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Greens

and the rise of
antibiotic resistance

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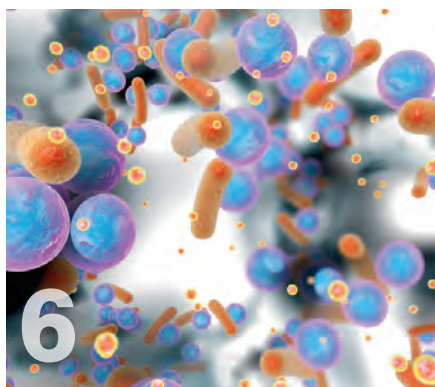
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The news of gene editing of human embryos in the US has been received with a mixture of excitement and caution.

Dr Shoukhrat Mitalipov, the man who produced the world's first cloned monkey embryos in 2007, and colleagues at Oregon Health and Science University have successfully corrected a mutation implicated in a heritable heart condition in pre-implantation human embryos using the CRISPR–Cas9 genome-editing technique.

The success holds promise for preventing inherited diseases, but experts are urging caution. Soon after the publication of Mitalipov's paper in the journal *Nature*, an international group of 11 organisations with genetics expertise issued a statement urging a cautious but proactive approach to gene editing. The Human Genetics Society of Australasia is one of the signatories.

The organisations have agreed that, at this time, it is inappropriate to perform germline gene editing that culminates in human pregnancy. There is, however, no reason to prohibit in vitro (outside of a living organism) germline genome-editing research, with appropriate oversight and consent, or to prohibit public funding for such research. Further, the group agreed that before any future clinical application of germline genome editing takes place, there should be a compelling medical

rationale to use this approach; an evidence base to support its clinical use; an ethical justification; and a transparent and public process to solicit and incorporate stakeholder input.

The CRISPR revolution is also transforming the food and agriculture sector, improving disease resistance and crop yield. This issue features an interview with award-winning scientist Dr Jonathan Plett, who talks about gene editing and other latest developments in the world of plants. Go to page 22 to read his interview. Plett is one of the speakers at this year's ComBio 2017 conference, being held at the Adelaide Convention Centre from 2–5 October 2017.

This year's conference themes include plant biology; biotechnology and sustainable futures; developmental, stem cell and regenerative biology; proteins and proteomics; genomes, epigenetics and bioinformatics; cell biology; cell signalling and metabolism; education; and career development. The event incorporates the annual meetings of the Australian Society for Biochemistry and Molecular Biology; the Australian Society of Plant Scientists; and the Australia and New Zealand Society for Cell and Developmental Biology.

I hope you enjoy reading this issue as much as I have enjoyed putting it together. If you have an interesting story, product or research paper to share, I'd love to hear from you.

Regards,
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By recreating the evolutionary history of class 1 integrons — a class of DNA elements known to be a major player in the rise of antibiotic resistance — Macquarie University researchers have identified how these integrons first entered the human food chain 100 years ago.

“C lass 1 integrons are genetic elements that play a major role in the global dissemination of antibiotic resistance because they can capture gene cassettes from a vast pool of resistance genes, and are resident on diverse mobile elements,” the scientists wrote in the journal *PLOS ONE*. They hypothesised that “a single environmental class 1 integron gave rise to the ancestor of clinical class 1 integrons, since these all share a highly conserved *intI1* [gene] sequence”.

“In turn,” they said, “this implies that a single event resulted in the movement of one variant of the class 1 integron into the human microbiota. The descendants of this initial event have given rise to a pool of genetic elements that have successfully spread into diverse bacterial species, and are now universally present in the commensal bacteria of humans and their domesticated animals.

“Once this ancestral integron made its way into the human commensal or pathogenic flora, it was exposed to various selection pressures, eventually leading to the acquisition of more than 130 different resistance genes.”

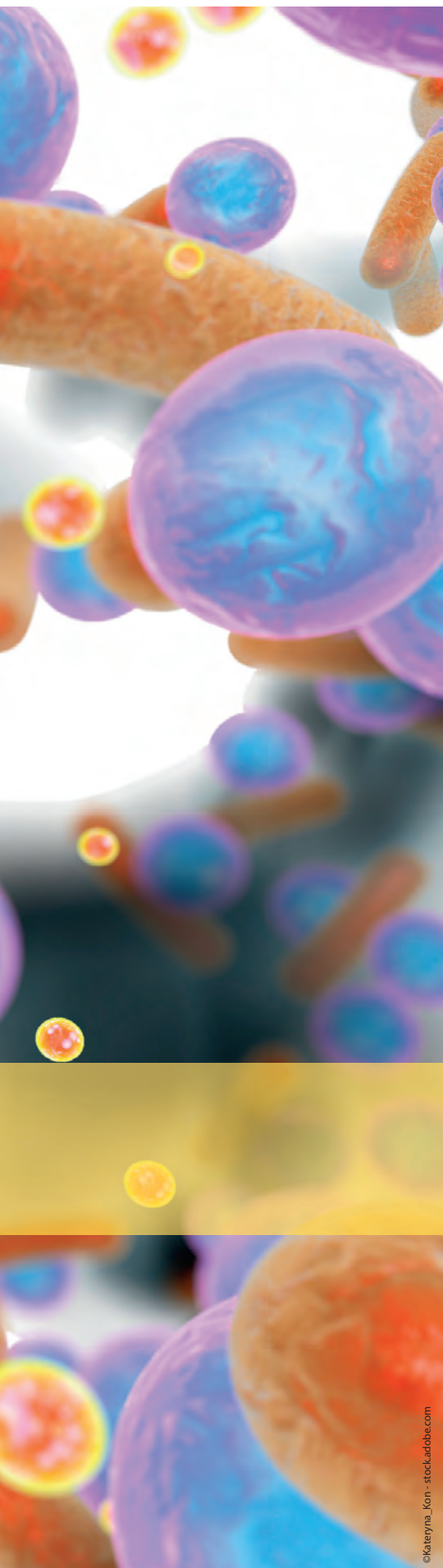
The integron is likely to have originated inside a bacterial cell living on the surface of plants, the researchers claimed, as recently as 100 years ago. Driven by human activity, the integron has now invaded a diverse range of bacterial and animal hosts across every continent on Earth, including Antarctica, spreading to over 70 bacterial species of medical importance.

But how did the preclinical form of class 1 integrons make its way from the natural environment into the human microbiota (gut bacteria) in the first place? According to the researchers, the most likely route was via water



How eating our greens
led to the rise of

antibiotic
resistance



These findings thus provide insights to help limit the current crisis in antibiotic resistance, with the researchers calling for more advanced monitoring and surveillance of the ways in which these resistance genes travel.

or foodborne bacteria. Bacteria that occur on foodstuffs that are eaten raw, or lightly cooked, were seen as particularly likely candidates.

The scientists set out to reconstruct the route taken by the integron by examining various foods, including leafy vegetables, for their potential carriage of integron-bearing bacteria. Promising bacteria were isolated from leaves using a stomacher, with mixed cultures screened for *intI1* using PCR. Positive cultures were then plated out to obtain single colonies, which were rescreened for *intI1*.

So what was the result? Ironically, the researchers found that the culprit may well have been a vegetable which is usually known for its health benefits.

“We found these integrons in a particular bacterial strain isolated from baby spinach leaves, which provides a plausible route for transmission of environmental integrons into the human microbiota,” said Professor Michael Gillings, a co-author on the study. The evidence was difficult to deny, with 70 individual colonies recovered from a single collection sample found to be PCR-positive for *intI1*.

Once resident in the microbiota, the study found, the possession of genes known to confer resistance to arsenic, mercury and disinfectants supplied both the integron and its bacterial host with a means of preferential survival, since all these agents of selection were in use before the antibiotic era. Coupled with the human misuse of antibiotics, this eventually led to integrons being able to pollute our food supplies and colonise wild and domesticated animals.

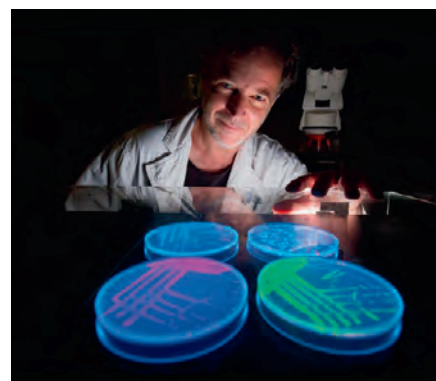
“When humans or animals consume antibiotics, 70% of that drug can be excreted as waste,” Professor Gillings explained. “Our waste management system isn’t able to filter

out the metals, disinfectants or antibiotic agents. This waste helps select and maintain antibiotic-resistant bacteria in the environment. Consequently, the class 1 integron now pollutes all human-dominated ecosystems.”

These findings thus provide insights to help limit the current crisis in antibiotic resistance, with the researchers calling for more advanced monitoring and surveillance of the ways in which these resistance genes travel. They are also calling for set of standards regulating the release of metals, disinfectants, antibiotics and other agents into the environment — especially via human waste.

“By mapping the introduction and spread of antibiotic resistance, we hope to slow the spread of resistance by modifying how humans use and dispose of antibiotics,” Professor Gillings said.

“Class 1 integrons now exist in every human gut and ecosystem and contain more than 130 antibiotic-resistance genes. Understanding the types of resistance genes in each integron and how they spread is the only way modern medicine can hope to compete with the rapid spread of resistance.”



Professor Michael Gillings.
Image credit: Chris Stacey.

Blood collection tube coated in Taipan venom

Australian biotech company Q-Sera has developed a blood collection tube which rapidly produces high-quality serum for testing. The secret to the company's success? Proteins sourced from the venom of the Australian Coastal Taipan.

Serum is the gold standard for biochemical analysis of blood samples and is produced when blood clots. But standard serum tubes can clot poorly, leading to laboratory issues, and are unable to clot the blood of some patients — such as anticoagulated cardiac patients or people taking medicine such as warfarin or other oral anticoagulants.

“In hospitals, particularly where urgent test results are required, the delay and poor quality of serum can hold up life-saving treatment or cause errors in patient diagnosis,” said Q-Sera CEO Michael Grant.

By isolating proteins in the venom of some of the world's deadliest snakes, Q-Sera has developed a novel class of coagulation agents patented for use in blood collection tubes. These ‘prothrombin activators’ were initially sourced from snake venom but can now be produced from modified cell lines using standard pharmaceutical manufacturing processes; the company's lead active produced using these ‘recombinant’ methods is a coagulation agent known as RAPClot.

Blood collection tubes coated with the coagulation agent have been found to rapidly produce high-quality serum, even if the blood sample contains anticoagulants. These benefits may translate into cost efficiencies for healthcare systems and improved outcomes for patients.

The Q-Sera technology is based on the research of scientists from The University of Queensland (UQ). It was licensed to Q-Sera by UniQuest, UQ's main commercialisation company, and has received investment from both the Medical Research Commercialisation Fund (MRCF) and Uniseed, who along with other institutional investors have funded Q-Sera's activities.

Q-Sera is currently working with a number of multinational medical device companies to bring the technology and its benefits to the market. In addition to approval in EU, the primary patent has recently been granted in Japan, with approvals in other jurisdictions expected shortly.



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Leading genome sequencing platform comes to Melbourne

The Australian Genome Research Facility (AGRF) and the University of Melbourne Centre for Cancer Research (UMCCR) have established a state-of-the-art NovaSeq genome sequencing platform at the Victorian Comprehensive Cancer Centre (VCCC). The platform is expected to revolutionise the detection, diagnosis and treatment of cancer and rare genetic disease through rapid and efficient genome analysis.

Through their Genomics Innovation Hub partnership, the partners are among the first globally to receive and deploy NovaSeq DNA sequencing technology from Illumina. The technology was purchased with assistance from the National Collaboration Research Infrastructure Strategy (NCRIS) Agility Fund for nationally significant infrastructure, secured through the support of Bioplatforms Australia.

A single NovaSeq 6000 instrument has the capability to sequence 50 human genomes in less than two days, paving the way towards the sub-\$100 genome and advances in clinical genomics and precision medicine. It also has potential applications in the agricultural and environmental industries.

“When we pioneered the genome sequencing of our first Australian cancer patient seven years ago, it took more than six months to complete and cost roughly \$1 million,” said UMCCR Director of Research Professor Sean Grimmond. “NovaSeq technology, coupled with the latest computing solutions, now provides us with the means to carry out similar studies in days and at the price of an MRI.”

“The acquisition of NovaSeq technology delivers on AGRF's commitment to leading innovation and supporting world-class Australian genomic science,” said AGRF CEO Dr Irene Kourtis. “Importantly, the collaborative relationship with the University of Melbourne and the other Genomics Innovation Hub partners will help advance Australia's place at the forefront of medical research and patient care.”



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When immune cells turn toxic

A subpopulation of immune cells that normally fend off pathogens can turn against the host during certain infections, an international research team has revealed.

Led by Dr Mansour Haeryfar from Western University, Canada, the researchers found that these immune cells, called mucosa-associated invariant T (MAIT) cells, can mount a rapid and robust inflammatory response that may contribute to severe organ damage or even death due to infections that lead to toxic shock syndrome — a life-threatening inflammatory response brought on by exposure to bacterial superantigens, which are toxins harboured and secreted by certain common bacteria. Counterintuitively, it is not the bacteria or its toxins that make toxic shock fatal, but rather the overzealous inflammatory response triggered and perpetuated by the immune system.

The researchers used both animal models and human cells to demonstrate the hyper-responsiveness of MAIT cells to systemic exposure to bacterial superantigens. The team also demonstrated that as MAIT cells responded to superantigens, they began to develop signs of exhaustion and failure to participate in antimicrobial host defence. This exhaustion may lead to immunosuppression, which can also have fatal consequences due to increased susceptibility to secondary, opportunistic infections.

“In this context, MAIT cells are actually disease causing as opposed to protective,” said Dr Haeryfar. “We have shown that MAIT cells are the most powerful source of an inflammatory mediator called interferon- γ , thus likely contributing to morbidity associated with toxic shock syndrome and similar superantigen-mediated illnesses.”

Based on these findings, published in the journal *PLOS Biology*, “we propose that timely and efficient therapies that target MAIT cells will likely benefit the patients by preventing uncontrolled inflammation and also by relieving immunosuppression”, said Dr Haeryfar.



Dr Mansour Haeryfar
in his laboratory at
Western University.



UNSW's new
Biological Sciences
building, home to the
Ramaciotti Centre for
Genomics.

Genomics facility opens at UNSW

UNSW's Ramaciotti Centre for Genomics, said to be the largest and most comprehensive university-based facility of its kind in Australia, has found a new home.

Established in 1999 with a grant from the Clive and Vera Ramaciotti Foundation, the Ramaciotti Centre is one of the few dedicated genomics facilities in Australia that accommodates a full suite of genomics technologies and links these together using process management software. Recently relocated to UNSW's \$165 million Biosciences Building, the centre is now celebrating the opening of new custom-designed facilities.

“The new facility is designed for future growth, to further support the genomics community in NSW and in Australia,” said UNSW geneticist Professor Marc Wilkins, director of the Ramaciotti Centre.

Amongst other state-of-the-art technology, the centre will house two next-generation sequencing platforms that are anticipated to put NSW at the forefront of international genome sequencing capabilities. One of the new instruments, the Illumina NovaSeq 6000, can sequence up to three terabases of DNA in a single run — the equivalent of sequencing one human genome 930 times.

“This instrument is also very flexible and permits the analysis of genomes, gene expression and the regulatory processes that control this,” said Professor Wilkins. “It can be used for the analysis of animal, plant and microbial samples important for fundamental research into molecular biology, for research into agriculture and the environment, and for research into human wellness and disease.”

The centre is also housing a PacBio Sequel platform — an instrument that sequences single molecules of DNA.

“Remarkably, it can sequence lengths of DNA of up to 98 kilobases, and sequence up to one million of these simultaneously in one run,” Professor Wilkins said. “This type of sequencer is revolutionising genome sequencing of species that have, to date, been impossible to decode by other techniques.”

Professor Wilkins said the centre's co-location with proteomics, bioinformatics, flow cytometry and imaging facilities will better facilitate collaboration among its 500 users each year, with collaborators coming from fields as diverse as biomedicine, conservation, the environment, agriculture and biotechnology. The centre is currently working with UNSW Professor Emad El-Omar and his team from St George Hospital to map the microbiota of the gut, which is linked to diseases include stroke, asthma, obesity, diabetes, mental health and pre-eclampsia in pregnant women.

The centre was also instrumental in a 2015 study of the koala genome, which revealed that the marsupials were genetically diverse and that their declining populations were the result of human-related activity rather than inbreeding. The sequencing of the koala genome has since informed policy and management decisions crucial to preserving this iconic species.

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Cucumbers in space

Japanese scientists have grown cucumbers in space flight.

Plant roots grow to find water, according to a process known as hydrotropism. Roots are also influenced by gravity and tend to grow downwards — this is called gravitropism.

Studying the effect of hydrotropism on roots on Earth is difficult because of the competing influence of gravitropism. To find out whether gravity or water had the greater influence on root growth, scientists at Tohoku University grew cucumber plants in the microgravity environment onboard the International Space Station.

In their experiments, the scientists were able to untangle the competing effects of water and gravity to show that, in microgravity, water (hydrotropism) had more influence in controlling root growth. Their results were published in the journal *New Phytologist*.



Image credit: JAXA, NASA

Astronaut Dr Ron Garan watering cucumber seedlings onboard the ISS.

“We will be able to utilise roots’ ability to sense moisture gradients for controlling root growth orientation and efficiently growing plants in future space farms,” said Dr Hideyuki Takahashi, senior author of the study.

Cucumbers were chosen for the study as they — like other ‘cucurbitaceous’ seedlings such as melons, pumpkins and squash — feature specialised protuberances, or pegs, whose formation is regulated by gravity. These pegs form during the plant’s early growth stage to help the seedlings emerge from their hard seed coat and anchor the developing plant in the soil while its roots form.

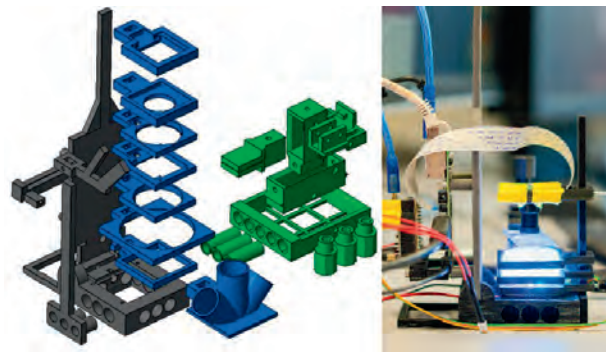


Image credit: Tom Baden

3D print your lab equipment

Neuroscientists from the Universities of Tübingen and Sussex have developed ‘FlyPi’ — a low-cost imaging and microscope system for research, training and teaching. The findings of their research, led by André Maia Chagas and Tom Baden, have been published in *PLOS Biology*.

The intricate equipment necessary for modern neuroscience experiments can easily cost tens of thousands of dollars when relying on commercially available solutions. FlyPi, on the other hand, can perform many standard lab protocols, including light and fluorescence microscopy, optogenetics, thermogenetics and behavioural studies on small animals such as roundworms, fruit flies and zebrafish larvae.

The design is based on a 3D-printed framework holding a Raspberry Pi computer and camera, cheap LEDs for lighting and simple lenses, and optical and thermal control circuits based on Arduino, an open-source microcontroller. Taken together, the components cost less than €100 (\$147) for the basic system and can be modified to suit the lab’s purposes. The FlyPi system provides modular, low-cost options for research and assembly, and instructions for use are made available free of charge via open-source platforms.

The developers of the FlyPi system share a keen interest in spreading ‘open labware’. Together with co-author Lucia Prieto Godino of the University of Lausanne, the developers have taught courses in 3D printing, programming and DIY lab equipment at universities in Kenya, Uganda, Ghana, Nigeria, South Africa, Sudan and Tanzania.

“Many institutions around the world have little money to spend on costly equipment,” said Baden. “We think it is very important that neuroscientific training and research open up to larger numbers of students and junior scientists. So we hope that, with open labware such as our FlyPi, we can offer a starting point.”

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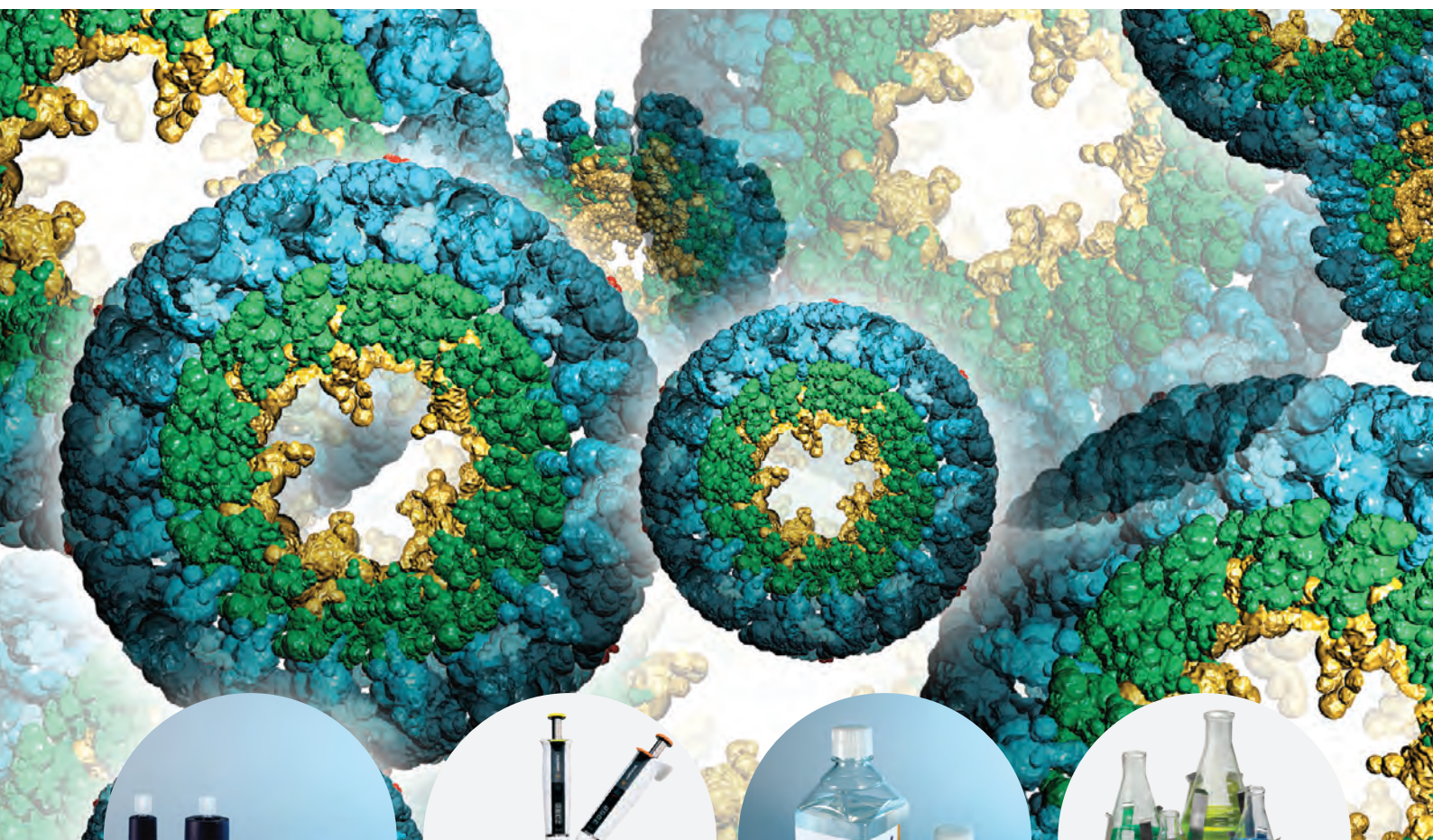
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Treating childhood allergies with gut bacteria

Australian biotech company Ondek is on a mission to develop an immunotherapy based on the gram-negative bacterium *Helicobacter pylori* — previously known as *Campylobacter pylori* — which it hopes to eventually deploy as a new treatment for childhood allergy.

As noted by Ondek Chairman Peter Hammond, there has been “a dramatic rise in the prevalence of allergic diseases” over the past few decades.

“According to the World Allergy Organization, an estimated 30% to 40% of the global population suffered from some form of allergic condition in 2011,” Hammond stated.

This so-called ‘allergy epidemic’ has been linked by various experts to increased hygiene and

reduced exposure to microorganisms in childhood, termed the ‘hygiene hypothesis’. As explained by Ondek founder Professor Barry Marshall, a world authority on *H. pylori*, “[when] children aren’t exposed to enough infectious or non-infectious bacteria, the immune system can get ramped up”.

“They then can become more reactive to all kinds of new proteins in their diet or susceptible to pollen in the air,” Professor Marshall said.

In 1982, Professor Marshall and Dr Robin Warren were responsible for the discovery that chronic *H. pylori* infection can trigger the development of stomach ulcers. It was a breakthrough that revolutionised the medical

management of these ulcers and helped to generate a cure — and subsequently won the two researchers the 2005 Nobel Prize for Medicine and Physiology.

“Dr Warren saw bacteria in the stomach when he was checking biopsies for stomach cancer,” Professor Marshall recalled. “He could see inflammation [gastritis] but did not really make a connection with bacteria initially. I was interested in answering the question of ‘how do bacteria survive in the acid stomach?’; therefore, we were really exploring the wonders of bacteria and, as a side effect, discovered that these bacteria were the cause of peptic ulcers and probably gastric cancer.”



It all began in 2008, when New York researchers published what they claimed to be “the first [study] to report an inverse association between *H. pylori* seropositivity and asthma in children” in *The Journal of Infectious Diseases*. Since then they have been joined by researchers from Switzerland to Israel, all of whom have come to the same conclusion: the risk of developing allergy is reduced in the presence of infection with *H. pylori*.

“*H. pylori* is a potent immune modulator,” explained Dr Jenny Harry, CEO of Ondek. “It acts to suppress a hypersensitive immune system and thereby reduce a person’s response to an allergic challenge, eg, exposure to pollen or peanuts. This modulatory action has a greater effect when the immune system is developing, ie, in infants or young children. Consequently, young children exposed to *H. pylori* have a lowered risk of becoming allergic.

“The impact of this is significant when we consider that approximately 50% of the kids that present with eczema — the earliest sign of allergy — will proceed to develop a food allergy or allergic asthma later in life.”

Now Ondek is utilising Professor Marshall’s prize-winning insights to create a *H. pylori*-based drug to rebalance the human immune system and improve the treatment of common allergies. The aim is to release a product that will downregulate hypersensitive allergic responses, with the main ingredient of the new product harnessing the immune modulatory properties of *H. pylori*.

“The wider medical community is recognising the important role of the microbiome in regulating the immune system,” Professor Marshall said. “*H. pylori* is a unique member of the natural gut microbiome and has a potent immune regulatory function.

“In the 21st century, as *H. pylori* is disappearing, humans in response have become hyperreactive to environmental allergens. If we put *H. pylori* back in a safe way, we can move allergic people back into a normal range.”

The company has already patented a killed derivative of *H. pylori* to be developed as a natural and safe immunotherapy called ImmBALANCE, which has been in development for the past four years and is being formulated as a dry powder which can be presented as tablets or capsules or dissolved in drinks.

“Children could put it in a drink and, over the course of a few months, suppress their allergic response,” Professor Marshall noted.

“By developing an oral product which contains non-viable *H. pylori*, we can get the immune advantages that Stone Age man used to get by having live bacteria, with none of the disadvantages.

“It won’t depress your immune system; it will just take the edge off.”

Back in 2013, Ondek received a \$919,596 development grant from the National Health and Medical Research Council (NHMRC) to support the clinical development of ImmBALANCE. Four years later, the company is on a high after recently receiving \$3.59 million in equity funding from investors looking to support the development of the new allergy treatment.

The company’s business strategy is to develop ImmBALANCE through to clinical proof of concept before partnering with a global pharmaceutical firm that has the capacity to complete clinical development and take the product to international markets. The target indication is childhood eczema, as the Ondek team believes the product will be most effective during the development of the immune system during infancy and childhood. It will also be tested against existing allergies and other chronic inflammatory diseases in adults.

“Capital raised will be prudently deployed to scale up manufacturing of the new drug compound and generate preclinical safety and efficacy data ahead of a meeting with the US Food and Drug Administration (FDA) later next year to seek guidance and permission to start regulatory toxicology studies and human trials,” said Dr Harry.

Ondek will be looking to trial ImmBALANCE in humans within two to three years.

About half of the world’s population is currently infected with *H. pylori*, according to the World Health Organization, with the bacterium surviving in the human stomach by modulating the host’s immune system. But while 10% of people with long-term infection will develop an ulcer and have an increased risk of stomach cancer, the vast majority carry the bug without developing any symptoms. In fact, *H. pylori* appears to be beneficial for the development of a healthy immune system, with several independent studies having shown an inverse correlation between the presence of *H. pylori* and the incidence of allergic disorders such as eczema and asthma.

Female-led sample sharing database changing the future of biological research



The world of biological research is vast, with an estimated 8.7 million multicellular species and countless additional unicellular organisms on Earth — many still unidentified. In order to understand our ever-changing biological landscape, it is important for biological researchers to work efficiently and cost-effectively.

PhD students Madeline Green and Lauren Meyer were conducting research on sharks and rays across Oceania when they became frustrated spending valuable research time liaising with other researchers for tissue samples. To fix this problem, they started Otlet.

Otlet is the first database of biological research samples available to researchers worldwide. The database functions as a virtual tissue bank where researchers can upload available samples, search for ones they need, and have selected samples shipped to their lab.

A database of this nature is nothing short of a game changer for biological research, as it has created a single central collaborative network for researchers to obtain tissue samples around the globe.

As Otlet grows, founders Meyer and Green hope to see the start-up become the new standard for biological researchers.

“Our goal is for scientists starting a new project requiring samples to think ‘I’ll check to see what’s on Otlet,’” says Otlet co-founder Green.

The Otlet team is working to integrate the database into research-focused universities and museums, while also connecting grassroots, NGO and small-scale institutions.

The database can have an especially big impact on grassroots organisations conducting research, where samples from understudied and under-represented areas and developing nations can be linked with large institutions for analysis.

“When we enable scientists to have greater access to samples and collaborate at a global scale, what we are really doing is accelerating our understanding of the natural world. This heightened level of understanding of animals and their environments means we are in the unique position of protecting and conserving biodiversity globally,” says Green.

Otlet is a database made by researchers, for researchers. Sharing samples between scientists requires trust. Green and Meyer are building their business to create a trusted and usable resource for scientists like themselves.

The development of Otlet has been made possible by BlueChilli’s SheStarts program. SheStarts is a national initiative to boost female leadership in the start-up economy, backed by major supporters including GSK Australia. Green and Meyer were able to team up with SheStarts to couple their knowledge of the research world with business skills to launch a start-up.

“The SheStarts program, with the support of organisations like GSK Australia, has

been integral to the success of Otlet. From business models to partnerships and hiring, we now have a deep understanding of what’s required to establish a sustainable company. The program has introduced us to incredible people with a tremendous willingness and capacity to help, and for us that means taking a vision and growing it into a successful company,” says Green.

Otlet launched a pilot project to test the idea called Shark Share Global. In the first two months the pilot attracted over 140 users across 26 countries and had hundreds of samples uploaded.

The main Otlet database is designed for all types of biological samples from non-human organisms, and is accessible to researchers belonging to institutions, research organisations, and government agencies.

As the global ecological landscape changes, it is more important than ever that biological samples are in the hands of researchers — not buried away in a freezer. Otlet allows scientists to focus on completing their research, not hunting down samples.

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PCR cycler

Speed and enhanced optimisation functions like the 2D-Gradient make the Mastercycler X50 PCR cycler a suitable tool for research in molecular biology.

Block temperature control and regulation enable optimisation, while the adaptable user management and extensive documentation capabilities give peace of mind to laboratories working or conforming to set standards. A highly intuitive touch display, low noise levels, low power consumption and the versatile flexlid lid concept complete the product.

Up to 10 units can be combined, making the product suitable for high-throughput applications or labs with a high number of users running different assays. For users who require more flexibility or throughput, up to 50 units can be combined in a computer-controlled network.

Features include: a 2D-Gradient for PCR optimisation; a heating rate of up to 10°C/s; a wide selection of blocks, from a fast silver block to 384; the flexlid concept, with automatic height adjustment of the lid allowing the use of all types of consumables; and a small footprint.

Applications include fast PCR, PCR optimisation, standard PCR, incubation and cycle sequencing.

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Disposable safety gloves

With the uvex u-fit product range, uvex offers high-quality disposable safety gloves which ensure a high level of safety and functionality. The gloves offer protection in many industry sectors, including the chemical, medical and food industries and in production, enabling comfortable and precise work. The disposable safety gloves are available in two different materials to cater for this wide range of application areas.

The uvex u-fit lite is thin and free from all potential allergenic vulcanisation accelerators. Chloroprene makes the uvex u-fit strong model particularly flexible, while its wall thickness makes it adequate as a chemical protection glove in accordance with EN 374. The accuracy of fit and elasticity makes it comparable with natural latex, according to the company, but without the potential to cause allergies.

UVEX SAFETY AUSTRALIA LIMITED PARTNERSHIP

www.uvex-safety.com.au

Automated double dispensing system

The Attension Theta is a versatile optical tensiometer used to characterise material surfaces and interfaces between gas, liquid and solid phases. It measures static and dynamic contact angle, 3D surface roughness, surface free energy, surface and interfacial tension, and interfacial rheology. The product is used in research, development and quality control in a variety of industries such as chemicals, pharmaceuticals, electronics, foods and energy.

A series of upgrades has now been developed for the Attension Theta. One of these upgrades is a dual dispensing system which utilises two disposable tip dispensers. This allows the user to quickly determine surface free energy (SFE), which provides valuable information about the surface chemistry. The automatic disposable tip dispenser makes cleaning easy while also enabling the drop volume to be dispensed precisely by calculating the droplet volume from the live image.

A further upgrade includes the product's camera, which offers advanced imaging to capture fast wetting phenomena up to 3009 fps and experience precise drop shape analyses with 1984 x 1264 pixel resolution. This is included in every system.

The device can be combined with a 3D topography module that is said to take the wettability and adhesion analysis to another level. It is claimed to be the first system that can measure both contact angle and surface roughness of the sample in a single measurement — and calculate the contact angle without the effect of the roughness.

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Gold standard in mineral analysis

SA analytical instrumentation provider Chrysos is developing a gold analysis process that is said to be up to three times more accurate than conventional methods.

Known as PhotonAssay, the process uses high-powered X-ray machines to activate the gold in a given sample and measure the signal it gives off to quickly and accurately quantify how much gold is present. It was invented by CSIRO and helps to reduce the environmental impact of mineral processing, as it eliminates the need for toxic chemicals and lead.

"The challenge the [mining] industry has at the moment is that the current methods for analysing gold ore are not fast enough and require too much work," Chrysos CTO and PhotonAssay founder James Tickner explained.

During the PhotonAssay procedure, a sample is put into a plastic screw-top jar weighing about half a kilogram. The jar is then placed on a conveyor belt inside Chrysos's analysis machine. Different metals are counted atom by atom on the basis of the unique signatures produced after excitation using an X-ray beam.

"Our process itself is not new, but we have developed it further to be more accurate... It also has the potential to assess other metals as well like silver or copper," Tickner said.

A series of trials by CSIRO researchers in Canada demonstrated the technology's performance, with results showing that PhotonAssay will be able to measure samples with gold levels as low as 30 parts per billion. The level of precision depends on the

amount of gold in each sample, but for high-grade samples, the accuracy was within about 1%.

Chrysos is now setting up its first production unit in Western Australia, working in partnership with mining company Ausdrill and analytical service provider MinAnalytical. Ausdrill's COO of Australian operations, Andrew Broad, said the destructive nature of contemporary procedures such as Fire Assays and the speed of PhotonAssay led the company to partner with Chrysos.

"There are two major issues with how things are done now with Fire Assays — they are quite laborious and it is quite difficult to get skilled labour in that field and they take anywhere between 24–48 hours to get results, reduced to just minutes using PhotonAssay," Broad said.

"Fire Assay is also very destructive, but with this [PhotonAssay] you can run further tests on a sample at a later date," Broad continued. He said one of the main benefits of PhotonAssay was its reduced environmental impact because it eliminated the need for dangerous chemicals and lead, which are used in other competing technologies.

Ausdrill plans to set up its first unit in Perth, which is projected to be up and running in December. A second mine-site unit is planned for Kalgoorlie by the middle of next year. The company then hopes to export the technology to other projects in Africa.

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Understanding plant-microbe interactions

With a relentless passion for plants, a strong desire to secure the world's food resources and numerous papers and awards under his belt, Dr Jonathan Plett from Western Sydney University is one of Australia's most promising scientists.

Last year, Plett's research and engagement on the relationships between plants and the fungi in soils saw him receive the much-coveted 2016 NSW Young Tall Poppy Science Award. Issued by the Australian Institute of Policy and Science, the Young Tall Poppy Science Awards recognise promising young scientists who achieve scientific excellence and demonstrate a commitment to sharing their passion and knowledge.

Plett is one of the many interesting speakers at this year's ComBio conference, being held at the Adelaide Convention Centre from 2–5 October. We interviewed him to learn more about his past, present and future in the world of plants.

Lab+Life Scientist: How did you become interested in plant science?

Jonathan Plett: The love of research runs in the family — my father and brother are both engineers, my mother was in the field of Biblical studies and my cousin's in English literature. I, on the other hand, loved plants. From a young age, how plants grow and flower and flourish has fascinated me.

My father had a huge veggie garden that he would dedicate hours to every week, from early spring to the final frost. As a young child, he'd let me look through seed catalogues with him and let me pick out a few seeds that I could plant and grow myself. This began a lifelong passion for growing plants. When I was 10, an English couple moved

in next door and proceeded to turn their entire property into a huge flower garden. When they saw how enthralled I was with their achievement, they offered to teach me how to grow flowers. So I roped my father into the deal and, through their tutelage and a lot of sage advice from my father, I planted my first flower garden and spent the next five years learning how to grow a whole range of perennial flowering plants, bushes and vines. I have never looked back — every house I have lived in since has always had at least a corner of the yard or patio dedicated to growing plants, and this has naturally extended now into my work.

So I suppose that the possibility of being able to turn my passion for plants into a career was what drew me into studying science and eventually into a career in research.

LLS: What's your lab's current research focus?

JP: Currently my group is focused on trying to understand how the plant immune system works. Specifically, we are trying to understand how the plant is able to filter/identify/interpret chemical and protein signals from soil-borne microorganisms (microbes) to determine if a given microbe will be beneficial or detrimental to plant health. We hope to use this information to breed new crops or select new stock for forestry plantations that are better able to withstand disease-causing microbes, while fostering relationships with other microbes that can benefit their health and productivity.

LLS: Tell us about your 'eureka' moments.

JP: One of the most exciting eureka moments in our lab was a couple of years ago. We had spent

a number of years studying how plant immune responses were controlled during the interaction between plants and either disease-causing or beneficial microbes.

We found that if certain immune responses were triggered they would kill off the microbe, regardless of whether that microbe was beneficial or detrimental to plant health. This led us to hypothesise that crop breeding programs aimed at delivering disease-resistant cultivars may inadvertently also be breeding for reduced association with symbiotic beneficial microbes — if the breeding process led to the selection of new varieties that made use of these particular detrimental immune responses. Together with the Department of Primary Industries and Pulse Breeding Australia, we tested this hypothesis and found that it was true — in certain varieties of chickpea, the disease resistance that had been bred into the variety also reduced nutrients that the plant normally sourced from symbiosis with beneficial soil microbes. This discovery has led to a continued project with the Department of Primary Industries and Pulse Breeding Australia to help with selection of new legume varieties that are disease resistant without losing the ability to form beneficial symbiotic relationships with soil microbes.

LLS: What are you going to talk about at ComBio?

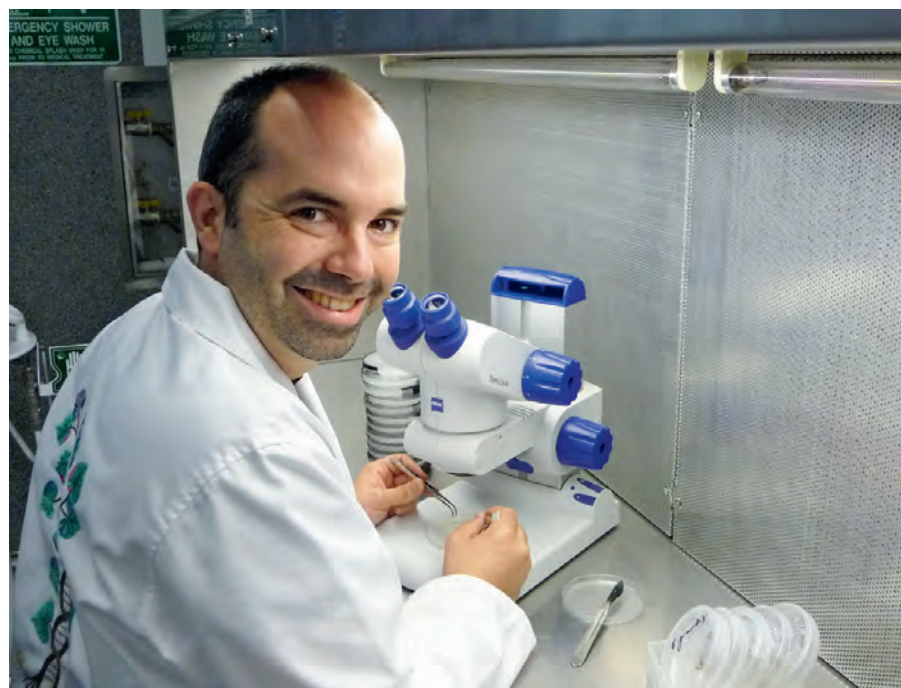
JP: I will be talking about the work that led up to the eureka moment.

The abstract, if you'd like, is that in forest and agricultural ecosystems, plant roots are valuable real estate where beneficial and pathogenic microbes are competing for the chance to colonise, and exploit, plant nutritional resources. Our understanding of the inter-kingdom communication that occurs between host and microbial cells to favour the formation of these interactions is still developing.

The objective of my research is to 'listen in' on these molecular dialogues and to understand how plants are able to distinguish between beneficial and detrimental associations with the plethora of microbes found within the rhizosphere. I will focus my discussion on recent advances in our understanding of how the plant hosts are able to deploy different types of defences, depending upon the microbes present in the soil, and how microbes attempt to manipulate these defence responses. I will conclude with the ramifications this recent work has on how we approach plant breeding and plant varietal selection for agriculture and forestry applications.

LLS: What are some of the biggest challenges in researching plants?

JP: I actually see that there are more benefits to doing research in plants than there are challenges. If I were to pick one, however, it would be the speed with which one can work with plants. People who work with bacteria or yeast as research models have a generation time on the order of minutes to hours. When you work with plants, this generation time is on the order of months to, if you work with trees, decades. So if you want to manipulate the genetics of certain plant models, it can be extremely challenging and time-consuming. However, new technologies and methodologies are starting to change this. So, thankfully, the future may hold new ways of working with recalcitrant



plant models that are important in both managed and natural environments.

LLS: Can you highlight some of the benefits of the latest technological advancements?

JP: Like any science, technological advances in recent years have helped us immensely. Some of the biggest aids to my work have been the availability of fully annotated plant genomes to study the genetics of my plants of interest (eg, chickpea, eucalypts, etc). Advances in the area of gene and RNA sequencing have also brought down the costs of doing genetic profiling of plants, making larger scale and more meaningful studies of how plants interact with microbes more feasible.

LLS: What about gene editing?

JP: There are huge opportunities to use new technological advances such as gene editing to develop new crops that will meet future food needs. With genome editing, we can breed crops that are more disease tolerant, that are nutrient efficient and

that produce more bountiful crops at a faster pace and in a more targeted manner than with traditional breeding. The biggest challenge, as always, is public perception of gene editing and public acceptance of the safety of such technology.

LLS: What are some of the areas where progress hasn't happened as fast you'd have liked?

JP: I would say that one of the areas that makes me most frustrated is in how we, as a scientific community, have not taken/made opportunities to communicate what we do with the general public. This has led to some of the problems I mentioned earlier, such as people questioning the safety of genetically modified organisms —

it has led to questions of whether research is important or if it even affects their daily life. Lack of communication of our work with governing bodies has led to cutbacks in essential basic science that will give the breakthroughs that we need in the coming years. I cannot count the number of times I have heard non-scientists ask "why should I care about research?" — and that makes me incredibly sad.

I would hope that our generation of scientists, and the new generation of researchers that are currently coming through their schooling, would realise the importance of science communication outside of the normal academic circles. I hope that people would make use of social media, talk with journalists and get people excited about science. I would hope that within my lifetime, I will no longer hear questions on whether science and research support society, but rather how society can further support research.



Ductless fume hoods

AirClean Systems' Endeavour ductless fume hoods feature the easy-to-use AirSafe NXT automatic safety controller for added operator safety. The colour touchscreen controller automatically increases or decreases blower speed to maintain the user's preset face velocity, ensuring airflow is within standard operating parameters. The current face velocity is displayed at all times.

AirSafe NXT also monitors the bonded carbon filtration bed, alerting the user audibly and visually should filter saturation occur. Additionally, it displays the approved chemical class for the hood and waits for a confirmation from the user before allowing the hood to be used.

The controller also provides a multilanguage and multiunit capability not found in most ductless hoods, according to the company. With the press of a button, users can switch the controller language between English, Spanish, French and German. Airflow can be displayed in both linear feet per minute (LFM) and metres per second (m/s).

Endeavour ductless hoods eliminate the need for installation, ductwork and over-built HVAC systems associated with traditional fume hood use within the laboratory. An onboard energy meter, accessed via AirSafe NXT, displays the real-time and lifetime energy use of the hood.

Endeavour's rolled-entry design combined with AirZone baffling provides laminar flow within the cabinet, preventing eddy currents and keeping fumes or particulate from escaping the hood. Seamless, thermally welded polypropylene construction means the product will never rust, providing years of service life. All electronics and blowers are post-filter, so they are never exposed to chemicals used in the hood.

The ductless fume hoods ship fully assembled, requiring minimal installation. Simply place on a cabinet, stand or benchtop and plug into a standard 110 or 220 V outlet. The fume hood can be installed and used within minutes of being removed from its shipping container.

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Precisa is a manufacturer of analytical, benchtop and specialist application balances that are suitable for research, QA and teaching labs.

The 390 Series is Precisa's premium line of balances to suit discerning science applications such as pharma and metrology. The EP/ES 360 Series balances are full-featured and functional products with rich application sets for demanding users, while the LT/LS/LX 321 Series balances are mid-range devices for general-purpose weighing. The XB 320 Series balances are for customers who need economical models and the BJ Series balances are for simple weighing requirements.

The company also provides the XM Series moisture balances, which are said to offer high quality and performance.

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Automated isothermal titration calorimetry systems

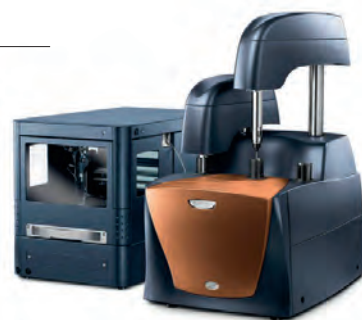
The Affinity ITC and ITC Auto are designed for challenging life science laboratory environments that require high sensitivity and high productivity.

The instruments are powerful tools for measuring a wide variety of molecular interactions and bring advanced engineering to all critical aspects of the measurement, ensuring high-quality ITC data. The fully automated, user-selectable system cleaning routines eliminate run-to-run contamination.

The AccuShot feature delivers the titrant to the right location for the best mixing, while FlexSpin provides innovative slow-speed stirring, efficient mixing and high sensitivity. The powerful ITCRun and NanoAnalyze features offer a comprehensive suite of tools for method optimisation, model fitting, batch analysis, graphing and data export.

Other features include: intelligent hardware positioning for precise injections; and solid-state active heating and cooling for true isothermal temperature control choice of standard (1 mL) or low-volume (190 μ L) cells. A 96-well, temperature-controlled liquid handling autosampler can be included with initial purchase or added at a later date.

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Leakproof vials

A series of leakproof vials has been developed to provide sample protection and user safety by enabling correct cap application every time. The lid-lock design of the Thermo Scientific Samco Clicktainer vials makes them suitable for the secure transport of valuable and often hazardous clinical, research and forensic samples.

The vials are designed for the secure collection and handling of fluid, solid and powder samples, including urine, sputum and stool specimens. They bear the CE mark and are compliant with applicable FDA regulations. They also are 95 kPa leak- and pressure-tested in accordance with standards BS EN 14401 and 14254, respectively, and are tested to support their use in hospital pneumatic transport systems.

Users simply turn the lid gently past the lock symbol and an audible 'click' sound will signify the lid is fully sealed. The click mechanism is tactile and clear markers on the lid and vial also indicate when the lid is correctly closed. Users can thus be confident their samples are safe, while the durable tab design reduces the risk of torn gloves or break-off leading to potential contamination of the sample.

The wide 53 mm opening is designed for easy specimen collection and handling, and the cap is available in multiple colours for sample differentiation and management. In addition, the vials are available gamma-irradiated to a sterility assurance level (SAL) of 10^{-6} for routine microbiology and more sensitive applications or non-sterile for general use.

The vials are available in 120 and 90 mL formats with an optional built-in temperature strip. They are compliant with the requirements of In Vitro Diagnostic Device Directive 98/79/EC.

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Nitrogen generator

Peak Scientific has unveiled its Infinity XE 50 Series nitrogen generator. Designed to cater for numerous applications across a typical laboratory, from a single source solution, the series provides a variable flow of nitrogen gas ranging from 11 to 432 L/min and at purities up to 99.5%.

The series is suitable for a wide range of applications, including LC-MS, ELSD, sample evaporation, NMR, FTMS and glove boxes, with the potential of providing nitrogen for multiple applications across an entire lab. The versatile generator can also be used for industrial applications such as modified atmosphere packaging and wine bottling.

The product line has a high-performance range available across four models (5011, 5021, 5031 and 5041). Features include purity monitoring with optional failsafe shutdown and eco mode for maximum energy efficiency and reduced running costs.

The series is engineered, assembled and performance tested at Peak Scientific's ISO 9001 compliant manufacturing centre of excellence in the UK. It is backed with the company's global on-site technical support.

Peak Scientific Instruments Pty Ltd
www.peakscientific.com



Bead mill homogeniser

The Bead Ruptor 24 Elite, from Omni, is the most powerful bead mill homogeniser available — calculated from speed and displacement, the g-forces generated by the BR24E exceed all other bead mill homogenisers on the market. It is suitable for grinding, lysing and homogenising biological samples prior to molecular extraction.

The product includes an intuitive touch-screen controller with the ability to store up to 99 programs for quick recall. It also offers versatility, with the ability to process virtually any sample size including 0.5, 1.5, 2, 7, 15, 30 and 50 mL tubes as well as strip-well tubes. Cryogenic processing is easy with the addition of the Omni Cryo 24 system.

An integrated lid lock prevents opening during use and the front-loading design facilitates easy loading/unloading of samples.

Due to greater tube displacement and acceleration, and a carriage motion which minimises swirling, the unit is said to produce greater impact forces than any other bead mill on the market for maximum processing efficiency. With its large capacity and no cooldown time requirement between cycles, the device maximises throughput.

The homogeniser is configured for use with the Omni range of nucleic acid extraction kits, enabling users to extract high-yield/high-quality protein, DNA and RNA from tissues, yeast, bacteria, soil or faeces. The kits can also be supplied without bead tubes for use with other prep methods.

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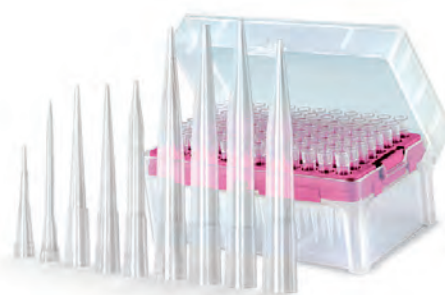
Naturally we can still help you with traditional Vortex mixers if that is what you require. Please see our current range of models from the VELP ZX3 or Classic line of mixers.

As a special offer you can buy the infra-red models for just \$20 more than its conventional version. Just mention the code **REF474** when placing your order.

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Surgical scissors

World Precision Instruments (WPI) has introduced MemoryFlex surgical scissors, which are claimed to cut better, last longer and cause less trauma to tissue. The memory steel flexes, maintaining a high sheer bias on the cutting edge and enabling the scissors to cut all the way to the tip.

Most surgical instruments are made of hardened stainless steel that requires a significant amount of carbon. Though carbon aids in the stiffness, it is also responsible for the brittleness, corrosiveness and inflexibility found in all surgical instruments. Traditional scissors additionally fail because they get loose — when this happens, the individual blades splay apart, crushing soft tissue in between them.

Memory steel, on the other hand, is flexible and always returns to its original shape. While the rivet or screw (pivot point) in a pair of common scissors is the weakest point, the pivotal rivet is the strongest part of the WPI scissors. They can cleanly cut through 64 layers of latex, while other scissors on the market are not able to handle eight layers.

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Trace metals fume hoods

UniFlow Polypro Trace Metals fume hoods are specifically designed for applications where, for correct testing results, it is imperative that the fume hood be constructed of nonmetallic materials. Trace metals fume hoods are suitable for water treatment, marine and soil sciences, environmental toxic analysis and toxicology.

The fume chamber, including the work surface, is welded one-piece seamless of white polypropylene. The baffle is fabricated of the same white polypropylene and the exterior is constructed of chemical- and flame-resistant white composite resin. The hood is equipped with front horizontal sliding sashes that are either tempered glass or polycarbonate with four sash panels on two tracks, vapour-proof lighting, switches and an exhaust collar.

A wide selection of accessories and services is offered, including polypropylene cabinets to maintain the nonmetallic requirement. The fume hood is offered in widths of 48, 60, 72 and 96", with either 30 or 36" depths.

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From Vietnam War refugee to STEM superstar

She arrived in Australia as an asylum seeker from the Vietnam War, with no English-speaking skills and nothing but the clothes on her back.

Now, more than 20 years later, RMIT University lecturer Dr Tien Huynh has been named as one of the 30 'Superstars of STEM' by Science & Technology Australia. Huynh was selected for her work promoting environmental sustainability, and improving the quality of life and equality for the underprivileged.

The Superstars of STEM program recognises females who are smashing stereotypes and leading the way as role models for young women and girls across science, technology, engineering and mathematics (STEM). The first ever round of superstars was announced by Minister for Industry, Innovation and Science Arthur Sinodinos AO, with the final 30 participants selected from more than 300 applicants. The successful candidates will

now receive training and development to use social media, TV, radio and public speaking opportunities to carve out a more diverse face for STEM.

Born in Vietnam, Huynh immigrated to Australia as a six-year old with her mother and sister. Coming from a war-torn country, she has always treasured the value of quality education.

"My parents instilled the importance of education from an early age," Huynh said. "They believed that education was quintessential for opportunity and freedom, to choose what we wanted to do and follow our passions."

Huynh found her passion for science at university under the tutelage of an amazing mentor, Professor Ann Lawrie. "She was so generous with her time and knowledge to everyone around her. I have an enormous amount of respect for her passion and contributions in science," said Huynh.

From there, she went on to complete her doctorate at the University of Melbourne



and postdoctoral research overseas (England and Italy) in evolutionary phylogenetics and conservation biology, before returning to Australia to focus on her postdoctoral research in cancer, tissue repair, neuropharmacology and drug discovery technologies.

Her passion about environmental sustainability, enriched quality lifestyles and equality for the underprivileged is the driving force that has underpinned her research and teaching for over 20 years. Huynh's current research is focused on plants with high nutritional and medicinal values, including red gac and sabah snake grass — both of which are said to have high anticancer properties.

Huynh, along with Associate Professor Danilla Grando, is co-founder of the Centre for Health and Biological Innovations Lab. Her many achievements include establishing community transformative projects for endangered and medicinal plants, environmental sustainability and agricultural upcycling. She is a regular invited speaker and advisor for government, business and entrepreneurial ventures in ASEAN, with collaborations in Vietnam, Malaysia and Thailand.

Huynh coordinates outreach activities to inspire young minds in STEM, mentors female Asian students and academics to inspire greatness and overcome challenges in their life and careers, and leads overseas work programs that bridge the gap between gender, age and cultural differences.

“It’s an exciting time to be in STEM; there are so many opportunities and possibilities. You only have one life, so dream big, live with passion and make it count,” said Huynh.

Huynh is passionate about inspiring young minds and bridging the gap between research and commercialisation, saying, “There is so much opportunity in the brilliant minds that Australia produces. We invest so much into secondary and tertiary education, we need to capitalise on that and keep the talent in Australia to generate a



My motto is ‘Great achievements can come from humble beginnings’

national income, rather than letting our greatest assets go overseas.”

Huynh said being named a Superstar of STEM was a wonderful opportunity to inspire more young minds and give hope to girls who have nothing.

“My motto is ‘Great achievements can come from humble beginnings’,” Huynh said.

While there are tremendous opportunities, the world of science and research comes with its own set of challenges. “The biggest challenge has been to get recognition for the unseen work that we as academics and scientists do, not just for myself but I’m sure for others also. The many after-hours and weekends sacrificed to mark exams and write manuscripts that are often unrewarded. I am still trying to overcome it, but I think it is a worthwhile challenge because it inspires and transforms so many young lives when it does get recognised,” said Huynh.

“I am most proud when I see my students go on to achieve their own successes and still remember me, knowing that I contributed to their journey.”

Science & Technology Australia President-Elect Professor Emma Johnston said that studies in the USA and other countries similar to Australia had shown female STEM professionals were significantly under-represented.

“Superstars of STEM is the first program of its kind and will prove vital for the future of STEM in Australia,” Professor Johnston said.

“We want Australian girls to realise that there are some amazing, capable and impressive women working as scientists and technologists too, and that they work in and out of the lab in places you might not expect.”

GPC/SEC system for measuring the distribution of molecular weights

The Malvern OMNISEC Gel Permeation Chromatography (GPC)/Size Exclusion Chromatography (SEC) uses multi-detection technology for characterising both proteins and polymers. It employs a concentration detector, viscometer and light scattering detector acting in concert, with each detector providing complementary but different information.

The light scattering detector provides a direct measurement of absolute molecular weight and eliminates the need for column calibration. The viscometer detector provides a direct measurement of intrinsic viscosity or molecular density and allows the determination of molecular size, conformation and structure. Concentration is measured with a differential refractive index detector (RI) and is necessary for the determination of both molecular weight and intrinsic viscosity.

Multi-detection is able to accomplish all this and more without the need for lengthy column calibration. Simply running a single narrow standard will verify the instrument constants as well as performing corrections for inter-detector volume and peak broadening effects. The peak broadening calculations are critical to good multi-detector GPC/SEC and the calculations used in the OMNISEC software are the result of over 25 years’ experience with this type of algorithm. The addition of Viscotek SEC-MALS 20 to Malvern’s range of detectors means that the company can provide every commercially available light scattering technology for GPC/SEC.

ATA Scientific Pty Ltd
www.atascientific.com.au





Dispenser and diluter system

Laboratory efficiency can be improved for many repetitive dilution and dispensing tasks by using an automated dilution/dispensing system. Furthermore, OHS requirements mean that handling corrosive, dangerous or acidic compounds should be taken out of the hands of manual operators where possible.

The D-Lab DL-D50 Pro dispenser brings safety and precision to the laboratory. Whether the user requires a single-syringe repetitive dispenser to dispense the same volume of acid time and time again, or a dual-syringe system that can automatically dilute samples to a precision of $\pm 0.2\%$ and perform serial dilutions for standard preparations, D-Lab has a system to suit.

Syringe sizes on offer cover a range from 25 μL through to 25 mL to meet all diluting and dispensing applications, and syringes can easily be interchanged as methods alter. The pipetting speed can be altered over nine stages to suit a wide array of diluent viscosities with a maximum dispensing rate of 6000 $\mu\text{L/s}$. The fluid path is all inert, composed of borosilicate glass, PTFE and CTFE, and a Teflon valve option means the systems can be used for the harshest acids used in digestion labs.

Walker Scientific Pty Ltd
www.walkerscientific.com.au

ELISA kits

AdipoGen Life Sciences has released its latest ELISA kits. The sandwich ELISAs can be used for the quantitative determination of analytes in a range of biological fluids.

The kits cover both human and mouse reactivities and come in 96-well formats for ease of use. The plate is pre-coated with a monoclonal antibody specific to the analyte.

The ELISA kits are suitable for the examination of various disease areas, including metabolic syndrome biomarkers, inflammatory disease biomarkers, cancer, autoimmune diseases and cytokines. The kits are useful for researchers seeking to quantify different biomarkers using quality products.

The kits have been extensively validated, with citations in peer-reviewed literature. They offer high specificity and sensitivity, enabling reproducible results with low inter- and intra-assay variation.

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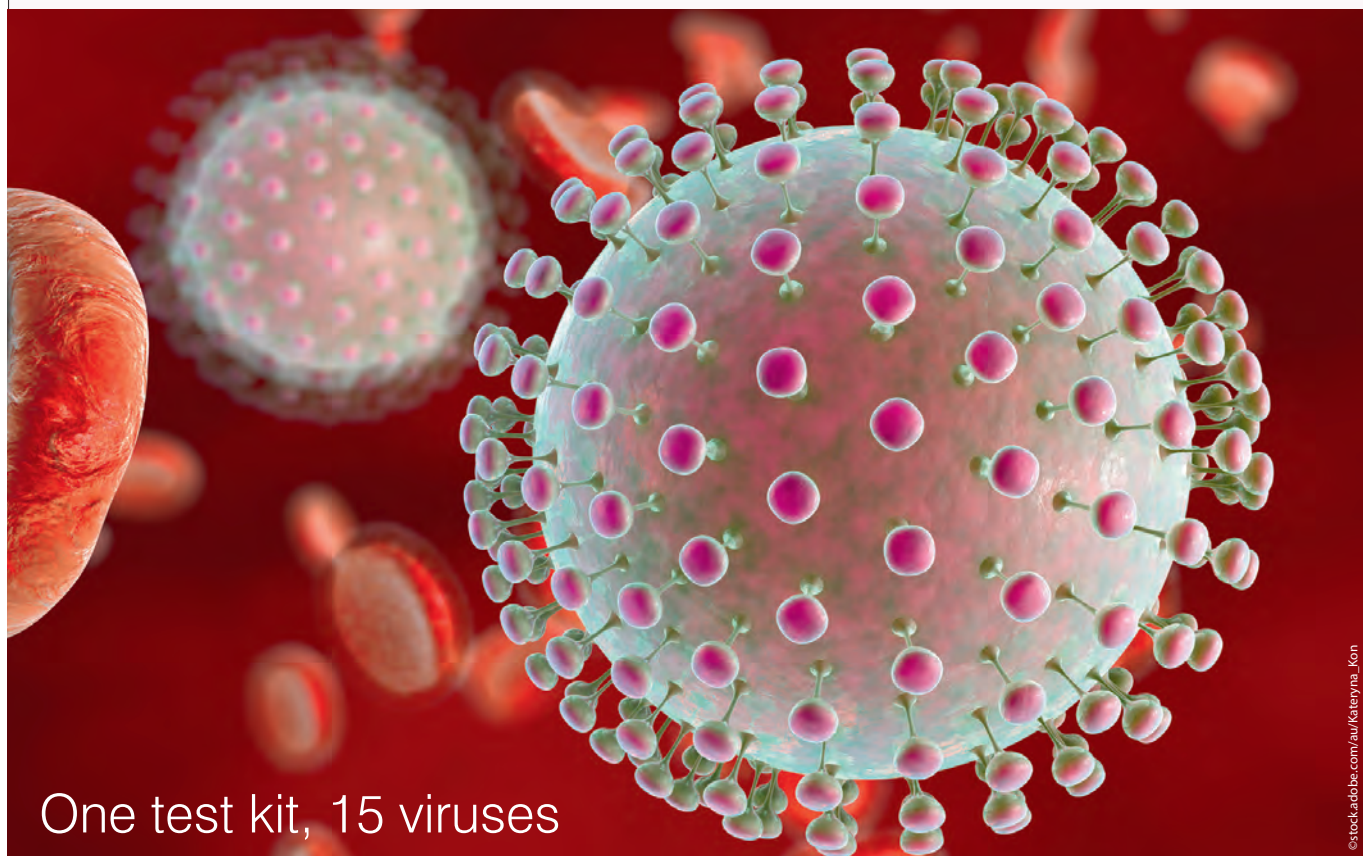
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One test kit, 15 viruses

Molecular diagnostics company Genetic Signatures announced the results of a clinical trial testing its *Flavivirus* detection kit at the 27th European Congress of Clinical Microbiology and Infectious Diseases (ECCMID) earlier this year. The trial, which was conducted in partnership with Port Vila Central Hospital, has demonstrated the global potential of the detection kit in helping prevent the spread of serious infectious diseases such as Zika and West Nile virus.

The *Flaviviridae* are a family of viruses that are found primarily in ticks and mosquitoes and can infect humans, causing widespread morbidity and mortality throughout the developed and developing world. Some of the mosquito-transmitted viruses include yellow fever, dengue fever, Japanese encephalitis, West Nile viruses and Zika virus, while flaviviruses transmitted by ticks are responsible for encephalitis and haemorrhagic diseases.

Hampering the efforts of the international health community, this complex viral family has many similar variants, making conventional detection methods labour intensive. To help address this global challenge, Genetic Signatures' flavivirus pathogen detection kit prototype leverages the company's 3base technology that is also found in the company's enteric, respiratory and STI product suite.

Using existing compatible nucleic acid extraction equipment (or a low-cost, easy-to-install and easy-to-use robot equivalent), hospital and pathology labs will be able to test for 15 of the most common variants of the flaviviruses and alphaviruses, including all four dengue serotypes, in a single real-time polymerase chain reaction (PCR) primer test. Once the virus family type is determined, a second regional test has been designed for Australia, Asia, Africa, Latin America, America or Europe to then determine the specific viral infection.

"Mosquito- and tick-borne illnesses are complex and certainly not unique to the developing world," said Genetic Signatures CEO Dr John Melki. "As awareness for flavivirus-related diseases grows, the Genetic Signatures Flavivirus pathogen detection kit, which benefits from the simpler and more effective capabilities of 3base technology, will help address this complex global challenge head-on."

Vanuatu experienced a significant outbreak of dengue fever late last year. With dengue haemorrhagic fever (DHF) having a more than 20% mortality rate if left untreated, diagnosis was difficult and time consuming as most samples had to be sent to New Zealand for detection analysis.

"In a 187-patient cohort, our new screening kit detected 123 cases of dengue, of which 116 were confirmed to be serotype 2," said Genetic Signatures Chief Scientific Officer Dr Doug Millar, who presented the trial results at ECCMID.

"Furthermore, our real-time PCR assay was able to deliver faster results with a high degree of accuracy. This provides a high degree of confidence in the results obtained, much quicker patient outcomes and valuable population infection data for future location-based planning and mitigation."

"Along with the ability to screen for multiple flavivirus and alphavirus pathogens in a short space of time, the practical benefits of this new detection kit include saved resources and the opportunity to more rapidly help millions of people around the world and prevent the wider spread of these serious infectious diseases," said Dr Melki.

Genetic Signatures
www.geneticsignatures.com



Multimode microplate readers

Tecan's Infinite 200 PRO series of multimode microplate readers has been updated to better serve the life sciences market, with a number of options and configurations designed to provide flexible and user-friendly solutions for entry-level research applications. The microplate reader is now available in six application-focused configurations, allowing researchers to choose the best solution for their specific needs, with the option to upgrade as requirements change.

The budget-friendly configurations include two singlemode and four multimode configurations for absorbance, luminescence and fluorescence detection. Together with a range of optional modules, these instruments ensure high-quality results for ELISAs, nucleic acid quantification, reporter assay technologies and drug discovery applications, including HTRF and fluorescence polarisation. This upgradeable platform can help to simplify target applications and laboratory workflows.

Tecan Australia

www.tecan.com.au

Safety glasses

uvex i-works safety glasses deliver a combination of performance, safety and style. The duo-component technology results in a well-balanced, non-slip and pressure-free fit.

The lightweight glasses provide eye protection with extended wearer comfort. Slimline side arms make the product suitable when worn with other PPE, especially earmuffs. The panoramic lens works together with the permanent lens coating technology, delivering a high level of optical clarity, even after repeated cleaning.

The glasses provide 100% UV 400 protection and are available in Clear and Grey Category 3 (14% VLT) tint options, with either an anti-scratch coating or an anti-fog coating applied to the inside and outside of the lens. They are manufactured, tested and certified to the Australian and New Zealand Standard AS/NZS 1337.1 and the European standard EN166, which includes impact and sun glare protection.

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Single-cell sequencing solution

Complex biological systems are fundamentally determined by the coordinated functions of individual cells. The transcriptional heterogeneity that drives this complexity is often masked by conventional technologies that only provide bulk transcriptome data.

Although high-dimensional gene expression analysis has been enabled by RNA-Seq, it is currently still a challenge to generate thousands of single-cell NGS libraries in a high-throughput and user-friendly manner. To deliver on the promise of single-cell biology, a robust technology is required that enables controlled experiments with multiple samples, treatment conditions and time points.

The Illumina Bio-Rad Single-Cell Sequencing Solution pairs Bio-Rad's Droplet Digital Technology with Illumina NGS library preparation and analysis technology to provide a comprehensive workflow for single-cell analysis. This combination of a simple and fast workflow enables single-cell information to be revealed by allowing users to analyse multiple samples in parallel, under multiple treatment conditions and at multiple time points. It also enables reproducible interrogation of single-cell transcriptomes from multiple cell types.

The scalable, robust, single-cell NGS sample prep methodology will enable researchers to apply the sensitivity and precision of RNA-Seq to questions in single-cell biology.

Illumina Australia Pty Ltd
www.illumina.com



Allergen test strips and kits

The checking of raw materials and the identification of critical points during food processing are of vital importance to avoid hidden allergens and cross-contaminations.

Testing the final product is necessary for the correct labelling of pre-packed and unpacked foods. Zeulab offers appropriate allergen detection tests for each food business.

Proteon Express strip tests are for the qualitative detection of milk, egg, gluten and soy allergens in food and working surfaces. The tests offer qualitative results (positive/negative) in just few minutes, with neither qualified staff nor laboratory equipment required.

Proteon Elisa allergen testing kits provide a quantitative determination of the same allergens in food and working surfaces. To perform these tests, a small laboratory with some equipment is required.

The kits are suitable for scrutinising suppliers and verifying good manufacturing practices in industrial production lines or retail food worktops.

Novasys Group Pty Ltd
www.novasys.com.au



NMR module for the quantification of metabolites in urine

Bruker has announced a product for the quantification of metabolites in urine using nuclear magnetic resonance (NMR). The B.I.QUANT-UR module of the company's Avance IVDr (In Vitro Diagnostics research) NMR platform is designed to provide precise, sensitive and fully reproducible results that have demonstrated potential in preclinical animal and clinical/translational research.

Urine is an important body fluid in metabolomics due to little interference with metabolite binding proteins. Large sample cohorts in clinical studies demand automated solutions capable of measuring and analysing with highest information content and quantitative reproducibility. The B.I.QUANT-UR module is a completely automated solution that can replace multiple conventional analysis methods.

The Avance IVDr platform is optimised for clinical and translational research. It uses standard operating procedures (SOPs) to automatically generate high-quality spectra, with full quantitative reproducibility and lab-to-lab transferability, from urine measurements. This ensures high quantitative precision of analytical and statistical results at a throughput of approximately 80–100 urine samples in 24 h.

The routines introduced for urine quantification also take into account substantial matrix changes going from neonates to children/adults, which all affect metabolite chemical shifts and lead to varying overlap situations due to ionic matrix changes in these two different age classes.

The module can quantify up to 150 metabolic compounds, including disease markers and non-targeted classification against healthy newborn models, opening areas of research in diseases such as diabetes, metabolic syndrome and obesity. Additionally, the tool can be used to investigate the role which nutrition and environmental conditions play in health, including functional food efficiency and drug dosage.

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Patenting biotech in Australia — an update

Obtaining a patent for a biotech invention is crucial to its further development and eventual commercialisation.

Whether it's a new drug, insecticide or diagnostic, the developer needs to know they will have exclusive ownership of the invention and enjoy a return on their usually significant investment when they take the invention to the market.

So what does Australian law say about what can and can't be patented in the biotech space?

The law

There are two leading Australian court decisions relating to biotech patentable subject matter.

The first (relevant to all technology areas including biotech) is the often-cited decision in *National Research Development Corporation v Commissioner of Patents* (1959) 102 CLR 252

(NRDC), which related to a method of removing weeds from a crop using a selective herbicide.

In this case, the High Court ruled that to meet Australia's non-prescriptive requirements for patentable subject matter ("manner of manufacture"), an invention must relate to an artificially created state of affairs that is of economic significance.

The second is *D'Arcy v Myriad Genetics Inc* (2015) HCA 35 in which the High Court revoked Myriad's patent claims for nucleic acids that were markers for breast cancer on the basis that the nucleic acids were mere information.

Nucleic acids

As a result of the Myriad decision, naturally occurring nucleic acids and nucleic acids substantially the same as naturally occurring nucleic acids are no longer patentable.

The reasoning behind this is that although drafted as a product claim, the “substance” of the claim is in fact information that is not “made” by human action. In turn, it is well established that information is not patentable subject matter.

As a result, there is some uncertainty as to the patentability of biotechnology-related inventions.

The Australian Patent Office has produced examination guidelines based on its interpretation of *Myriad*, which sees the Patent Office applying the exclusion broadly and objecting to claims defining genomic DNA, mRNA, cDNA, interfering RNAs, probes and primers, for example.

However, functional nucleic acids, such as interfering RNAs and exon-skipping nucleic

acids, do not encode proteins. Therefore, it is difficult to accept that interfering RNAs and exon-skipping nucleic acids are mere information and encompassed by the exclusion set down in *Myriad*. In fact, *Myriad* is completely silent with respect to functional nucleic acids.

Despite current Patent Office practice, non-naturally occurring nucleic acids remain patentable. Examples include single nucleic acids derived from two or more different sources (ie, chimeric nucleic acids) and nucleic acids that encode non-naturally occurring proteins, for example, a humanised antibody such as HERCEPTIN (for treating HER2 positive breast cancer) or a human antibody produced by phage display technology such as HUMIRA (for treating rheumatoid arthritis).

Stem cells

Australian patent law excludes from patentability “human beings, and the biological processes for their generation”.

In theory, if other processes such as nuclear transfer are employed that generate an “embryo” that cannot become a human being, they too should be patentable. This is yet to be tested.

Antibodies

While antibodies are patentable in Australia, changes to Australian patent law in 2013, known as Raising the Bar, have tightened the requirements.

Whereas prior to April 2013 antibodies could be defined by as few as one CDR, standard antibodies must now be claimed by defining at least three heavy chain CDRs and at least three light chain CDRs.

Claiming antibodies defined by their competition with another antibody for an epitope is



While antibodies are patentable in Australia, changes to Australian patent law in 2013, known as Raising the Bar, have tightened the requirements.

This has been interpreted as prohibiting “all biological processes applied from fertilisation to birth — so long as the process is indeed one that directly relates to the generation of the human being”.

The patent examiners’ manual continues to assert that embryos and processes for generating or culturing human embryos for any purpose, including the harvest of stem cells, are not patentable, and that the exclusion extends to all means of generating human embryos and includes generation of embryos by nuclear transfer, altered nuclear transfer, activation of gametes and parthenogenesis.

Unlike other requirements for patentability, adding features to a claim cannot rescue a claim that falls foul of this exception — one feature, irrespective of all other features, is enough to render a claim unpatentable.

However, in *International Stem Cell Corporation* [2016] APO 52, the Patent Office decided recently that an embryo generated by parthenogenesis did not contravene the exclusion because under no circumstances could the “embryo” generate a human being.

possible, but at least requires the epitope to be novel and inventive and defined structurally in the claim.

Summary

At least with respect to nucleic acids, it appears that Australian patent practice now is more restrictive than that of the US under the US prohibition of patenting products of nature. For example, cDNA is no longer patentable in Australia, but remains patentable in the US.

At the same time, patent practice surrounding stem cell technologies appears to be evolving in step with the technologies. Interestingly, this evolution of patentable subject matter exclusions reflects the evolution that was always intended for non-excluded patentable subject matter (see *National Development Research Corporation v Commissioner of Patents* [1959] 102 CLR 252).

Finally, Australian patent practice with respect to antibodies is now generally consistent with that of other jurisdictions, notably Europe.

Griffith Hack

www.griffithhack.com

To date, the only concession the Patent Office has made is in respect of a composition comprising an interfering RNA, rather than interfering RNA per se (*Arrowhead Research Corporation* [2016] APO 70), but this has not affected primary examination. Therefore, although it is arguable whether the Patent Office’s interpretation and application of *Myriad* should be so broad, it seems it will take a hearing before the Patent Office challenging patent office practice and a subsequent appeal to the court to decide whether functional nucleic acids per se are returned to patentability.



PCR workstations

AirClean Systems' AC600 Series PCR workstations are designed for the manipulation and amplification of DNA and RNA, reducing risk of sample contamination. Made in the USA and shipped fully assembled, the microprocessor-controlled PCR workstations are available in widths of 0.6, 0.8 and 1.2 m. Additional features include built-in 254 nm ultraviolet lights for irradiation and HEPA filtration for a clean work area.

The UVTest Microprocessor Controller, available on the 0.8 and 1.2 m models, maintains airflow to provide a clean Class 100 work area during PCR preparation. UVTest provides audible and visible alarms to alert the end user of insufficient airflow, UV bulb changes and HEPA filter changes. It also allows the operator to vary blower speed and digitally set irradiation timer and lab event timer to current application requirements.

The PCR workstations offer innovative seamless UV-reflective Lexan construction with 360° visibility. In addition, each workstation features an interlocking sash with a safety switch that automatically turns off the ultraviolet light and activates blower and fluorescent light when the sash is raised.

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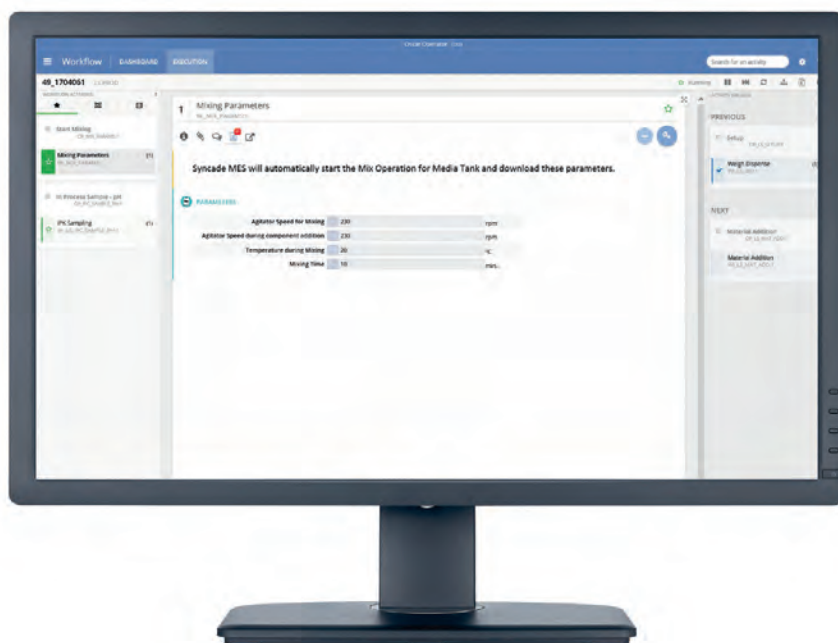
The cellZscope2 from nanoAnalytics is a device for measuring the transepithelial/ endothelial impedance of cell layers under physiological conditions. Easy to operate and with a broad range of applications, it is particularly suitable for studying the influence of substances such as drugs, toxins, etc. on the barrier function of cell layers.

The computer-controlled device allows automated, long-term monitoring experiments with up to 24 different cell cultures simultaneously. Various types of barrier-forming cells cultured on the permeable membranes of standard cell culture inserts can be analysed.

Features include: an automated TEER measuring system compatible with all standard cell culture inserts; electronics with improved time resolution and sensitivity ($<5 \Omega \text{ cm}^2$); and a docking station that ensures hassle-free handling. There are no device-specific consumables required and the product design makes the system easy to clean. A combination of different well sizes and insert types is also possible.

SciTech Pty Ltd

www.scitech.com.au



Manufacturing execution software

Emerson Automation Solutions has released the Syncade manufacturing execution system (MES) Workflow version 4.9 application to help life science manufacturers reduce time to market and streamline batch records and compliance. The software features a fast and dynamic user environment, including embedded step-by-step guidance that gives operators the tools needed to execute recipes properly.

Operators are provided with one-touch access to critical information such as equipment readiness and previews of upcoming recipe steps. In addition, operators can collaborate by logging questions or comments in the application.

Regulatory compliance is made easy, as the software prevents operators from deviating from a validated process. Electronic signatures enable recipe compliance by tracking and documenting approved activities.

The latest release adds a web-based application and offers flexible access via tablets and computers, as well as fast data transfer and user-input response. Because the product is a thin-client application, installation on workstations is eliminated and application maintenance is reduced.

Emerson Automation Solutions

www.emersonprocess.com.au

Femtosecond-pumped supercontinuum source

The Thorlabs SC4500 Mid Infrared (MIR) Supercontinuum Source is claimed to be the first femtosecond-pumped supercontinuum source on the market. It spans over a wavelength range from approximately 1.3 to 4.5 μm (7500 to 2200 cm^{-1}) and emits more than 300 mW of average output power in a collimated beam. Within this range, the source's brightness is said to exceed that of traditional light sources, such as glow bars and even synchrotron sources, by orders of magnitude.

The supercontinuum light is generated by pumping a dispersion-engineered indium fluoride (InF_3) fibre with a high-power femtosecond fibre laser. Unlike supercontinuum sources pumped in the long-pulse regime (picoseconds to nanoseconds), the spectrum of a femtosecond-pumped source is stable from pulse to pulse. As a result, the supercontinuum source provides output noise of less than 0.025% RMS.

The product combines soft glass fibre draw and splicing, low-noise electronic design and ultrafast fibre laser design expertise. The low-noise, high-brightness and laser-like beam performance of the product makes it suitable for environmental sensing, biological and chemical threat identification, absorption spectroscopy and ultrafast spectroscopy applications requiring highly sensitive measurements.

Lastek Pty Ltd

www.lastek.com.au

Chromatography data system

SCION Instruments has announced the release of its chromatography data system CompassCDS version 4.0, with features and capabilities that extend its applicability to a wide range of laboratories.

The product provides a user-friendly and application-rich GUI with integration, calculation and reporting capabilities. Industry-, function- and application-specific add-ons and plug-ins are available to fit a wide range of specific laboratory needs.

Robust in design for 24/7 operation, it scales from standalone to enterprise-wide client/server installations with centralised system administration and data management. The product also complies with national and international regulations and guidelines including 21CFR11 and ISO/IEC 17025.

Other features include: HPLC instrument support for Agilent's 1100 and 12xx LC series; the ability to control GCs from SCION, Bruker, Varian and Agilent; 3D data acquisition from PDA/FLD HPLC detectors; processing of 3D data including chromatogram and spectra extraction, library search, purity calculations, etc; AnIML support (converter and viewer) for long-term archiving of raw (2D/3D) and meta data; and multilanguage support, with Chinese being the first addition and other languages to follow.

These additions extend the applicability of the system from the initial focus on refineries and petrochem/chem into pharma/biotech and food, contributing largely to automate processes and workflows in R&D, IPC and QC of intermediates and final products. It is suitable for multivendor, multi-instrument GC and LC laboratories.

Scientifix Pty Ltd

www.scientifix.com.au

Knockout/knockdown validated antibodies

Antibodies are essential tools for both basic and clinical research. However, there has been growing distrust of commercially available antibodies with regard to specificity and performance variability. As a result, the research community and funding agencies have demanded that antibody suppliers increase their efforts to more thoroughly validate these reagents. One approach to address this is through knockdown or knockout of the target protein by RNAi- or CRISPR-mediated technologies.

In support of this goal, GeneTex is conducting knockdown-based validation as a fundamental component of its antibody quality assurance process. To date, GeneTex has evaluated over 500 products covering research topics such as apoptosis, metabolism, epithelial-mesenchymal transition and neurodegenerative diseases. The company will continue to expand these efforts in the future.

All GeneTex antibodies that have passed the KO/KD test will be labelled with the KO/KD validated icon.

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High-flux XRD keeps researchers at the forefront

UNSW recently purchased a 9 kW Rigaku SmartLab X-ray diffractometer for its Mark Wainwright Analytical Centre — a central analytical facility that brings together a vast array of measurement and characterisation equipment that enables researchers to carry out detailed analyses of their samples. The lab is heavily used, clocking up over 31,000 hours of X-ray time in 2016, which included training of over 150 researchers from areas such as materials science (particularly photovoltaics research), chemistry, geology, chemical and petroleum engineering and physics.

The SmartLab is said to be suitable for high-end research, combining high-intensity X-ray flux with a host of intelligent features that provide impressive analytical power and versatility. It is powered by Rigaku's rotating anode technology, which is claimed to result in the highest X-ray flux of any homelab instrument. This allows faster, higher sample throughput and a good chance of detecting trace phases. Other key features include auto alignment, user-friendly guidance software, a host of optically encoded attachments and the ability to measure powders.

UNSW ordered the SmartLab TF (thin film variant) incorporating Rigaku's in-plane arm, making it suitable for characterising thin films and coatings. This innovation allows a host of coating measurements to be taken quickly, providing more detail in less time about the structure, orientation, morphology and composition of thin films. As such, it will be invaluable to researchers involved in fields including solar cells, semiconductors, optoelectronics and biomaterials.

"The SmartLab was the best tool to enable high-throughput analysis of novel multilayer and epitaxial thin films designed for photovoltaics, electromechanical ferroelectrics and spintronics," said Dr Chris Marjo, head of the centre's solid state and elemental analysis unit. "Its unique thin-film analytical prowess provides additional valuable capabilities to our facility. The new instrument will provide structural data that will also complement our surface chemical analysis using photoelectron spectroscopy (XPS, UPS) and mass spectrometry (ToF-SIMS)."

The product was supplied by AXT, Rigaku's distributor in Australia and New Zealand. According to AXT Managing Director Richard Trett, the diffractometer's high performance, analytical ability and versatility will help UNSW remain at the forefront of research.

AXT Pty Ltd
www.axt.com.au



Measurement of surface-molecule interactions

Q-Sense offers a series of analysis systems designed to measure surface-molecule interactions in real time using quartz crystal microbalance with dissipation (QCM-D) monitoring technology.

The launch of the Q-Sense Initiator has enabled surface scientists, who have a need for an introductory Q-Sense system capable of fundamental analysis, to gain access to the technology. Q-Sense Initiator maintains the core Q-Sense functions and quality while focusing on more customer segments. The Q-Sense Dfind software simplifies data handling and reporting through an intuitive interface and powerful tools for complex analysis.

QCM-D monitoring (patented by Q-Sense) enables real-time measurements of both mass/thickness (frequency) and structural properties (dissipation) of molecular layers. By measuring the dissipation parameter (D), the QCM-D allows for the analysis of soft films that do not obey the linear relation between change in frequency and change in mass. In this way the dissipation parameter provides novel insights regarding structural (viscoelastic) properties of adsorbed layers. Combined with the Q-Sense Dfind analysis software, the user can access information such as mass, thickness, viscoelastic properties and adsorption rates, and quantify, compile and compare data from start to end.

ATA Scientific Pty Ltd
www.atascientific.com.au



Handwash station kits

Enware has produced three functional Type B Handwash Station Kits that are said to meet all the requirements for healthcare applications.

The kits provide a simple yet compliant solution to the requirements of the Australasian Health Facility Guidelines and meet hospital handwash guidelines. They also aid in infection control while still being user-friendly with easy maintenance. The kits are suitable for hospitals as well as healthcare and research facilities.

All kits come complete with Enware Kolo Rekord basin and shroud and a choice of tapware. Users can choose from an eSQX touch-free electronic mixer, a Leva wall-mounted surgeon set or an Enmatic 5000 series sensor tap.

The Kolo Rekord basin was designed for health care, incorporating an anti-water-harboursing design with no overflow for better infection control and a fully rimmed basin for water and splash retention. There is reduced risk of bacterial growth with all surfaces glazed, allowing also for easy cleaning, maintenance and longevity.

Enware's eSQX is a technically advanced, touch-free, point-of-use thermostatic mixer. This technology provides a temperature-controlled, infrared-operated warm water outlet, well matched to the Kolo Rekord basin. Features such as flush cycles, dead-leg elimination, hands-free usage and a laminar flow outlet all aid in controlling *Legionella*, infection control and bacterial growth.

Enware Australia Pty Ltd

www.enware.com.au

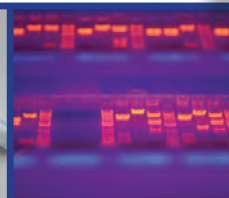


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Monash discovery paves way for growing replacement organs

Organ shortage is a major problem around the world, as the current world demand for transplant organs far exceeds the supply. At any given moment, around 1400 people in Australia are waiting for an organ transplant.

Not surprisingly, the numbers are even worse in the US. Around 117,179 people in the US are waiting for a lifesaving organ transplant according to the United Network for Organ Sharing, a non-profit scientific and education organisation located in Richmond, Virginia.

A discovery by Australian scientists could ease this severe shortage, paving the way to producing replacement organs for damaged hearts, kidneys and bowels using patients' own stem cells.

Scientists led by Professor Peter Currie, director of the Australian Regenerative Medicine Institute at Monash University, have found that a protein called Meox1, active in stem cells, is central to directing muscle growth. Currie's team focused on the zebrafish, a small, fast-growing tropical fish native to South-East Asia, which is used widely as a model for human biology.

Scientists worldwide have long been growing miniature organs in petri dishes, using them to better understand disease and natural self-repair

mechanisms in the body, as well as for drug testing. "But we have known almost nothing about how organs grow in the living animal — the cellular basis of how stem cells make all that tissue," said Professor Currie. "If we're ever going to grow complete organs in the laboratory or directly in a patient's body, we have to know how to grow them properly."

"My lab is exploring one of last frontiers of developmental biology — how organ growth is regulated by stem cells."

"Prior to our work in this field, we didn't even know that these growth-specific stem cells existed or how they were used. Just knowing that they exist leads us to the possibility of orchestrating them, controlling them or reactivating them to regrow damaged tissue."

Professor Currie cautions that while this stem cell discovery represents a significant advance in knowledge, the timeline for producing replacement organs in the laboratory remains unknown, though it is closer now to science fact than fiction.

Sterilisable motor, gear and encoder drive system

maxon motor offers the combination of a brushless DC motor (BLDC motor), a planetary gearhead and a choice of incremental and absolute encoder, all assembled to order in a sterilisable form. The system opens up possibilities for the medical automation, laboratory automation and dental fields.

The encoder has the optional output formats of both incremental to 1024 counts per revolution or absolute with a 4096 cpt (12 bit). In standard combination with high-speed brushless motors in 13 and 16 mm diameter, speeds of 120,000 rpm and power levels over 100 W are possible.

The high input speed gearheads can be selected with the correct ratio to match the application's speed and torque requirements and are of a robust, stainless steel, laser-welded construction. Medical hand tools and specialist tools for controlled environments will benefit from the system.

maxon motor Australia Pty Ltd
www.maxonmotor.com.au



Miniature torque sensor

FUTEK has announced the QTA141 Micro Reaction Torque Sensor. With a miniature footprint of 22 mm in diameter by 10 mm in height, the sensor was designed to provide a precision torque measurement solution for miniature DC servo motors. It also features a 10 mm diameter central hole, allowing a motor drive shaft and coupling to pass cleanly through the sensor. The reduction in size allows the product to fit where most reaction torque sensors cannot.

The sensor features $\pm 0.5\%$ non-linearity, $\pm 0.5\%$ hysteresis and $\pm 0.1\%$ non-repeatability, with metal foil strain gauges in both clockwise and counter-clockwise torque directions. Other features include: a 1 Nm capacity that is said to exceed the stall torque of other 22 mm gear motors; rated output of 1.3 mV/V; safe overload of 150%; and lightweight aluminium construction.

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Bioreactors and single-use bags

Sartorius Stedim Biotech has launched its next-generation BIostat STR, a fully scalable, single-use bioreactor family based on a conventional stirred-tank design. The bioreactors are an intelligent, low-risk bioprocess development solution for use in multiproduct facilities, as well as contract manufacturing organisations.

The bioreactor series, consisting of five systems in different sizes, offers working volumes from 12.5 to 2000 L. Featuring upgraded hardware and software, as well as fully integrated Flexsafe STR single-use bags, the range ensures quick and easy bioprocess scale-up of biologics and vaccines.

The bioreactors are equipped with an improved stainless steel bag holder for user-friendly installation of the single-use bag, which is manufactured from a robust multilayer S80 polyethylene film. The formulation of resins and additives for the film is fully characterised and extrusion process parameters are controlled within established ranges, providing consistent batch-to-batch extractable and leachable profiles.

The fully self-contained design of the bioreactor and its bag prevents product cross-contamination, saving time in set-up, validation, clean-in-place procedures and sterilise-in-place operations. Scale-down, linear scale-up and process transfer from 250 mL to 2000 L can be achieved in weeks rather than months.

The system is designed for efficient oxygen transfer, mixing and CO₂ stripping. These features ensure good cell culture performance with reproducible high-density growth of even sensitive cell lines. As a result, the bioreactors are suitable for achieving high cell densities in continuous processes and for safe manufacture of vaccines and recombinant proteins in cGMP environments.

The bioreactor range provides flexibility in bioprocess control and data acquisition, as software connectivity has been upgraded to allow integrated control by either BioPAT MFCS software or commonly used third-party industrial distributed control systems (DCS), such as Emerson DeltaV or Siemens SIMATIC PCS7.

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Sequencing completed

The world of genomics just got a whole lot richer, with scientists completing sequencing for not one but two crop genomes.

A global team of researchers has published the first-ever wild emmer wheat genome sequence. Wild emmer is the original form of nearly all the domesticated wheat in the world, including durum (pasta) and bread wheat. Wild emmer is too low-yielding to be of use to farmers today, but it contains many characteristics that are being used by plant breeders to improve wheat.

The study was published in the journal *Science* and led by Dr Assaf Distelfeld of Tel Aviv University, Israel, in collaboration with international scientists and Israel-based company NRGene. According to Dr Distelfeld, NRGene's bioinformatics technology enabled the researchers to create a "time tunnel" that they could use to examine wheat from before the origins of agriculture.

"Our comparison to modern wheat has enabled us to identify the genes involved in domestication — the transition from wheat grown in the wild to modern-day varieties," Dr Distelfeld explained. "While the seeds of wild wheat readily fall off the plant and scatter, a change in two genes meant that in domesticated wheat, the seeds

remained attached to the stalk; it is this trait that enabled humans to harvest wheat."

"This new resource allowed us to identify a number of other genes controlling main traits that were selected by early humans during wheat domestication and that served as foundation for developing modern wheat cultivars," added Dr Eduard Akhunov of Kansas State University, a co-author on the study. "These genes provide an invaluable resource for empowering future breeding efforts. Wild emmer is known as a source of novel variation that can help to improve the nutritional quality of grain as well as tolerance to diseases and water-limiting conditions."

"New genomic tools are already being implemented to identify novel genes for wheat production improvement under changing environment," added co-author Dr Zvi Peleg of the Hebrew University of Jerusalem. "While many modern wheat cultivars are susceptible to water stress, wild emmer has undergone a long evolutionary history under the drought-prone Mediterranean climate. Thus, utilisation of the wild genes in wheat breeding programs promotes producing more yield for less water."

For the first time, the sequences of the 14 chromosomes of wild emmer wheat have been collapsed into a refined order, thanks to additional

technology that utilises DNA and protein links. As noted by co-author Dr Nils Stein, from the Leibniz Institute of Plant Genetics and Crop Plant Research, "It was originally tested in humans and recently demonstrated in barley, both of which have smaller genomes than wild emmer wheat."

"This sequencing approach used for wild emmer wheat is unprecedented and has paved the way to sequence durum wheat (the domesticated form of wild emmer)," said co-author Dr Luigi Cattivelli, head of the CREA Research Centre for Genomics and Bioinformatics and coordinator of the International Durum Wheat Genome Sequencing Consortium. "Now we can better understand how humanity transformed this wild plant into a modern, high-yielding and high-quality crop."

Mutant rice

News of the wheat sequencing came just one day after US scientists reported the first whole-genome sequenced fast-neutron induced mutant population of Kitaake, a model rice variety that completes its life cycle in just nine weeks and is not sensitive to photoperiod changes. Scientists are investigating this variety as part of their work to optimise crops for biofuel production, seeking to identify genes that control key traits

such as yield, resistance to disease and water use efficiency.

Populations of mutant plants, each one having one or more genes altered, are an important tool for elucidating gene function. With whole-genome sequencing at the single nucleotide level, researchers can infer the functions of the genes by observing the gain or loss of particular traits. But the utility of existing rice mutant collections has been limited by several factors, including the cultivars' lengthy six-month life cycle and the lack of sequence information for most of the mutant lines.

Researchers led by Pamela Ronald, a professor at UC Davis and director of Grass Genetics at the Department of Energy's Joint BioEnergy Institute, have now published their work sequencing a mutant population of Kitaake in *The Plant Cell*. Their research is expected to accelerate functional genetic research in rice and other monocots, a type of flowering plant species that includes grasses.

"Some of the most popular rice varieties people use right now only have two generations per year," noted co-author Guotian Li, deputy director of Grass Genetics at JBEL. "Kitaake has up to four, which really speeds up functional genomics work."

In a previously published study, Li and fellow co-authors Mawsheng Chern and Rashmi Jain demonstrated that fast-neutron irradiation produced abundant and diverse mutations in Kitaake, including single base substitutions, deletions, insertions, inversions, translocations and duplications. Li explained, "Fast-neutron irradiation causes different types of mutations and gives different alleles of genes so we really

Populations of mutant plants, each one having one or more genes altered, are an important tool for elucidating gene function.

can get something that's not achievable from other collections."

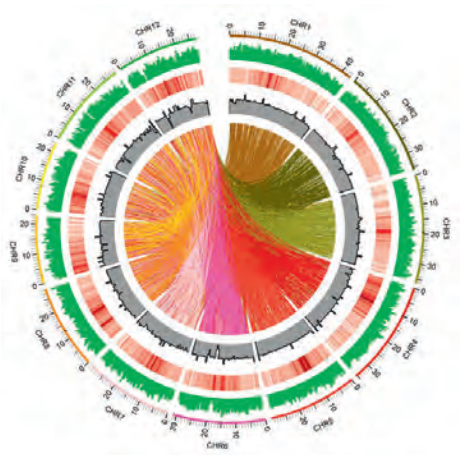
Whole-genome sequencing of this mutant population — 1504 lines in total with 45-fold coverage — allowed the researchers to pinpoint each mutation at a single-nucleotide resolution. They identified 91,513 mutations affecting 32,307 genes, 58% of all genes in the roughly 389-megabase rice genome. A high proportion of these were loss-of-function mutations.

Using this mutant collection, the Grass Genetics group identified an inversion affecting a single gene as the causative mutation for the short-grain phenotype in one mutant line with a population containing just 50 plants. In contrast, researchers needed more than 16,000 plants to identify the same gene using the conventional approach.

"This comparison clearly demonstrates the power of the sequenced mutant population for rapid genetic analysis," said Ronald.

This high-density, high-resolution catalogue of mutations provides researchers with opportunities to discover novel genes and functional elements controlling diverse biological pathways. The Grass Genetics group has now established an open-access

web portal called KitBase which allows users to find information related to the mutant collection, including sequence, mutation and phenotypic data for each rice line. To access the portal, visit <http://kitbase.ucdavis.edu>.



Genome-wide distribution of fast-neutron-induced mutations in the Kitaake rice mutant population (green). Even distribution of mutations is important to achieve saturation of the genome. Coloured lines (centre) represent translocations of DNA fragments from one chromosome to another.

Image credit: Guotian Li and Rashmi Jain/Berkeley Lab.



High-speed cooled camera with CMOS sensor

SPOT Imaging has released the RT sCMOS cooled camera with Sony's Pregius technology to address the high imaging demands of life-science professionals.

It is said to be the only high-speed camera on the market that currently employs a cooled Sony Pregius CMOS Sensor. Deep cooling allows dim images to be seen without becoming obscured by dark current, while the global shutter ensures undistorted images of moving specimens. The camera is optimal for fluorescence microscopy, FISH, GFP imaging, immunofluorescence and 3D deconvolution applications.

Deep cooling of the image sensor to -20°C supports long exposure times. The Sony Pregius IMX250 CMOS image sensor offers almost three times the sensitivity of the current benchmark CCD camera using the Sony ICX694. It is back-illuminated and features enhanced Near-IR technology.

The superfast USB3 monochrome camera operates at 36 fps at full resolution and 70 fps with 2x2 binning. Its resolution capabilities are two and half times greater than that of the RT3 and work at 5 MP live. The product is compatible with Mac and Windows operating systems.

Other applications for the camera include spinning disc confocal, FRAP, high-speed multi-colour fluorescence, electrophysiology, calcium imaging, ion transport physiology, ratiometrics imaging and voltage-sensitive dyes.

SciTech Pty Ltd

www.scitech.com.au

Blood cell washer

Fully automated, the Thermo Scientific CW3 Cell Washer has been engineered to combine the benefits of efficient performance with user-friendly design and safe operation. Users can select one of the preset programs that have been designed to run in automatic mode, accelerate blood cell washing cycles and achieve time savings, while allowing for ease of use and sample safety.

The cell washer has been designed to achieve optimal corpuscle dryness by allowing users to preset the desired decanting speed. At the same time, corpuscle washing is improved via the optional overflow method. It enables precise, thorough, reproducible and rapid blood cell washing of up to 24 tubes in a 3 min run.

For washing, tubes swing at a fixed positive angle to sediment cells rapidly at the bottom of the tube, whereas when decanting, the rotor holds tubes at a slightly negative angle and the saline is decanted centrifugally. The result is optimised pelleting performance. Furthermore, the flexibility to use 12- or 24-place rotors and standardised, repeatable procedures enables the instrument to adapt to the processes and protocols already in place within the lab.

Built with sample safety in mind, the compact cell washer features an automatic alert mechanism that informs users about low or disrupted saline levels and when a run is complete. A view port on top of the unit facilitates quick calibration, while the saline distributor is mounted directly on top of the rotor to reduce the risk of cross-contamination.

The washer is also equipped with tube racks bearing red and blue number labelling for easy sample balancing. When closed-monitoring of the washing process is required, the system can be operated manually to allow for cells that need to be washed step by step. As a low-maintenance instrument, the cell washer includes easy-to-change pump tubing and an easy-to-remove catch basin, rotor and rotating bowl.

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AGTA 2017 Annual Conference



The 17th annual conference of the Australasian Genomic Technologies Association (AGTA) will be held in Tasmania at the Hotel Grand Chancellor from 29 October–1 November 2017.

It is a must-attend event for researchers and industry representatives working with genomic technologies in a variety of contexts, including platform development, medical genomics, functional genomics, non-model systems, epigenomics and plant genomics. The conference also offers an important opportunity for computational biologists, bioinformaticians and data visualisation specialists to interact with technologists and biologists. This is one of the reasons that the Australian genomics community has a dynamic cross-disciplinary and innovative approach to genomic analysis, and is at the forefront of analysis tools for new types of 'omics' data.

AGTA returns to Tasmania for the second time after a successful meeting in 2010. The island state has since become an even more sought out conference location thanks to the addition of local attractions such as the Museum of Old and New Art (Mona), which is also the location of the AGTA17 conference dinner.

The conference is broadly focused on all aspects of genomic technologies and their uses and attracts a diverse and well-engaged audience. The event will engage researchers, industry members and other stakeholders from a wide cross-section of Australian and New Zealand research institutes, genomic service providers, clinical facilities and universities — eager to learn about new and evolving technologies and

to hear how those technologies are being applied to genomics research.

The conference will feature an exciting line-up of presenters and topics covering new approaches to genome assembly, microbial and single-cell genomics, as well as in silico prediction of functionality, dogs, devils and more. Some of the high-profile speakers to be presenting at the conference include:

- Elinor Karlsson, director of the Vertebrate Genomics group at the Broad Institute and leader of the 'Darwin's Dogs' project
- Deanna Church, senior director of application at 10xGenomics and genome assembly expert
- Pauline Ng from the Genome Institute of Singapore and creator of the SIFT algorithm for mutation prediction
- Kimberly Reynolds from the Green Center for Systems Biology at UT Southwestern

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Mettler-Toledo's range of Safeline X-ray systems comprises the X33, X36 and X37 series. The systems are said to offer manufacturers significant benefits when installed on production lines.

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www.aacb.asn.au/eventsinfo/annual-scientific-conference

The Antarctic Frontier

September 13–15, Hobart
<https://www.science.org.au/news-and-events/events/antarctic-frontier-developing-research-extreme-environment>

Australian Entomological Society 48th AGM and Scientific Conference

September 17–20, Terrigal
www.aesconferences.com.au/

SBA17 — Synthetic Biology Australasia Conference 2017

September 21–22, Sydney
<http://synbioaustralasia.org/sba2017/>

ISEB23

September 24–29, Cairns
www.cvent.com/events/iseb23/event-summary-8154be59091a42868709c3e8542fe5a1.aspx

Science Protecting Plant Health 2017

September 26–28, Brisbane
www.sciplant2017.com.au/

ComBio 2017

October 2–5, Adelaide
www.combio.org.au/combio2017/

2017 ANZOS Annual Scientific Meeting

October 4–6, Adelaide
<http://anzos.com/>

Australia Biotech Invest 2017

October 24, Melbourne
<http://ausbiotechinvestment.com.au/>

Food Structures, Digestion and Health International Conference 2017

October 24–27, Sydney
<https://events.csiro.au/Events/2017/February/10/Food-Structures-Digestion-Health-Int-Payment>

AGTA17

October 29–November 1, Hobart
<http://agtaconference.org/>

Laboratory Management & Lab Design Conference 2017

November 13–15, Melbourne
www.labmanagers.org.au

Emerging Polymer Technologies Summit 2017

November 22–24, Melbourne
www.epts17.org/

Innovate Biotech 2017

November 27–28, Brisbane
<https://innovateconferences.com/biotech>

Innovate Medicine 2017

November 29–30, Brisbane
<https://innovateconferences.com/medicine>

Innovate Antibiotics 2017

December 1–2, Brisbane
<https://innovateconferences.com/antibiotics>

LSC — 2017 IEEE Life Sciences Conference

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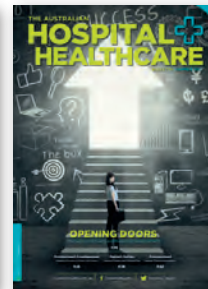
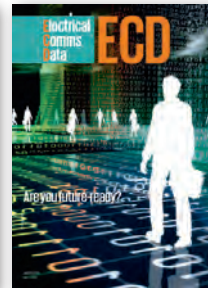
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