Lab+Life SCIENTIST

TARGETING
METABOLIC VULNERABILITIES
OF CANCER

DWARF GALAXY
RUNNING OUT OF GAS

STAY SAFE
IN RESEARCH LABS

FEB/MAR 2019
VOL.29 NO.6
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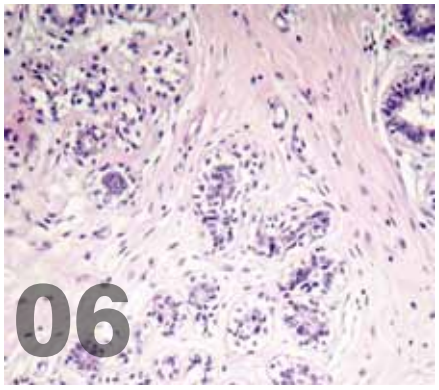

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From chemical to biological to electrical, the laboratory environment presents a number of challenges, risks and hazards. In the rush of sample preparation, pipetting, mixing, conducting experiments and writing papers, safety precautions and procedures often get neglected. Also, the "it won't happen to me" mindset is often the reason most people tend to ignore safety advice and warnings.

No-one knows how many incidents and near-misses happen in laboratories across Australia. Ansell, a global provider of health and safety solutions, conducted a survey in 2016 — in partnership with National Safety Council of Australia (NSCA) Foundation — to understand and benchmark hand safety performance and improvement trends. The survey found that 47% of safety managers were worried about under-reporting of injuries, suggesting that the reported safety performance of many companies is overstated. Concerns about blame/punishment, complacency and avoiding red tape/bureaucracy were thought to be the main reasons for under-reporting. 60% of respondents cited the main reason for not using hand protection or for using the wrong hand protection is that it can interfere with comfort and ability to perform.

Hand safety is important, not just for your work but also for your quality of life. While PPE is often the last line of defence, it's important to wear protective clothing, gloves, goggles and safety shields when working with chemicals, liquids or other hazardous substances that may cause injuries. The article on page 28 provides tips on choosing the right gloves. This issue also features an article on safe handling and storage of cryogens (page 36).

In any laboratory, safety is paramount. Now may be a good time to review your safety procedures. Don't wait for an incident to make a safety plan.

Safety is one of the many important and interesting topics covered in this issue. The lead article talks about metabolomics, the rapidly growing branch of 'omics', and the developments in the field. The article on page 14 details how researchers at CSIRO's Murchison Radio-astronomy Observatory in Western Australia used the Australian SKA Pathfinder (ASKAP) radio telescope to witness the end for one of the Milky Way's neighbouring galaxies.

Lastly, it's with mixed feelings of sadness and gratitude that I announce that after almost 8 years at WF Media, I'm leaving to pursue my passion of making science fun for children. I have thoroughly enjoyed editing *Lab+Life Scientist* over the last two years. I'll miss hearing and writing about all the wonderful work that you all — our immensely talented Australian researchers, universities, industry organisations and clients — do to provide answers to global challenges. Thank you for giving me the opportunity to participate in this industry and share your stories.

All the best.

Regards,
Mansi Gandhi
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Mansi Gandhi

Metabolomics, a study of small molecules — or metabolites — within organisms, cells and tissues, is an important and rapidly growing branch of 'omics'.

Metabolic reprogramming in cancer

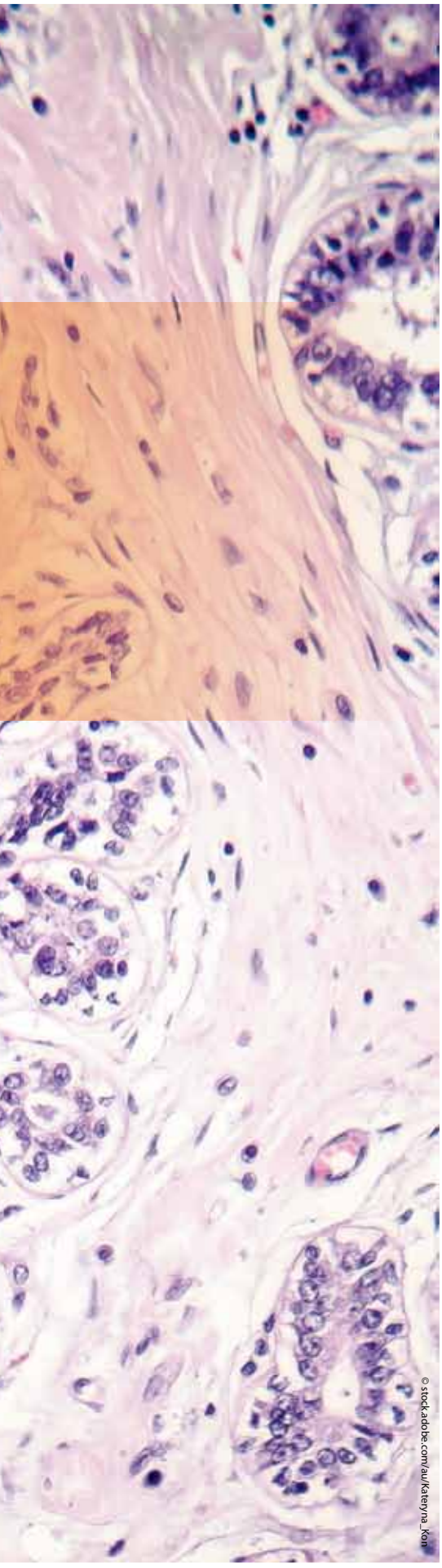
Metabolomics has demonstrated significant potential in early diagnosis of diseases, in therapy monitoring and in understanding the pathogenesis of different diseases, according to research firm Technavio.

"Researchers are investigating metabolome coverage in human breast cancer tissues to undertake metabolic profiling. The derived metabolomic results can be used to classify breast cancer based on tumour biology. They also allow the identification of new prognostic and predictive markers and the discovery of new targets for future therapeutic interventions. The increasing applications of metabolomics offer researchers insights into human health and these are necessary to understand chronic diseases," according to a senior research analyst at Technavio.

"The biomarker and drug discovery segment held the largest metabolomics market share in 2018, accounting for over 45% of the market. This application segment is expected to dominate the global market throughout the forecast period."

Considering the growing significance of the field, it was only fitting for Lorne Proteomics to dedicate one full day to metabolomics. The 24th Annual Lorne Proteomics Symposium featured the 1st Lorne Metabolomics Symposium (held on 8 February 2019) — which included sessions on a range of topics including metabolomics in health and disease, small molecules, new methods, lipids and lipidomics, and lipid/small molecule imaging MS.

The symposium featured leading international and local metabolomics researchers, including Dr Kristin Brown, Peter MacCallum Cancer Centre, Victoria; Professor Dr Ron Heeren, Maastricht University, The Netherlands; Dr Jessica Lasky-Su, Brigham



and Women's Hospital, United States; and Dr Robert Trengove, Murdoch University, Western Australia. We interviewed Dr Brown to get some insights on the field of metabolomics and her research focus.

Dr Kristin Brown is a group leader in the Cancer Therapeutics Program at the Peter MacCallum Cancer Centre and also holds a joint appointment in the Department of Biochemistry and Molecular Biology at the University of Melbourne.

Curiosity, passion and science

Brown became interested in science at a very young age. "Science was always my favourite subject at school. I'm not entirely sure why this was the case — I loved the fact that there was so much to be discovered and I loved learning about famous scientists and how their research had changed the world we live in — [for] example, Marie Curie and Edward Jenner. Regardless, I knew from quite an early age that I wanted to be a scientist," Brown said.

She undertook a science degree at the University of Canterbury, New Zealand, after completing high school. "My laboratory-based practical classes convinced me that science was the career for me. I loved being in the lab — the challenge of designing an experiment, learning how to troubleshoot when things went wrong and the thrill of generating an exciting piece of data. I was hooked!"

Brown's love for the laboratory saw her complete a Master of Science (MSc) from the University of Canterbury, with the research component of the MSc degree in a laboratory based at the Christchurch School of Medicine. She then proceeded to undertake PhD studies through the University of Otago but still based at the Christchurch School of Medicine. Following that, Brown relocated to Boston in 2010 to undertake a postdoctoral fellowship at Harvard Medical School (HMS). Her passion and hard work paid off and she was promoted to the position of instructor at HMS. "I absolutely loved the research environment provided by HMS and HMS-affiliated institutions. It was amazing to be surrounded by so many like-minded individuals."

Metabolic reprogramming

In September 2016, Brown relocated from Boston to Melbourne to establish an independent research laboratory at the Peter MacCallum Cancer Centre. By integrating metabolomics, transcriptomics and proteomics data, the Brown Lab investigates how cell metabolism contributes to cancer development, progression and therapy resistance.

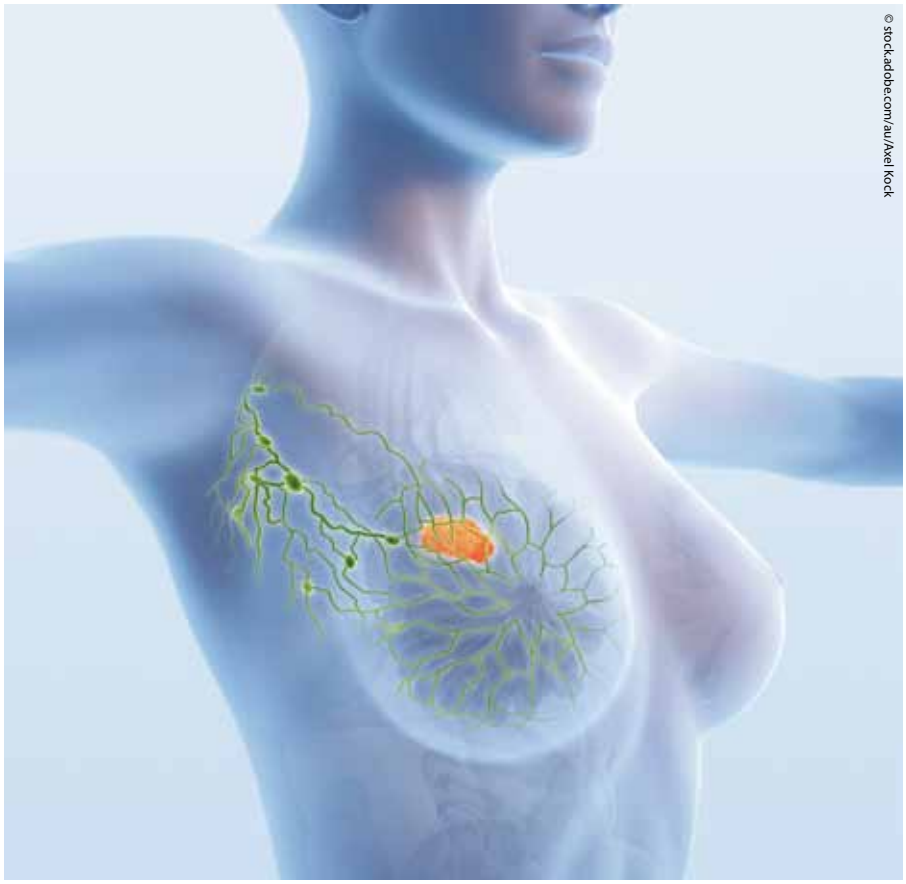
"Metabolic reprogramming is a hallmark of cancer that is required to fulfil the unique metabolic demands of cancer cells."

Innovations in mass spectrometry platforms have enabled metabolomics to complement other — omics technologies (including proteomics) as key technologies in research, said Brown. "Increasingly, cancer researchers are employing metabolomics methodologies to try to understand the diverse ways in which metabolism impacts cancer."

In recent years, there has been growing interest in developing strategies to exploit the metabolic vulnerabilities of cancer cells for therapeutic gain. However, our ability to do this is dependent on a thorough understanding of the molecular mechanisms underpinning metabolic reprogramming in cancer. This is the research focus of my lab. Moreover, we investigate how reprogramming of cellular metabolism contributes to malignant transformation, tumour progression and therapy resistance, with a particular focus on breast cancer."

TNBC

In Australia, around 15,000 women are diagnosed with breast cancer every year, of which around 15% have triple-negative breast cancer (TNBC) — a particularly aggressive subtype of breast cancer with limited treatment options.



"Approximately 15–30% of breast tumours detected by screening are unlikely to be problematic if left alone. We need to work out better ways to identify the tumours that actually pose a threat and focus on treating these patients," Brown said.

"We need to better understand the 'risk factors' for the disease (genetic, environmental, etc). This will allow more focus to be put toward breast cancer prevention, as opposed to trying to treat the disease once it has taken hold.

"Conventional chemotherapy agents remain the standard of care for TNBC, yet only 30–40% of patients with early-stage TNBC respond to chemotherapy. The long-term prognosis for patients with residual disease after chemotherapy is poor. There is an urgent need to identify mechanisms that limit the efficacy of chemotherapy, and to develop combination therapy approaches to improve the efficacy of chemotherapy for treating TNBC. We have previously shown that chemotherapy agents reprogram pyrimidine metabolism and demonstrated that a clinically approved inhibitor of pyrimidine synthesis can sensitise TNBC cells to chemotherapy. This study provided evidence that chemotherapy-treated cancer cells have unique metabolic requirements that can be exploited for therapeutic gain."

Cancer cell metabolism

At the 1st Lorne Metabolomics Symposium, Brown talked about some of her lab's studies investigating the ways in which cancer cell metabolism is influenced by both cell-intrinsic (eg, oncogenes) and cell-extrinsic (eg, anticancer therapy) factors.

Signalling networks downstream of oncogenes regulate cancer cell metabolism. "Our recent studies have focused on the oncogenic transcriptional co-activator YAP. Aberrant activation of YAP is widespread in human cancers, yet there is little knowledge regarding mechanisms by which YAP drives tumourigenesis. We find that YAP overexpression induces *de novo* lipogenesis *in vitro* and *in vivo* via transcriptional upregulation of a critical effector of the oncogenic phosphoinositide 3-kinase (PI3K) pathway.

"Importantly, inhibition of key enzymes in the *de novo* lipogenesis pathway blocks the uncontrolled proliferation associated with YAP-driven transformation. Our data reveal a mechanism of crosstalk between two important oncogenic signalling pathways and reveal a metabolic vulnerability that can be targeted to disrupt oncogenic YAP activity.

"A variety of factors in the tumour microenvironment also have a major impact on cancer cell metabolism. Our studies have focused on characterising metabolic reprogramming events triggered upon chemotherapy exposure. Using *in vitro* and *in vivo* metabolomic profiling, we find that chemotherapy exposure induces an increase in the abundance of pyrimidine nucleotides as a result of increased flux through the *de novo* pyrimidine synthesis pathway. We find that pharmacological inhibition of *de novo* pyrimidine synthesis sensitises cancer cells to genotoxic chemotherapy agents by exacerbating DNA damage.

"Our studies provide preclinical evidence to demonstrate that adaptive reprograming of *de novo* pyrimidine synthesis represents a metabolic vulnerability that can be exploited to improve the anticancer activity of genotoxic chemotherapy agents for the treatment of TNBC."

Our ultimate goal is to see these rationally designed combination therapy strategies be employed in the clinic to improve patient survival.

The ultimate goal

While metabolomics methods and technologies may assist in finding new treatments for cancer, the field has its own challenges. One of the major challenges, according to Brown, is trying to identify the most appropriate models to study cancer cell metabolism. "There are strengths and weaknesses to all laboratory models (2D cell culture, 3D cell culture, ex vivo culture and animal models). Researchers need to think carefully about the benefits and limitations of each model system before undertaking metabolomics studies."

Brown and her team continue to investigate the ways in which adaptive reprogramming of metabolism contributes to chemotherapy resistance in TNBC. "We hope that this will allow us to identify additional combination therapy strategies to improve the treatment of TNBC. Our ultimate goal is to see these rationally designed combination therapy strategies be employed in the clinic to improve patient survival."

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Image credit: Gwen and Rodger Elliot, Royal Botanic Gardens Victoria.

Genomics for Australian Plants Framework Initiative launched

Genome sequencing is providing significant genetic information for many of the world's plant species. However, more can be achieved in Australia through an innovative collaborative approach, according to Andrew Gilbert, General Manager, Bioplatforms Australia.

"Australia has a long history of cooperation and creation of world-class and game-changing approaches such as Australia's Virtual Herbarium (AVH), a single portal for critical biodiversity information and a global first. Similarly, this initiative will place Australia at the forefront of understanding plant evolution and conservation," he said.

Professor David Cantrill, the scientific lead of the initiative and Executive Director of Science at the Royal Botanic Gardens Victoria, said, "Using genomics has accelerated our understanding and ability to conserve Australian plant diversity; however, collaboration will advance our depth and breadth of knowledge significantly."

Bioplatforms Australia's Genomics for Australian Plants Framework Initiative establishes a genomics resource for native Australian plants. It will facilitate research using genomics approaches for a more thorough understanding of the evolution and conservation of our flora. The project is led by researchers from the Australian State and National Herbaria and Botanic Gardens community and will be driven by the plant research community, bringing together researchers, data specialists, state governments, commonwealth government agencies and plant conservation agencies.

Australia has around 24,000 species of native vascular plants, many of which are found nowhere else in the world. These plants have evolved highly diverse traits to thrive in the continent's varied and often harsh climates and provide a unique landscape to the region. This diversity is reflected in the high variation in size and the complexity of Australian plant genomes, ranging from a fiftieth to 50 times that of the human genome (60 Mb to ~150 Gb).The initiative will create genomic infrastructure across the 'Plant Tree of Life' with the sequencing of key/strategic native plant specimen/species. The integrated network built across the country will collaborate in the collection, management, dissemination and application of genomic data for Australian plants.

The consortium will carry out an initial pilot on three native plant species: the golden wattle (*Acacia pycnantha*) native to Australia's Capital Territory and the floral emblem of Australia; an Australian endemic spider flower native to Western Australia (*Areocleome oxalidea*); and the Waratah (*Telopea speciosissima*), native to the south-eastern parts of Australia and the NSW state emblem.

Wild yeasts may improve wine from warmer climates

A research team led by the University of Adelaide has found yeasts that naturally occur on grapes may improve wines produced in warmer climates — despite the fact that the use of these 'wild' yeasts during the production process has mostly been discouraged by winemakers.

As explained by Dr Ana Hranilovic, a recent PhD graduate from the university's ARC Training Centre for Innovative Wine Production, "Intentional over-ripening of grapes, as well as rising global temperatures due to climate change, produces excess sugar in grapes, which is converted to ethanol during fermentation. This results in highly alcoholic wines.

"Highly alcoholic wines may not necessarily be a good thing," she continued. "Wine fashions change as consumers' tastes change but also these wines can lack acidity, be different in flavour and lead to a higher cost to the consumer in the form of higher taxes."

'Fixing' such wines can be difficult or costly — for example, boosting acidity for a 'fresher' taste and to reduce the risk of bacterial spoilage adds to the production costs. The good news is that these problems may be solved through the use of different yeasts — yeasts which winemakers have always tried to suppress during production.

"These yeasts don't always improve wine as they can cause different off-flavours," Dr Hranilovic said.

However, Dr Hranilovic has discovered that certain strains of naturally occurring yeasts have beneficial effects in wine production. She revealed, "The yeast *Lachancea thermotolerans* produces high levels of acidity in the form of lactic or 'good' acid. This type of acid improves the wine by giving it a soft, mellow taste.

"But *Lachancea thermotolerans*, and other similar yeasts, cannot be used on their own as they are not capable of consuming all the grape sugars. They must be used in conjunction with the typical 'wine yeasts'.

"We now need to do more research into how different blends of yeasts affect the taste and the quality of wine."

Dr Hranilovic's research was supported by the University of Bordeaux, Charles Sturt University through the National Wine and Grape Industry Centre (NWGIC), CSIRO and Laffort Oenology. It has been published in the journal *Scientific Reports*.


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Peeling off slimy bacterial biofilms

Researchers have found a new way to completely peel off bacterial biofilms.

By looking at the films from a biological as well as mechanical engineering perspective, Princeton University researchers showed that water penetrating the junction between biofilms and surfaces, coupled with gentle peeling, can result in effective removals.

The work, bridging molecular biology, materials science and mechanical engineering, took advantage of the collaborative research communities between molecular biology and engineering.

The new method is expected to help in thwarting harmful biofilms, as well as controlling the beneficial biofilms increasingly relied on for wastewater treatment, microbial fuel cells and other applications.

The method has been developed by Jing Yan, an associate research scholar working jointly in the Princeton labs of Howard Stone, the Donald R. Dixon '69 and Elizabeth W. Dixon Professor of Mechanical and Aerospace Engineering; and Bonnie Bassler, the Squibb Professor of Molecular Biology and Howard Hughes Medical Institute Investigator. Yan is the co-lead author of the paper along with Alexis Moreau, who was a visiting student in Stone's lab and is now back at the University of Montpellier in France. The findings have been published in journal *Advanced Materials*.

"By investigating and defining the material properties of bacterial biofilms, rather than their biological properties, we have invented a new method for detaching entire biofilms," said study co-author Bonnie Bassler.

For their investigation, the Princeton researchers turned to the bacterium *Vibrio cholerae*, which forms biofilms in seawater and fresh water and in the human intestine. Measurements revealed that the biofilms it produces exhibit mechanical behaviours very similar to hydrogels, which are materials extensively studied in Stone's lab.

Well-characterised, manipulatable hydrogels have many applications, especially in biomedicine, including wound dressing, drug delivery and tissue engineering.

Bioherbicide approved to combat introduced weeds

A natural weed control, developed back in 2010 to help manage one of Australia's most invasive introduced weeds, has become the first woody weed bioherbicide to be granted federal regulatory approval.

The Di Bak Parkinsonia fungal bioherbicide was created at The University of Queensland (UQ) by plant pathologist Professor Victor Galea and Dr Naomi Diplock, in order to combat the invasive *Parkinsonia* plant. Prof Galea said he co-developed the bioherbicide using naturally occurring fungi that cause dieback.

"It was developed as a result of research conducted with Dr Diplock to explore the cause of dieback of *Parkinsonia* that occurs naturally in our landscape, with a view to harnessing it to create a natural management method," he said.

"The result has been a new and effective biological agent that is safe to use, causes minimal harm to the environment and will result in sustainable and ethical control.

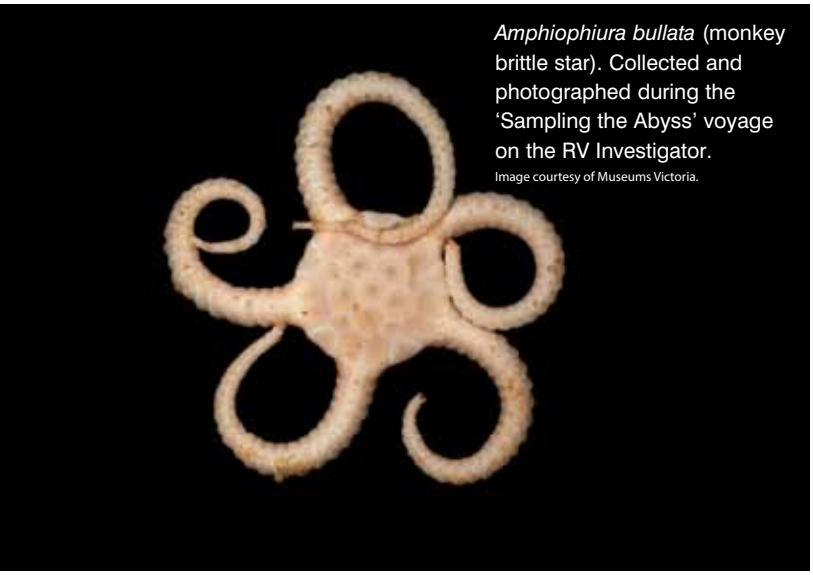
"This bioherbicide, which can be made into capsules and injected into trees, will change the way we manage woody weeds in our landscape."

Seeking approval to market the product from the Australian Pesticides and Veterinary Medicines Authority (APVMA), UQ commercialisation company UniQuest formed BioHerbicides Australia (BHA). BHA Managing Director Peter Riikonen said the bioherbicide finally received regulatory approval in December 2018, following a large study involving 90 trial sites across northern Australia.

"Parkinsonia is one of Australia's most invasive weeds, threatening rangelands, wetlands and natural waterways, as well as native plants and animal species," Riikonen said.

"This weed is so problematic that in many parts of the country, the law requires landholders to contain *Parkinsonia* bush on their properties.

"Current attempts to control this introduced species involve invasive mechanical clearing of land or potentially harmful chemical sprays, which is why our fungal bioherbicide has so much potential.



Amphiophiura bullata (monkey brittle star). Collected and photographed during the 'Sampling the Abyss' voyage on the RV Investigator.
Image courtesy of Museums Victoria.

New ocean species are evolving fastest in Antarctica

New research led by Museums Victoria has overturned previous theories about how the biodiversity of our oceans evolved, with important implications for conservation.

The deep sea is the world's largest ecosystem — where ancient fauna or 'living fossils' survive at the same time that new species are fast evolving — and requires just as much protection as more familiar habitats, like coral reefs and mangroves. Yet a lack of knowledge about marine life in these dark waters has made it unclear how best to protect and preserve these environments from human exploitation like fishing or deep-sea mining.

Biologists have long speculated that evolution is 'sped up' by relatively high tropical temperatures, with development being slower in cooler and deeper waters. However, the new research finds that evolution does not follow one course, but rather depends on the geological, climatic and biological history of each ecosystem.

To study patterns of evolution across the world's oceans, researchers led by Dr Tim O'Hara, Senior Curator of Marine Invertebrates at Museums Victoria, focused on the evolution of deep-sea 'brittle stars' (*Ophiuroidea*). These spiny echinoderms, with a typically circular body and five long arms, are abundant on the seafloor globally, making them ideal for studying large-scale patterns of how marine life arose and spread around the planet.

Utilising DNA data collected on 2017's 'Sampling the Abyss' voyage — a month-long expedition that explored the abyssal ocean depths off the eastern coast of Australia — the researchers were able to reconstruct a comprehensive picture of how brittle stars have evolved across the Indian and Pacific Oceans in the Southern Hemisphere. Dr O'Hara was Chief Scientist on the voyage, which took place aboard the CSIRO Marine National Facility research vessel *Investigator*.

"Sequencing the DNA from these specimens can unlock the history of life on our planet," Dr O'Hara said.

Curiously, speciation was found to be highest in the coldest region: Antarctica. These waters appear to still be recovering from extinction events of tens of millions of years ago, when ice sheets began to dominate and water temperatures plummeted. New species that evolved as a result are still in the process of diversifying, and are doing so rapidly.

AXT adds LIBS product line from ELEMISSION

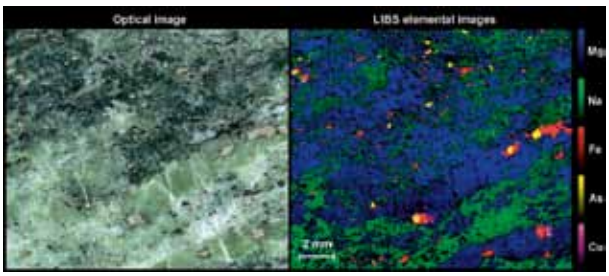
Scientific equipment supplier AXT has signed an exclusive distribution agreement with ELEMISSION, a Canadian-based company that specialises in large-scale micro characterisation using continuous LIBS (laser-induced breakdown spectroscopy) scanning technology. The company's process analytical chemistry systems provide sensitive solutions for the minerals and alloy markets.

LIBS is an atomic emission spectroscopy (AES) technique that entails zapping the surface of a sample with a laser. The resulting micro-plasma can be analysed using a spectrometer, yielding quantitative elemental distributions down to ppb sensitivity. Unlike X-ray-based techniques, LIBS can measure any element in the periodic table — including light elements such as lithium, boron and phosphorous — to high sensitivity.

LIBS has been continually developed over many years, with ELEMISSION further refining the technology using the latest lasers and electronics, resulting in real-time process analysers suited to industrial applications.

With the ability to analyse from 100 to 1000 points per second, the company's systems are suited to real-time analysis in industrial applications. They have the ability to provide real-time feedback to process controllers, which can result in increased plant efficiency and enhanced product quality. With the addition of sophisticated chemometric software, the LIBS systems also provide mineralogy, mineral chemistry and elemental quantifications, allowing users to distinguish between such minerals as hematite (Fe_2O_3) and goethite (FeO(OH)).

ELEMISSION has developed a number of platforms that can be tailored to suit the exact requirements of a given application, including on-belt analysers, drill core, rocks/minerals and even slurries. In all cases, no sample preparation is required. The company's automated Industry 4.0 solutions have been robustly designed to operate 24/7 in harsh operating conditions that often combine heat, humidity, dust and vibrations. Areas of application include iron ore sinter plants, scrap aluminium sorting, mineral process monitoring, metal analysis and high-throughput elemental imaging, to name a few.



Mineral sample, optical microscopy image (left) and LIBS elemental map (right) generated using an ELEMISSION high-throughput LIBS scanner.

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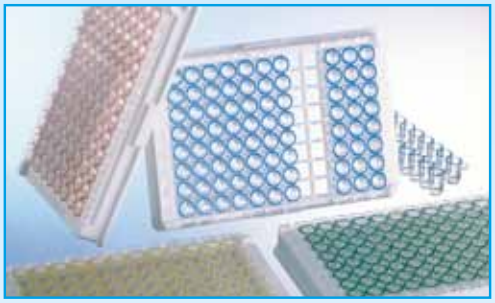

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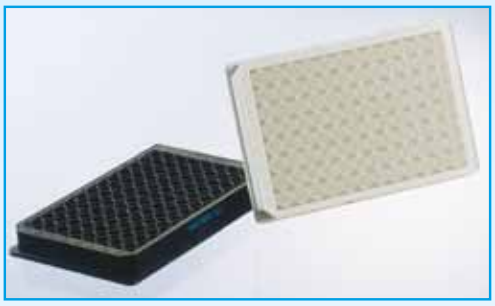

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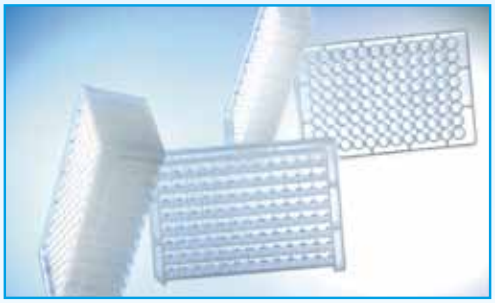
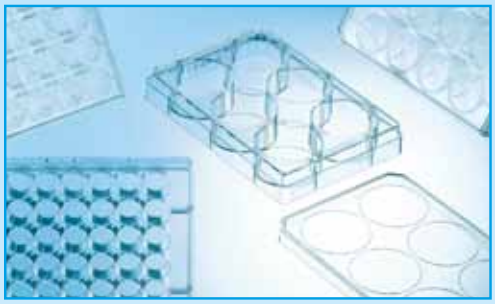


Sample Storage



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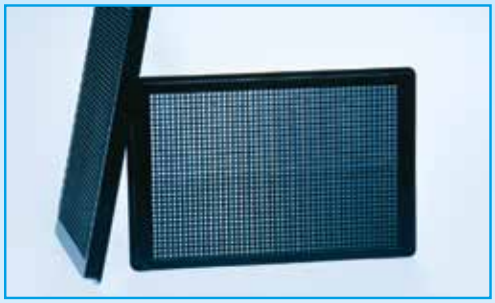

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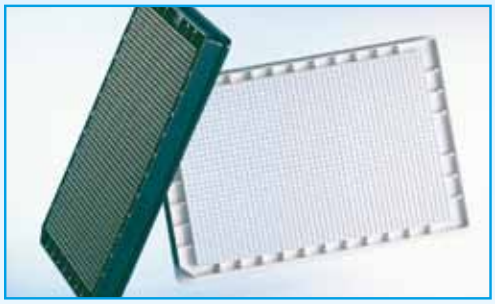

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Lauren Davis

Hydrogen loss

hints at the impending death of a galaxy

Using the Australian SKA Pathfinder (ASKAP) radio telescope, based at CSIRO's Murchison Radio-astronomy Observatory in Western Australia, researchers have witnessed what they claim is the beginning of the end for one of the Milky Way's neighbouring galaxies.

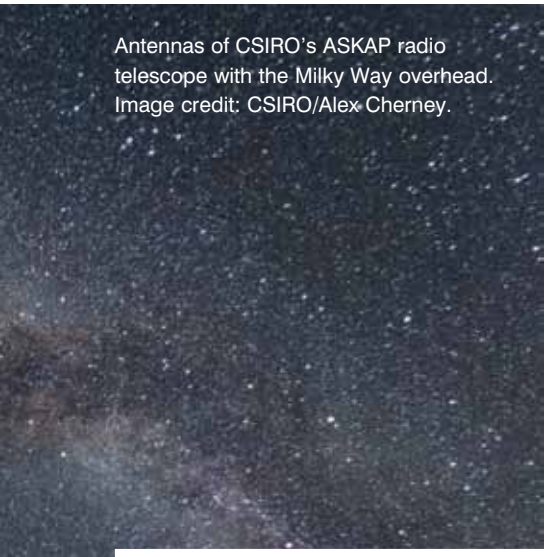
The neighbour in question, the Small Magellanic Cloud (SMC), is a dwarf galaxy based less than 200,000 light years from the Milky Way. Alongside its sibling, the Large Magellanic Cloud (LMC), it is just close enough to Earth to be visible in the night sky with the naked eye — and with other dwarf galaxies located substantially further away, that makes it an ideal subject for study.

Professor Naomi McClure-Griffiths, from the Research School of Astronomy & Astrophysics at the Australian National University (ANU), has been studying the SMC as part of her work on the evolution of galaxies. Along with a team that includes Dr David McConnell from the CSIRO, she has been probing the interactions between the small galaxy and its environment — and as the world's fastest survey radio telescope, ASKAP has been key to the project's success.

"The Magellanic Clouds are objects of interest in the Southern Sky, and they've always been on the list of interesting things that ASKAP would look at once it was operational," Dr McConnell said. "Once we got to the point of having a reasonable fraction of the telescope operational, the Small Magellanic Cloud was an obvious choice to make some test observations."

The last radio telescope to image the SMC was CSIRO's Australia Telescope Compact Array (ATCA), based in Narrabri, northern NSW, which comprises six 22-m-diameter antennas. But while the 30-year-old array has received various upgrades over the years, it can still only form one beam in the sky at any one time, and so had to undertake 320 separate pointings in order to image the SMC.

"It had to essentially point at lots and lots of positions across the sky," Dr McConnell said. "Each one of those takes time, and so that means there's a lot of time involved in making observations — and then there's also a lot of complexity in stitching all those little tiny images together, to make one big picture."



Antennas of CSIRO's ASKAP radio telescope with the Milky Way overhead. Image credit: CSIRO/Alex Cherney.

A radio image of hydrogen gas in the Small Magellanic Cloud as observed by CSIRO's ASKAP telescope. Image credit: Naomi McClure-Griffiths et al, CSIRO's ASKAP telescope.

By contrast, ASKAP contains 36 antennas, each measuring 12 m in diameter, spread across an area of 6 km. And while only 16 of these antennas were operational at the time of the study, that was enough to image the entire Small Magellanic Cloud in a single panoramic shot taken over three nights, capturing features three times finer than what had been achieved previously. Data from CSIRO's Parkes radio telescope was also added to pick up fainter details.

"ASKAP has specially designed and quite novel receivers, in a structure called a phased array feed," Dr McConnell explained. "And that's a bit analogous to the difference between a one-pixel camera and a 36-pixel camera. We can form simultaneously 36 beams on the sky; we configure them in a closely packed pattern over the object to be studied, and the receiver allows us to form a single image over the whole pattern."

Significantly, ASKAP's image of the SMC reveals a powerful outflow of neutral hydrogen gas (HI), the main ingredient of stars, extending at least 2 kiloparsecs from the star-forming bar of the galaxy and making its way towards the nearby Magellanic Stream of gas clouds, which encircles the Milky Way.

"We're looking at a particular emission that is made by hydrogen atoms, and by analysing that in a spectral sense, by looking at the different strengths of that signal related to the wavelength of the radiation, we can tell how fast the hydrogen we're looking at is moving towards us or away from us," Dr McConnell said.

Writing in the journal *Nature Astronomy*, the researchers claim that the SMC is currently experiencing a particularly large outflow of HI, which they assume originated in its most recent burst of star formation — and that's a problem, because the SMC doesn't have a strong enough gravitational field to retain this valuable material.

"The Small Magellanic Cloud is a lot smaller than our own galaxy, and it doesn't have a huge amount of mass — and so its gravitational field is not as strong," Dr McConnell explained. "And so any gas that gets pushed around, if it gets a hard enough shove, it will just leave the galaxy.

"Whenever there are supernovae — when stars reach the end of their life and go bang — they explode and push the surrounding gas away. And in the Small Magellanic Cloud, there have been quite a lot of supernovae over the recent past — and when I say recent, I mean millions of years. There have been new stars being born, big heavy stars that get through their life pretty quickly and then go bang as a supernova, and when there's a lot of them in the one place, that pushes a lot of gas. And the SMC is so small that that gas is pushed so hard that it's just running away, leaving the galaxy."

Furthermore, the researchers discovered that this outflow is up to an order of magnitude greater than the SMC's star-formation rate — so for every Sun-sized star the SMC makes, it loses up to 10 times that amount of hydrogen gas. If the SMC loses all its hydrogen it will also lose its ability to create new stars, and thus its ability to survive.

"This gas that we can see leaving the Small Magellanic Cloud is lost for future star formation," Dr McConnell said. "Any gas it loses limits the number of new stars it can make. And so ultimately, the size of the Cloud will just diminish, and it won't have enough gas to make more stars."

So where exactly is all this hydrogen gas going? The theory is that it is feeding directly into the Magellanic Stream, whose own source of gas has long been speculated. Dr McConnell suggested that the gravitational pull of the Milky Way may also contribute to this outflow and "direct the gas into the stream".

The Milky Way may also find itself a beneficiary of the SMC's slow death, as any outflow that doesn't join the Magellanic Stream may end up spiralling back into our own galaxy. And as the SMC eventually fizzles out — a process that will, admittedly, take billions of years — any remaining material is likely to be similarly taken in by the Milky Way.

So as the Small Magellanic Cloud inches towards its inevitable demise, ASKAP continues to add new capabilities to observe the whole process as best it can. At the time of writing, 28 out of the telescope's 36 antennas have come online — each one enabling more detailed images than the last.

"We'll get somewhat sharper images than that one we've just made, and the other thing is, we'll get more detail in the velocity of the gas; in terms of being able to measure the speed of the gas's motion," Dr McConnell said. "So both those advances in the telescope will make the images better, and the information more useful."

Along with further imaging of the Small Magellanic Cloud, the ASKAP team has a long-term plan to observe the Large Magellanic Cloud, the Magellanic Stream and eventually the entire Southern Sky. It therefore appears that when it comes to ASKAP's imaging capabilities, the sky truly is the limit.

"They've got a very big program ahead of them — this is just a little warm-up," Dr McConnell said.

Liquid handler and fraction controller

The Shimadzu LH-40 Liquid Handler and FRC-40 Fraction Collector are designed to significantly improve capabilities and scalability of the Shimadzu Nexera Prep System.

The LH-40 liquid handler can be used both as a fraction collector and an auto-sampler. It enables seamless purity checks through re-injection in order to provide more efficient preparative purification. Up to six FRC-40 fraction collector units can be connected to enable fractionation into up to 3240 10 mm test tubes.

The Nexera Prep Preparative Purification LC System with AI can investigate separation conditions at the analysis scale then select the size of the preparative column based on the purification amount or injection volume and determine the instrument configuration according to the mobile phase flow rate. It can also select the fraction collector and container size according to the target number of fractions and fraction volume.

Other benefits offered by the system include: optimise the separation and fraction conditions for preparative work; re-inject fractions as necessary, perform analysis,and purity check; perform preparative purification analysis based on detection signals from up to four detector channels, to recognise noises and peaks and selectively detect fractionate target peaks (patent applied); sample rescue function to prevent wastage.

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

Focused ion beam system

The Hitachi Ethos FIB-SEM incorporates the latest-generation FE-SEM with beam brightness and stability. Ethos is designed to deliver high-resolution imaging at low voltages combined with ion optics for nanoscale precision processing.

Features include: high-performance FE-SEM column with dual lens mode; high-throughput material processing; microsampling system; triple-beam capable; large multiport chamber and stage for various applications.

The Ethos SEM column is composed of a magnetic- and electrostatic-field compound objective lens system configured as two lens modes. High Resolution (HR) mode achieves sample observation at high resolution by immersing the sample within the magnetic field of the lens system. Field Free (FF) mode offers real-time FIB processing for high accuracy end point milling. Hyper switching between FIB irradiation and SEM imaging as fast as 10 ns offers real-time fabrication and observation views with clarity.

Hitachi Australia Ltd
www.hitachi.com.au

MRI-compatible headstage

Blackrock Microsystems has released a small, light and MRI-compatible headstage for applications in the field of electrophysiology involving animals such as rodents, cats and primates.

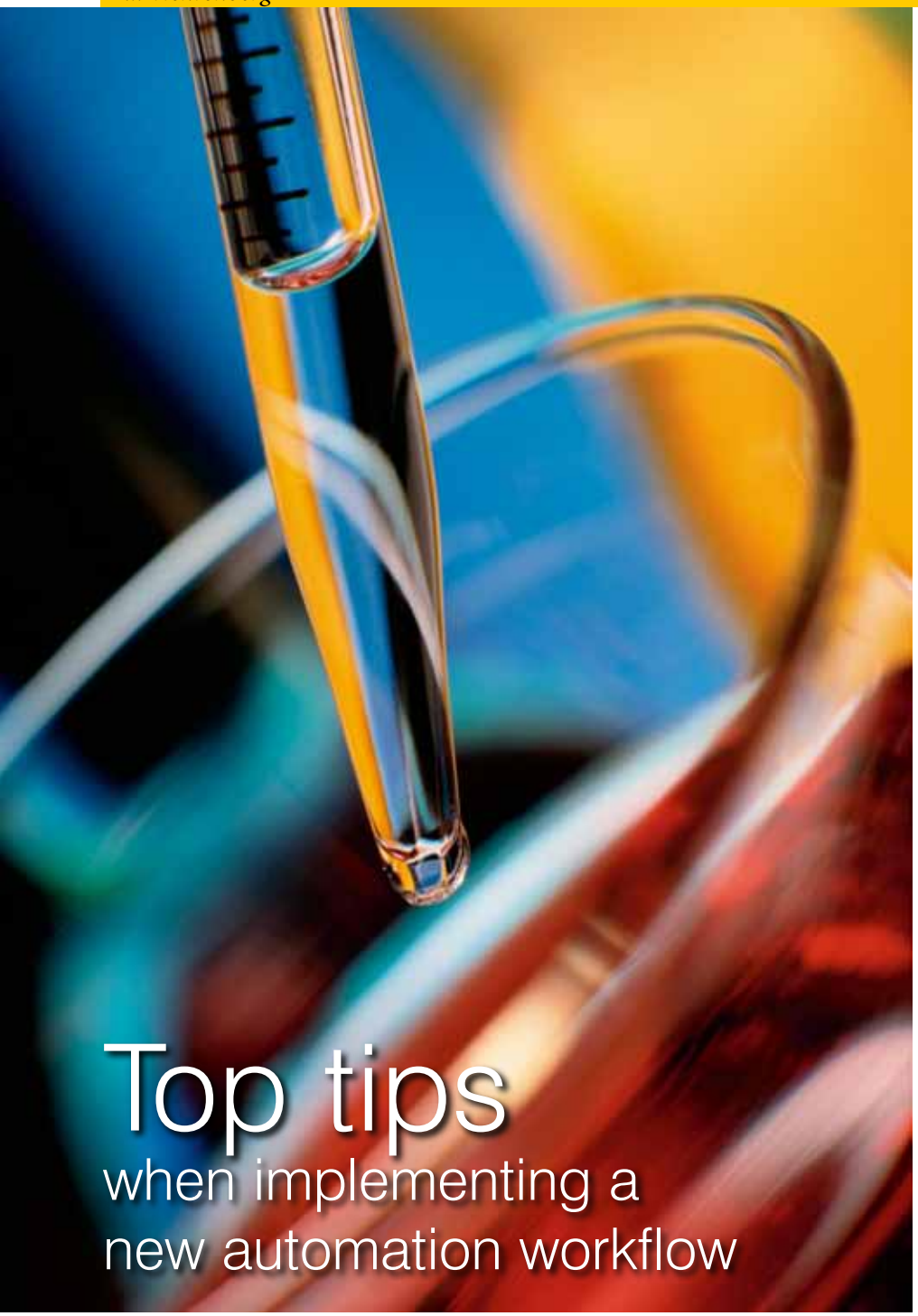
The MRI Compatible Electrophysiology Headstage is a lightweight, 16-channel, single-unit, analog recording headstage for small animals that fits in the bore with the animal. It buffers and then transmits neural signals with high signal quality through a coaxial ribbon cable to a CerePlex A or front-end amplifier (FEA). The data is then acquired by either a CerePlex Direct or a neural signal processor (NSP).

The head stage will allow small animal researchers to directly correlate neural activity with haemodynamic changes detected on MRI for awake and responsive subjects. The shielded ribbon cable has good noise immunity.

The dimensions of the headstage are 10 x 20 x 2.3 mm and it weighs 0.5 g.

SciTech Pty Ltd
www.scitech.com.au

Hal Wehrenberg



Top tips when implementing a new automation workflow

Planning to implement a new automation workflow in your lab? Here are some tips to ensure a fast, smooth implementation.

Preparation

Preparing for automation of your workflow can help you save plenty of time in choosing the right robot and using it efficiently. Robots are not magical creatures. The assay that is being evaluated for automation must work manually, ie, on the bench. If it doesn't, it is highly unlikely that automation alone will solve the problems with the protocol. If the plan is to miniaturise an assay with automation, it's important to test that it works. Once the goal is clearly defined, automating that becomes straightforward and easy to verify. And once the simple version is automated, the user has successfully achieved the goal, or is well placed to turn that feasibility step into a high-throughput reality.

Training

Robots can't replace people (just yet). Good automation requires the brains, lab expertise and problem-solving skills of a human being with a technical mindset. Appoint a person with aptitude, enthusiasm, problem-solving skills, a strong assay understanding and interest in software/instrumentation in the role of automation specialist. The ideal candidate will see this as a career step. It doesn't mean that they will be operating robots all their life; this responsibility could help them get promoted to the post of a lab manager or become responsible for a discovery project.

Implementation

It's important to remember that it will take time to get the first run right. There will be plenty of opportunities for optimisation, minor adjustments, as well as major improvements. Implementing miniaturisation of the assay can lead to significant savings on costly reagents, resulting in a return on investment beyond time and robust reproducibility. By allocating time for this in the project, the robot can provide significant leverage for assay standardisation across different sites.

Compliance

The robot may have features that could help comply with industry regulations and opportunities, such as audit trails and electronic signatures. Documentation of processes can help meet quality standards. Understand which norms impact using an instrument in a compliant fashion (or find the person in your company who understands) and assess in advance of purchasing how automation fits in your processes. Talk to the vendor about the features of the instrument, and identify experts within your organisation who understand what is essential in regards to automation.

Return on investment

Making a capital equipment investment, especially if it's your company's first shiny new robot, is a sign of success and can excite everyone, including top management. Those who aren't actively involved in planning may expect the ROI to start on day one after the installation. That's rarely the case. Ensure that everyone understands the implementation of the instrument will be done with purpose, systematically and successfully. Show them your game plan — it creates confidence in your approach. The ROI is real and significant, but it is often measured over years, not days. Keeping expectations realistic may be the key to success.

Tecan Australia
www.tecan.com.au

Modular lab furniture

HEMCO's UniLine furniture offerings include base cabinets, wall cabinets, countertops, sinks, fixtures, base tables, mobile workstations, specialty storage cabinets and peg boards.

UniLine casework groupings are designed to incorporate the company's most popular casework styles in a complete package. HEMCO's services can also include a complete turnkey installation.

HEMCO Corporation
www.hemcocorp.com

Colour digital camera

The DS-Ri2 is a 16.25 MP, high-definition colour camera from Nikon providing good colour reproduction and fast frame rates.

The CMOS sensor (36 x 23.9 mm images size) enables one-shot capture of high-definition images. It is designed to allow faster imaging than pixel shift imaging comprising multiple-shot images, and to reduce vibration during image capture.

The camera is suitable for brightfield imaging of pathological samples, which require high-colour reproducibility. The large pixel size (7.3 μm pixel pitch) allows weak light to be captured by each pixel and the low-noise circuit design is optimised for microscope imaging. With the USB 3.0 and CMOS sensor, which provides high-speed data readout, the product has a frame rate of 45 fps (1636 x 1088 pixels). This enables fast live-image display and easy observation point selection and focusing.

Coherent Scientific Pty Ltd
www.coherent.com.au

Image analysis software

Media Cybernetics has released Image-Pro v10 analysis software.

Image-Pro is a powerful 64-bit image analysis platform replacing Image-Pro Plus. It is suitable for applications including life science, pathology, biological science, cell biology, plant biology, oncology, entomology and dental science.

The software makes it easy to capture, process, measure, analyse and share images and data. Users can add one or more of the Image-Pro modules, eg, 2D Capture or 3D Visualisation and Analysis, to expand the functionality of the platform to match their needs.

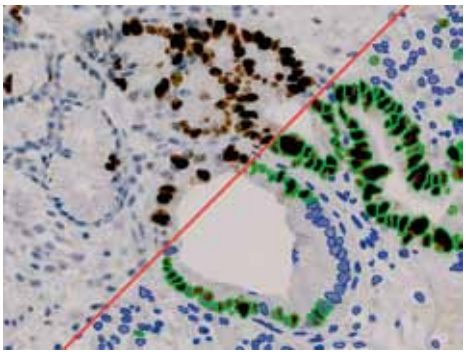


Image-Pro v10 offers an improved interface and the ability to add modules to increase functionality of the product and add apps to simplify the workflow. There has also been an improvement to the stack alignment function with subpixel alignment. Image-Pro set-up installs the latest patch.

Other features include: TWAIN support in 64-bit Image-Pro; count/size segmentation methods to define the cells for intensity tracking; options to flip TWAIN captured image in capture group; a checkbox for setting macro command interactivity; tick marks in Calibration Marker; the ability to capture to an existing image destination (overwrite or append); support for the Image Set Analyser App to macro batch processing; the ability to merge and/or split measured lines; and the ability to calculate overlaps in Tiling View.

Users may optionally implement local network licensing using the licensing server.

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Powerful microscope captures 'haystack' nanoscaffold

In an effort to better understand how cells move throughout our bodies — and the rod-like actin filaments that drive the process — US scientists have used one of the most powerful microscopes in the world to identify a dense, dynamic and disorganised actin filament nanoscaffold — resembling a haystack — that is induced in response to a molecular signal.

This is the first time researchers have directly visualised, at the molecular level, a structure that is triggered in response to a cellular signal, and significantly expands our understanding of how cells move. The research was conducted by scientists from Sanford Burnham Prebys Medical Discovery Institute (SBP) and University of North Carolina at Chapel Hill (UNC-Chapel Hill), and published in the *Proceedings of the National Academy of Sciences (PNAS)*.

"Cryo-electron microscopy is revolutionising our understanding of the inner workings of cells," said Dorit Hanein, a professor at SBP and senior author on the paper. "This technology allowed us to collect robust, 3D images of regions of cells — similar to MRI, which creates detailed images of our body. We were able to visualise cells in their natural state, which revealed a never-before-seen actin nano-architecture within the cell."

In the study, the scientists used SBP's cryo-electron microscope (Titan Krios), artificial intelligence (AI) and tailor-made computational and cell imaging approaches to compare nanoscale images of mouse fibroblasts to time-stamped light images of fluorescent Rac1, a protein that regulates cell movement, response to force or strain (mechanosensing) and pathogen invasion.

This technically complex workflow — which bridged five orders of magnitude in scale (tens of microns to nanometres) — took years to develop to its current level of robustness and accuracy and was made possible through experimental and computational efforts of the structural biologist teams at SBP and the biosensors team at UNC-Chapel Hill.

The images revealed a densely packed, disorganised, scaffold-like structure comprising short actin rods. These structures sprang into view in defined regions where Rac1 was activated, and quickly dissipated when Rac1 signalling stopped — in as little as two and a half minutes.

This dynamic scaffold contrasted sharply with various other actin assemblies in areas of low Rac1 activation — some comprising long, aligned rods of actin and others comprising short actin rods branching from the sides of longer actin filaments. The volume encasing the actin scaffold was devoid of common cellular structures, such as ribosomes, microtubules, vesicles and more, likely due to the structure's intense density.

"We were surprised that experiment after experiment revealed these unique hotspots of unaligned, densely packed actin rods in regions that correlated with Rac1 activation," said Niels Volkmann, a professor at SBP who led the computational part of the study. "We believe this disorder is actually the scaffold's strength — it grants the flexibility and versatility to build larger, complex actin filament architectures in response to additional local spatial cues."

Next, the scientists would like to expand the protocol to visualise more structures that are created in response to other molecular signals and to further develop the technology to allow access to other regions of the cell.

"This study is only the beginning," said Hanein. "Now that we developed this quantitative nanoscale workflow that correlates dynamic signalling behaviour with the nanoscale resolution of electron cryo-tomography, we and additional scientists can implement this powerful analytical tool not only for deciphering the inner workings of cell movement but also for elucidating the dynamics of many other macromolecular machines in an unperturbed cellular environment.

"Actin is a building-block protein; it interacts with more than 150 actin-binding proteins to generate diverse structures, each serving a unique function. We have a surplus of different signals that we would like to map, which could yield even more insights into how cells move."

Plastic moulds

The Hylec plastic moulds for casting concrete test cylinders offer an alternative to conventional steel moulds. The moulds weigh less than 1.5 kg each, and around 2–4 samples can be safely carried by test personnel.

Features include: detachable carry handle; stackable with interlocking cap and base; a rigid plastic, detachable lid prevents samples drying out; include a stainless steel base insert flat to 20 microns to prevent damage from rodding; more accurate than alternatives as mould diameter is between 99.8 and 100 mm.

The base includes an outer steel plate to enable the mould to be used with a mechanical vibrator with magnetic clamping. In operation the mould inner surfaces are coated with oil prior to casting of the sample to ensure easy removal of the sample by applying air pressure to the hole in the base. Water can also be used for sample ejection.

The lid and mould, being plastic, insulate the sample against the effects of hot and cold weather. Tests show sample strength using plastic moulds is stronger at 3 and 10 days but with no detectable difference at 28 days.

Hylec Controls Pty Ltd
www.hyleccontrols.com.au

Protein analysis instrument

The Stunner from Unchained Labs can measure both protein size and concentration in a single instrument. It is designed specifically for protein and biologics researchers.

Using UV/Vis spectroscopy and DLS (dynamic light scattering), the product is able to simultaneously measure protein concentration, hydrodynamic size and polydispersity, and to detect aggregates. This saves the user time, helping them to narrow down optimal formulations more quickly.

The product requires only a 2 μL sample, with no need for dilution or sample preparation. The system can process single samples in as little as 1 min. For higher throughputs, the concentration of an entire 96 well-plate can be completed in 12 min, or both concentration and sizing in 1 h. To provide the user with a more comprehensive picture of how their formulation behaves, it can also determine the effects of parameters such as storage, agitation and changes to process chemistry.

The instrument measures the concentration of each sample in a series using real-time DLS, ensuring correct results and letting the user know if their sample is prone to aggregation. The user can also determine the stability of their protein formulation using a host of stand methods or they can create their own custom aggregation index.

AXT Pty Ltd
www.axt.com.au

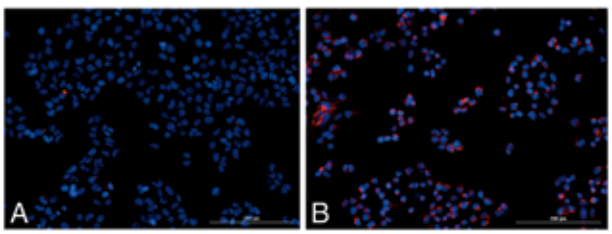
Live lysosomal cell imaging

Cayman Chemical's Lysosomal Staining Kit (Red Fluorescence) is a convenient tool for imaging lysosomes in live cells. The kit utilises a red fluorescent dye that permeates the lysosomes based on pH gradient. Once protonated, the dye is unable to leave the lysosome, resulting in enhanced fluorescence.

The kit includes bafilomycin A_1, which is an inhibitor of the vacuolar ATPase. Treatment with bafilomycin A_1 results in decreased lysosomal fluorescence upon staining with the lysosomal staining reagent.

Lysosomes are intracellular organelles that contain enzymes used for the hydrolysis of waste materials and other cellular debris. The pH of the lysosome is ~4.5 to 4.8 and is optimal for these hydrolytic enzymes. The lysosomal pH gradient is maintained through vacuolar ATPases which pump protons into the lysosomes.

Sapphire Bioscience
www.sapphirebioscience.com



Panel A shows Huh7 cells treated with 1 µM Bafilomycin A_1 vs. *Panel B* shows Huh7 cells treated with vehicle. Cell images were obtained using the Cytation™ 5 Cell Imaging Multi-Mode Reader (BioTek Instruments, Inc.).

Guard column cartridges

The Restec Raptor EXP UHPLC guard column cartridges provide protection from particulates and matrix contamination, especially when using dilute-and-shoot or other minimal sample preparation techniques.

The guard column cartridges for Raptor 1.8 μm columns withstand the same UHPLC pressures as their analytical column counterparts. UltraShield filters are available for filtering out particulates, minimising extra column volume and maximising sample throughput when using SPE, SLE or other extensive sample preparations — but new cartridges are a valuable alternative when using dilute-and-shoot or other minimal sample preparation techniques.

Leco Australia Pty Ltd
www.leco.com.au

Vacuum concentrators

The Thermo Fisher Scientific SpeedVac vacuum concentrators offer a library of pre-programmed protocols, while also allowing users to create custom programs, for fast evaporation of a broad range of solvents.

Like their predecessors, the new vacuum concentrators are designed to achieve a reduced drying time and are compatible with a large number of solvents, with an aim to improve laboratory efficiency and productivity across a wide array of pharmaceutical, biotechnology, academic research, industrial, agricultural and food testing applications.

The portfolio consists of eight vacuum concentrators, ranging from a compact, integrated device designed for low-volume sample preparation, to medium-capacity models available in either integrated or modular designs, to large, modular systems addressing high-volume sample preparation needs.

Products include: Model DNA130; Model SPD120; Model SPD130DLX; Model SPD140DDA; Models SDP1030 and SDP2030; Model SPD210; Model SPD-300DDA.

Thermo Fisher Scientific
www.thermofisher.com.au

Rare genetic brain disorder identified

Researchers have identified a rare genetic brain disorder that causes severe neurological damage in children after a mild fever or illness.

Only six cases have been recorded worldwide and all the children died soon after suffering either a fever or illness.

"An international group of biologists and clinicians*, was able to link genetic mutations to an enzyme deficiency which leads to devastating effects in tissues such as the brain and the heart," said lead researcher Nicole Van Bergen from the Murdoch Children's Research Institute (MCRI).

Whole-exome or whole-genome sequencing identified recessive NAXD variants in each case.

Dr Van Bergen, who also holds an an honorary position at the University of Melbourne, said that given the underlying genetic basis of the disorder is now understood, future research will investigate whether treatment for the condition is possible.

The disorder was identified by an international team of researchers, led by MCRI.

"Affected children typically suffered from episodes of neurological regression triggered by mild fever or infection, neurodegeneration, and skin lesions, eventually leading to early childhood death," Dr Van Bergen said.

"Cells are constantly carrying out thousands of chemical reactions which are collectively called the cell's metabolism," she said.

"Metabolism generates unwanted side products, which can become harmful if they accumulate in cells."

She said to prevent toxicity, cells have evolved what are called metabolite repair systems: enzymes whose role is to repair or remove metabolic side products and metabolite repair is a relatively new concept and related disorders have only just started to be identified.

MCRI Genetics Director and University of Melbourne Professor John Christodoulou said NADHX is one example of an unwanted metabolic side product.

Professor John Christodoulou said in healthy cells, the levels of this molecule are kept very low through detoxification by a metabolite repair system that consists of two partner enzymes, NAXE and NAXD.

"These enzymes are found across all tissues in humans, and in many of other living species, highlighting their fundamental role in biological systems," Prof Christodoulou said. "This is the first study to identify pathogenic mutations in NAXD, the most crucial enzyme in the cell repair system."

Prof Christodoulou said the MCRI team worked closely with the Luxembourg Centre for Systems Biomedicine at the University of Luxembourg.

The Head of the Enzymology and Metabolism research group at the University of Luxembourg, Dr Carole Linster, said her group was contacted because of their expertise with the key enzyme.

"We discovered the molecular role of NAXD in 2011 — and provided key results about the functional consequences of the mutations," Dr Linster said.

"Using methodologies previously developed by the group, the researchers were able to demonstrate that, in skin cells derived from the young patients and containing mutations in the NAXD gene, the abnormal NADHX compound accumulates."

The researchers found evidence of impaired function of the mitochondria (the cell's energy factories) in patient cells and showed that mutant versions of the NAXD enzyme were less efficient in repairing the unwanted side product.

Dr Linster said it was especially interesting that the mutations induced thermolability — a decreased enzyme function at higher temperatures.

"This observation may at least in part explain why the disease onset in the patients coincided with episodes of fever," she said.

"Taken together, the generated results allow to classify NAXD deficiency as a novel metabolite repair disorder with a direct impact in key tissues, such as the brain and the heart.

"Only few metabolite repair disorders have been described to date."

The researchers said that given the rapid progress in genomic sequencing, more mysterious rare diseases are likely to be identified through international collaborations of clinicians and research scientists collaborating internationally.

The findings have been published in a research paper titled 'NAD(P)HX Dehydratase (NAXD) Deficiency: A Novel Neurodegenerative Disorder Exacerbated By Febrile Illnesses' in the journal *Brain*.

*Key researchers came from MCRI, the University of Luxembourg, the Children's Hospital of Philadelphia, the University of Exeter Medical School, Royal Brompton and St George's University Hospital, Technische Universität München and Siegen's DRK-Childrens-Hospital, the Kasturba Medical College and Hospital and the Wellcome Centre for Mitochondrial Research.

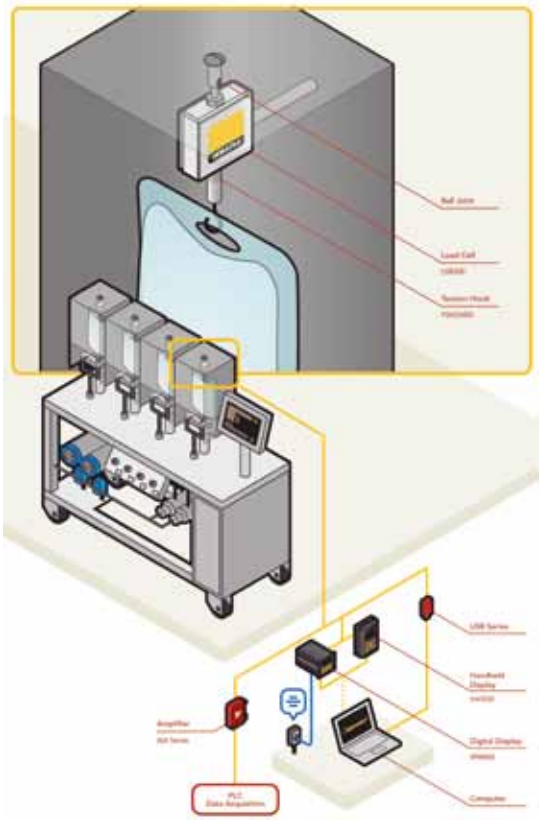
S-Beam load cells for IV bag weighing

The FUTEK LSB200 Jr. Miniature S-Beam Load Cell will measure the tension force applied by an IV bag.

Laboratory equipment, such as dialysis machines or patient monitoring devices, often use test and measurement products either within the machinery or for quality testing. As per the illustration, FUTEK's LSB200 Miniature S-Beam Jr. Load Cell has been mounted to the fixture frame of the IV bag weighing apparatus. By using the LSB200 accessory hook, the IV bag can then be anchored to the load cell. Equipped with built-in overload protection, it will then measure the tensile force applied, streaming the data to any of the following instruments: IAA Amplifiers, IHH500, IPM650 or USB Solutions.

Technicians can record results, log and graph data when using either of FUTEK's digital displays or USB solutions with SENSIT Test and Measurement Software.

Metromatics Pty Ltd
www.metromatics.com.au



Real-time cell history recorder

The JuLI Stage is a real-time cell history recorder and digital fluorescence imaging analyser designed to support cell biology research.

Users can acquire cell images and videos from different cell culture plates (up to 384 wells) in an incubator. Equipped with a fully automated x-y-z stage and multichannel imaging (three colour fluorescence — GFP, RFP and DAPI — and bright channel) and sensitive filter-based optics, the stage can be optimised for a variety of live cell assays. Time lapse images record the whole history of a cell from beginning to end.

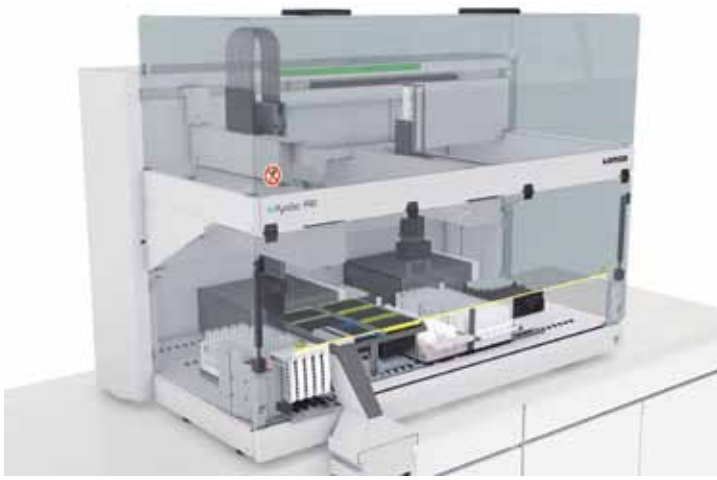
The image stitching functionality is suitable for analysing tissue sections or stem cell colonies in the entire well from individual high-resolution images. JuLI Stage software is easy to use and can be remotely controlled, allowing any user to monitor cell cultures and analyse experimental data from outside the laboratory.

The product is suitable for monitoring cell proliferation, fluorescence expression, angiogenesis, differentiation and cytotoxicity, cell growth, migration studies, 3D spheroid imaging, cell viability measurement, wound healing, apoptosis and more.

ATA Scientific is the local distributor for the NanoEnTek JuLI Stage live cell imaging and analysis system. The company offers ongoing applications assistance and a range of technical services, including operator training and preventative maintenance.

ATA Scientific Pty Ltd
www.atascientific.com.au

Automated endotoxin detection



The PyroTec PRO, from Lonza, is a fully automated, plate-based robotic solution for endotoxin detection. Integrated with the latest version of Lonza's dynamic control WinKQCL 6.0 Software platform, the system has been designed to meet the needs of rapidly changing requirements of QC testing laboratories for fully automated processing of simple to complex sample matrices.

As a powerful combination of robotic liquid-handling technology with an automation software module, the system is designed to improve data integrity organically with the capture of metadata from the automated preparation, adding traceability into tracking, trending and audit controls. It takes any new and existing templates and dynamically 'scripts' the instructions to an automation template with relatively minimal effort from the end user, regardless of how complex the sample type or testing requirements.

The product is said to enhance assay robustness and reproducibility for increased confidence in the precision of results; reduce manual intervention, simplifying QC testing workflows and eliminating the human error potential; and reduce retest rates as well as out-of-specification and out-of-trend deviations, thereby improving the laboratory's performance. It provides efficient endotoxin testing regardless of the complexity of sample/diluent types and analytical requirements.

The device integrates with laboratory information management systems or Lonza's MODA Solution, facilitating fully paperless workflows and traceability of sample life cycle. Unlike conventional cartridge-based systems, it does not require the use of expensive reagents. It aligns with the US FDA's Process Analytical Technology Initiative and Data Integrity requirements and is fully compliant with the US Pharmacopeia Bacterial Endotoxin Test guidance.

Lonza Australia Pty Ltd
www.lonza.com

Safety at hand

Single-use gloves, though disposable in nature, perform an important role in providing barrier protection against a range of workplace hazards. Therefore, the same decision criteria used for any personal protective equipment selection needs to be applied.

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Single-use gloves are often used because they tend to be thinner than other styles of hand protection. This construction delivers increased dexterity and tactility, making it easier to handle small components or tools and lessening the likelihood of hand fatigue.

Materials — or polymers — used in the construction of single-use gloves include: latex, nitrile, neoprene, polyisoprene and vinyl. Each demonstrates different physical properties that make them more- or less-suited to specific tasks and environmental conditions.

When looking for the most appropriate alternative, a thorough risk analysis must be performed in order to identify the presence of multiple hazards. Once all hazards are identified, the strengths and weaknesses of each available base material can be assessed and the polymer type that delivers the greatest harm minimisation selected. Each of the common polymer materials has a different set of characteristics that makes them a more- or less-suited option specific to the hazards posed. Understanding the material properties of each — and matching them to the application — can significantly simplify the selection process.

Latex

When it comes to fit and comfort, latex — a naturally occurring material — is often regarded as having the edge over other polymers. It offers a high degree of dexterity and elasticity, delivers good grip in both wet and dry conditions and features effective insulating properties. Latex can offer splash protection against some chemical families but performs poorly against oils and greases, which degrade the material and make it porous. It is also unsuitable for use with undiluted ketones and aldehydes. Latex withstands tear reasonably well, although this depends on both the thickness of the material and how the glove is manufactured. Once the go-to solution for disposable glove wearers, an increasing prevalence of latex protein allergy has led to the development of non-latex alternatives that offer similar levels of wearer comfort, without allergy risk.

Nitrile

Nitrile is a synthetic polymer that provides excellent resistance to puncture and abrasion. It is free of latex proteins and plasticisers, meaning that allergy risk is limited. New-generation nitrile gloves are thinner and stronger than their predecessors, providing high levels of tactility, durability and sensitivity — particularly at the fingertip. Nitrile is a suitable alternative across a range of applications and environments, particularly when multiple hazards are present. It is increasingly used because it offers a high degree of chemical resistance, although is not recommended for use with ketones or organic solvents. Nitrile is slightly stiffer than latex, which can compromise wet or oily grip capability.

Neoprene

Neoprene — or Polychloroprene — is another synthetic polymer. Its soft, yet strong, properties make it suitable for a range of demanding applications including clean, sterile and wet environments. It offers similar elasticity and comfort to latex alternatives, without the associated allergy risks, and is more elastic and dense than nitrile. Neoprene offers strong protection against acids and base chemicals but is not recommended for use with organic or hydrocarbon solvents. Its medium mechanical properties offer less resistance to puncture and abrasion than either nitrile or latex options.

Polyisoprene

Polyisoprene mimics all the positive attributes of latex without the associated protein allergy risks. It has good insulating properties, offers excellent elasticity and delivers superior sensitivity, dexterity and wet grip. It does not perform well in protection against oils and greases. The material cost is higher than some other alternatives, making it prohibitive for some applications. It is generally reserved for use in surgical or industrial clean/sterile environments.

Vinyl

The weaknesses associated with vinyl gloves generally outweigh the benefits. A low cost, low allergy-risk alternative, vinyl gloves offer good abrasion resistance, but are susceptible to rips and tears. Vinyl contains plasticisers which may irritate the skin and make it a less environmentally friendly option. It also features poor elasticity, does not hold its shape and degrades when in contact with fatty foods. Vinyl is not recommended for use with ketones and organic solvents.

Ansell
www.ppe.ansell.com.au

Liquid handling system

Hamilton Robotics is combining precision engineering, performance and craftsmanship with a high level of support and service to provide a complete solution in liquid handling automation.

Through good space management, styling and agility, the Hamilton Microlab VANTAGE Liquid Handling System is an intelligent and logistically efficient platform. Moving beyond basic platforms that assist lab technicians with protocols and workflows, the product puts the user in control in order to optimise their own lab.

Offering various liquid handling technologies and intelligent software, the product is a compact platform that is designed to provide enhanced performance and increased walkaway time. It also has an optimisation capability that is said to ensure the instrument remains in good condition for the next decade.

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

Laboratory freezer with electronic controller

The 478-litre LIEBHERR Laboratory Freezer with electronic controller (LGv 5010) is suitable for laboratories requiring a large-volume freezer but with limited floor space available. Samples and reagents can be optimally stored between -9°C and -35°C, and the high-tech electronic controller allows temperatures to be set to 1/10°C accuracy for precise temperature control.

The laboratory freezer comes with five fully adjustable shelves, eight drawers and two baskets, allowing users to mix and match the way they store their samples and reagents. The dynamic (forced-air) cooling system works in conjunction with the efficient compressor, thick insulation and eco-friendly, energy-efficient refrigerant (R 290), ensuring a stable and consistent internal temperature.

Using a hot gas defrost system, the laboratory freezer is designed to defrost less often and faster (in just 12 min) without compromising the integrity of samples and reagents. Visual and audible alarms warn users of temperature breaches, and an integrated data memory records and stores min/max temperature and alarm events for 41 days.

The laboratory freezer is equipped with a keypad lock to prevent temperature and alarm settings being changed without a passcode and is fitted with a lock to protect against unauthorised access. An access port for external temperature sensors allows probes to be fed into the back of the unit, maintaining the integrity of the door seal and temperature control.

Temperature and alarm data can be transferred to external building management systems via RS485 interface and alarms can be forwarded to an email, phone, etc, via volt-free contact for extra security.

Andi-Co Australia
liebherrprofessional.com.au

Concrete compression test machine

Hylec's heavy-duty Concrete Compression Test Machine is suitable for small concrete testing laboratories.

This machine has a rigid wall-type welded frame with little vertical deflection and good lateral stability. The frame components are manufactured using CNC machines, precision jigs and robot welders to ensure a frame with a more accurate alignment of cylinder and upper spherical bearing than is possible with a manually machined and welded frame.

Product features include: a precision cylinder; low friction long-life seals; an upper oil-filled double ball seat; auto tare at the start of each test to eliminate measurement drift; passes the European stability test; provides 1% accuracy from 30 kN to 3 MN.

Other features include: a programmable pull-back at the end of each test for minimum cycle time; optional — load frame can be supplied with lower platen bolted to the piston to prevent the ingress of dirt between spacers or platen.

This instrument uses a high-pressure, long-life piston pump driven by a standard AC motor and vector controller to achieve loading rates with an accuracy of 5% between 0.5 and 15 kN/s.

It includes a separate console housing the hydraulics and controls. The controller can be connected to a computer network via Ethernet or USB.

Hylec Controls Pty Ltd
www.hyleccontrols.com.au

Spectrometer

The Thermo Scientific Nicolet iS20 FTIR spectrometer enables analytical scientists in pharmaceutical, polymer, chemical and forensics labs to identify unknown compounds, verify incoming materials, conduct failure analysis and conduct root cause studies by easily collecting and interpreting FTIR data.

The LightDrive Optical Engine technology delivers high spectral resolution (0.25 cm^{-1}) and signal-to-noise ratios (50,000:1) to help identify possible contaminants or characterise defects present in small quantities.

The redesigned optical system consists of four critical components — an infrared source, interferometer, laser and detector.

The system features a touch panel with a multicoloured LED scan bar designed to assist data collection from even the most challenging samples and help users understand their instrument status at a glance.

Other benefits include: cloud-based spectroscopy software with improved functionality; the ability to interface easily with external modules, including the Thermo Scientific Nicolet iN5 and Continuμm infrared microscopes; a 10-year warranty on laser, interferometer and source.

Thermo Fisher Scientific
www.thermofisher.com.au

Variable gene expression helps plants survive environmental change

As parents of identical twins will tell you, their children are not actually identical, even though they have the same genes. This is also true in the plant world.

Now, researchers from the University of Cambridge have discovered how 'twin' plants with identical genes, grown in identical environments, continue to display unique characteristics all of their own. Their work has been published in the journal *Molecular Systems Biology*.

Plant scientists at the Sainsbury Laboratory Cambridge University (SLCU) have built a gene expression atlas that maps the 'noisy genes' of genetically identical plants and found that around 9% of the genes in otherwise identical plants are highly variable in the way that they behave. Interestingly, many of these highly variable (noisiest) genes help a plant respond to its environment, including genes involved in reacting to light, temperature, pathogens and nutrients. This is the first time that global levels of noise in gene expression have been measured in plants.

What is gene expression?

Looking at the full genetic code (genome) of an individual plant or animal is not enough to fully understand the individual's characteristics, as the way genes behave (gene expression) can differ markedly between individuals with the same genome. A gene is expressed when the genetic code of the gene is used to direct a set of reactions that synthesise a protein or other functional molecule within a cell. Copying a segment of DNA to RNA is the first step in this sequence and is called transcription. In this study, 'noise' in gene expression refers to the measured level of variation in RNA between individual plants. Measuring the variability in gene expression reveals which genes are noisier than others.

The SLCU's Dr Sandra Cortijo is researching how gene expression is regulated and what causes some genes to be expressed in unpredictable ways. To examine this, she took on the mammoth task of measuring global levels of noise in gene expression in a single plant species. Using genetically identical plants, she measured the expression of all their individual genes over a 24-hour period.

"For our model plant, we used seedlings of a small wild brassica relative, called thale cress (*Arabidopsis thaliana*), which is most commonly seen growing as a weed in the cracks of pavements," Dr Cortijo said. "We performed RNA-sequencing on individual seedlings every two hours over a 24-hour period and analysed the variability for 15,646 individual genes in the plant's genome.

"We identified that 9% (1358 individual genes) of the genes were highly variable for at least one time point during the 24-hour period. We found

that these highly variable genes fell into two sets influenced by the diurnal cycle — genes with more variable activity at night or genes that have more variable activity during the day."

As part of the study, Dr Cortijo also identified factors that might increase gene expression variability. Highly variable genes tend to be shorter, to be targeted by a higher number of other genes (transcription factors) and to be characterised by a 'closed' chromatin environment (which is an environment that allows gene expression to be altered by attaching additional molecules during the gene reading process (transcription) without actually changing a cell's DNA).

"These results shed new light on the impact of transcriptional variability in gene expression regulation in plants and can be used as a foundation for further studies into how noisy genes are connected with how plants respond to their environment," Dr Cortijo said.

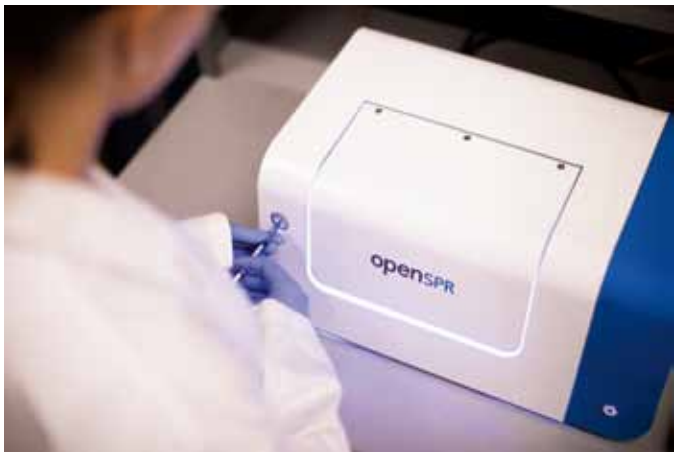
This variation in gene behaviour could be useful in nature for populations of genetically similar plants to hedge against environmental stress such as drought, high salinity or extreme temperatures. This means that there will always be a few plants in the population that are prepared to survive different stresses due to their variable gene behaviours. But this variability can also be a problem, such as in agriculture where environments are more controlled and farmers want uniform crops that germinate and flower at the same time and respond equally to applications of fertilisers and water.

> The evolution of variable gene expression could increase the robustness of a plant population against varying environments without changing their genes.

"The evolution of variable gene expression could increase the robustness of a plant population against varying environments without changing their genes," Dr Cortijo said. "Understanding how plants produce and regulate this noise in gene expression will be important for the future development of more uniform performing crops and to understand how populations of wild plants can survive more frequent weather extremes due to climate change."

Dr Cortijo's data can be found in the online open-access atlas AraNoisy — a web-based tool enabling plant scientists around the world to study how gene expression variability influences plant survival and diversity within clonal populations. According to SLCU Research Group Leader Dr James Locke, the data serves as a significant new resource for further research.

"This is an important resource for scientists studying how genetically identical plants survive fluctuating environments and provides a basis for future work looking at how genetic and epigenetic factors regulate variability for individual genes," Dr Locke said.



Surface plasmon resonance (SPR) instrument

Nicoya Lifesciences OpenSPR is a benchtop surface plasmon resonance (SPR) instrument designed to provide real-time molecular binding data without the use of labels on the molecules of interest.

By measuring binding interactions as they occur, OpenSPR allows researchers to determine both the association rate constant (k_a) and dissociation rate constant (k_d) of a wide range of biomolecular interactions. A key benefit of SPR is that it does not require labelling molecules with fluorophores or metals, so molecular interactions may more closely resemble native behaviour.

OpenSPR is compatible with proteins, nucleic acids, small molecules and even viruses and cells. It has two flow channels which can be operated either independently or simultaneously to provide data on both an interaction of interest and a control. It has the capacity to measure ka from $1x10^3$ to $1x10^7$ 1/M*s and k_d from 0.1 to $1x10^{-6}$, allowing determination of affinity constants ranging from mM to pM. The basic instrument is operated manually, but it can be upgraded with the XT autosampler to provide fully automated 24/7 operation.

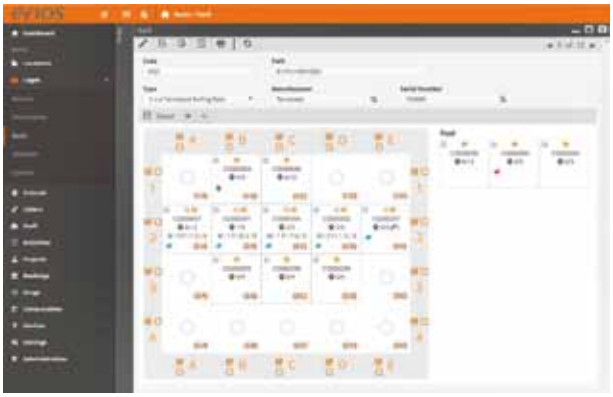
With a compact footprint, the instrument easily fits on a benchtop and is targeted at research groups that frequently perform interaction studies and are seeking the convenience of having an instrument in their own lab.

Jomar Life Research
www.jlresearch.com.au

Lab animal management software

The BSI enos Version 3 lab animal management software can be easily customised to match the user's facility and optimise processes and procedures, providing time-saving efficiencies.

Benefits include: save time and costs by aligning the adaptable software with the evolving needs of the facility; autofill features for cages inside racks; easy tracking and management of animals, activities, protocols, staff, skills, drugs, equipment, stock and much more; adjust software to suit the role and profiles of individual team members including facility managers, investigators, veterinarians and technicians.



The enos customisable ID generators provide consistent IDs that can be configured to match the facility processes. It includes the use of prefix with an auto-increment so that each ID can be unique. Other features include visualisation of calculated properties, new ways to present data, enhanced search capabilities as well as functional developments to labels, cages locations, stocks, instruments and activities.

APAC Scientific Pty Ltd
www.apacscientific.com

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Image courtesy of BOC.

Cryogen safety

Liquefied atmospheric gases, also referred to as cryogenic liquids, present several safety hazards. This article provides an overview on potential risks and precautions to be taken when handling cryogens.

These gases — including oxygen, nitrogen, argon and helium — are liquefied by cooling to low temperatures, and therefore present a number of potential hazards.

Risks

Over-pressurisation — When vaporised into gas, liquefied gases increase in volume. This results in a large pressure increase if the volume change is restricted. Cryogenic systems must therefore be designed with adequate pressure relief on storage vessels and anywhere where liquid may be trapped, such as pipework between valves.

Embrittlement — The most significant consideration when selecting equipment and materials for low temperature use is that of possible brittle fracture. Metals used in any equipment should satisfy the impact test requirements of the design code being used.

Fire hazards — If the atmosphere is enriched with oxygen the likelihood and potential intensity of fire is increased. Combustible materials that are not usually combustible in air will burn fiercely in an enriched oxygen atmosphere. Clothing saturated with oxygen will burn vigorously with potentially fatal results.

Dense cold vapour — Due to the relatively high density of the cold vapour of the liquids, the gases may collect and persist in low-lying areas, posing an oxygen deficiency or enrichment hazard. Manholes, trenches, basements, drainage systems, underground service ducts and any low-lying, poorly ventilated areas may pose such a hazard.

Cold burns and frostbite — Due to the low temperatures of liquefied atmospheric gases, the liquid, cold vapour or gas can cause similar damage to the skin to heat burns. Unprotected parts of the skin coming into contact with uninsulated items of cold equipment may also become stuck to them and the flesh may be torn on removal.

Liquid air condensation — While nitrogen and helium appear to be safe from the risk of combustion because they are inert, these liquids are cold enough at normal boiling points to condense oxygen from the atmosphere.

This produces higher oxygen content than normal air, increasing the risk of combustion.

Asphyxiation and hypothermia — The evaporation of inert cryogenic liquids or solids may, in evaporating, produce oxygen-deficient atmospheres, which will result in asphyxiation if breathed. Atmospheres containing less than 10% oxygen can produce brain damage and perhaps death. Low air temperatures arising from the proximity of liquefied atmospheric gases can cause hypothermia and all people at risk should wear warm clothing.

Effect of cold on lungs — Transient exposure to very cold gas produces discomfort in breathing and can provoke an asthma attack in susceptible people.

Exposure avoidance and safety

- Contact with cold surfaces — where possible insulate all exposed cold surfaces using suitable materials.
- Splashes and spillages — use suitable PPE; use appropriate manual handling equipment when moving vessels containing cryogenic liquids.
- Report all leaks immediately to site emergency response, emergency services and your supplier.
- Prolonged exposure to low temperature environments — use suitable insulating PPE; minimise time of exposure.
- Inadequate design/incorrect choice of materials — only use competent system designers; only use approved materials; conduct regular planned preventive maintenance; do not exceed the flow rate specified for the equipment; comply with relevant design standards.

Information and training

All people who work with low-temperature liquefied gases or systems using such gases should be given adequate training on the risks of asphyxiation, fire hazards, cold burns, frostbite and hypothermia. Special attention should be drawn to the insidious nature of the risks due to the rapidity of the effects, coupled with the fact than an operator may be completely unaware that a hazardous condition has developed. Fire response procedures, including locations of shut-off points, must be in place and training conducted.

Protective clothing

Protective clothing is only intended to protect the wearer handling cold equipment from accidental contact with liquefied atmospheric gases or parts in contact with it. Non-absorbent leather or insulated gloves should always be worn when handling anything that is, or has been recently, in contact with cryogenic liquids. The gloves should be a loose fit so that they can easily be removed if liquid should splash onto or into them. Gauntlet gloves are not recommended because liquid can easily splash into the wide cuff.

It is essential that clothing is kept free of oil and grease where oxygen is in use. Goggles or a facemask should be used to protect the eyes and face when carrying out operations where spraying or splashing of liquid may occur. Long-sleeved clothing should be worn. These clothes should be without open pockets or turn-ups where liquid could collect. Trousers should be worn outside boots for the same reason.

Warning signs

Warning signs should be displayed as necessary and barriers should be placed indicating the extent of the hazard. Any pictogram used should comply with Australian regulation AS 1319.

BOC Limited
www.boc.com.au

Isothermal titration calorimetry system and analysis software

Isothermal titration calorimetry (ITC) is one of the most robust and convenient techniques to examine biomolecular interactions by detecting any reaction heat that takes place. The technique delivers direct, label-free measurements of binding affinity (K_D), stoichiometry (n), free energy (ΔG), enthalpy (ΔH) and entropy (ΔS) in a single experiment. However, the technology has not always been widely applied particularly in drug discovery because of the significant protein and compound consumption associated with conventional methodologies and the broad affinity range that needs to be measured.

The Malvern MicroCal PEAQ-ITC addresses this and many other challenges with a series of enhanced capabilities. Featuring a wide affinity range, fast response time and high signal to noise, the product enables the analysis of weak to high affinity binders (at high and low concentrations) with high reproducibility. The non-reactive Hastelloy cell ensures chemical resistance and compatibility with biological samples while the precision pipette enables smaller injection volumes.

Software delivers fast analysis with high data sensitivity and fully automated options for unattended operation, minimising user subjectivity. Moreover, the analysis software package allows for the determination of the active concentration of the target protein or the ligand concentration or both when the appropriate controls are used.

Additional tools simplify the fitting of complex binding isotherms that may be seen when titrating with mixtures of enantiomers, some competition experiments or with targets that have more than one binding site. These benefits highlight the value of the additional features integrated within the analysis software and the advantages the system provides for powerful data interpretation.

ATA Scientific Pty Ltd
www.atascientific.com.au

Automated solid phase extraction

The Shimadzu Biotage Horizon SmartPrep II Extractor System is designed for the simple automation of manual solid phase extraction (SPE) methods. Just like manual SPE, up to 12 samples per SmartPrep II System can be run in one batch. A user-friendly touch-screen paired with intuitive SmartPrep software offers full control. Users can run the same method or different methods for each of the 12 samples, as required.

Key features and benefits include: positive pressure sample and solvent flow rates for the best recoveries and precision; use any commercially available standard in 1, 3 or 6 mL cartridges; four fractions per sample can be collected or discarded; modular and scalable to match the laboratory workload; samples from 1 mL to 1 L can be easily accommodated; automated filtering, concentration, clean-up and buffer exchange; automated sample dilution prior to SPE; easy coordination with a variety of barcode readers; reports in pdf, csv or txt formats.

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

RecA protein and DNA-damage response

University of Wollongong researchers have used molecular 'Velcro' to understand how an important protein, RecA, goes about repairing damaged DNA in bacteria.

RecA assesses the extent of the damage and what repairs are needed and coordinates the repair activity at the damage site. It sounds an SOS alarm, with more than 40 different genes responding to the call to action.

While RecA activates or switches on the various repair mechanisms that don't introduce errors, it also switches on mechanisms that introduce errors while replicating DNA as a last-ditch attempt to help cells survive. Unfortunately, this process can lead to critical changes in the DNA sequence.

"These changes or mutations are no longer recognised as errors, and the new sequence is replicated in new generations of cells. It doesn't revert back to its original form," said Molecular Horizons Research Fellow and study lead author Dr Harshad Ghodke.

This creates a problem for treating bacterial infections. While antibiotics go to kill the bacteria, RecA swoops in to help cells survive the antibiotic treatment, and the cells that survive now have potentially antibiotic resistant mutations that render drugs ineffective.

The difficulty for researchers in understanding how RecA does its job, and potentially designing drugs that counter its repair work, is that no-one has been able to see where exactly repair activities occur inside living cells.

"RecA surrounds a single strand of DNA to form a filament that then signals the SOS response," Ghodke said.

"Typically, researchers would attach a bright fluorescent tag to RecA so they can take images of it as it goes to work. But with the attached tag, the RecA doesn't do its job very well, and stops functioning as it would in the cellular environment."

The fluorescence signal from the tag also makes it difficult to distinguish RecA that is actively involved in repair work from that which is idle or stored away in the cell awaiting an emergency call-out.

"Imagine taking an aerial photo of a city where you can only see fire trucks directly below. You can't tell if they are actively fighting fire or waiting for a call in the fire station. If we only wanted to see the fire trucks at the site of a burning building, you could attach lights to fire hydrants so that they turn on when fire trucks attach to them and conclude that adjacent buildings are on fire.

"We did a similar thing with visualising the RecA filament. We used a viral protein that naturally interacts with the RecA filament so it wouldn't interfere with how it works, while lighting up the RecA filament as it takes part in the damage response."

To help visualise this new approach to illuminate this DNA repair process inside living *Escherichia coli* bacteria cells, the researchers turned to 3D printing to create physical models of RecA to enable them to see its shape and form.

Molecular Horizons Director, Distinguished Professor Antoine van Oijen, said a key to biological processes is to think in structures and shapes.

"We know from the imaging we do that proteins are dynamic objects. If we think of them as 3D structures we can start to visualise how they change and what causes those changes, leading to a clearer understanding of how these proteins work.

"With a physical structure, you can see the interfaces and design methods to attach other proteins. Then using sophisticated imaging tools we can take short films that for the first time, really show us how they work."

Professor van Oijen said the development paves the way for new drug treatments that overcome antibiotic resistance.

In some cases, mutated cells deactivate the drug or no longer have the target protein the drug molecules are searching for and a rogue cell is not destroyed.

"Antibiotic resistance is a hugely important global challenge. We don't want to get rid of antibiotics altogether because when they work they're incredibly effective. If we can visualise these processes we can then understand the physical connections between molecules and the structure of proteins and potentially design new drugs that will prevent bacterial cells from becoming resistant."

The research was published in the journal *eLife*.

Automated methods for NGS

PerkinElmer has more than 150 tested automated methods available for the most frequently used NGS library prep kits.

This library of standardised and tested automated methods offers flexibility in the choice of kits to suit different applications. Together with the PerkinElmer suite of automated liquid handling solutions optimised for NGS applications, the library provides the ability to adapt to users' requirements.

PerkinElmer offers a suite of liquid handlers providing laboratories the flexibility of choosing an automation solution based on their throughput needs.

NGS applications automated on the JANUS G3 NGS Express workstation for low-to-moderate throughput include — library preparation, amplicon preparation, target capture preparation and sample normalisation. The Zephyr G3 NGS workstation is a benchtop liquid handler designed to automate the construction of 48 to 96 next generation sequencing (NGS) libraries per day. Over 40 automated methods are currently available on this platform including qPCR set-up, Post PCR SPRI purification and indexed library pooling just to mention a few. For laboratories that require high-throughput capabilities, the Sciclone G3 NGSx liquid handling workstations offer walkaway NGS library preparation. With over 88 automated library prep, sequence capture and normalisation protocols currently developed for use with this NGS workstation, the time and effort associated with protocol automation is greatly reduced. The products are designed for research use only, not for use in diagnostic procedures.

PerkinElmer Pty Ltd
www.perkinelmer.com

Environmental *Listeria* detection system

The Neogen ANSR Listeria Right Now system is able to detect low numbers of ***Listeria*** spp., including ***L. monocytogenes***, from environmental samples without enrichment. Detecting possible environmental ***Listeria*** contamination in 1 h allows food manufacturers the ability to find a potential problem quickly and fix the issue before it becomes a serious problem, ie, detect, clean and retest in the same shift.

The system employs an isothermal, amplified nucleic acid-based reaction to target ribosomal RNA. Amplification occurs through a polymerisation mechanism by a specific endonuclease with a fast cycle time. Detection occurs in real time using a fluorescent molecular beacon.

Ribosomal RNA is present in greater numbers in ***Listeria*** cells than the traditional DNA target (~1000–10,000 copies per cell vs 1 copy per cell for DNA). This can result in a 1000–10,000-fold increase in target analyte concentration. The availability of more targets and the fast cycle time enable detection in 1 h without the need for enrichment.

Cell Biosciences Pty Ltd
www.cellbiosciences.com.au

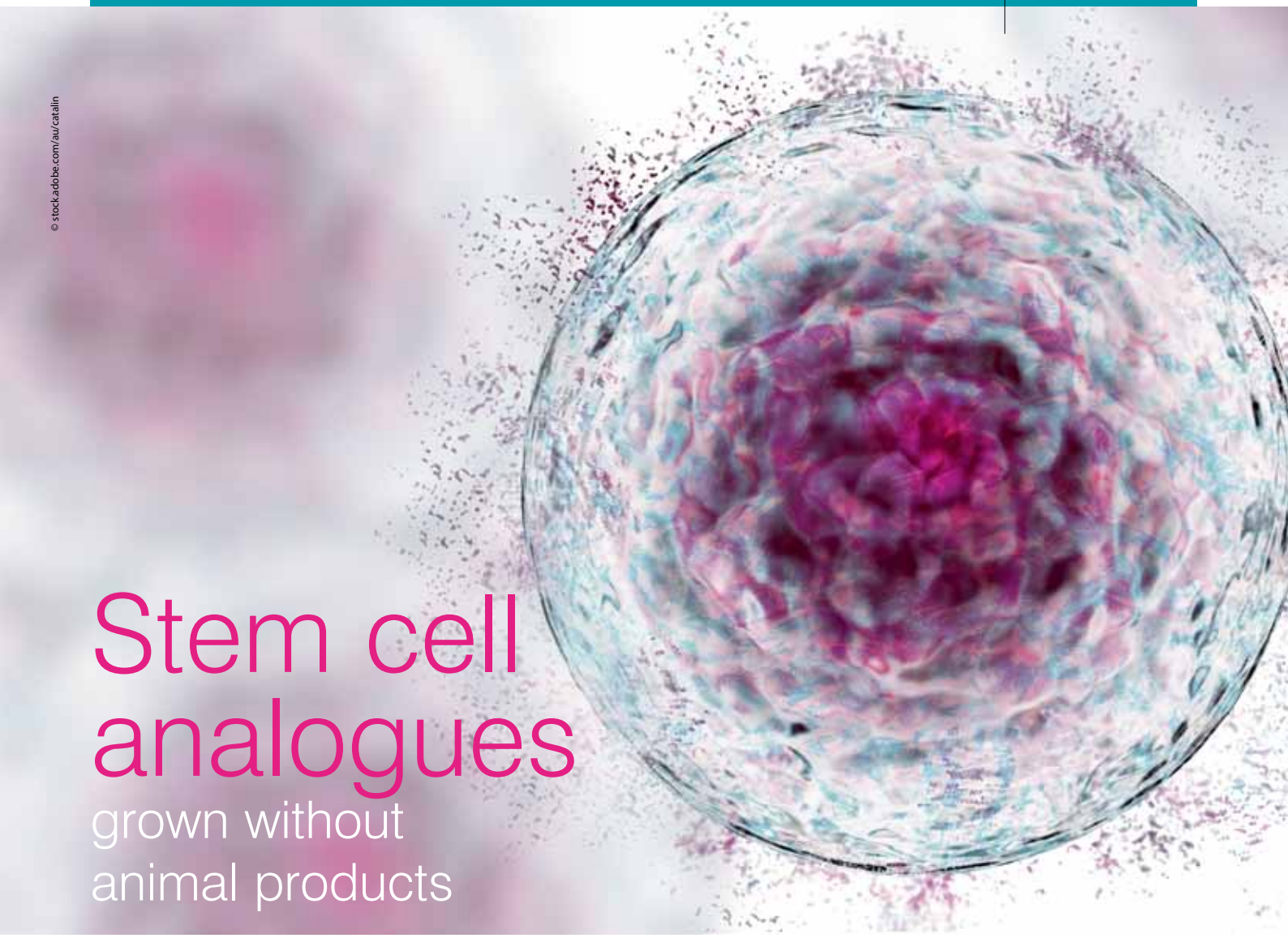
Dynamic mechanical analyser

TA Instruments' ElectroForce DMA 3200 Dynamic Mechanical Analyser provides new capabilities for testing of physically larger and stiffer specimens, and over wider ranges of deformation. For example, a composite sample for which the specimen must be large to guarantee test results that are representative of the total macrostructure. It may not be feasible or advisable to cut this material small enough for a lower-force DMA instrument without compromising its structural integrity and impacting material properties.

Dynamic mechanical analysis (DMA) is a technique used to characterise viscoelastic behaviour of materials as a function of force, strain, time and temperature. This technique quantifies material parameters such as modulus (stiffness) and damping or energy absorption over a range of loads, temperature and time. The latest instrument complements TA's DMA850 and RSA-G2 DMA products, enabling both DMA and fatigue testing to a maximum force of 500 Newtons, which is over 10 times higher compared to lower-force offerings.

DMA3200 combines core technologies from both ElectroForce and TA Instruments. Linear motion is applied by the powerful and durable ElectroForce motor derived from Bose Corporation's high-performance electromagnetic speaker technologies. Precise temperature control is achieved through the Forced Convection Oven (FCO), a system popularised through use in the research-grade RSA-G2 and ARES-G2 and designed by TA Instruments' thermal design experts. Finally, the instrument's new control algorithms and analysis software are designed to deliver precise and reliable results for users.

TA Instruments
www.tainstruments.com



Stem cell analogues grown without animal products

Scientists from the New York Stem Cell Foundation (NYSCF) Research Institute have reported valuable progress towards creating clinical-grade cells for treatment of bone disease and injury.

As noted in the journal *Stem Cell Research and Therapy*, the team have identified two types of growth media that could support effective expansion of mesenchymal progenitor (MP) cells from stem cells in a clinically compatible, Good Manufacturing Practice (GMP) setting. GMP guidelines require that cells to be used as therapies are created without the use of animal-derived substances.

"NYSCF is committed to bringing effective cellular therapies to patients in need," said NYSCF CEO Susan L Solomon. "To establish these therapies, it is essential to produce high-quality cells that meet safety requirements for clinical use, which is a step that this research is helping us achieve."

MP cells are important because they resemble mesenchymal stem cells (MSCs). MSCs can go on to form a variety of cell types — including bone cells, cartilage cells, muscle cells and fat cells — and can modulate the behaviour of many other types of cell types in the body. They are a frequent target for cell therapies in which healthy cells are introduced into the body to treat diseases or reconstruct tissues and organs.

But MSCs are often scarce, and do not expand well enough to provide the number of cells needed for an effective therapy. MP cells, on the other hand, can be produced in large numbers for each patient when generated from induced pluripotent stem cells (iPSCs). They therefore hold extraordinary promise for the treatment of blood, heart and immune diseases, as well as repair of damaged bone and cartilage.

"MP cells have been derived from iPSCs before, but never in a growth medium that does not contain animal-derived compounds," said Giuseppe Maria de Peppo, NYSCF – Ralph Lauren Senior Investigator, who led the study.

The researchers compared MP cells grown in a medium supplemented with foetal bovine serum, a product derived from cows, to MP cells grown in two different 'xeno-free' media (ie, made without animal products) — one supplemented with human platelet lysates and one commercial high-performance GMP medium (Allegro Unison Medium). The team found that while MP cells grown in the xeno-free and GMP media showed slightly different cell morphology, expansion potential, gene expression and cytokine profile than those grown in the medium containing foetal bovine serum, the cells were healthy and functional in these new conditions. Collectively, the results show promise for the eventual application of MP cells in cellular therapies.

"We are glad to see that MP cells grown in GMP-compliant media showed the same biological and functional properties as those grown in research-grade media that contains animal products," de Peppo said. "The results will help us plan for movement of these cells out of the lab and into the clinic."

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https://anzmbs.asn.au/2019-conference/

Hunter Cell Biology Meeting 2019
March 18–22, Hunter Valley
http://www.huntermeeting.org.au/

4th International Conference on Plant Science and Physiology
March 25–26, 2019, Sydney
http://aip.org.au/event/4th-international-conference-on-plant-science-and-physiology/

Australasian Society of Diagnostic Genomics (ASDG) 2019
April 5–7, 2019, Adelaide
https://www.asdgconference.com.au/

2019 Australian Coral Reef Society Conference
May 7–9, Queensland
https://australiancoralreefsociety.org/conference/2019-acrs-conference/

ASID Annual Scientific Meeting 2019
May 16–18, 2019, Darwin
https://www.asid.net.au/meetings/asid-annual-scientific-meeting-2019

AMOS-ICTMO 2019
June 11–15, Darwin
https://www.amos.org.au/event/amos-ictmo-2019/

International Conference on Cytochrome P450
June 23–27, Brisbane
https://my.vanderbilt.edu/p450meetings/

42nd MERGA Conference – 2019
June 30–July 4, Sydney
http://www.promaco.com.au/events/MERGA/

AMSA 2019: Marine Science for a Blue Economy
July 7–11, Perth
http://amsa19.amsa.asn.au/

International Congress of Mucosal Immunology
July 16–20, 2019, Brisbane
http://www.socmucimm.org/

The 43rd Human Genetics Society of Australasia (HGSA) Annual Scientific Meeting
August 3–6, New Zealand
https://www.hgsa.org.au/about/43rd-annual-scientific-meeting

Science meets Parliament 2019
August 13–14, Canberra
https://scienceandtechnologyaustralia.org.au/

The 2019 Australian Genomics National Conference
September 5–6, 2019, Melbourne
https://www.australiangenomics.org.au

14th World Congress on Inflammation
September 15–19, 2019, Brisbane
https://www.wci2019.org/

ASBMB 2019
October 1–3, 2019, Perth
https://asbmb2019.com.au/

5th International Symposium on the System of Radiological Protection
November 19–21, 2019, Adelaide
https://icrp2019.com/

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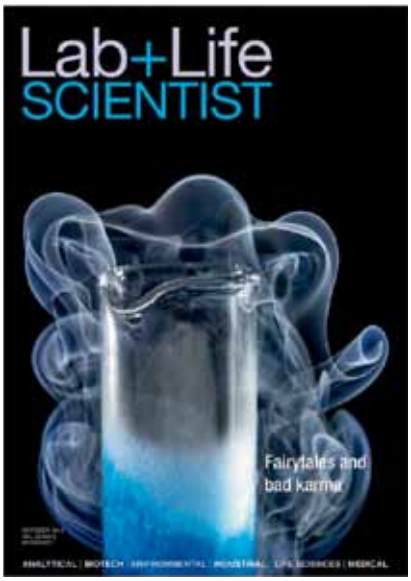

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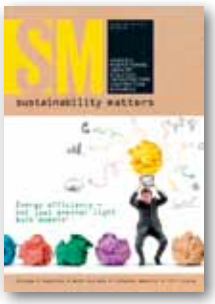

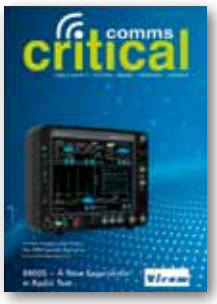

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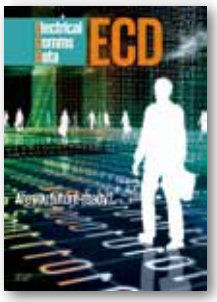

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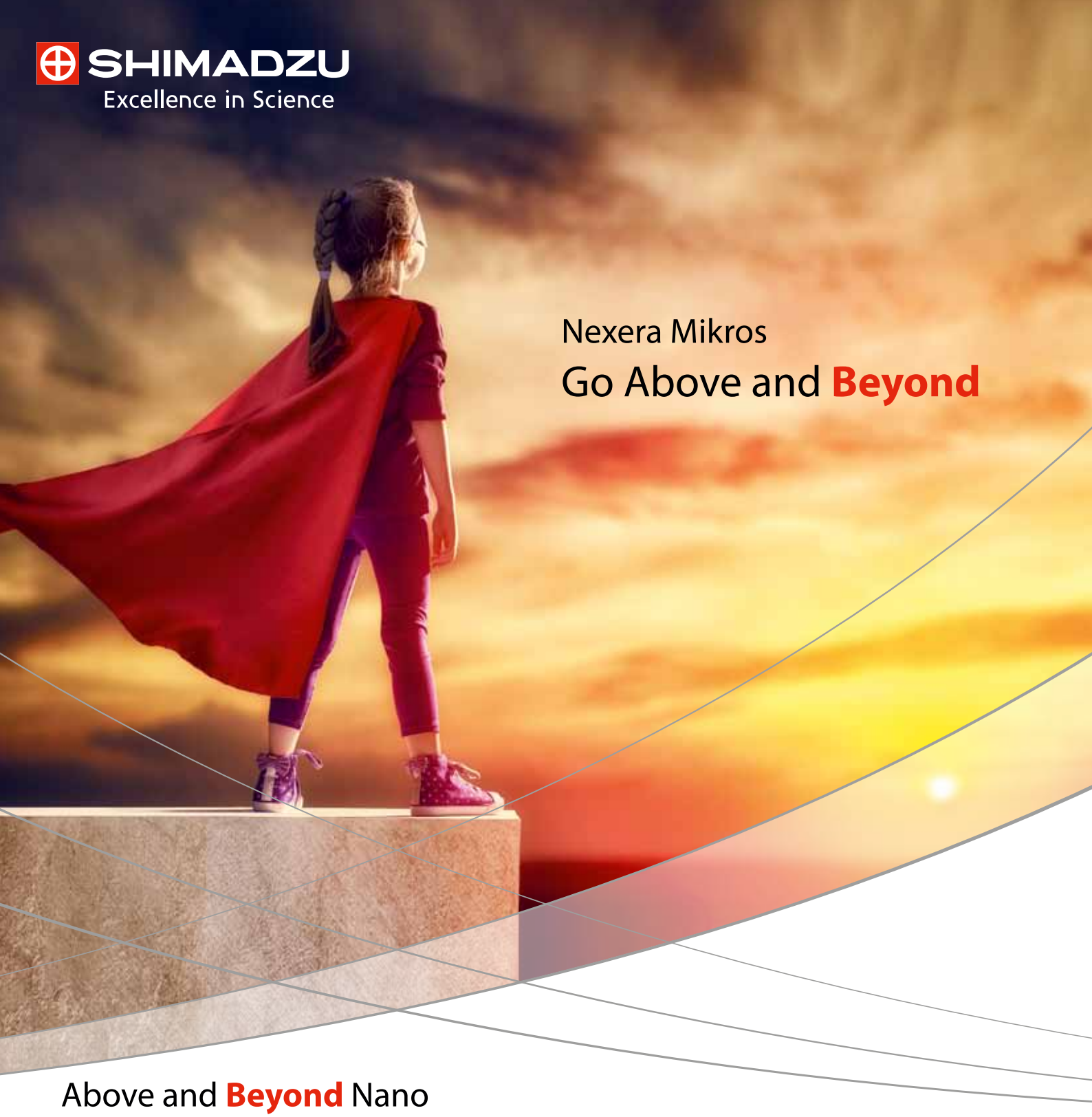

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