Lab+Life SCIENTIST

DNA DETECTION
OF CROWN-OF-THORNS STARFISH

ADVANCES IN
MICROSCOPY

WHY ARE
POTENTIALLY IMPORTANT GENES
IGNORED?

BYE, BYE
E. COLI

OCT/NOV 2018
VOL.29 NO.4
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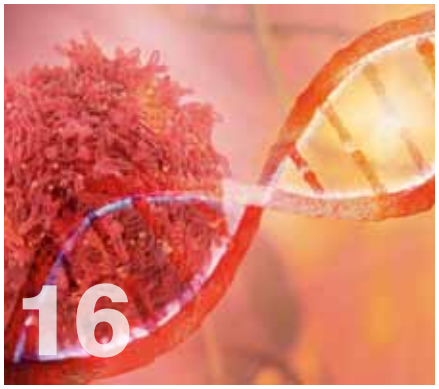

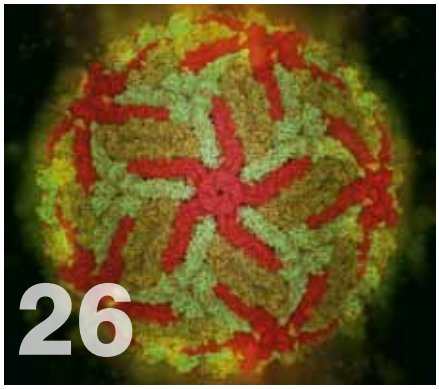

Welcome to the October/November issue of *Lab+Life Scientist*.

Sydney recently had the opportunity to host the 19th International Microscopy Congress. The event saw over 2100 scientists and researchers from close to 50 countries come together to discuss and explore the latest advances in microscopy and microanalysis. The event also inspired the next generation of young scientists with its Schools Outreach Program, which welcomed 570 students from 19 schools. The program also featured a 'Young Scientists Assembly' where 50 young scientists from around the world enjoyed the opportunity to discuss career planning with some of the most senior figures in the field.

"Without Microscopy, there is no modern science — end of story," said Australia's Chief Scientist, Dr Alan Finkel, in his opening speech at IMC19.

An investment in this field (microscopy) is an investment in nanoparticles that target such things as a drug directly to malignant cells; 3D printed lattices that act like tiny factories for T-cells; vital in the new generation of cancer immunotherapies and more, said Dr Finkel.

Recent advances in microscopy have transformed health, science and industry globally and in Australia.

In September, two Nobel Laureates and the NSW Chief Scientist & Engineer unveiled a vital new piece of scientific infrastructure at the University of Sydney — a multimillion-dollar transmission electron microscope (TEM). Standing 4.5 m tall, the microscope is housed in the $150 million Sydney Nanoscience Hub in a room that is shielded from electromagnetic interference and 'floats' architecturally independent from the building to minimise vibrations. The TEM can simultaneously analyse the atomic structure and the spectral nature of materials. Available for use by industry, the microscope has applications in geosciences, mining, chemical and advanced manufacturing industries.

Separately, the Victor Chang Cardiac Research Institute and UNSW also launched a multimillion-dollar cryo-electron microscopy (cryo-EM) machine. The 240,000-times magnification cryo-EM machine is fitted with the next generation of highly sensitive cameras that allow researchers to image samples frozen at liquid ethane temperatures with never-before-seen clarity. Head of Structural Biology at the Victor Chang Institute Dr Alastair Stewart said investing in cryo-EM was "building for the future" of structural biology.

Microscopy is one of the many interesting topics covered in this issue of *Lab+Life Scientist*. Other topics include: bias in biomedical research; genetic variation in cancer cell lines; eliminating its risk of *E. coli* contamination; cane toad genetics; gene drive and malaria amongst others.

I do hope you enjoy this issue of the magazine and if you have a story to tell or a new product announcement to share, please drop me a line at LLS@wfmedia.com.au.

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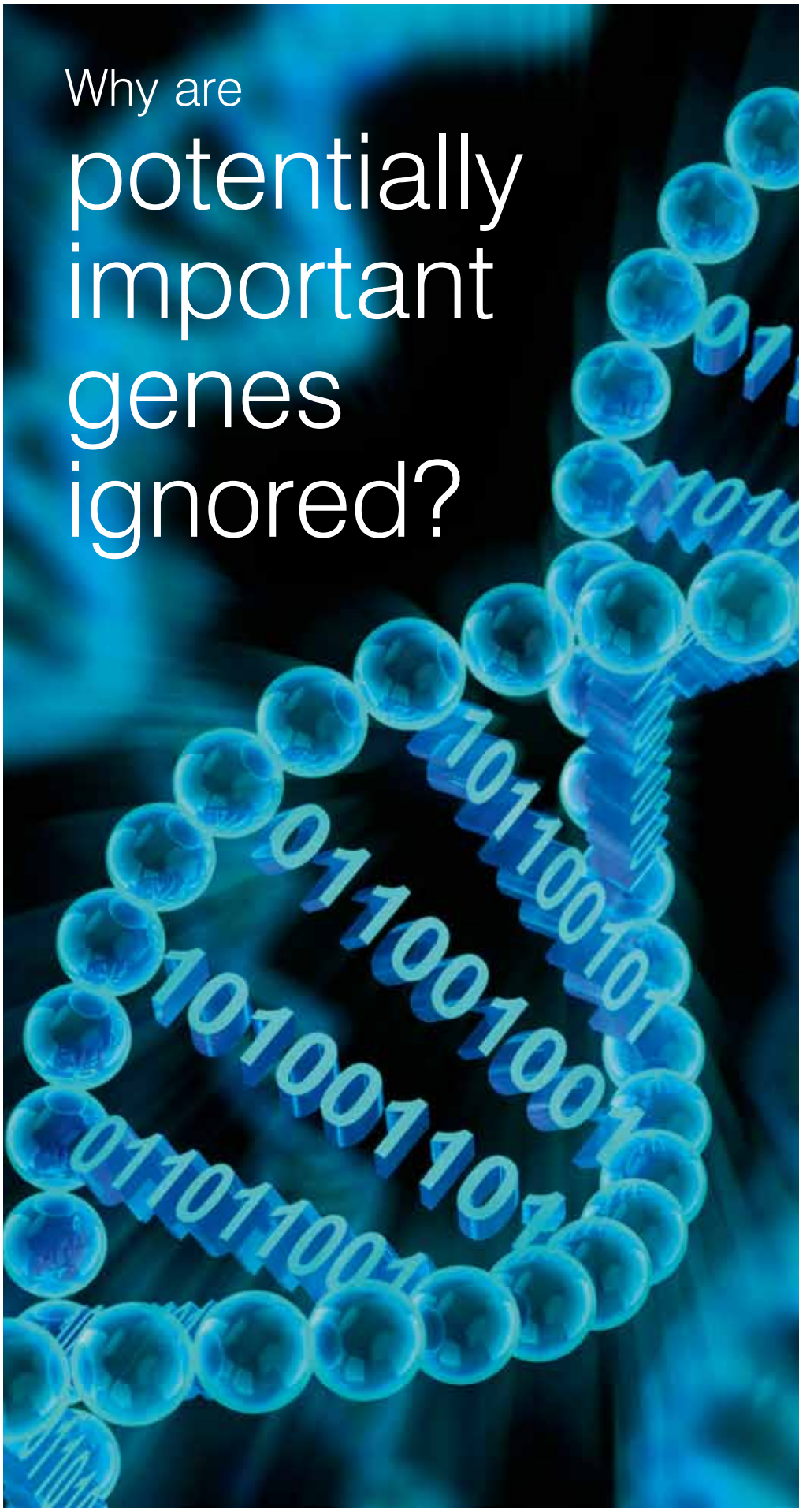
Mansi Gandhi

Most research on human genes only concentrates on around 2000 out of nearly 20,000 genes. New research highlights the need to incentivise the study of other genes important to human health.

Why are potentially important genes ignored?

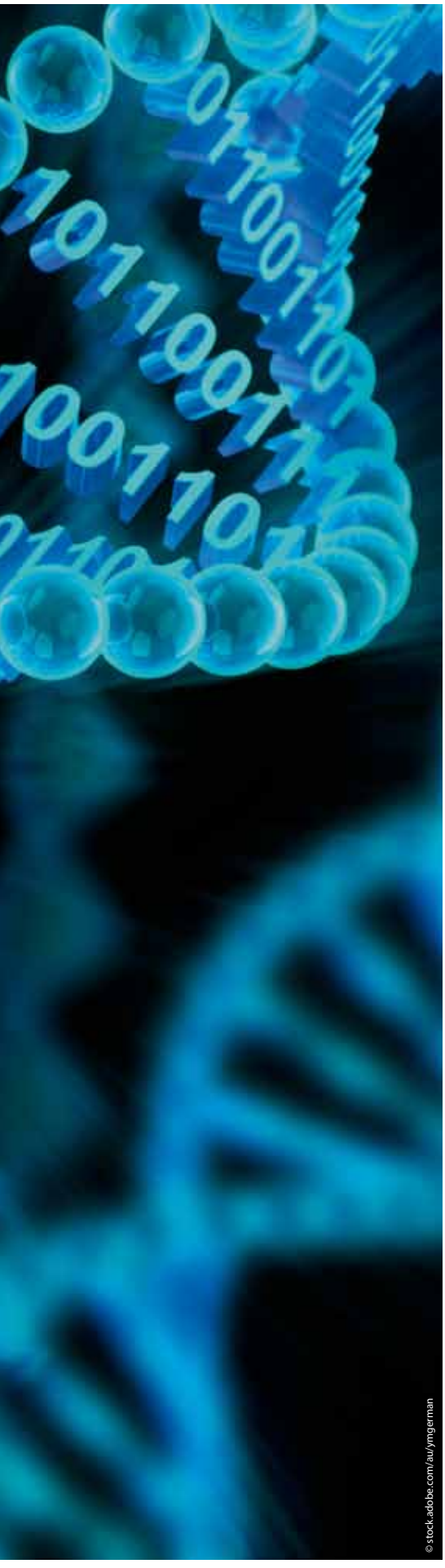


Researchers continue to study the same 10% of all human genes whose sequences are known while ignoring many potentially important genes.

To find out why, a team from Northwestern University (NU), led by Thomas Stoeger and Luís Amaral, compiled 36 distinct resources describing various aspects of biomedical research and analysed the large database for answers. The number of publications on individual genes, the year of the first publication about them, the extent of funding and the existence of related drugs can be predicted using machine learning methods, according to the team. Their findings have been published in *PLOS Biology* (https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.2006643).

But why do biomedical researchers keep studying the same 10% of genes? There are several distinct factors, which all favour research on well-established topics, said Stoeger. "For instance, justifying future research plans is easier if it is possible to draw a more specific picture of the anticipated outcome of a study. Being able to build upon prior knowledge, and to use existing reagents, or to participate in focused conferences, can facilitate future research and save time for individual investigations. Along these lines we find that individual researchers have more successful careers if they avoid the least studied genes."

So, basically, historical bias, bolstered by research funding mechanisms and social force, is a key reason why biomedical researchers continue to study the same 10% of genes while ignoring many genes known to play roles in disease. Biomedical research is primarily guided



Some of these genes include an understudied breast cancer gene cluster and genes connected to lung cancer that could be at least as important as well-studied genes.

by a handful of generic chemical and biological characteristics of genes, which facilitated experimentation during the 1980s and 1990s, rather than the physiological importance of individual genes or their relevance to human disease, according to the team.

The Human Genome Project

The Human Genome Project — the identification and mapping of all human genes, completed in 2003 — promised to expand the scope of scientific study beyond the small group of genes scientists had studied since the 1980s. But the Northwestern researchers found that 30% of all genes have never been the focus of a scientific study and less than 10% of genes are the subject of more than 90% of published papers. And this despite the increasing availability of new techniques to study and characterise genes.

"The Human Genome Project has allowed a study such as ours, and it has promoted several large-scale studies, which have already identified interesting starting points for closer studies," said Stoeger. However, presently we do not sufficiently promote the latter, he said. The Northwestern team's observations are restricted to biology and show that there is huge potential for further discoveries. However, there is no reason to believe that the underlying processes are specific to biology, noted Stoeger.

With researchers focused on just 2000 human genes, the biology encoded by the remaining 18,000 genes is largely uncharacterised. Some of these genes, the researchers note, include an understudied breast cancer gene cluster and genes connected to lung cancer that could be at least as important as well-studied genes.

Stoeger and others (https://www.nature.com/articles/s41598-018-19333-x) have found examples in many of the distinct processes studied by genome-wide association study (GWAS). "Other cases that I, personally, find very interesting are unstudied genes relating to human growth, or Inflammatory Bowel Disease." Another example is C9orf72, a gene relevant to ALS that has not been widely studied before but is now attracting significant research attention.

Stoeger participated in the first genome-wide tissue-specific RNAi screen in Drosophila during his undergraduate studies. That helped him understand that several genes, which were important for proper development of tissues, would not have been studied before. (https://www.ncbi.nlm.nih.gov/pubmed/19363474). When Stoegar was pursuing his PhD, there was a limited budget to select candidate genes. Hence, he actively exploited biases in past research patterns to select candidate genes in a manner that would maximise the chances of timely feasible follow-up experiments, and the chance to appeal to many readers and create a high-impact publication.

Knowing the unknown

"Since I believed that the unknown may strongly influence research and the current understanding of human health in ways that are presently only marginally understood, it seemed very important to understand why researchers would study certain genes and not others, and whether there might already be the potential for moving toward the understudied areas of biology. Since genes are perturbable, and represent a non-abstract entity, focusing on genes would allow to bridge meta-

studies of science with useful gene-specific advise that could be exploited by individual researchers, and help them to address the underlying bias."

The Northwestern team anticipates that it will take 20 more years until half of the protein coding genes are being studied by focused research publications. "Since this would mark a low threshold for 'understanding' it could take several further decades until their physiological and molecular roles are truly understood," said Stoeger.

Stoeger and his team show that large-scale efforts, which disrupt the function of individual genes, have already identified several largely uncharacterised, and under-characterised, genes, which are important to biology.

Identifying gaps

Further, the team show that many of these genes could already be studied by current technologies. "Biology is in the extremely lucky and exciting situation that — because since the human genome project we know the catalogue of human protein-coding genes — we could use data to identify gaps in our knowledge. One promising direction to mitigate the present situation would be to use data to provide extra freedom and security to those investigators that avoid the most-studied genes and hence do not profit from the same incentives as the researchers that study the 10% most-studied genes."

Stoeger collaborated with Professor Luís Amaral in the department of chemical and biological engineering in Northwestern's McCormick School of Engineering. Stoeger, Amaral, postdoctoral fellow Martin Gerlach and Richard I Morimoto, the Bill and Gayle Cook Professor of Molecular Biosciences in Northwestern's Weinberg College of Arts and Sciences, conducted the study.

The researchers applied a systems approach to the data — which included chemical, physical, biological, historical and experimental data — to uncover underlying patterns. In addition to explaining why some genes are not studied, they can explain the level to which an individual gene is studied. And they can do that for approximately 15,000 genes. "Social forces and funding mechanisms reinforce a focus of present-day science on past research topics."

A public resource

"In order to accelerate the pace of discovery, we propose the need for funding mechanisms of scientists and calls for proposals that encourage the pursuit of nonredundant and likely highly unpredictable research directions," the researchers wrote in the *PLOS Biology* paper. "In order to counter the career forces currently pushing towards conformity, there would be a need for stable, long-term support for such innovators to focus on the unknown. Just as the Royal Society sponsored target studies of the unknown with an eye towards the economic potential of certain discoveries, we also predict that exploring the uncharted territories of unknown biology by investigating unstudied and understudied genes will yield satisfying observations that would contribute economically and medically. We believe that the resource presented here provides a jumping point for further systems-level investigation on the formation of scientific knowledge ... and a guide to researchers who want to identify promising but little-studied genes."

Looking forward, the Northwestern team is developing a public resource that could help identify understudied genes that have the potential to be of critical importance to specific diseases. The resource includes information on any extraordinary chemical property, if a gene is highly active in a specific tissue and if there is a strong link to a disease.

The research was supported by the National Science Foundation, the Department of Defense's Army Research Office, the National Institute of Aging, the National Institute of Allergy and Infectious Diseases, the Simons Foundation, the Daniel F. and Ada L. Rice Foundation and a gift from John and Leslie McQuown.

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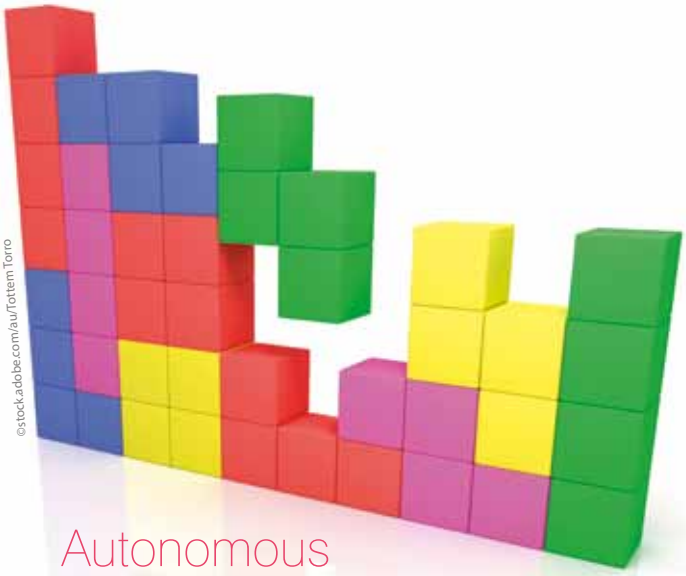


Autonomous breast cancer detection program evokes Tetris

Researchers from the University of Adelaide's Australian Institute for Machine Learning (AIML) have developed a fully automated medical image analysis program to detect breast tumours — and its method may seem a little familiar.

In conjunction with an MRI scan, the AI-based autonomous program employs the traversal movement and style of a retro video game to examine the breast area. It was developed by University of Adelaide PhD candidate Gabriel Maicas Suso and AIML Associate Professor Gustavo Carneiro.

"Just as vintage video game Tetris manipulated geometric shapes to fit a space, this program uses a green square to navigate and search over the breast image to locate lesions," said Maicas Suso. "The square changes to red in colour if a lesion is detected."

The researchers created the program by applying deep reinforcement learning methods, a form of artificial intelligence that enables computers and machines to learn how to do complex tasks without being programmed by humans. As a result, the program can independently analyse breast tissue.

Critically, they were able to train the computer program with a relatively small amount of data, which is a challenge in medical imaging. Assoc Prof Carneiro said, "By incorporating machine learning into medical imaging analysis, we have developed a program that intuitively locates lesions quickly and accurately."

How quick? According to Maicas Suso, "Our research shows that this unique approach is 1.78 times faster in finding a lesion than existing methods of detecting breast cancer, and the results are just as accurate."

Assoc Prof Carneiro noted that more research is needed before the program could be used clinically. The ultimate aim, he said, "is for this detection method to be used by radiologists to complement, support and assist their important work in making a precise and quick prognosis".

New $5m microscope installed at UQ

The University of Queensland has installed a new $5 million Hitachi HF5000 200 kV Transmission Electron Microscope that can see objects smaller than the very smallest atom — a hydrogen atom.

Advanced health tools, battery technology and nanomaterials are all potential developments that could flow from the microscope at the newly renovated Hawken Microscopy Facility at UQ's Centre for Microscopy and Microanalysis.

Centre Director Professor Roger Wepf said the new technology would help bring together researchers from quantum physics to molecular biology, potentially leading to groundbreaking technologies.

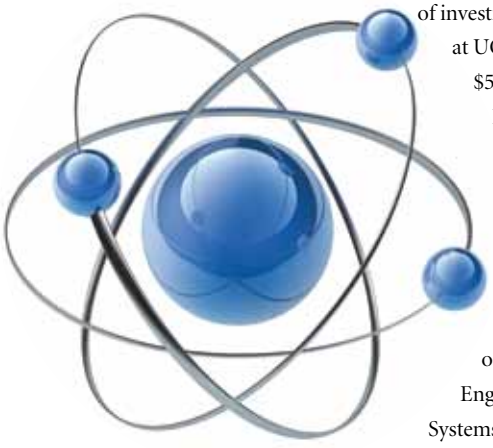
"This microscope has enough power to see to a millionth the diameter of a human hair, which means you can see even small variations in the spacing between atom lattices in metals and semiconductors," he said.

"Getting down to this infinitesimally microscopic level is going to open up discoveries in the fields of health, synthetic biology, advanced materials and unique electronic devices.

"Imagine being able to manipulate ultrathin electronic or magnetic materials in real time, test nanoscale battery models or see how a drug is delivered to a cell on a molecular or atomic scale."

Professor Wepf said the microscope provided a unique research platform. He said Hitachi, along with other partners, including scientific equipment specialists NewSpec, were keen to push technological boundaries in efforts that would help position Queensland at the centre of a sixth technological wave, the so-called sustainable 'green wave'.

Professor Wepf was joined at the launch by Hitachi Vice President and Executive Officer Mikio Takagi, Member for Redlands Kim Richards MP, UQ Provost Professor Aidan Byrne and NewSpec CEO Graeme Jones.



The infrastructure is part of a raft of investments in microscopy at UQ, which includes $5.5 million for the Hawken facility's refurbishment and $4.5 million for a nanolithography suite as part of the Australian Research Council's Centre of Excellence for Engineered Quantum Systems (EQUS).

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New algorithm could improve rare disease diagnosis

Stanford scientists have developed an algorithm, called Phrank, that automates the most labour-intensive part of genetic diagnosis — that is matching a patient's genetic sequence and symptoms to a disease described in the scientific literature.

Without computer help, this match-up process is said to take 20–40 hours per patient. The expert looks at a list of around 100 of the patient's suspicious-looking mutations, makes an educated guess about which one might cause disease, checks the scientific literature, then moves on to the next one.

The algorithm developed Gill Bejerano, PhD, associate professor of developmental biology and of computer science at Stanford, and his colleagues is said to cut the time needed by 90%. Findings have been published in the journal *Genetics in Medicine*.

The algorithm's name, Phrank — a mashup of "phenotype" and "rank" — hints at how it works. It compares a patient's symptoms and gene data to a knowledge base of medical literature, generating a ranked list of which rare genetic diseases are most likely to be responsible for the symptoms. The clinician has a logical starting point for making a diagnosis, which can be confirmed with one to four hours of effort per case instead of 20–40 hours. The mathematical workings of Phrank aren't tied to a specific database, which makes it much more flexible to use.

Phrank is also claimed to dramatically outperform earlier algorithms that have tried to do the same thing, according to the paper. Bejerano's team validated Phrank on medical and genetic data from 169 patients, an important advance over earlier studies in the field. Prior studies had tested algorithms on made-up patients instead because real-patient data for this research is hard to come by.

"The problem is that this test [using synthetic patients] is just too easy," Bejerano said. "Real patients don't look exactly like a textbook description." On data from real patients, one older algorithm ranked the patient's true diagnosis 33rd, on average, on the list of potential diagnoses it generated; Phrank, on average, ranked the true diagnosis fourth.

Phrank also holds potential for helping doctors identify new genetic diseases, Bejerano said. For example, if a patient's symptoms can't be matched to any known human diseases, the algorithm could check for clues in a broader knowledge base. "You might get the result that mouse experiments cause phenotypes similar to your patient, that you may have found the first human patient that suffers from this disease," Bejerano said.

Ultimately, "nobody is going to replace a clinician making a diagnosis", he said. But new technology could help experts use their time more efficiently, helping many more patients get diagnosed, he said.

The lead authors of the paper are graduate students Karthik Jagadeesh, MS, and Johannes Birgmeier, MS. Other Stanford co-authors are Jon Bernstein, MD, PhD, associate professor of pediatrics; undergraduate student Cole Deisseroth; and former graduate students Harendra Guturu, PhD, and Aaron Wenger, PhD. The work was funded by Stanford graduate fellowships, Stanford Bio-X, DARPA, the David and Lucile Packard Foundation and Microsoft. Stanford's departments of Developmental Biology, of Computer Science and of Pediatrics also supported the work.

Protein found to help limit inflammation

Researchers from The University of Queensland (UQ) have discovered a previously unknown role for the cholesterol regulatory protein LRP1, showing that it also manages the body's inflammation response.

Led by Dr Lin Luo and Professor Jennifer Stow, from UQ's Institute for Molecular Bioscience, the discovery will help us understand how poorly controlled inflammation exacerbates diseases including cystic fibrosis, Alzheimer's, atherosclerosis and cancer.

As explained by Professor Stow, chronic inflammatory diseases occur when inflammation cannot be effectively switched off, leading to recurrent damage to organs such as the lungs. "Inflammation is typically launched to ward off infection or danger, then subsequently curtailed to avoid ongoing tissue damage," she said.

"The inflammatory response is activated by Toll-like receptors, which are pathogen detectors on the surface of immune cells that serve as an alarm system for the body by recognising disease-causing or damaging molecules.

"We found that LRP1 is simultaneously activated and works in tandem with the pathogen detectors to ensure the inflammatory response is robust but self-limiting.

"LRP1 acts as a vital brake in this pathway, ensuring that inflammation does not go on to damage our own organs."

Published in the journal *Cell Reports*, the discovery may have significant implications for the future treatment of chronic inflammatory diseases, enhancing our understanding of the growing link between cholesterol, metabolism and inflammation.

"We are using this discovery to develop ways to manipulate inflammation which could help to limit organ damage in conditions like cystic fibrosis and other chronic diseases," Professor Stow said.

"While these interwoven systems are complicated, they are important to research and understand from a treatment perspective, offering both challenges and exciting potential for the cross-purposing of new and existing drugs."

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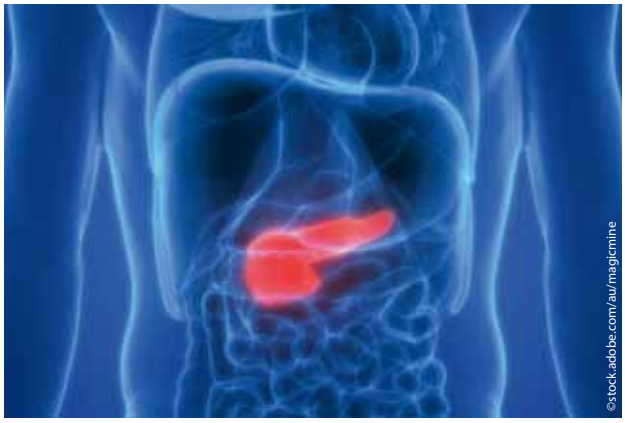

'Educated killer cells' show promise in pancreatic cancer

Researchers from the UK, US and Australia have demonstrated the success of a new, cell-based immunotherapy for pancreatic cancer. Published in the journal *Gut*, the team's treatment led to mice being completely free of cancer — including cancer cells that had already spread to the liver and lungs.

Pancreatic cancer is often diagnosed at a late and advanced stage, when the tumour has already spread to other organs. Current treatments only marginally extend the lifespan of pancreatic cancer patients, with five-year survival at just 7.7%.

Seeking to combat this, the research team obtained pancreatic cancer cells from patients with late-stage disease and transplanted them into mice. They then took the patients' immune cells and modified them to specifically identify and eliminate the cancer cells — which is why they're also called educated killer cells, or CAR-T cells.

"After injecting these CAR-T cells into mice, they were capable of finding any cancer cells in the body, stick to them via surface markers and subsequently destroy the cancer cells," said Professor Chris Heeschen, lead author on the study from UNSW Medicine. "The treatment was so effective that the animals remained tumour-free."

The researchers also introduced a new technology that allows them to completely control the activity of CAR-T cells. Using so-called 'switchable CAR-T cells', the team used this new concept for the first time in pancreatic cancer, and divided cancer target recognition and subsequent killing of the cancer cells into two separate processes.

"Switchable CAR-T cells now allow us to stop the treatment, if required, thus making our therapy extremely safe," said joint corresponding author Dr Alexandra Aicher, who recently moved to UNSW Sydney. "Switchable CAR-T cells will also ensure we can rapidly adapt our treatment target to another cancer surface marker, if resistance may occur."

The team now hopes to bring this promising therapy to the clinic, and is seeking funding to progress. Professor Heeschen noted, "The next step will be to combine CAR-T cells with treatments that make it easier for the CAR-T cells to reach the cancer cells.

"Pancreatic cancer is known for its fortress-like structure that needs to be overcome in order for the CAR-T cells to reach their target cells and remain at maximum activity. We hope to have this new treatment strategy ready for the clinic within the next three years, pending funding."

Genetically engineered bacteria turn sugar into hydrogen

Macquarie University scientists are engineering bacteria that turn sugar into hydrogen — a breakthrough in renewable energy research that has received a $1.1 million grant from the Australian Renewable Energy Agency (ARENA).

While 95% of the hydrogen used worldwide currently is produced from fossil fuels, increasingly people are looking at how to produce hydrogen from renewables. For example, Dr Louise Brown, co-leader of the new project, noted that a lot of recent research efforts are focused on using electrolysis to produce hydrogen by splitting water molecules into oxygen and hydrogen, achieved by using electricity generated from solar and wind.

"Other people are taking a biological route and tweaking photosynthesis in algae to produce hydrogen," she said.

"We think we can use genetically engineered bacteria — in our case, *E. coli* — which will be able to eat glucose produced from renewable sources likes sugar cane and cereals. We'll also be looking at other low-cost carbohydrate feedstocks as well."

Professor Robert Willows, another project co-leader, explained, "The aim of our project is to design a system that produces hydrogen relatively rapidly and at yields that are commercially viable. The bacterial approach has many advantages over hydrogen from algae, including that it doesn't need large open ponds."

"Even in the lab we can produce enough hydrogen in a day, from a few spoonfuls of sugar, to produce enough energy to charge your mobile phone for up to two weeks," added Dr Brown.

The researchers have teamed up with BOC Australia and Bioplatforms Australia on the project, with the three-year ARENA grant to be matched by an additional $1.7 million in further funding and in-kind support.

"BOC is committed to supporting Australian research and development into the production and use of cleaner gaseous fuels for mobility and energy," said Alex Dronoff, BOC General Manager Hydrogen and LNG. "Renewable hydrogen is a fuel of the future, and we are proud to share our global expertise with researchers from Macquarie University as they enter this next phase of technology development."

"The team will be able to use our research infrastructure to better understand the changes they're making to the genes, proteins and metabolism of the bacteria they're engineering," added Andrew Gilbert, General Manager of Bioplatforms Australia. "We are delighted to support this valuable project that showcases clever science to innovatively produce hydrogen."

The study is one of 16 hydrogen R&D projects to receive ARENA funding, with the agency awarding nine organisations a total of $22.1 million as part of a special funding round. Other projects are being carried out by the Australian National University, Monash University, Queensland University of Technology, RMIT University, The University of Melbourne, UNSW, The University of Western Australia and CSIRO.

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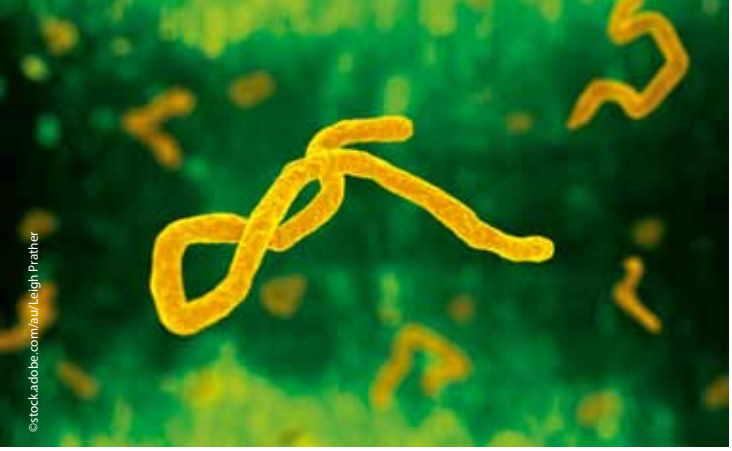


How does the immune system protect itself against Ebola?

Two types of human antibodies that target different parts of the Ebola virus synergise their antiviral effects by inhibiting different steps of infection, according to a new study from US researchers — an insight which could lead to the development of effective antibody-based therapies.

The unprecedented Ebola virus epidemic in West Africa from 2013 to 2016 resulted in more than 11,000 human fatalities, demonstrating the urgent need for treatments against this virus and related highly pathogenic filoviruses. Yet despite intense international collaborative efforts, there is still no licensed therapeutic available against filovirus disease.

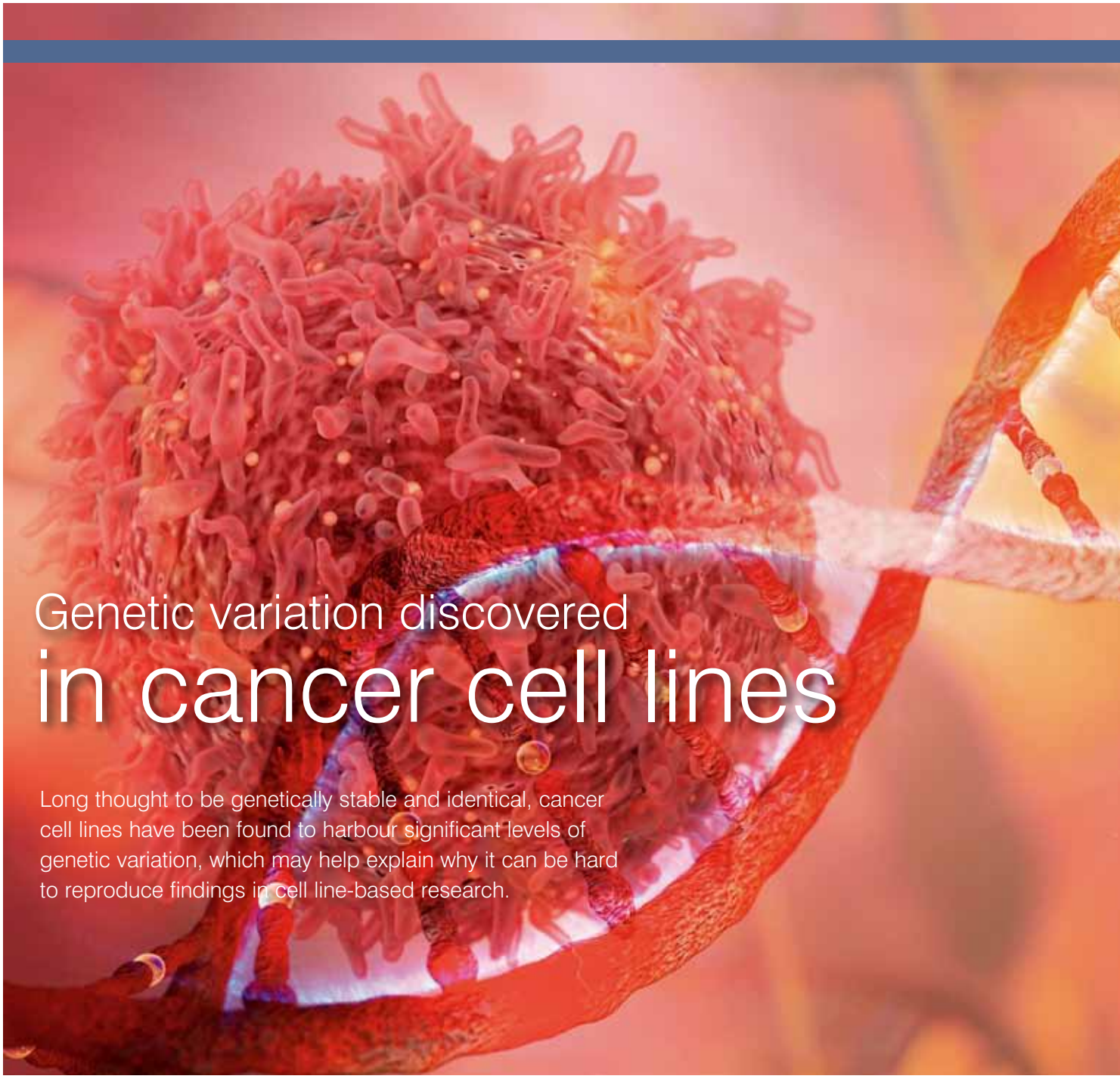
Further progress in the development of effective antibody-based therapies for filovirus infections requires a better understanding of the mechanism underlying their protective effect. Although the human immune system can produce strong antibody responses against filoviruses, the effects on multiple steps of filovirus infection have not been clear.

To address this gap in knowledge, Philipp Ilinykh from the University of Texas Medical Branch and colleagues evaluated the mechanisms underlying the antiviral effects of a diverse panel of monoclonal antibodies obtained from several survivors of natural Ebola virus infections. The results of their work were published in the journal *PLOS Pathogens*.

The researchers found that monoclonal antibodies that targeted either the glycan cap or stem region of the viral glycoprotein interfered with and targeted different steps of filovirus infection. For example, glycan cap-specific antibodies inhibited viral attachment to the cell surface, cell-to-cell transmission and virion budding. By contrast, stem-specific antibodies triggered the activation of natural killer cells and the destruction of infected cells by monocytes and neutrophils.

Taken together, the findings suggest that different types of antibodies exert cooperative effects by blocking distinct steps of filovirus infection. According to the authors, antibody cocktails that combine complementary antiviral effects should be tested in future studies.

"The current approach for treatment of filovirus infections with antibody cocktails tested in animal models utilises the principle of targeting of non-overlapping epitopes," said Alexander Bukreyev, a co-author on the study. "Our study suggests that possible synergistic effects of antibodies which block various steps of viral replication should be also considered."



Genetic variation discovered in cancer cell lines

Long thought to be genetically stable and identical, cancer cell lines have been found to harbour significant levels of genetic variation, which may help explain why it can be hard to reproduce findings in cell line-based research.

Cell lines form the backbone of cancer research. These individual groups of cells, typically collected from patients' tumour samples and cultured to grow indefinitely in the laboratory, enable everything from basic genetic research to drug discovery.

But while scientists have thought that individual cell lines remain genetically uniform even as they continue to grow and divide, they can in fact evolve in ways that dramatically change their responses to drugs. That's according to researchers from the Broad Institute and collaborating institutions, whose findings have been published in the journal *Nature*.

"The main message here is not that cell lines and culture-based models are bad," said Broad core institute member Todd Golub, co-senior author on the study. "Rather, you should know your model, and understand its properties and limitations. Knowing requires a level of genetic and genomic characterisation beyond what we usually think about. Skipping this sort of careful characterisation is not an option."

Researchers have long recognised that cell lines do not perfectly mimic their tumour of origin. Still, they are considered representative and stable enough to provide accurate insights into cancer biology and drug response. In fact, every cancer treatment available today was at some point tested in these laboratory models.

However, scientists often struggle to reproduce study results from cell lines. In addition, no-one has yet undertaken a systematic effort to measure how, and the extent to which, the cells in cancer cell lines change genetically over time, and whether those changes affect drug responses.

"You can find many examples in the literature pointing out inconsistencies in drug sensitivity data from cell line experiments," said first author Uri Ben-David, a postdoctoral fellow in the Golub lab. "We wanted to look for signs of evolution and connect the dots between changes within lines and those inconsistencies."

The researchers first began to suspect that these cell lines evolve when they reanalysed sequencing data from 106 lines housed in two large collections: the Broad-Novartis Cancer Cell Line Encyclopedia (CCLE) and the Wellcome Sanger Institute's Genomics of Drug Sensitivity in Cancer. These lines should be genetically identical in both collections,

but the team found high levels of variability. For instance, 19% of the genetic mutations the team found were present in only one collection or the other.

The team then ran deep molecular analyses on 27 and 23 strains, respectively, of two widely used cell lines: the oestrogen receptor-positive breast cancer line MCF-7 and the lung cancer line A549. The analysis included whole-genome DNA sequencing, targeted DNA sequencing of nearly 450 genes commonly mutated in cancer, and bulk and single-cell RNA sequencing. Each of the strains represented a batch of cells from the line with a distinct history (eg, different kinds of lab manipulation, different length of time in culture, different original source).

Their data revealed striking genomic differences between strains, ranging from single base pair mutations to large-scale changes in genome structure (eg, losses of entire chromosome arms) to major changes in gene expression — all indicating that the cell lines were neither as stable nor as identical as the researchers thought. These genetic and expression differences also affected the strains' growth rates, cell size and shape, and other traits. Targeted sequencing on an additional 11 cancer cells lines, representing a variety of tumour types (prostate, colon, liver, skin), resulted in further genetic variability between lines.

By conducting experiments with different laboratory conditions, the team found that even changing the kind of nutrient media in which a cell line is cultivated can give some cells within a strain a growth advantage over others, allowing genetically distinct populations to evolve. And by extracting single cells and growing them in culture, the team also found that the progeny of isolated single cells could spontaneously acquire new mutations — showing that new, genetically diverse populations of cells could arise within a strain from individually isolated cells.

To understand how these genetic changes might affect drug response, the team tested the 27 MCF-7 strains against 321 drugs. Any given drug's ability to slow the growth of or kill a strain's cells correlated with the strain's genetic features and its expression of genes targeted by the drug.

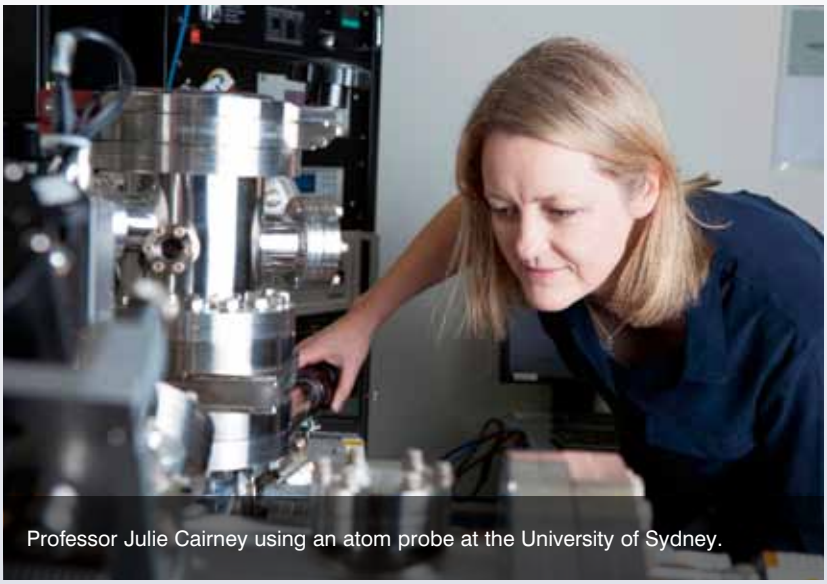
The findings complement those of another study led by Golub and Ben-David that examined patient-derived xenograft (PDX) models (which are generated by implanting tumour cells from a cancer patient into a mouse). In 2017, they reported in *Nature Genetics* that over time human cancer cells in PDX models lose characteristic genetic features seen in patients and gain new features not encountered in humans, changes that correlated with shifts in the models' drug sensitivities.

Taken together, the findings highlight a need for scientists to take extra care to ensure that cell line-based models of cancer reflect the tumour they are studying. They must understand how the cells they are using may have diverged genetically from their parent line, so as to make accurate comparisons across experiments.

To that end, the team has developed and will release an online tool, Cell STRAINER, to help researchers benchmark their models, estimating how much a cell line strain they use has diverged genetically from reference samples in the CCLE collection. They also noted that the cell lines' capacity for evolution could actually provide an opportunity to study a variety of aspects of cancer biology and tumour evolution.

"Because the strains have the same general genetic background, you could test the same compound on two strains and use their features to study the compound's mechanism of action, or the influences of gene expression differences on sensitivity," said Golub. "Or you could investigate tumour heterogeneity and the selective pressures that cause strains to evolve."

Ultrahigh-resolution TEM unveiled in Sydney



Professor Julie Cairney using an atom probe at the University of Sydney.

Two Nobel Laureates and the NSW Chief Scientist & Engineer recently unveiled a vital new piece of scientific infrastructure at the University of Sydney — a multimillion-dollar transmission electron microscope (TEM).

The Thermo Fisher Themis-Z TEM is believed to have the highest resolution of any microscope in Australia, providing researchers with unparalleled access to the mysteries of the atomic structure of materials. Standing 4.5 m tall, the microscope is housed in the $150 million Sydney Nanoscience Hub in a room that is shielded from electromagnetic interference and 'floats' architecturally independent from the building to minimise vibrations.

The TEM is the only such microscope in Australia that is monochromated and double corrected, meaning it can simultaneously analyse the atomic structure and the spectral nature of materials. This technique enables the machine to obtain images with resolution better than 0.06 billionths of a metre (0.06 nm) — about 10 times smaller than the distance between silicon atoms or five times smaller than the distance between carbon atoms in diamond.

Available for use by industry, the microscope has applications in geosciences, mining, chemical and advanced manufacturing industries. It is critical for the design of semiconductor structures such as those fabricated in cleanrooms at the Research and Prototype Foundry in the Sydney Nanoscience Hub.

The aberration-corrected transmission electron microscope in the Sydney Nanoscience Hub.

According to University of Sydney Vice-Chancellor and Principal Dr Michael Spence, vision, hard work and collaboration will yield results through the science this instrument can facilitate. For example, 2018 Eureka Prize winner Professor Thomas Maschmeyer said the new machine will be a boon to his research into renewables.

"Defects in functional materials are often critical to performance, be that mechanical, electronic, optical or chemical," Prof Maschmeyer said. "The new instrument will allow us to probe active sites, integral for catalysis or energy storage, with atomic clarity."

Prof Julie Cairney, Director of Sydney Microscopy & Microanalysis, is meanwhile working on new materials used to build life-saving stents during heart surgery. The new microscope will provide essential information about the structure and stability of these materials, allowing her team to be more effective in their work.

"With this device, we not only get to see the atomic structure but simultaneously analyse chemical information, such as inter-atomic forces, which is a huge advantage in materials science," Prof Cairney said. "The research application space is truly vast."

The device was launched by NSW Chief Scientist & Engineer Professor Hugh Durrant-Whyte in his first week of official functions, alongside two Nobel Laureates in Chemistry visiting Sydney for the 19th International Microscopy Congress.

Columbia University's Prof Joachim Frank was awarded a Nobel Prize last year for developing another innovative type of transmission electron microscopy, known as cryo-TEM, which is able to determine biological structures in solution to high resolution. The University of Sydney will soon acquire a cryo-TEM to add to its array of scientific infrastructure.

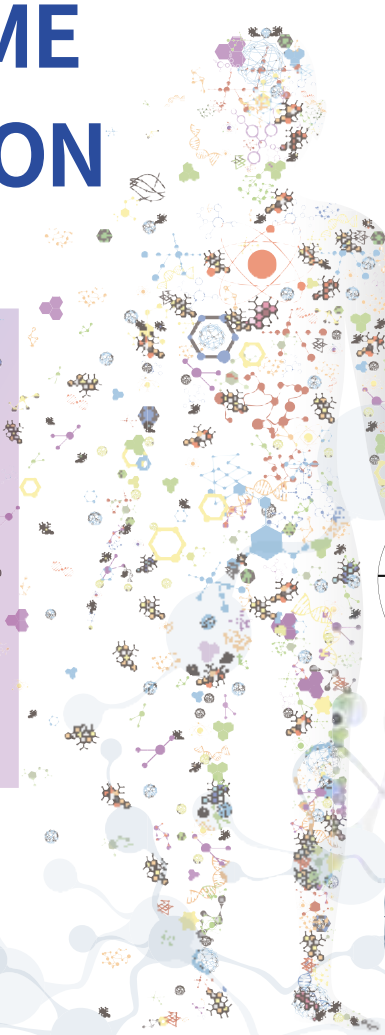
"I want to emphasise the role of scientific infrastructure," Prof Frank said at the launch. "I've done most of my work computationally — and that data had to come from somewhere from people who can operate these microscopes.

"It is from efforts such as what I see happening here at Sydney where this happens. This really is a milestone for your institution."

Thermo Fisher Scientific
www.thermofisher.com.au

Humanizing Genomics
macrogen
OCEANIA

HUMAN WHOLE GENOME SEQUENCING PROMOTION



Human WGS on NovaSeq 6000

1,230*

AUD/sample

Specifications

- Truseq PCR free kit or Truseq Nano DNA library kit
- 30X coverage per sample at raw data level
- Raw data deliverable

Remarks

- Free sample and library QC's
- Free HDD for data deliverable

Terms

- Contract must be signed by December 31, 2018
- Sample must be received by January 31, 2018
- * Other conditions may apply

For more details, please contact us at
ngs@macrogen.com or Trystan.whang@macrogen.com.au

website: www.macrogen.com I www.macrogen.com.au

Semi-micro balance

The Pioneer PX5 combines essential weighing functionality with competitive performance, offering high accuracy and repeatability. It is intuitively designed for intelligent operation and suitable for laboratory and research applications.

The PX5 features a second line display for additional information or guidance, a static removal bar for convenient grounding of samples, and USB and RS232 connectivity for easy communication with electronic devices and printers. With cast metal lower housing, sub-pan and a stainless steel weighing pan, the device is durably constructed for versatile and long-term use.

The PX5 includes essential weighing applications such as basic weighing, parts counting, percent weighing, animal weighing and density determination, allowing for versatility in everyday operations. Intuitively designed, the product includes features such as user-selectable environmental filters to ensure operation in a variety of settings, user-defined brightness settings, auto-tare, auto-dim, user-definable project and user IDs, internal calibration, software overload/underload indicator and stability indicator.

Capella Science
www.capellascience.com.au

Software platform for single cell isolation

Molecular Machines Inc (MMI), a provider of technologies for microscopy-based single cell isolation, has launched the MMI CellTools 5.0 Software Platform.

With more than 25 years of customer-focused innovation and continuous improvements, the software is now easier and more straightforward to use. Importantly, it is designed to provide higher image quality and facilitate more precise sample acquisition than before.

The product's autofocus tool now provides high precision in depth, while a focus map with an unlimited number of interpolation points can be defined to smoothen uneven samples. Several features enable high image quality, such as the CMOS camera support. Improved image and video documentation features make the most out of the user's sample and the dark interface style is suited to fluorescence applications.

The MMI CellTools software package has also been extended with the novel MMI CellScan module. The MMI CellScan seamlessly integrates into CellTools platform to combine laser microdissection and whole slide imaging to feature novel applications and improved workflow for digital pathology and precision medicine.

SciTech Pty Ltd
www.scitech.com.au

Silicone isolators

Grace Bio-Labs' Silicone Isolators allow researchers to isolate specimens using removable hydrophobic barriers. They may be used to isolate cells grown in culture dishes or separate multiple specimens affixed to microscope slides.

The isolators are available in red silicone, 0.5 to 2.5 mm thick, pre-cut or as sheet material with or without secure seal clean adhesive on one or both surfaces. Non-adhesive isolators are autoclavable and re-usable.

The isolators remain sealed to smooth surfaces during washing steps. Where additional sealing is required, SecureSeal adhesive on one or both surfaces is recommended. Closed chambers may be formed using flexible RNase free, HybriSlip covers. The recommended use temperature is -62 to 218°C.

Recommended applications include: protein and DNA microarrays, hydrogel, immunohistochemistry, fluorescence in situ hybridisation (FISH), biopolymers and imaging.

Sapphire Bioscience
www.sapphirebioscience.com

Magnetic stirrer

The IKA Plate (RCT digital) is a stirring plate with a hardened glass top enclosure for maximum visibility, chemical resistance and safety. The product also features a fast-responding digital display with Alnico magnet technology for good temperature stability and high residual induction.

The IKA Plate (RCT digital) has a round aluminium plate for stirring volumes up to 20 L (H_2O) and runs at speeds ranging from 50 to 1500 rpm. The integrated timer and counter function support the control of kinetics and sensitive reactions. The IKA SmartTemp function protects users intelligently and predictably.

In addition, the unit is supplied with a PT1000 temperature probe that will increase the temperature stability, and a range of accessories is available to make the item versatile and adaptable for any laboratory. Regular firmware updates allow improvement to the plate over time.

The magnetic stirrer comes with a lifetime warranty.

Labtek
www.labtek.com.au

ELISA kits

CatchPoint SimpleStep ELISA kits have been developed using a fluorescent substrate to provide improved linearity over an extended dynamic range when compared to TMB substrate, the most widely used colorimetric substrate for ELISA. The extended dynamic range provides good quantification at both the lower and the upper end of the curve.

Kits are optimised for a one-wash, 90 min protocol. The stable signal provides readout flexibility for up to 24 h with no compromise on sensitivity. Kits contain high-quality antibodies for batch-to-batch consistency and reproducibility.

CatchPoint SimpleStep ELISA kits have been developed in collaboration with Molecular Devices and optimised using the company's Multi-Mode Microplate Readers. Kits are offered against 60 common targets and a further 700+ colorimetric SimpleStep ELISA kits.

Abcam Australia Pty Ltd
www.abcam.com

Human cell expression system

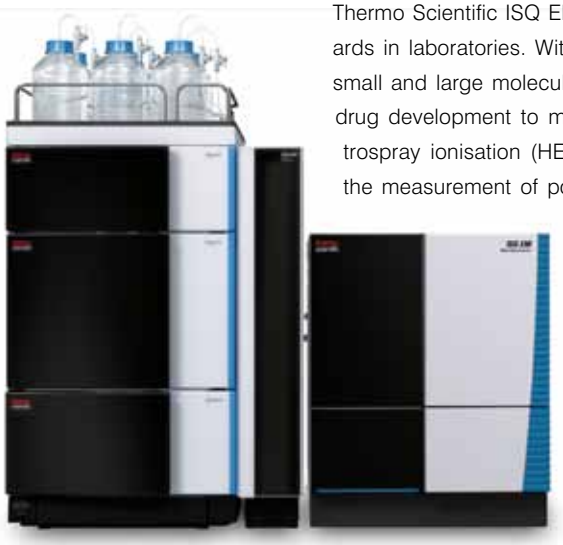
Stem cell, regenerative medicine and cellular therapy labs conducting research, development and clinical trials benefit from the use of authentic human proteins with the best possible activity and stability for human cell-based studies. For this reason, HumanZyme has developed the HumaXpress human cell expression system, which produces authentic recombinant HumanKine proteins with correct post-translational modifications, subunit assembly, folding, secretion and stability. The company's HEK293 expression system produces mature, authentically human proteins with native biological function.

Correctly glycosylated recombinant human cytokines from a human cell line offer certain advantages over proteins produced in ***E. coli*** or CHO cells, including good stability and activity in cell culture. The HumaXpress system produces proteins with native human folding and glycosylation that often demonstrate high stability and specific activity over proteins produced in ***E. coli,*** according to the company.

In addition, the system correctly assembles protein subunits, eg, human IL-23, a glycosylated heterodimer formed by the two subunits p19 and p40. Mature, native IL-23 from HumanZyme contains both authentic human glycosylation as well as the natural disulfide bond linking the two subunits.

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

Single quadrupole mass spectrometer

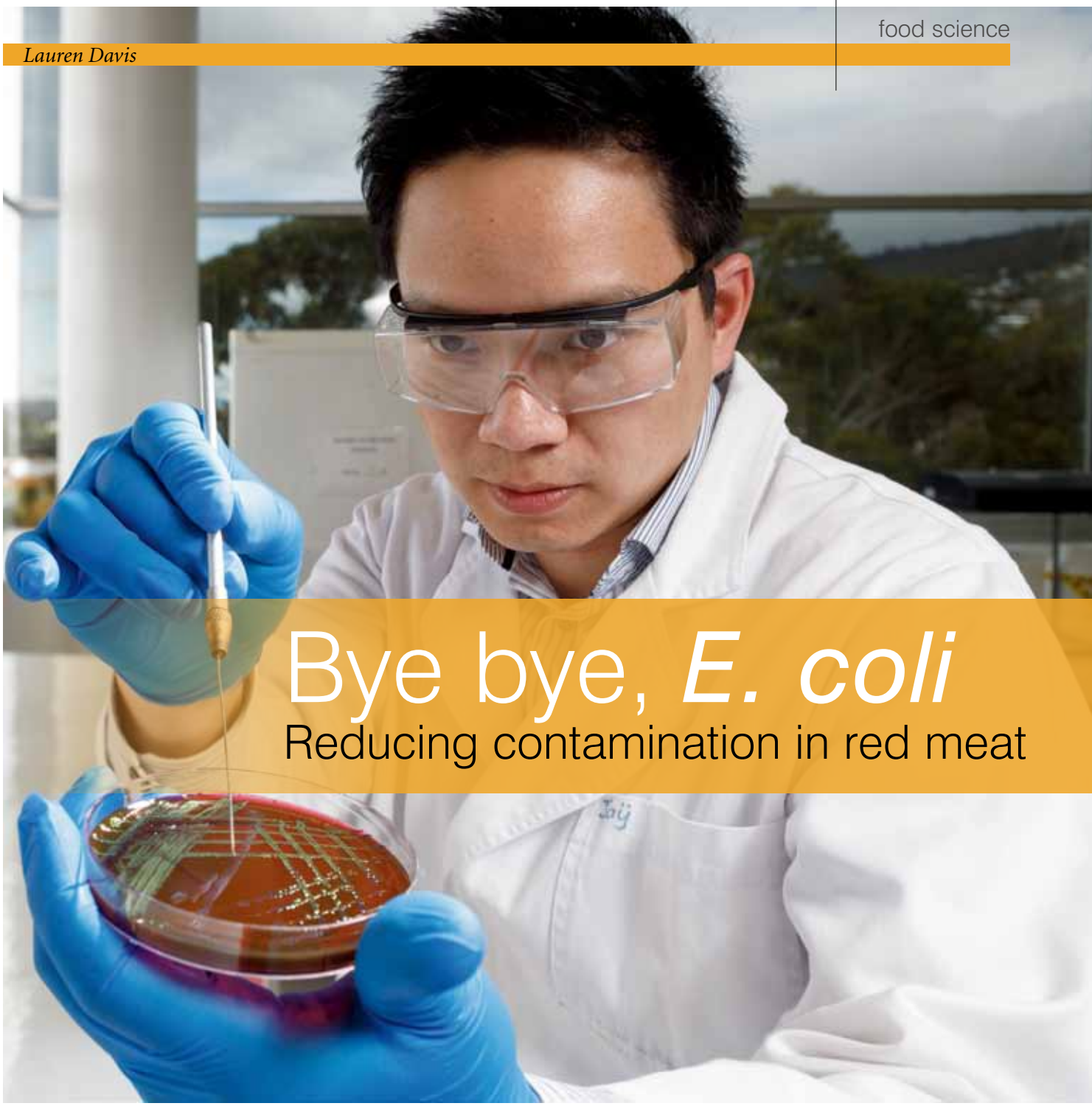


Driven by industry demand for a robust, easy-to-implement system, Thermo Fisher Scientific designed the Thermo Scientific ISQ EM single quadrupole mass spectrometer for high performance and productivity standards in laboratories. With a mass range of 10–2000 m/z, the system offers the power to detect and quantify small and large molecules, and supports analytical needs across an extensive range of applications — from drug development to manufacturing support and quality control. The system's high-performing heated electrospray ionisation (HESI) and dual HESI/atmospheric pressure chemical ionisation (APCI) probes facilitate the measurement of polar and non-polar analytes, enabling application flexibility.

The product was designed to enable novice and expert mass spectrometry users to take advantage of LC-MS's good sensitivity and selectivity for the rapid analysis of complex sample matrices. The device is integrated with the HPLC and fully controlled by Thermo Scientific Chromeleon Chromatography Data System (CDS), which offers tools to guide users through LC-MS method development and select appropriate source conditions. Thermo Scientific Chromeleon XPS Open Access software also supports the ISQ EM with walk-up workflows for simple daily operation.

Thermo Fisher Scientific
www.thermofisher.com.au

Lauren Davis



Bye bye, *E. coli*

Reducing contamination in red meat

Food safety researchers from the Tasmanian Institute of Agriculture (TIA) have come together with industry in a joint effort to enhance the quality of Australian red meat — by eliminating its risk of ***E. coli*** contamination.

The project is being supervised by Dr Chawalit (Jay) Kocharunchitt, a Research Fellow at the TIA whose work is funded by Meat & Livestock Australia and the Australian Meat Processor Corporation. He explained that most types of *E. coli* are harmless to humans, but other, rarer types are pathogenic and can cause infections and serious illness if consumed.

"The Australian meat industry is one of the largest exporters of red meat, so they have really stringent requirements for the presence of *E. coli* on meat," Dr Kocharunchitt said. "So if there is one cell of *E. coli* present on meat, they can reject the whole lot."

Australian red meat has a good reputation, said Dr Kocharunchitt, but this is typically the result of good practice and hygiene rather than any specific antimicrobial preventive measures. Some processors do carry out hot water treatment on their beef, he said, "but this requires a big cabinet which is quite expensive to maintain and expensive to set up as well".

Dr Kocharunchitt has specialised in food safety for some time, having originally examined *E. coli* behaviour as part of his PhD. He found that *E. coli* "switches off a lot of its own mechanisms" as a way of defending itself against oxidative stress, which the bacteria typically experiences in low-temperature

environments. With this in mind, he and his team deployed a common chemical that is both approved for use on meat and a known oxidising agent, to be sprayed on refrigerated carcasses at a time when the 'cold-shocked' *E. coli* will be particularly sensitised to oxidative stress.

"We have found through our laboratory and pilot trials that spraying beef carcasses with oxidant and water during refrigeration, a process known as spray chilling, causes significant reductions in *E. coli* numbers … and retains water in the beef, so the weight, quality and safety of the meat is maintained," Dr Kocharunchitt said.

The trials have required Dr Kocharunchitt and his team to cross borders, working with food processor JBS Australia at its abattoir in the town of Scone, NSW — a facility that recently installed its own spray-chilling cabinet.

"The initial part of this trial we conducted at JBS's Longford plant, which is in northern Tasmania, just to get an idea of how much *E. coli* is present on meat," Dr Kocharunchitt explained. There, the team captured real-time data over a 24-hour period, giving them a microbiological baseline which they later used to design the proper experiment — which would run for a total of two months — at the Scone plant in NSW.

"The JBS plant has already installed a hot water system, for hot water treatment," Dr Kocharunchitt noted. "But because of the space and because of the expense … they're looking into alternative methods to eliminate *E. coli* on meat."

With the Scone trial having begun at the end of August, it will be some time before the researchers have thoroughly examined all their results — and not just surrounding the effectiveness of the chemical on *E. coli* reduction.

"We are also looking at the way this chemical impacts the meat, because we want to see if it affects the way it looks, the way it tastes, etc," Dr Kocharunchitt said.

"We have the preliminary data from the lab, but we still need to look at the commercial scale how it will impact the quality of the products."

Nevertheless, Dr Kocharunchitt is confident that the trial will clarify the next steps to develop the method towards a commercial-ready solution — one that will consistently eliminate *E. coli* and other bacterial pathogens from beef and lamb carcasses in the abattoir.

"We are working with industry to ensure our research contributes to solving real problems, and with help from JBS we are testing our method further," he said.

Water purification system

The Autwomatic Plus 1+2 Water Purification System from Wasserlab has the ability to produce three qualities of purified laboratory water used direct from the mains water supply: Type I ultrapure water for HPLC, ICP-MS, IC, TOC analysis, molecular biology, PCR, cell culture, DNA sequencing and monoclonal antibody production; Type II pure water for general laboratory applications such as preparation of microbiological culture media, reagents and buffers, RIA/ELISA, atomic absorption and flame spectrophotometry; and osmotised water for cleaning of feeding autoclaves or washing machines.

The system can be connected directly to the tap water to produce Type I, II and III water to the ASTM standard. It is offered in several models, with Type II water production rates of 3, 5 or 10 L/h and with storage tank options of 10, 30 and 50 L. Type I water is produced at 1.1 L/h. An integrated UV lamp (185/254 nm) reduces organic contamination to <3 ppb and the ultrafiltration module ensures a bacterial count of <1 cfu/mL and endotoxin count of <0.03 IU/mL.

Dispensing is manual, time-controlled or volume-controlled. All parameters can be monitored via an 11 cm touch screen, and detailed information such as the hours of installation, hours of operation and volumes produced is easily accessible. The cartridge system facilitates quick and easy drip-free changes.

Capella Science
www.capellascience.com.au

Four-way image splitter

The MultiSplit from Cairn Research is a four-way image splitting device dividing an image into two, three or four separate spatially equivalent components which can be displayed side by side on a single camera chip.

Splitting is usually performed on the basis of wavelength and/or polarisation, allowing applications where there is a requirement for simultaneous or high-speed acquisition of multiple image emission bands or polarisation states. The simultaneous acquisition of up to four images offers a benefit over manual or electronic filter changers, as there is no longer a need to pause acquisition while the filter position is changed. This allows the user's camera to be operated in high-speed stream modes and reduces demands on the software.

Applications include: simultaneous multidepth imaging (using independent lenses); Förster resonance energy transfer (FRET); ratiometric calcium, voltage and pH imaging; simultaneous multifluorescent probe imaging; polarisation studies (anisotropy); spinning disk confocal; super-resolution STORM/PALM/SIM; 3D super-resolution PALM/STORM (using cylindrical lenses); and simultaneous phase contrast/DIC and fluorescence.

SciTech Pty Ltd
www.scitech.com.au

Stomacher bags

Grade's homogeniser/blender and separator bags come in a range of sizes from 80 to 3500 mL and are available with straight or curved bottoms and with or without filters. Also available are Grade disposable straws to pipette samples after homogenisation.

The bags are suitable for all types of blender machines and are made to exacting standards. Laboratories worldwide use the bags due to their durable composition and the low likelihood of bags bursting when in use. They are manufactured under an ISO 9001 approved quality control system and have a negligible failure rate.

Grade has made a robust bag by using the correct blend of polymers (high-quality, food-grade LDPE) for good strength and elasticity. Bags are tested at up to eight times the normal usage to ensure each individually numbered and traceable batch is up to standard.

The easy-to-open double size (4 mm) seal makes any faults totally visible, giving users the added security of no leakage. The bags are gamma irradiated for sample integrity and have a minimum shelf life of five years.

Standard homogeniser/blender bags are available in three sizes: 80, 400 and 3500 mL. Separator bags come in 400 mL sizes with curved or straight bottoms.

Rowe Scientific Pty Ltd
www.rowe.com.au

New cryo-EM microscope

for Victor Chang, UNSW

The Victor Chang Cardiac Research Institute and UNSW have launched a multimillion-dollar cryo-electron microscopy (cryo-EM) machine.

The 240,000-times magnification cryo-electron microscopy (cryo-EM) machine is fitted with the next generation of highly sensitive cameras that allow researchers to image samples frozen at liquid ethane temperatures with never-before-seen clarity.

The multimillion-dollar unit, which is said to be a first for Sydney, has been purchased by the Victor Chang Cardiac Research Institute and installed in the Electron Microscope Unit at UNSW Sydney. Weighing close to a tonne, the microscope had to be placed on a separated concrete slab to be isolated from vibrations and shielded from electromagnetic interference.

Head of Structural Biology at the Victor Chang Institute Dr Alastair Stewart said investing in the cryo-EM was "building for the future" of structural biology.

"Having this new piece of equipment is extremely exciting," Dr Stewart said. "Ultimately it will allow us to make even more advances in cardiovascular research, putting NSW at the forefront of world-class discoveries."

Dr Stewart said the microscope would give scientists an atomic-level understanding of how cells divide and produce new cells, which is critical to the future development of antibiotics to fight superbugs that can cause heart disease.

UNSW Deputy Vice-Chancellor (Research) Professor Nicholas Fisk said this partnership between the university and the Victor Chang Institute was an important step in servicing the growing demand for cryo-dedicated electron microscopy.

"This groundbreaking new microscope will allow researchers insight into how viruses replicate, how cardiac arrhythmias appear and how diseases such as Alzheimer's develop," Professor Fisk said.

"Cryo-EM is revolutionising the field of structural biology, and will allow our researchers to diagnose and analyse diseases of the future."

Nobel Laureate Professor Joachim Frank joined scientists from UNSW and the Victor Chang Institute to open the cryo-EM and to talk about how the technology is revolutionising research.

Professor Frank shared the 2017 Nobel Prize in chemistry for discovering this new and more powerful method of capturing three-dimensional images of biological molecules in atomic detail.

With an increasing number of structural biologists wanting to use cryo-electron microscopy, the Victor Chang Cardiac Research Institute is planning for the Thermo Fisher Talos Arctica microscope to be available for cardiovascular researchers state-wide.

Temperature calibrator

The Fluke 1551A, Fluke 1552A 'Stik' Thermometers offer a digital substitute for the mercury-in-glass thermometers.

The thermometers are designed to provide accuracy of ±0.05°C over full range and are suitable for working outdoors in environments where potentially explosive gases may be present or on the floor of a processing plant. The accuracy specification is said to be easy to understand since it includes all uncertainty components, including drift, for up to one year. The RTD probe is hinged and swivels 90° allowing users to easily view the temperature measurement from the large backlit LCD. The thermometers include a low-battery indicator and auto-off function that shuts down the thermometer to prevent erroneous measurements due to low battery life.

The Fluke 1523 and Fluke 1524 Reference Thermometers measure, graph and record PRTs, thermocouples and thermistors. These thermometer readouts deliver accuracy, wide measurement range, temperature logging and trending, all in a handheld tool that can be taken anywhere. The reference thermometer allows users to handle field applications, laboratory measurements and data logging with ease.

Separately, the Fluke Calibration 2271A Industrial Pressure Calibrator provides a complete, automated solution for calibrating a wide variety of pressure gauges and sensors. The modular design allows it to be configured to meet different needs and budgets, and expanded to cover a broad workload. It is compatible with modules at two different accuracy classes, to provide maximum flexibility in workload and budget. The PM200 modules provide 0.02% FS for most ranges. The PM500 modules provide 0.01% reading, allowing the 2271A to be used to test or calibrate higher accuracy transmitters and digital gauges.

The 2271A is suitable for calibration laboratories starting out in pressure calibration because it offers wide pressure measurement capabilities in a single instrument. Everything needed for calibrating pressure is said to be included. The 2271A is also suitable for labs that calibrate pressure transmitters and gauges and want to expand their capabilities or make their processes more efficient.

Fluke Australia Pty Ltd
www.fluke.com.au

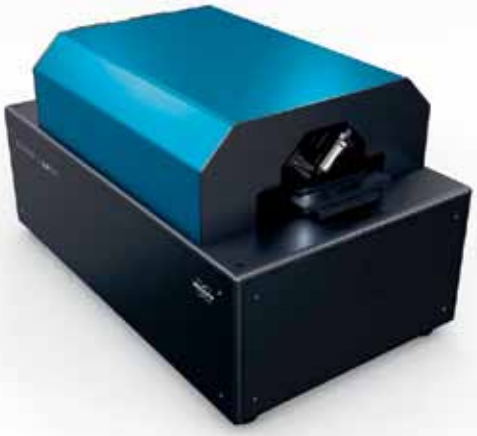
Multiview light-sheet microscope

The QuVi SPIM is part of Luxendo's range of light-sheet microscopes. Combining dual views with dual detection channels, it enables large-scale imaging of living samples. Typical applications of the light-sheet microscope include living, fixed and cleared brain slices, long-term imaging of 3D cell culture models (spheroids, organoids, tumoroids), imaging of conventional cell culture in high throughput and even functional (eg, calcium) imaging.

Its novel stage design facilitates the use of SBS-format plates while its quick-load feature boosts user-friendliness and sample accessibility. Since the objective lenses are exchangeable, a wide variety of samples of different sizes and preparations can be imaged such as biophysical methods like FLIM and FCS. It can also generate image data for multidimensional analysis of biological events and processes.

Key features include: easy sample accessibility through quick load feature; compact, vibration-free and robust design; resolution down to 340 nm in 3D; and a browser-based user interface.

SciTech Pty Ltd
www.scitech.com.au



Actin stain

The ABP Biosciences EasyProbe ActinGreen 488 Stain is a selective, high-affinity F-actin probe that is conjugated to a bright, photostable, green-fluorescent Andy Fluor 488 dye. The stain is formulated in a ready-to-use solution that is provided in a convenient dropper bottle. Just tip and drip two drops of stain solution to the cell slide to stain the cells.

Features include: high-affinity staining of F-actin with high specificity; ready-to-use liquid formulation in convenient dropper bottle, with no need to dilute, weigh or pipette; and a bright fluorescence signal.

The stain has an excitation maximum at 500 nm and an emission maximum at 525 nm. It can be detected through standard GFP and FITC filters.

Sapphire Bioscience
www.sapphirebioscience.com

Single-axis IEPE accelerometer

Dytran Instruments has introduced the Model 3168D2 single-axis IEPE quartz accelerometer for health and usage monitoring systems (HUMS) and flight test applications.

Featuring a thru-hole design for 360° cable orientation, the sensor has mechanical and electrical filters that effectively eliminate ultrahigh-frequency energy that can cause signal saturation (common in high-speed gearbox applications). The filters also act as a barrier to 'zero shift' phenomena in the data by protecting the sensing element from high-amplitude, high-frequency mechanical impacts.

In addition, the filters suppress the natural frequency of the sensor to assure correct 'in-band' vibration measurements during all test applications. The sensing element is internally isolated from the outer case to prevent ground loops and is enclosed by a Faraday shield that prevents EMI/RFI interference.

The sensitivity is 10 mV/g, the frequency range is 1 to 10,000 Hz (±3 dB) and the rugged, stainless steel case is hermetically sealed for operation in high-humidity or wet environments. The integral Teflon cable terminates in twisted pair shielded flying leads and is available in various lengths.

Typical uses include applications such as high-frequency aircraft/airframe vibration monitoring; HUMS and transmission vibration measurements; and any general-purpose, high-energy applications where signal saturation, shock overload and zero shift are potentially affecting signal integrity.

Metromatics Pty Ltd
www.metromatics.com.au

Imaging and cell analysis system

The Livecyte imaging and cell analysis system from Phasefocus is a new modality that employs Ptychographic Quantitative Phase Imaging (QPI). This technology leverages phase shift information to generate high-contrast cell images under low levels of light intensity, allowing individual cells to be identified and tracked for prolonged periods without the need for perturbing labels. This ability to image under a more natural environment with reduced risk of phototoxicity not only supports the use of sensitive cell types such as primary and stem cells, but also enables viable cells to be recovered for subsequent analysis.

The live cell imaging system is non-invasive, easy to use and label- and artefact-free. It has low phototoxicity, making it suitable for imaging sensitive precious primary cells.

Continuous field of view with no loss of resolution enables highly motile cells to be tracked during long time-lapse imaging. Automated tracking software meanwhile monitors changes in individual cells through multiple cell divisions, eliminating the need for manual processing.

Livecyte represents a rapid means of gaining deeper insights into biological processes, associated with a wide range of disease conditions with positive implications for drug discovery and development of personalised medicine.

ATA Scientific Pty Ltd
www.atascientific.com.au

Molecular details
of one of the key migraine initiators revealed

Migraines affect approximately two million Australians and are characterised by symptoms including pain, nausea and poor sleep. They account for nearly 3% of all time lost to disability.

Now, Melbourne researchers have revealed the molecular details of the key initiators in migraine headaches.

In a paper published in *Nature*, researchers from the Monash Institute of Pharmaceutical Sciences (MIPS) led by Doctor Lynn Liang, Doctor Denise Wootten and Professor Patrick Sexton have reported that a key player in the initiation, and pain, of migraines is a neuropeptide called calcitonin gene-related peptide (CGRP).

In order to generate the pain response, CGRP must interact with a particular receptor in the brain. However, there is an added level of complexity because this particular receptor is unusual: it will not respond to CGRP unless another 'partner protein' is present. Very recently, the first drug to prevent migraines was approved. This drug, Amovig, acts by binding to the CGRP receptor to block CGRP interacting with its target.

This study presents the first high-resolution structure of the activated CGRP receptor, together with CGRP and its main signal-transmitting partner. The study's findings are a major breakthrough for understanding how the selectivity of receptors can be controlled by novel protein partners.

"Our work, solving the structure of the activated receptor complex, allows design of novel drugs that can activate the receptor," said Dr Denise Wootten.

"Excitingly, the CGRP receptor is not just a villain but can also be activated for beneficial outcomes. For example, there is accumulating evidence that activation of the receptor could be used to treat inflammatory bowel disease, or resistant hypertension."

"The CGRP receptor structure is the first example where we have been able to capture a snapshot of a receptor that has this complex mechanism of action, one that is vital to the control of many physiologically important receptors," Professor Sexton said. "It provides key insight into why drugs targeting this class of multidomain proteins have been difficult to develop."

The research was a multidisciplinary, international collaborative effort driven by MIPS researchers, with key contributions by collaborators at the Max Planck Institute of Biochemistry in Germany, the University of Essex in the UK, the University of Auckland in New Zealand, Fudan University in China and the Mayo Clinic in the US.

MIPS Director Professor Christopher Porter said, "This research could pave the way for novel drug development in areas of ongoing therapeutic need.

"Professor Sexton and Doctor Wootten have provided unique insight into the activated form of the CGRP receptor. Perhaps most importantly it sets the fundamental framework for the development of next-generation medicines that interact with this critical disease target."

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Automated -80°C biostorage system

Arktic is an innovative concept in biospecimen storage, providing a flexible and automated biobanking solution. Offering high-density -80°C storage in a compact system, Arktic rapidly picks only the specimens that the user requests, delivering them in a standard 96-position rack and ensuring the integrity of all others.

Designed to fit into standard laboratories and running off standard power outlets, the system has no special infrastructure requirements. It can be quickly installed and will have the user's automated biobanking facility up and running in minimal time.

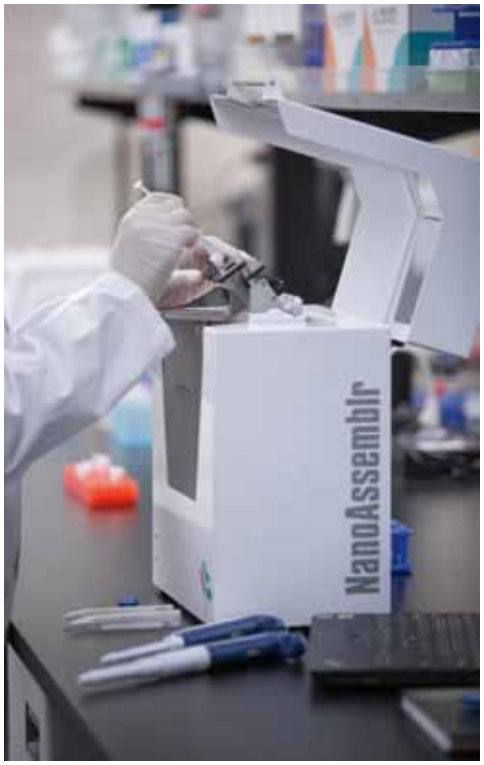
Using pneumatic technology, with no mechanical components in the cold zone, Arktic's design is elegant and robust, requiring little maintenance.

The dry-air atmosphere with good temperature uniformity offers a suitable storage environment for valuable specimens. State-of-the-art insulation ensures maximum thermal efficiency, minimises running costs and maintains the temperature for extended periods in the event of a power outage. A UPS can also be integrated to protect against power failures. An optional backup refrigeration unit can also be included for additional peace of mind.

A simple-to-use interface allows users to easily retrieve the samples they require and offers a secure connection to existing LIMS systems for full sample integration.

TTP Labtech's Arktic is designed to help users say goodbye to ice-encrusted specimens and old-style freezers; usher in fast, automated and efficient sample retrieval; and accelerate their workflows.

AXT Pty Ltd
www.axt.com.au



Rapid manufacture of nanoparticles

Current nanoparticle manufacturing methods can be sensitive to reaction conditions, difficult to reproduce, labour intensive and challenging to scale. The automated NanoAssemblr Benchtop is designed to solve these significant issues and allow scientists to accelerate the discovery and development of novel nanomedicines from bench to clinic.

The NanoAssemblr technology is designed for fast and controlled molecular self-assembly of nanoparticles (~20 to 120+ nm) at nanolitre scale (<20 nL) through the use of highly engineered microfluidic mixing cartridges. Formulation runs require less than a minute therefore more than 30 formulations can be completed in a day for rapid optimisation. Fast mixing (<3 ms) on a small scale allows reproducible control over particle formation, resulting in consistent particle populations with low polydispersities.

Nanoparticles can be engineered with defined characteristics including chemical composition, drug/component ratio and drug/component concentrations. Small molecules, peptides and nucleic acids can be formulated into lipid, polymer or hybrid nanoparticles and more.

Applications include: protein delivery and screening, nucleic acid delivery and screening, nanoparticle design, targeted drug delivery, lipid nanoparticles, liposomes and polymeric nanoparticles.

ATA Scientific Pty Ltd
www.atascientific.com.au

2′3′-cGAMP ELISA kit

Sensitive and direct measurement of cGAMP levels in cell lysates is now possible with Cayman's 2′3′-cGAMP ELISA Kit. Developed in conjunction with expert nucleotide scientists at Biolog Life Science Institute, the assay is designed to provide key improvements from the previous methods used to quantify 2′3′-cGAMP content and offers good sensitivity in the low pg/mL range.

2′3′-cGAMP acts as a second messenger during host defence and may also have roles in autoimmune or inflammatory diseases, including cancer. It is produced when the DNA sensor, cyclic GMP-AMP synthase (cGAS), detects the presence of nucleic acids in the cytosol of mammalian.

2′3′-cGAMP binds tightly to the adaptor protein STING (stimulator of interferon genes), which initiates the recruitment and activation of downstream proteins (TBK1 and IRF3) that induce the transcription and translation of type I interferon (IFN), a potent antiviral cytokine. Modulation of cGAS activity with subsequent induction or inhibition of 2′3′-cGAMP formation is an active target of pharmacological intervention for cancer immunotherapies and autoimmune therapies.

By enabling sensitive quantification of cGAMP levels in cells, Cayman's 2′3′-cGAMP ELISA Kit can be used to assess the effectiveness of novel inhibitors in preclinical studies. The product is also useful for nonclinical users needing quantify 2′3′-cGAMP content, since the assay is suitable for monitoring the kinetics of 2′3′-cGAMP formation and hydrolysis in a biological setting.

Along with cyclic dinucleotides, recombinant STING variants and other key targets, the assay kit fits within a suite of tools available from Cayman to study the cGAS-STING-IFN signalling axis.

Sapphire Bioscience
www.sapphirebioscience.com

DNA detection of crown-of-thorns starfish to improve monitoring

Researchers at the Australian Institute of Marine Science (AIMS) have made a significant breakthrough in the war against crown-of-thorns starfish, developing a cost-effective method for detecting the DNA of the coral-eating pest.

According to AIMS senior research leader Dr Sven Uthicke, the method — published in the journal *Coral Reefs* — will improve monitoring and early detection of the reef pest, allowing reef managers to contain outbreaks sooner.

"It's a genetic probe which we had developed to detect seastar larvae in plankton and we have been able to modify the method," Dr Uthicke said.

"We have worked on this for the past three years, and we have been able to adapt this to make it more sensitive to detect adult crown-of-thorns seastar."

Ecological monitoring has so far failed to detect early stages of an outbreak, preventing timely intervention. The current method for detecting outbreaks is on-reef field surveys using divers, said Dr Uthicke, but by the time these methods detect outbreaks, the outbreak is usually well established.

"Standard monitoring techniques only identify about 5% of the pest on reefs, but this new method will allow us to clearly identify whether greater numbers are present," Dr Uthicke said.

"It counts the number of gene copies in the sample of seawater from a reef using a novel technique called digital droplet PCR."

During recent field work, using the probe on 11 reefs of the Great Barrier Reef, crown-of-thorns starfish DNA was detectable on those suffering outbreaks. In contrast, crown-of-thorns starfish DNA was absent from 'post-outbreak' reefs after populations collapsed, and from 'pre-outbreak' reefs.

The fourth wave of outbreaks since the 1960s started around 2010 on Australia's far northern Great Barrier Reef and has seen the significant loss of coral cover to the voracious appetite of the starfish, making it a major contributor to the coral reef crisis.

This outbreak has spread as far south as Townsville along the Great Barrier Reefs, and is expected to continue south.

Anti-ranibizumab antibodies

Bio-Rad Laboratories has launched a range of recombinant monoclonal anti-ranibizumab antibodies that are highly specific for the monoclonal antibody drug ranibizumab (Lucentis) or the complex of ranibizumab with its target, vascular endothelial growth factor A (VEGF-A).

Ranibizumab is used for the treatment of wet age-related macular degeneration (AMD), a common form of age-related vision loss, and for macular edema and diabetic retinopathy. The anti-ranibizumab antibodies are inhibitory, non-inhibitory and drug-target complex specific antibodies and designed for use in pharmacokinetic (PK) and immunogenicity assays for ranibizumab and biosimilars.

Ranibizumab is a Fab fragment drug and is present at low levels in patient samples, which presents challenges for PK assay design and sensitivity. Bio-Rad's high-affinity ranibizumab-VEGF complex specific antibody overcomes those challenges by enabling the development of a PK antigen capture assay to measure free drug.

The anti-idiotypic antibodies are generated using Human Combinatorial Antibody Library (HuCAL) and CysDisplay, a proprietary method of phage display with guided selection methods to obtain highly targeted reagents. The recombinant production method also ensures a consistent and secure supply.

The anti-ranibizumab antibodies are approved for in vitro research and for commercial applications of in vitro testing services that support preclinical and clinical drug and biosimilar development and patient monitoring.

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

FIB-SEM

TESCAN has released the S9000X, its latest flagship Xe plasma FIB-SEM. It is a useful tool for those involved in ultrahigh-resolution imaging and nanomachining, TEM lamellae preparation and 3D materials analysis.

The Xe plasma FIB (iFIB+) provides precise, damage-free, large-area cross-sectioning coupled with a high throughput rate, up to 50 times faster than conventional gallium FIBs. Furthermore, the use of Xe helps to overcome some of the drawbacks of using gallium including amorphisation, which can lead to incorrect analyses.

Another benefit of the iFIB+ Xe plasma FIB column is that it offers a good field of view resulting in the ability to carry out large-area cross-sectioning as well as offering high levels of automation. This will assist users by reducing the bottlenecks in TEM sample preparation and accelerating 3D materials characterisation.

The column is coupled with TESCAN's next-generation TriGlav ultrahigh-resolution SEM. The three objective lens system used in the TriGlav column reduces aberration, allowing users to achieve sub-nanometre resolution (0.7 nm) while keeping the high current (400 nA). It also enables field-free imaging of magnetic samples and live monitoring of FIB operations. Energy-filtered axial BSE signal collection also provides enhanced surface sensitivity, while adaptive spot shape optimisation results in good contrast at all beam currents.

The SEM is also useful for 3D materials characterisation. With its specifically designed chamber geometry, it can easily incorporate multiple detectors including EDS, EBSD, CL, X-ray source and ToF-SIMS. ToF-SIMS can also be fully integrated and offers isotope identification as well as light element (down to hydrogen) detection, with Xe enhancing the already good detection limits (better than 5 ppm). The rapid rates of material removal make the system suitable for 3D materials analysis, including tomography.

AXT Pty Ltd
www.axt.com.au

Ultrasensitive back-illuminated camera

Andor Technology has released the ultrasensitive Sona back-illuminated camera for fluorescence microscopy. Featuring 95% quantum efficiency and vacuum cooling down to -45°C, Sona provides good sCMOS sensitivity, thus preserving living cells during extended measurement periods. It also enables the capture of large fields of cells or whole embryos with high clarity.

Sona is suitable for quantitative measurement. Linearity of >99.7% ensures correct measurement in applications such as FRET, ion signalling and gene expression analysis. The Sona platform also has low fan vibration, meaning measurement precision will not be compromised in vibration-sensitive set-ups such as super-resolution and electrophysiology.

Sona is available in two formats, each with an 11 μm pixel size. The 4.2 MP Sona 4.2B-11 provides access to the entire 2048 x 2048 array, offering a 32 mm sensor diagonal, harnessing the entire field of view available from the microscope. This highly flexible model is readily adaptable to a range of objective lens magnifications, from 100x down to 40x.

The Sona 2.0B-11 model features a 2 MP array that is sized to maximise the field of view available through modern 22 mm C-mount microscope ports. Preconfigured and easily accessible ROIs directly match to various smaller microscope port sizes, making the Sona 2.0B-11 usable across multiple set-ups and simplifying the process of selecting the right camera for the laboratory.

Coherent Scientific Pty Ltd
www.coherent.com.au

5 MP compact CMOS cameras

Thorlabs has added the CS505 series 5 MP CMOS cameras to its line of compact scientific cameras. Combining a high pixel count (2448 x 2048) and a peak quantum efficiency of 79% at 600 nm with less than 2.5 e^- of RMS read noise, the series is suitable for scientific imaging applications.

The cameras are available with either a monochrome or colour sensor and can generate full-frame 5 MP readout at 35 fps with 12-bit resolution. Measuring just 2.38″ (at its widest point) x 2.78″, the compact camera housing has been engineered to provide passive thermal management for the sensor, reducing dark current without the need for a cooling fan or thermoelectric cooler.

The compact scientific cameras integrate a comprehensive software suite that includes ThorCam (a Windows GUI) as well as support for third-party applications such as ImageJ/Micro-manager, LabVIEW, MatLab and a developer-friendly SDK. A USB 3.0 interface provides compatibility with most computers.

The small form factor of the compact scientific series is feature rich, enabling seamless integration into a multitude of set-ups. An adjustable C-Mount adapter is factory installed into the SM1-threaded optical aperture of the camera for out-of-the-box compatibility with industry-standard microscopes and camera lenses. Various mounting taps are also provided for optical post and 30 mm cage system compatibility.

The 6:5 aspect ratio and 3.45 μm pixel size make the 5 MP cameras suitable for a wide variety of microscope imaging techniques, from quantitative low-light fluorescence microscopy to transmitted-light imaging. Suggested applications include fluorescence and brightfield microscopy, machine vision and materials inspection.

SDR Scientific
www.sdr.com.au

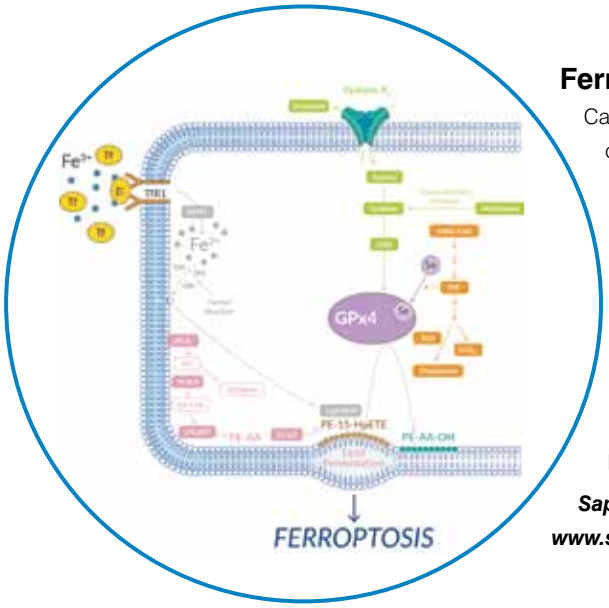
Cleaning system

Using electrochemical activation (ECA) technology, the Klarion system produces powerful cleaning and sanitising solutions that are said to be safer than traditional chemicals.

By combining only salt, water and electricity, the system can output sodium hydroxide cleaner and hypochlorous acid sanitiser, which is produced on demand, in ready-to-use concentrations. The solutions produced are designed to be just as effective, if not more so, than using traditional chemical solutions.

The system has no upfront cost or capital expenditure, as the cost is calculated based on the volume of cleaner and sanitiser produced per month. It is also compact, so no matter the size of the facility the Klarion system can be incorporated as part of the user's cleaning system.

Spraying Systems Co Pty Ltd
www.spray.com.au



Ferroptosis research tools

Cayman Chemical offers tools for detecting ferroptosis, a form of cell death caused by iron-dependent lipid peroxide accumulation.

Ferroptosis has been implicated in diseases of the brain, kidneys, liver and heart, and is important to controlling the oxidative stress response. Although the morphological appearance of cells undergoing ferroptosis differs only subtly from apoptosis and necroptosis, the process is distinctly different in its underlying biochemistry.

Cayman provides several key inducers and inhibitors to better understand the ferroptotic pathway. Reagents and assay kits are available to measure both glutathione and the activity of glutathione peroxidase in cells. Oxidised lipid standards and lipid peroxidation assays and probes are also available.

Sapphire Bioscience
www.sapphirebioscience.com

SPONSORED CONTENT

Rapid, automated, component-specific particle characterisation using Morphologically-Directed Raman Spectroscopy (MDRS)

Morphological imaging is a versatile technique that combines particle size measurements — such as length and width — with particle shape assessments — such as circularity and convexity — to fully characterise both spherical and irregularly shaped particles.

Manual microscopy, which can be time-consuming, subjective and potentially inaccurate, is progressively being replaced with more efficient automated imaging for many applications, including pharmaceuticals, energy storage, additive manufacturing, forensics, building materials, mining/minerals and spray drying to name a few.

Automated imaging is now an established technique for gathering statistically relevant particle size and shape data, and when combined with Raman spectroscopy it also provides comprehensive chemical analysis. Morphologically-directed imaging using Raman spectroscopy enables characterisation through the collection of spectral data for particle populations of interest. The technique is particularly useful for the precise and reliable identification of particles within a blend that cannot be differentiated on the basis of size and shape alone. Sample spectra can be correlated with reference spectra to securely identify particles and gather data uniquely for them. The ability to isolate a particle population on the basis of particle size and shape allows the efficient direction of spectroscopy to those particles of interest, providing complete and time-efficient characterisation.

Built on the market-leading success of previous systems, the new Morphologi 4 automated static imaging system and Morphologi 4-ID, with integrated Morphologically-Directed Raman Spectroscopy (MDRS®), are powerful tools for every scientist seeking absolute analysis and understanding of their samples.

The Morphologi 4 is a fully automated system for characterising particles ranging in size from less than one micron to over a millimetre. Sharp Edge analysis, a new automated segmentation algorithm, makes it easier to detect and define particles. The 18 MP camera and enclosure of the sample during imaging has led to higher measurement sensitivity. These advances make it possible to accurately measure light-sensitive and low-contrast samples, such as proteins and certain mineral and chemical species, and deliver enhanced shape parameter sensitivity for samples.

The Morphologi 4-ID delivers Morphologically-Directed Raman Spectroscopy (MDRS), integrating the static imaging capabilities of the Morphologi 4 with Raman spectroscopy to enable the component-specific morphological characterisation of different chemical species in a mixture. The instrument is fully automated and is designed to allow both particle characterisation scientists with limited spectroscopy experience, and more experienced spectroscopists to gain an in-depth understanding of their particulate samples.

Applications where the new Morphologi instruments add particular value include: characterisation of the Reference Listed Drug (RLD) during deformulation in generic pharmaceutical development; determination of the morphological profile of the Active Pharmaceutical Ingredient (API) during chemical development; chemical identification and morphological characterisation of formulation components during formulation development; batch-to-batch comparability; the identification of foreign particles and troubleshooting during manufacturing.

ATA Scientific Pty Ltd
+61 2 9541 3500
enquiries@atascientific.com.au
www.atascientific.com.au

LC-MS/MS collection for quantitation of veterinary drugs

Food scientists can now take advantage of a start-to-finish solution that offers robust and sensitive analysis of multiresidue veterinary drugs in complex animal-derived sample matrices, helping identify animal and dairy products that may be unsafe for human consumption.

The Thermo Scientific VetDrugs Explorer Collection is a single-provider, liquid chromatography-mass spectrometry/mass spectrometry (LC-MS/MS)-based solution that enables the quantitation required to meet current regulatory standards of more than 160 veterinary drugs in analytically challenging sample matrices. It provides users with a single, pre-tested, all-encompassing solution for the robust and productive testing of animal and dairy products for multiresidue veterinary drugs, operating at a rapid pace while avoiding the challenges associated with setting up a similar workflow independently.

The comprehensive collection includes: the QuEChERS (Quick Easy Cheap Effective Rugged Safe) kit for simple and reproducible sample preparation; an HPLC column with chemistry specific for the detection of veterinary drugs; robust and high-throughput LC-MS/MS for uptime; a triple quadrupole mass spectrometer for fast and sensitive quantitation of analytes in a variety of matrices; and an extensive built-in compound database for the screening, quantifying and reporting of samples.

The collection is designed to help limit the aberrant use of veterinary drugs in agriculture, including antibiotics, βagonists and steroids, by supplying food safety laboratories, government agencies and contract organisations with a solution that can help them monitor, detect and report these drugs to appropriate authorities in a robust and productive manner.

Thermo Fisher Scientific
www.thermofisher.com.au

Anti-pembrolizumab and anti-nivolumab antibodies

Bio-Rad Laboratories has launched a range of anti-idiotypic antibodies targeting the immune checkpoint inhibitor drugs pembrolizumab (Keytruda) and nivolumab (Opdivo). Anti-pembrolizumab and anti-nivolumab antibodies are designed for use in bioanalytical assays to monitor the drug levels in cancer patients.

Pembrolizumab and nivolumab have recently been approved for the treatment of multiple cancers, including non-small cell lung cancer, head and neck squamous cell carcinoma and metastatic melanoma. The anti-pembrolizumab and anti-nivolumab antibodies inhibit the binding of the drugs to their target, programmed cell death protein 1 (PD-1), enabling the free drug to be detected.

Bio-Rad's three anti-pembrolizumab and five anti-nivolumab recombinant monoclonal anti-idiotypic antibodies are highly specific for pembrolizumab and nivolumab, respectively. The antibodies are suitable for the development of pharmacokinetic bridging ELISAs as well as for use as reference standards in anti-drug antibody assays.

The anti-idiotypic antibodies are generated using Human Combinatorial Antibody Library (HuCAL) and CysDisplay, a proprietary method of phage display with guided selection methods to obtain highly targeted reagents. The recombinant production method also ensures a consistent and secure supply.

The anti-pembrolizumab and anti-nivolumab antibodies are approved for in vitro research purposes and for commercial applications of in vitro testing services to support preclinical and clinical drug development and patient monitoring.

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

Augmented reality smartglasses

Epson Australia's Moverio BT-35E augmented reality smartglasses have a transparent Si-OLED display. The smartglasses feature an interface unit with HDMI and USB Type-C ports to easily connect to popular output devices and seamlessly blend digital content into the real world.

The product is suitable for a range of applications, including enterprise drone piloting often used by real estate companies and engineers to survey ground or housing, remote field support such as the checking of powerlines, health, and visitor experience in museums and galleries where 'wearable' information is the best way to communicate facts.

The smartglasses function as a wearable display for any standard HDMI (HDMI1.4) output device, as well as any USB Type-C output device supporting DisplayPort Alt Mode, reducing the need to create or port content to the Moverio platform.

Comfortably and durably designed for daily use, the smartglasses allow users to keep their display in front of them as they carry out their tasks, allowing for increased productivity. Offering an easy out-of-box experience, they provide easy plug-and-play operation with no special software required.

Epson Australia Pty Ltd
www.epson.com.au

Image credit: UNSW

Scientists assemble the cane toad genome

An international research team, led by UNSW, has unlocked the DNA of the cane toad. Published in the journal ***GigaScience***, the breakthrough will help scientists gain a better understanding of what makes Australia's most infamous amphibian tick.

As explained by project leader Prof Peter White, from UNSW, "There are major gaps in our understanding of cane toad genetics, and up until now no-one had put the genome together." A decade ago, Western Australian researchers tried to sequence the cane toad genome, but they encountered obstacles and didn't complete the project.

For this project, the researchers worked at the Ramaciotti Centre for Genomics at UNSW, which has played a role in decoding the genomes of other iconic Australian species, including the koala. Lead author Dr Rich Edwards explained, "By using the cutting-edge sequencing technology and expertise available at UNSW, we sequenced 360-odd billion base pairs and assembled one of the best-quality amphibian genomes to date.

"We managed to decipher more than 90% of the cane toad genes using technology that can sequence very long pieces of DNA, which makes the task of putting together the genome jigsaw much easier."

Having a draft cane toad genome is expected to help to close key knowledge gaps and accelerate cane toad research. More toads can now be sequenced at a fraction of the cost, and the genome is freely available — anyone can access it now and conduct further research.

"Future analysis of the genome will provide insights into cane toad evolution and enrich our understanding of their interplay with the ecosystem at large — it will help us understand how the toad spreads, how its toxin works, and provide new avenues to try to control its population," said study co-author and cane toad expert Professor Rick Shine from the University of Sydney.

"Very few amphibian genomes have been sequenced to date, so this is also great news for amphibians. Having a reference genome could provide valuable insights into how invasive species evolve to adapt to new environments."

Having the genome will also help researchers to find new options for controlling the toad population. Professor White noted, "Current measures like physical removal haven't been successful, but new methods to teach native species not to eat the toad — called taste aversion — give new hope. However, we need more approaches to control this invasive species."

One such alternative measure is biocontrol, ie, using a virus to help control the toad population — for which the toad's genetic material is essential. As explained by UNSW PhD student Alice Russo, "To find a virus for biocontrol, we need access to the toad's DNA and RNA.

"DNA contains ancient fragments of viruses — the DNA of every animal can sometimes catalogue past infections."

While viruses have previously been used to control the European rabbit population, the issue with cane toad viruses is that they could potentially infect native amphibians — which is why researchers are seeking to find a cane toad-specific virus.

In a paper published in the *Journal of Virology*, Russo and her colleagues describe how they sampled cane toads from different Australian locations and, using a combination of DNA and RNA sequencing, found three new viruses.

"Up until we published this paper, only one family of viruses was known to affect the cane toad," Russo said. "This is the first paper that has found different viruses, which is very promising.

"This paper has opened the door: we found a retrovirus, a picornavirus and a circovirus which are genetically similar to viruses infecting frogs, reptiles and fish. For two of them, we found a full genome — both could potentially be used as biocontrol agents."

Knowing these new viral sequences will help inform future studies which will investigate their prevalence and potential as agents for biocontrol. And while there's a lot more work to be done, Professor White said these two papers are "the first — but most important — steps in finding an effective way to control the cane toad".

Inverted microscope

The Eclipse Ti2 delivers a 25 mm FOV suitable for large-scale and high-throughput imaging. Complemented by the latest large-format CMOS cameras, this extended view is designed to increase data capture and achieve full system-level imaging effortlessly.

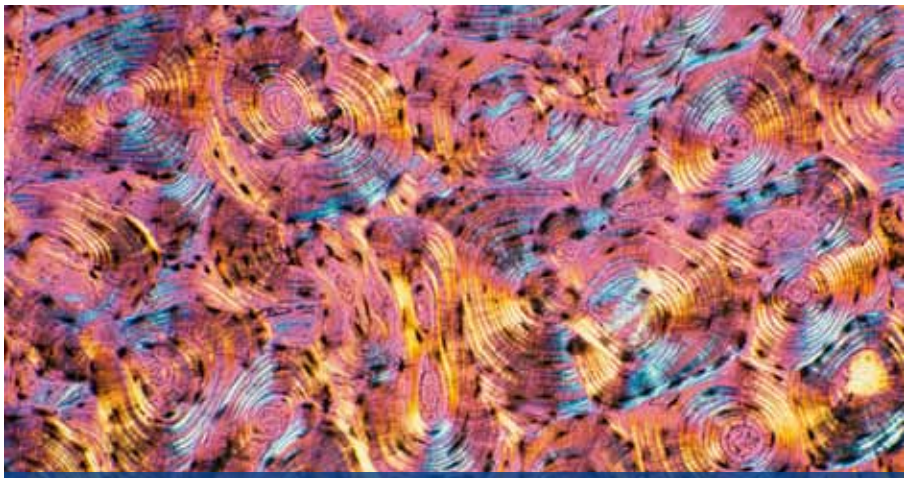
Nikon DS CMOS cameras are equipped with the large 30 x 23.9 mm, 16.25 MP sensor to maximise the performance of the Ti2.

An assist guide provides interactive graphical procedures for all available microscope modes, allowing users of any experience level to quickly perform any necessary alignment tasks. A vast array of sensors detects and continuously monitors the status of all major components, automatically displaying any set-up errors.

The increasing demands for higher throughput and faster acquisitions can be achieved easily by a combination of advanced hardware and sophisticated software. Users can explore research with NIS-Elements, the latest acquisition interface that features advanced image capture and analysis controls. It also includes a JOBS interface for automated and conditional experimental routines.

Coherent Scientific has a Ti2 demonstration system equipped with the latest in LED diascopic and epi-fluorescent illumination, and stage-top environmental control. Interested users can contact the company to trial the system in their laboratory.

Coherent Scientific Pty Ltd
www.coherent.com.au



11th Victorian Cell and Developmental Biology Meeting
November 30, Melbourne
The 11th Victorian Cell and Developmental Biology Meeting will be held on November 30 at Monash University, Clayton Campus. Featuring plenary lectures by Prof Jane Visvader and Prof Moira O'Bryan, this year's program will feature four sessions of short talks that have been selected from submitted abstracts, with engaging poster sessions during breaks.
https://www.monash.edu/anzscdb/victorian-meeting#

AusBiotech 2018
October 31–November 2, Brisbane
https://www.ausbiotech.org/events/event/AusBiotech-2018

IEEE NSS-MIC 2018 — 2018 IEEE Nuclear Science Symposium and Medical Imaging Conference
November 10–17, Sydney
http://www.nssmic.org/2018/

2018 COSA Annual Scientific Meeting (ASM)
November 13–15, Perth
https://www.cosa.org.au/events/annual-scientific-meeting/

Australasian Leukaemia & Lymphoma Scientific Meeting
November 13–16, Brisbane
http://www.allg.org.au/events.html

ACIPC 2018
November 19–21, Brisbane
http://www.acipcconference.com.au/

Australasian Society for Immunology 47th ASM 2018
December 2–6, Perth
http://www.asi2018.org/

Pharmaceutics Meeting 2018
December 3–4, Sydney
https://www.meetingsint.com/pharma-conferences/pharmaceutics

The 9th Australian Colloid & Interface Symposium
February 3–7, 2019, Tasmania
https://acis.wildapricot.org/events

24th Lorne Proteomics Symposium 2019
February 7–10, Lorne
www.australasianproteomics.org.au

44th Lorne Conference on Protein Structure and Function
February 10–14, Lorne
www.lorneproteins.org

31st Lorne Cancer Conference
February 14–16, Lorne
www.lornecancer.org

40th Lorne Genome Conference 2019
February 17–19, Lorne
www.lornegenome.org

Lorne Infection & Immunity Conference 2019
February 20–22, Lorne
www.lorneinfectionimmunity.org

Antimicrobials 2019
21–23 February, Sydney
http://www.antimicrobials2019.com

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

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

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

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

Editor
Mansi Gandhi
LLS@wfmedia.com.au

Assistant Editor
Lauren Davis

Publishing Director/MD
Geoff Hird

Art Director/Production Manager
Julie Wright

Art/Production
Colleen Sam, Wendy Blume

Circulation
Dianna Alberry, Sue Lavery
circulation@wfmedia.com.au

Copy Control
Mitchie Mullins
copy@wfmedia.com.au

Advertising Sales

Sales Manager: Kerrie Robinson
Ph:0400 886 311
krobinson@wfmedia.com.au

Nikki Edwards
Ph: 0431 107 407
nedwards@wfmedia.com.au

Tim Thompson
Ph: 0421 623 958
tthompson@wfmedia.com.au

If you have any queries regarding our privacy policy please email privacy@wfmedia.com.au

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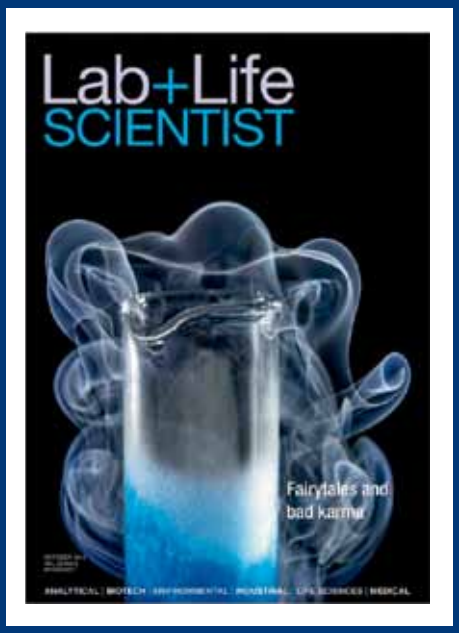

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