

Lab+Life SCIENTIST



Scientists find
anthrax,
bubonic plague
and more on
NY subway

Face-to-face with
Ian Gardner

Australia's new
cryo-electron
microscope

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Anthrax and bubonic plague were among the 637 known bacterial, viral, fungal and animal species identified in the New York City Subway system. Only 12% of the bacteria species sampled are known to have some association with disease, but more interestingly still, 48.3% of the DNA sampled did not match any known organism.



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Antibiotic with no resistance discovered

Researchers from Northeastern University have discovered an antibiotic which eliminates pathogens without encountering any detectable resistance - a promising weapon in the war against superbugs such as methicillin-resistant *Staphylococcus aureus* (MRSA).

W

riting in the journal *Nature*, the study authors stated, "Most antibiotics were produced by screening soil microorganisms, but this limited resource of cultivable bacteria was overmined by the 1960s. Synthetic approaches to produce antibiotics have been unable to replace this platform." Professors Kim Lewis and Slava Epstein thus sought to tap into a new source of antibiotics: uncultured bacteria, which make up 99% of all species in external environments.

Through the creation of the iChip - a miniature device that can isolate and help grow single cells in their natural environment - Lewis and Epstein founded biotechnology company NovoBiotic Pharmaceuticals, which has gone on to assemble about 50,000 strains of uncultured bacteria and discover 25 new antibiotics. During a recent screening for antimicrobial material, the team discovered their latest antibiotic (termed teixobactin), which they said "inhibits cell wall synthesis by binding to a highly conserved motif of

lipid II (precursor of peptidoglycan) and lipid III (precursor of cell wall teichoic acid)".

The compound showed potent killing against a broad panel of bacterial pathogens - including MRSA and *Mycobacterium tuberculosis* - while encountering no resistance. Lewis said this marks the first discovery of an antibiotic to which resistance by mutations of pathogens have not been identified, suggesting that the compound "evolved to be free of resistance".

"Teixobactin's dual mode of action and binding to non-peptidic regions suggest that resistance will be very difficult to develop," he said.

"This challenges the dogma that we've operated under that bacteria will always develop resistance."

Lewis said the research lays new ground to advance his work on treating MRSA and other chronic infections, with the team hoping to eventually develop teixobactin into a drug. They concluded, "The properties of this compound suggest a path towards developing antibiotics that are likely to avoid development of resistance."

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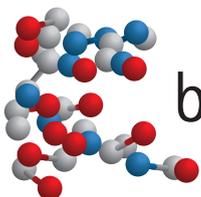
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Ian Gardner, President of Australia's peak national industry association - Science Industry Australia Ltd (SIA), discusses how SIA represents the professional science industry.

Lab+Life Scientist: What led you to scientific instrumentation as a career?

Ian Gardner: I'd always considered myself a scientist and thought that would be my career path.

I started work as a laboratory assistant in the paint industry back in 1977. After that I moved into a trainee chemist role and did a Bachelor of Applied Science at Monash University (Caulfield Campus) part-time - I've been Melbourne-based throughout my career.

As my career progressed I took on technical management roles, coupled with a Graduate Diploma of Business Administration at Swinburne University. I then moved into laboratory management roles.

I was lucky to be trained back in the 1970s and 80s when people were given a broad skill base. Back in those days as a trainee or lab assistant, people were trained in all aspects of the business. I did some work in quality control, went to the factory and saw how things were done there, did time in sales, talked to customers, so I got a very broad training.

These days training has become very focused. People are given a specific role to do; back in those days people were better able to get a real feel for a company.

I ran my own business for a number of years in the specialty chemical formulation and manufacturing area.

I seemed to have a natural ability to turn my skills to managing small offices.

From there I was drawn into sales and marketing in the specialty chemical area - colleagues encouragingly told me I had natural powers of persuasion and would do well - but I left that industry back in 2009. That was when I happened upon a job in the scientific instrument area with John Morris Scientific and from there became regional manager with AVT Services, also in the scientific instrument area, specialising in vacuum-based applications.

LLS: How did you become president of Science Industry Australia?





“We want to ensure SIA is involved in matters of genuine concern to the scientific community and industry.”

IG: I started getting involved in industry associations when I worked in the paint industry. The Surface Coatings Association of Australia was the first association I was involved with.

I went up through the ranks of being on various committees - branch, conference and technical education committees. I then became chairman, a member of national committees and then national president in 2003. After that I became immediate past-president, which coincided with me changing industries.

Having joined AVT Services, I became an active member of Science Industry Australia (SIA). I was elected to the board in 2011 and subsequently elected president in January 2014. I am very fortunate that AVT Services sees value in giving back to the industry in which we operate by actively contributing to relevant industry associations and is supportive of the position I have in SIA.

When I joined the board we had a very good president, Glen O’Sullivan, who had been in the position for about four years. He remains an active board member.

People knew of my past experience with industry associations. I’ve been on boards and subcommittees, making submissions to government and conducting those sort of roles since the late 1980s - so it was suggested that I become president of SIA.

LLS: Can you tell us a bit about the recent restructure the SIA has undergone?

IG: It’s a restructure around developing more consultative decision-making - decision-making on behalf of the industry or the association that involves the whole board and subcommittees of the board.

Our aim is to involve a larger cross-section of members, both our corporate members through SIA and our Australasian Laboratory Managers Association (ALMA) members - SIA also administers ALMA.

We’re involving ALMA members a lot more in the decision-making process which, from a board level, we felt wasn’t happening enough in the past.

We have a good cross-section of people on the SIA board who have substantial and relevant experience over what has been a tough period for the industry.

SIA board members have worked through the global financial crisis and we know how hard it is for

companies to look at membership of associations and allow people to be involved - the time and cost factors involved can be unappealing. This also goes for attendance at conferences.

We know it is difficult and we know we need to be very focused on providing value for money in what we do. It’s not rocket science. All industry associations are going through this at the moment.

We’ve already begun this with one of our board members, Nigel Simpson, taking on the role of membership engagement. He is getting out there talking to SIA and ALMA members about what they want from the association.

It’s all very well for us to sit around as a board and say what we think members want - but how would we know? So we are going out there and talking face to face with members asking them what services they want provided. We want to add value to being a member of the association.

LLS: How many members does SIA have?

IG: SIA has around 60 members and ALMA has around 100. We’ve got a good spread of people who are, or have been, working in industry or laboratories.

We’ve clearly got to grow our membership base and we are doing that by engaging with members and talking to them about what they want. And we are getting more input and involvement.

We are not averse to anything at the moment - we are very open-minded about what we could do to grow the association.

LLS: How are you involving members in this year’s annual SIA conference?

IG: We have formed a conference committee that meets regularly and we have a program subcommittee in place that includes a range of people including ALMA members and people involved in lab design. We’re putting together what we think is a really good program for this year’s meeting.

I’m already feeling encouraged and buoyed by the difference this more consultative decision-making approach is making.

This year will be our 10th annual lab managers conference and we are pretty excited about it. We are developing a program and seminars that will be of direct interest to people.

LLS: What else is on offer for SIA members?

IG: Something we identified from our 2014 conference that we think will provide value to members is providing information about areas that are of concern to laboratories.

New labelling legislation for GHS hazardous chemicals (the Globally Harmonised System of Classification and Labelling of Chemicals), for example, came up at last year's conference as an area that many people were unaware of.

This new classification and labelling legislation is coming next year and we are putting together a series of one-day roadshow workshops that will be held around Australia throughout 2015.

The new legislation will have an impact on manufacturers, importers, anyone involved in the use of these chemicals - all the way downstream into the actual labs that use them.

We identified that a lot of lab managers and staff are not aware of the impact this new legislation will have on them, so we are putting together a series of workshops that will bring people up to speed with what is going to happen and how it will impact their laboratory. It's all about what is required once a hazardous chemical comes into a lab: how it is stored, handled, labelled, disposed of, the hazards involved and so on, as well as communication of the hazard itself.

We anticipate the workshops will attract members and non-members and hopefully, in attending, they will realise the value of being involved in organisations like ALMA and SIA.

Something else we are working on is gaining representation from South Australia and Western Australia on the board. This goes hand in hand with increasing our membership base across these states.

SIA has been inclined to be a bit eastern-seaboard focused - we currently have Sydney-, Melbourne- and Brisbane-based board members and that's where we rotate our conferences - so we are looking at ways of getting representation from other states.

The roadshow workshops are the first part of this strategy. In fact, the first two locations for the workshops will be Adelaide and Perth. We are hoping this will get the ball rolling in terms of recognition of SIA and ALMA in those states and lead to ongoing activity.

We are also approaching our members about whether they want SIA support, for example, in getting involved in a change to an Australian standard and whether SIA should have a member on a particular standards committee. We want to ensure SIA is involved in matters of genuine concern to the scientific community and industry.

LLS: Is SIA interacting with the government or involved in lobbying for anything at the moment?

IG: At the moment, no.



Representation to government is an area that the SIA board realises it needs to pick up.

This was the reason behind the initial formation of SIA 15 years ago. The government at the time prompted the formation of the association, which involved an action plan for the science industry that was driven by SIA.

Over time, and as a result of changes in government, that action plan has been dropped, but a lot of good information was generated because of it.

Part of our goal in raising the profile of SIA is to increase that component of our activity.

It requires us to look at areas that are relevant, where we can make a difference or have input, and nominate people to sit on the various government subcommittees or legislative committees appropriate to our industry.

My previous involvement with other industry associations involved membership on various government committees, so I am familiar with this type of work.

SIA needs to recognise that government and bureaucrats will look to us as the representative body of the Australian science industry and ask us to become involved in a specific committee or give advice on a change of legislation.

We're certainly always open to talk to people.

LLS: Does SIA have input into the government's approach to funding science?

IG: SIA reports to its members on actual research funding. But funding of research is a little bit removed from what we do because we are more focused on the industry side of science and that sits beyond research. But in terms of reporting to our members, we certainly do that.

We produce the Science Industry Digest through which we report on opportunities for, or granting of, funds. It is important to our membership to know where funding has been granted or whether opportunities exist.

We also have the SIA business barometer where we report on industry spending on various categories

of scientific instrumentation. We produce that on a quarterly basis.

Obviously it is tough at the moment - funding is tough for everyone.

We would always like to see more government support for research funding. We have some very good research going on here in Australia and obviously we would like to see that continue.

I don't think science is getting the significance or the support that it needs.

Australia continues to produce high-quality research but when you look at government funding for research in Australia compared to other OECD countries we are a long way down the list. That's the reality, so as a body SIA aims to do as much as it can in the relevant areas to lobby government to increase that level of funding.

We have a close relationship with the Chief Scientist, Professor Ian Chubb. He is our patron and attends SIA functions and addresses discussions with us.

We are very supportive of what he is doing, such as his recommendations for a strategic approach to science.

We understand that science is just one part of an overall budget process, but we certainly are there waving the flag. At the moment we are working hand in hand with the Chief Scientist on this and how SIA can help in terms of new legislation that is coming in.

LLS: Do you think the Australian science industry is in a good position?

IG: In terms of growth, our recent business barometer indicates that things have been fairly stable for the last 12 months - there have been peaks and troughs but overall there is relative stability.

The drop in the dollar has not been that good for the industry because a lot of suppliers import products. From a supplier's point of view, the battle is trying to maintain the actual supply of product to the customer without imposing the full flow-on of any decrease in the Australian dollar value.

LLS: What about the local science industry, is it receiving enough support?

IG: The local manufacture of scientific products in Australia has declined a lot. There is a little bit going on and those companies maintain membership with SIA, but a large-scale approach to local manufacture has waned in the last 15 or 20 years.

A lot of supply is now reliant on import.

As I mentioned, the formation of SIA was initially based around that, but support for the local manufacture of scientific equipment and that push by the government of the day has been withdrawn. We still see a need for the association and to report on it, but the manufacturing side of the science industry on a large scale has pretty much gone offshore.

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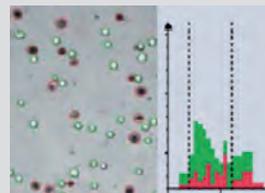
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The real message we'd like to get out to the research community - local institutions and organisations in particular - is to support local suppliers.

It's very easy to jump on the web and order something directly from China, the US or Europe, but obviously we, and the government, would like to see support for Australian industry.

Companies that represent overseas suppliers in Australia need support and there are benefits in doing that such as local capability and support being readily available. If you purchase a product on the internet you can run into problems if you need service because it will not be available locally, whereas if you support local suppliers of scientific equipment then that follow-up is at hand.

LLS: What are your plans for the future of the SIA?

IG: It is certainly about membership engagement and involvement.

And we are actively pursuing that. We are throwing our annual conference open to a larger group of people, for example - and already we are starting to see the benefits of that. That diverse input is going to make a big difference to the technical content in our program this year.

Another plan for the future is to grow the association in other areas of Australia - to get more involvement from Western Australia and South Australia. This is both in activities we conduct there, which hopefully will reflect in membership, and involvement on committees and at a board level.

From SIA's view we try to make sure we are available and that people are aware of us. If a government body says they are looking for support, we want to make sure we are in the right place at the right time so that they are looking to us or advising us.

We have a big database that we've built upon over the years, so when someone has a message they want to send to a large group of the sector we are able to spread that message for them - whether they are within universities, research institutions or industry.

We need to increase our profile and be out there to be aware of opportunities where we can put our hand up to represent our industry.

We want to be the body that people turn to to represent them and provide them with support.

We are involved in some government committees.

We've got strong links with bureaucrats in Canberra and meet regularly throughout the year; but rather than be involved in one-on-one meetings, I believe we need to be involved in more working parties, for example, on behalf of the industry.

We want to be the voice of industry and provide industry input on those working parties or standards committees or whatever is needed to support the industry.

New head for NHMRC

Immunologist and virologist Professor Anne Kelso AO has been appointed as the new chief executive officer of the National Health and Medical Research Council (NHMRC) and will take up the position in April.

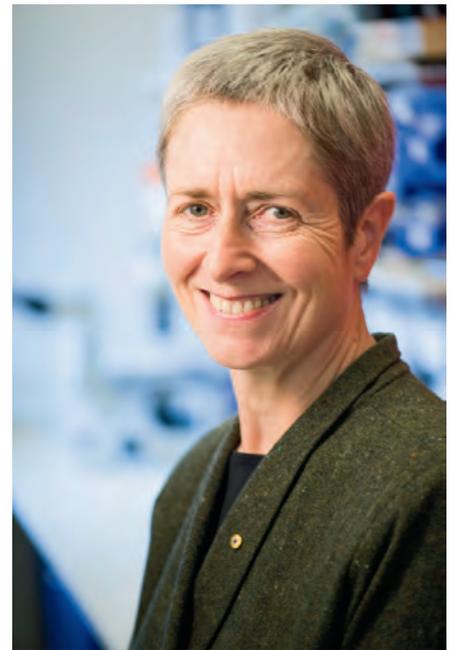
Kelso has a distinguished career in medical research and an impressive track record in immunology and influenza research.

She obtained a Bachelor of Science (Honours) and PhD from the University of Melbourne and has developed significant global health experience and networks through her work with the World Health Organization (WHO).

As director of the WHO Collaborating Centre for Reference and Research on Influenza, Kelso worked on surveillance and vaccine policy relating to pandemic viruses and provided technical advice to ministers of health throughout the Asia-Pacific region.

She also runs a small lab at the Peter Doherty Institute for Immunity and Infection - at the University of Melbourne - pursuing work on fundamental aspects of T cell immunology.

Kelso will succeed Professor Warwick Anderson AO as the NHMRC's chief executive officer.



AIMS council gets a revamp

The Australian Institute of Marine Science (AIMS) has entered 2015 with a new chair and three new members appointed to its council.

The Hon Penelope Wensley AC, former Queensland Governor and distinguished diplomat, began her role as chair of the council on 1 January 2015.

Scientist and businesswoman Diana Hoff, ecosystem scientist and research executive Dr Stephen Morton and chartered accountant Roy Peterson have been appointed as part-time members of the council, with their terms beginning at the end of last year.

The tropical marine research agency plays a key role in providing large-scale, long-term research to support governments, industry and the community in making informed decisions about the sustainable use and protection of Australia's marine estate.

"I congratulate Dr Wensley, Ms Hoff, Dr Morton and Mr Peterson and look forward to working with them closely as the government further embeds science at the centre of Australia's industry policy," said Minister for Industry and Science, Ian MacFarlane, in a statement.

The council consists of a chairperson, AIMS chief executive officer and four other members. With the exception of the chief executive officer, all council members are non-executive appointments nominated by the Minister for Industry and Science.

Retiring council chair was Wayne Osborn, and retiring members included John Grace, Nicholas Mathiou and Elizabeth Montano.



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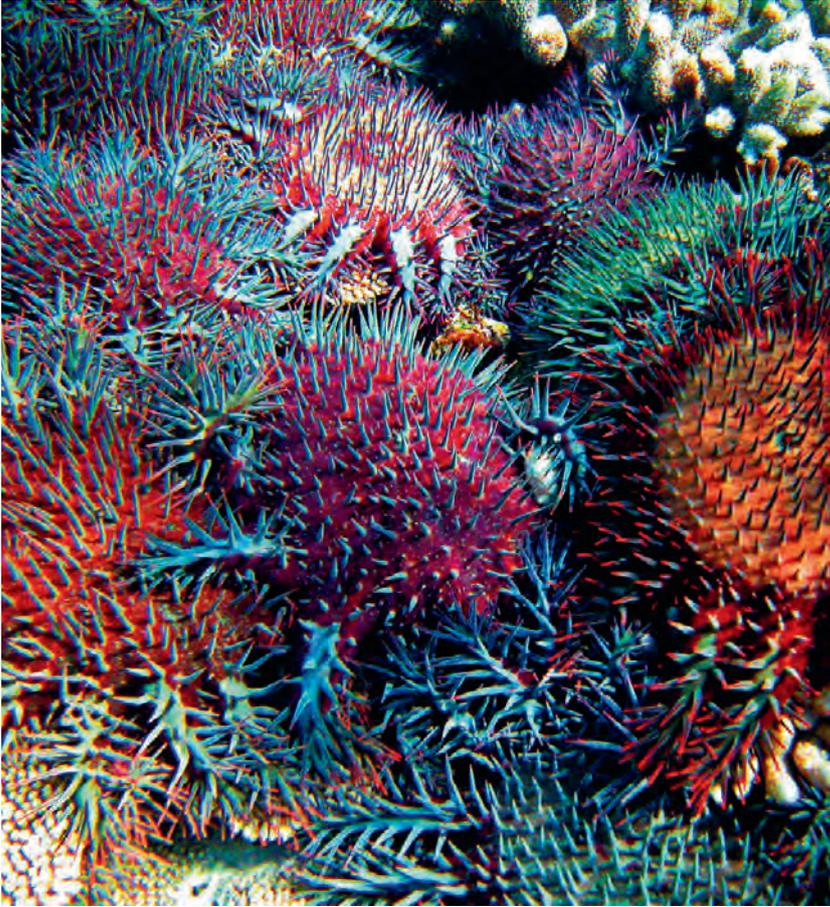
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Crown of thorns thrives in warmer seas

Increasing ocean temperatures are supporting a boom in crown of thorns (COTS) numbers, a venomous starfish that poses one of the most significant threats to the Great Barrier Reef (GBR).

The research, most of which was carried out in the National Sea Simulator by scientists from the Australian Institute of Marine Science (AIMS), the University of Sydney and the University of Otago, has revealed that rising sea surface temperatures are contributing to the survival rate of the coral-eating seastar *Acanthaster planci*.

The COTS is native to coral reefs in the Indo-Pacific region. On healthy coral reefs, the starfish plays an important role, as it tends to feed on the fastest growing corals such as staghorns and plate corals, allowing slower-growing coral species to form colonies and helping to increase coral diversity.

“Warmer sea temperatures were found in this study to enhance COTS survival along with other, cumulative pressures on the reef,” said AIMS scientist Dr Sven Uthicke.

A 2°C increase in sea temperature can increase the probability of survival of COTS by 240% under certain conditions - such as the availability of nutrients for COTS larvae to feed on.

Recognising the synergistic effects of increased nutrient flows and sea surface temperatures on COTS survival will help scientists better understand COTS outbreaks.

COTS outbreaks place a significant stress on the survival of corals on the GBR. Research indicates that COTS outbreaks are a major contributor to the estimated 50% decline in coral cover during 1985 and 2012.

“Given that the most moderate climate change scenarios predict a 1-2°C increase in average sea temperatures, the present study further demonstrates the value of taking a holistic, multivariable approach to understand better how cumulative factors affect the survival of species such as COTS,” Uthicke concluded.

The study has been published in *Scientific Reports*.

Australia Day honours for medical researchers

Burnet Institute Director and CEO Professor Brendan Crabb was awarded a Companion of the Order of Australia in the Australia Day 2015 Honours List for his contributions to medical research and global health.

Crabb is widely recognised for his significant contributions as a molecular biologist in malaria research. His research has included the development of a malaria vaccine and the identification of new treatments for this disease.

He is also well recognised in his leadership of Melbourne-based medical research and public health institution Burnet Institute, and for his work in promoting medical research through the Association of Australian Medical Research Institutes, of which he is immediate past president.

Crabb described the award as an unexpected delight and tremendous honour.

“I accept it recognising that any achievement I have made has relied extensively on others; particularly on colleagues and family,” Crabb said. “I also acknowledge that the award is as much about the issues I care about and the people I work for as it is about me. My focus is on the poorest, most marginalised and vulnerable people in our community and around the globe. Any award to me recognises them.”

Crabb also has a strong interest and longstanding involvement in education and is passionately committed to science and medical research advocacy.

Medical research received its fair share of honours this year with cardiovascular endocrinologist Professor John Funder and kidney transplant specialist Professor Jeremy Chapman also appointed Companions of the Order of Australia in acknowledgment of their services to medicine.

See the Australia Day 2015 Honours List for a complete list of recipients.





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Jellyfish swimming skills help explain blooms

Jellyfish can detect the direction of ocean currents and swim strongly against them, a finding that could help in predicting and avoiding problematic jellyfish blooms.

Barrel-jellyfish were observed to actively swim in a particular direction at the surface of the ocean. The jellyfish were also tagged and tracked using GPS and found to have directional swimming preferences.

“Jellyfish are not just bags of jelly drifting passively in the oceans,” said Deakin University’s Professor Graeme Hays in a statement. “They are incredibly advanced in their orientation abilities.”

“Detecting ocean currents without fixed visual reference points is thought to be close to impossible and is not seen, for example, in lots of migrating vertebrates including birds and turtles.”

The model the researchers developed of the jellyfishes’ behaviour, together with ocean currents, helps to explain how jellyfish form blooms that include hundreds to millions of individuals for periods up to several months.

Jellyfish blooms appear to be on the increase. En masse jellyfish can destroy fisheries, clog fishing nets, cause power plant outages and sting holiday-makers.

It’s not clear exactly how the jellyfish figure out which way to go.

The researchers suggest the animals could detect current shear across their body surface, or they may indirectly assess the direction of drift using other cues such as the Earth’s magnetic field or infrasound.

“Now that we have shown this remarkable behaviour by one species, we need to see how broadly it applies to other species of jellyfish,” Hays said. “This will allow improved management of jellyfish blooms.”

This study has been published in *Current Biology*.

Chief Scientist term extended

Australia’s Chief Scientist, Professor Ian Chubb AC, has agreed to continue in the role to the end of 2015.

Chubb will continue to provide independent advice to the government on science, technology, engineering and mathematics (STEM), as well as advocate for Australian science internationally.

A staunch advocate for Australian science, Chubb has recently been calling the government to develop a long-term strategy that provides sustained support for Australian science - including building competitiveness, supporting education and training, and strengthening research and international engagement.

The government recently announced a \$12 million commitment to boosting interest in STEM subjects in schools.

As Chief Scientist, Chubb will also continue to work with the government on developing and implementing science and research priorities through the Commonwealth Science Council.

Chubb began his tenure in 2011 and is Australia’s seventh Chief Scientist since the role was established in 1989.

The government plans to begin an international recruitment process for a new appointee to the role for 2016.

Goodnow joins Garvan as deputy director

Professor Chris Goodnow has joined the Garvan Institute of Medical Research as deputy director. He has also accepted The Bill and Patricia Ritchie Foundation Chair.

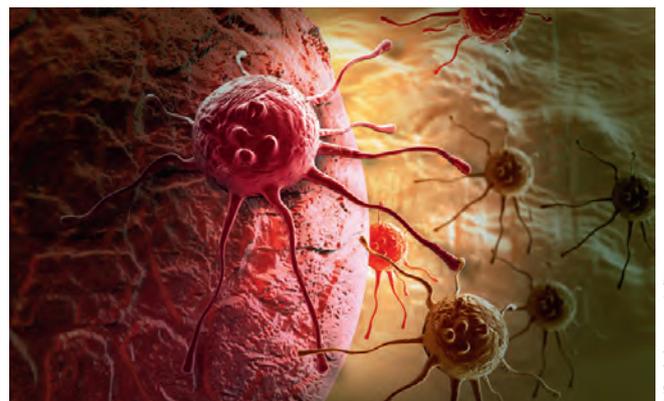
At Garvan he will head the Immunogenomics Group to investigate the underlying genetic causes of immune disorders, particularly autoimmune diseases.

Goodnow, who is current president of the Australasian Society for Immunology, leaves the Division of Immunology at the John Curtin School of Medical Research, Australian National University (ANU). He joined ANU in 1997 as Professor and director of the Medical Genome Centre, leading its development into a Major National Research Facility, the Australian Phenomics Facility.

While at Garvan, Goodnow will continue to pursue his interest in how the immune system makes its decisions, in particular how it distinguishes between ‘self’ and ‘non-self’.

He will take full advantage of the powerful whole genome sequencers at The Kinghorn Cancer Centre as well as in-house capacity to engineer mice with specific genetic mutations.

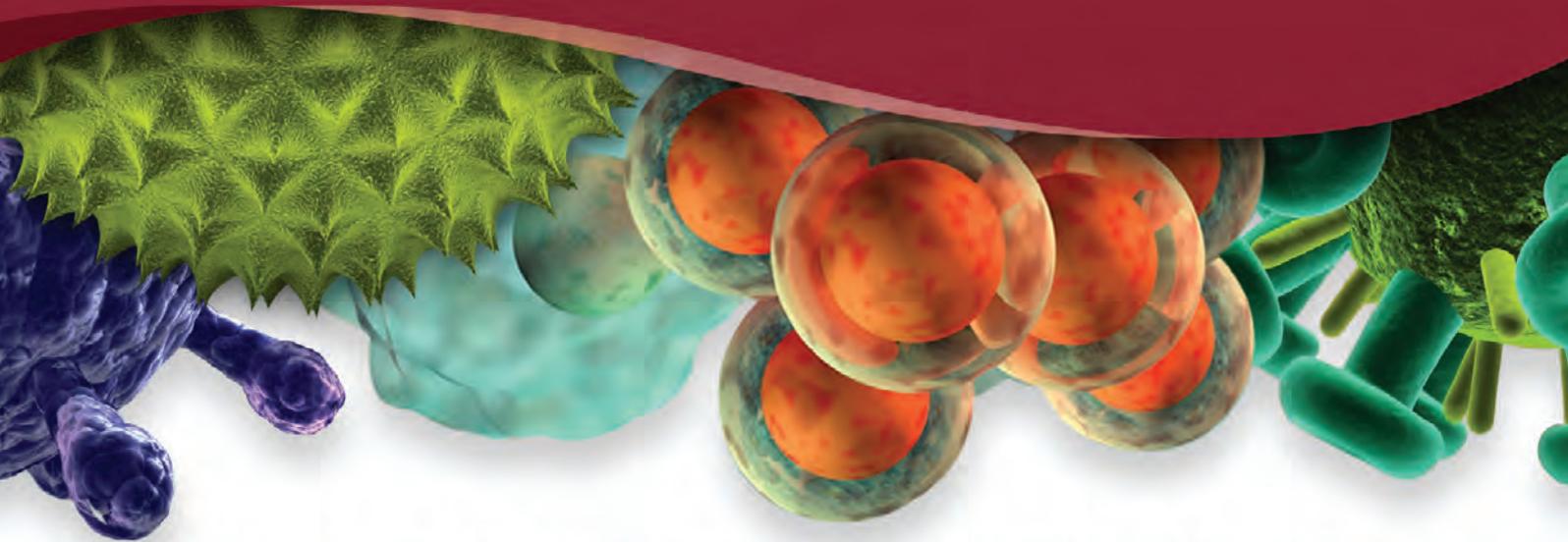
At the same time, he hopes to establish a network of people working in the field of autoimmunity to combine clinical expertise with genomic and molecular immunology research.





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The mystery of the disappearing bees revealed?

Writing in the journal *Proceedings of the National Academy of Sciences*, the researchers explained that many factors have been identified as stressors linked to CCD, including pathogens, pesticides and nutritional deficits. However, it remains unclear “why colonies frequently react to stressors by losing almost their entire adult bee population in a short time, resulting in a colony population collapse”, they said.

The scientists used radio tracking to follow thousands of bees throughout their entire lives to map their accelerated decline. They found that bees reacted to stress by starting to forage when young - but did not cope well with having grown up too fast.

“Precocious foragers completed far fewer foraging trips in their life and had a higher risk of death in their first flights,” the authors said. This put pressure on the colony social structure and disrupted the colonies’ finely balanced social dynamics, triggering a population collapse.

“Bee colonies contain a precise balance of bees specialised in the different roles the society needs,” said Dr Andrew Barron of Macquarie University’s Department of Biological Sciences. “If that balance is upset by young bees starting to forage early, sometimes the colony cannot cope.”

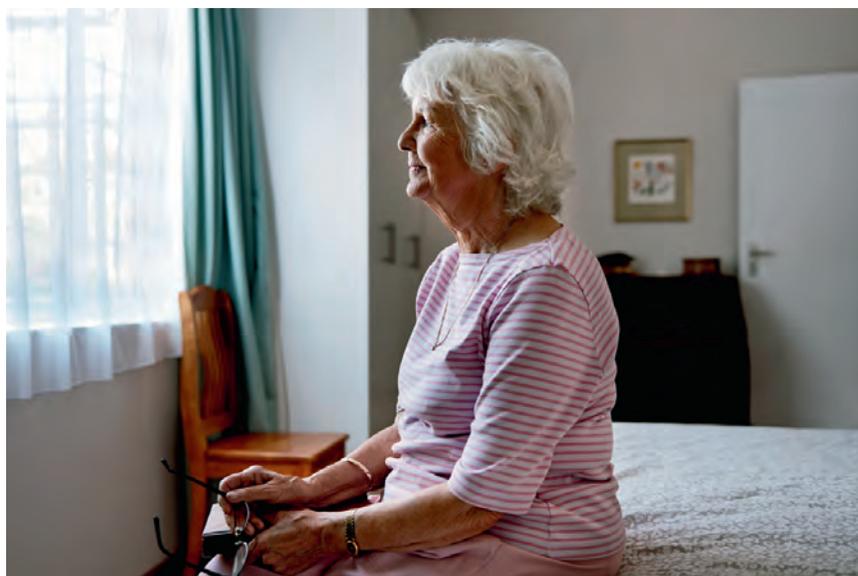
The researchers constructed a demographic model where forager death rates were chronically elevated and found that “an increasingly younger forager force caused a positive feedback that dramatically accelerated terminal population decline in the colony”, they said. This resulted in a breakdown in division of labour and loss of the adult population.

By understanding the process of colony failure, the authors hope to identify effective strategies to improve colony resistance. These include rescue packages for sick colonies and new sensors to detect colonies at risk of failure.

Fellowship scheme for young dementia researchers

Minister for Education and Training Christopher Pyne has announced a new fellowship scheme to expand research capacity in dementia. The fellowships will be funded by the National Health and Medical Research Council and the Australian Research Council as part of the ‘Building the workforce’ element of the government’s \$200 million Boosting Dementia Research Initiative.

The NHMRC-ARC Dementia Research Development Fellowships Scheme provides opportunities for postdoctoral researchers to engage in advanced training in the health, medical, fundamental sciences, social, economic and cultural fields relevant to dementia, in either Australia or overseas. Supported research will be undertaken under a dementia priority framework based on national and international strategies, spanning primary prevention, secondary prevention, treatment and quality of life and care. Interested researchers can now apply for grants on the NHMRC website.



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Proposed ASTM guide for analysing alternative chemical use

ASTM International has proposed a standard which will function as a template that helps companies analyse how any one chemical’s use has social, economic and ecological implications at each stage of a product’s life cycle.

“WK40619, New Guide for Making Chemical Selection Decisions in the Life Cycle of Products” is expected to help companies follow a process, and document and rationalise how to incorporate sustainability into



their business decisions related to products and ingredients. This will enable them to respond to growing regulatory requirements in a systematic way.

The guide is being developed by Subcommittee E60.80 on General Sustainability Standards. According to the chair of the Committee on Sustainability (E60), Michael Schmeida, it would be particularly useful to manufacturers and consultants when determining whether to use greener chemicals and adopt new technologies that fulfil sustainability goals of a business.

“Green building systems and codes could potentially use the proposed standard as a means of meeting green chemistry credits and goals,” Schmeida said. “In addition, regulators could reference it as a compliance path for their green chemistry regulations.”



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Science 50:50 to encourage more female scientists

Prominent scientist and inventor Professor Veena Sahajwalla has launched the Science 50:50 initiative - a program to inspire young women to pursue degrees and careers in the fields of STEM (science, technology, engineering and mathematics). The premise of the program is simple: since half of the population is female, why not half the scientists and technologists?

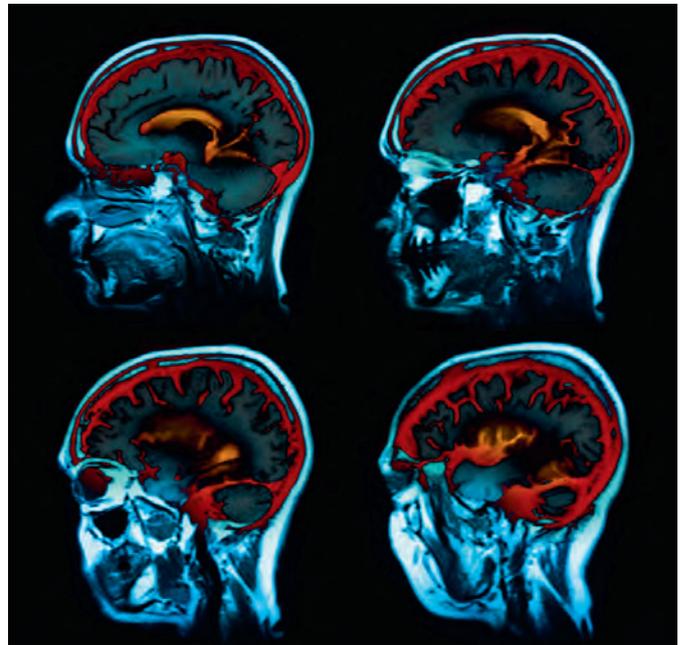
The number of female high-school students taking advanced maths is half that of boys, while only 1.5% of Year 12 girls study the STEM trio of advanced maths, physics and chemistry. Professor Sahajwalla, who was the only girl in her engineering course at university, said this underrepresentation has a lot to do with young women's perception of science as a career.

"If we want to secure Australia's future prosperity, challenging the stereotype of the scientist as a man in a white lab coat is a good place to start," she said.

Professor Sahajwalla, the director of the Centre for Sustainable Materials Research and Technology at UNSW, was last year awarded an Australian Research Council (ARC) Georgina Sweet Australian Laureate Fellowship to enable her to promote women in research. With the support of this fellowship, as well as that of UNSW and scientific and industry partners, Science 50:50 will:

- create internship opportunities for girls to get an experience of scientific careers,
- launch a New Innovators Competition offering university scholarships to the girls who submit the most original and innovative ideas for solving real-world problems,
- provide an engaging video series on extraordinary women in research, industry and other areas,
- engage girls with science and technology through school visits,
- build a network of interested people to help link girls with mentors.

For more information, and to get involved in the program, visit <http://www.science.unsw.edu.au/50-50>.



Lonza announces collaborations and pilot study results

Life sciences company Lonza has announced collaboration agreements with two prominent innovation clusters in France and Italy, as well as the publication of two early pilot studies conducted in tandem with Lipogen.

Medicen Paris Region, one of Europe's biggest life sciences and healthcare clusters, aims to highlight and reinforce the Paris Region as Europe's leading industrial centre for medical devices innovations and health technologies. BioPmed Innovation Cluster in Italy meanwhile promotes and develops the use of different technological solutions from many companies to address unmet medical needs. Lonza will offer cluster members technical presentations and workshops on specific Lonza technologies and will share its expertise in a range of early-stage product development topics.

"These collaboration agreements will benefit Lonza by giving us a better understanding of the mid- and long-term strategies of the biotech industry in Europe," said Anne Hays, head of Lonza's Custom Development Services Organization. "We will also get an early look at potential technology in-licensing opportunities and learn about new therapeutic and technological developments to benefit patients."

Lonza has also revealed the results of two early pilot studies, performed using soy lecithin-derived phosphatidylserine (PS) and phosphatidic acid (PA), in the journal *Advances in Therapy*. The studies provide evidence suggesting a combination of PS and PA - as in Lonza's MemreePlus ingredient - can support memory and cognitive function, which is especially apparent in those who have developed cognition deficiencies.

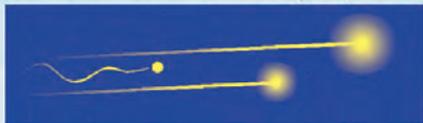
Since 2011, Lonza and PS supplier Lipogen have worked together under an exclusive distribution agreement to offer Lipogen's PS products as Lonza MemreePS ingredient. The pilot studies were funded by Lipogen and used a combination of 100 mg PS and 80 mg PA three times per day.

The first study, conducted over three months in 72 functioning, non-depressive elderly with memory problems, demonstrated a statistically significant positive influence of PS and PA on memory, mood and cognition in pre-post comparison. The second study, held over two months in 96 patients with Alzheimer's disease, demonstrated a significant stabilising effect of PS and PA on daily functioning, as well as improvements in emotional state and self-reported general condition.

At the conclusion of the studies, the combination of PS and PA demonstrated a positive influence on memory, mood and cognition among elderly test subjects with memory problems. Additionally, the studies show PS is efficiently absorbed after oral consumption.



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A microbial portrait of the New York City Subway system



Anthrax and bubonic plague were among the 637 known bacterial, viral, fungal and animal species identified in the New York City Subway system. Only 12% of the bacteria species sampled are known to have some association with disease, but more interestingly still, 48.3% of the DNA sampled did not match any known organism.

The microbes that call the New York City Subway system home are mostly harmless, but include samples of disease-causing bacteria that are resistant to drugs - and even DNA fragments associated with anthrax and bubonic plague - according to a citywide microbiome map published by Weill Cornell Medical College investigators.

The study, published in *Cell Systems*, demonstrates that it is possible and useful to develop a pathogen map - dubbed a 'PathoMap' - of a city, with the heavily travelled subway a proxy for New York's population. It is a baseline assessment, and repeated sampling could be used for long-term, accurate disease surveillance, bioterrorism threat mitigation and large-scale health management for New York, according to the study's senior investigator, Dr Christopher E Mason, an assistant professor in Weill Cornell's Department of Physiology and Biophysics and in the HRH Prince Alwaleed Bin Talal Bin Abdulaziz Al-Saud Institute for Computational Biomedicine (ICB).

The PathoMap findings are generally reassuring, indicating no need to avoid the subway system or use protective gloves. The majority of the 637 known bacterial, viral, fungal and animal species he and his co-authors detected were non-pathogenic and represent normal bacteria present on human skin and the human body. Culture experiments revealed that all subway sites tested possess live bacteria.

Strikingly, about half of the sequences of DNA they collected could not be identified - they did not match any organism known to the National Center for Biotechnology Information or the Centers for Disease Control and Prevention. These represent organisms that New Yorkers touch every day, but were uncharacterised and undiscovered until this study. The findings underscore the vast potential for scientific exploration that is still largely untapped and yet right under scientists' fingertips.

"Our data show evidence that most bacteria in these densely populated, highly trafficked transit areas are neutral to human health, and much of it is commonly found on the skin or in the gastrointestinal tract," Dr Mason said. "These bacteria may even be

helpful, since they can out-compete any dangerous bacteria."

But the researchers also say that 12% of the bacteria species they sampled showed some association with disease. For example, live, antibiotic-resistant bacteria were present in 27% of the samples they collected. And they detected two samples with DNA fragments of *Bacillus anthracis* (anthrax) and three samples with a plasmid associated with *Yersinia pestis* (bubonic plague) - both at very low levels. Notably, the presence of these DNA fragments does not indicate they are alive, and culture experiments showed no evidence of them being alive.

These apparently virulent organisms are not linked to widespread sickness or disease, Dr Mason said. "They are instead likely just the co-habitants of any shared urban infrastructure and city, but wider testing is needed to determine how common this is in other cities."

For example, there has not been a single reported case of the plague in New York City since the PathoMap project began in June 2013.

"Despite finding traces of pathogenic microbes, their presence isn't substantial enough to pose a threat to human health," Dr Mason said. "The presence of these microbes and the lack of reported medical cases is truly a testament to our body's immune system, and our innate ability to continuously adapt to our environment.

"PathoMap also establishes the first baseline data for an entire city, revealing that low levels of pathogens are typical of this environment," he added. "While this is expected in rural environments, and also present in livestock, we've never seen these levels before in cities. We can now monitor for changes and potential threats to this balanced microbial ecosystem."

Jumping into the unknown

Scientists now believe that the diversity of microorganisms that are present in, on and around humans comprise a significant component of overall health. In the average human, there are 10 times as many microbes as human cells, and products processed by these microbes comprise more than one-third of the active, small molecules in the bloodstream. This collective microbiome is seen to impact health by exacerbating or resisting infectious diseases, controlling obesity risk and regulating metabolic rates.

Yet there is very little known about the native microbial communities that surround people in streets, buildings or public transit areas.

In the study, the research team - which includes investigators from five other New York City medical centres and others from around the country and internationally - sought to define the microbiome in New York City's subway system, which in 2013 was used by an average of 5.5 million people per day, according to the city's Metropolitan Transportation Authority. Over the past 17 months, the team - many of them student volunteers, medical students and graduate students - used nylon swabs to collect, in triplicate, DNA from turnstiles, wooden and metal benches, stairway hand railings, garbage bins and kiosks in all open subway stations in 24 subway lines in five boroughs. The team also collected samples from the inside of trains, including seats, doors, poles and handrails. Investigators are currently analysing additional samples collected during all four seasons to study the temporal dynamics of the microbiome.

The sample collectors were equipped with a mobile app built by the researchers, which allowed them to timestamp each of the samples, tag it using a global positioning system and log the data in real time. DNA from the microbes was sequenced using the most advanced research technology at the Weill Cornell Epigenomics Facility and the HudsonAlpha Institute for Biotechnology. They sequenced 1457 samples out of more than 4200 collected, and the results were analysed in the ICB.

"We had our hypothesis about what's on the surfaces of the subway, which reflects a massive, diverse, busy metropolis, but we really had no idea what we would find," said co-lead author Ebrahim Afshinnekoo, a senior at Macaulay Honors College-Queens who starting working on the project as a Tri-Institutional Computational Biology and Medicine Summer Student in 2013.

The majority of the DNA from all the samples, 48.3%, did not match any known organism, "which underscores the vast wealth of unknown species that are ubiquitous in urban areas", Afshinnekoo said.

The most commonly found organism (46.9%) was bacteria. Despite some riders' fears of catching cold or flu from fellow straphangers, viruses were rare - they made up 0.032% of the samples. However, some seasonal viruses are RNA viruses, not DNA viruses, and they would not be identified with the collection methods used in the study.

Of the known bacteria, the majority (57%) found on the surfaces of the subway have never been associated with human disease, whereas about 31% represented opportunistic bacteria that might pose health risks for immune-compromised, injured or disease-susceptible



populations, researchers report. The remaining 12% have some evidence of pathogenicity.

They found that dozens of microbial species were unique to each area of the train, and that there is a significant range of microbial diversity across different subway lines. The Bronx was found to be the most diverse with the most number of species found, followed by Brooklyn, Manhattan and Queens. Staten Island was the least diverse.

"We built maps that detail what organisms are present in each area of the city, creating a molecular portrait of the metropolis," said co-lead author Dr Cem Meydan, a postdoctoral associate at Weill Cornell Medical College.

Despite sampling surfaces of areas of high human traffic and contact, the researchers found that only an average of 0.2% of reads uniquely mapped to the human genome. Using tools like AncestryMapper and ADMIXTURE, the investigators took human alleles and recreated census data of a particular subway station or neighbourhood. Their results showed that the trace levels of human DNA left on the surface of the subway can recapitulate the US Census data. For example, a Hispanic area near Chinatown in Manhattan appeared to hold a strong mixture of Asian and Hispanic human genes. An area of North Harlem showed African and Hispanic genes, and an area of Brooklyn with a predominantly white population was predicted to be Finnish, British and Tuscan.

"This provides a forensic ability to learn about the ancestry of the people who transit a station," Dr Mason said, "and it means the DNA people leave behind can reveal a clue as to the area's demographics."

The researchers also compared their microbial data with US census data, as well as average ridership data from the MTA. They found a slightly positive correlation between these two variables and the population density of microbes on the subway,

suggesting that the more people in an area, the more diverse the types of bacteria.

Efforts like PathoMap in New York can readily be applied to other cities to provide a new tool for disease and threat surveillance, Dr Mason said. "With the further development of sequencing technologies, I believe having a live model tracking the levels of potential pathogens could be possible," he said. "I envision PathoMap to be the first step in that model."

Projects are already underway that build on PathoMap's initial data and further the researchers' goal of investigating the microbiome of large, complex cities. Collaborators across the country have collected samples from airports, subways, transit hubs, taxis and public parks located in 14 states - including New Jersey, Massachusetts, Maryland, Florida, Illinois, Texas and California. By sequencing the DNA of these samples, Dr Mason hopes to create the first ever comparison of major cities in the nation that contextualises urban and rural, and high-density and low-density environments.

The impact of Superstorm Sandy

The researchers also worked with the MTA to gain access to the South Ferry station that was completely submerged by Superstorm Sandy in 2012, and which was still closed during sampling. (The station reopened in April 2013.) Dr Mason's team sampled the walls and floors of the station and found 10 species of bacteria present that were found nowhere else in the system. Notably, all of the species are normally found in marine or aquatic environments.

"The walls of the subway still carry the echo of the hurricane, and you can see it in the microbiome. The big questions are - how long will it stay? How does this impact health and the design of the built environment of the subway? This is why we have kept sampling and swabbing since we started. The temporal dynamics are key," said Dr Mason.

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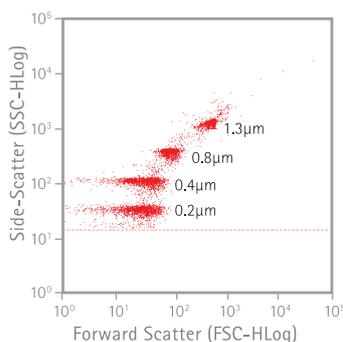
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The product is easy to use, with intuitive software and a large colour display. Once the maximum permissible pressure is reached, the instrument regulates the temperature for safety and keeps reactions running instead of cutting them off. The pressure measurement is fully integrated in the instrument; no further sensors need to be attached.

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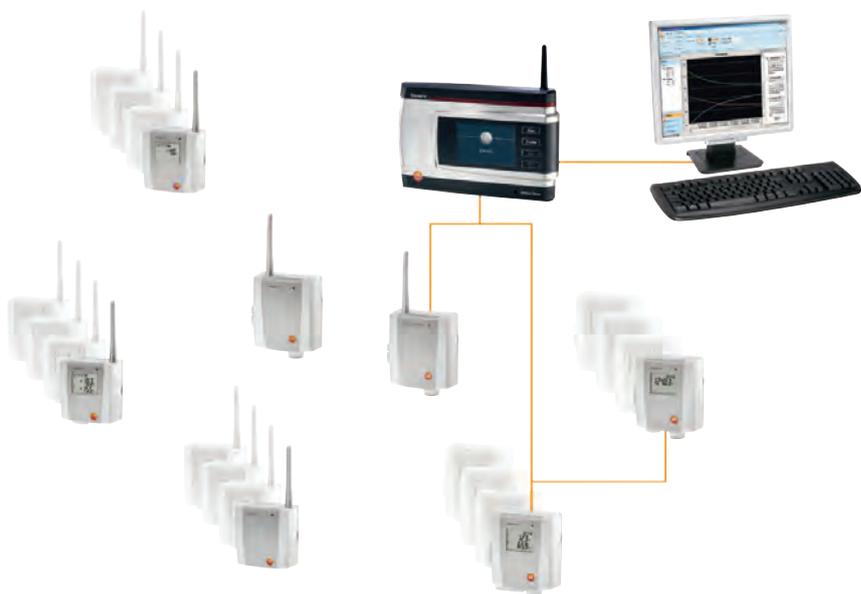


Monitoring and documenting the temperature of sensitive goods

Having the ability to keep track of the temperature storage of sensitive goods is crucial in healthcare. Everything from incubators to medical refrigeration units must be kept within the strictest boundaries.

The testo Saveris temperature monitoring system is capable of keeping such measurements in check and is currently being put to use by Eastern Health Pathology in several locations across the eastern suburbs of Melbourne. Tony O'Neill, the associate director and core laboratory manager of Eastern Health, explained that the organisation's expansion has seen the testo system become more valuable than ever.

"We're the second largest metropolitan health network within Victoria," he said. "One of our acute care hospitals - Box Hill Hospital - has just opened up a brand new facility and it's close to double the size of what it was, so our workload and requirements are on the increase."



Eastern Health Pathology has three separate laboratories, each of which has devices such as freezers, waterbaths and incubators which must be carefully monitored by accurate thermometers. O'Neill said the company owns "a variety of devices that have to be kept in expected temperature ranges - from -80°C freezers all the way up to incubators in the mid-40°C range".

"We have a regulatory requirement to make sure that these devices are maintained at expected temperatures," O'Neill continued. "Any variation from this may affect patient testing and diagnosis. For example, incubating microbiology plates, storage of blood products and

storage of frozen samples must all be done and documented appropriately.

"To talk specifically *about blood storage device*, there are incredibly strict regulations upon the temperature tolerances of blood product refrigerators and freezers. We're storing thousands of dollars' worth of donated blood and plasma products and if the temperatures are not maintained at appropriate levels, the products have to be discarded.

"Not only do we need appropriate control of our temperature-sensitive devices - we also have to have very good record keeping of temperature data that can be reproduced when required."

O'Neill said the testo system has ironed out previously inefficient processes at the company. The system can consistently log data - storing up to 40,000 measurement values - and is highly accurate.

"Before testo, we had a series of individual local temperature monitoring systems on each applicable device and we had to go round and actually manually check and record that those devices were operating at the right temperature," he said. "That manual checking, depending on the device, may have only been on a 24-hour basis.

"[Using the testo Saveris system] means that all of our devices are being monitored in a universal, continuous manner. It's exactly the same process no matter what the device is - if there is an alarm, we know exactly what device it is. Our response to the alarm can be simply recorded, which makes it easier to manage and track issues, if any. We also have the ability to monitor devices located in areas which may not be staffed 24 hours a day."

To keep up with new technology, testo has just launched a cloud-based Wi-Fi temperature monitoring system called testo Saveris 2. Although this system is very similar to its big brother testo Saveris, Saveris 2 is primarily designed for small to medium applications.



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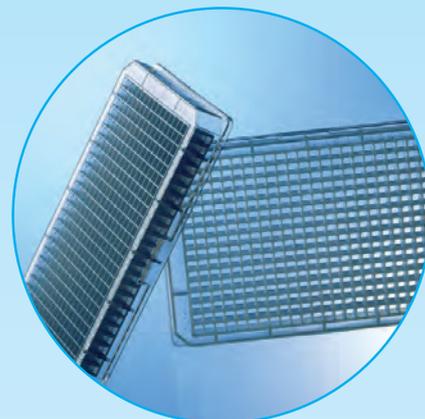
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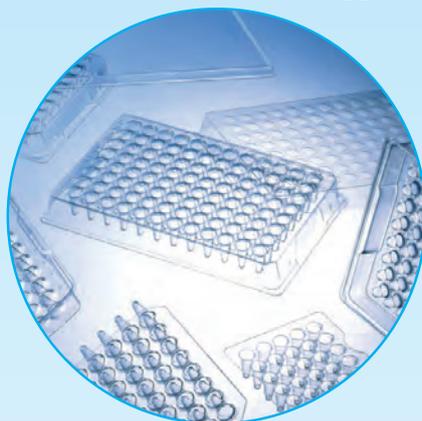
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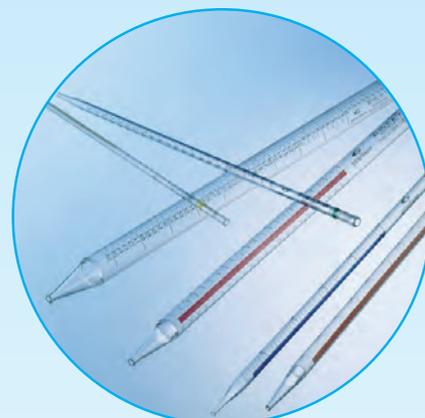
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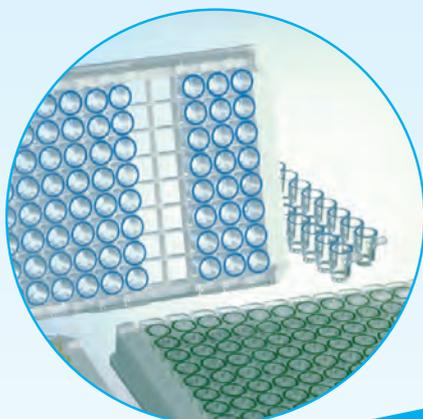
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The PCR Decontamination Kit removes DNA contamination from PCR mastermixes. Contaminating DNA can be removed in the presence of primers and probe by utilising a specific dsDNase. The dsDNase is irreversibly inactivated by heating, leaving the mastermix components unaffected. The product reduces background to improve target detection with no effect on PCR sensitivity. It has an easy protocol to decontaminate directly in the mastermix.

The gDNA Removal Kit removes DNA contamination from RNA prior to reverse transcription. It uses a heat labile dsDNase which is irreversibly inactivated at low temperatures. This enables an inactivation step which is gentle enough to preserve both quality and quantity of all present RNA. The product removes gDNA from RNA prior to reverse transcription in the same tube. HL-dsDNase is inactivated without reducing quality or quantity of RNA. The method minimises pipetting steps and is suitable for high-throughput experiments.

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Flow cytometer

Merck Millipore offers the guava easyCyte 12 flow cytometer, a simple and powerful benchtop method for multicolour flow cytometry. The system has been shown to detect particles as small as 0.2 μm , which is said to be a significant improvement over typical flow cytometers.

The increase in performance gives researchers better sensitivity and resolution for their experiments. Improved sensitivity provides better separation, making gating and identifying dimmer populations easier. Resolution down to 0.2 μm opens up different application areas, particularly for researchers analysing small particles and beads, as well as studying bacteria or algae.

The flow cytometer uses three excitation lasers to detect up to 12 parameters simultaneously, including 10 fluorescent colours, plus forward and side scatter for size and granularity determination. The upgraded lasers and scanning technology reduce channel bleed-over and improve resolution.

Single- and multisample processing options are offered, and high-throughput analysis is possible with robotic sample trays that automatically handle 96-well microplates and up to 10 sample tubes. The platform is said to consume less sample, generate less waste and be easier to maintain than traditional systems.

The system, capable of detecting mammalian and microbial cells and beads, offers an intuitive interface for every laboratory budget. A sample of fluorescently labelled cells is aspirated into a microcapillary flow cell, which eliminates the need for sheath fluid and provides absolute cell counts. The flow cell is self-aligning and user-replaceable, reducing downtime and service visits.

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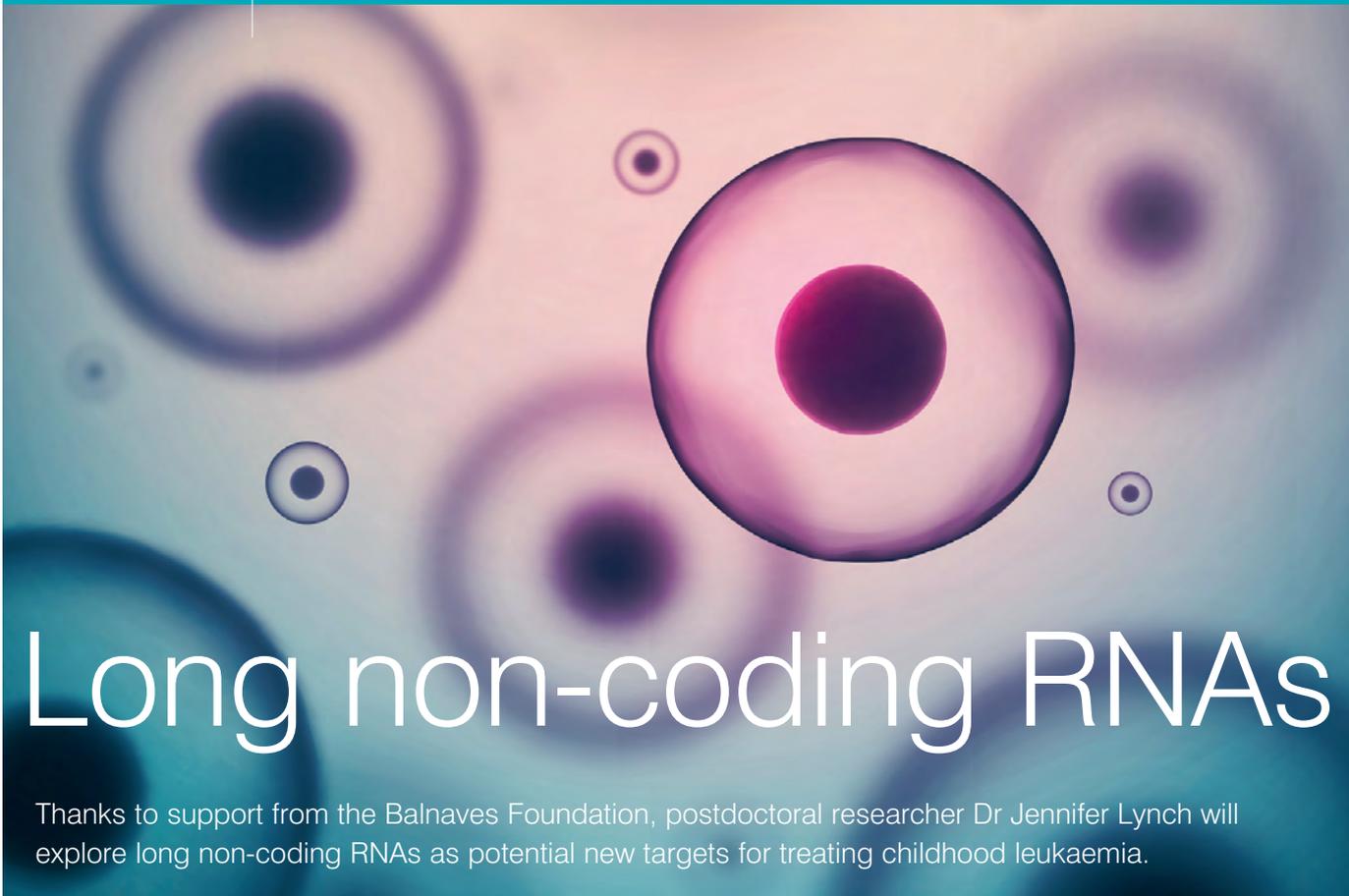
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Long non-coding RNAs

Thanks to support from the Balnaves Foundation, postdoctoral researcher Dr Jennifer Lynch will explore long non-coding RNAs as potential new targets for treating childhood leukaemia.

©Lonely/Dollar Photo Club

Dr Jennifer Lynch, 2014 Balnaves Young Researcher of the Year, is using her \$100,000 award to support a one-year research project to better understand long non-coding RNAs in acute childhood leukaemia.

An early-career researcher with the Cancer and Stem Cell Biology Group at Children's Cancer Institute Australia (CCIA), Lynch will look at whether targeting long non-coding RNAs can provide a new way of treating acute lymphoblastic leukaemia (ALL).

"I recently recruited a research assistant," said Lynch, who is in the second year of her postdoc. "So the work has just started. We plan to look at a particularly aggressive subtype of ALL, called MLL-rearranged ALL."

ALL is an acute form of leukaemia characterised by the overproduction of lymphoblasts - cancerous immature white blood cells. The lymphoblasts accumulate in the bone marrow and impede the production of normal blood cells.

ALL is most common in children between 2 and 5 years of age.

MLL-rearranged ALL is the most aggressive subtype of childhood leukaemia and has a very poor prognosis. It is characterised by a high incidence of chromosomal translocations or rearrangements in the MLL gene. These chromosomal rearrangements are an important predictor of adverse outcome.

"We aim to begin figuring out how this chromosomal rearrangement contributes to the aggressiveness of MLL-rearranged leukaemia," explained Lynch. "Several long non-coding RNAs have been characterised and linked to the MLL-rearrangement and we plan to look at how they contribute to the disease and to maintenance of the disease."

Long non-coding RNAs are part of a large set of non-protein coding transcripts that, combined with short non-coding RNAs and the protein-coding messenger RNAs, form the human transcriptome.

Not a lot is known about the function of long non-coding RNAs, but they have been linked to blood development and cancer.

Lynch will use recently reported evidence on the association of long non-coding RNAs with ALL as well as investigating a novel long non-coding RNA her group at CCIA believe to be associated with acute myeloid leukaemia (AML).

"We have a publication in the pipeline on a gene that we propose plays a critical role in regulating stem cell behaviour in AML and we have evidence to suggest that this gene might be regulated by a long non-coding RNA," Lynch said.

Long non-coding RNAs also interact with chromatin-modifying complexes and regulate gene expression. Lynch plans to look at the different

expression of specific genes between wild-type leukaemia and MLL leukaemia as well as identify binding partners that interact with the long non-coding RNAs.

"We know that the activity of long non-coding RNAs depends on their physical interaction with binding partners," she said. "Identifying critical binding partners provides the opportunity to develop inhibitors that perturb the interaction of long non-coding RNAs with binding partners and potentially develop a new way of treating ALL."

"Understanding the mechanisms of action of these molecules and how they contribute to cancer will facilitate the development of more targeted therapies."

Dr Denise Yu, a research officer with the Experimental Therapeutics Program at CCIA, also received a \$100,000 award for her research to identify metabolic pathways in cancer cells that may be new targets for treating neuroblastoma - the most common solid cancer found in infants.

The Balnaves Foundation established the Balnaves Foundation Young Researcher's Fund in 2008 to support the development of original ideas in childhood cancer research. Through the foundation, renowned Australian philanthropist Neil Balnaves AO invests more than \$2.5 million each year to support education, medicine and the arts with a focus on young people, the disadvantaged and Indigenous communities.

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DIY: How to measure Planck's constant using LEGO



Meanwhile, the second was originally defined as 1/86 400 of a day ... It is now defined as the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom.

Currently the kilogram is the only SI base unit that relies on a specific physical artefact (a chunk of metal sitting in a vault in France), the international prototype of the kilogram, for its definition.

But this definition is on its way out - physicists are about to change the definition of mass so that it depends on Planck's constant rather than on the mass of the lump of metal in Paris.

Redefining the kilogram using Planck's constant

Planck's constant describes the relationship between the energy and frequency of an electromagnetic wave in an equation known as the Planck-Einstein relation: $E = h\nu$ (where E is energy, ν is frequency and h is Planck's constant).

It is one of the five constants of nature (the speed of light, the Planck constant, an elementary charge, the Boltzmann constant and the Avogadro number) that the SI system of measurements requires to have exact values.

So now there is the imperative to know Planck's constant with a high degree of accuracy.

Planck's constant comes in because of an historical idiosyncrasy in the way power units have been defined. Since 1990, almost all electrical measurements have been calibrated using a system of units in which Planck's constant, along with various other constants, are defined rather than measured.

By contrast, mechanical power relies on ordinary SI units, which rely on a measured value of Planck's constant. By comparing electrical power in conventional units to mechanical power in SI units, h can be determined.

Watt balance

One kind of device that can be used to measure mass based on Planck's constant or taken the other way, to find a value for Planck's constant based on a known mass, is called a watt balance. It does its work by balancing the force exerted by gravity with the force of current in a coil - the mass of an object can be calculated by comparing the mechanical power to the electrical power in the device.

This device is simple in principle. The idea is to balance the force on a mass due to gravity with the force generated by a current-carrying coil in a magnetic field. The mass can then be calculated in a straightforward way by comparing the mechanical power to the



Image of three similar versions of the LEGO watt balance. The acrylic cases are backlit with blue LEDs and serve the purpose of blocking out disturbances from air currents. Two hinged doors on the front panel allow for small masses to be placed and removed from the mass pans. All the electronics are mounted below the wooden base board. Four adjustable feet are used for levelling the balance. Credit: arXiv:1412.1699 [physics.ins-det]

electrical power involved in the experiment (the machine gets its name because electrical and mechanical power are both measured in watts).

The experiment involves measurements of only the voltage and current through the coil as well as the velocity of the mass as it moves through the coil. It also requires an accurate value for g , the acceleration due to gravity, which can be easily read off a website operated by the National Oceanic and Atmospheric Administration by entering any location on the planet.

Build your own watt balance using LEGO

Scientists at NIST and other places have built elaborate and expensive watt balances, but in a new effort, they wanted to find a way to create one that anyone could build. They found a way to do this using LEGO blocks. They actually built three, one of which they chose to outline in detail, describing not only how it works, but the parts used so that others could build one too.

Their design, they say, would require a would-be constructor to lay down just \$634 for all the parts, which include 2 sub-mW lasers, photodiode, controllers, etc. They note that some industrious sorts would likely be able to reduce costs using other less expensive parts they source themselves.

They've also written a paper (A LEGO watt balance: An apparatus to demonstrate the definition of mass based on the new SI - <http://arxiv.org/abs/1412.1699>) in which they describe their device and how it was built, should readers wish to construct one of their own.

So if you're searching for the perfect present for the physicist who has everything or fancy a little LEGO fun for yourself, how about creating a LEGO kit for measuring one of the universe's fundamental constants?

standard atmospheric pressure and supported on two cylinders of at least one centimetre diameter, symmetrically placed in the same horizontal plane at a distance of 571 mm from each other.

This definition was replaced in 1960 using a definition based on a wavelength of krypton-86 radiation. This definition was adopted in order to reduce the uncertainty with which the meter may be realised. In turn, to further reduce the uncertainty, in 1983 this latter definition was replaced by the following definition: The meter is the length of the path travelled by light in vacuum during a time interval of 1/299 792 458 of a second.

MRI systems

MR Solutions is a developer of innovative preclinical imaging solutions. The company's superconducting, cryogen-free, preclinical MRI systems up to 7 Tesla are suitable for in vivo investigations in areas such as oncology, developmental biology, cardiovascular disease, neurology and drug development. They are complemented by multimodality capabilities with imaging modalities, such as PET and SPECT for real-time/simultaneous imaging with MRI.

The systems feature the company's cryogen-free superconducting magnet technology, which eliminates the need for liquid helium cooling. The MRIs are self-shielded, which means room shielding is not required. The lack of liquid helium means installation requirements such as quench pipes are not required.

The MRIs have small fringe-fields and can be operated next to other sensitive laboratory systems. This means multimodality imaging is easily achieved. The systems come with field strengths from 3 to 7 T and bore sizes from 17 to 31 cm, making them suited to all small animal models.

PET and SPECT modules expand the MRI system with multimodal imaging capabilities, with the different data sets able to be simultaneously acquired. It is possible to operate the same MRI at different field strengths, further enhancing the capabilities of the instruments.

AXT Pty Ltd

www.axt.com.au



Serial dilution system for viable cell count determination

The Inlabtec Serial Dilution System automates the traditionally labour-intensive process of serial dilution and replaces glass tubes with single-use sterile bags. The system consists of a dispenser unit and a bag holder for handling the Serial Dilution Bags.

The product's safe and comfortable pipetting helps prevent mistakes and cumbersome cap handling. Its standardised dilution process ensures good data quality and there is no physical stress due to manual sample vortexing. The system is said to provide a short payback time for labs currently processing 100+ dilution tubes daily.

Australasian Medical & Scientific Ltd

www.amsl.com.au

F5 pentafluorophenyl columns

Phenomenex announces Kinetex F5 - a robust pentafluorophenyl propyl (PFP) core-shell phase said to overcome the reproducibility and performance limitations of existing PFP and F5 products which were found to produce sporadic basic compound adsorption and analyte retention time shifting.

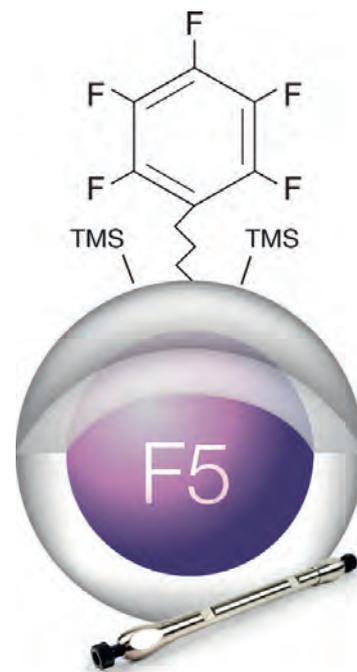
The phase is claimed to deliver improved reproducibility and reduced method development time with its dynamic and responsive chemical functionality. It is suitable for HPLC/UHPLC development work with its combination of polar and non-polar interactions including hydrogen bonding, electrostatic, hydrophobic, aromatic and steric/planar mechanisms. Additional versatility of the phase gives scientists the ability to use reversed phase, 2D-LC, HILIC, SFC or even 100% aqueous separation modes.

With its fluorinated groups and carbon ring structure, the product is suitable for both polar and non-polar compound separations as well as challenging methods that include halogenated, conjugated or isomeric compounds. It is available in 2.6 and 1.7 μm particle sizes and delivers all the advantages of Phenomenex Core-Shell Technology, including good resolution, high efficiency, easy method transferability and cost savings from reduced solvent consumption.

The Kinetex 2.6 μm F5 provides performance comparable to sub-2 μm particles on both standard HPLC and UHPLC systems. The 1.7 μm column delivers 20% greater efficiencies than fully porous sub-2 μm products.

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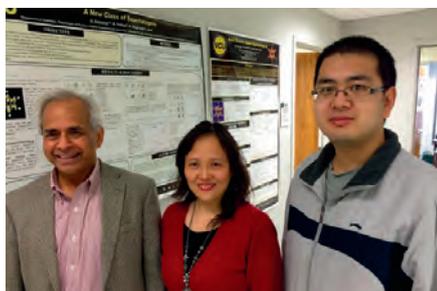
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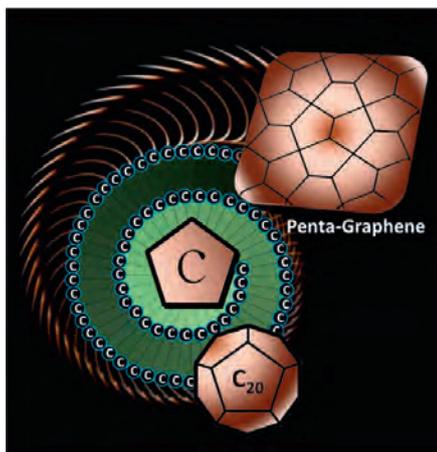
New structural variant of carbon made of pentagons

Researchers from the US and China have discovered a structural variant of carbon called 'penta-graphene' - a very thin sheet of pure carbon that resembles the pentagonal pattern of the tiles which pave the streets of Cairo.

©iHor-seamless/Dollar Photo Club



The authors of the paper include Puru Jena, a distinguished professor in VCU's Department of Physics; Qian Wang, a professor at Peking University and an adjunct professor at VCU; and Jian Zhou, a postdoctoral researcher at VCU.



Unlike most forms of carbon, which are made of hexagonal building blocks and sometimes interspersed with pentagons, carbon structures composed only of pentagons were, until now, unknown. Writing in the journal *Proceedings of the National Academy of Sciences*, the researchers ask, "Is it possible to have materials made exclusively of carbon pentagons and if so will they be stable and have unusual properties?"

Qian Wang, a professor at Peking University and an adjunct professor at Virginia Commonwealth University (VCU), explained that she was dining in a restaurant with her husband when she noticed artwork on the wall depicting pentagon tiles from the streets of Cairo.

"I took a picture and sent it to one of my students, and said, 'I think we can make this. It might be stable. But you must check it carefully,'" she recalled. "He did, and it turned out that this structure is so beautiful yet also very simple."

The researchers simulated the synthesis of penta-graphene - a two-dimensional carbon allotrope composed entirely of pentagons - using computer modelling. According to their calculations, "the new carbon polymorph is not only dynamically

and mechanically stable, but also can withstand temperatures as high as 1000 K", the authors said.

"You know the saying 'diamonds are forever?'" said senior author Puru Jena from VCU. "That's because it takes a lot of energy to convert diamond back into graphite. This will be similar."

Penta-graphene's mechanical strength is derived from a rare property known as negative Poisson's ratio, said the researchers, as a result of its unique atomic configuration. The way the material stretches is particularly unusual, with Wang noting, "If you stretch graphene, it will expand along the direction it is stretched but contract along the perpendicular direction. However, if you stretch penta-graphene, it will expand in both directions."

And while graphene is a conductor of electricity, penta-graphene is a semiconductor. Jena explained, "When you take graphene and roll it up, you make what is called a carbon nanotube, which can be metallic or semiconducting. Penta-graphene, when you roll it up, will also make a nanotube, but it is always semiconducting."

Although penta-graphene is currently only theoretical, Jena believes the eventual synthesis of the material will "open up an entirely new branch of carbon science". The versatility of the penta-graphene and its derivatives is expected to have applications in electronics, biomedicine, nanotechnology and more.



PBMC isolation tube

SepMate is a tube that facilitates the isolation of PBMCs or specific cell types by density gradient centrifugation. It contains an insert that provides a barrier between the density gradient medium and blood.

The insert lets the user quickly layer blood over the density gradient medium (eg, Ficoll-Paque, Lymphoprep, etc) and prevents the layers from mixing. After centrifugation with the brake on, PBMCs are simply poured into a fresh tube.

The tubes are easy to use, preventing slow and laborious sample layering over the density gradient medium. Centrifugation takes just 10 min with the brake on and the product minimises variability between separations.

StemCell Technologies Australia Pty Ltd
www.stemcell.com

Infrared thermal imaging camera

The lightweight Flir T390, with a range of -20 to 1200°C, is suitable for almost any thermal imaging application. The high-temperature infrared camera can be used for electrical surveys, building diagnostics and mechanical inspections. It is available to rent from TechRentals.

With an improved refresh rate (50 Hz PAL) and laser locator, the product is suitable for inspecting moving targets. A 3.5" colour touch screen, auto and manual focus, target illuminator and voice/text annotation all make for a user-friendly IR camera.

The device is equipped with a 3.1 MP visual light camera to complement the 320 x 240 thermal images. It also features picture-in-picture overlay; panoramic image stitching; automated periodic frame capture options with intervals from 10 s to 24 h; and a USB connection allowing for 16-bit radiometric infrared image streaming to a PC.



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Surface disinfectant

Actril Cold Sterilant is a ready-to-use disinfectant and sterilant for hard surfaces commonly found in laboratories and pharmaceutical cleanrooms. It is suitable for surfaces made from non-porous materials such as plastics, stainless steel or glass.

The powerful disinfectant contains a mixture of 0.08% peracetic acid and 1% hydrogen peroxide. It is effective against a broad spectrum of organisms, including bacterial spores, fungal spores, bacteria, mycobacteria, yeast, moulds and viruses.

The sterilant is not a systemic bactericide - rather, it is an oxidiser that attacks and breaks down the organic components of microorganisms, not just killing them but destroying their structure. This means it is fast acting and effective.

The product has been optimised for the cleanroom environment by packaging it to bring straight into the cleanroom.

Onboard Solutions

www.onboardsolutions.com



Multiplex tissue staining

Understanding cancer biology and assessment of complex biological function requires simultaneous interrogation of multiple pathways combined with context provided by tissue images. Standard methods provide an incomplete picture: flow cytometry excels at multiplex analysis but destroys the context provided by tissue, and analysis of individual markers in serial sections is unable to promote understanding of single cell co-expression, particularly for three or more markers at a time.

With Opal Multiplex Tissue Staining, users can overcome these challenges and achieve robust, specific multiplex tissue biomarker measurement. Antibodies can be selected based on performance rather than species. The typical 4-plex Opal staining procedure may be completed within one day. The method is compatible with the standard research IHC workflow in the lab and is amenable to automation.

PerkinElmer Pty Ltd

www.perkinelmer.com



Vacuum pumps

Atlas Copco vacuum pumps support the needs of users across a range of markets, including mining, cement, paper, refineries and food, as well as industries as diverse as aerospace, automotive, refrigeration, glass, bottling, canning and woodworking.

The GHS VSD+ series is a range of efficient, intelligent vacuum pumps with a variable speed drive (VSD). Designed to deliver peak performance at operating pressures found in industrial applications, the series is claimed to offer: energy savings of around 50%; high efficiency to reduce life-cycle costs; better performance against oil-sealed and dry vane vacuum pumps; quiet operation; sustainable productivity; and reduced environmental impact due to ultrahigh oil retention.

The GVD 0.7-28 series small two-stage, oil-sealed rotary vane pumps deliver good ultimate vacuum pressure, high pumping efficiency and good vapour handling capabilities with quiet operation. All pumps/motors are approved to UL and CSA standards and many feature a patented mode selector switch, meaning one model is suitable for both high-vacuum or high-throughput applications.

The GVD 40-275 series two-stage, oil-sealed rotary vane vacuum pumps feature high ultimate vacuum, rapid pumping speeds, quiet operation and the ability to handle water vapour. The direct drive rotary vane pumps are inherently compact and vibration-free. With their finger-proof fan and coupling housings, they offer operator protection.

The ZRS 250-4200 mechanical booster pumps, based on the simple rotary lobe principle, are suitable for applications where high pumping speeds are required for pressures in the region of 0.01 to 50 mbar. The pump must always be backed by another pump, which can deliver against a high-pressure differential to atmospheric pressure. Operating at relatively low pressures, the booster pump is not exposed to the same concentrations of corrosive process media as is the backing pump.

The GLS 250-500 series features an efficient, space-saving design. It has been improved to deliver better dependability and productivity, combined with minimal maintenance and process downtime. This is important in demanding applications such as the automotive and aerospace industries, and their supply chains.

Liquid ring vacuum pumps are offered in a number of configurations, suitable for operation in once through, partial or total recirculation. The AW liquid ring vacuum pumps are available for both single- and two-stage pumps with capacities from 200-37,500 m³/h and vacuum levels down to 30 mbar.

Atlas Copco Compressors Australia

www.atlascopco.com.au

Robotic tips

Manufactured to high standards for automation systems, Biotix robotic tips are said to deliver accuracy and precision every time.

Serial numbers on each rack ensure complete traceability, and lot-specific certification comes in every pack. Accuracy is improved with a low retentive resin, while BioReady status ensures tips are free of RNase, DNase and endotoxins.

Robotic tips come filtered or non-filtered and in clear or black for liquid sensing. Platforms include Agilent, Beckman, Tecan and Molecular Devices and tips come in 96 or 384 formats. The introduction of Statix technology in 384-format tips removes static build-up within the tip rack, preventing unnecessary equipment delays.

Interpath Services Pty Ltd
www.interpath.com.au

Water purification systems

Merck Millipore has announced its AFS 40E, 80E, 120E and 150E water purification systems, developed to provide clinical laboratories with an economical water purification solution for daily water volumes of up to 3000 L.

Elix electrodeionisation (EDI) technology ensures constant water quality with low and predictable running costs, while ERA (Evolutive Reject Adjustment) technology takes feed water quality into account in order to automatically optimise water recovery and reduce water usage costs. The systems offer users 24/7 real-time monitoring and remote control over their water purification systems, as well as enhanced services.

The units have been designed to provide quick and precise remote diagnostics and offer proactive service in order to avoid downtime.

With its large touch screen, the system is designed for intuitive operation and for supporting the user with easy step-by-step instructions during routine maintenance. For increased flexibility, the interface can also be accessed from another location, using a PC, tablet or smartphone through a web browser.

Mobile and customisable, the range is designed to make the best use of lab space. The quiet, compact systems are mounted on wheels. Users can choose from a number of options and accessories, including an online total organic carbon (TOC) monitor, degassing option and sanitary sampling valve.

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The average animal cell is $10\ \mu\text{m}$ across - why? Why aren't they bigger?

Gravity explains why cells are microscopic

The traditional explanation has been that if cells were any bigger it would be difficult to get enough nutrients and energy to support them. However, in a paper in *Nature Cell Biology* late last year, Princeton bioengineers Marina Feric and Cliff Brangwynne described their probing of cellular inner space, the cell nucleus and their discovery that gravity could limit cell size.

The researchers studied the mechanics of the cell nucleus using eggs from the African clawed frog, *Xenopus laevis*. (Bio factoid: scientists who work in *Xenopus* call each other 'froggers'.)

As cells go, *Xenopus* eggs are enormous. The *Xenopus* egg nucleus alone is bigger than most of the cells found in humans. If the average human cell is the size of an average American house, frog eggs are the size of the Empire State Building! Feric and Brangwynne want to know more about the mechanics of these skyscraper-sized cells.

Giant *Xenopus* egg cells manage to support thousands of membrane-less compartments inside the nucleus. Most cellular compartments are surrounded by membranes, but some aren't. They're like beer without a bottle or sheep without a fence. There's nothing to really support them or keep them separate. They don't seem to be affected by gravity either; otherwise, they would eventually all pool together at the bottom of the nucleus. Yet they don't.

One type of these membrane-less compartments are the nuclear bodies. They are liquid-like drops, made up of RNA and proteins. Inside the nucleus, they act like droplets of vinegar in oil, that is, whenever they get close together, they fuse and sink. And yet unlike the vinegar in salad dressing, all the little nuclear bodies in the nucleus don't clump into one big pool at the bottom. Feric and Brangwynne previously found that an actin mesh was preventing the nuclear bodies from clumping by keeping them small. But how strong was the mesh?

Feric and Brangwynne wanted to measure gravity's pull on nuclear bodies and against the

actin mesh that contained them. They injected a tiny magnetic bead into the nucleus and turned on a magnet to add a known force. They found that the actin mesh in the nucleus is softer than jelly but, like jelly, with some prodding it returns to its original shape. Actin continues to hold up the nuclear bodies against gravity like pieces of fruit in a jelly mould but, under rising force, the nuclear jelly undergoes sheer thickening, a non-Newtonian property where a liquid becomes more viscous, a property that probably protects the nucleus. At a high enough force though, the actin mesh breaks and can no longer hold up the nuclear bodies.

This suggests that actin's mechanical properties are finely tuned to resist the force of gravity but also allow flexibility and rigidity of the cell nucleus to support life.

American Society for Cell Biology
www.ascb.org

Image: *Xenopus laevis* 02 by Brian Gratwicke - Flickr: *Xenopus laevis*. Licensed under CC BY 2.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Xenopus_laevis_02.jpg#mediaviewer/File:Xenopus_laevis_02.jpg



Unified chromatography system

The fully automated, supercritical fluidic chromatography-based Nexera Unified Chromatography system (Nexera UC) can sequentially analyse up to 48 samples by utilising automatic extraction and chromatographic separation combined with high-sensitivity detection of targets by mass spectrometry. It is designed for a wide range of applications, including monitoring pesticides; biomarkers; additives; pharmaceuticals and biopharmaceuticals; and cleaning validation.

The system eliminates the need for complicated sample pre-treatment and enables stable analysis of delicate samples that are prone to oxidation or dissociation if exposed to air. In the analysis of pesticides in food products, it takes only 5 m for a complete analysis sample pre-treatment. Furthermore, the fully automated system has a high target analyte recovery rate.

The product offers several separation modes, enabling the separation of a wide range of compounds at once - something which is not possible with single systems that are based on gas and liquid chromatography. The automated extraction and chromatography is achieved using a mobile phase of supercritical fluidic carbon dioxide (that exhibits the solubility of liquids and diffusivity of gases), into which alcohol and other such organic solvents are added.

The system is capable of high-sensitivity analysis of approximately 500 different types of pesticides in less than 1 h. It also reduces the quantity of organic solvents used for such applications as the chiral analysis of enantiomers that are common in pharmaceutical drugs.

Shimadzu Scientific Instruments (Oceania) Pty Ltd

www.shimadzu.com.au

Disposable floor cloth for liquid spillages

Spillages on hard floors - such as blood, urine, chemical or bodily fluids in operating theatres and general laboratories - can cause considerable problems. SpillEx from Vileda Professional is a disposable, super-absorbing floor cloth that takes care of liquid spillages in minutes.

One cloth can absorb and hold up to 1.2 L of water and up to 500 mL of NaCl 0.9% (similar to urine). It will not drip when lifting and moving, as the product transforms the liquid spill into a gel through the high concentration of super-absorbent polymers in its inner layer. A PE foil on the top side functions as a liquid barrier for hygienic disposal of the used cloth.



Onboard Solutions

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Centrifuges

Gyrozen is a Korean manufacturer of quality laboratory centrifuges, distributed in Australia by Bio-Strategy. The company's extensive portfolio covers 14 models, ranging from personal micro centrifuges to floor-standing SuperSpeed refrigerated centrifuges designed to meet the user's exact needs.

Manufactured and tested to IEC standards, the units offer stable spinning operation within $\pm 2\%$ variation of set speed. The brushless induction drive motors are quiet and maintenance-free.

Safety is ensured, with the door lock mechanism in effect while the rotor is in motion; double- or triple-laminated ABS/steel door for added protection; door drop protection; clinical and research models offering aerosol-tight bucket sealing; automatic rotor detection on many models; imbalance protection; and alarms for over-speeding and overheating.

The refrigerated models offer fast cooling, achieving 4°C within 5 min. With plenty of cooling capacity, the units can maintain 4°C even at maximum speed.

The centrifuge range comes with a two-year warranty and is backed by Bio-Strategy through its trained, qualified service team.

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

Multimode microplate reader

The Spark 10M multimode microplate reader, from Tecan, is designed to offer flexibility and productivity in cell biology and genomics applications. From microbiology research and cell-based assays to rapid DNA quantification, the product delivers a combination of advanced capabilities and ease of use to simplify daily work.

The company's Fusion Optics offer users the choice of filter- or monochromator-based measurements - or even a combination of both - at the touch of a button, meaning laboratories no longer have to choose between flexibility and sensitivity. The system is complemented by high-speed monochromators which provide a complete absorbance scan, from 200 to 1000 nm, in under 5 s.

Developed from the outset with cell-based assays in mind, the reader includes a host of software and hardware features designed to simplify cell biology protocols. It combines precise temperature regulation and plate shaking options with a fully integrated Gas Control Module (GCM), offering in-reader incubation capabilities for walkaway, long-term studies. Productivity and reproducibility are further improved by the addition of a humidity cassette and automated lid handling, helping to precisely balance gas exchange and provide evaporation protection.



The product also features a bright-field cell counting module. Controlled by the system's user-oriented SparkControl software and intuitive touchscreen interface, the features make it easy to set up and run even complex assay protocols.

Tecan Australia
www.tecan.com.au

Rabbit monoclonal antibodies

Rabbit monoclonal (RabMAB) antibodies offer the antigen recognition of the rabbit immune system combined with the specificity and consistency of a monoclonal, providing antibodies with good binding affinity and bioactivity in a wide variety of biological assays. RabMAB technology makes it possible to develop high-quality monoclonal antibodies for research, diagnostic and therapeutic applications.

Abcam Australia Pty Ltd
www.abcam.com



GPC/SEC platform

Malvern has produced a gel permeation chromatography/size-exclusion chromatography solution by coupling efficient sample separation with fully optimised, multidetector analysis. The platform delivers the high performance, ease of use and productivity demanded in the development of novel natural and synthetic polymers, pharmaceutical products, foods and other macromolecules.

Omnisec Reveal includes four detectors: refractive index, UV/Vis photodiode array, low-angle/right-angle light scattering and viscometer. Its light-scattering detector is so sensitive that it can accurately measure molecular weights as low as 200 Da. Good temperature control across the complete module further boosts the accuracy of all measurements.

Omnisec Resolve consists of a sample degasser, pump, autosampler and column oven, each optimised for precise, high-resolution separations. A low-volume, high-efficiency degasser design enables rapid switchover from one sample type to another. The temperature-controlled autosampler eliminates injection waste, minimising the sample required for routine measurement and, in combination with the column oven, maintains all samples under closely controlled conditions throughout the analysis.

ATA Scientific Pty Ltd

www.atascientific.com.au

Stainless steel touch panel PC

The AFP-6152 is a projected capacitive touch stainless steel panel PC from Aaeon. It is housed in a fanless, sealed, 316L stainless steel, IP66 certified enclosure with M12 waterproof I/O connectors.

The PC is supplied with an internal 15" 1024 x 768 resolution LCD that features 400 nits luminance and a wide viewing angle. An anti-scratch, 5-wire Glass-Film-Glass touch screen makes the product suitable for operator panel and HMI control applications.

The unit features a built-in, energy-efficient Intel Atom D525 1.8 GHz processor with 2 GB of DDR3 memory. An internal 2.5" SATA2 hard drive bay and internal SD card slot are provided for system and data storage. Rear waterproof M12 I/O connectors provide access to two COM ports, two USB 2.0 ports, one Gigabit Ethernet port and DC power.



The product requires a 9-30 VDC power source and can operate in -20 to 50°C environments. VESA 75/100 rear-mounting holes allow the panel PC to be securely wall or arm mounted.

The PC is suitable for laboratory, food and beverage processing and industrial hosedown environments. It is compatible with Windows operating systems, allowing it to support a wide range of off-the-shelf and custom-developed industrial applications.

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Temperature-controlled gas displacement pycnometer

The AccuPyc II Series are fast, fully automatic gas displacement pycnometers that provide high-speed, high-precision volume measurements and true density calculations on a wide variety of powders, solids and slurries. Micromeritics has added a versatile temperature-control solution to the series with the introduction of the AccuPyc II TEC.

The AccuPyc II TEC is suitable for use with temperature-sensitive or viscous samples where environmental temperature cannot be adequately controlled.

The product features a Peltier thermoelectric device to deliver temperature stability and accurate temperature control from 15 to 36°C, adjustable in 0.1°C increments. Available in stand-alone models with sample chamber sizes of 10 and 100 cm³, the instrument also comes in an analysis module version for remote operation when utilising an AccuPyc II control module.

Optional software can also enable the instrument to determine the density of semi-solid bituminous materials. With the TEC software, data can be closely correlated to those obtained with ASTM Test Method D70-09, but with faster specific gravity, volume and density results. This option includes disposable sample cups to limit contamination and minimise cleaning of the sample chamber between analyses.

Particle & Surface Sciences Pty Ltd

www.pss.aus.net



Direct concentration of large sample volumes into vials

SampleGenie 4 is the latest version of Genevac's technology for direct concentration of large sample volumes into vials, designed for use in the Rocket Synergy Evaporator. The technology eliminates a number of time-consuming sample handling steps, lowers labour costs and improves data reliability.

SampleGenie technology has enabled samples in Genevac Rocket Synergy, HT and EZ-2 series evaporators to be dried or concentrated directly into a single vial, eliminating the need for reformatting of samples after drying. The protocol is simplified to a single overnight drying step before storage or analysis.

The latest generation has been precision-engineered to reduce the risk of vial breakage. It accommodates sample volumes of up to 250 mL and features a vial adapter insert to suit a range of vials - from 12 to 28 mm diameter and up to 70 mm tall. It is suitable for applications including environmental analysis, metabolism and toxicology studies, and food and beverage research, as well as post-purification protocols in chemical/life science research.

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2.8 kW DC power supply

The Centrex XFR 2.8 kW programmable DC power supply is suitable for providing power for research, production testing and development, and original equipment manufacturer (OEM) applications. It is available to rent from TechRentals.

The product has a voltage range 0 to 600 V and current range 0 to 4 A. The supplies have good thermal management, allowing units to be stacked in rack mounts without any ventilation space required between them.

'Soft switching' virtually eliminates switching transients for high efficiency, reduced heat generation and decreased stress on the switching transistors. Other features include remote sense with 5 V line loss compensation, and overvoltage and overtemperature protection.

TechRentals

www.techrentals.com.au



Delegations set to support global outreach of Australian biotech and medtech



AusBiotech will be leading missions to the world's largest and most relevant biotech and medtech events over the coming months - in Shanghai, Hong Kong, Korea and USA - to support Australian companies in their outreach and global development.

Registration is now open for Australian delegations to:

- Biotech Invest Korea at the BioKorea International Convention, to be held in Seoul, Korea, from 8-10 April 2015;

- Australian Pavilion at the China International Medical Equipment Fair, 15-18 May 2015 in Shanghai, China;
- Asia Biotech Invest, 19-21 May 2015 in Kowloon, Hong Kong; and
- Australian Pavilion at the BIO International Convention, 15-18 June 2015 in Philadelphia, USA.

The Australian pavilions will offer exhibiting companies more than just an exhibition space, with

packages of total support. The recognisable Brand Australia images, shared services, informal meeting areas, meeting rooms and reception counters will ensure you maximise your chances of achieving a successful outcome at these major events.

The investment missions showcase Australian companies for partnering and investing opportunities. Participation in these events, in many cases, is subsidised by government support, making the costs of participation lower than attending alone.

You may be eligible to claim some of your marketing and promotion costs associated with the exhibitions through the Export Market Development Grant scheme. For more information, visit www.austrade.gov.au.

Some state governments also provide financial assistance to exporters to attend international exhibitions, such as Victoria's Trade Mission Assistance Program. Please contact your local state development office to discuss applicable programs.

For more information on each event, see www.ausbiotech.org/events and click on 'International' for a full list of upcoming opportunities.

Call for transitional arrangements for R&D Tax incentive cap

The passage of legislation last week to cap claims on the Research and Development (R&D) Tax Incentive and its retrospective application to 1 July 2014 has prompted calls for the government to provide transitional arrangements for biotech companies abandoned in a difficult position.

The Tax Laws Amendment (Research and Development) Bill 2013 was initially introduced by the federal government to exclude companies with a \$20 billion turnover from accessing the R&D Tax Incentive - but in a last-minute shock deal, an amendment put by the Palmer United Party was agreed and passed to cap claims at a \$100 million of expenditure.

AusBiotech said the change was significant for the Australian innovation ecosystem and will impact many more companies than was originally intended, large and small. It also capped claims retrospectively to include the current tax year, more than halfway through the financial year.

"Companies that have already made investment decisions and committed to R&D programs based on advice or approval for R&D activities in 2014-15 will be left in the lurch," said AusBiotech CEO Dr Anna Lavelle.

"Transitional arrangements are needed to assist companies that have made commitments based on the program's provisions and allowed for the 2013 Bill's original intent before the amendment sent plans awry. The backdating of this latest amendment will cause havoc with planning, create even greater uncertainty and discourage the industry from investing, which needs to be counterbalanced.

"While aimed at large companies, we will see the impacts felt throughout the industry, with more research and development expected to move offshore and the ecosystem that supports small developing companies set to contract as funds are extracted from the sector.

"The plan to take funds out of the reach of innovators and not reinvest them into innovation contradicts the government's rhetoric on growing and supporting innovation and the resulting 'smart' jobs, where Australia has competitive strength in pharmaceuticals and medical devices.

"The unrelenting threat to the R&D Tax Incentive and efforts to trim and cap is unsettling for an industry that takes many years to develop each treatment, diagnostic, cure and medical device."

Companies caught by the sudden and retrospective changes are invited to add ballast to AusBiotech's representations with company examples. Please contact AusBiotech Communications Manager Lorraine Chiroiu (lchiroiu@ausbiotech.org) if your company is impacted.



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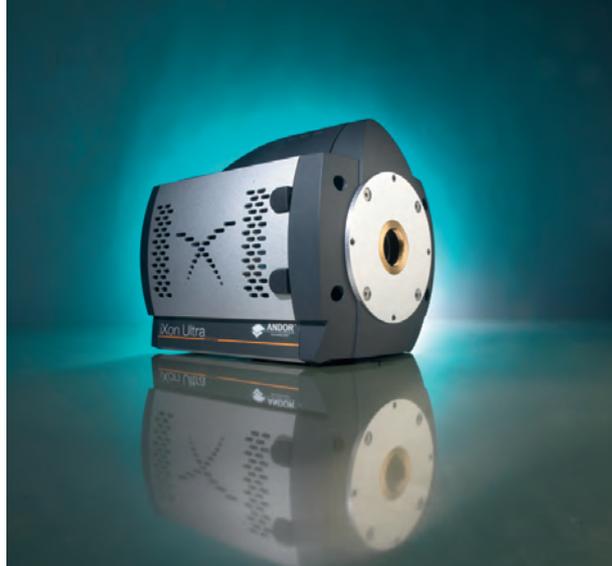
The Andor iXon Ultra 888 MP, back-illuminated EMCCD camera offers single-photon sensitivity across a large field of view at 26 fps. It is claimed to represent a performance boost for the largest available EMCCD sensor, as well as the first USB 3.0-enabled EMCCD camera.

With a 1024 x 1024 sensor format and 13 μm pixel size, the resolving power, field of view and speed of the device render it attractive and versatile for demanding applications. It has been re-engineered to facilitate a 3x acceleration of the pixel readout speed to 30 MHz while maintaining quantitative stability, propelling the full frame performance to video rate.

The product is designed to be flexible yet easy to use, optimisable for a wide variety of application requirements in a single click via the OptAcquire feature. Signal can be quantitatively calibrated in units of electrons or photons, either in real time or post-processing. The camera's technology offers automated recalibration of EM gain, alongside anti-ageing protection.

Applications include: single molecule detection; super-resolution microscopy (PALM, STORM); TIRF microscopy; spinning disk confocal microscopy; vesicle trafficking; ion signalling; cell motility; luminescence; FRET/FRAP; single photon counting; voltage-sensitive dyes.

SciTech Pty Ltd
www.scitech.com.au



Tube rollers

Stuart has updated its range of tube rollers. The products are suitable for laboratories that have demand for rolling as a form of mixing.

Gentler than shaking, rolling tubes provide steady mixing over long periods of time. This makes them suitable for mixing blood samples, viscous substances and liquid-solid suspensions where minimal aeration is required. They also aid in the defrosting of samples and are designed for continuous operation.

Units can be used in incubators up to 60°C and with humidity up to 80% or in cold rooms down to 4°C. The roller mixers are robustly constructed and designed for easy cleaning, with plastic rollers and a drip tray to collect accidental spillages. The addition of removable side panels and detachable roller tubes means the mixer can adapt to even more users' needs.

The user can conveniently detach the product's roller tubes to allow large vessels to be accommodated, as well as allowing the user to mix a wide variety of differently sized tubes and bottles. Any of the roller tubes can be removed to allow the user to choose the arrangement depending on their needs.

Removable side panels provide the user with peace of mind, as samples will be mixed effectively during continued use. The side panels ensure the sample bottles do not slide off the mixer during use and, as a result, provide a high level of safety and functionality.

The mixers are available with analog or digital control; six or nine rollers; and fixed or variable speed. The accessory stacking system SRT/STACK is available where bench space is at a premium.

LabFriend
www.labfriend.com.au

Stereo microscope

Lynx Stereo Microscopes are suitable for intricate tasks that require high-resolution stereo viewing, such as observation of stem cells. The eyepiece-less optics of the product means it can be placed behind the glass within a laminar flow cabinet, allowing researchers to inspect the live stem cells in both bright- and dark-field illumination with up to 40x magnification.

The microscope head allows the system to deliver clarity and accuracy through a viewer instead of the traditional binocular eyepiece. This allows the operator to view the subject without the need to be directly in contact with the microscope, and to wear prescription spectacles if needed. The device allows for movement and flexibility, with a range of vertical adjustments allowing the instrument to be quickly set up at the desired eye level for any operator and correspondingly to enforce correct posture from being the glass.

The microscope enhances the contrast of stem cells by the tilting mirror within the sub-stage of the unit. This creates a pseudo effect for both dark- and bright-field microscopy, maximising the contrast of the cells for both inspection and manipulation. Both fields are important features for both dissection and inspection.

Hawker Richardson

www.hawkerrichardson.com.au

Mini centrifuges

The Thermo Scientific mySPIN mini centrifuges are designed for protocols requiring quick spin downs, micro-filter cell separations and HPLC samples, as well as applications with a high RCF requirement. The products provide researchers with simplicity, ergonomics and flexibility in a compact footprint for personalised workstations.

The mySPIN 6 and mySPIN 12 mini centrifuges allow researchers to easily perform fast spins within 20-30 s. The centrifuges feature a compact, ergonomic design to fit personal workstations for daily applications, as well as an intuitive display for easy operation.

The mini centrifuges also offer tool-free rotor exchange; a brushless motor for quiet operation and low vibration; safety features for user assurance; and maximum speeds up to 6000 (mySPIN 6) and 12,500 rpm (mySPIN 12).

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At the newly opened Clive and Vera Ramaciotti Centre for Structural Cryo Electron Microscopy, located at Monash University, stands the FEI Titan Krios cryo-electron microscope (EM). It is three metres tall, weighs around one tonne, boasts a 300 kV electron gun and is the only one of its kind in Australia.

Clearer than crystal

Australia's new cryo-electron microscope

The Ramaciotti Centre and this \$5 million microscope are central to the work of the ARC Centre of Excellence in Advanced Molecular Imaging (Imaging CoE), administered by Monash University, which brings together biologists, physicists and chemists from several collaborating organisations to characterise and visualise the interactions that underpin immune responses. The CoE aims to transform our understanding of the immune system and, in doing so, also transform the science of microscopy.

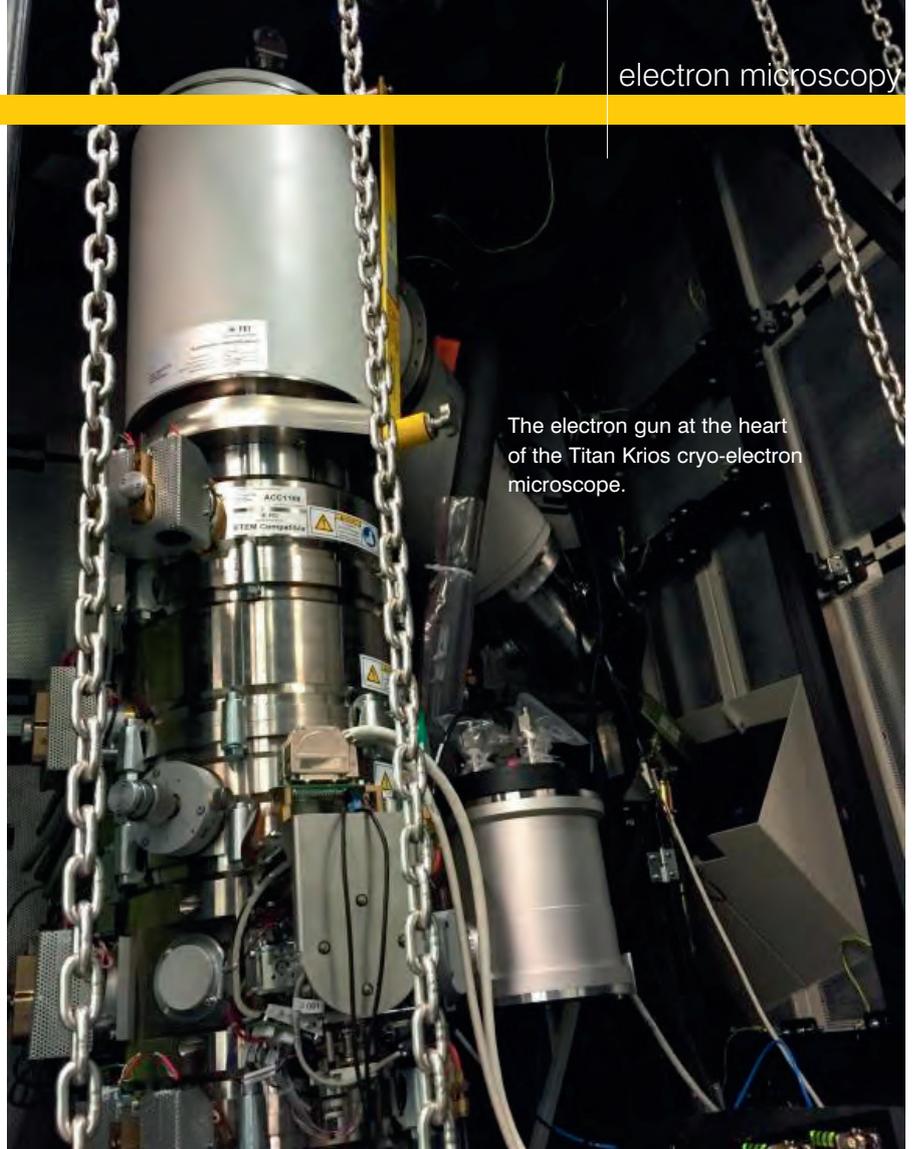
Imaging CoE Director Professor James Whisstock explained that scientists “used microscopy to look at biological structures for many decades, but these have typically been lower resolution ... so you could see sort of big blobs where there were big proteins”. Some have tried to solve this problem using crystallography, but Professor Whisstock soon realised there are some things that “you’re just never going to be able to crystallise”.

The answer lay in advances in computational methods, physics and engineering, led by microscope manufacturer FEI. The company’s Titan Krios cryo-EM fires high-energy electrons through a sample that’s frozen in a pool of liquid ethane at -200°C. By snap-freezing the samples, this not only holds in place the shape of molecules and the complexes they form, but does so in their natural cellular environment of water.

Some of the electrons in the microscope’s beam are deflected or absorbed by the molecules in the sample when they pass through it, and these rays can be used to create a 2D image of the sample. Multiple images obtained by passing the electron beam through hundreds of samples can then be automatically pieced together to determine the 3D shapes.

“The Titan Krios is powerful enough to resolve those intricate 3D shapes, identifying the position of individual atoms within a biological molecule and creating exquisitely detailed models including the molecules’ loops and side chains,” Professor Whisstock said. “It fills a gap, seeing things that X-ray crystallography and the synchrotron can’t see.”

Until recently, Australian researchers had been forced to join long overseas waiting lists in order to utilise this cutting-edge technology. Professor Whisstock explained that he and his colleagues felt the need to build their own electron microscopy centre for structural biologists, believing that “if we didn’t go down this path ... the Australian community would be left behind, as it were, in terms of being able to access the technology”.



The electron gun at the heart of the Titan Krios cryo-electron microscope.

Now such a centre has been established, funded with support from the Ramaciotti Foundations, the Australian Research Council, Monash University, the Walter and Eliza Hall Institute of Medical Research, La Trobe University and the National Health and Medical Research Council. Not only is it home to what is said to be the most powerful biological microscope in Australia, but the cryo-EM is also “much easier to use than a standard electron microscope”, according to Professor Whisstock.

In addition to its high-quality optics, good stability and sensitive camera systems, the Krios features an auto-loader specially developed by FEI. This “allows you to load automatically 12 samples into the microscope”, Professor Whisstock said, “and switch between them, and keep the samples stable for up to eight or nine days”.

“You can go and have a cup of coffee while the Krios does all the work,” he added.

The Krios is not the only significant piece of technology in the centre, which houses five microscopes of various in total as well as other sample preparation equipment. In fact, Monash University is already home to a large range of research platforms and facilities, all of which are underpinned by the Monash eResearch Centre for the collection, storage, processing and management of research data.

Professor Whisstock said the university recognises that “different platforms can help one another” - a strategy which will be significantly augmented by the new centre.

The facility has already been booked for a range of studies, one of which will be led by Professor Whisstock himself. He and his team are conducting research into perforins, which form pores in membranes of infected cells. These pores are used by the immune system as conduits for delivering large toxic molecules and nanoparticles into infected cells - and could equally be used to smuggle compounds into cells for therapeutic purposes. The team plans to make different kinds of these molecules and study the 3D structure of the pores they form under the Krios.

Other planned research projects will investigate a potential malaria drug, antibiotic resistance, mitochondria, insulin and its receptor, transcription and more. Professor Whisstock explained that the facility was set up in order to be as accessible to the science community as possible, stating, “This type of endeavour only really is successful if it is genuinely influencing a community.” Given the amount of interest the centre and its technology has already generated - and the potential impact this technology could have on Australian research - the influence of the centre is sure to be substantial.

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Head Office
Cnr. Fox Valley Road & Kiogle Street,
(Locked Bag 1289)
Wahroonga NSW 2076
Ph: +61 2 9487 2700
Fax: +61 2 9489 1265

Chief Editor
Janette Woodhouse
LLS@westwick-farrow.com.au

Contributing Editor
Susan Williamson

Editorial Assistant Lauren Davis

Publisher
Geoff Hird

Art Director/Production Manager
Julie Wright

Art Production
Tanya Scarselletti, Odette Boulton

Circulation Manager
Sue Lavery
circulation@westwick-farrow.com.au

Copy Control
Mitchie Mullins
copy@westwick-farrow.com.au

Advertising Sales
National Sales Manager
Nicola Fender-Fox
Ph: 0414 703 780
nfender-fox@westwick-farrow.com.au

NSW, QLD
Liz Wilson
Ph: 0403 528 558
lwilson@westwick-farrow.com.au

VIC, SA
Sandra Romanin
Ph: 0414 558 464
sromanin@westwick-farrow.com.au

WA
Mandi Grubisin
Ph: 0468 840 739
mgrubisin@westwick-farrow.com.au

Asia
Lachlan Rainey
Ph: +61 (0) 402 157 167
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AusMedtech 2015

The AusMedtech 2015 conference for medtech executives provides business partnering opportunities for decision-makers. It brings together key stakeholders in the Australian and international medical devices and diagnostics sector to discuss the major factors in global medtech success. The comprehensive program will include a trade exhibition, networking events and AusPartnering - a networking and partnering platform enabling delegates to schedule 30-minute meetings with other attendees. The conference will target key commercial issues such as export opportunities, finance and investment, hot technologies and updates in the fields of IP, regulatory approvals, health economics and reimbursement, and sales networks.

Organised by AusBiotech, AusMedtech 2015 will run from 29 to 30 April, 2015 at Pullman Melbourne on the Park in Melbourne. Visit www.ausmedtech.com.au to register to attend.

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8-12 March 2015, New Orleans
pittcon.org

ASID Annual Scientific Meeting 2015

18-21 March 2015, Auckland
www.asid.net.au/meetings/2015-asm

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8-10 April 2015, Seoul, Korea
www.biokorea.org

5th International Congenital CMV Conference and 15th International CMV/Beta Herpes virus workshop

20-24 April 2015, Brisbane
www.conference.qimrberghofer.edu.au/page/international_CMV_workshop

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www.australia2040.com.au

Australian Society for Microbiology ASM 2015

12-15 July 2015, Canberra
www.theasm.org.au

2015 Chemical Proteomics Symposium

16-17 July 2015, Sydney
www.cmri.org.au/Research/Workshops-and-Symposia/2015-Chemical-Proteomics-Symposium

2nd Asia-Oceania Conference on Neutron Scattering

18-23 July 2015, Manly, NSW
www.ansto.gov.au/ResearchHub/Bragg/CurrentResearch/ConferencesandWorkshops/#sthash.EQmDE6UV.dpuf

48th Annual AIFST Convention & the 15th Australian Food Microbiology Conference

11-13 August 2015, Sydney
www.aifst.asn.au/convention

ESA Clinical Weekend

21-23 August 2015, Adelaide
www.esaclinicalweekend.org.au

ESA-SRB 2015, ASM

23-26 August 2015, Adelaide
www.esa-srb.org.au

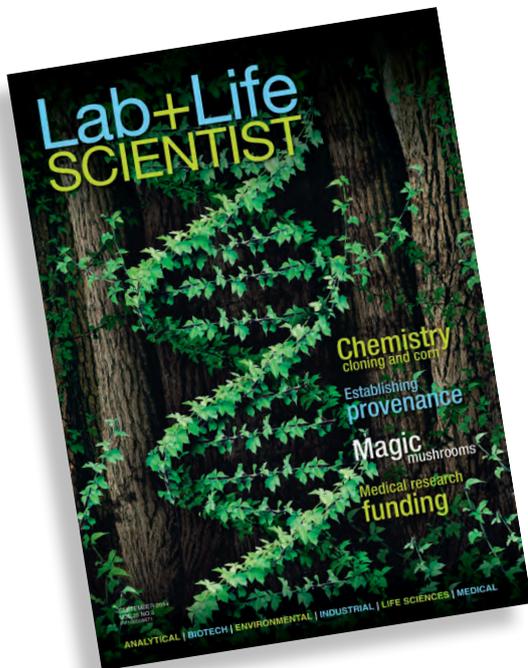
25th ISN-APSN Biennial Meeting

23-27 August 2015, Cairns
www.neurochemistry.org/biennial-meeting/isn-2015-biennial-meeting.html?id=18

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- 11 Scientific Officer - R&D
- 23 Scientist
- 17 Student - Undergrad/Apprentice
- 10 Technical Officer
- 9 Technician - IT
- 8 Technician - Maintenance/Service

INDUSTRY

(please choose one only)

- 1 Agriculture/Rural
- 47 Biotech
- 3 Chemicals/Allied Products
- 40 Cleaning
- 50 Consulting/Contracting
- 5 Defence/Military
- 6 Education/Training
- 8 Engineering Services
- 9 Environmental Services
- 10 Finance/Banking/Insurance/Legal
- 11 Food - Bakery
- 12 Food - Beverages
- 13 Food - Confectionary
- 14 Food - Dairy
- 15 Food - Fruit & Vegetables
- 16 Food - Meat
- 17 Government
- 20 Health/Medical
- 43 Information Technology
- 21 Instrumentalities (eg CSIRO)
- 26 Laboratory - Analytical
- 27 Laboratory - Clinical/Medical
- 28 Laboratory - Life Sciences
- 29 Logistics/Transport/Warehouse
- 30 Manufacturing
- 31 Mining
- 32 Oil/Gas/Coal
- 48 Pharma/BioPharma
- 34 Processing
- 35 Retail/Wholesale/Hire
- 36 Service/Maintenance
- 38 Testing/Certification (eg NATA)
- 39 Utilities

COMPANY SIZE

(please choose one only)

- 1 Under 100
- 2 100 - 250
- 3 251 - 500
- 4 Over 500

[†] For qualified industry professionals outside Australia, the digital magazine and eNewsletters are available FREE of charge. If you would like the print magazine, contact circulation@westwick-farrow.com.au for subscription prices in your region.

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