms, leaves, pollen, paper, wood, fabric, plastic, ceramics, etc. Again, an optional cooling stage can further minimise thermal damage due to the electron beam on sensitive samples.

The product can identify elemental information by using an optional EDX system manufactured by Bruker or Oxford Instruments. EDX systems can detect elements from B to Am in both low and high vacuums. Dedicated software modules for data capture, automated element ID, elemental mapping, point and line scan, and automatic report generation simplify the identification of unknown materials.

Other features include: one-click auto start; auto focus, auto brightness and contrast; colour camera navigation; XYTR motorised stage; 3D view; maximum sample size 70 mm diameter and 50 mm height; 120,000x magnification; SE/BSE mixed-signal mode; and three vacuum levels.

The product is suitable for users requiring good image quality with high throughput where biological or non-conductive samples necessitate minimal sample preparation.

NewSpec Pty Ltd
www.newspec.com.au

Real-time PCR assay for *Listeria monocytogenes*

The DuPont Nutrition and Health - Diagnostics BAX System Real-Time PCR Assay for ***Listeria monocytogenes*** kit is now available. The assay is claimed to combine shorter, simpler, sample preparation and faster real-time processing than the company's previous assays for ***L. monocytogenes*** without sacrificing accuracy or reliability.

The product completes the BAX System portfolio of real-time PCR assays for commonly tested pathogens. It provides additional flexibility by allowing users to test for ***L. monocytogenes***, genus ***Listeria*** and ***Salmonella*** simultaneously in about an hour.

The company can provide a complete testing solution for ***Salmonella***, ***E. coli*** O157:H7, non-O157 STEC, genus ***Listeria***, ***L. monocytogenes***, ***Campylobacter*** and more on a single, easy-to-use platform, helping users to release products quickly and save on inventory costs.

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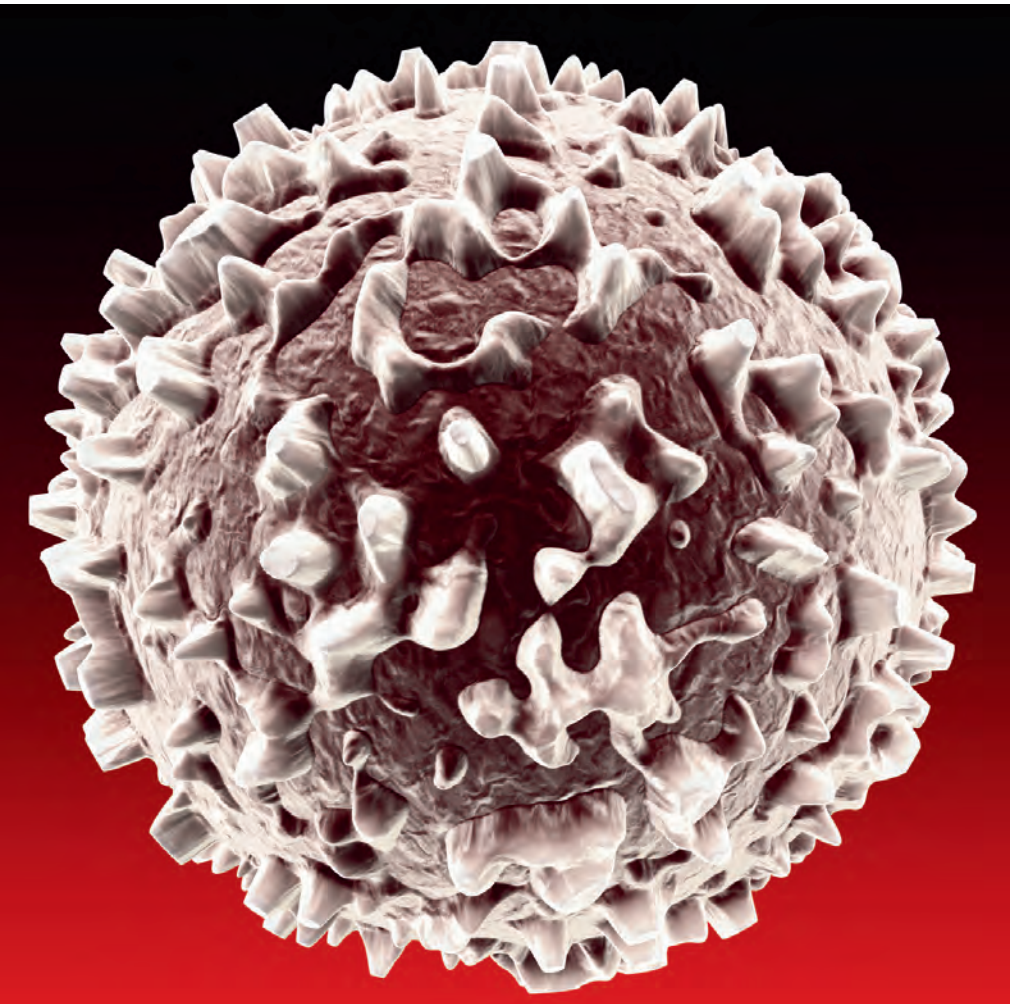
Susan Williamson



Potential new treatment for GVHD

A potential new treatment option for bone marrow transplant patients who suffer the serious complication of chronic graft-versus-host disease (GVHD) has been uncovered.

A team of researchers, led by the QIMR Berghofer Medical Research Institute's Dr Kelli MacDonald, has found that macrophages from donor bone marrow appear to be a key player in the development of chronic GVHD.

"Now that we've identified the white blood cells, or macrophages, that are driving the process, we're keen to test an antibody we think will block the process," MacDonald said.

GVHD is a major complication of allogeneic (matched donor) stem cell transplants. It can present as acute or chronic and occurs when donor cells recognise a patient's tissue as foreign and start to reject it. Both forms of the condition are life-threatening.

Chronic GVHD occurs about 100 days post-transplant and appears similar to autoimmune diseases in which tissue scarring (fibrosis) is a feature. Skin is the primary organ affected but the lungs and mouth are often also involved.

Currently, most donor stem cells for transplant are collected from the peripheral blood using a technique that mobilises cells from the marrow into the blood. This technique has improved patient outcomes, but levels of chronic GVHD have increased - and, other than steroids, there are few treatment options.

Several mouse models of GVHD exist and MacDonald's team has been working with multiple mouse models for chronic GVHD.

"We are using two mouse models to look at the skin," MacDonald said. "We have also been working with a colleague in the USA, Professor Bruce Blazar, who is using a different mouse model to look at chronic GVHD in the lung. We swapped samples with him and have confirmed our results in different tissues using the different models."

MacDonald's team has been looking at what controls the development and function of macrophages which accumulate in the damaged tissues. They first found that the macrophages infiltrating in the skin lesions of the mouse model were derived from the donor bone marrow.

They then showed that the macrophages were releasing the cytokine TGF-beta into the local tissue environment they inhabited. TGF-beta instructs neighbouring cells to make collagen, resulting in the formation of the excess connective or scar tissue that characterises fibrosis.

"We have used an antibody to block the cytokine CSF-1 that instructs bone-marrow-derived monocytes to move into the tissue and change into this pathogenic macrophage," said MacDonald. "These monocyte-derived macrophages are key contributors to the process by which fibrosis occurs."

Fibrosis is not just associated with chronic GVHD; it occurs in other disease settings such as chronic liver disease, which means this antibody could have much broader applications than GVHD.

"We are talking with pharmaceutical companies that have already generated and tested antibodies that block the human CSF-1 molecule and hope to be able to use these agents in the very near future," said MacDonald.

MacDonald hopes they will start clinical trials next year for patients with GVHD who have failed steroid treatment.

The findings were published in *The Journal of Clinical Investigation*.

pH meter

The FiveGo pH is a handy, portable meter that provides rapid and reliable results on the go. The device can be used in applications including the field, the laboratory, the food and beverage sector, agriculture, industry, water and the environment.

The product has the storage capacity for up to 30 measurements and mV/ORP measuring mode. It meets IP54 specifications for protection against dust and water. It also has automatic endpoint recognition and calibration with automatic buffer recognition.

The meter features five self-explanatory operating and function buttons for easy measurement, menu access, saving and recalling results and calibration recall. The device will also provide information on the condition of the electrode and the battery level. It allows for fast changeover between pH and mV parameters or between conductivity, TDS and salinity.

The product's large and intuitive display simultaneously shows readings, temperature and endpoint criteria along with helpful icons. This allows for easy use by any technician, along with a large five-button keypad for easy manipulation.

The unit is available from LabFriend in four different options: basic kit with LE438 pH electrode, IP54 connection caps and several buffer sachets; field kit with carry bag; four sample bottles; or a food kit with LE427 puncture pH electrode, IP54 connection caps and several buffer sachets, with carry bag and four sample bottles.

LabFriend
www.labfriend.com.au

RNA-binding protein immunoprecipitation kits

Merck Millipore has introduced the Magna Nuclear RNA-binding Protein Immunoprecipitation (RIP) kits. The kits are designed to allow the discovery and analysis of both coding and non-coding chromatin-associated RNAs.

Two versions of the kit are available, enabling users to analyse RNA both strongly and weakly associated with chromatin; one version uses cross-linked chromatin while the other uses native chromatin. Native RIP allows recovery of high-affinity, more direct interactions while the cross-linked method is designed to capture higher molecular weight complexes and more readily trap weaker interacting RNAs.

Compared with other kits available to researchers, the product is said to deliver lower background signals and high signal-to-noise ratios, and has been demonstrated to work in RNA-seq to enable NGS-based discovery and profiling. The kits offer flexible and scalable input requirements; RNA can be recovered from as few as 5000 cells (cross-linked) or 100,000 cells (native).

Merck Pty Limited
www.merckmillipore.com

Accelerated chromatographic isolation

Biotage has launched ACI (Accelerated Chromatographic Isolation), converting simple flash purification into a faster and more economical way to isolate pure compounds.

The product is expected to improve the efficiency of the laboratory, embracing developments in purification technology to guide chemists towards improved chromatography. Traditional purification taking more than 15 min is reduced to 5 min; a 250 mg scale laboratory-scale experiment can now be purified in less than 3 min on a 10 g column with an ACI-enabled Biotage Isolera flash purification system.

Biotage Isolera systems already recommend cartridges based on the sample size and programmed TLC data; they work out the best solvent gradient based on compound and provide real-time indication of eluting compounds using UV, ELSD or mass detection. Working seamlessly with the system, ACI's simple wizard quickly guides chemists through the system. Existing Biotage Isolera systems can be upgraded to ACI systems, and ACI will come with all new production systems.

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L+LS

Lauren Davis

When it comes to finding new sources of energy, the Australian Plasma Fusion Research Facility (APFRF) is looking onwards and upwards - quite literally, in fact. The Sun and the stars are powered by fusion energy - fuel formed from the fusion of hydrogen into helium - in a process which the facility hopes to help reproduce here on Earth.

Powering the future with plasma fusion

Plasma fusion is considered a clean form of nuclear technology by which hydrogen isotopes are heated to many millions of degrees, causing them to fuse together and release vast amounts of energy. It has several advantages over nuclear fission: the raw materials can be extracted from seawater; the end product is helium, not a long-lived radioactive isotope; and the reaction cannot get out of control. The Australian Plasma Fusion Research Facility represents Australia's involvement in the international fusion effort.

Located in The Australian National University's (ANU) Plasma Research Laboratory, the $35 million APFRF was originally known as the National Plasma Fusion Research Facility, opened in 1997 and based around Australia's largest fusion experiment: the H-1 Heliac stellarator. The device confines hot plasma within a magnetic field 10,000 times stronger than the Earth's and is the only stellarator in the Southern Hemisphere.

Now the facility has been significantly upgraded thanks to a Commonwealth investment of $7 million under the Education Investment Fund's Super Science Initiative. Dr Boyd Blackwell, a senior fellow in the Plasma Research Laboratory, said the four-year upgrade has improved the APFRF in a number of ways.

"The radiofrequency heating system is the biggest single cost in this upgrade," said Dr Blackwell, referring to the system which heats the plasma to millions of degrees - hotter than the core of the Sun. "You need a lot of power - 400 kW - to do that and, as a research facility, we needed flexibility in that power."

The facility purchased a 2x200 kW RF heating system comprising two RF power amplifiers from Ampegon, based on the company's new Digital Radio Mondiale transmitters, and a cooled antenna with a flexible matching system constructed in the ANU Research School of Physics and Engineering workshops. These sources provide five times more power than the previous devices, consume less power, are fully remotely controlled and can run independently at different frequencies. Dr Blackwell said, "We can change the frequency over a range of 4-20 MHz, and we can program the shape of the pulses that generate the plasma."

He went on to say that the facility used upgrade funding to develop a number of innovative remote plasma measurement systems because, due to the high temperatures involved in plasma fusion, "you have to look at it from a long way away".

"Australia … is renowned for development of remote instrumentation for plasma, and our lab in particular specialises in imaging," Dr Blackwell said. "That means that you don't make just one measurement - you don't even make a bunch of measurements, you make a whole picture worth of measurements.

"A lot of the upgrade funding went into developing a number of those instruments - you could call them ultrafast cameras, if you like, because they produce images in the end, but they're much more than a camera. For example, they produce images of the radio waves that heat the plasma, or the fluctuations in the plasma."

One of these instruments, developed at the APFRF, has recently provided the first images of the magnetic field inside a tokamak plasma, which will help researchers better understand confinement, said Dr Blackwell. Professor John Howard, the director of the facility, is continuing this research with this instrument on Korea's National Fusion Research Institute (NFRI) flagship experiment 'KSTAR'.

The facility has also developed a plasma device called the Magnetised Plasma Interaction Experiment (MAGPIE), which creates conditions approaching those at the edge of a fusion reactor. Dr Blackwell explained that the materials used to create fusion reactor walls must be able to withstand an extremely high heat load, as well as the atom displacement caused by the bombardment of neutrons that carry the energy.

"MAGPIE can create peak fluxes of one million watts per square metre under the right conditions, so we can put carbon, tungsten, molybdenum and other very high-temperature materials in there, and we can create a plasma nearby and can study the interaction between the plasma and the materials," he said. APFRF's collaborator on the experiment, the Australian Nuclear Science and Technology Organisation (ANSTO), meanwhile creates the atomic displacements to simulate the neutron damage.

In a recent experiment, MAGPIE discovered small bubbles forming on the surface of a tungsten-lathanum alloy after exposure to high-energy helium plasma. As noted by Dr Blackwell, "That is not good, because it means that little pieces will fall off. If the little pieces fall off, they cool the plasma and dampen the reaction. Fortunately, MAGPIE is able to reproduce this on a small scale. Under very well controlled conditions, we can use the excellent tools we have in Australia … to try to probe the cause of these bubbles and hopefully in the end prevent them."

The project is very much a collaborative one, utilising the resources of not only ANU and ANSTO but also the Australian Synchrotron. According to Dr Blackwell, "It wouldn't work without all that [collaboration] happening." This work has in fact led to two new collaborations: one involving the ANU positron facility and another with the Dutch Institute for Fundamental Energy Research.

The facility is powering the future in more ways than one. Although APFRF doesn't have the budget to break any world records, Dr Blackwell described it as "as much as anything, an excellent student and postdoc training platform", enabling students to "get hands-on experience with brand new ideas in remote measuring systems" - more so than if they were under the pressure of handling billion-dollar devices. Many Australian graduates have gone on to do great things around the world, he said, including Dr David Campbell, a University of Sydney graduate, who is Assistant Deputy Director-General and Director of Plasma Operations with ITER - a multibillion-dollar, multinational experiment currently being built in France by a consortium of 35 nations.

When it commences operation in 2020, ITER aims to demonstrate the technological and scientific feasibility of fusion energy on a large scale, with a volume 10 times larger than any existing magnetic fusion experiment. From 50 MW of input power, the ITER machine is designed to produce 500 MW of fusion power - on par with a small power station - making it the first of all fusion experiments to produce net energy. Dr Blackwell said APFRF hopes to one day contribute to the global project, ideally providing theoretical and data analysis as well as an imaging instrument which takes advantage of ideas developed at the facility. He noted that Australia's participation is not yet secured, but the capabilities provided by the recent upgrades are "all part of 'Powering Ahead', the Australian fusion community's strategic plan to build up momentum and hopefully win increased funding for fusion science Australia-wide".

So how long until we can live in a world powered essentially limitless, safe, greenhouse gas-free fusion energy? Dr Blackwell admitted that the steps of demonstration, commercialisation, production and infrastructure replacement could easily take 100 years, but ultimately concluded, "I think we'll have a very clear answer about whether it can be done with magnetic confinement or not in 10-20 years." It's clearly an exciting time for plasma fusion research and, thanks to the APFRF, Australia can anticipate being part of this new age of clean energy production.

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Australian Synchrotron User Meeting
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events.synchrotron.org.au/conferenceDisplay.py?confId=3

Sydney Cancer Conference
26-28 November, Sydney
sydney.edu.au/cancer-research/SCC2014

Australasian Society for Immunology) Annual Scientific Meeting (ASI)
1-5 December, Wollongong
asi2014.org

Australasian Society for Immunology 44th Annual Scientific Meeting
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www.asi2014.org

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100 to 1000µl Pipettes.
Six position carousel stand
Labnet BioFree™ Pipette Tips

Part Number
P3942-SK4

To receive discount please quote the following Promotion Code: **LBN-1114-1** *when Ordering.*

www.pacificlab.com.au

MELBOURNE · SYDNEY · BRISBANE · ADELAIDE · PERTH · AUCKLAND

Life Science | Clinical | Pharma-ceutical

Enduro MiniMix 3-D Shaker

Perfect for processing Western Blots

Labnet International, Inc.

Special price $455*

12 Months Warranty

Features:

- Combines the motions of an orbital shaker and rocker to produce a three dimensional action
- Supplied with a non-slip rubber mat to help keep boxes in place on the platform
- Designed for processing blots and staining gel
- Optimal fixed speed and tilt
- Compact and light weight

Includes Enduro MiniMix 3-D shaker with non-stop slip mat and two large blotting boxes.

for full Specs simply Click here

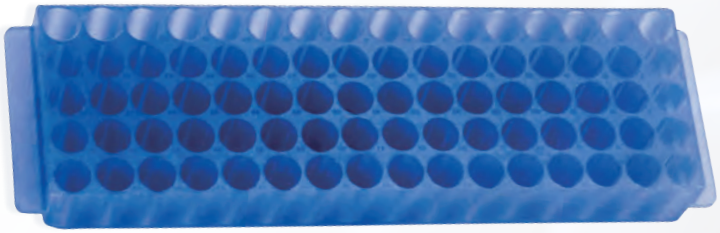
Part Number
S0600-230V-UK

To receive discount please quote the following Promotion Code: **LBN-1114-1** *when Ordering.*

Life Science | Clinical | Pharma-ceutical

80 Well Rack 1.5/2.0ml Tube - Blue

AXYGEN SCIENTIFIC

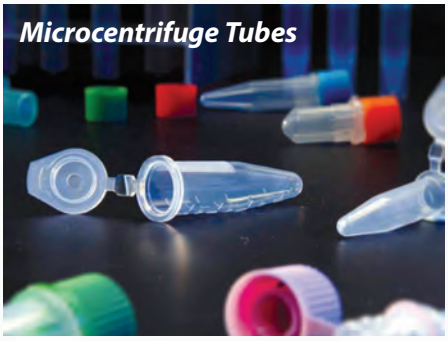


Only $2.40* Each

Offer Valid while stocks last only!

Features:

- Holds eighty 1.5 or 2.0 mL microcentrifuge and screw cap tubes
- Made from Polypropylene, resistant to most lab chemicals
- Conical bottom wells allow superior stability for conical tubes
- Numbered wells and frosted side writing panel for sample identification



Axygen™ Microcentrifuge tubes are also available in 1.5mL and 2.0 mL with Snap Lock as well as Screw Cap closures.

To receive discount please quote the following Promotion Code: **AXY-1114-1** *when Ordering.*

Part Number
R-80-BF

In Stock! Ready to ship

Life Science | Food & Beverage | Clinical | Water | Pharma-ceutical | Industrial

Single Block Package
Accublock Dry Bath + Aluminium Block
(of your choice)*

Ideal to be used in applications in molecular biology, histology, clinical, environmental and industrial settings

Only $550* Package Price

12 Months Warranty

Features:

- *Microprocessor enables precise, accurate control and rapid heating*
- *Stainless steel block chamber ensures an even transfer of heat*
- *Easy calibration to in-house standards when required*
- *Digital performance and convenience*
- *Broad temperature range up to 150°C*
- *Compatible with other interchangeable blocks*

for full Specs simply **Click here**

Offer includes:
** One Aluminium Block of your choice, excludes block D1196-PCR and all Dual Blocks*

To receive discount please quote the following Promotion Code: **LBN-1114-1** *when Ordering.*

Part Number
D1100-230V

Pre Bar-Coded PCR Microplates

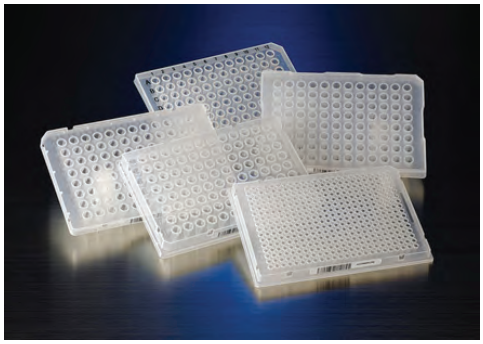
AXYGEN

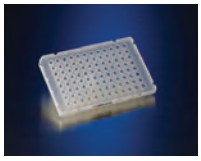
Life Science | Clinical | Pharma-ceutical

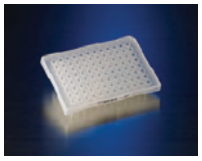
- *Barcode on south side of the plate between well H1-H12 for 96 well plates and between well P1-P24 for 384 well plates*
- *Ultra-thin and consistent wall thickness allows precise thermal transfer*
- *Continuous and unique barcode sequence*
- *Certified RNase- / DNase-free*
- *Polypropylene made*
- *Clear color*

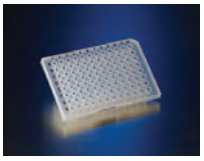
Nonsterile | Nonpyrogenic

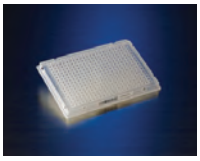
Introductory Special Pricing




PCR-96-LP-AB-C-PBC


PCR-96-AB-C-PBC


PCR-96M2-HS-C-PBC


PCR-384M2-C-PBC

Part Number	Description	Material	Qty / Case	Price AUD*	Minimal Order*
PCR-96-LP-AB-C-PBC	96 Well Barcoded Clear Low Profile PCR Microplates for ABI	Polypropylene	100	$450.00	≥3 Case
PCR-96-AB-C-PBC	96 Well Barcoded Clear PCR Plate for ABI	Polypropylene	50	$225.00	≥4 Case
PCR-96M2-HS-C-PBC	96 Well Barcoded Clear PCR Half Skirt Plate with a Single Notch	Polypropylene	50	$165.00	≥6 Case
PCR-384M2-C-PBC	384 Well Barcoded PCR Microplates	Polypropylene	50	$260.00	≥4 Case

** Minimum purchase quantity applies to receive special pricing*

To receive discount please quote the following Promotion Code: **AXY-1114-1** *when Ordering.*

Life Science | Clinical | Pharma-ceutical

Personal Mini Water Bath 5.5 Litres

Sleek
Convenient
Efficient

LABWIT®

LABWIT ® Waterbaths deliver superior temperature control and uniformity

Special price $465*

Power Ready Australian standards

18 Months Warranty

Ideal for applications where temperature uniformity and control are crucial

Features:

- Temperature range: ambient - 99.9°C, with nominal temperature accuracy of ± 0.1°C
- Mini sized 5.5L tank ideal for personal use
- LED display and analogue temperature adjustment
- Stainless steel perforated diffuser included as standard
- High precision temperature sensor probe
- High-density insulation minimizes heat losses

Contact us to arrange an On-Site demonstration

In Stock! Ready to ship

The ZSQ-3 is a robust piece of equipment that will suit any laboratory, it is reliable and easy to use.

Part Number **ZSQ-3**

To receive discount on these LABWIT® unit please quote the following Promotion Code: **LBW-1114-2** when Ordering.

other LABWIT ® waterbaths available at Pacificlab

Part Number **ZWY-110X30**

Part Number **ZSXH-625**

High performance baths from LABWIT ® range in capacity of 5.5, 18 and 25 litres.

Larger volume units include a stainless steel diffuser shelf and a hinged gable cover as standard equipment.

Life Science | Clinical | Pharma-ceutical

Shaking Double Stack **Incubator** 170L Volume

LABWIT®

Ex-Display Unit
$6,390*

Integrated unit with minimal footprint capable of holding a massive 28 x 250ml erlenmeyer flasks!

Features:

- *Orbital movement with speed adjustable from 30-300rpm and 26mm shaking diameter*
- *Maximizes capacity with two 496 x 350mm trays included as standard*
- *Cooling capacity for 4 - 60°C operation*
- *External Dimensions 720 x 650 x 1310 mm (h)*
- *Also holds up to 18 x 750ml flasks sizes*

High quality #304 stainless steel for excellent durability of interiors.

Part Number **ZWYR-2102C**

In Stock! Ready to ship

To receive discount on these LABWIT® unit please quote the following Promotion Code: **LBW-1114-2** *when Ordering.*

** Pricing on Ex-Display Units applies while stock lasts only. Units may have minor scratch and dent marks.*

18 Months Warranty

Power Ready Australian standards

Introducing the **NEW** B Series **Programmable Drying Ovens**

Special price
$1,480*

Features:

- *55L Oven carefully engineered for daily work up to temperature ranges of ambient+5 to 200°C with a temp. accuracy of 0.1°C*
- *PID Microprocessor controller with programmable control of 9 segments and 18 steps*
- *Improved "Push and Catch" hermetic door closure system for optimal air tightness and minimal heat loss*
- *Internal forced-air convection and three dimensional heating systems ensure air circulation and heat distribution*
- *Adjustable air ventilation discharges excessive humidity evaporation*
- *Two shelves are included as standard, capacity of 4 as optional upgrade*
- *External Dimensions 520 x 525 x 830 mm*

To receive discount on these LABWIT® unit please quote the following Promotion Code: **LBW-1114-2** *when Ordering.*

18 Months Warranty

Power Ready Australian standards

Part Number **ZXRD-B5055**

for full Specs simply **Click here**

Food & Beverage | Water | Pharma-ceutical | Industrial

NEW DR 1900 Spectrophotometer Portable

Introductory Special Pricing

Features:

- Light and compact unit, ideal to carry anywhere
- Accurate wavelength range of 340 to 800nm
- Rugged construction, test in the most demanding conditions
- Loaded with more pre-programmed methods than any other portable spectrophotometer

Contact us for a free of charge quote

12 Months Warranty

Part Number
DR1900-01H

for full Specs simply Click here

Powerful field instrument with over 220 commonly tested water methods

Capable to recive a broad range of vial sizes

NEW DR 900 Handheld Colorimeter

Introductory Special Pricing

12 Months Warranty

Features:

- Save time storing most used standard methods, only 4 clicks to retrieve
- Hand-held unit, rugged, waterproof and dustproof colorimeter
- Stores data for up to 500 tests, quick download through USB conectivity
- Provides access to 90 of the most common parameters
- Improved and intuitive user interface

Field ready in every way possible

Fast and simple water testing for the most demanding field environments

for full Specs simply Click here

Part Number
9385100

Terms and Conditions

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